Henry Shaw
St. Louis

To
The Botanic Garden
Calcutta
India

THE

BOTANICAL W'ORKS

1115.

OF THE LATE

GEORGE ENGELMANN

COLLECTED FOR HENRY SHAW, ESQ.

EDITED BY

WILLIAM TRELEASE AND ASA GRAY.

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EDITORIA/V[1] PREFACE.

Tins complete collection of the Botanical Publications of the late Dr. ENGELMANN has been made at the suggestion and by means of the generosity of his fellow-townsman Mr. HENRY SHAW, who thus rears a memorial of his old friend and associate not less appropriate than those in bronze and marble, commemorating distinguished men, with which he has adorned the beautiful park which he gives to the city of St. Louis. He thus greatly obliges and benefits the botanists of our own and future times; for these publications were very widely scattered, and many of them were practically inaccessible to those who most needed to use them, and in their dispersed condition all were difficult to consult.

Their great extent will excite the surprise even of those who thought themselves well acquainted witli Dr Engelmann'8 work. They are the more remarkable as being the result of studies and labors dflb from the preoccupations and toils of a well-filled professional life, the fruit of hours which would naturally have been devoted to recreation and needful rest. *

The classification and arrangement of the papers, and essentially the whole editorial krtwr has devolved upon the Engelmann Professor in the Shaw School of Botany, Dr. Trelease, under my supervision. The labor has been long and onerous. Most of the papers were published under conditions unfavorable to proof-readiug; indeed, some of the Government publications were not revised by the author at allL The more serious misprints were found to be corrected in the author's own copies,, and there were many other corrections or slight changes; all of which have as much as possible been attended to in the reprint.

It was difficult to recover the illustrations of Dr. Engelmann's papers, but it was evidently very necessary to have them. Through the kind attention of Professor Baird, the Secretary of the Smithsonian Iustitutyro, the steel plates of the seventy-six quarto engravings of the Cactace© of ;he Mexicau Boundary Survey were found at Washington, and permission was obtained to use ;hem. SfvAl of them were badly rusted, and had to be repaired at considerable expense.

The twenty-four plates illustrating the memoir on the Cactace© of Whipple's exploration across ;he continent on the thirty-fifth parallel, and the three plates of Simpson's expedition had been mgraved or drawn on stone, and the stones were not in existence. The figures have been excellently ^produced by Messrs. Armstrong & Co., of the Riverside Press, who took great pains to further mr plans.

• The original plates illustrating various octavo publications, such as the early monograph of tacutinea, having been mainly lost or destroyed, they have been reproduced in photo-electrotypes;

and so they are incorporated into the letter-press, along with several original illustrations of the kind, such as the page of grape-seeds which illustrated Dr. Eugelmann's well-known essay on the American Grape-vines in the Catalogue of Bush and Son and Meisner, and the large and excellent figures illustrating articles which he from time to time contributed to the " Gardeners* Chronicle/' edited by his friend Dr. Maxwell T. Masters. Most cordial thanks are due to Mr. Bush and to Dr. Masters for the prompt and valuable gift of these electrotypes; also to the Smithsonian Institution for facilitating the transmission of the "Gardeners' Chronicle" electrotypes from London.

The artotype portrait of Dr. Engelmann which faces the titlepage, made by Brimmer and Kalb of St. Louis from the best photograph extant, is from the same negative as that published in the fourth volume of the " Transactions of the Academy of Science of St. Louis/' and is used by the permission of the Academy.

It has been thought proper to append to this Preface the memorial in which the American Academy of Arts and Sciences expressed its sense of the loss which science had sustained in the death of Dr. Engelmann. But it is better that the writings should fully speak for themselves. That the present collection may most beneficially serve to perpetuate his memory and services among botanists is the hope and expectation of his surviving associate,

ASA GRAY.

CAMBRIDGE, MASSACHUSETTS,
March 25, 1887.

BIOGRAPHICAL · SKETCH.

EEPUINTED FROM THE PROCEEDINGS OF TUE AMERICAN ACADEMY OF ARTS AND SCIENCES, VOL. XX. pp. 516-522.

IN the death of Dr. Engclmann, which took place on the 4th of February, 1884, the American Academy lost one of its very few Associate Fellows in the Botanical Section, and the science one of its most eminent and venerable cultivators. He was born at Frankfort-on-the-Main, Feb. 2, 1809, and had therefore just completed his seventy-fifth year. His father, a younger member of the family of £ngelmanns who for several generations served as clergymen at Bacharach on the Rhine, was also educated for the ministry, and was a graduate of the University of Halle; but he devoted his life to education. Marrying the daughter of George Oswald May, a somewhat distinguished portrait-painter, they established at Frankfort, and carried on for a time with much success, a school for young ladies, such as are common in the United States, but were then a novelty in Germany. George Engelmann was the eldest of thirteen children born of this marriage, nine of whom survived to mauhood. Assisted by a scholarship founded by " the Reformed Congregation of Frankfort," he went to the University of Heidelberg in the year 1827, where lie had as fellow-students and companions Karl Schimper and Alexander Braun. With the latter he maintained an intimate friendship and correspondence, interrupted only by the death of Braun in 1877. The former, who manifested unusual genius as a philosophical naturalist, after laying the foundations of phyllotaxy, to be built upon by Braun and others, abandoned, through some singular infirmity of temper, an opening scientific career of the highest promise, upon which the three young friends, Agassiz, Braun, and Schimper, and in his turn Engelmann, had zealously entered.

Embarrassed by some troubles growing out of a political demonstration by the students at Heidelberg, Engelmann in the autumn of 1828 went to Berlin University for two years, and thence to Wiirzburg, where he took his degree of Doctor in Medicine in the summer of 1831. His inaugural dissertation, *De Antholyri Prodromus,* which he published at Frankfort in 1832, testifies to^iis early predilection for Botany, and to his truly scientific turn of mind. It is a morphological dissertation, founded chiefly on the study of monstrosities, illustrated by five plates filled with his own drawings. It was therefore quite in the line with the little treatise on the " Metamorphosis of Plants"[1] published forty years before by another and the most distinguished native of Frankfort; and it appeared so opportunely that it had the honor of Goethe's notice and approval. Goethe's correspondent Madame von Willema, sent a copy to him only four weeks before his death. Goethe resiwrded making kind inquiries after young Engelmann, who, he said, had completely apprehended his ideas of vegetable morphology, and had shown such genius in their development that he offered to place in this young botanist's bauds the store of unpublished notes and sketches which he had

mulated.

[1] 10001 The spring and summer of 1832 were passed at Paris in medical and scientific studies, with Braun and A<masiz as compayions, leading, as he records, "a glorious life in scientific union, in spite

of the cholera." Meanwhile Dr. Engelmann's uncles had resolved to make some laud investments in the valley of the Mississippi, and he willingly became their agent. At least one of the family was already settled in Illinois, not far from St. I^ouis. Dr. Engelmann, sailing from Bremen for Baltimore in September, joined his relatives in the course of the winter, made many lonely and somewhat adventurous journeys on horseback in Southern Illinois, Missouri, and Arkansas, which yielded no other fruits than those of botanical exploration; and finally he established himself in the practice of medicine at St. Louis, late in the autumn of 1835. St. Louis was then rather a frontier trading-post than a town, of barely eight or ten thousand inhabitants. He lived to see it become a metropolis of over four hundred thousand. He began in absolute poverty, the small means he had brought from Europe completely exhausted. In four years he had laid the foundations of success in his profession, and had earned the means for making a voyage to Germany, and, fulfilling a long-standing engagement, for bringing to a frugal home the chosen companion of his life, Dora Hartsmann, his cousin, whom he married at Kreuznach on the 11th of June, 1840. On his way homeward, at New York, the writer of this memorial formed the personal acquaintance of Dr. Engelmann; and thus began the friendship and the scientific association which bos continued unbroken for almost half a century.

Dr. Engelinann's position as a leading physician in St. Louis, as well among the American as the German and French population, was now soon established. He was even able in 1856, without risk, to leave his practice for two years, to devote most of the first summer to botanical investigation in Cambridge, and then, with his wife and young son, to revisit their native land, and to fill up a prolonged vacation in interesting travel and study. In the year 1868 the family visited Europe for a year, the son remaining to pursue his medical studies in Berlin. And lastly, his companion of nearly forty years having been removed by death in January, 1879, aud his own robust health having suffered serious and indeed alarming deterioration, he sailed again for Germany in the summer of 1883. The voyage was so beneficial that he was able to take up some botanical investigations, which, however, were soon interrupted by serious symptoms. But the return voyage proved wonderfully restorative, and when, in early autumn, he rejoined his friends here, they could hope that the unfinished scientific labors, which he at once resumed with alacrity of spirit, might still for a while be carried on with comfort. So indeed they were, in some measure, after his return to his home, yet with increasing infirmity and no little suffering until the sudden illness supervened which in a few days brought his honorable and well-filled life to a close.

In the latter part of his life Dr. Engelmann was able to explore considerable portions of his adopted country, the mountains of North Carolina and Tennessee, the Lake Superior region, and the Rocky Mountains and contiguous plains in Colorado and adjacent territories, and so to study in place, and with the particularity which characterized his work, the *Cacti,* the *Conifcrct,* and other groups of plants which he had for many years been specially investigating. " In 1880 he made a long journey through the forests of the Pacific States, where he saw for the first time in the state of nature plants which he had studied and described more than thirty years before. Dr. Engelmann's associates [so one of them declares] will never forget his courage and industry, his enthusiasm and zeal, his abounding good-nature, and his kindness and consideration of every one with whom ho came in contact" His associates, and also all his published writings, may testify to his acuteness in observation, his indomitable perseverance in investigation, his critical judgment, and a rare openness of mind which prompted him continually to revise old conclusions in the light of ne* facts or ideas.

In the consideration of Dr. Engelmann's botanical work, — to which these lines will naturally b3 devoted, — it should be remembered that his life was that of an eminent and trusted physician, in large and general practice, who even in age and failing health was unable, however he would have chosen, to refuse professional services to those who claimed them; tliut he devoted only the

residual hours, which most men use for rest or recreation, to scientific pursuits, — mainly to botany, yet not exclusively. He was much occupied with meteorology. On establishing his home at St. Louis, he began a series of thermometrical and barometrical observations, which he continued regularly and systematically to the last, when at home always taking the observations himself, — the indoor ones even up to the last day but one of his life. Even in the last week he was seen sweeping a path through the snow in his garden to reach his maximum and minimum thermometers. His latest publication (issued since his death by the St. Louis Academy of Sciences) is a digest and full representation of the thermometrical part of these observations for forty-seven years. He apologizes for not waiting the completion of the half-century before summing up the results, and shows that these could not after three more years be appreciably different.

A list of Dr. Engelmann's botanical papers and notes, collected by his friend and associate Professor Sargent, and published in Coulter's Botanical Gazette for May, 1884, contains about one hundred entries, and is certainly not quite complete. His earliest publication, his inaugural thesis already mentioned *{Be Antholyri Prodromus),* is a treatise upon teratology in its relations to morphology. It is a remarkable production for the time and for a mere medical student with botanical predilections. There is an interesting recent analysis of it in " Nature," for April 24, by Dr. Masters, the leading teratologist of our day, who compares it with Moquin-Tandon's more elaborate *Timtologit Viyitalc,* published ten years afterwards, and who declares that" when we compare the two works from a philosophical point of view, and consider that the one was a mere college essay, while the other was the work of a professed botanist, we must admit that Engelrnann's treatise, so far as it goes, affords evidence of deeper insight into the nature and causes of the. deviations from the ordinary conformation of plants than does that of Moquin."

Transferred to tho valley of the Mississippi and surrounded by plants most of which still needed critical examination, Dr. Engelmann's avocation in botany and his mode of work were marked out for him. Nothing escaped his attention; he drew with facility; and he methodically secured his observations by notes and sketches, available for his own after-use and for that of his correspondents. But the lasting impression which he has made upon North American botany is due to his wise habit of studying his subjects in their systematic relations, and of devoting himself to a particular genus or group of plants (generally the more difficult) until he had elucidated it as com* pletely as lay within his power. In this way all his work was made to tell effectively. Thus his first monograph was of the genus *Cuscuta* (published in the " American Journal of Science," in 1842), of which when Eugclmann took it up we were supposed to have only one indigenous species, and that not peculiar to the United States, but which he immediately brought up to fourteen species without goin^ west of the Mississippi valley. In the year 1859, after an investigation of the whole genus in the materials scattered through the principal herbaria of Europe and this country, he published in the first volume of the St. Louis Academy of Sciences a systematic arrangement of all the *Cuscntcc,* characterizing seventy-seven species, besides others classed as perhaps varieties. Mentioning here only monographfcul subjects, we should next refer to his investigations of the Cactus family, upon which his work was most extensive and important, as well as particularly difficult, and upon which Dr. En^eimonn's authority is of the very highest. He essentially for the first time established tho arrangement of these plants upon floral and carpological characters. This formidable work was be«uii in his sketch of the Botany of Dr. A. Wislizenus's Expedition from Missouri to Northern Mexico, in the Litter's memoir of this tour, published by the United States Senate. It was followed up by iiis account (in the "American Journal of Science," 1852) of the Giant Cactus on the Gila *(Cereus giganteas)* and an allied species; by his synopsis of the Cactaceae of the United States, publisbed in the "Proceedings of the American Academy of Arts and Sciences," 1856; and by his two illustrated memoirs upon the Southern and Western species, one contributed to the fourth volume of the aeries of Pacific Kailroad Expedition Reports, the other to Emory's Report on the Mexican

Boundary Survey. He had made large preparations for a greatly needed revision of at least the North American *Cactaccce.* But although his collections and sketches will be indispensable to the future monographer, very much knowledge of this difficult group of plants is lost by his death.'

Upon two other peculiarly American groups of plants, very difficult, of elucidation in herbarium specimens, *Yucca* and *Agave,* Dr. Engelmann may be said to have brought his work up to the time. Nothing of importance is yet to be added to what he modestly styles "Notes on the Genus Yucca," published in the third volume of the Transactions of the St. Louis Academy, 1873, and not much to the "Notes on Agave," illustrated by photographs, included in the same volume and published in 1875. Less difficult as respects the material to work upon, but well adapted for his painstaking, precise, and thorough handling, were such genera as *Juncics* (elaborately monographed in the second volume of the Transactions of the St. Louis Academy, and also exemplified in distributed sets of specimens), *Euphorbia* (in the fourth volume of the Pacific Railroad Reports, and in the Botany of the Mexican Boundary), *Sagittaria* and its allies, *Callitric/ie, hottcs* (of which his final revision is probably ready for publication), and the North American *Loranthaccce,* to which *Spavganium,* certain groups of *Gentiana,* and some other genera would have to be added in any complete enumeration. Revisions of these genera were also kindly contributed to Dr. Gray's Manual; and he was an important collaborator in several of the memoirs of his surviving associate and friend.

Of the highest interest, and among the best specimens of Dr. Engelmaiin's botanical work, are his various papers upon the American Oaks and the *Conifcra* published in the Transactions of the St. Louis Academy and elsewhere, — the results of long-continued and most conscientious study. The same must be said of his persevering study of the North American Vines, of which he at length recognized and characterized a dozen species, — excellent subjects for his nice discrimination, and now becoming of no small importance to grape-growers, both in this country and in Europe. Nearly all that we know scientifically of our species and forms of *Vitis* is directly due to Dr. Engelmann's investigations. His first separate publication upon them, "The Grape-vines of Missouri," was published in 1860; bis last, a re-elaboration of the American secies, with figures of their seeds, is in the third edition of the Bushberg Catalogue, published only a few months ago.

Imperfect as this mere sketch of Dr. Engelmunn's botanical authorship must needs be, it may show how much may be done for science in a busy physician's *horm subsccivce,* and in his occasional vacations. Not very many of those who could devote their whole time to botany have accomplished as much. It need not be said, and yet perhaps it should not pass unrecorded, that Dr. Engelmann was appreciated by his fellow-botanists both at home and abroad; that his name is upon the rolls of most of the societies devoted to the investigation of Nature; that he was "everywhere the recognized authority in those departments of his favorite science which had most interested him," and that, personally one of the most ufliible and kindly of men, he was as much beloved as respected by those who knew him.

More than fifty years ago his oldest associates in this country — one of thorn his survivor — dedicated to him a raonotypical genus of plants, a native of the plains over whose borders the young immigrant on his arrival wandered solitary and disheartened. Since then the name of Engelmann has, by his own researches and authorship, become unalterably associated with the Buffalo-grass of the plains, the noblest Conifers of the Ilocky Mountains, the most stately Cactus in the world, and with most of the associated secies, as well as with many other plants of which j>erhap3 only the annals of botany may take account. It has been well said by a congenial biographer, that "the Western plains will still be bright with the yellow rays of *Engclmannia,* and that the splendid Spruce, the fairest of them all, which bears the name of Engelmann, will still, it is to be hoped, cover with noble forests the highest slopeft of the Ilocky Mountains, recalling to men, as long as the study of trees occupies their thoughts, the memory of a pure, upright, and laborious life."

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I.

DE ANTHOLYSI PRODROMUS: DISSERTATIO INAUGURALIS PHYTOMORPHOLOGICA,

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FBANCOFURTI AD MOENUH. PBOSTAT AFQP H. L. BEOENNEE.

XDCCCXXXIL

SoCIBfATI NATUBAB SCBUTATOBUM SBXKBNBBBOIAHAB IK HAC IPSA CBBB PATBIA FLOBBHTI BAKB QUAU8CUNQUB PB1MITIAB D. D. D. AUCTOB.

PKAEFATIO.

DISSERTATTUNCULAM hanc quod in lucem sum prolaturus, excusationi mihi sunt univereitatis Herbipolitanae leges, quae tale quid*cribi jubentes hoc auctoris inceptum securius reddunt a vituperationa Quibus legibus cum obtemperarem, libenter quoque usus essem facultate, quam dat gratiosus ille medicorum ordo, scribendi linguft vernaculfi> quae vix tantum intra emortuae istius linguae terminos compesci se sinunt; sed alia voluit mos urbis patriae. Philologus, qui latinitatem tantum spectet, non videbit hoc opellum; naturae autem studiosus neglectA formft in rem animum advertat Quod de liuguft philologo, artifici mihi dicendum est de iconibus, quas, ut [61 omnia accuratissime perficerentur, ipse lapidi inscripsL

His praemissis, quae de re ips& mihi dicenda sunt, meliore proferam animo, quamquam, in thematis optione liber, alius voluntatem non habeo, quft nitar. Jam enim prius botanicen amavi ac colui, cumque Heidelbergae Musarum signa sequerer, ducentibus amicissimis atque praestantissimis •iris ALEXANDRO BRAUK et CABOLO SCHIMPER eo perveni, ut ratione naturae magis congruente indagandas esse plantas sentiam, qu& ratione jam dudum magnus GOETHE, qui noster est non ob communem urbem natalem, sed ob communitatem patriae, quique omnes ingenio nihil non perlustrante jungit, clarissimo lumine nobis praelucet Sed inde ab illo tempore medicinae operam navans horas subsecivas tantum huic scientiae relinquere poteram, quae non minus gravis est atque amabilis discipula Attamen ex hftc sol& ego aliquod, quod mihi sit pioprium, quodque non nullA

dignum esse videatur studiosi indagatione, afferre poteram, adjuvantibus compluribus VV. [7]
DD., inter quos inprimis amicissimus ALEX. BRAUN maximâ cum gratiâ nominandus.

Qui, quod hanc mihi rem tractandam suinpserim, miretur, velim ut introductione lectA sententiam mutet Jam hoc unuin dicendum puto, mihi neque antbolysim, neque in universum doctrinam de abnormitatibus cognoscendam ultimam esse studii metam; nihil volui, nisi ad magnum systema organographiae, physiologiae ejusque, quae omnia in se continet, doctrinae de metamorphosi plantarum particulam addere.

Terminos quosdam novos excuses, cum non ex vanâ termonomaniâ orti sint, sed ex necessitate nonnulla brevius accuratiusque nominandi et definiendi.

Nimis auctum est opus inter colligendum, magnâ naturfi semper semperque novam mihi praebente materiem; jam libello finis erat sistendus, sed, cum quae haberem nimia essent,
hie nonnisi epitomen profero; integrum tractatum spero fore ut postea, si VV. DD. judicium [8]
non nullam mihi dederit adhortationem, studio continuo auctum et emendatum in publicum prodere possim.

INTRODUCTIO.

1. NATURA vivit; ejus vitą conspicitur in formatione et evolutions Sicuti autem quod vivit diversos tenet gradus, sicuti vita ipsa divers4 eaț dignitate, ita evolutio quoque et formatio diversa est in bomine ejusque spiritu, in bestiis, in plantis, nee minus in terrA mundoque. Clarissime apparet evolutionis progressus in plantis, simplicissimae in iis leges exprimuntur, quae obscure tantum in corporibus coelestibus indicantur, quarum implicationes in aniroalibus et in homiue difficilius solvuntur. Ex plantarum igitur historiâ (historia autem est narratio evolutionis ejusque processus) facilius et certius communes evolutionis leges cognoscemus,

2. In animalium et formsi et vitA uuitas, organa quidem structure non minus ac functione sunt diversa, eundem tamen finem spectant Inde a conceptionis momento animal complures gradus percurrit, dum autem maxima est forinationis vis, in utero vel ovo absconditum est; gradus per terapora solum distinguuntur, ita ut, cum posteriores emergant, priores transierint

3. Plantae vero organa externa et, quae dicunt> peripherica nobis offerunt; quae inter se [12] simillima invenimus, singula autem, altero quodammodo libero ab altero, destinationi vitae vegetabilis respondere videntur: planta est multitudo. Unitas autem in solis plantarum organis, in foliis, posita est, quae unâ cum interfoliis[1] (cognatis caulis partibus) individua dicamus, neque, uti botanicis nonnullis videbatur esse justum, ramos, gemmasve. Quomodo folia, individua vegetabilia, per totam plantarum vitam variis formis appareant, et in ipsis floribus mutata tantum conspiciantur, ex iis quae infra dicemus, manifestum fiet

4 Accuratius autem indogantes haud fugiet, ne folia quidem individualia esse sensu strictiore; folia enim vel in plantis quas perfectissimas esse arbitramur, ad divisionem tendunt et multiplicationem; stipulae a foliis sejunguntur, quae ipsa laciniantur et in foliola diffinduntur, nee minus gemmaein maigine et intra dentes procreantur *{Bryophyllum calycinum, Malaxis paludwa, Cardamine pr'atensis,* aliae). Non audacius igitur agere arbitramur statuendo, plantarum organa ejusmodi, ut vita plantarum peripherica sit et externa, ad multitudinem tendere, et unitatem semper discerpere, notionem igitur individui[2] solis respondere animalibus, et improprie tantum nee [13] nisi comparationis causft plantis ejusve organis attribui.

6. Cunctae appendices plantae, quas omnes folia[8] latiore significatione dicimus, in certft qu&dam serie disponuntur. Infima caulis folia, folia oaudicina, parva sunt, imperfecta, saepe squamiformia; turn in caule vel etiam in caudice magis expansa, formis tamen incultis, sine gemmis inveniuntur; folia autem caulina videmus magis evoluta, dentata, dissecta, etc., plerumque ex axillis

[1] Oelger, Mag. f. Fhraitc. 1880, Jan. pag. %

[1] Indiridnnra semper est nnam, nee vero unitas semper indiTldoalis; regnam quoque vegeUbile (cf. O"othil plantam primitiTam, Urpflanze, in itineris per Italiam descriptione), classes pUnUrum, (amiliae, genera, species uuiutem ontendunt menti, aenribas plant* ipaa, ramiia, floa, fraotoa; folium autem rerum individnum esse ridebatur.

• Folia lingui venwumU egregie Blätter [vopter ezpansionem nombaiitur.

gemmas proferentia foliiferas, quae omnia diciraus folia vegetationis (Laub, phylla, frondes ?); haec sequuntur folia subfloralia (bracteae, involucra, calyces exteriores), quae in axillis flores fovent vel ramos floriferos ; nisi jam sterilia evadant et transitura nobis ostendant ad folia floralia (folia calycina s. sepala, f. perigonialia s. tepala DeC, f. corollina s. petala, f. pollinaria s. stamina, f. pistillaria s. folia, quae pistillum constituunt, quae singula clausa carpia dicenda sunt), quibus, caulis formatione oppressâ, normalis foliorum formatio finitur, quâ de re infra latius disserendum, si opus videatur post ea, quae jam ante hos XL annos *Göthe* in libello, de metamorphosi ingeniosissime agente, docuit.

Videraus altiores foliorum gradus fieri per inferiores, neque ex inferioribus, qui ipsi nondum pereunt, sed durant; formationes inferiores juxta altiores observantur; ergo gradus non per tempora, ut in animalibus, discreti sunt, simul magis per spatia.

6. Plantain igitur demonstrasse mibi videor, aptissimam esse, in quâ explorentur formationis processus atque evolutionis leges propter. structuram simpliciorem, propter vitam [14] inateriali magis addictam formationi, propter organa extrorsum posita, propter manifestos et per spatium progredientes evolutionis gradus.

7. Formatio, evolutio progrediens, metamorphosis, in singulis naturae formis non minus ac in cunctâ naturâ apparet, raro autem sensim fit et paulatim ; plerumque per distinctions gradus et quasi saltuatim progreditur. Turn novus quisque gradus, qui gradus tantum est et seriei articulus facile singulars aliquod, distinctum et proprium esse videtur. Diligentius autem indagantibus obviam fit nisus naturae et intentio ex alio gradu in alium perveniendi, qui nisus fluctuatione formationis et formis transitivis manifestus fit. Nam tendenti ad finem metaphorphosi est promotio et repugnatio et normalis amborum proportio. Nutationes hujus proportionis efficiunt formationes transitivas, abnormitates proportionis evolutiones abnormes.[4] Quae ipsae viam nobis ostendunt expeditiorem et intervalla quae sunt inter diversos gradus explent, ita ut raetaraorphoseos progressum intelligamus. Abnormitates eniin in ultiinos naturae recessus nos ducunt, et, quae vitae rationem oculis abscondunt, velamina revolvunt· Ita fieri potest, ut conjungamus quae divisa esse videantur, separemus leges semper veras ab iis, quae mutari possunt, cognoscamus grandem in innumeris ejus formis naturae simplicitatem.

8. Quantum his ultimis lustris disquisitiones abnormitatum animalium contulerint ad intelligendum normalem formationis processum, exponere non opus est In plantis [15] autem earuni investigationem eodem esse pretio dignam, nisi majore, consequi mihi videtur ea, quae supra dicta sunt. In animalibus porro vitia primae formationis dicta nonnisi in perparvi vitae periodo inveniuntur, in plantis vero exsistere possunt per omnem earum vitam vegetationi dicatam.

9. Abnormes evolutiones fieri vidimus ex irimio motu et ex nimisi impeditione. Illae, in quibus praetermittitur unus alterve gradus, rariores sunt. Multo saepius autem invenimus formationes nimiA impeditione effectas, quae formationes impeditae (Hemmungsbildungen) vocantur, quas, ut perveniamus ad ipsain rem hûe in dissertatiunculd tractandam, opus est, ut paulo accuratius inspiciamus.

DE FORMATIOXIBUS IMPEDITIS.

10. Dicimus *impeditas* omnes formationes in quibus evolutio, quominus rite progrediatur, impedita est. Animalium formationes impeditae eo videntur, quod evolutio gradum, ad quem pervenerit, non relinquat, vel tardius saltern procedat, — quae autem in plantis raro tantum

« MoDitrottUtet diem non pommm, notio enim haec wt I concern MtuetU, ridettar a reguU tbborrwe, quod Ule «U
pionw. iubjectiva, et id indict, quod wtuibiu, rvguUru | quod monttretar.

inveniuntur. Saepe vero formatio seriei organorum impeditur, ita ut gradus aliquis constantius teneatur, et loco altioris gradus semper vel per aliquod spatium tempusque ejusmodi solum gradus forniationes appareant.

11. In omnibus vegetabilis vitae gradibus evolutio cohiberi potest. Cum vero inprimis tractandum proposuissemus florem, etiam floris solius formationes impeditas contemplare [16] liceat. Neque autem inflorescentia ejusque folia (folia subfloralia) omittenda sunt.

In flore, in quo plerumque singuli gradus uno duobusve verticillis efformantur, formationis impedimentum efficit, ut verticillorum nunierus augeatur, nee non hue referenda est multiplicatio numeri foliorum in ipsis verticillis. Quae multiplicatio saepe continuâ serie per omnes floris verticillos invenitur. Id quoque formationis impedimenta ortum esse dici potest, ex quo, valido progressu favente, saepe altior gradus et aucta seminum generatio attingitur; saepe autem tales flores, oculo speciosi, steriles evadunt.[6] Ea tandem abnormitas formatio impedita est, qua nisi numerus, magnitudo tamen foliorum verticilli cujusdam ita augetur, ut folia verticillorum 8equentium capiant damnum.

1. FORMATIO FOLIORUM SUBFLORALIUM IMPEDITA.

12. Impeditionis, qu& florum evolutio retardatur, exemplum praebent> *Calla palustris* et *C. aethiopica,* quae interdum binis spathis instructae sunt. In graminibus nonnullis, e. g. in *Bromo velutino* glumarum aucto numero flores plane supprimuntur, id quod in *Hyacintho monstroso* quoque obviam fit, cujus bracteae nil nisi ramos bracteatos proferunt. *Scabiosa columbaria* cum denso foliorum fasciculo loco capituli invenitur; et *Hieraciumfallax* reperi, cujus anthodium foliosum paucos tantum vel nullos flosculos continebat; *Coreopsidis ferulae/olme* exemplar, in [17] horto botanico Francofurtensi cultum, flosculos non profert, sed ex capitulo dense folioso anthodia secundaria emergunt simili modo constructa. *Lythrum Salicaria* haud raro auctarum bractearum racemum floribus carentem praebet. *Plantaginis vwjoris*, Veronicae spicatac, Echii vulgaris,*[7] *Mdiloti arvensis* et *RHM fructicosi** abnormitates observatae suut *Hyacintho* illo haud absimiles'; loco spicarum vel singulorum florum paniculae ramosae solis bracteis instructae obviam fiunt. *Dianthus caryophylhis* denique, quem sub *imbricati** nomine in hortis interdum videre licet, aucto. squamarum calycinarum numero, quae spicani longiorem flore incompleto vel nullo terminatam efiformant, singularem suum acquirit adspectum.

2. FORMATIO FOLIORUM CALYCINORUM IMPEDITA.

13: Multiplicatio calycis et suppressio ceterorum foliorum floralium in *Stachye lanatd* hortorum conspicitur; *A. Braun* in *Myosoti palustri* earn vidit et *Courtois*[10] in *Veronicd medid* (?) una cum gemraifl axillaribus^ In *Campanuld rapunculoide* omnes hujus abnormitatis gradus apparent, multiplicatione calycis sine altiorum graduum detrimento usque ad suppressionem eorum totalem." Iu *AquUegiae vulgaris* flore pleno stellate et in *Nigellae damascenae* flore pleno [18] partim vel proreus delentur verticilli interiores.

[6] De Candolle tales floras, nunxro partium auctos, ?m«I«oentiAetaborta,et Nees von Esenbeck (Handbnch der Botanik, II. 164) divisionc simplicium foliorura Mterali ortos esse statuit, de quibus eiplicationibus plura dicere mperfluam. — De yerticillorum naturft, singulorum loiiorum digniute et snecessione vide infrn. Cf. praeterea A. Bmim de strobilin in Nor. Act Leop., Vol. XV. pare 1.

[7] A. Braan in litt.

[7] Bot. Zeitunp, 1829, pag. 441.

[8] Spenner, Flora Friburg., pag. 744.

[9] Nov. Act LropoM.. Vol. XV. tab. 28, fig. 3. -F.phein. N«t· Our. Cent., 3 et 4, Ann. 1716, p. 368. - Botan. Magaz., tab. 1622.

[10] Bydragen tot de Natnurk. Wetensch., 2 Deel, pag. 226.

[11] Vide Tab. III. fig. 15 et 16. Cf. Weinmann, Phytanth. iconogr. Nro. 292, c.

3. FORMATIO FOLIORUM: PERIGONIALIUM IMPEDITA.

14. Omnes gradus hujus impeditionis in *Tulipd Gesneriand, Lilio candido* (una cum apostasi) et multis aliis *Liliaceis* cultis observare licet; nee non in *Colchico autumncdi, Croco sativo, Convallarid majali,* aliis Monocotyledoneis. Inter Dicotyledoneas, quibus perigonium attribuendum est, invenitur haec abnornritas in *Caltlid palustri, Anemone hortensi, Cleniatide Viticelld,* aliis.

4. FORMATIO FOLIORUM COROLLIXORUM IMPEMTA.

15. Multi flores pleni, quibus horti abundant, hue pertinent. Flores semipleni illi dicuntur, quorum folia genitalia haud plane abolescunt multiplicatione foliorum corollinorum, in plenissimis autem floribus prorsus deleta sunt. — Exempla fusius afferre liaud necessarium ; in familiis *Primulaccarum, Jasmiaearum, Solanearum, Contortarum, Polcmoniaccarum, Campanulacearum,* praesertini *Rosacearum, Caryophyllearum, Violariarum, Malvacearum, Cruci/erarum, Ranunculacearum,* aliis frequenter occurrunt. Icones plurimae prostant, inultae autem satis viles, et niiniine accuratae.

5. FORMATIO FOLIORUM POLLINARIUM IMPEDITA.

16. Haec formatio impedita raro invenitur ; in solis *Diantho caryophyllo* et *Saponarid qffirinali* loco duonim tres vel quatuor verticillos staminum vidi, et in *Chcirantho Cheiri* et *Thlaspi arvensi* observavi quatuor breviora stamina, loco duorutn. Pistillis tali abnormitate [19] suppressis flores masculi cum staminum numero aucto orirentur; nondura autem tale quid inveni, normaliter vero in *Potcrio* exstare videtur, quod certo ad genus *Sanguisorbae* pertinet; nee minus in quibusdam *Accris* speciebus.[12]

6. MULTIPLICATIO FOLIORUM PISTILLARIUM.

17. Haud legitime hanc abnormitatein formationibus impeditis adnumerare possumus; etsi autem folia, quorum evolutio supprimatur, non sequantur, saepe semina, quominus maturescant, impediuntur. Multiplicationem verticilli gynoecei in *Gentiand*™ *Brassicd oleraced,*[1]* *Papavtrt somni/ero,*[ib] *Aquilegid vulgari*[16] observaverunt botanici; nee minus in fructibus, quos *Jaeger*[1]* appellat praegnantes, et in parte eorum, quibus nomen dat pullulantium, in *malts, pyris,*[w] *vialis aurantiis,* aliis. Auctus singulorum carpiorum in codem verticillo collectonim numerus in *Pruni* et *Amygdali*[19] speciebus (2 — 5 carpia) occurrit, in *Mercuriali anniul* (3 — 4 c), *Euphorbid Paraliade*[70] (5 a), *Medicagine lupulina* (2 — 5 a), *Gleditschid*[71] (2 a), *Mimosd*[21] (5 a); siniili modo in *Diantho* (5 — C) et *Cruciferi** (3 — 4 — 10) interdum folia pistillaria plura, quain fieri [20] solet, ovarium o>nstituentia repcriuntur.[23]

7. AUCTUS FOLIORUM FLORALIUM PER OMNES VERTICILLOS NUMKRUS.

18. Flores, quorum omnes verticilli solito majorcin fulioruin numerum continent, quoe pleiomeres (ir\€iW, /A€pov) voairi'in, in multis plantis *(Rutd, ChrysotfjUenio, Adard,* aliis) vix abnormes stint *Paris* invenitur pentameris et hexaineris, *Tulipd, Ornitfoynlum*™ *Allium,* aliao *IMiaceac* 7 — 12meres. Inter Dicotyleiloneas *Aiutgallis, Primula, Camjxinula, fttmbucus* (6 — lRmeria), *Solanum* (inprimis & *Lycopersicum), Symphytum, Fuchsia,* complurus *Umbcllifcnie, Philadelphia,*

[11] Cf. Spenner, Flom FriK, r*«- 1084.
[w] De dud. Orgwiogr., T.b. XL. fig. 6 et 7.
w VideTah. IV. fi$_K$. 2.
** 8chimper in der Botan. Zeitung 1829, pag. 426.
[M] A. Brian in litt
[17] Minbildaogen, ptg. 221.
>• Dc Cand. Organogr., Tab. XLIII.
»• Tab. I. fig. 4.
• Kut-pr in IJnoara, II. \+g. 85.
[n] D>o (àmi. Organogni|>hie.
« B«t. Zeitung 182V, pag. 433.
* Unnaca, IV. pag. 383. Inde Fingfr'huth Donm ronstituit»p*rifm, Oruithogalam octandran; Cf. Bot Zritung 1828, pag. *b\)2.*

Rosa, Bubus, Clematis, Ranunculus, niultae aliae numero partium variant. *Brasticam Napum* cum verticillis trimeribus[24] inveni, et *Brassicam oleraceam* cum tetrameribus, etc. Etiam quae in *Compositis* observantur, hue referre licet; calathides interdum latiores fiunt, flosculonim ligulatorum series in disco oritur, denique calathis in duas dividitur; id quod praecipue cum caulis fasciatione conjunctum est, simili inodo, quo illi flores pleiomeres cum fasciatione inveniuntur.

8. AMPLIFICATIO COROLLAE. [21]

19. Auctionem magnitudinis non minus ac auctionem numeri foliorum formationibus impeditis adnumerandaui'esse, jam dixL Quae auctio praecipue in foliis corollinis observata, staminibus magis evolutis, pistilla debilitat vel supprimit in multis *Labiatis* praecipue in *Mentkd, Thymo, Lamio,* aliis. Hue fortasse *Circaea intermedia* pertinet, quae nonnisi forma *C. alpinae* esse videtur; ipsa *Campanula Speculum* et *hybrida* jungendae et hâc ratione explicandae sunt

Contraria in aliis familiis occurrunt, amplificatione enim corollae stamina abolescunt in *Compositarum Badiatarum* floribus, quos plenos vocant hortulani, in *Bellide, Astere, Tagete,* multis aliis, inter quas *Calendula offidnalis* eo mirabilis est, quod onmes disci flosculi fertiles fiunt Nee non in *Scabiosd arvensi* haec abnormitas observatur.

In nonnullis plantis stamina et pistilla supprimuntur corollae amplificatione; hue *Viburnum Opulus* et *Violae* nonnullae, inprimis *V. mirabilis.* Etiam *Hydrangea hortensis* calyce corollino amplificato hie potest nominari.

20. Ab his formationibus impeditis magna abnonnitatum classis eo distinguenda est, quod non impedito progressu sed manifesto regressu oriuntur. Hue pertinent metamorphoses vere retrogradae, quibus organa, dum evolvuntur, afficiuntur, nee non inferiorum graduum, qui jam superati erant, repetitio. — Quae si in flore apparent, *aniholysis* est, et de h&c, ejus nomine et naturd, ejus signis, speciebus et combinationibus, ejus causis et conclusionibus ex ed [22] duceudis, in h&c dissertatiunculfc agam.

* Verticilli Cruciferarum nonnales diineres aunt; vide A. Braun, de squamarum in rtrobilis online, in NOT. Act Leopold., VoL XV. Tab. XXXII. fig. 1.

DE ANTHOLYSI.

21. NOMEX *antholysis,* quantum scio, in Spenneri Florft Friburgensi primura usurpatur. Compositum est ex verbo *ἄvOos,* flos, et *\'vetp,* solvere, ergo floris solutiouem sigiiificat, totalem vel partialem unitatis in floro eversionem.

Antholysis est commutatio abnormis organorura floris normalem in raodura constitutorum, metamorphoses vere retrogradae, quas patiuntur in evolutione, transformatio foliorum altioris gradus in inferiorera, nisus ad finera diminutus et sublatus.

22. Antholysis facile distinguitur a plurimis aliis abnorraitatibus; cum solis fonnationibus impeditis interdum, ut confundatur, fieri potest. Multo autem differre eo videtur, quod in foliis floralibus, antholysi mutatis, semper vel in numero, vel in formft, vel in matcrie, vel in collocatione, vel in alio ad cetera orgaua respectu vestigia evolutionis ad altiorem grodum destinatae inveniantur. Interdum vero ne minimam quidem diflèrentiam observamus ; e. g. *Rosae* flos aut fonnatione petulonim impedit&> qu& stamina parti in supprimuntur, aut inutatione staminum exteriorum in petala, semiplenus fieri potest; ipsae formationes intermediae, partim antheras partim petala significantcs, hand certo evolutionem retrogradam indicant, eo minus, cum antholyses ot formationes iinpeditue saepius coqjnnctae occurrant.

23. Secundum organa floris et secundum mutationes eorura multos antholysis modos [24] discernimus; certos autem fines inter eos constituere nequiiuus, cum antholyses non factae sint individua.

In commutationes hie inquirimus abnormes, distinguimns igitur antholyses secundum mutationis rationem. Aliae distributiones, optimae sane ei, qui alia spectans hanc rem tractarct, fieri poesunt secundum floris organa et secundum plantarum familias. Minus apte disponerentur secundum causas, secundum perfectionem et alias rutionea

I. ANTHOLYSES, QUIBUS SOLA FOLIA FLORALIA LABORANT, SINE AXIS MUTATIONfc

1. ltEGRBBSUa

24. Regressus (Rttckbildung) simplicissima foliorum floralium metamorphosis retitignula est, quA haec anteoedentis gnulus foliis similia fiunt

Interdora plurima vel omnia folia floralia talem in modum mutantur, vel unins tantom vertieflli folia; nbi autem singula solummodo folia corripiuntur, videmus ea, quae externa sunt et prima, maxima muteri, plane secundum leges successions in disposition foliorum.[11]

• Cf. A. Brmum OnlnungderScboppen andraTanutpT'o *» *** Nor. Act Unp , Vol. XV.pml.

a. *Begressus Foliorum Pistillarium in Folia Pollinaria.*

25. Haec metamorphosis nonnisi certo quodam sensu nominari potest regressus; quin autem reverb inveniatur, haud dubitandum, quidqiiid dicant *Sckuttz*™ *Gmelin*[71] et alii Sane [25] opposita sunt folia pistillaria et pollinaria, magis opposita, quam ulla alia in plantarum evolutione. In naturft autem nulla infinite est contrapositio, atque forraationes intermedias transitivasque et ratione suspicamur, et observation demonstramus. QuS, ips& autem contrapositions argumentanuir, folia pollinaria et pistillaria ejusdem esse dignitatis, nee folia pollinaria esse formationem transitivam inter folia caulina et folia pistillaria, «ed foliorum caulinorum vires, quibus ipsa vere hermaphrodita gemmas generant, in oppositos, quos dicunt, factores divisae in foliis pollinaribus et pistillaribus apparent, quae conjuncta procreaut indifferentissimum semen.[38] Itaque, alterum folium altero magis evolutum esse, dici non potest; mutatio tamen foliorum pistillarium in folia pollinaria inter antholyses numeranda est, cum mutatio *retrograda* sit in formam gradus antecedents, et uuitatem perfectionemque florum laedat

26. Observata est haec metamorphosis in *Salice cinered, silesiacd* et *capred*[7]* nee minus in *Salice labylonicd*;™ cujus arbores, alias semper femineae, in ramis nonnullis fere solos [26] flores mascnlos proferebant; et in *Euphorbid*:*[1] Intra *PrimtUae acaulis* paulo aperta ovaria *Schimper** in valvis antheras polliniferas animadvertit *Omtianam campestrem* conspexit *Bocper*[2]* cum mutatione alterius carpii in an therein, altero paene integro. In *Campanuld persicifolid* ^ et *C. rapunculoide*** vidi organon antherae simile in uno stylo; denique in *Cheiranthi Clieiri* flore dimidium folium pistillare in antherae thecam conversum observavL

b. *Regresms Foliorum Pistillarium in Expansions Petaloideas.*

27. Folia pistillaria clausa nón aperiuntur hftc antholysis form&, sed stigma et stylus expanduntur, germen autem ipsum sensim abolescit, usquedum plane deletum sit, et petaloideum folium locum occupaverit

Expansiones tales occurrunt in *Colchico autumnali** *Diantho caryophyllo*;** *Hibisco Bosd *inm*i;** *Papavere somnifero;** *Nigelld arvensi*[40] semper in floribus plenis; hue quoque pertinent *Anemones Juniensis* flores pleni, quorum germina, staminibus integris, evanita sunt In *Scabiosd arvensi* stigmata elongati styli in foliola coerulea mutata vidi; similem in *Ixmicerd* [27] *Periclymeno* observationem *Koning*[il] describit

c. *Mutatio Parastemonum in Stamina.*

28. Parastemones intra verticillos staminum collocati haud frequenter inveniuntur, nbi autem adsuQt, facUe in vera mutantur stamina. Quod occurrit in *Eupomatid laurin&f** *Aquilegid vul-*

» Natur der lebendigen Pflaue, I. i»g. 294.

[17] NatarwiasenachAftl. Abbandlnngen TOD einer GeseU-•chart in Wdrtemb., I.*R1. pag. 808. Aigainenta, qnae oontim afferantur, Tel plane negatira sunt, cum doctiarimt illi non aatU obaoraiient naturam ; Tel tbeoretica rant et falsis PriiicipiU nitnntnr, e. g. 0 m e 1 i n i aaaertione (pag. 801): Je böher die Bildung vorangeiebritten 1st, desto ^enlger ist «ta Rttckacbritt mÖglicb! Sane tab quid omnem obeervatao nem •ttperfluam redderet

* Improprie {gitnr de harmaplirodítis pUntis floribusque wqtmntnr; floe sic dictua bennapbroditua talia est, in quo folia madme dtana, asm nempe (nti etsi tnnltis eontradicentlons optime ajunt) distincta, propius cohibentur, eigo •tnctlus dbi opponuntur, qnam in floribus unlsexualibiu; altioram igitur floras bennaphroditi attingunt gradoirt.

• Uebaniebt der Arbeiten der scbles. <3esellscb. f. yaterland. Cultur., 1825,

* Schimper in der botaniscben Zeitnng 1829, pag. 422.

[11] Roeper En urn. Eupbork, pag. ML

a Bot Zeitg. 1829, pag. 424. Spenner FL Fribuig., pag. 1061.

» Linnaea, I. pag. 457.

M Tab. III. fig. 10 et 11.

* Ibidem, fig. 14.

* Jaeger, Missbildgen., pag. 76.

« L . c

« L. c, pag. 77.

» Goetbe, Metam. d. Pflancm, | 80.

* Jaeger, Missb., pag. 77.

« Bydragen tot de Katunrk. Wetensch«9 II. pag. S96V Tab. II.

« R. Brown, General Remarks, Tab, IL

gari[4]* et *Paecmid Moutan*** Hue quoque id pertinet, quod saepius in *Sempcrvivo tectorum* observatum est, cujus sic dicta nectaria in stamina vel pistilla conversa erant.

d. *Regressus Foliorum Pollinarium in Folia Corollina.*

29. Affinitatem amborum organorum jam dudum cognoverunt botanici, et transitus inter ea diligenter observaverunt. Utrum autem anthera an filamentura in petalum mutetur, haud certum esse videtur; in *Rosd, Diantho, Papavere* utrumque conspicitur; *De Candolle* falli videtur contendendo ex antherâ fieri cucullatum petalum, ex.filamento autem planum; *Aquilcgiae* exemplum, quod affert, falsum. Plerumque sensim expanditur planumque fit folium pollinare, et antherae rudimenta in medio, saepius in margine relinquuntur. Mutatio frequeutior est in floribus, quorum corollae magnae, coloratae, eleutheropetalae (polypetalae) sunt, et stamina plurima. Saepe, id quod jam dixi, hie regressus cum corollae formatione impedita conjunct us.

30. Orania, quae inveniuntur, exempla afferre, cum frequentissima sint, superfluum; [28] solas dicam *Primulam, Veronicam;** *Orcbanchenf** *Vincam;*[7] *Gentianamf** *Viburnum;*® *Zoniceram;*[0] *Scabiosam,*[61] *Camponulam;*[M] inter plantas eleutheropetalas *Daucum, Mcdicagintm, Spartium, Anthyllin, Coronillam, Clitoriam*;** multas *Rosaceas* et *Caryophylleas, Violam.* Mira est haec metamorphosis in *Malvaceis;* in *Alced rosed* ex columnft androeceâ parvi, ut ita appelleut, flosculi staininibus et petalis instructi fiunt, quâ de re infra plura. Segressus ille porro invenitur in *Cruci/eris* compluribus, *Citro, Papavere,* multis *Jlanunculaceis.*

e. *Regressus Foliorum Pollinarium in Folia Perigonialia.*

31. De h&c metamorphosi eadein quae de modo memomtâ dfcenda sunt Exempla nobis praebent *Tulipa* multaeque *Liliaceae* cultae, nee non 7mi.[M] Uaud rarus hie multiplieationis modus in *CaUhd paltutri, Anemonis,* aliia

f. *Begrestus Foliarum Pollinarium in Folia Colt/etna Colcrala.* [29]

32. Solura occurrit in floribus, quorum petala sepalis coloratis regressn simflia facta sunt; turn stamina statiin fiunt sepaloidea, petalomm formft praetermissft. In *Nigdld dam ascend, AquiUgid vulgari, Delphinio* tale quid invenitur.

g. *Rtgrcssus Foliorum Corollinonim in Folia Calycina.*

33. Haec antholysis certo quodam sensu virescentiae adnumeranda; Bed praeter id quod non omnee calyces sunt virides, regressui ita affinis est, ut scparare earn haud liceat Ubi non tarn regressus, quam virescentia vera adest, semper totus flos una laborat Saepe simul staminum regressu corolla alia oritur, saepe etiam prorsus nova corolla additur." Regressus petalorum apparebat in *Tcuerio Chanuudrye, Vxncd minare** *Campanuld penictfolid;** et *C. rapuncuUmU,*

[4] De Candolle, — .. - 427.
[*] Link, Elem. Philc Bot., R. Rnnm, 1. c.
[6] Botanical Tracts, by Hill, Tab. VII. fig. 4.
[7] Speciosissimum exrapUr, qood Behinper pmpe Monachiam invenl lis abnormitatibus abundat.
[8] ©. OMMI. Organogr., TaK XLVII.
[9] Schimper in der bot. Zritir. 1«». r-C. 440.
[10] In floribus, quorum corolla paulo amplificata est, stamina petaloidea invent.

•o RTdra^n tot da Nat Wetnarb., II. pa«. »6.
« Ab atnidarimo A. M a ja r propa Rrttekiwui coIWtoro exemp»Ur; a'tngola ax ataninlboa orU peUb Don connata erant.
••TaKIII. **. 10 at 11
« Jaurr, MlaiMiiL, pair. 109.
" Wriomaam Pbytmnth. loooofr. Kro. 609, a.
• CT. Tab. III. ft*. 9.
« IV OBmiolb OrKawiKr., TtK XLVII.
" Tab. III. Ag. 9. .

Banco Cdrotd (cujus foraa talis maturat fructus petalis pereisteutibus), *Bosdf* Pyro Malo** pluribus *Caryophylleis,® Dictamno albo,ⁿ Thlaspi Burst pastoris.*

h. *Begressus Foliorum Perigonialium in Folia Bubjhralia vel Folia Vegetatimis.* [30]

34. Interdum in *Tulipd* obviam est; inter Dicotyledoneas in *Calthd palustri, Anemone nemorosd? A. ranunculoidę* A. hortend;** in *Anemone Fulsatilld*⁶* folia perigonialia virescunt nee diifinduntur in foliorum involucraliutn modum.

i. *Begressus Foliorum Calydnorum in "Folia Suhjkralia vel Folia Vegetation^.*

35. Hie regressus, quern etiara frondescentiain dicere possumus, frequenter occurrit, saepe cum aliis antholysis formis conjunctus, quales sunt disjunctio, apostasis, etc. Exempla, quae aut ipse observavi, aut ex scriptis laudatis hausi, inveniuntur in *Primuld* etotore" *Convolvulo S^um," Gentian* campestri;"* hue pappi in folia vera mutatio in *Scorzonerd octangular^* et *Senecwne mlgariP* Regressus calycis porro apparet in *Campanula" Athamantd* CWtrf* inultis *Sosaceis,* inprimis *Ro*d>* Ceraso? Amygdalo?* egregie in *Geo rivali?* nee non in *Fragand;* [31]
in *Caryophylleis* plerumque cum apostasi, in *Thlaspi arvensi,* eujus sepala persistent* fiunt; in *Chtirantko Lin* et *incano.* Bracteae *Papaveris arientalu, braeteat** sepala sunt retrograda; *Ranunculus* denique foliis calycinis virescentibus dissectisque occumt

k *Rtgresmt toliics Floris ex Formd Irregulari in Begularcm.*

36. Flores nomaliter irregular interdum in antholysim tendentes normales fiunt, et turn *peloriae* dicuntur. Actione naturae magis Hber4 nomae tahum florum intimae manitotms apparent, et ex involutione aliis conditionibus effectl prodeunt, quo regular* cmque flori innata structura exhS^tur. Evolutio partium normaliter abortientum, qua *De CandolU* pelonarum formationem explicit, non causa ejus equela est.

Pelorias invenerunt in *Orchide,* -- -- *sonatis* nonnullis *Labiatis, Violá, Medicagine, Aconito,* aliis.

ounuuuuuu formation! peloriarum id est, quod in floribus folia pistillaria, quae numero baud respondent ceterorum verticillomm foliis, isomeres fiant et totius flons regulantatem per-
· ficiant *Campanula? Medicago, Muium? Cera**? Amygdalvs* JharUhus** inultaeque [32]
aliae plantae hujus abnormitatis regularis exempla offerunt

L *Appendix. Integrorum Ortus Florum ex Foliis PoUinaribus mviatis.*

37. Singularis haec evolutio in *Alced rosed* observari licet Jam supra vidimus, ex column* staminum novos fieri axes staminibus et petalis instructs. Porro in novi hujus pedunculi cacu-

■ Cf. e. g. Tab. III. fig. 8.
■ Morgenblatt 1829 Nro. 268. Prope Carlsruhe similis arbor fait (A. Brann); in amboram floribus simul stamina 15 ezterna in carpia erant muUU metamorpbosi abnormem in moduin progrediente.
60 Bot Zeitung, 1829, pag. 487.
ⁿ Flora fnneaise, Tom. IV. pag. 784.
« ana. rar. plant bitt. II. pag. 247.
« Tab. I. fig. 2.' *
« Weinmann, Phyt ic Nro. 123, o.
• L. o. Nro. 889, c. et d.
« L. a Nro. 882, b., et Boton. Zeitg. 1881, pag. 8.
ᵐ Tab. I. fig. 8.
• Tkb. I. fig. 1.
• De Cand. Organogr., Tab. XXXII. fig. 6.
TO Tab. V. fig. 24-26.
n Tab. in. fig. 15 et 16; Iinnaea, I. pag. 454; Weinm. Phyt. ic. Nro. 294.
» Tab. V. fig. 14.
W Tab. III. fig. 3.
" Jäger, Missbild., pag. 57.
n Weinro. Phyt ic. Nro. 102, b.
T« Hoc est Anemone dodecapbylla Krook. Flor. Siles., II. pag. 285, Tab. XX.
" fab. III. fig. 10 et 15.
n De Cand. Oiganograpb.
" De Cand. jard. de Centre, Tab. XVIII.
» Tab. I. fig. 4, ubl autem quatuor tantom oarpia admnt; alias qninqne occurrunt
« Jager, Missbild., pag. 142.

mine interdum carpiorum verticillus oritur, circum quern stamina et petala arctius componuntur; petala exteriora mutantur in sepala, quae cetera circumdant involvuntque. Haec sepala sensim abeunt in petala ad columnam floris primarii androeceam pertinentia.[82] Froliferationis modus did potest haec abuonnitas, multo autem differt ratione evolutionis ab iis, qui infra expouendi sunt

2. VIRESCENTIA.

38. Virescentia floris (Vergriinung) ea mutatio est, quâ omnia vel plurima ejus organa colorem viridem et texturam finniorein acquirunt, frequenter quoque re verâ in modum foliorum vegetationis expanduntur. Saepe duos virescentiae modos distinguere licet: 1, solam virescentiam formâ organorum primitivâ plus minusve servatfi, virescentiam sensu strictiore; et 2, virescentiam, quâ organa, servatâ collocatione alioque ad floreni respectu, foliis vegetationis simillima fiunt, frondescentiam (Verlaulmng). Haud ubique talem virescentiae divisionein, quae divereos tantum ejusdem mutationis gradus indicare videtur, possumus adhibere.

Virescentia multo magis quam regressus floribus nocet; raro tantum semina maturare permittit; vera monstra efficit

Singulorum floris organorum virescentia hue referri potest; foliorum vero corollinornm [33] atque calycinoruin virescentia majore jure supra tractata est, et foliorum pistillarium virescentia, cum semper cum disjunctione conspiciatur, infra commemorabitur.

39. Flores virescentes* reperiuntur in *Colchico autumnali;*** folia perigonialia viridia erant aeque ac stamina et pistilla, quae polliue ovulisque carebant In *Euphorbid stvllulatd Roper*** ramulum bifolium vidit, florem nempe masculum virescentem; quod etiam in *Ei'phorlnd ajparissid* observavL *Anagallu phoenkea* [tt] autumuo saepe cum floribus viridibus occurriL Virescentiam *Siachyis silvatieae* et *Symphyti officinal is Schimptr* vidit et depiuxit;[88] illius calyx gamosepalus reroanebat, hujus uutem in 5 folia mnjora mutatus erat; corollae et stamina firma, viridia; pistilla mirum in modum mutata, de quibus infra fusius disserendum.

Eximias maximeque varias virescentiae formas in *Gilid glomerifiord* animadverti; calyx pleramque auctus, tubulosus vel in quinque folia disjunct us corollarn parvam viridem circumdat, cnju8 folia interdum pinnatifida fiunt; filamenta hcrlmcea parvas anthems virides sustinent; gennen amplificatura saepe in folia lanceolata vel pinnatifida dividitur.[87] *Gcntianae amarcllae* virescentiam *AUc. Braun* et *Lonieerae XyloMci Jagcr** viderunt [34]

Camni[m] *Scabiosam columbarium* describit, in cujus floribus viridibus filamenta foliola viridia ferebant Alium virescentiae modum amic. *Av£-Lallemant*[w] in *Scabiosd agrtsti* obscrvavit; calycis externi et interni folia majora ut dissecta erant, nee non stipite soj)arata; corolla cum staminibus parva, viridis; pintillum paene atolitum.

In *Stneciane vulgari* egregiaiu seritMu flosculorum viili a normalibus n«que ail piano viri«lea, quorum paucw TaK V. fig. 23-26 exhibui. Similem abuormiUtem *Cauini** obeervavit in *Cirsio triccphalode ;* nee non *Calendula* Tab. V. fig. 28 ilcpicta cum illis congruit

Campanula rapuiicnUAdu* flores viresceiites baud ruri sunt;« iutenluni intra foru pUtilUria frondescentia et aperU oriuntur nova folia,* qu& ratione denique deosus foliorum fasciculus pruvenit,* cujus autem evolutio etiam formationis impod^ento explicari potest

•» Tah. I. fig. 6 et 7.

•• Burner's Arehir fur d. Bot., Bd. II. Stttck % \ma. 2SS.

" fcjjam. Kupborh., p^. 42.

•• Tmb. I. fi«. 9 et 10; Tab. II. fig. 1.

» Geigrr'i Migrnx. fUr Pharmacie 1830, Jan., Tak. 17. et Y. Quod deaoriptio iconum dent, ralde dolmdom eat; eaedmaimt ioones, qoaa Schimper in miTeiita natorae •tadioaoram Heid«Ibergae 1829 protolit Bymphytam tab etiam in berbario Societ naturae acrut BettkaBh. •erntnr.

Tab. II. fig. 8-14.

Mi»bild.(pag. 6*.

Opoec pbytolng., II. pag. 549.

I>e I'laiiUa i|uibaadam Ital. bur. etc Diaert iasngnr. Berolini 1829, pag. 8 et 9, fig. 6-12.

Joorn. de Pbya., Tom. LXXXDL psg. 401.

Tab. HI. fig. IS.

Linnaea, I. 454.

Tab. III. fig. I5 et 11

40. Speciosum floram virescentium ordinem in *Torili Anthrinco** animadverti; floras plerumque siinul hypogyni fiebant Antherae mutatae erant in folia petiolata (rarius sessilia, fig. 8) rotunda, tetraptera aut plana, interdum incisa (fig. 6 et 8), folia pistillaria disjuncta erant et una cum foliis calycinis amplificatione nimiâ foliorum pollinariuui repressa, quod si secus [35] eveniebat, magna et lata erant (fig. 3), aut angusta et craasa ex margine 2-4 folia, quae seraina involverant, edebant (fig. 4-5). Etiam in *Dauco Carotd* et *Heracleo Sphmdylio* virescentia occurrit.

Trifolii repentis floras virides saepius observati sunt, quorum *Jaeger** *De CandolU** et *Schimper** icones ederunt In capite de disjunction latius de his mutationibus loquemur.

Bubum calycis foliis petiolatis aculeatis, foliis corollinis viridibus, viridibusque et caudatis carpiis *Spenner* describit.*

Virescentem *Lychnidem silvestrem* et *Alsinen mediam* observavit *A. Braun.*

Reseda lutea et *R. Phyteuma* abnormitatibus inveniuntur huc pertinentibus, de quibus infra.

Dictamnus albus[100] aliquoties occurrit sepalis et petalis viridibus, staminibus viridibus rubescentibusque, antheris liaud dehiscentibus vel in viridia folia tetraptera mutatis; folia pistillaria aperta, plentmque expanse.

Tropaeolum mâtus interdum cum magis minusve perfecta floram virescentia conspicitur.™ *Jaeger* sepala vidit disjuncta, petala viridia, petiolata, spatulata vel peltata; stamina plerumque abolita; ovarium amplificatum apice hians; vel stamina mutata in folia vmdia, hastata, pistilluin autem debilitatum, minimum.

41. *Cruci/erae* saepius floras herbaceos praebent Tab. IV. fig. 3-20 icones partium [36] *Erydmi officinal** exhibent Petala saepe desunt; sepala majora, folia pollinam plerumque magna, viridia, foliis caulinis calycinibusve similia, vel tetraptera' vel paululum tantunt mutata, sed viridia, sine polline; folia pistillaria saepe desiderantur, vel multiphciter transformata sunt' quae infra tractabuntur. *Erydmum chdranthoide,*™ et *E. Barbarea, Alyssun incanum, Peltana alliacea,* et JBvk-u *-a**™?* nee non *Turritis glabra*™ similem in modum abnonnes observati sunt. *Uredim candidd* floras interdum virescunt, quod in *Sisymbno tenuifolio* et *Thlaspi Burvi pastoru* vidi *Betperis matronal** cum floribus plenis herbaceis bic inde in hortis deprehenditur.«*

FloreTvirescentes *Banuneulacearum* non tarn frequentes sunt *Delphinium cravncaule* ammadvertit *Soeyer*™ cum 5 foliis calycinis et 3 pistillaribus petiolatis dentatU, petalis parvis cucullatis, staminibus minus mutatis. *Delphinium Ajaeis* cum plenis floribus viridibus *Weinmann*™ depinxit *AquiUoiae vulgaris* exemplar *Jaeger*™ coluit, cujus folia calycina et corollina (haec calcare destituta) virescebant; folia pistillaria aperta, lobata erant *Anemone nemorosa* postremo nominanda est, in quâ omnia foUa viridia, dissecta, incisa facta erant«» Quod in *Anemone hortenriV*[0] quoque occurrit

3. DISJUNCT*). [37]

42. Disjunctio fTwmiung) cum apostasi antholysis sensu strictissimo est, solutio foUorum, quae in flora unite et conjuncta erant Hie qnoque constat, ut in certis quibusdam casibus id, quod in

[100] Tab. v. fig. l-ia.

[N] MSMK, p«g. 83, fig. 8-10.

"Oi$_W$uiogr»pb.,T»b. XXVTII.6g. 1.

• lfag. *t* PUnn. 18J0, JMU, TWb, V. fig. 87-97. et TaL VI. fig. l-».

" FK Fribnrg., *mg.* 744.

[m] Mtrcbjuid in lUm. Actd. des 8cfamon 1<93, T«g- »*> •t Eywnhaidt In Unnwft, I. pug. 677, cam Tub. VII.

* Richard. GrandriM der Bot.. p«g. 878. Weiniiwnn, Phyt, ic Nro. 758, d. NOT. act. Leop., VoL X. pag- 811, cum tabuli.

'« Bydrapen tot de Nat Wet., II. *j»g.* 226.

»> Rot. Zeitg. 1829, peg. 434.

IN Riishard, GrandriM der Bot, pag. 246.

w» Weinmann, Phyt, ic Nro. 572, a.

M* Enum. Euphorb., pag. 45 in noUL

*» Phyt., ia Nro. 409.

»'• Miwb., pag. 78, fig. 4-7.

"• De Cond. Organogr., Tab. XXXV. Ida Ton Okea, 1818, pag. 1003.

uo Weinm., Phyt., ic Nro. 122, d.

aliis altior gradus esse appareat, inferior sit. Calyces et corollas eleutheromeres (partibus liberis) altioris gradus evolutiones esse habemus, quam gamomeres (partibus connatis), et in plantis, quas summas arbitramur in regno vegetabili, videmus. Attamen hie disjunctionem calycum corollarumque gamomerium metamorphosis retrogradae formationibus adnumerare debemus; apostaseos initium esse, elucebit

a. *Disjunctio Foliorum PistUlarium.*

43. Haec disjunctio in plurimis floribus virescentibus obviam est, sed sola quoque invenitur. Diversos gradus distinguere possumus. 1. Carpia in uno conjuncta ovario separantur, sed singula remanent clausa 2. Ovarium clausum est, interne autem quae antea conjuncta erant sejunguntur, dissepimenta abolescunt. 3. Folia pistillaria frondescunt, disjunguntur, interdum in margine ovula retinent monstrosa, saepe manent stigmate coronata; postremo etiam haec signa functionis prioris evanescunt, et folia plana viridia aut colorata adsunt

44. Magni momenti ovulorum commutatio est, sed hucusque plane praetermiserunt earn, usque amic *C. Schimper* primus accuratissime sagacissimeque cam investigaverit. Embryonis tegumenta, in quae cl. *R. Brown* diligentissime inquisivit, hand clauduntur, uti in normali evolutione fit, sed in foliola convoluta mutautur, ex quibus saepe vestigia embryonis prominent; postremo folium externum planum fit et expansum, et omnia, quae sequuntur, abolescunt, vel [38] interdum rudimenta formâ stipitis remanent; folium ipsum sessile aut funiculo umbilicali suffultum in margine folii pistillaris collocatum est, vel plane coucrescit cum hoc et lobos dentesve efficit. Secundum nonnullas observationes a vero non niultum a)>essc mihi videor contendendo, loco seminum veras evolvi gemmas floriferas vel foliiferas; quam ad evolutioncm transitus apparet in seminibus quarumdam *Liliacearum* interdum in bulbillos conversia

45. Sola disjunctio carpiorum clausorum adest in *malts auranttis* et *citreis,* quae cornuta vocantur; etiam in *Athamantd Cervarid* earn vidi.[111]

Disjunctio interim ovariorum externe clausorum eversis dissepimentis optirao conspicitur in *Stachyis nlvaticae* [m] et *Symphyti offidnalis* floribus virescentibus. Folia pistillaria manifesto duo apparent, et duo constituunt loculamenta, interdum nonnisi unum. Simile quid vidi in *Gilid glommflord*[lu] et *Eryrimo officinali.*™

Aperture ipsa ovarii in *Graminibus* nonnunquam reperitur, ambobus foliis pistillaribus diajunctis auctisque. *Gramina* ejusmodi abnormia saepe vivipara dicuntur, uti omnia, quao virescentid foliorum floralium subfloraliumque commutata sunt Manifestissimam vidi disjunctionem in *PhUo Bohmcri,* nee non in *Phleo pratensi* aliisque.

In cultis *Liliaccis,* praesertiin *Tulijns,* saepius obviam est

Primulam acauUm™ *Siachyem silvaticam,*[1]* *Symphytum officinaU*™ *Schimper* obeer- [39] yavit cum oyariis apertis; qui similem quoque metamorphosin in *Orabanche gracili* invenit In *Anagallulc phoenieed* disjunctionem foliorum pistillarium et in uno hujus plantae floro diruptionem ovarii protradentibus ramulis foliiaque loco ^eminurn evolutis animadvert!."[8]

Diversos disjunction!* gradus et inutotionis ovulorum in *Gilid glameri/ord* Tab. II. fig. 11-13 et 16-18 adspieere licet *Qentiana campestru*[IW] ut *Campanula rapunculoid** » similem in moduui uisjunctae occurrunt

46. *UmbeUi/erii* haec antholysis hand insolita Quam praesertim vidi in *Torili Anthrueo;*[m] folia pistillana aucta sunt, lata, ovulis destituta; vel linearia, canaliculata sunt et in margino pro-

>» TmK V. fig. 17.

[112] Tab. II. «ir. 10 et 17.

[113] Tab. IV. fig. 2.

[114] Spenn. Fl. Frib., pag. 1061.

[m] [u] ag. [f], Pharm. 1830, Jan., Tab. IV. fig. 20-24.

[115] U c. fig. 17 et 19.

[116] T.U. II. fig. W.

[117] Tab. III. fig. 13 et 15.

[118] Tab. V. fig. 1-6.

ferunt embryonum tegumenta expansa in folia et amplificata. Hue etiam *Dancus Carota, Heracleum gphondylium, Angelica sUvestris* referenda.[122]

Trifolium repent cum legumine aperto *Jaeger*™ et egregie *Schimper* depiimt;™ folia ovulorum fiunt pinnae folii pistillaris. *Lathyri latifolii* inentionem facit *De Candolle*™ legumine in folium plauum mutato instructi.

Bosarum carpia interdum aperiuntur, et folia tomentosa- vel vindia, vel partnn rube- [40] scentia fiunt *Amygdala* persica*™ et *Prunus Cerasus*™ saepius in flonbus plenis aperturam et frondescentiam carpioruin numero auctoruui ostendunt.

JXarUhi caryophylli ovarium incipiente diaphysi plerumque apentur; an *Beseddsaepius* idem apparebat; *B. llL* icoues *Schimper* praebef[2]* ovariis amplificatis apertis et ovubs vano modo mutatis. *Dutamnum* et *Tropaeolum* de virescentia disserens jam descnpsi.

Pistilla *Cr^/erarnm* a £ L vidi in *Brassic* oleraee4»>Chsiranthe Ch»n* et *Ery.no ojfi*-rudi*;™ in Ulis siliqua uno latere hiscebat, in hoc auteui folia pistallana disjuncto erant, frondescentia, inte«^ vel ovulis dentata. *JSrydmum Barbarea, Alysmm, tncanuw.* et *PeUana aliacea*™ nee non *Cardamine pratenm *>* siinili modo transformatoe observatae sunt

Paeonia et *Delphinium Ajacis* "» folia pistillaria plana petaloidea ostendunt in flonbus plems. *Delphinium craJauU Boeper*™ describit cum carpiis aperth vmdibus in marguie foholis loco ovulorum instructis. Simile quid in *Aguilegid vulgan Jaeger* ™ observavit

b. *Disjunclio PettUorum Gamomerium.*

47 Haec antholysis forma non frequenter occurrit; quam vidi in *Anagallide* «» vire- [41] scente; in *r^r . ./a h i r* ftnimadvertit Nominantur ab auctonbus *Sdanum tuberosum,*[137] *Co amoena,*[139] *Rhodora Canadensis,*[140] *Azalea periclymena,*[141] postrer *Campanula Medium.*[142]

Dunctio foliorum perigonialium gamomerium in *Convallarid majali* obviam est, plerumque una cum apoetasi et ecblastesi

c *Disjundio Sepalorum Gamomerium.*

48 Disiunctio sepalorum vel sola invenitur, vel juncta cum calycis frondescentia. Hue referri debet disiunctio calycisipigyni ab ovario, cum flos normaliter epigynus fiat hypogynus.

Foemca^noruKsjunctio in *Primuld elation,*™ *Symphyto oJUinali* virescente, *Geninnd camped**™ reperitur; in *Basis* saepius alias abnormibus, ranus 8ola;i« in *Caryophyllm* una cum tas ^Caiyx Buperus fit hypogynus in *Campanvid persidfoli**™ *TorUi Anthrisco,*™ *Athamantd Cervarid,*[1]* *Daueo Carotd*[m] aliisque *UmbeUi/eris.*

«• Mag. f. Phumu J»n. 1880, Tab. VI. fig. 10 aqq-. «* A. Brtun lu Utt.
[135] S b., pag. 82, fig. 9.
[134] f. Pharm. Jan. 1880, Tab. V. fig. 89, 96, et98; Tab. VI. fig. 1-9.
i« Iftro. Ugum., Tab. II. fig. 1-3.
[m] Tab. I. fig. 4-5.
i» Linnaea, V. 175.
» Mag. f. Pharrn. Jan. 1881, Tab. V. fig. 89 aqq.
» TaK IV. fig. 2.
» L. c, fig. 4-20.
[Ul] Rot. Zeitg. 1829, pag. 484.
» Spenner, FL Friboin-. pag. 921. nota.
» Soholti, Nat. d. leb. Pflanie, II. pag. 110.
[104] Enum. Euphorb., pag. 45 ia notA.
i» Missb., pag. 78, fig. 4-7.
l" Tab. I. fig. 9 et 10 ; Tab. II. figa. 1, 6, et 7.
w Bot. Zi'itg. 1829, pag. 714.
in Hopkirk, Flora anotnala. Glaagow, 1817.
i» De Candolle Organogr., Tab. XLII. fig. 5.
W L. c, fig. 2.
i« Hopkirk, 1. c
"» De Caud. Org., Tab. XLII. fig. 1.
i« Weinm., Phyt., ic Nro. S82, e.
M« Tab. I. fig. 1.
"» Tab. III. fig. 1 et 8.
»«• L. c, fig. 9.
"1 Tab. V. fig. 1-8 aqq.
"• L. c, fig. lft-17.
u» Mag. f. Pharm. 1880, Jan., Tab. VI. fig. 10.

II. ANTHOLTSES, QUIBUS FLORIS AXIS NECESSARIO MUTATUR. [42]

1. APOSTASIS.

49. Apostasis foliorum floralium (Auseinanderheben), evolutione interfoliorum in flore nonnali suppressorum effecta, disjunctionis altior gradus dici potest Positione in caule obliquft incipit apostasis; alter folii margo in verticillo ceterorum locum tenet, alter removetur. Distinguere possumus apostasin verticillorum integrorum et apostasin singulorum foliorum; porro apostasin in extends et in internis foliis floralibus. Apostasis singulorum foliorum et quidem exteriorum multo saepius occurrit; haèc folia, caulinis proxima, facilius a flore separantur.

50. Exteriorum foliorum floralium apostasis obviam est in *Convallarid majali* et *Tnlipd Gesneriand* cultis *Anagallidis phoeniceae* calycem totura a corolla, remotum vidi;[140] *Veronica Chamacdrys* apostasi una cum ecblastesi routatur. Integrum calycem singulaque folia calycina apostatica *Schimper* in *Orobanche gracili* observavit *Solarium Lycoptmcum*[m] et *Gentiana campestris*[m] cum unius sepali apostasi nee non ecblastesi inveniuntur. *Torilis Anthrisci* totius calycis et singulorum sepalorum apostasim depinxi Tab. X. fig. 11 et 12, a. *Rosa* saepius profert sepalum in medio tubo calycino. *A. Braun* in *Hyperico* apostasim sepali vidit, nee non in *Hcllcboro foetido* una cum fronJescentia; *Calthae palustris* exempla multa in ejus herbario conspexi cum apostasi vel obliquitate singuli folii perigonialis. Dispersionem omnium sepalorum et [43] apostasim singulorum verticillorum dimerium in *Braced olcracrd* observavi.

51. Apostasis foliorum floralium intemorum saepius obviam est in floribus plenis diaphysim incipiens; inprimis in *Tulipd,* multis *liosaceis, Caryophyllcis, Cruciferis, Hanunculaceis.*[1]** Porro invenitur cum verâ diaphysi ita, ut in novo axe intima folia floralia attollantur; e.g. folia virescentia vel rubescentia ex carpiis staminibusve orta *Rosarum;* in *Get ritalis* exemplo in herbario *socid. not, strut. Senkenbergianae* nonnuUa stamina, quae non mutata esse videntur, in axe continuato collocata sunk Postremo tertius hujus abnormitatis modus is est, qno stamina et pistilla vel pistilla sola in axe elongato evehuntur; illud.in *Geo rivali,*[m] hoc in *Ccr<ui8,*[m] *Dictamno*[m] et *Cardamine*™ obeervatum est

2. DIAPHY81&

52. Diaphysis (Durchwachsung) continuatione «xis floralis per florem efficitur, elongatione pedunculi, qui receptaculo terminatus erat, et novorum organorutn in eo procreatione. Cum ecblastesi coufundebatur diaphysis, quamvis jam *Oöthe* in libello de plantarum metamorphosi eas stricte distinxisset nominibus *Durchwuchs* et *UcberwucJis.*

Diaphysis triplici modo fieri potest 1. Intimao floris partes mutatae attolluntur apostasi, amplificantur, novo iutegumento involvuntur et postremo plus minusve perfectos [44] flores secundarios exhibent. Id quod obviam est in *Lilinceis, Borneo*, CaryophylUu, Cruetferis, Sanunculaceis,* 2. Folia pistillaria aperiuntur et cjilycis loco circumdant novum florem, qui petalis imperfectis tantum et convolutis si^niKcatur, vel plane excultus perficitur; in *Eo$aceis, CaryvpkyUcii, Rutaeeis.* 3. Ultiinus idemque perfectissimus diaphysis gradus is est, quo in caulis fine intra folia pistillaria oritur nova gemma, ex qu&> cum axis elongetur, ramus foliosus vel inflorescentia vel flos evolvitnr. Quod iuvenieUnt in *Polygoneis, Penonatis, Labiatu, Atjxrifolii*, Gtntianeis, ComposUis, Umbeili/cris, Jfaaceis, Caryophylleis, Rutaccis, Cruci/erU, RanuneulaerU*

Flos secundarius saepe iterum antholyticus cat, praesortim novi luborat diaphysl

63. In *Pkleo pratenti* iuter disjuncU folia pUtillaria |ierfectum culmuin exire vidi Primus et

"•Tib. II. flg. 6et 7.
«« Iinnac^ I. 458.
[m] TtK I. ft*, l.
[m] J^tr, Mi^Uia., f*g. 132 iqq.

a>t. Zritg. 1831. |«K. 280.
LintiM, V. f*g. 175.
L. e., I. pM(. 584.
Hpennrr, Fl. Frih.,)««. *921* in ttrtl.

secundus diaphysis modus occurrit in *Tulipd;*™ in *Bumiee arifolio*™ singuli florea, in *Anagallide phomiced*™ foliosi rami, in *Orobanche graeUi (Sehimper)* racemi laete florentes procreverunt ex floribus primariis. In *Staehye silvaticd*[1]*[1] *Sehimper* novos florea, iterum diaphytos. in *Symphyto officinali*[m] autem totas inflorescentias ex florum viridium disjunctis foliis pistillaribus provenisse vidit; nee non de *Qmtland acauli* loquens, ex cujus floribus virescentibua turionea foliosi protrudebantur, iteruin ad eundem certissimum auctorem et diligenthsimum sagacissi- [45] mumque observatoreni provocandum mihi est.[168]

In *Hierado fallace* ramulum dense foliosuin ex fructu maturescente evolutum vidi™ Diaphysin *Cirsii tritepkalodis Camni »* describit; stigmata styli viridis, foliacea ut bracteae calathidem novam includebant; nee minus ipse vidi in *CalmMd* et *Senecwm* ex singulo flosculo totum receptaculum, flosculonnn vestigiis notatum, evehi.[186]

54. Nonnullae *Umbelliferae* diaphysi mutantur; *Athamanta Cervana*™ et *Daucus Carota* sine ali& floris abnormitate; *Tvrilis Anthriteus*™ autem cum virescentia, in illis singuli flores, in Me plerumque umbeUulae vel umbellae oriuntur. In *Medicagim lupulvnd* inter tria floris primarii carpia secundarium inveni.

* *Bosaceae* multas multiplicesque diaphyses praebent In ips& *Rosd* ex tubi catycini^ fundo emergit stipes petala, nonnuUa stamina et viridia ex carpiis orta folia proferens;^ vel tubus calycinus evTnescit et axis cum foliis ex staminibus carpiisque ortis elongatur, quae supra in novum coliguntur florem;"0 vel caulis novum florem completum profert, vel folia vegetationis pinnata, pluresque interdum flores; omnes antholysis fonnae adhuc perlustratoe una inveniiintur. Singu- Lrabnormitatem *Botarum* hie nominate tantum, cum infra latius desenbatur; alabastra nempe ad internum tubi calycini marginem orta» id quod diaphysis did non potest, quippa [46] quae semper centralis est, ad quam autem fig. 7 transitum ostendere videtur. In *Amygdah periled* diaphysis ita fit, ut ex carpus numero auctis calyx novi floris formetur; smnlia in *Amygdala ZnUli* et iW *Cera«>*™ observantur, sed flos secundanus ibi sessilis fflc pedunculo squamoso elatus est *Fyra* quoque, ex quibus novi flores et fructus gignuntur,^ hie nominanda sunt. *Zvbi* diaphysin *SpeLr* ™^xponit, et in *Oeo rivali* ea saepius reperitur;» folia flons pnmarn calycina saepe frondescunt et in flore secundario petalis mutatis supplentur.

65. Inter *CaryophylUas* diaphysis inprimis in *Durnth) caryophyllo* culto occurrit; interdum oriuntur in ovariis inapertis nov& alabastra,^ vel ovarium apertum constituit novi floris calycem, vel prorsus novus flos oritur,^ et nonnunquam tertius flos ex secundo procrescit In *SUeru*™ et *Lychnide Flore cuculi*™ diaphysis invenitur. Cujus vestigia interdum in *CaryophylUarum* floribus plenissimis adsunt

Diaphysin ter quaterque xepetitam *Besedae Ivieae* describit *Schtmper*™ onentem antequam ovarium aperiatur.

Omnes diaphysis modos supra commemoratos *EyaenJuirdt* in *Dutamru> aJbo* obser- [47] vavit[m]

» JUger, Mlasbild., pag. 180. Linnaea, I. 595.
[m] Bot. Zeitg. 18i9, pag. 440.
"• Tab. II. fig. 7.
» Mag. f. Phann. 1880, Jan., Tab. IV. fig. 25-28.
[m] L. c, fig. 17 et 19.
[16S] Bot Zeitg. 1829, pag. 440.
»* Tab. V. fig. 24.
[Iai] Joura. de Phya., Tom. LXXXIX. pag. 401.
»« Tab. V. fig. 26-28.
»« L. c.[f] fig. lft-20.
»« L. c, fig. 18.
» Tab. III. fig. 2.
[m] L. c, fig. 4-7.
in Jäger, Missbild., pag. 152.
u* Bonnet, Recherches anr l'nMge dea feuillea 1754, Mém. IV. PI. XXVI. fig. 1-2.
>w Fl. Frib., pag. 744.
«» Breynii, Exot. cent I. Tab. LX. Hill, Prolif. Flowers, Tab. IV. Bot Zeitg. 1881, pag. 280, etc. Ipse quoque earn saepius vidi.
i* Bot. Zeitg. 1829, p. 487.
in JaKw, Miwbild., pag. 144. Weirnn., Phyt ic, Nro. 886, etc. Hill, Prolif. Flowers, Tab. VI.
in Weinm., Phyt. ic, Nro. 680, d.
m Jäger, Miasbild., pag. 142.
W Bot. Zeitg. 1829, pag. 488.
i" Linnaea, I. pag. 584.

Cntei/erae duas hujus metamorphosis .rationes praebent; alteram videmus in floribus plenis *Siliquosarum ;* in axe elongato incompleti flores proveniunt, petaloruin coronae interdum nonnullis staminibus praeditae.[182] Altera ratio in floribus virescentibus obviam est, nonnisi inflorescentiae evadunt, nunquam singulos flores observavi. In *Erysimo qfficinali*[is]* totum hujus antholysis progressum vidi. In fundo pistilli clausi sed amplificati nova folia procreantur, quae serius majora facta dirumpunt tegumenta; vel folia pistillaria prius disjunguntur et folia nova laete excrescunt; alias folia pistillaria in novo axe tolluntur quasi cotyledones inflorescentiae inter ea enatae. Praeterea in *Erysimo clieirantlwvle*™ *E. barbared, Alysso incano* et *Pdtarid alliaced*[186] talem mutationem inveneruut perscrutatores. In *Brassicd Napo* ex flore minus abuormi, solo pistillo carente, racemum florum normalium provenisse vidi.

Inter *Ranunculaccas* in cultaruin *Calthae palustris* et *Ranunculi acris,*[196] *R. asiatici* et *Anemones hortends*[1]*[1] floribus plenis plus minusve perfecta diaphysis reperitur; praeterea in *Anemones ranunculoidis* exemplo in Tauno monte ab humanissimo *J. Becker* collecto[M] completum florem secundarium conspicere licet

3. ECBLASTESIS. [48]

56. Gemmarum apparitio intra florem, in axillis folionim floralium, quae proliferatio proprie sic dicta est (Sprosszeugung), hie autem propter hujus noininis confusionem ecblastesis (Aussprossen) nominatur, suinmus antholysis pradus est Folia floralia in hâc antholysi minus ad propagationem per seinina respiciunt, sed ratione folionim vegetationis gemmas proferunt. £x his geniinis evolvuntur vel flores vel iuflorescentiae vel rami foliosi.

a. *Ecblaslcsis Foliar urn Calycinurum.*

57. Folia calycina? vegetationis foliis maxirne aflinia, aaope iis gemmarum qnoqiio procreationo similia fiunt; et in omnibus formis folionim calycinoruin ceterum normalibus, et in abnormibus, virescentibus, disjunctis, apostaticis oliservare licet ccblastesin.

Exempla profero *Rumicem obtutifolium*;** *Vertmicam Chamedrycm (A. Braun),* ex cujun singulis floribus totus evolvebatar racemus; *Solanum Lycapersicum*;*™ *Gcntianam eampestrem*[m] *Campanulam rapuncnloulem.*[m]

Varios ecblastesis modos *UmbeUiferae* praebent, quorum nonnulli in Tab. V. depicti suut In *AthamarUd Cervarid*[1W] flos praeterea vix mutatus est, notmisi scpala quaedam intordum aucta sunt, interdum simul hypogyna. Similia observavi in *Dauco Caroid, Bu^curo falcalo, Torili Anthrisco* et *Schimper*[m] in *Apia gravcolentc, Pastinacd ofirinali, HcracUo Rphnndylio,* [40] *Angdicd silvestri.* In virescentibus *Torili* Anthrùvi* floribus plerumque totne umhrilae ex sepalorum axillis procreantur; folia pollinaria simul diminuuntur et sacpe alxilescunt[191]

Inter *hyumintms Srhimprr*[I]™ saepius invenit ocblasU»sin folinrum calycincmim c. g. in *Mdiloto kuctinthd, Coronilld varid, Mnliaujin* sntivd* tt *lupulind,* in qua idem i|«e qucique vidL

Caryophyllcae haml mro in axillis sc|Kiloriiiii fn>iiili-sii-ntiiiiii *vl* apwtatironiiu ramoe pignunt ratione lllms *Umtinwu* minillimsl. KxiMiipla vidiTimt *Alex. limnn*% *Mùmjrr*™ muinulla i[quoc^e in *Aramria trincrvid, Ayrottanuid UUhaginc, Lyrhnule Flore ntntli, L silccsln, Sttlland*

[182] Jager, MIMIIIM., PR«. 135, fig. 21.
[183] Cf. T«b. IV. f$_K$. 5. (J:17.
[184] Bydragen tot i|r N«t. Wrtmvh., II. *Jmg.* 226.
[185] Schimper in IW.t. *Irix** 1S'J9V |M^. 434.
[187] Jager, Mtmbild, pag. 133.
[187] Hill, Pn.Iir. FloiurH, T«b I.-III.
[188] T«h. I. fitf. 2.
[189] Schimper in .|.r 1'»t. Z. its H29, |»g 421.
[190] Linnaea, Tom. I. |«£. 4SH.
[191] Tab. I. ft$_K$. I.
[192] Tab. III. ft*. 1%-1<V
[193] *T*U.* V. fije. 11-17, rt 21.
[194] Il»t. 7^itK. IH'H>, |«$_g$ is;..
[195] Tab. V. hg. 12.
[196] Bot Zeitg. 1829, pag. 621.
[197] L. c.

glaucd, compluribus *Silenis* et *GypsophUis.* Plane alia est ecblastesis in *Diantho caryophyllo* hortorum, ex floribus plenis procreantur intra calycein minus mutatum flores secundarii interdum longe pedunculati.[198]

In *Besedd luted*[m] compluries commemorate ex axillis quoque sepalorum flores procrescunt.

Crudferas saepius cum gemmis sepalorum non mutatorum vel apostaticorum axillaribus vidi, e.g. *Brassicam oleraceam*™ *Erysimum officinale, Cheiranthum Chciri; De Candolle* describit[201] *Cardaminen hirsutani,* quae verisimiliter cum *Brassicd* in Tab. IV. fig. 1 delineata congruit. [50]

In *Cleome*™ *Aconito*[m] *Delphinio*[70]* saepius ecblastesis foliorum calycinorum observata est

b. *Ecblastesis Foliorum Perigonialium.*

58. Flores axillares ex foliis perigonium constituentibus rariores inveniuntur. Sola, quae afferre mihi licet, exempla sunt *Convallaria majalis,* ubi occurrit cum disjunction et apostasi, et *ByacirUhus botryoides,* cujus formas speciosissimas *Alex. Braun* prope Monachiam legit; perigonium initio non disjunctum in involucri modum flores cingebat secundarios ex axillis protnisos, folia genitalia evanuerant, tandem elongabatur axis, folia perigonialia disjungebantur, et ut bracteae coeruleae ad basin cujusque pedunculi secundarii collocabantur; turn scapus in racemum terminabatur compositum.

Ex Dicotyledoneis *Caltha palustris*™ et plures *Clematides*** hie nominandae sunt

c *Ecblastesis Foliorum Corollinorum.* [51]

59. A pluribus raemoratur auctoribus; in virescentibus *Tropaeoli majoris* floribus *Jaeger* et *Nees von Escnbcck*™ invenerunt gemmas axillares petalorum; quas in *Brassicd Napo* diaphyta *Schimper* vidit; et de eadem antholysi in *Erysimo cheirantJwide* loquitur *Courtois***

d. *Ecblastesis Foliorum Pollinarium.*

60. Ipse nee hunc nee modo dictum proliferationis modum observavi; ni autein fallor, *Schimper* eum iu *Brassicd Napo* illft invenit In scriptis vero semel tantum de h&c ecblastesi mentio fit; *De Candolle*** enim narrat, *Choisy* Genevae reperisse in horto botanico *Rosas,* quae ad internum tubi calycini raarginem protulerint alabastra in axillis foliorum pollinarium. Omnia autem congruunt indicando, hanc observationem similem ease illi, de qu& statim loquar, nee hue pertinere.

e. *Ecblastesis Foliorum PistUlarittm.*

61. Folia pistillaria texturft jam foliis calycinis magis sunt affinia, et facilius talem in modum in generationis actioue mutari videntur, ut in axillis, loco marginum, prolem proferant Id quod *Eystnkardt*[m] invenit in *Didamno albo,* nee non ipse vidi in *Brassicd oUraced.*™

[m] Goth*, Metam. d. Pflaozen, § 105.
[m] Rot Zeitg. 1829, pug. 489.
" Tab. IV. fig. let 2.
I TWorio llofncntairo, pag. 122. Quae do explicand& floris Cruciferarum BtructurA De Candolle ibi colligit, minime rei naturae congniunt, flores tecundarii certo non procreicebant loco ataminum breviorom aed ex axillis aepalonim exteriorum; praeterea haec Cardamine, uti nonnallae alias Cruciferae aaepo tetraDdra ocenrrit. Quam roazime Uli ezplicatione et ea floris Aconiti (8choltz, Nat. d. lebend. Pflanze, II. pag. 114) ct floris papUionacci (Datrochet in Archiv. g^n. de MtSdccine, Juillet 1881) grandia noatri Q 51h i i, qui adhuc usque varias scif ntiae diadplinaa alto sao ingenio illuatrat, aententia probatur, qnft metamorphosis doctrinnm nnper mnltos qnidem assecutarn ease dicit asseclaa, sed multiplicity etiam perperam intelligi, et snpra modum fincaqiie extendi (Metam. d. Pfl. mit gpflcbichtl. Nacht Stuttg. 1831).
»» Bot Zeit^. 1829, png. 421.
» L c. et Schultz, Nat. d. leb. Pfl., II. pag. 114.
»* A. Braun in litt.
[105] Linnafft, L 458. Spenner, F1. Frib,, pag. 1080.
W Bot. Zeitg. 1829, pag. 421.
*" Nov. Act Leop., VoL XIII. pag. 811'.
** Bydragen tot de Nat. Wetensch., Deel II. pag. 226.
** Organographie, I. pag. 487.
"o Linnaea, I. pag. 684.
«» Tab. IV. fig. 2.

Hie quoque illae *Rosae*[m] commemorandae sint, quae, diaphysi sane propinquae, ecblastesi tamen ortae esse videntur. Ad internam tubi calycini superficiem (in receptaculo excavato) vel in margine hujus tubi intra frondescentia minusve mutata, solum sterilia carpia obviam sunt alabastra plus minusve completa; quae, ut magis evolvantur (uti fig. 7 ostendit), fieri potest Non plane intelligo rationem hujus abaormitatis, ipsam autem esse haud dubitandam certum est [52j

Adduntur quaedam de Inflorescentiis Antholysi Oriundis..

62. De evolutione inflorescentiarum haud locuturus sum, solum de ortu integrarum inflorescentiarum ex singulorum florum solutione, de processu hujus evolutionis et de discriminibus inflorescentiarum inde elucentibus.

Inflorescentiae plerumque solâ ecblastesi *{HyadrUhus, Convallaria, Brassica,* Tab. IV. fig. 2) ex floribus oriuntur; quae diaphysi evolvuntur paene liberae sunt a floribus primariis *(Erysimum,* Tab. IV. fig. 6-7); sed etiam ecblastesi cum diaphysi fieri possuut inflorescentiae *(Athamania,* Tab. V. fig. 21, *Medicago).* Plurimae inter has inflorescentias racemosae[318] sunt sive cen tripe tales sive tales, quae legibus de cujusvis gemmae et ranii et floris evolutione communibus obtemperant, et extrinsecus introrsum sive ab imo ad summum evolvuntur. Inflorescentiae cymosoe sive ceutrifugales turn solum fieri possunt, si flos primarius (vel secundarius diaphysi ortus) plus minusve completus remanet, ut inflorescentiae centrum referre possit *(Gentiana,* Tab. I. fig. 1, *Caryophylleae* multae, nee non certo quodam sensu *Convolmdus,* Tab. I. fig. 3), si igitur pauca tantuin folia floralia et quidem calycina ax ilia res proferunt florcs (quod sane fit in normali horum foliorum successione centripetali) interdum eundem in modum nmtatos, nee flos primarius plane tollitur. [53]

Praeter exempla modo nominata ex plantis prius descriptis complura hue pertinent

COMBINATIONS ANTHOLYSI U1L

63. Postquam brevissime in antholysium forraas inquisivimus, iterum dicendum est, omnes, quas distinguimus, formas ejusdem tantum processus significationem esse, metamorphosis nempo retrogradae in flore apparentis; frequenter igitur, interdum etiam necessarie, conjunctas invenirl Quam oonjunctionem vocamus *eombinationem,* si unicum efficit adspectum, *complicationan,* si plures antholysis formae in diversis floris organis et sine necessario connexu apparent Saepe vero combinationem et complicationem accurate distinguere nequimus, ambas igitur coojunctos percensebimus.

1. COMBIKATIONES ANTHOLT8IUM CUM AUI8 FLOWS ABN0BMITATIBU8.

64 1. Combinatio cum metamorphosi abnormi progrediente saepius occurrit; certum aliquod organon medium et quasi centrale constituitur, cui quae antecedunt, metaiuorphosi progrediente, rotrogradi autem quae sequuntur similia fiunt; ita interdum corolla se habet, a g. in *Primuld elatiore, Drasxicd Napo, Mud nmd.* Modo contrario alia folia calycina petaloidea fiuut, alia frondescentia,[114] vel pctala in sepala, stamina vero mutantur in carpia,[115] etc

2. Combinationes cum formationibus impeditis frequentes sunt, quod supra expoeuimus; inprimis regrcssus, sed apostasis*[16] quoque nee non diaphysis*[7] et ecblastesis*[1'] una cum illis inveuiuntur. [541

«* Tab. III. fig. 4-7.
»• R/>p«r, *de* Inflorr^ntiù in UnoaeA, I.t ptg. 4S3.
«H ROM, Tab. III. fig. 3.
•» Pyrua Malna. cf. supra, 33.
[00] Lilium cmndi<lam; vide hoc nti exempU afqnentia infer formaUoiM* impeditai.

«[7] Rrabinam eolntnbaria UK anr, 8enkrt»K
«• Gunpanula, Tah. III. fig. 13 M 16, Ifjrarlntlioa itmua. Hirraciam faUax, Curaopak.lmikafolb, PUntago, Dianthna, rtr.

2. COMBINATIONES A^THOLTSIUM INTER 8£ IPSAS.

65. 1. *Begressus* foliorum floralium saepe per complures verticillos invenitur, ita ut regressua foliorum unius verticilli regressum sequentium excitet[219] In universum regressus in plurimis aliis antholysis formis obviam est, quae conjunctio tarn arcta, saepe quoque tarn necessaria eat, ut vix combinationem appellare possimus.

2. *Virescentia* saepe cum disjunctione[m] invenitur, rarius etiam cum apostasi,[221] frequenter autem cum diaphysi[222] et ecblastesi,[328] ad quas metamorphoses inprimis flores virescentes inclinant.

3. *Disjunctio* saepe virescentiam sequitur, saepe quoque apostasim[m] antecedit; minus arete consociata cum ecblastesi*" et diaphysi[228] invenitur disjunctio verticillorum exter- [55] norum; necessario autem cum disjunctione ecblastesis foliorum pistillarium[287] occurrit, nee non in diaphysi axis elongatus plerumque procrescit per folia pistillaria disjuncta,[228] nisi ovarium prorsus deletum sit

4 *Apo8tasi8* praeter eas, quas jam dixi combinationes saepe cum diaphysi[239] et ecblastesi[980] reperitur; foliorum externorum apostasis cum ilia, interiorum autem cum *hie*

5. *Diaphysis* cum his antholysibus jam nominata est; cum ecblastesi interdum observatur, quibus conjunctis luxuriosissime flores protruduntur secundarii et unibellulas, capitula, etc. formant[281]

6. *Ecblastexi** combinationes modo expositae- sunt; frequentissimae sunt cum virescentift, disjunctione et apostasi

CAUSAE ANTHOLYSIS.

66. Antholysis, quamvis in singulis floris organis obviam sit, totum tamen laedit florem; de loco igitur loquentes, quo antholysis occurrit* non oigana singula floris, sed locum in plantA, ubi flos sedet antholyticus, intelligimus; et *localem* s. *topicam* s. *solitariam* vocamus antholysim in singulo plaucisve plantae floribus obviam; vel omnes plurimive flores morbosi sunt, turn antholysis est *qriphytica.*TM

Plantae antholyticos proferentes flores, quas ipsas brevi antholyticas appellare possumus, [56] 8olitariae occurrunt, antholysis turn *sporadica* dicenda est; vel in certis quibusdam locis, quo antholyses *enchoricae*** fiunt* vel tandem in quibusdam annis, annique temporibus sunt frequentiores, turn dici possunt antholyses *enchronicae.*

67. Proclives praesertim sunt ad antholysim plantae structuiA magls evolutdet typo magis composito praeditae; antholyses igitur frequentiores in Dicotyledoneis.

Maxima autem ad antholysim propensio est floribus, qui primi inflorescentiae terminalis (axis primarii) evolvuntur, quo igitur plants* hue usque sola folia vegetationis ramosque proferens, continuo transit in florum formationem; qui *locus* appellari potest *criticus* s. *regio critica* s. ad significationem magis peculiarem *anthocritica.*[M] In inflorescentiis cymosis, inprimis dichotomis, in hoc

** CamptnuU, Tab. III. fig. 9 et 10; nimUe exemplar amlc. Dr. 0. Varrentrapp prope Briickeuau invenit.

[m] Roaa, Anagallia, Tab. I. fig. 9etlO; Torilis Anthriacaa, Tab. V. fig. 1 aqq.

[m] AnagaUia, Tab. II. fig. 6; Torilia, Tab. V. fig. 11.

» Eryiimnm, Tab. IV. fig. 6 et 7.

** Torilia, Tab. V. fig. 12.

[m] Gentiana, Tab. I. fig. 1; Convallaria, etc

«• Eadem ezempla; Oaryophylleae.

"•Boaa, AnagaUia, etc

[m] Biaiaica, Tab. IV. «g. 2.

[m] Eryrinmm, TWb. IV. fig. 6 et 7, eta

[m] Idem ezemplnm refero; Dictamnam, etc

** Garyophylleae, Gentiana, etc

*» Atbamanta, Tab. V. fig. 21, Medicago, etc

** In modum verbi epidemicna formatom Yocatakm, *M roO ifnrroO.*

[m] Molina qnam endemieae, qnod Tocabnlnm, nti epidemiena cam aolis bominibna bominumque morbis convenit Encboricna, qnod ipatio, enebroniena autem, qnod tempora cirenmacriptnm eat, exprimit

«* A. Brann in lift. lam Gtttbe hone tranaitnm, bano crisim cognovit, nti ex tractate aaepina landato elncet, nee non in cannine die Metamorpboae der Pflansen inacripto dicit: Urn die Aobae g^lr^angt, entaoheidet der bergende Kelcb rich.

loco critico flos centralis primarius positus est; in racemosis autera infimi flores racemi terminalis; et in his ipsis floribus antholyses solitariae occurrunt, nisi aliis causis efficiuntur. Exempla antholysiuni in floribus centralibus praebeut *Solaneac, Asperifoliae, Gentianeae, Caryophylleae, Ifypcricum ;* in infimis extreciisve floribus inflorentiarum racemosarum inveniuntur in *Humice, Personatis, Zeguminosis, Crucifcris, Clcomis, Aconito,* etc.

68. Causae externae praedisponentes, sod aeque ac modo dictae etiaui antbolyses ipsas efficients sunt, 1. certi quidam auni anuique tempora tempestate huraidâ tepidâque, quae praesertim vegetationis organis favet; hie annus 1831 talis est nee non an. 1829 multique alii; ex iisdem causis antholyses vere et autumno saepe frequentes sunt 2. Locales nonnullae causae in plantas quarundam region urn agunt, ut antholyticae fiant; prope Heidelbergam e. g. *Arenaria trinervia,* prope Monachiam *Hyacinthus hotryoides* antholyticus enchorice crescunt; nee non ipse circum Wirceburgam multas antliolyses vidi, quas hie, Francofurti, iucassuin quaero, quamvis plantae, in quibus obviam erant, sint vulgares, e. g. *Erysimum officinale.* [57]

69. Causae internae efficientes partim jam inter praedisponentes tractatae sunt, e. g. praesertim locus criticus. Magni praeterea momenti est hereditas, sed solae antholyses epiphyticae hereditariae esse possunt. Hereditas est, cum plantae lignosae quoque anno similes antholyses proferant; quod saepissime occurrit, immo raro tantum mutantur in statum normalera. Siinilem tenacitatem in abnormitatibus seinel excultis observamus in plantis perennibus; eundemque in modum quaeque propagationis ratio se habet, quâ exemplar solum, non species multiplicatur. Propagatio antholysium per semina in his aeque ac in plantis annuis interdum, multo autem rarius occurrit; sane in talibus tantum, quas semina maturare abnormitas sinit.

Inter iuternas antholysis causas porro a mult is scriptoribus ** pistilli metamorphosis uti dicunt *virtualis (virtuelle Metamorjyhose)* nuncupatur ; de quâ, seminura nempe abortu, dicendum est (praeter id quod ipsa jam abnormitas sit, et aliam, quam non explicaverint, causam habeat), eam esse sequelam nee causam antholysis; pistillum enim serius forniatum baud in organa prius evoluta talem in modum agere potest; ex alterft parte omnes quoque contra loquuntur observationes. [58]

70. Externae antholysis causae efficientes multae sunt, plurimae autem minus perscrutatae. Plerumque nutrimenta copiosa, solum pingne, bumiditas et tepor lumine abeente, nee non frequens transplantatio indicantur. Alia causa est vulneratio per insecta et mutilatio; praesertim inutilatio inflorescentiae racemosae, cujus flores turn supremi succo adfluente facile antholytici fiunt Etiain *Uredincs,* flori, interdum etiain vegetationis organis enatae, antholysim excitant

DE IIS, QUAE EX ANTHOLYSIUM PERSCRUTATIONE COLLIGI POSSUNT.

71. Animuin in antbolyses advertere maxirai momenti est ad indagandum vitae vegetabilis processum ; omnia autem, quae inde sequuntur, explicaro haud* meura est, nee hujus libolli ratione nee viribus meis permittitur. Pauca tantum afferam.

In universum antholysis physiologiae plantarum inaximi roomenti est; nobis demonstrate vitam vegetabilem ab initio tendere in florem, et ejusmodi constitui evolutionis plantae processum et definiri; cum hie nisus, contendendo cum evolutione singula sola spectante organa, postremo vincat unitatemque et harmoniam minus perfecte in inflorescontiû optinie autem et pulcherrime in flore assequatur et teneat, vel, disjunctivo illo studio singular florem fonnatuin (antbolysi) solvente, ad majorem saepe splendorem lai^ioremque florum formationcm progrediatur. [69]

72. Magis in singnla inquirentibus antholysis egre^ne jiatefacit metamorphosis mysteria, venun enim et ipsam commututionem onteudit, et iuanifestiHsime dutuonstmt, eadem csse Dec prorsus

[m] Ja^rr, MiMif>iM.(jwj? . Ill rt tlii« lnri«; Link, Rlmi. philns. bot., *fm&* 179; Hr.

diyersa organa oinnia plantaruin; docet, quam inane sit multorum botanicorum omnia, quae vel minimum discrimeu praebeant, discernendi studium, cum indicet vanas esse tales differentias, et termonomaniam hanc (monomania appellari possit, monomania quae in infinitain multitudinem discerptionemque tendit) accuratiori indagationi nocere, earaque impedire, nee non ipsi botanicae describenti plus daniui afferre quam utilitatis. Quo autem minime dicimus, omnes esse delendas differentias, immo, dum cuncta folia ejusdem rationis organa esse cognoscimus, distinguimus gradus ab ipsa n&tuńl evolutione saltuatim progredieute effectos et mauifestatos.

73. Antholysis igitur praesertim foliaceam omnium organorum vegetabilium naturam palam facit. Involucra, calyces, corollas, quas monophylla, monosepalos, monopetalas dixerant, gamorneria esse docet, i. e. ex multis constituta foliis conjunctis, quae ne ejusdem quidem sint di^nitatis (vide 77). Singula harum partium gamomerium folia distiuguere et cognoscere docet, quaiflvis sint occulta; osteudit, ut unum tantum sed mirabile afferam exemplum, partes, quas *Linn£* in *EuphorUis* vocaverat folia corollina, nonnisi glandulas esse marginales foliorum involucralium, quarum binae in rotundas vel lunatas partes commissurales sint connexae, cum foliorum summae partes in minimas contrahantur lacinias, iuferiores autem efformeut tubum sic [601 dictum calycinum (cf. 83).

74. Stamina esse folia ex antholysis studio luculenter apparet; nee non in lucem ponitur antherarum formatio; foliis enim constituuntur convolutis et efformantibus infundibulum, cujus oris anguli deprimuntur, cum commissure, marginum cum costa folii medianS, concrescat, et efficiunt rimas thecarum; pollen autem in superficie folii intern§, secernitur.[286] Quae *R Brown* de structure staminum dixit, haud multum absunt ab h&c setitentifi, quam debemus perscrutationibus novissimis *A. Braun.* Quam autem *Beeper* in *Enunieratione Euphorbiarum* (pag. 46 in not&) protulit opiuionem, stamina esse inflata folia, parencliymate in pollen mutato, antholysis certe non confirmare videtur.

75. Pistillorum rationem antholysis non minus patefacit. Demonstrat unum *(Leguminosae)* vel plura folia *(Papaveraceae)* hie involuta et connata esse, facie superiore introrsum versa, et clausam cavitatem, saepe in plura loculamenta divisam, efformare; et in suturis commissuras plerumque tumescentes, quas vocant placentas, efficere, ex quibus novae formatioues, ovula nempe, procreentur.

Discimus fructuum dehiscentium (a g. capsularum) folia plerumque non in margine sejun<u ad dispergenda semina, sed saepius ad costam medianam, quae in evolutionis processu a marginibus conjunctis dignitate et gravitate superabatur; valvas igitur fructuum non siugulis foliis pistillaribus, sed binis dimidiis foliis constituL

Cognoscimus dissepimenta effici foliorum pistillarium partibus plerumque marginalibus, [61] qnae nunc in medio ovario placentas constituunt diversas (e. g. *Solaneae)* vel in unam (placentam centralem) connatas (e. g. *Caryophylleae)*; nunc autem ad internam ovarii superficiem placentas formantes in medium extenduntur et ita septa effingunt *(Grudferae).* Sunt autem plantae *(Ldbiatae* et *Asperifoliae),* in quibus non solum per dissepimenta separatio, sed perfecta quoque divisio perficiatur medio folio constricto, quae formatio antholysi solvitur, et in vera oculisque manifesta disponitur folia pistillaria.

Simili ratione antholysis certiores nos facit de natuiA seminum sic dictorum nudorum, quae dimidio *(Labiatae, Aiperifoliae)* vel uno (multae *Bosaceae, Banunculaccae),* saepe quoque duobus *(Gramineae, Compositae)* includuntur foliis pistillaribus.

76. Denique in obscuram ovulorum naturam nos inspicere sinit antholysis. Ovula apparent gemmae altioris gradus, quae ut evolvanturjaola fecundatione polline effect^ fieri potest, Ovulorum tegumenta folia sunt, funiculus autem umbilicalis axis, qui evolutione inverse, extroraum nempe directA (in floribus virescentibus), reverd in modum caulis foliorumque viridium commutantur (cf. 44).

77. Antholysis porro successionera foliorum cognoscere nos docet Veros verticillos i. c. tales,

JT ** Bmnn ta Utt_ Cf_ Tab_ v_ ft«- [10]- Spcramus fore ut plura do spoctatissimA hAc dotoctione ejui auctor mox in puDlicum prodat.

quorum partcs s. folia ejusdcm dignitatis, simul orta, eundemque in modum evoluta sint, nusquam inveniri ostendit; ctiam in illis, in quibus ne aestivatio quidein certiores nos facere possit (aestivatio inprimis valvata, contorta, aliae), in quibus vel connatae sint partes, folia non simul, sed in certû quâdani formata esse successione; quin aestivationem interdum in falsam nos ducere [62] viam confirmat; e. g. lateralia *Crucifcrarum* sepala, quae cum facilius regressu, apostasi et ecblastcsi mutentur, inferiora sunt et priora, in aestivatione interiora videntur. Complura alia hujusmodi exerapla inveniuntur.

Praeterea ex antholysi discimus successionem vcrticillorum; diversorum enim graduum folia plerumque non eâdem ratione neque in eodem ordine collocantur; sed in successione et ordine non minus ac in fornuî et evolutione foliorum per distinctiores procedit natura gradus.[287]

78. Pauca quaedam de antholysis diguitate dixi; sed et ad universam biologiam atque physiologiaui maximi esse potest momenti, et multorum peculiarium organorum naturam explicandi nobis praebet facultatem. Quae autein indagationcs, cum illae in philosophiani, bae vero in organographiam magis quam in doctrinam de abnornritatibus has ipsas contemplantem pertiueant, liic nimis lomje nos abducerent.

APPENDIX. [63]

LYSIS INFLORESCENTIARUM, AXTriESMOLYSIS.

79. Inflorcsccntiae (anthesmi, *ávdecpoX)* iutegrum quoddam ct unum esso apparent, ct saepe simillimae sunt ipsis lloribus ; ita ut *Compositarum* capitula nominata sunt flores compositi, nee uon adhuc *Euphorbiaruvi* inflorescеiitios nonuulli putant esse (lores simplices. Vel magis in abnormitatibus inflorescentiarum similitudo elucet; et anthesmolysim cum antholysi mutatis mutandis prorsus fere congruentem distinguimus.

I. METAMORPHOSIS RKTROCRADA FOLIORUM SUBFLORALIUM VEL SINGULORUM FLORUM, CUI CEKTUS (JU1DAM AD INFLORESCENT1AM EST RESPECTUS.

1. MLTATIO FLOKUM CENTRALISM IN FORMAS FLORIBUS PERIPHERICI8 SIMILES.

80. Haec metamorphosis plerumque amplificationem, sacpo quoque irregularitatem corollae efficit, quarura sequelam, internorum vcrticillorum commutationcm, jam supm (19) descripsimus. Exemplo sunt *Viburnum Opulus, Hydrangea hartrnsut, Sralnosa* ***arcautii;*** inprimis autein inultae *Compositae radiatae,* inter quas singularuin ad8f)cctum pmeliet *Calnulula officinalis,* cujus flosculi diacoidei peripliericis eo quoque similes Jiunt, quod somina inaturant

2. MITATIO FLOKUM PERiniERICORUM IX INTI/>RESCESTIA& [fi4]

81. Qui transitus plurilms aiitholysis mixlis efficitur, quft do ro cf. C2. Antholysis floruin penphericorum efficit authesmolysim, cum curtil qiuViam rntiono mutct totius iniloreacentiao habituia Non cognoeci nequit talis muUtio, ubi vestigia anthnlysia rciuanclnnt, quibus autcm absontibus ab abnonnitate (87) descriptA diatingui non potcst Exeiuiila inter *UmbcUiferas, Compostta**** alias invenimus.

3. FBONDESCENTU FOUORUM SUBFLORAUUM ; EVOLLTIO EORCM UDI IN STATU NOBMAU DESUXT.

82. Haec abnormitas com viroscentiA uti modo dictio anthesmolysiji furraae cum rcKrcssu comparan possunt; et folia sabfloralia, quae calyces finguut exteriorcs vd involucra, plane eodem inodo mutantur, quo calyces ipsl

*** Cf. tractatum saepius laudatum auctore Alex. Braun in Nov. Act. Leop., ol. XV. 1. Ordnung der Schuppen an Tannzapfen, in compluribus locis.

^ Tab. V. fig. 22.

Quae virescentia frequenter occurrit, cum folia subfloralia vegetationis foliis maxime sint affinia. *Aroideae* exenipla proferunt, nee non *Gramineae* et *Junceae,* quae hâc nietamorphosi formam acquirunt interdum viviparam dictam. In *Euphorbiis* semper disjunctio una apparet. *Plantago* saepe invenitur cum bractearum frondescenti& (varietas phyllostachya); folia involucralia frondese'entia conspiciuntur in *Convolvulo,*[289] in *Scabiosd,* in quâ etiam virescentia palearum et calycum exteriorum obviam est. *Compositarum* folia involucralia saepe frondescunt, interdum paleae quoque, quae etiam apparent in receptaculis normaliter nudis, e. g. in *ITicracio, Pyrethro, Coreopside.* Eadem in *Umbelliferis* reperiuntur. In *Tilid* vidi intra paniculam bracteas iis, quibus tota suffulta est inflorescentia, similes. In *Cruciferis,* e. g. *Brasskd* et *Cheirantho,* saepe in coiymbo apparent folia subfloralia.

4. DISJUNCTIO FOLIORUM SUBFLORALIUM. [65]

83. Quae disjunctio rara est, cum involucra gamomeria ipsa minime sint frequentia. Sola *EuphyrUamm* exempla mihi innotuerunt. Involucri (calycis *L)* laciniae amplificantur, glandulae (petala Z.) disjunguntur, postremo folia libera, maTgine giandulis s. callosis intumescentiis instructa inveniuntur. *Bdper* hunc processum in *Enumerations Euphorbiarum* optime exposuit, pluresque addidit icones.

II. METAMORPHOSIS RETROGRADA INFLORESCENTIARUM, AXE NECESSARIE MUTATO.

1. APOSTASIS FOLIORUM SUBFLORALIUM EORUMVE PRODUCTORUM.

84. Apostasim glumarum insignem observavi in *Lolio perenni.* In *Euphorbid* apostasis foliorum involucralium disjunctorum interdum occurrit; *Convolvulum Sepium,* vide Tab. I. fig. 3. Inter *Compositor* saepius obviam est; vidi in *Leontodonte, Wedelid pcrfoliatd,* aliis. Capitulum primarium *Eryngii* interdum praebet folia involucralia cum floribus nonnullis apostatica; eximias vidi umbellulas apostaticas in *Athamantd Cervarid.*

2. DIAPHYSIS INFLORESCENTIARUM.

85. Eodem modo, quo axis in flore terminatus est, caulis plerumque in inflorescentiis, in illis quoque, quae flore centrali non terminantur (in inflorescentiis racemosis), finitur. Iuterdum autem in modum abnormem elongatur, et metA superatA iterum folia vegetationis profert et folia subfloralia nee non flores ipsos.

In *Tritico repente* culmi ex spiculis florentibus proveniebant; ex *Pini Lariats* strobilis inteTdum rami foliosi.[240] Ex inflorescentiae centro in *Euphorbid palustri Röper*[1]* novum involucrum solos flores masculos includens emergere vidit; et ex *Primtdae* umbelld interdum altera procrescit [66] Diaphyses ipsas capitulorum in *Compositis* non animadverti, vestigium autem hujus anthesmolysis mo in *SpilarUhe oleraced*[742] vidisse puto. *Umlclliferac* saepe umbellas diaphytas ostendunt, rarius diaphytas umbellulas. Nee non ramulum foliosum in *CoronUld varid* e centro umbellae provenientem observavi.

3. ECBLASTESIS FOUORUM SUBFLORALIUM NORMALITER STERILIUM.

86. *Euphorbia* interdum ex axillis foliorum involucralium apostaticorum ramos profert Flores axillares ex foliis involucralibus *Convolvuli Sepium*** nee non ex squamis calycinis *Dianthi caryophylli* provenientes saepius inveni. In foliorum subfloralium verticillo nonnunquam in *Malvacearum* praesertim cultis speciebus flores axillares observantur*[4] Haud rari sunt in foliis involucralibus *Anemonamm.*

[m] Tab. I. fig. 8.
[910] Do Candolle Organogr., Tab.'XXXVI. fig. 8.
[m] Enom. Euphorb., pag. 86.
•" Tab. V. fig. 29.
[10] Tab. I. fig. 8.
[214] Spenner, Fl. Fribnig., pag. 888.

4 PKOCREATIO PRODUCTORUM AXILLARIUM MAJORUM LOCO MINORUM EX FOLIORUM SUBFLORALIUM AXILLIS.

87. Haud ubique hanc abnormitatein inerâ ecblastesi explicare possumus; gemmae axillares, sane niinores quidem, jam in statu norrnali aderant, quae saepe (vide supra) [67] antholysi in ramos foliosos integrasve inflorescentias inutantur; plerumque autem nova haec proles jam ab initio ad majorem evolutionem destinata, nee serius metamorphosi retrogradâ amplificata esse videtur.

In *Gramincis* saepe ex axillis bractearum novae spiculae proveniunt loco singulorom flomm; id quod magni momenti est in *Lolio,* cum Jiac raetamorphosi *Tritico, Fcstucac* aliisque *Gramiivcarum* generibus siniilliinum fiat. Interdum gramiua ex bnictearum axillis gemmas foliiferas proferunt, quo vivipara fiunt. Alia exempla praebent *Hyacinthus* et *Strclitzia.* In *Plantaginc lanccolatd* sessilia, rarius quoque pedunculata capitula ad basin, nonnunquam in apice capituli primarii procrescunt *Dipmvus* et coinplures *Scabiome* similes abnormitates (quo proliferao vel viviparae dicuntur) ostendunt. Eodum IIICKIO multae *Vompositac* se habent; *Senccio, Belli*, Antkemis, Coreopsis, Calendula, Hicraciiwi, Lactuca* aliae pruliferae inveniuntur. Aflinis est etiam *Umbcllifcrarum* proliferatio, e.g. in *Enjngv), Bupleuro, Apia, Adhu:d, Sio, Athamantd, Pcuccdano, fferaclco, Pastinacd, Laserpitio,* etc. Postremo *Sunyuisorbam* nou possum non nomiuarc.

88. Antbesmolyses efldem ratione inque iisdem locis proveniuut ac antbolyses, nee non iisdem efficiuntur causis. De iis, quae ad melius intelligendam bistoriam plantarum derivari possint ex anthesmolysibus, multa dicenda sink Pauca aliis locis sunt memorata; plura praetermitto, cum Ho rum metiimorpliosim retrogradam exliil>cns similitudinem tantum in mutandis inflorescentiis indicaturus essem. Quae quoad virus effecisse milii videor, itaque dissertationem [G8] bane, primitias meas et tirouis quasi rudiiiKMituni, benevolo trado lectori scientiain coleutL

EXPLICATIO TAIIULAKUM.

TABULA I.

Fi¡*A*- 1. OENTIANA CAMPESTIUS cum npr**taHi *vt* n H.iMrsj wj»ali <>xt(>nii, cet«'ri?» triiuip acpid'n* amplifirati*.

Fi¡{. 2. ANEMONE RAKUNITLOIDKM, in mjin involucm jphvllo fit* Ofolius priiuo fulio frumli*ccntc» avdi't, ex cujtis centre coinplitiH tlo* HA^uinlariiH jppM*rrHK·it,

Fig. 3. CONVOLVULUS SEPIUM cum rn>n<l«i«»titia *vt* <*cManti^i amfmnim f. »ubflomliuni$_f$ altcro apoatAtico, et cum frondeacentilmA <lU«»}>UH t»xtt'ri<>ril>ti<« ml vein fiiiKTiM fitliin.

Fig. 4-5. AMHJDALUS PERbiCA auct«) wrpiuruin iiuincro, tribus Ji»«juiittiH ct marginc altcro frondescentibtu. Fig. 5. Sectio traDsvunmliii.

Fig. 5-7. ALCEA BOSEA. Ffc' f>. SiTtio vfrtiralix florin plrni, in nijin r^uninA androcreA alalm»tra compMa, (luonim alu*niin iliiNM^tum wt, np|tariMit. Fi>;. 7. Pan miumnao aliun fluriis in i|tiA carpiorum ViTticillun MtiimiiijIiiiH et |M*taIin rim·tiM nrtim *v*L*

rig. 8-10. ANAUALLIH ARVENHitt piioENKKA rum rt..ri1»u«* vin^«iitil»u«. Fig H ViniMantia inripitUN; f. rtm>llinin puiiutiuTibuit, iiur^in«> purtMinuM-fiitil>u«, IIIH» *v* tlorilui* fliurri. Fi^. II. Flt« vitvurrnn, |M-tiilii« pliuiu iliwjuiictiH *nmt* i|miim aiithi-siu vi*gi-ti« aUjuc aiiiplifkalin. Fig. 1U Fl**i siiiiiilift in outbiia ; atlliuc •taiuina conspiciuutur.

TA nrr.A 11.

Fig. 1-7. AVAUALMH ARVENHW PHOENICEA. Fi»j 1. H,-i vin-«r.-ti« .lin]w-t Aiitli-in, ra|-u!A a in,.I. f.·rat A ; en, «|iiao cmitim-hat, fi« 2 depict* mint OTIIIH nmfnl.i, .|ii..riiin n.>iititi11n fi-. .1-5 m-tii^ nurU apparent.

F«!*' 6. Fl« ^ virt>MOt»ni1 *r*lym* aprmUtaro.

Fig. 7. Fl«* vinwDR <liaphytn», cal,rce apn»Utirr$_S$ i« tnli, mininii* m|.»n- r^nrro, vl frondescentibus

Fig. 8-18. Cl:MA U LOME HI FLORA. Fig. H. Flos virescens corolla minima, ovario multum amplificato

Fig. 9. Similis flos, ovario autem majore, stipitato.
Fig. 10. Flos virescens omnibus partibus inprimis ovario longe stipitato amplificatis, staminibus inchisis.
Fig. 11. Flos similis staminibus exsertis, f. pistillaribus apice disjunctis.
Fig. 12. Flos similis, minor, f. calycinis et pistillaribus magis disjunctis.
Fig. 13. Flos virescens f. corollinis et pistillaribus frondescentibus.
Fig. 14. Flos virescens f. calycinis plane disjunctis, f. corollinis minimis, incisis, pistillo abolito.
Fig. 15. Ovarium simile illi fig. 8 depicto, sectione transverea* apertum.
Fig. 16. Ovarium simile, sectione longitudinali apertum.
Fig. 17. Ovarium illi fig. 9 depicto simile, sectione transverse apertum, placentis peripherici fila (loco funiculorum umbilicaliuin) proferentibus.
Fig. 18. Ovarium floris fig. 10 depicti dissectum et expansum; tribus placentis sterilibus praeter singulum locum, ex quo multa ovula plus minusve virescentia procrescunt.
Fig. 4-14 bis, fig. 3-6 et 15-18 octies magnitudinem naturalem superant.

TABULA III.

Fig. 1-8. ROSAE. Fig. 1. Flos dissectus tubo calycino abolito, receptaculo hemisphaerico.
Fig. 2. Flos dissectus, ex cujus receptaculo stipes petala Btamymet virescentia f. pistillaria proferens attollitur.
Fig. 3. Floe regressu, disjunctione, apostasi, diaphysi multipliciter mutatus; f. calycinis (quorum unius decidui cicatrix conspicitur) aliis frondescentibus, aliis petaloideis. Folia viridia incisa, quae conspiciuntur in apice axis, calycia loco florem Becundarium includunt.
Fig. 4-6. Flores dissecti, quiad intemum receptaculi marginem alabastra secundaria (dissecta) proferunt.
Fig. 7. Similis flos dissectus ; ex superficie intemfi receptaculi provenit flos secundarius pedunculo elatus folioeo foliisque incisis cincto, diaphysis vestigia ostendens, cum alabastro altero connatus. Fig. 8 hujus floris secundarii cum alabaatro connati faciem extemam ex latere opposite exhibet.
*ig. 9-16. CAMPANULAS. Fig. 9. Extemae, fig. 10 internae partes floris CAMPANULAE PERSICIPOLIAE regressu et disjunctione multifariam mutatae.
Fig. H. Stylus floris alius ex eodem exemplari antberae tbecam profcrens ; bis auctus.
Fig. 12. CAMPANULA RAPUNCULOIDES, staminibus in alteram corollam mutatis, quae corpusculum flavum antherae Bimilem tanquam originis vestigium ostendit. Corollae dissectae sunt et expansae.
Fig. 13. Ejusdem plantae floe virescens, f. pistillaribus amplificatis apice disjunctis.
Fig. 14. Styli ex ejusdem plantae flore, conjuncti, quinquetidi, partę nnd proferente flavum corpusculum glabrum antherae thecam inapertam referens.
Fig. 15. Formatio sepalorum impedita de efidem plantâ, in quorum centro complura f. pistillaria disjuncta evoluta eunt, cum ovulis ad margines. Unum f. sepaloideorum ex axillŕt profert ramulum.
Fig. 16. CAMPANULAS RAPUNCULOIDIS ramulus folioeus loco floris, qui calycis formatio impedita ease videtur cum ecblasteai.

TABULA IV.

Fig. 1-2. BRABSIOA OLRRACRA. Fig. 1. Floe defloratue, cujus sepala exteriora persistentia ecblasteai laboiant.
Fig. 2. Floe apostasi et ecblasteai f. calycinorum, disjunctione et ecblasteei f. pistillarium, nee non generatione novi minus abnormis pietilli intra primarium maxime mutatua.
Fig. 3-20. ERTSIMUM OFPICINALE. Fig. 3. Flos virescene etaminibus minue mutatie, pietillo in eaccom amplum convereo ovula monetroea proferente.
Fig. 4. Floe similie f. pistillaribus apice dfejunctis.
Fig. 5. Flos similis f. *f* istillaribus plane disjunctis, novie intra ea foliis procrescentibua.
Fig. 6. Floe vircecens f. corollinie abolitis, f. pistillaribus axe elongato totamque infloTcecentiam proferente apoetaticie.
•Fig. 7. Floe eimilis, f. tamen corollinis pistillaribueque in magna f. viridia comnmtatis.
Fig. 8-11. Stamina in f. viridia transeuntia. Fig. 8-10 £ tetraptera exbibent; fig. 9, eectionem priorie transverealem ; fig. 11, poetremo transitum alio eoque rariore modo effectum.
Fig. 12. Ovarium eacciforme non disjunctum, diseectum; ovulis amplificatis, setosis, foramine (micropyle) per embryonem protrusum dilatato.
Fig. 13. Simile ovarium, in quo ovulorum loco folia hirta in placenta* collocantnr vel petioli e. etipitee parvi. Fig. 14-15 tolia folia oetendunt
Fig. 16-17. Folia pistillaria diajuncta ex floribua ceterum nonnalibue in margine dentee ovnligenoe ipeaqne ovula ferentee. Fig. 18-20 eingula ovula exhibent: 18 est a; 19, b; et 20, c.
Fig. 3-7 et 13,16 et 17 quater, fig. 8-11,14 et 15 octies, fig. 12 et 18-20 sedeciee magnitudinem naturalem enperant.

TABULA V.

Fig. 1-13. TORILIS ANTHRISCUB. Fig. 1. Flos virescens mesogynns; f. pistillaribus apice disjunctis; tmum f. corollinorum amotum est, ut ovariuim melius conspiciatur.

Fig. 2. Flos viridis, uti omnes, qui sequuntur, hypogynus.

Fig. 3. Flos viridis *t* pistillaribus prae ceteris aniplificatis.

Fig. 4. Flos viridis, inter cujus f. pistillaria qiiatuor folia viridia incisa (tegumenta ovulorum) apparent.

Fig. 5. Folia pistillaria cum duobus ovulorum foliis, quae stipitem parvum (axis rudimentum) ferunt.

Fig. 6. Flos viridis f. pollinaribus petiolati*, aniplificatis, rotundatis, incisis, tetrapteris a. planis. Folia plann secundum ea, quae in 74 exposita sunt, exteriore infundibuli polliuaris parte formantur.

Fig. 7. Sectio transversa f. pollinaris tetrapteri.

Fig. a Flos viridis f. calycinis evolutis, f. pollinaribus sessilibus, ovalibus, incisis.

Fig. 9et 10. Folia pollinaria tetraptera.

Fig. 11. Flos viridis, calyce amplificato apostatico.

Fig. 12. Flos viridis, w pal is ex axillis floras et umbellam proferentibus ; f. pollinaria desunt. a. Flos secundarius, incompletus sepalis apostaticis. b. Flos incompletus virescens. c Umbel la, quae ipea ex flore secundario ecblastesi orta videtur; floris tertiorii petalum d. adhuc superest.

Fig. 13. Flos virulis hypogynus, ex quo novus flos diaphysi provenit, qui iteruin ecblastesi aut diaphysi umbellulam tertiariam cum fructibus maturcscentibus profert.

Fig. 14-21 ATHAMANTA CERVARIA. Fig. 14. Ecblastesis ex f. calycini amplificati axillâ.

Fig. 15. Ecblastesis ex f. calycini amplificati hypogyni axilla[d].

Fig. 16. Similis antholysis.

Fig. 17. Ecblastesis f. calycinorum vix mutatorum vel disjunctorum ; carpia disjuncta.

Fig. 18. Diaphysis uno flore secundario.

Fig. 19. Diaphysi* duobus floribus secundarifo, calyce paulum dirupto.

Fig. 20. Floe diaphytus dissectus.

Fig. 21. Umbellula secundaria ecblastesi et diaphysi orta ex flore primario, cujus magnam portem adhuc videre licet

Fig. 22-20. COMPOSITAB. Fig. 23-26. SENECIO VULOARIS. Fig. 22. Cupitulum flosculis centralibus virencentibuR, periphericis in inflorescentias necundarias mutatis. Fig. 23. Floeculus nonnalis. Fig. 24. Floeculus paalo virescens, uti plurimi in illo capitulo. Fig. 25. Flueculus vinescens, pappo partim in folia, ovario in stipitem conveno, con>114 diniinutl. Fig. 26. Flosculun plane viridis inflorescentiae vestigia in corolla inflatt includens. Singuli hi floaculi ex illo capitulo (fig. 22) desumti, proeter nonnalem (fig- 23).

Fig. 27. HriRACii PALLACIS frnctas, qui diaphysi romulum denne fdlimmm profert ^

Fig. 28. Flocculus virescens CALENDULA* OFPICIVALU calyce et corolU commaUtb in quina folia novum receptaculum, diaphysi ortum, indudentia.

Fig. 29. Gapitulnm SPILANTHIS OLKRACSAB dissectum, medio eonstrictatn et iU diaphydm orientem indicant.

Omnet flgone, exeeptis fig. 22 bis auctl et fig. 29 magnitadinem manndem exhibentD$_9$ qaater tnctae sunt.•

• It has been found nectsiar T to omit the figures, partly colored, which illustrated this ^—^\m_{w_a} on account of the difficulty of reproducing them ; but the references and explanations are retained in full. The subject is treated in so completely analytical a manner that no effort has been made to include the «JTI*MW referred to in the **^^» at the and of the volume. — Ei*.

II.

SKETCH

OF THB

BOTANY OP DR. A. WISLIZENUS'S EXPEDITION

FBOM

MISSOUEI TO SANTA FÉ, CHIHUAHUA, PAEBAS, SALTILLO, MONTEREY AND MATAMOEOS.

PBIHTED BEPAEATELY FBOM A "MEMOIB OF A TOUB TO NOBTHBBN MEXICO IN 1846 AND 1847, BY A. WISLBENUR. M D PRINTED FOE THE USE OF THB SENATE OF THB UNITED STATES." WASHINGTON, 1848.

DH. WISUZEOJS has intrusted to me his very interesting botanical collections, with the desire that I should describe the numerous novelties included in them. Gladly would I have done so, had not leisure been wanting, and were I not here (in St Louis) cut off from laree collections and libraries. As it is, I can only give a general view of the flora of the regions toversed, and describe* few of the most interesting new plants collected; with the apprehension However, that some of them may have been published already from other sources, without my beins aware of it.

In examining the collections of Dr. Wislizenus, I have been materially aided by havine it in my power to compare the plants which Dr. Josiah Gregg, the author of that interesting work "The Commerce of the Prairies," has gathered between Chihuahua and the mouth of the Rio Gmnrf« but particularly about Monterey and Saltillo, and a share of which, with great liberality he hi communicated to me. His and Dr. W.'s collections together, form a very fine herbarium for tho£

The route of Dr. Wislizenus encompassed, as it were, the valley of the Rio Grande and the whc ottt HO ? ? * ftTrS *' ^ Wm ^ L HfS Pknt8 P*^6 therefore of th « « d^ter of the floras of the widely different countries which are separated by this valley. Indeed, the flora of the valley of the Rio Grande connects the United States, the Califomian. the Mexican and 2' xexan floras, including species or genera, or families, peculiar to each of these countries

The f™, Z. ffj 688*6 1 Portion of the route traverse8 th« la^ge western prairies, rising gradually from about 1,000 feet above the Gulf of Mexico, near Independence, MiLuri, to 4.000 teinrt of the Cimarron River. The plants collected on the first part of this section, as far west as the crossings of the Arkansas River, are those well known as the inhabitants of our western plains. I ch^!!£ rT8, 0*618' M *>to*J interesting to the botanist, or distinguished by giving a character to the landscape, in the order in which they were collected, *TradJLia Virjnka* $, ox

aristata, CEnothera Missouricnsis, scrrulata, spcciosa, &c, *Pentstcmon Cobaca, Astragalus caryocarpus* (common as far west as Santa Fe), *Delphinium azureum, Baptisia australis, Malva Papaver, Schrankia uncinata* and *angustata, Echinacea angustifolia, Aplopappus spinulosus, Gaura coccijica, Sida coccinea, Sophora sericea, Sesle'rui dactyloides, Hordeum pusillum, Engelmannia pinnatifida, Pyrrhopappus grandiflorus, Gaillardia pulcliella*; *Argemone Mexicana* (with very hispid stem and large white flowers).

The plants collected between the Arkansas and Cimarron rivers are rarer, some of them known to us only through Dr. James, who accompanied Long's expedition to those regions in 1820. We find here *Cosmùlium gracile,* Ton*, and Or, which has also been collected about Santa *F4* and farther down the Ifio Grande; *Cucumis ? percnnis,* James, found also near [88 (4)] Santa Fé and about Chihuahua, and by Mr. Lindheimer, in Texas; the petals being united about two-thirds of their length, it cannot be retained under the genus *Cucumis; Hoffmannseggia Jamesii,* T. and G., was also gathered on this part of the journey; several species of *Psoralea, Petalosteman* and *Astragalus;* also Torrey's *Gaura villosa* and *Krameria lanccolata; Erysimum asperum,* which before was not known to grow so far south; *Polygala alba, Lygodcsmia juncca.* Here we also, for the first time, meet with *Rhus trdobata,* Nutt., which, farther west, becomes a very common plant.f A new *Talinum,* which I have named *T. calycinum}* was found in sandy soil on the Cimarron. This plant has, like the nearly allied *T. terctifolium* of the United States, a remarkable tenacity of life, so much so that specimens collected, pressed and "dried," in June, 1846, when they reached me in August, 1847, fourteen months later, grew vigorously after being planted.

Psoralea hypogcea, Nutt, was collected near Cold Spring, and *Yucca angustifulìut,* from here to Santa F&

From Cedar Creek the mountainous region commences with an elevation of near 5,000 feet above the Gulf, and extends to Santa Fé to about 7,000 feet With the mountains we get also to the region of the pines, and of the cacti. Dr. Wislizenus has here collected two species of *Pinus,* both of which appear to be undescribed, so that I venture to give now a short account of them. The most interesting one, on account of its useful fruit, as well as its botanical associations, in the nut piue of New Mexico (Piflon), *Pinws edulis?* nearly related to the uut pine of

[1] TALINCM CAi.YCiycM, n. up.: rhiznmnte crowo, CAiiiiYmA demum rnnwsift; folii* nuUervtibua elongnti*, hani triangulari products; pedunculU clnnpitit midi.*; cyma brni:te<>*n; w|in1i* 2 ovnto-orbiculnti*, ha*i pruductiff, cuspidatis, persistentibus; petalis fugacibus calycciii bis supcruntibus; staminibiu sub 30; stylo clongato, sligniatibuB 3 abtaevutis.

ID sandy soil on the Cimarmn, fl. in June. Differ* fmm *T. Urrtifolium* l»r it* lai^r lcarcn, lnrppr flowon, much larger penistent sepals, larger fruit ami seed. Leaves lj to *2* iuches long, flutter* 10 to 11 [Ift] lines in diameter; capsule and seeds twice as larKe as in *T. UrctifUium.*

[1] Pnrcs IDULIS, n. sp.: sqoamis turimiuin nvatis acutU aflprewin ; larinii* Taptiamm aMireviatarum circinato-revolutis, demum deciduis; foliis binis brvvibug ri^i'li*, cun'iN tvnuiwitne utriatiw, mniviiu? liovibus aupra concavis glaocis, subtiis convexi* viridibus; strobiltM seMilibus irecti«», suliglobuso couicis, si|Uaniia apice dilatato pyramidal!*, inennibos; seminibus obormii^ aptrris, magiii*, ti^ta tcnuiore.

Not lire from the Cimarron to Santa Fc\ and probably throughout New Mexico. A small tree, 10 to 20, ranrly 30 feet high; trunk 8 to IS inches in diameter; Icare* 12 to 18 linen Irni* and. as h the ca» in all other pine*, on-care on the inner or upper surface when in twos, and carinate when in threes, which in our »|ieriea is very seldom the case. Cones about 18 lines in diameter; seeds about 6 lines long, and 4 in diameter; shell much thinner than a haid-not's; kernel, when slightly baked, very pleasant.

* Abu£ unt in the m »* • * * the Arkan$M Rim. with beautiful flowert, but only abimt 6 Inches high; etrteialy annual.

tIAs> many other planU n^Dtioo^ hei^ it hs. hs«i asOsetsd In abundant and btaoUfiil specimen, by *MT!A.*

Fraul'er, a younjr Oerman collector, who has investigated the regions about 8anU Fe during last emson (U47), and has made most valuable u><l well-prrarrved ruUectiotu, some seta of «hi«·h he oifert for *m\r* I nhall rrpmtrdly I* obiigrd to refer to him whrti f|>r«kinK of th«* flnni of Rinta *V4.*

northeastern Mexico, i ^ o d « « p e m ^ ^pecimens of which were sent to me by Dr. Gregg, t[89] <*» as collected on the battlefield of Buena Vista), and to the nut pine of California, P . « » *phylla,* Torr. and Frem., -these three species being the western representatives of *Knus* AM and *Cem* ^ *l* eastern con nd ^ ies, ***** * the most common pine of New M e ^ and the most useful for i, A third species, J * . {M James ›-s overlooked byDr. « * -' « but has been collected in fit

aa Dr. James has already " ^ *J* ^ * .* ^ to be the product of *Pinus cdulis.* I shall Phones, so much eaten in Santa F6, appear pnncip y r mountains of Chihuahua. have occasion to spe I come to the flora of the ere, and continues to Santa Fé, as well as the justly *Linum perenne* S?£SS *otentilla, Œnothera, Artemisia,* and *Penstemon,* were so-called *Lathyrus o* collected in this district.

Among the most remarkable plants met with were *ctacea.* After having observed on the Arkansas, and northeast of it, nothing but an *Opuntia,* probably is not different from *O. vul-* *garis,* Dr. W. came at once, as soon as the mountain and the pine woods commenced, on several beautiful and interesting members of this curiouETmily, an evidence that he approached the favorite home of the cactus tob£^o. specimens of a strange *Opmtia* were found,

On Waggon-mound the first <*"«» dry, sp nous, rizontal W n e 9 . Th6 [90 (6)] with an « ™ ^ K u ; 8 ^ ^ ^ Fé to the height of 8 or 10 feet, and plant was here only 5 feet high' bu^^grows a b o u t a ^ In the latter ^ ^ ^ ^ ft grows continues to be found as far as Clnhuab*m* " J ^ J J * ' M Dr• w• inform9 me> and offers a most to be a tree of 20 or 30, and *V ^ J ^ * f £ U .* It is evidently the plant which Torrey beautiful aspect when ^. * £ * £ ? £ Z *Cast*. *BUo,* HBK. It is nearly allied to and Jam? doubtMy ^ *J S S* ^ ^ *'> Mu M * ^ * * described, Op„r« Arum, Wdld, W r * * 7 2 S *o. a******* the Tree Cactus, or Foconoztle, as called can give it no more appropriate name wu»u

m • -noamis turionum elongnto^cuminatia, flmbriatis, squaiTosis; laciniis vaginarum

Iambus, atramqae tennuBime rtnatw, tupra «"-"""! dura. iaermibuB; ^minibu. ^ ^ ^ ^ ^ Saltillo. A small tree, 10 to 80 feet high; leave, in *torn.* m<« Moimtain borders, near Buena Vista, ana foregoing species; nut of the same size, but much more slender than in the ovate, obtuse, adpressed scales of the young shoots and mostly single, terete leave.;* cone and seeds are simikr to ^ ^ " ^ ^ *wmi^* fimbriatis, luarro^ subpersirtentlbu.; once vaginis seminibus obovatis breviter alatis. ovatis s. elongato conica, squamis Mountains of New Mexico, common. A large and fine tree, often 80 to 100 feet high, 2 and even 3 feet in diamet sheaths 6 lines long, mostly black; leaves generally in threes, rough, 3½ to 6 inches long, in the specimens before crowded towards the end of the branches; cones 2½ to 3½ inches long; seed larger than the wing, without this 3 to 4 line, long and S wide. ^^ ,,,,,{,, boriamtalibua, ramuUs eylindrid., tubnculatta, • OrusriA ARBOBBCB^ ^ *J* ^ ^ *S Z A* , «culeo» 12-30 corneos rtramineo-wginato. terete, nndiqu. ^]U - i i l « * ^ ^ § n o § e ^ T o v a r i o tuberculato, tuberculi. ^bSO apice «pala «buUU et porrecto. gerenUbus, l a m u l u . ^ S J ^ J J J w .epali,interioribus 10-13 obovatis, petall.obovatlaj JOUUM.. ar^la. tonmto- ^ ^ ^ u ^ l d ! f ^ ^ i e ^ o v ^ l o b o ^ tuberculata, profunde umbilici •maiginath; rtigmatOm. suW» patalu; bacca fl»J^»dWfflllo; flowers in May and June; fruit, at leut abnut Mountain, of New Merico to « ^ > » ^ the T S T 0 - T h «, «d more feet high. 5 to 10 inches in Santa of the specimens on Waggon-Mound diame

by the Mexicans, according to Dr. Gregg. The stems of the. dead plant present a most singular appearance; the soft parts having rotted away, a net-work of woody fibres remains, forming a hollow tube, with very regular rhombic meshes, which correspond with the tubercles of the living plant

The first *Mamillaria* was also met with on Waggon-mound, — a species nearly related to *M. vivipara* of the Missouri, and also to the Texan *M. radiosa* (Engelm. in Plaut Iindh. inedit), but probably distinct from either. Mr. Fendler has collected the same species near Santa Fd

On Wolf Creek the curious and beautiful *Fallngia paradoxa,* Endl., looking like a shrubby *Geum,* was found in flower and fruit; also a (new?) species of *Streptanthus,* and an interesting *Geranium,* which I named *G. pentagynum;** because of its having its five styles only slightly united at base, while most other *Gerania* have them united for about two-thirds or more [91 (7)] of their length.

In the prairies about Wolf Creek, in an elevation of between 6,000 and 7,000 feet, the smallest of a tribe of *Caclacem* was discovered, numerous species of which urere found in the course of the journey south and southeast: several others have also been discovered iu Texaa I mean those dwarfish *Cerci,* some of which have been described with the South American genus *Echinopsis,* or have been referred alternately to *Cereus* or *Echinocactus,* and which I propose to distinguish from all these under the name of *Echinoeereus,*[7] indicating their intermediate position between *Cereus* and *Echinocadus:* they approach more closely to *Cereus,* in which genus they, as well as the genus *Echinopsis,* should perhaps be included as sub-genera.

The species mentioned above is distinguished from all others known to roe by its yellowish green flowers, the others having crimson or purple flowers. I have uauied it, therefore, *Echinoeereus viridijbrus.**

•oath only 12 to SO, generally fewer on the under side of the branch let*; spines horn-colored, with straw-colored loose •heaths, from 3 to 10 lines, generally about 6 lines long. Flowen purple, 3 inches in diameter; stamens red ; fruit •boot 1 inch long, yellow.

[9] QE&ANICM PENTAOTNUM, n. up.: perenne, canle erèctn nunoto cam petiolis retrono-piloso; foliis strignso-pnbescentibas inferioribus 7-, saperiorihus 3-&-partitis, svtfuientis inciso-lobatis; pedicellis binis, glanduloso-pobescentibcs; •spalis glandnloais, aristati*; petalis ba*i villo brevi iiutructis, ad venas pilosiuscali*, oborati* integris; filainentis eilistis; OYariofcUn<dul<*o; »tylt* ima parte aolum connafu; capsula glanduloso-pubescente.

On Wolf Creęk, flower* in Juue. Several »tem» 1 foot high from a large ligneous rhixoma; similar to *0. Wiaeuia-* *•» bat easiljr dintinguished fn>m this and in<Mt other species by the styles being uaited only for J or \ of their length ; flowen of the same sue, but arintc of «e|«li much larger ; leaves only 2 or 8| inches wide.*

[v] EcHivocsfttcs, n. gen. Pvrig»iiii tubus ultra germen productos, abbreviates. Sepala exterior* s. tabi sab-akla, k aiillk tomentosis *wttm* s. scuta* geivntes. Sepala inUsriora sabpeUloidea el petala longiora plorvwrialla eorollaai broiler infandibuliformem s. sab-caiD|ianulatam amuhuitia. Stamina nunjenmiswroa tubo adnaU, limbo brerioca t. earn sabsBquantia. Stylus •taiuina vii supentis. Stigma multiratliatam. Bacca palrilligerm setosm s. acaWaU, perigonb cofooata. Seminam U»U dura tuberculata nignu Embryo vix ennratas coiyledonibas btevibas contrariis.

^^ Globose, or nostly orate; simple, or mostly branching from the hase or cespitose; tubercles forming few or ''*'*** *F****** ri^; ^lllco*io* •hort or long spines, distant or approximate, often Tery crowded; vertex never woolly; towers latent, prodoeed bom last yss^s growth, opening only in sunshine, bat for two or Uira days in «c7JJ5^^gJtloria dark weather. ^ ^

[illegible] VIRIDIFLORUS, n. sp.: ovato-globosus, humilis, mb-IS-«(MUtoa; arcolia hocwJttfa, approxiaatK junioribu[illegible] ; ,,eBWi I6_18 **** »*u««J[11]^ l<O««li»Hi. lonRioribo* fiucM,* reliqoia albidk, entnU aullo a. elongato [illegible] spiseCo; 8o<lbo> iat<nUt*a[s]; talw polrillw* 15-90 •lho-tomeobMi* MCM alfaM 5-10 gtrantibot stipato; ea, [illegible] tuberculatis.

Prairies on Wolf Creek, flowers in June; Santa Fé, flowers in May (Fendler). Body 1 to 1½ inch high, oval; spines 1 or 1½ to 3 lines long; central spine when present 6 to 7 lines long; flower 1 inch long and wide, outside green brown, inside yellowish green; petals only 2 lines wide, being about 5 lines long.

* This "seems to be *Geranium Fremontii* (Torr.) of Fremont's second report," according to Dr. Torrey, in a note appended by Wislizenus; but in Watson's Index (p. 151) it is said to be synonymous with *G. Richardsonii.* — Ed.

A careful examination of the seeds of numerous *Cactacea,* has indicated to me two principal divisions in that family: 1. Cotyledons, more or less distinct, directed with their edges to the edge (or towards the umbilicus), and with their faces to the flattened side of the seed; when curved, accumbent 2. Cotyledons, mostly very distinct, foliaceous, directed with their edges to the faces, and with their faces to the edges of the seed (or towards the umbilicus); when curved, incumbent, and often circular or spiral.

The first class comprises *Mamillaria,* with a straight embryo; and doubtless, also, [92 (8)] *Mdocactus,* seeds of which, however, have not been examined by me; and *Echinocactiis,* mostly with a curved embryo. The second class includes *Echinocereus,* with a nearly straight embryo, and very short cotyledons; *Cereus,* with a curved embryo, and foliaceous incumbent cotyledons (probably also *Echinopsis* and *PUocereus,* and perhaps *Phyllocactus* and *Epiphyllum) ; Opuntia,* with a circular or spiral embryo (circular and with a larger albumen in all *Opuntice cylindracece ;* spiral and with a much smaller albumen in all *Opwntice ellipticce* examined by me), and very laige cotyledons. *Ehipsalis* and *Percskia* may also belong here, but were out of my reach.

The flowers of all the species belonging to the first class, with the exception of some *Mamillariat,* make their appearance on the growth of the same year. Those of the second class produce the flowers always upon the growth of the next preceding or former years. The first class may, therefore, be distinguished by the name of *Cactacece paralleled* (from the direction of the cotyledons), or *0. apici floras* (from the position of the flowers). The second class can be named, in a corresponding manner, *Cactacex contraries, or C. lateriflorce.*

Echinocereus is principally distinguished from *Cereus* proper by its low growth; its short, more or less oval stems, which are frequently branching at base, and thereby cespitose; by the diurnal flowers, with short tubes; by the nearly straight embryo, with short cotyledons. From *Echinopsis,* to which some species have been referred, it differs also by the short-tubed diurnal flowers, and by the numerous filaments being adnate to the lower part of the tube. For further particulars compare the note 7. The species of *Echinocereus* inhabit Texas and the northern parts of Mexico, where *Cerei* proper are very rare. They extend even farther north than the *Echinocacti;* but appear to be excluded from the old limits of the United States, where the cactus family is represented only by some *Opuntite* and *MamiUaria.* The southern limits of the *Echinocerei* are unknown to me, but I doubt whether they extend far in that direction; the nearly-related *Echinopses,* on the contraiy, appear to be exclusively inhabitants of South America, especially the La Plata countries.

As I am speaking of the geographical distribution of the *Cactacece,* I may as well add here that *ifamillarice* were found throughout the whole extent of Dr. Wislizenus's tour, and that at least four species occur in Texas. *Echinocacti* were observed only south of Santa F6, and from there to Matamoros, but none on the highest mountains, which were occupied by *Opuntice, Mamillarim,* and *Echinocerei;* two *Echinocacti* have been found in Texas. Only two species of true *Cerei* were seen; one of a peculiar type about Chihuahua, and another near the mouth of the Rio Grande, which does not appear to differ from the wide-spread *C. variabilis,* Pfeiff. *Opwdiec elliptic*,* as well as cy/tn-*draceas,* were observed* from New Mexico to Matamoros, and species of both are also found in Texas. *Melocadi, Phyllocacti,* and other genera of *Cactaceee,* not mentioned above, were not met tfith.

The notes and collections of Dr. Wislizenus confirm the opinion of that acute observer and successful cultivator of *Caetaceae,* Prince Salm-Dyck, viz.: that most species of this family have a very limited geographical range, the most striking exception being those belonging to the genus *Opuntia.*

On the same day two other species of *Echinocereus* were found *in* pine timber, both [93 (9)] with beautiful deep red flowers.[9] We shall have occasion to speak of others hereafter.

[9] EOHIHOOBRBUB TBIGL0CHIDIATU8, n. *p.: ovato-cylindricuB, 6-7-coetatus, cortia nndulatif acutis; aitolis •ponb, orbicuUtia, jnnioribus albo-Ianatia; nculeis 3-6, plernmque 3, recto oompretsSs tngnlatia, cinem'a, aulxiefleiis;

After leaving Santa F6, Dr. Wislizenus directed his course southward along the Rio Grande. The country was partly mountainous and rocky; partly, and principally along the river, sandy; on an average between 4,000 and 5,000 feet above the ocean. Here we find again some of the plants of the plains and of Texas, as *Polanisia trachyspcrma,* T. and G.; *Hoffmanscggia Jamcsii,* T. and G. An interesting *Prasopis* with screw-shaped legumes nearly allied to *P. odorata,* Torr. and Frem., of California, was the first shrubby miinoseous plant observed during the journey, a tribe which hereafter becomes more and more abundant; *Menlzclia* sp. *Cosmidium gracile, Eustoma, Hcliotropium currasavicum, Maurandia antirrhiniflcra,* a beautiful large flowered *Datura, Abronia, Hendecandra Texensis,* and many others. Near Olla the first specimens appeared of a new species of *Zarrca,*[10] the first and most northern form of the shrubby *Zygophyllaccct,* more abundant [94 (10)] farther south. In the same neighborhood the mezquite tree or shrub was first met with, probably *Alyarobia glarululosa,* T. and G. From here the mezquite was abundantly found down to Matamoros, but the specimens collected appear to indicate that there are at least two different species.

On the next day, near Sabino, an interesting bignoniaceous shrub was collected for the first time, undoubtedly the *Chilopsis* of Don, which farther south appears more abundantly. Its slightly twining branches, willow-like slender glutinous leaves, and large paler or darker red flowers, render it a very remarkable shrub. Dr. Gregg mentions it under the name of *"Mimbrc,"* as one of the most beautiful shrubs of northern Mexico. The character given by Don, and that of De Candolle, appear defective, though I cannot doubt that both had our plant in view. From the very com-

floribus lateraiibu*, tuho pulvillis 15-20 albo-toment/wia seta* *pino«w apicc fuacaii 2-5 gcrrntihu* Btipato; sepalis interioribus sub-12 oblongo-linearibiw obtuais ; petal U 12-15 obovatis obtusis; utoniiuibus]>ctula suba*iuantibuh; •tigmatibus 8-10 virescentibus.

On Wolf Creek, in pine wood*, flowers in Juno; Santa ¥6 (Fendler) 4 to 6 inche* high, 2 to 2} in diameter; spines in young specimens 4 to ft, in older one* generally 3 *[lwo] lateral ones 8 to 14 lines long, one bent «luwn only 6 to 8 lines long. Flower* 2 to 2| inches long, 2 inches in diameter; setose spines of tube 3 to 6 or 7 lines long; petals deep crimson, 6 to 7 lines wide; filaments and anther* red. In specimens from SanU Fe\ collected by Mr. Fendler, the flowers are near 3 inches long, the petals 8 to 9 lines wide, and the setae on the tube are spinoua, with browniah points.

ECHIMOCBRXUS oocciNRUff, n. *p.: globono ovatti*. 9-11 costatnn, costis tuberculosis subinterruptis; areolie ovatis junioribusalbo-tomentosis; aculei* rodialibu* &-10all>idui, rectw, oblique porrectw, iiuperioribu* brvviorihua; centralism 1-3 longioiibos albidia s. orneis; floribus lateralibus; tulm pulvillis 18-25 albo-tomenUisis, setas tenues albidas 8-11 gerentibos stipato; sepalis interioribus 8-10 oblongo linearibus obtusi*; petalis 1(>-12 obuvatis obtuius; tUmini-*«• brerioribns; sUgmatibus (M virweentibtw.

With the foregoing, also about Santa F^. — Only If to 2 inches high, 1} to 1) inch in diameter; like moat other •packs of this genus, either single or generally branching frnm the bane and c«*piU)*e, sometime* forming clusters of 10 to 15 heads. Bpinas terete all more or k«w erect none apprwed as in many other species; radiating onea 3 to 6, centra] ones 8 to 10 linea long. Flower* 1| to 1| inch long. *»d 1 to If wide when fully expanded; bri»tle» of tube 3 to 6 lines long; petals deep crimson 4 to 6 lin<« wide; filament* rwl, anthers ml or yellow. The flowers rusenible much Uiose of the last specie*, hut tb. plant is very dinVn-nL

f I. l. , ^ [illegible]LUTUIOtA» •••?•: divaricat-KramimWrna, ml nndn* glutinnsm; f«»liin brcvitrr pHinlatis, U[illegible]
loiioiis oblique oratis mucronatis, nenromia, e»riacein, *m\vn*m»* pil».M glutincMis; floribus intrr folia o<»:«iu [illegible]
fructu [illegible]

[illegible] ^^ "* **** C**BblI' *» **" *nka, U> Cbihi»hu» ami Sdtill..: J« shout [illegible]
[illegible] *mA A,,,as fmU "I* in Ju, r- shrul>» «» H f«t hiKh, rrry wurh bnuirbt<d, very
[illegible] Leaflets 3 to 6 li[illegible]
fruit 3 'ines
shining.* [illegible]

* This "seems to be *Larrea Mexicana* of Moricand, described and figured in a wgrk to «hkh IH. L Ul not access." — Dr. Torrey, in a note appended to the paper by Wislizenus. — Ed.

plete specimens obtained both by Dr. Wislizenus and Dr. Gregg, I am enabled to correct those errors.[11]

Near Albuquerque a curious *Opuntia* was observed; it evidently belongs to *Opuntice cylindracece,* but has short clavate joints, which make the name of 0. *clavata*[u] most [95 (11)] appropriate. A singular plant, with the habit of a *Ranunculus,* but nearly related to *Saururus,* was also found in this neighborhood among grass on the banks of the Rio Grande. The genus has been described by Nuttall from specimens collected by him in California, but whether his *Anemopsis Calif arnica* is specifically identical with the New Mexican plant, remains to be seen, as this last has regularly 6 leaved involucres, about 6 stamens, and is perfectly glabrous.

While the last mentioned plants indicate that we approach another botanical region, we are surprised to meet here with *Polygonum amphibium,* common in the Old and in the New World, and *Cephalanthus occidental*™, so widely diffused in the United States.

The famous desert, the Jornada del Muerto, furnished, as was to be expected, its quota of interesting plants. A *Crucifera* near *Biscutella,* of Europe, but with very short styles and white flowers, was here met with abundantly. I had considered it as the type of a new genus, when I found in Hooker's London Journal of Botany of February, 1845, Harvey's description of his new Californian genus *Dithyrea*™ which probably must be made to embrace our plant as a second species.

A new species of *Talinum,* with single axillary flowers, was found for the first time [96 (12)] in the Jornada, but was again collected further south, towards Chihuahua. *Dalea lanata,*

[11] CHILOPSIB, Don, char, emend. Calyx ovatus plus rainusve bilobus, lobo altero breviter3-,altero2-dentato; corolla basi tubulosa curvata, fauce dilatata campanulata, limbo 5-lobo, crispato-crenato; stamina 4 fertilia didynama, antherarum nudarum lobis ovatis, obtusis; quintum sterile brevius nudum; ovarium ovatura; stylus filiformw; stigma bilamellatum; capsula siliquafurmis, elongata, bilocularis, eepto contrario placentifero; semina transversa margine ntroqne comosa.

An eTect Mexican shrub, 8 to 12 feet high, ends of branches often slightly twining; branches smooth, and glutinous or rarely woolly; lower leaves somewhat opposite, upper ones sparse, lanceolate-linear, long-acuminate, glabrous or glutinous; racemes compound, terminal, pubescent; pedicels bracted, corolla rose colored or deeper red or purple.

Along water-courses or in ravines, from Sabino, near Albuquerque to Chihuahua, Saltillo and Monterey. Leaves 2 to 4 inches long, 1 to 3 lines wide; flowers 1* to If inch long; fruit 6 to 10 inches long; seeds with the coma 6 lines long.

There are perhaps two species : one from the neighborhood of Saltillo, with larger, paler flowers, broader, not glutinous leaves, and woolly branchlets, perhaps the *Ch. wUigrui* Don; the other from New Mexico and Chihuahua, with longer, narrower glutinous leaves, perfectly glabrous, glutinous branchlets, and darker and smaller flowers, may be *Ch. linearu,* DC., or a new species, *Ch. glutiwm.* The calyx is variable in both.

[11] OPUNTIA CLAVATA, n. sp.: prostrata, ramulis ascendentibus, obovato-clavatis, tuberculatis; areolis orbiculatis albo-tomentosiB, matgine roperiore Betas albas spinescentes gerentibus; aculeis albis complanatis, radiantibus, 6-12 minoribus, centnlibus 4-7 majoribus, longioribus deflexis; floribus terminalibus; areolis ovarii 30-45-{50] albo-tomentoeiR, aetas albas 10-15 gerentibus; sepalis interioribus ovato-lanceolatis acuminatis s. cuspidatis; petalis obtusis, crows, sapius mucronatisi stigmatibus 7-10 brevibus erectis; bacca elongato cUvata, profunde uinbilicato, setaceo-Rpinosa,

About Albuqueique (W.), about Santa Fe, on the high plains, never ou the mountains (Fendler). Mr. Fendler informs me that the ascending joints sprout from or near their base, and that in this manner they finally form a large spreading mass, often 2 and even 4 feet in diameter, to which the white shining spines give a very pretty appearance. Joints or branchlets 1½ to 2 inches long, tubercles at their base smaller, with shorter spines, towards the upper and thicker end larger, with stouter and longer spines; radial spines 2 to 4, central ones from 4 to 9 or 10 lines long; ovary 15 lines long, flower yellow, 2 inches in diameter; stigmas only 1½ line long; fruit apparently dry and spiny, 1½ to 1} inch long; seeds smoother than those of most other *Opuntiv,* rostrate, with a circular embryo. Apparently near *OpunHm platyacantha,* Salm.; but the tuberculated joints and the shape of the embryo approach it closely to *0. eylindraeea.*

" DITHTRIA, Harv., char, emendat Sepala 4, basi aequalio, oblongo-linearia. Petala 4 gpathukta, basi ampliata. Stamina 6 tetradynama, libera, edentula. Stylus brevissimus: stigma incrassatum. SUicula sessilis, biscuUta, basi et

CerUaurea americana, Sapindus marginata, and a *Bolivaria,* probably identical with a new Texan species, brought to mind the flora of Arkansas and Texas, while the gigantic *Echinocactus Wxslizeni}** reminds us again that we are approaching the Mexican plateau. This enor- [97 (13)] mous cactus attained generally a height of 1 £ to 2 feet; specimens 3 feet high were rare, but one specimen was found which measured 4 feet in height, and near 7 feet in circumference; its top was covered with buds, flowers, and fruits, in all stages of development In size it ranges next to *Echinocactus ingens,* Zucc., specimens of which 5 to 6 feet high were collected near Zimapan, in Mexico. Another Mexican cactus, *E. platyceras,* Lem.f is said to grow 6, and even 10 feet high, and proportionately thick. *E. Wislizeni* is therefore the third in size in this genus.

From the same neighborhood a beautiful *Mamillaria* was sent in dried, as well as living specimens. It appears to be one of the few *MamUlarim bngimamnue,* though it differs in having purple, not yellow flowers, and stiflèr spines. By the name I have given it, 3/. *macronuris,*[15] I intended to indicate the unusually large size of different parts of the plant, the tubercles, the spines, and the flowers.

apice emarginata, a latere plano-comprena. Semina in loculis soli Una, compressa, inimarginata, horiiontalia. Cotyledoues plawe radiculae descend en ti septum spectanti accumbentes.

Annual (all?) plants of California and New Mexico, with stellate pubescence, repando-dentaU leaves, yellow(?) or white flowers in simple terminal racemes.

DITHYREA W is Liz EN I, n sp.: erecta incano-pnbescens ramom, folii* breviter petiolatiH repando-dcntatis, racemo umtalliformi, demum laxo elnngato; periicellis etflanduloeis, horizontalibus flore longioribiis, sepal is caJyci* aperii patulis; petal id (albis) obovatia, unguieulatis bani dilatata sub-cordatis; stigmate conlato conico; siliculis baai pmfundius emarginatis.

Common in sandy soil near Valverde and Fray Cristobal, north of the Jornada del Muerto; flowers in July Plant about 1 foot high, annual or biennial; leaves ovate lanceolate, attenuate in the short petiole*, closely resembling those of some specie* of *Gaum;* pedicel* filiform, longer than the flower or fruit; flowers white, about 3 lines in diameter, open; petals obovate, with a long and distinct claw, which is widened at base ; filaments also thickened at bow; ovary tomentose; style hardly viaible, morv distinct in the fruit, which is ft to 6 lines in transverse diameter, and about half as much from base to top; the valves appear to be closed at their attachment to the subulate solid dissepiment.

DITHTUA CALIFORNIA, Hanr.: pedicel 1 is bani bi glandulnsis horixnntalibua, flore multo brevioribos; tepalis calcyds cylindrici clauai ervctis; petal ia (aurvinf))ineari-s]vithuUtis; stiguiate bilobo; siliculis apice profuudius sjmafginatis.

Easily <tifttinfrai»bed by the characUm jmt eiinmerated from the New Mexican plant; though the difference in calyx and stigma will not permit a Kuntric separmtion.

[M] ECHHIOCACTUB WiBLtXKifI, n. sp.: ffiganU*!!*, vertice villoso-tomentnao; enstis . • . acutis crtnatis; arcnlia oblongia, approximatis, junioriUm fulvo-tnment<Mis; aculvis mlialibus flavi*, demum cinetvia, ponvctis; laieralibut sob-io Sfitaecis elon^mtk uvviasculia, snmmis infimisfjoe ft-« bnvinhbiui mbustinribua, annulatis; centralibos nibcllis anniiUtis, a rectis snmun fenis, 1 inferiore robusiismmn, supra piano, apice rvflexo-hamato; floribun sub veftacalilioii owio et tubo brevi campanulato sepalis imbricate auriciilaU>-a»nUtis GO-«> sti|«to ; st«|Nilis intcrioribus &-*) ovstii OMMS; petalis laneaolatas mneronatia, cmiuUtU; stvlo supra stamina nuiircfwsmiina brvvia longe exsetto; stlgmatibus klif

hmt [illegible] A«BMt with bwla, open *towen,* r<«on« *mi* ripe frniu on UM tune •pecimen. *U* linUTi 7? [illegible] **<***« which flower thn.uKh UM who). M»m, like £. *miupim*, Et^im.,* (in Plant [illegible] •w farmri d [illegible] kl!?!!!!? [illegible] «brir atila, eon* out at one* in •pring, and noaw *man* 4 fa* ku [illegible] >» tha flnt thqr ai« KMHaallr dovrloml during th« wb.4* M « . liaat l» «• [illegible] spinl Uto iShITIL [illegible] flowers 2 to 2½ inches with the remnants of the flower of the same length; seeds [illegible] «»»»». »Wi MMidmbU dUn^n, i. which Ik. eorn^l co.yU.loo. «« partly buried.

[16] MAMILLARIA MACRONURIS, n. sp.: *'****' "^ • • * - « * luh, * M latino elnncib crlimlrid.. incurvis, sulentis; areolis junioribus albo-tomentosis; aru s angulatis rectis, elongatis, omnibus patentis; radialibus sub-12

In the same region a strange plant was obtained for the first time, but then without flowers or fruit, and which, to the casual observer, appeared as curious as it is puzzling to the scientific botanist; single spiny sticks or stems having a soft and brittle wood, and a great deal of pith in the centre, one or more from the same root, but always without branches, 8 to 10 feet high, not more than half an inch thick, frequently overtopping the brush among which they were found, only towards the top with a few bunches of already yellow leaves. In the following spring the splendid crimson flowers of this plant were found by Dr. W. between Chihuahua and Parras, and to Dr. Gregg I am indebted for mature fruit, collected near Saltillo and Monterey. The plant proved to be a *Fouquiera,* two species of which had been found in Mexico by Humboldt; one of them, the *F. formosa,* a branching shrub, was only known in the flowering state; the other, *F. spinma,* a spinous tree, only in fruit The structure of the ovary of the first appeared to differ so much from that of the capsule of the second, that it was afterwards deemed necessary to distinguish both generically, and the second constituted then the genus *Bronnia.* Having both flowers and fruit of a third *Fouquiera,* I am enabled to solve the difficulty to some extent, and prove the neces* [98 (14)] 8ity of reuniting *Bronnia* with *Fouquiera.*[19] JjChe flower of *Fouquiera splendent,* as I have named the northern plant, is that of a true *Touquiera,* while the fruit is nearly that of *Bronnia !*

tenuioribus, olbidis; centralibus sub-3 robustioribus, longioribus, fuscis; floribus maximis, roseis; sepalis ovatis, acutis, fimbriatis; petalis mucronatis, fimbriatis; stylo supra stamina brevia longe exserto, stigiuutibus 8.

Sandy soil near Dofiana, in flower in August. All my specimens single; trunk oval, 1 to 2 inches high ; tubercles in 8 rows, 12 to 15 lines long, incurved; groove at first tomentose down to the tomentose supra-axillary areoia; radial spines 1 to If central 1* to 2 inches long; flowers 2} to 3 inches in length and diameter, probably larger than in any other species of this genus; petals rose-colored, darker red in the middle.

[16] FOUQUIERA, Humb. B. Kunth, charact. emendat. Calyx 5-sepalus, imbricatus, persistens. Corolla hypogyna, gamopetala, longe-tubulosa, limbo brevi 5-partito, patente, ostivatione incomplete contorta. Stamina 10-15, hypogyna, exserta; fllamenta inferne arcuata villoea, basi inter se coherentia; anthem biloculares, longitudinaliter dehiscentos, mucronato, basi cordate, imo dorso affixsD, introrsn. Ovarium liberum sessile; placentae 3 parietales ad centrum products neque connate, ovarium inde incomplete triloculare; ovula sub-18 ascendentia, in quaque placenta 6 bberiata; stylus filiformis trifidus. Capsula coriacea trivalvis; valvfe medio placentifera; placente demum margine centrali connate et a valvis solute placentam singulam centralem triangularem formantes. Semina 3-6 complanata, alata s. comosa; albumen tenuissimum membranaceum ; embryo magnus rectus, cotyledonibus planis, radicula breviori infera.

Mexican shrubs or trees, with soft fragile wood, and tuberculated, angular branches, the tubercles bearing spines, and in their axils single or fasciculate obovate entire leaves; splendid crimson flowers in terminal or subterminal spikes or panicles. At present only the following species of this genus are known:

1. P. FORMOSA, HBK.: fruticosa, spinis brevissimis, foliis solitariis oblongis subcarnosis; floribus scssilibuB arete spicatia, staminibus 12;, stylo apice tripartite.

2. P. BPLBND1K8, n. sp.: fruticosa, simplex, spinis longioribus, foliia fasciculatis, obovato-spathulatis, membranaceis; floribus breviter pedicellatia in paniculam thynoideam congestis, staminibus 15 ; stylo ultra medium tripartite, seminibus 3-6 comosis.

3. P. BPINOSA, HBK.: arboiw, ramosa, spinis longioribus, foliis plerumque fasciculate, obovato-oblongis, membranaceis; floribus pedicellatis corymboso-paniculatis; staminibus 10; seminibus 3 membranaceo-alatis.

Fouqmera $plenden$ is a common plant from the Jornada del Muerto, in New Mexico, to Chihuahua, Saltillo, and Monterey; flowers in April, fruit by the end of May.

A general description has already been given in the text In New Mexico it was seen only 8 or 10 feet high, but farther south it was found from 10 to 20 feet high, and in favorable localities it is said to grow even 30 feet high, and rarely thicker than about one inch in diameter. Bark smooth and ashy gray; spines horizontal, slightly curved, 6 to 10 lines long, disappearing on old stems; leaves deciduous fascicled in the axils of the spines towards the top of the stem, thort-p«tioled, spathulate, obtuse, membranaceous, glabrous, somewhat glaucous, 9 to 12 lines long, and 3 to 4 lines wide; panicles from the upper fascicles of leaves, near the top, one or several, erect, crowded, 4 to 6 inches long; pedicels bracted, longer than the yellowish chartaceous calyx; sepals orbicular 2 lines long; corolla scarlet 0 to 10 lines long; filaments at base slightly cohering with one another, and with the base of the corolla, villons below and with a small horisontal process, which forms an arch over the ovary. Placenta in the ovary lateral, 3, bearing each 6 ascending acute ovula, at the inner margin, where they appear to touch one another without being actually united

Towards El Paso a curious capparidaceous plant was collected, which appears to be nearly allied to the Californian *Orystylis* of Torrey and Fremont, and forms with it a distinct group in that family, approaching very closely to *Cruciftrce,* as has been remarked by Professor Torrey.

1 have named this new genus (in honor of its discoverer, who has, though unaided and often embarrassed in different ways, done so much towards the advancement of our knowledge of those northern provinces of Mexico—the first naturalist, it is believed, who explored [99 (15)] the regions between Santii Fé, Chihuahua, and Saltillo) *Wuslizcnia!*[11] From *Oxystylis* it is principally distinguished by its long stipitate ovary and capsule, which latter is reflexed, and by the elongated racemes; it may, however, have to be united with that genus.

On the mountains about El Paso, another of those cylindraceous *Opuntiat* was found, but much thinner and more slender than both species mentioned previously. To judge from an imperfect description, it must be nearly related to the Mexican *0. virgata,* Hort. Vind. I have given it the name of *0. vnginnta}** as the straw-colored loose sheaths of the long spines [100 (16)] are very remarkable. A new *Erhinoccrcus* was also collected here, which, on account of its dense covering with small spines, I have named *JLdasyacanthiis.*[1]* I have in cultivation one of

at that stage of the growth. Soon after they protoibly adhere in the centre to each other, and towards the ripening of the capsule detach themselves from the valve**, presenting a free ceutrul triangular spongy placenta, with about 6 (or by abortion less) seed.*. Cajwule coriaceous oval, ocutish, light brown, about 0 lines long. Seeds compressed, integument expanded in a wing, which is cordate at the iipjwr end, and finally resolve* itself into a coma of silky fibres. If my view of the ovary and fruit of this plant ẇ correct, the ovary in 1-celled, with 3 lateral placenta) — that of a true *Fouquieraj* the ripe cajwule is 1-celled, with one central placenta — that of *Iironnia,* and the unripe fruit inuit be 3-celled! *Fouquiera tpUndens* grows readily from cuts, and i-* med about Chihuahua for hedges and fence*.

[17] WibLlZENiA, n. gen. Se]Kila 4; petala 4 ohlonga, brevitcr unguiculata; alumina 6 toro cylindrico inscrta; filamenta filiformia longe exserta cwtivatione inflexa ; ovarium longe stipitutum, globose didymuru, biloculare, loculis 2-ovulatis ; stylus subulatus, elongiitus, stigma gloltosum. Cajwula siliculwfonnis, didyuia tulierculata cum stipite in pedicellum filiformem refracta, bilovularis, loculis plei-uniquc j»er alxutum 1-spermis; valvto urceoLiUo a dissepiinento pertuso solute, semen iucludente; semen conduplicato-reuiforuie, l»ve; cotyledones radicuho supers? incumbentes.

A glabrous New Mexican annual, much branched, of the habit of *Ckomdla,* with tenuUe leaven, distinct laciniate-fimbriate stipules, and bracted at last elongated racemes, small yellow flowers; fruit rvflexed, stipe with the equally long (not Mpimnid) style, and the small difUM>pimeiit persistent after the falling off of the valves.

W. RirRACTA, n. *p. (>n the upjHT crowing of the Rio Grande, near El Pano ; flowers and fruit in August. An interesting and quite anomalous plint, on account of its fruit with an almost complete dissuptmeut, and of iu stipules and bracts. TutarcuLited valves of the capsule squinting from the placenta), and though open, retaining the only (rarely two) seed-placenta forming a complete dissepiment, which, in the perfectly ripe and dry state, fiiudly becomes perforated in the centre.

[M] OPUNTIA VA<iiNATA, n. sp.: caule ligno^o, ervcto, rnmulii teretihus vix tulmrculatw; arcolis orbiculatin, albotomentosis, margine superiore fosciculum setarum brevium fuscamm, inferiore aculeum elongatum corneum vogina laxa rtraininea involutum, detlexum gerentibus; floribun jmrvin, ovario olxivato, onnilis 13 t^mientosis aetigeri* sti|»lo; sefMilis interioribus 8 et petalU 6 obovotis mucronatis; bocca obovaU profunde umbilical*, cornoso, tuimhiiaca; s^minibus paucis.

On the mountains near El Pano; in August in (lower and fruit. Ik-long* to *Opumtim cylimdnum* gracilior* (Srtlm-Dyck); [M?ha|w nearest to *0. virynta,* H. V., but <li<tin,kMii*!,«,l |»v the longer defleietl spinet. Apparently 3 or 4 feet high; ultimate branches 2} to 3 lines in diumetrr ; spine* ningk 1J to 2 indies Ion*, nuvly with a *wtctmA* Miialler one, straight, more or lew deflexal; epidennal nhi-ath yellow or hn>wnuh, very l»«*f at bsl coming off; ovary 4 to ft lines long; flower 6 to 9 linen in diam«-UT, pole yellow, with a greenish tinge ; stigma coaic, wllh 5 adprvswd (HymenU ; fruit 7 to 8 line* long.

»• KciiiNocERECs DAMTACASTHCg, n. «p.: ovato^blonjjus s. subcylimlricus. 17-18 cosutuo, eostis mlieicaUlto subinterrupti«, arvolin approximiitis omto.lanc«olatM, junionUw siU^rilled; arulei* aibłdi*, jonioribus apicr ruWK ra«lialibuAsiil>-IH jiorrectis, summis breYioriUs tenuioribus, Utcmlibuj infcrioribu-ijuc longiuribtis; centralibut *4r** pluribus dcfl**xi!i.

El Paso del Norte. The specimen I*for* n» - one of tbr Utfrsl - t's li inchf* hifch, on-1 3| inrhrs below and S inches aUiYi* in diameter ; wool on the young arwla unusually bmg, deciduous; up|wt spins* 3 lie

the largest specimens seen by Dr. Wislizenus, which is one foot high. In this neighborhood *Opuntia Tuna,* MilL, was seen for the first time; and this is perhaps the most northern limit of that extensively diffused species, as well as of *Agave Americana,* another common Mexican plant Both were found in greater perfection near Chihuahua, and from there constantly down to Monterey and the mouth of the Rio Grande. The *Opuntia* appears to extend also high up in Texas.

Together with these a *Dasylirion,* perhaps the same as the Texan species, was found here, and afterwards again near Saltillo.

From El Paso to Chihuahua the road lies in part through a dreadfully arid sand-hill district, where a peculiar *Martynia*™ was observed, and farther on through a lovely [101 (17)] country, which at that season (August), after the annual rains, was covered with a luxuriant vegetation. The elevation of the country is here between 4,000 and 5,000 feet above the gul£

The rare *Cwallia sinuata,* which Dr. Gregg has also sent from Monterey, was found in this part of the journey. Here also occurred a perennial species of *Linum,* with yellow petals, — so far, in America, the only perennial yellow-flowering *Linum;* it is distinguished by its long aristate sepals, whence the name.[21] Several *(Enotkefie,* not seen before, made now their appearance; different species of *Gilia,* a number of *Nyctaginece,* several *Asclepiadacece, Malvacece, Cucurbitaccce, Composites,* and others, were here collected; including a number of new species, which only want of time and references have for the present prevented me from describing. Near Lake Encinillas another *Mdrtynia** was found, which in its foliage comes nearer to *K proboscidea,* but is readily distinguished by its purple flowers. A beautiful yellow-flowering bignoniaceous shrub, — probably *Tecama dans,* Juss., — seen more frequently farther south, was observed for the first time near Gallejo Spring. Shrubby *Algarobice* were seen more plentifully, as also some other *MimosetB.*

Here would be the proper place to introduce a notice of the several species of *Yucca* found by Dr. Wislizenus; but unfortunately the labels of the specimens were partly lost, so that it is impossible at this time to arrange leaves, flowers, and fruits properly. Certain it is that several species besides *Yucca angustifolia,* mentioned above, wei^seen; that the leaves of all of them have filamentose edges, some with very fine, others with very coarse fibres on their margin; that the majority bear juiceless capsules with very thin, paper-like seeds, but that one species produces an

lower lateral ones slightly compressed 6 to 7 lines long, lowest 6 lines long; central spines nearly as long as the last, stouter than the others. Prom·*B.pectinahu* and *E. aupitotut* (see note 46), which it resembles, it is distinguished by the longer, not appressed spines, the larger number and size of the central spines, etc.

* MABTYNIA ABBNABIA, n. sp.: annua, glanduloso-pilosa foliis alternis, longe petiolatis, cordatis, 3-5-7-lobatis, lobis rotundatn, repando-denticulatis; bracteifl lanceolatia calycem obliquum, infra fissum, dimidium ©quantibus; staminibus 4; rostro pericarpium ©quanta.

Sandhills below El Paso, flowers August. Leaves 1J to 2 inches wide and long; flowers spotted, "yellow" (Dr. Wislizcnus), a little smaller than in Jf. *proboBcidea.*

[11] LINUM ABISTATUIC, IL sp.: catilibus e rhizomate ligneo pluribus, ramoaissimis, angulatis; foliis spanis Bubulatia, aristatis, superioribtts bracteisque denticulatds; sepalis lanceolato-linearibus trinerviis, arfetatis, margine membranaceo glanduloso-denticulatis; petalis (flavis) calcycem sub-duplo superantibus; stylis coalitis; capsula ovata, acuta, sepalis pereistentibus bis breviore.

In sandy soil near Carizal, south of El Paso; collected in August, in flower and fruit The rhizoma in the specimen before me is 6 inches long and 3 to 4 lines in diameter, white; stems numerous, 1 to 3 feet high, divaricately branched; upper leaves (lower not seen) 3 to 4 lines long; flowers 10 lines in diameter; sepals 4 lines long; petals sulphur yellow; styles united for about three-fourths of their length ; capsule 2 lines long.

* MABTTNTA YIOLACVA,n. sp.: annua, foliis alternis, cordatis, repando-sinuatis, acutedenticoktis, giabrinsculis; bracteis knceolatis calyce·obliquo, infra usque ad basin fisso, dimidio brevioribus; staminibus 4; roetro pericarpium superante.

Near Lake Encinillas, north of Chihuahua; flowers August; leaves 4 to 6 inches long, and nearly as wide, indistinctly sinuate-lobed, beset with small, sharp, distant teeth; flowen from pale red to deep violet purple, as large at in Jf. proboscidea.

edible succulent fruit with very thick seeds. Fortunately, the seeds collected by [102 (18)] Dr. Wislizenus arrived here in the best condition, and some have already germinated, so that we may hope to raise some of these species. *Yucca aloefolia,* of the Southern United States and Mexico, is said also to bear an edible fruit, but has serrulate leaves. We have therefore different species of *Yucca* with edible fruits, which may constitute a peculiar section in this genus.

The soil appeared to be too fertile here for the production of *Cacti;* and, with the exception of some *Opunticr,,* the only species collected between Paso and Chihuahua—about one hundred miles south of the former place — was *Cerats Grcggii*™ which was peculiarly interesting, as it is probably the most northern form of *Ccrcus* proper. The specimens sent for cultivation by Dr. Wislizenus were unfortunately dead when they arrived here, and neither flower nor fruit had been obtained; but Dr. Gregg has collected the same species near Codena, south of Chihuahua, in flower, from which I completed the description. I could not have given it a more appropiate name than thut of the zealous and intelligent explorer of those far-off regions. I learn from Prince Salm-Dyck lhat a *Ctreus,* probably the same species, was sent to England by Mr. Potts, of Chihuahua; but his specimens also did not live ; they were very remarkable for having a thick turnip-shaped root Neither Dr. Wislizenus nor Dr. Grc^g having paid attention to the root, I am unable to say whether their specimens agreed with those of Mr. Potts in this particular.

Dr. Wislizenus was forced to go from Chihuahua westward to CosihuiriachL However prejudicial this involuntary interruption of his journey may have been to the primary objects of his expedition, it appears that he could not have selected a more favorable field for botanical researches. Amongst the porphyry mountains of Cosihuiriachi and Llanos—which vary from 6,000 to 8,000 feet in height — and their deep chasm-like valleys, a great many undescribed species of plauts were found ; in fart, almost everything collected there appears to bo new !

Among the trees, I mention three species of pines, entirely different from those found farther north, but perhaps identical with some secies from the Pacific coast Tho most magnificent of these three is a species nearly related to *Pinius Strobus* and *lHnus JUxMs,* which I naiuo P. *ttrobiformii.'** Its size and gmwth, its foliugQ as well as tho shape of tho conos, [103 (19)] resemble the common white pine of tho north ; but the cones are two or three times as large, not to 8j»eak of tho other differences. It only grows on the highest mountains of this region, of about 8,000 fett elevation, and attains the height of KM) to 130 feet

Pinus macrophylla™ another inhabitant of the higher mountains of Chihuahua, is more common than the last Like it, it closely resembles a well-known 8j>eciefl of the United States, *P.*

[m] CBBIL'M ORBOOII, n. up.: we tin, ntnumua, peutaj-oniu ; armlin dinUiitiboi oblongu, nttfio-totnentnaia; aculris mi8*i% bnjTUMuniin, « Umi incrunMita »ul>ulatin, ii4uti**iiiiijs I>-0 nuli:ililm* aiibftcanria, infiinia loaiporibua, cetilmJi •ingulo defieio minuto; tuljo floris clnnpita, arv»h* <k>M> cimn*>-t<>im?silo»i« M»U» G-li iiitfricanUa a, spic* albida* gerentibus 11111100 ; sepali* interiorihm 15-*) rt |*Ulu* !!>-*> lancuulalus aruminatia, iflU^ru.

. North and aouth of Chihuahua; flower. April au.l May. St:m 1 to i fwt bi^h$_f$ •bout 6 line* in dkmcter; t??" *!-10 l Hlie Ionj?f exlnrlBcl J «^rp; flower aboat 6 itichin Lm« ainl i inchw in duum-Ur; brullo. uf *the* lube

* *mT* *''*5 int€riur ^ ^ ^ K~^ *V**** \^ \"<Vh·

ouink a*^JNU«.*TIIOIIIrollllltt» »• »p.: *«\u*m»* turionum ovati* aruminatu; ra^init Uuu, jmtulus deciauk; foi* ?.i:.nd .~"°7Diba*» •*J** sltto linmtia, actiU carinatii, aubtoa amvexia, niaiKtne tannbaiius aomtUlit; strobilis

obtusis inermi lemum recurvis.

about V€*ihnilit*hL Tb« tout* pine in thU I^OQ 100 to 13) f«i hi^b. KbcaU* 6 linfs loi« very deciduous ; leaves 2 is species forms, with *I'inus Strobus* "I* "^ /•*-.• l«uliar «rti<m, auUri^iuh.,1 *hy* tbnr firr Um and ib«tr cylindric pendulous squarrose cones. *Strobus* are the most slender, concave on the back, and strongly serrate ; those of *P. strobiformis* what more rigid, convex on the back, and slightly serrate ; those of *P. flexilis* are still more rigid, convex on UM back, and entire.

[n] PINUS MACROPHYLLA, n. T ^ " ^ ^ i 0 ^ *mmkmlk* ltalbri- foliis, squarrosis, persistentibus; vaginis elongatis, adpressis, laceris ...elongatis congestis ternis, quaternis (rarius quinis) longissimis, folu.

australis, from which it differs by its short cones, which have on each scale a mainmillary recurved tubercle, and by having the leaves not only in threes, but also in fours and even in fives. It may be near *P. oeddmtalis* of the interior of Mexico, but that has regularly five leaves in each sheath.

*Pinm Chtkuahuanaj** is the common pine of Cosihuiriachi and the mountains of Chihuahua, in general at an elevation of about 7,000 feet It grows only 30 to 50 feet high, and resembles somewhat *P. variabUis,* though sufficiently distinct Dr. Wializenus was unable to obtain specimens of a fourth pine, which is said to grow on the still higher mountains to the west, near Jesus-Maria, bearing cones 15 or 18 inches in length.

On the highest peaks in this region a species of *Arbidus* was found, which the inhabitants call *Matron*™. It is a small tree, with a smooth, red bark, bearing in November and December red edible berries. If it is at all distinct from *A. Menziesii,* Purah, of the northwest coast, which it closely resembles, it ought, from the color of its bark, to bear the name of *A. sanguinea.* [104 (20)] These, together with a low scrubby oak tree, with small perennial leaves, were the only trees collected about Cosihuiriachi. A species.of *Juniperus* with red berries, a *Thuja,* and a small-leaved *Cawania* (?),» all of them in fruit, were also brought from there.

Between Chihuahua and Cosihuiriachi, but especially about the latter place, the porphyritic soil produced a number of *Cadaem,* some strange *Eehinocacti,* several *MamiUarice,* a few *Opuntue,* and principally a great variety of *Eehinocerei.* One of the latter is completely covered with stout and Ion* spines;» another has short radiating spines, closely adpressed to the plant-,» a third has short radiating spines, with single stout, black central ones, which project from the plant in all directions;» a fourth is distinguished by its longer and curved reddish radiating spines,

marine carinaque serrulatis, ntrumque aspero-striatis, subglaucis; strobilis ovato conicis; squamis tuberculo conico,

^E^ZZSPZttSEEZl » to BOfet high; sheath 15 to 2O lines long; leaves 13 to 15 inches long in the specimens before me, in fours as well as m threes, rarely ID five* ; cone 4* inches long. Evidently Z» P. «,«**., Mich., but well distinguished by the charucten, enumerated.

» iVrnu *CkihuahuaU,* n sp : squamis turionum acuminatis, adpressis; vagims adpressis, elongate, lacerw, deciduis; folii* ternis (rare quaternis) supra glaucis, subtus virescentibus, favitar striatis, inargine tcnuissime serrulatis;

bus.

50 feet in height; leaves 2 to 3* inches long; serrulate on the margin, but with nearly smooth striae; cone in the

specimen tefo^eli inch lojfr ^ ^ ^ ^^ t w ^ t c e d a't apex, revolute, tomentose below; glabrous and glanduiar above, sweet*cented; *%^Jf£ £ ^^ WeU ,, the oUong kbe* *I* UnC long;

areolis elevatis, ovatis, snbapproxiinatis jonioribu. albWo-tomentods; aculei. radialibus 10-12 flandis, apice adustu^ plus minus porrectis; lateralibus majorib™, demum ,ubadpre«is,-«iperioribus minoribus; centrahbus sub-4 cornels, apice fuscw, 3 superionbus sursum TCrsis.inferioresininilolongioreporrecto.demumdeflexo.

CosihniriachiT — Sevtral oval stems, 4 to 5 inches high and 2J to 3 in diameter, from one base; upper, radial spines 4 to 6, lateral and inferior 8 to 10, upper central 9 to 12, lower one 15 to 20 lines long; spines at last

^"^ECHIHOCBKOB ADCSTUS, n. *: ovatuB, 13-l^costatus; areolis elevatis Janceolati^approximatis, junioribu. albo-tomentosis; aculeis ndUibo. 16-18 adpressu., alb.s, amce adustis; 4-6 superionbus brevibus, setaceis, centrali nullo. lateralibus inferioribusque longioribus,

to 2 in diameter ; upper spines 1, lower about 2, and lateral

Cosihuirinchi. — Plant 1½ to 4 i 4 to 5 lines lon

sp ." ovatus ia-14-coetatUB, areolis elevatis, ovatis, subapproximatia, junioribus adprewiB. junioribus apicc (ulustis, superioribus brevibiiH setaceis, lateralibus centnili sinjnilo lwrrecto, robusto, fusco.

** ECHINOCEREE RADIAMS, n. albo-villosis; aculeis IUUIIUibus 16-20 inferi

central spines brown or black, much stouter, 1 inch long'

with a stouter one projecting from their centre.[81] I have al] of these in cultivation, hut [105 (21)]
have not seen as yet ilowers or fruit from any of them; still they cannot but belong to my genus *Echinoccreiis,* to judge from analogy.

Some *Mamillaria* of Cosihuiriachi are distinguished by their compact shape; the tubercles are very short, globose, or even hemispherical, the spines strong, numerous, radiating, and addressed, the fruits central from a woolly vertex: *Mamillaria compada.**[2] Another, *M. pumvtifcra,*[23] belongs, together with two species from Texas and from tlie mouth of the Iiio Grande, to the section *Angulares,* with pyramidal 4-angled tubercles, and milky juico, which, hardening, forms a gum. A third species belongs to *CriniUr,* and is a most elegant little plant with numerous hair-like radiating, and one stout, hooked, central spine ; I have named it *M. barbatafi** The speci- [106 (22)]
men communicated by Dr. Wislizemts, the only one found, was dead when it arrived here, but many fruits were adhering to the plant, and I was thus fortunate enough to cultivate it from the seeds.

Other remarkable *Cartarcce* from the State of Chihuahua, which have been communicated to Dr. Wislizenus by Mr. Potts, of Chihuahua, arc not described here, as it is believed that Mr. Potts has sent them already to England, where no doubt long before this, they have been published.

Amongst the other distinguished plants of Cosihuiriachi and Llanos, I cannot omit to mention a beautiful *Delphinium?* which gruw abundantly here; a *Silnir,* which is perhaps new, but comes near to *& multicaulis,* Nutt, of the Kocky mountains, and *& Mofiniana,* DC, of Mexico; a new
*

[w] EciilNOCERKt'8 Runspixrfl, n. *p. : flongnto-ovatiifs 1 l-c«tttatiis; aivolj* flevntiH Luicvnlatift, nppmxinintifl, joniorihuA albidi>-vilWui; ncuK>ia radinlibu* ltt-IH, drmum adpnwi*, intertcxtiH ; 3-5 »upcrioribu* DCUCCI*, brtivibiw, albidis ; lateralibua elonipitM fiia-i*, rvcurvi*, iviitruli niii^'iilo, rt'btinto, fu*rn. pornrto.

Coftihniriacbi. — St«»m 4 im-hea high, b*«low 2} in diameter; upper radial rpinc* or bristle* 1 to 2, lower alwui 4, and lateral 7 to 9 lino L>n^; central npinc much stouter, 1 inch long.

[n] MAMILLARIA COMPACT A, n. up : nitnplex, hemisphwricii, *. <k>pn^v> ^lo)»o«a; ttiUrrulin aMirpviAtin, ovoMeo-enniciM, sulcatiti; an^>IiM ovato-Ianctyfl-uiit, juniorilma nllNvtoiuontiwiM ; orulein cimnibuii rmlialibu.% 13-Ht MilioM|Ualibtts rolnialiji, recnrvatls atlpniwi*, intrrU'XtifS albi«lU, mijM*ri«»ribiw npiro fu*ci*; milriii tiil«crculorum axilliMpic junioribut et rertic« tomvnUiHiji; lluribiui in vurtice conp^tin ; Wcw ellipticU pcripmio coronatiis viriiliUui; •eniioibiu obovaiii| bmbuiy fulviiu

CoaihuiriacbL — Plant S to 3} indict in •liamrtor ami 1} to S| inchcn bi^h ; tulierclai in 13 rowt, 4 linot bight 6 lines wide at bam*; *\viui+ inUTlnckin^, and th«*rvby «fU«n <lofonn^l and twinteil, stout, 7 to 10 lino* long.

[m] MAMILLARIA OUMXIFERA, n. up.: lartiflun, nimplex, brniiupbaTtica, tuU-rculU qumlinngtilato*|iTTmmidatit* Axillis areoliMjoe jiininribuji albo-tomcntiMiiji; aculrH rtvtin, rmlinlilmn 10-1S, infrrioribiui n»buati«Y a|>ke fnaci« tup* notes setaceos alUd<« tc*r superantibu*; ccntralibun 1-2 mbttstis brwibtin, fuMrii, (Mirroctia.

Cosihuinachi. — Frotu 3 to 5 inrlim in iliann-Urr, i| to 4 inch?* bi>;b ; wbrn wounded it exude* A milky fluid, which, hardening, forms a tnunfmrvnt or whitinh giim; tu»vrrW *m<M\y* in 13 oblique rflw^ 6 to 7 lines long, and 5 to 6 lim* wide at W; upper npim-n 2 to 3, lower *G* to 7, rpntrnl al>mt 2 lin« lonu. Klf»wrw and fmit not Prm, but pn>Ublr like tho* of two .itnilar »(*.K *M nppl.imni^* Kti^lm. ine.1., fn»m the Pirnlenali^ in Texan, and *m.* AesM^sVsnea, Eugelm. in.*!., fn»m tbe m«>itth «f the Kin (Sntndc ; l«4h are nl*n nimple, b«to*m»t, with pyrainU Uilwrdea, ami Mh have small reddUh wbiU' llowrrs an.l 1.mg rlivrUe srarU U•nle^ without the frmnanU *rt* the flown rfIT VV I l ^ f a f t Xh dh ... I^i ... nn^^ and in naac considerable numl^r .. ff iq^rii*, that thr red (tf ... or curate) berries of the MmMirut are alwajt deMitufr «f the rvmnant* of the Jierigime, He.: but the (oral) green frmtoalwajiaretoppe.lwithit.

[?] MAMILLARIA BARBATA, n. ap.: simple!, rfoimMlqiim: tttl^rrulontm aiillt* nu.1'ts; aruMs radialibus 10-15, cmtral, .•ngul. I-U -- i - -
lines in ..ngth.. ; ... ?y-i^«"«^»»*~ai^,i«ilK.^ifl ,iUflirt•f; tHi^ri.. i K,^ l.^: «.in« a t..4 ... tfc- >..u.i^r tuLr.!~,· — *U* oU.vte srt,.l.Kubtr, dark brown, minute.

[m] DELPHINIUM WISLIZENI, n. sp.: prmWf *rfrrtumt* ijfll|i,rf *J J* ^ ., *JviitAim* riun^., infimi. basi dilatatis;

*Bouvardia,** which is remarkably distinct from all the other Mexican species of this genus by its smoothness; an *Echeveria* perhaps identical with the Californian *B. aespiiosa,* DC.; several *Gerania,* which appear to be undescribed, one of them with white flowers; an *Eryngium,** with the lowest leaves most elegantly pectinated, and the upper ones pal- [107 (23)] mately divided; a *Zinnia,** intermediate between *Zinnia mtdtiflora* and *Z. clegans,* and which last season grew finely near St Louis from seeds picked from these specimens. Many other *Composites* have not yet been examined; a *Centaurea* may be found to be distinct from *C. Americana,* so far the only American species of that genus, which is so extensively diffused in the Old World.

Leaving aside several *Dale*, Lupini, Gilias,* a *Omtiana, Buchnera, Castilleia,* a number of *Labiate, Graminecc,* and many others, I will only mention a few more, which I had time to study more closely. First of all, the beautiful and delicate *Hevdwra sanguinea** probably the most southern, and certainly the most ornamental species of that genus. Next in beauty comes the

foliis pedatifide 5-7-partitis, laciniis incisis, segmentis linearibus, acutis, divaricate; floribus laxc panicnlato-rocemosis ; bractew subulatis ; lloribuB longe pedicellatis 5 calcore 8ubulat0, curvato repala m l o ^V*'''l**'' "P*1*8 2 exteri oribus acutis,3interioribu8obtu8i98imi8;l»toli8brevioribu8acuminatM;oyani8glabemmis.

On the Bufa, a porphyry rock near Cosihuiriachi. 8,000 feet high, m flower in September. Stem 2 to 2| feet high, slender, glabrouTglaucous; flowers sparse, with the spur 1* inch long, beautifully blue, on the outside slightly puberul t.

** S)nvAEDiAaLABKRBnfA,n.8p.: glaberrima, caule erecto terete; folife ternatis, breviter petiolatfe, ovate-lanceolatis, utrinque acuminatis, patentibus s. reflexis; cyma composite, foliaceu; calycia segments tubum bis supeiaotibus; corolla calyce quintuplo s. sexuplo longiore, ertus g l a W u l a , intus parce barbata.

Cosihuiriachi, flowers September. Perennial; 2 feet high, leaves 3 to »* inches long, 8 to 10 lines wide; flowers bright crimson, 12 to 15 lines long. Apparently one of the largest species of the genus; leaves entarely glabrous, not revolute on the margin.

"ÉBTNGIUM HETEBOPHYLIUIC, n. sp.: giaberrimum, caule erecto;foh« radicahbus oblan^olato-lmeanbus, acutis, penni-nerviis, serratis, serraturis cartilngineo-marginatis, ansteta; folns canlm.s infenonku. semto-pinnaMdis, superioribus palmati-partitis, segmentis linearibus incisis; foliw involucrahbus 10-13 hneanbus acunnnatis, spinoso bidentatis, rarius integris, capitulum ovale longe superantabus; bracteis coruleis subulatis flores superantibus, interi us lo bus.

^ m m o J T v d l e y s about Cosihuiriachi; flowers September. Biennial, 1* to 2 feet high; rmlical leaves 2 inches long,2 line, wide; involucml leave. 12 to 15 lines lon^l line wide;}«****>** 1"«imdiameter. Neartwo other Mexican specie*, *E.* CbrK»«, Lar, and *B. Hmk»,* Presl., d,«tinguish«l from the first by the larger number of linéar, not ovate serrate involucral leaves; from the other also by the larger number of those leaves which are generally toothed, not entire.

« ZINNIA INWRIIBDIA, n. «p.: caule erecto, wrnoso, pawe adpresse piloso; foliis scabns, infenonbus ovatis, ban obtasus superioribua subwoilibus ovato^rdatis acutis; pedunculo apice vix incmwto; involucri oyati squarai. marginauTobturis; paleis eristato-fimbriatis; radii hguhs oblanceolabs, extus scabnnsculis, cilutis; acheniia radii linearibus, disci 1-aristatis.

Common about Cosihuiriachi, flowers in September. Annual, I to 2 feet high; leaves 1 inch long, 6 to 8 lines wide ; flowering heads 18 to 20 lines in diameter. The cultivated specimens grew 3 feet high ; leaves 3 inches long and half a wide; head, hemispherica, larnw, Hgal* le* acute. Differ, from *Z.* muZh>fow by the less inflated ped«ncle,the broader and shorter leave* the cristate pal«o; *from Zdegatu,* which the shape of the leaves and of the chaff much resembles, by the shape of the achenia. I nfty state here that m all the cultivated as well as native specimens of *Z.mMjk*** the pale* are not entire, but fimbriate at the obtuse apex.

• HIUOHIBA BAKOUISEA, n. *ep. i* petiolis patenti pilosis; folus smu latissimo cordatu, orbiculah^ 6-7-lobatw, loW. incisis duplicatim dentatta, dliatb; junioribus pilosis; scapo nudo, infra parce piloso, supra cum pedicellis calycibnsquo coioratogia'nduloso; floribu. laxe-panJculaUs campanulatis; calycis lobie ovati. obtusw, sulwqualibus; petalislineari^pathulatwpeirfstontibua.cum.taminibnspistillisqueinclusis.

Porphyry mountain, of Llanos, flowers in September. Scape 8 to 12 .nche. b.gh; upper part, together with the flowers, bright scarlet; enclosed petals inserted below the throat of the calyx; stamens still lower; filaments equal iu length to the orbicular cordate red anthere.

bright-flowered *Pentstcmon coccineus;* *° *Lobelia mucronata,*[41] with fine red, and *Z. pccti-* [108 (24)]
nataf[2] with blue flowers. Amongst the most curious plants collected here is also to be mentioned an *EriogonumP* with inflated clavate internodia, and dark red flowers. *Pliascolus bilobatus,* ** is another interesting plant.

In the following spring Dr. Wislizenus accompanied the Missouri volunteers, under [109 (25)]
Colonel Doniphan, from Chihuahua to Pan-as, Saltillo, Monterey, and Matamoros.

Zealous as ever, ho again made large collections on this tour, but his duties as a military surgeon occupied his time rather more than the naturalist should have desired. Nevertheless his

[40] PENTSTEMON COCCINEUS, n. pp.: glaberrimna, glaucus, foliis infiniis obovatia, caulinis inferioribus oblongo-linearibu-s, su|>erioribus linearibiw minutU; racemo laxo, pedicellis oprraitis, elongatis, 2-brncteatia, 1-floris; calycis glandulosi segment is ovatis; corolla) tul>o supenie dilatato, limbo bilabiato, labio superiure ad medium bilubato; antheri* divaricatis tilamento sterili glabro, apice dilatato; ca|Miila acuminata,

Llano*, flowers in September and October. Stem 1 to 2 feet hi^h, nearly naked above, pedicels filiform, lower ones much longer than the flower, which is 15 to 18 lines in length; bright scarlet or crimson. Next to *P. imberbU,* Steud., but easily distinguished.

[41] LOBELIA MCCRONATA, n. *up* : perenni*, caule nirnplici erecto, glabro, infra follow, supra nudo; foliis iineari-lanceolati*, clongatia, acuuiinatis, argute denticubitia; tluribus laxe spicatis; bracteis linearibiw gland uluso-dentatis, inferioribiiA pedirellum 8ii|tcrnntil)U)S superioriburt eum n?<|uantibu8; calycibus hcmfrphicricift et |)dlicelliH hirti»; lobia calycis 8ulmlatis tubuni duplo ?<iijH'niiitiburt, tubum curolltT diiuidium fict^uantibus; lubia corulko supriori 1»UB lanceolatiM, inferioribim ovati« nnu'mnati*.

Cosibuiriachi idong rivuleU*; fiowen* in Septembrr. Stem 1 to 2 f«»t high; racemes 8hort, few (3 to 12) flowered; color of flower darker red than in L. *eanlirudu,* nion* like *L./uUtnu;* dintinguiHlied from all similar ones by the short lobea of the calyx, and the ovate mucnuiate lower negnicntM of the mndja.

I insert hen* the dr.«iTi)»tion of a nearly related N|HIKH from the country Mow Monterey.

LODKLIA PUYLUMTACHYA, n. sp : glaltm, caulc erecto, fulinH4>; foliin Luice«ilatis ariuuinatiis irn»gularitvT dentatis t. inferioribiiH subirit(*gri?*; Mpiai infra f<»li<Ma, elorigata, deriHiflnrn; bnirtet*! t*' mi lit is inferioriluiH flureni luiigi* nu|>vr-antibus, •uperioribm jniliirollo longioribun; calyrw glabri laciniis 8iibiilati>« riimllani vix iri|tiantil>u« s, ea breviorilw^; laciniis oorolln *u|>erioril»ii'« I mean I MM, inferionbiiH Luice«)lat«>-liiieanl»Ufs acuiuinatis.

Swamp* between MOIIUTW and Ci-rnilU>; flowem in May. Nt^ar *L Tcxensis,* IU.f, but dintingiiiAhcil by it» entire smoothness, by the long (IS to 1J in.·IK^), thick and fnluKvoim npike, and l»y the shorter segtuetita of the calyx.

[41] LOIIELIA PECTIN AT A, n. up : r.iule *vn+* to, ncahriii* -ulo, f<»)ii«o; fuliiM, brncUU et l«bi* calyriub |»ectin«to-dentatis, scaKrU; folii^ inferionhiH iibliiiigi>-lini-.mbim M^ililitH, *ii|irriorit»ii« e l«mi laU conlata, dtvtirn-nto angwUtJ*; rtxemo elongate dennifloni, l»m*·ten M«in-m «ul«v*|iiantiUiii; ralvrin tnU> turbituito peilicellum fDipuiiiU[1], l«»bi» duplo torioi*; tubo eorollsB brvvt, 1.>U« *u|K<noribuji lancet»Utu, iiiferioril>us ovali*, *\ medium oomlitb; antberb slylu4O« inrlniii, 2 inferioribus apic<; Imrbatiii

Coxihuiriachi in mout pbce«; flowem in SrpCnnlwr. Anntul (0 I In l| foot high; leave* abput 1 inch fa«fl •pike *dam* 4 to 6 incbm long, blue flowem « line* long; tuU* with 3 uliU about the mi-ltlle.

V^^•wwoiCM ATloiiDMM, n. sp.: |«muie. fohi« mlicalibiu |*HioUiw, lanrroUt^ eltrnpilus rillmiii; caulis glabri ...anci intenunliiis superne tumidi ... U »i i; cjiule itrntiin l i h t m s «l fU mutationes bracteis subulatis pilosis instructae bTolucrum aUretn rlonKEU>|«licrlUtum grrvntr, invulurm auni»nuUtii 5-dentatis, margine pilosis, multifloris.

6 to ^ *w l* ^ ^ ^ .* • ^^ rfilrmil>1<?tS ^>ww» »n H-i-t.-ml-T iVrrrniul. *H l» ifnt* high; leairrt all nrfie* much 1 ... ilf' 9 li0<* Wil1*,<m •horUr l*l|olr"i *11^ "f *ti»* '!•••••«' J[if]«n[u] *u>l»1 6 llfH<* •» *li*mHrr the* upprr « • 5-toothed, ineluftimT » t o " ******* l ** * *'mml **** * "whw l»nk'; in%..liunim aluul I line Img AIHI wiUr, always w-winged, Biniralarl y *n*mw K* • ^"^ red ^OWef»; lol«» of i^ngusiiuni aU»ut OJUAI; nut olir^-grrrn, nrumiiuit«, thn et by the hairy lemT ... ******** T11lT **l FWB, |nrluf« t*-» t»*r t-i U- «|«vi6«.ilU «|H%MI«^I. but A|>|«rt>nlly tlssli* per-ha|w their pumle^.l.w^ ^ **Pa*m *"»»"> »f lh« «k« in; iU< lar^- nuwU-r *>(*faw*n* in each invalur/um, a»J (not mentioned by Torrey).

... BILOBATUS, n. sp.: caule pn-U.UM<lMfHn^ h,T.lo; M,OIM ... pilosa reticulatis, lateralib^ ^ ... tantibus ... lUllnnl*TZi* ... L- .W^lk. tormiaali j-UoluU^s lmmn«.U«..tfM; i^lunral^ Mia longe supe- ... seminibus ... hirsutis, curvatis

Common about Cosihuiriachi; flu*** In 8rj4rtnWr ... T ... but the brown red flowers and ... •sad very suiall. ... siavi* %a?% . lt«r«i t«*t«t». I^viituc u lu»«« l-n*: «i*l I I*11* wider

collections are very full. Fortunately, Dr. Gregg accompanied the same expedition, and also made rich collections in that almost unknown region, which we may consider as the southwestern limits of the valley of the Eio Grande.

Before going into detail, I will only remark here, what a reference to the map and sections will more fully present, that the country between Chihuahua and Parras has a general elevation of from 4,000 to 5,000 feet; between Parras and Saltillo it rises from 5,000 to 6,000 feet, and thence it rapidly descends towards the lower Bio Grande.

South of Chihuahua a curious leafless *Euphorbia* was collected, with tuberous roots and leafless stem; nevertheless apparently a near relative of *S. cyathophora.* Here, for the first time, *Berber** trifoliata,* Moric., was met with, which appears to inhabit the whole middle and lower valley of the Rio Grande, as we find it again in this collection from Monterey, and Mr. Lindheimer has sent beautiful specimens from the Guadaloupe, in Texas.

Echinoeerei and *Echinocacti* appear in greater abundance. The rediscovery of the beautiful *Echinocereus pectinatus (Echinocactns pectinatus,* Scheidw., *E pectinifenis,* Lem., *Eehinopsis peetinata,* Salin, in part) is peculiarly interesting, as it furnishes the means of proving a Texan species, which has been confounded with it, to be entirely distinct The description of the plant (which died without producing flowers) found in several works, as well as in the latest publication on *Cactacew,* before me, of Foerster, Leipzig, 1846, was made, as Prince Salm informed me, from specimens sent from Chihuahua by Mr. Potts. It entirely agrees with my specimen from the same region. But the description in Foerstei's work of the flower of a specimen in Cassel, flowering in 1843 (not kuown from where obtained), shows that to be identical with a Texan species, [110 (26)] common between the Brazos and Nueces rivers, whfch I have described in Engelmann and Gray's Plant* Lindheimeriame (Boston Journal of Natural History, V. p. 247) under the name of *Cereus aespitosus,* and which should now be named *Echinoeereus caspitosus. Eehinopsis peetivata,* & *Imwr* ,Monv .,and 7. *Beiehenbachiana,* Salm, are perhaps forms of this Texan plant, which varies considerably in its native country. Dr. Wislizenus has sent me a living specimen and dried flowers of *E. pectinatus.* Unfortunately, the plant met with a similar fate to thoso sent to England by Mr. Potts, and there is none now in cultivation, if I am correctly informed; but I preserve the dried specimen in my herbarium, and have been enabled to draw up from it the description."

« EOHIKOCBMOS PECHHATOT mihi *(EduMttictut peeHtuOiu,* Scheidw.; *E. pectiniferus,* Lcm.) : simplex (an semper?), ovato-cylindricus, 23-costatus; ureolis elevatis, linearibus, approximate, junioribus albo-villoeis; aculefe ndiälibüs 16-20 sübrecurvis, adpressis, pectinatis, albia, apice roseis, superioribus inferioribiwque brevioribus, lateralibu8 lonRioribus; centralibus 2-6 brevissimis, uniseriatis 5 tnbo floris pulvillis 60-70 brevi-tomentosis aculeos albns 8. apicē rowos 12-15 gerentibus stipato; sepalis interioribus 18-20 oblanceolatis; petalis 16-18 oblongis, obtusifs •Mao-denticulatis, mucronatis.

Bacbimpa, south of Chihuahua; flowers in April. Stem 7 inches high, below 3J, above 2* inches in diameter; upper and lower spines 2 lines, lateral 4 lines long; central spines mostly 3, sometimes 2, and below as much as 5, in one vertical row 1 to 1 lineJn length. Flowers about 3 inches long and wide; red or purple spiny bristles on the tube 2 to 3 Unes long, the uppermost 3 to 5 lines long, only 3 to 6'together.

It will not be amiss to introduce hew again a more complete and correct description of its Texan relative.

ECHINOOBBIUS C4SPITOSUS mihi *(Echi»op*U peduuUa,* anctorum partim- Cfewu* *cayiU*^* Engelm. L c) : ovatus, cBRpitosus, 13-18-costatus, areolis elevatis, lineanbus, approximate jnnionbus albo-villosis; acnleis radiahbus 2O-3O eubrēcurvU adpressw, pectinatis, albis (nonnunquam roseis [castaneis], Lindh.) superioribus inferioribusque brevioribus lateralihiis lonrioōribus, centralibus nullw; tubo floris pulvillis 80-100 longe cinereo-villosis setas apice . . t o t L t L ^ ^ [illegible] 6–12 gerentibus, stipato; sepali. interioribus 18-25 oblanceolati, i n t ^ i . . denticiaati.; petali. 3(M0 obovTlanceolati., obtusis, acuto, s. mncronatM, cihato^enticnlatu,; st.gmatev.ndi ,nfund.bul.fonni, 13-18-parUto; bacca viridi ovata, perigonio coronata, villosa, setosa, demum nudata; semuubus obovatM tubercnlatis nigris.

From the B[illegible] e d ^ e ^ r e l y as much as 5 or 6 inches high and 2 to 3| inche. in diameter; longer lateral and of nearly the sam« th» Nnaeaa. in Texas, lindheimer; flowers in May and June. Generally 1 to 2 inches high

Near San Pablo another *Echinocereus*[4]* was found, and dried flowers as well as [111 (27)]
living specimens have safely arrived here. A large *Echinocactus** was collected near
Pelayo; unfortunately no flowers were seen, but the specimen brought to St Louis is so far in fine
condition. Of another smaller but most elegant species of the same genus,[48] Dr. Wislizenus col-
lected the living plant and flowers, and Dr. Gregg the ripe fruit It is distinct from
the other *Echinocacti* found in those regions by the membranaceous very thin sepaloid [112 (28)]

spines in different specimens 2 to 4 lines long. Flowers in the northern specimens, from Industry, 2 inches long and wide, in those from New Braunfeis 2| to 3 inches in diameter and length, generally a little wider than long when fully open ; brown or black bristles on the tube 2 to 5 or 6 lines long, surrounded by wool, which is often 3 lines in length.

*• ECHINOCEREUS ENNEACANTHUS, n. sp.: ovato-cylindricus 10-costatus ; areolis elevatis, orbiculatis, distantibus, junioribus breviter albo-tonientosis; aculeis angulatis, compressis, rectis, albis; radialibus 8 sifbaxjualibus, centrali singulo longiore, deinum dcflexo; floris tubo pulvillis 30-35 olbo-tonientosis setas spinescentes albidas fuRcatasqno inferioribus 6, superior!bus 2-3 gurentibus stipato; Repiilis interioribns 10-13 oblongo-lineanbufl, petulis 12-14 lineari-oblongis obtusis s. mucronatis, apice denticulitis; stigmatibus supra stamina brcvia cxsertis, 8-10 liuearibus elongatis.

Near San Pablo, south of Chihuahua; flowers in April. Plant 6 to 6 inches high, 3 to 4 in diameter, branching from the base ; areola) about 1 inch distant from one another; spines stout, angular, like those of *E. triglochidiutiui,* lateral spines 9 to 16, central one 18 to 22 lines long. Flowers 2j to 3 inches long, red ; spiny bristles in the axil* of the lowest sepals (on the ovary), four brown 2 to 4 lines long, and two white 3 to 4 lines long; higher up the number of the brown bristles diminishes, and on the upper part of the tube we find only two white bristles of 6 lines length in the axils.

[41] ECHINOCACTUS FLEXispiNCS, n. sp.: globosus, vcrtice subnudo, costis 13 obliquis, tuberculato snbinterroptis; areolis ovatis, junioribus albo-tomcntosis, distantibus; aculeis junioribus rubcllis, deinum cinereis; radialibus 9-11 rectis s. subflexuosis, superioribus tenuioribus, infimo breviori, curvato, lateralibus longioribus compreseis annulatis, rectiusculi*; centralibus 4 angulatis compressis annulatis, 3 superioribus lectiusculis a. curvatis, inferioro longidsiino flexuoso, plorumque paulo nncinato, deflexo.

Pelayo, between Chihuahua and Pnrras. The specimen before me is 10 inches high, and the same in diameter; ribs thick but not rounded ; areota (without the floriferous arcobo, which are 3 to 4 lines long) 6 lines long and 4 wide, 1 or lj inch distant; upper spines the most slender, Ij to 1$ inch long; lowest one 1 to 1| inch long, •touter; lateral spines lj to 3 inches in length, slightly and sometimes indistinctly annotated; upper central •pines 8} to 4 inches long; lower npiuc stoutest, 4 to 5 inchif long, mostly deflexed, often flexuous and twirted, more curved or even hooked at the extremity, much compressed, 4-aiiglcri, sharply cariitato above and below, slightly annulated.

• ECHTHOCACTTS UNOuropnrus, n. up.: deprcsso-globosus, eostis 21 interrupts tnbercnlaliis areolis approximatiB junioribos albo-tomentosifl; actileis radialibus sub-21 tenuioribun, albidis, recurvin, inUrtexti^ centralibus 5 (rariu* 9) robustioribos, longioribtus comeis, sunum verm*, singulo robusttomo, fu^co deorsum flexo; floris ovario taboqoo brevi sepalis membranacd^, auriculato-conlatia, firabriatis sliptto; peUlis oblongts obtnsis; stigmate bmrisumo conieo 10-15-milcato (*. putito T).

About Pelayo; flowers in May. A very elegant plant; the specimen before me 4 inches in diameter, 3 inches in height The large recurred spines * especially the stouUwt central one, which U of a WuUh horn-colnr, with a brown point, and is curved and bent downwwd like a large fang — am-r tho whole tnrfaee of the plant, and giro it a very fPett7 J!P?emnCe, LoWir mUg|lll « *&*" • <> >°. ^PP*1' 18 to 10 lines long; upper oentnl tpioes 18 to IB *Unm* long, hot lower stouter one only 10 to IS lines in length. Flowers dencriW from the shrivtdkd •pedmenf fooml on the lmngpi^abwtlPf al engthand ptohnbly pale r«L I lure little doubt that some fruit* collected in the *mane* iwm l»nom san Lonnio) by Dr. Qfogg belong to this ipedn; the fl«hy <md berry b 10 or IS HMI km&eoveivd JT^ JiJJJJ|j5 *"•iC*1" whkh •• tod •• ih. Oowen, Md crowned with the remiunU of UM IOWV; *+ is a very remarkable phnt, «d .ppmehM i i ^ m , *MmmUmim;* tb. tabmk. whloh lam tb. Intemiptad ribs are sideways com groove on their upper edge, which ends in a regular axillary depressed areola, like that o ... the scaly ovary and the curved embryo prove it to be an *Echinocactus.* The specimen brought here by Dr. Wislizenus died soon after it arrived, as many of those collected in April and May during the flowering season, though only two months on the road, while those collected the year before, between August and November, which had been packed up for eight or ten months, mostly do very well now. Dr. Gregg's seeds, however, have germinated well.

scales on the tube of the flower and the juicy glabrous fruit, in which respect it resembles my *E. setispinus* from Texas. *E. Texensis,* Hpfr., has a juicy fruit, covered with woolly and spiny scales; *R Wislizeni* and others have a dry fruit, covered with hard scales.

My *Opuntia frutescens* (Plant. Lindh., 1. c. p. 245), which had been collected by Mr. Lindheimer along the Colorado and Guadaloupe rivers, in Texas, was also found south of Chihuahua by Dr. Wislizenus, and again along the route near Parras,' and below Monterey. The suggestion made in the Plant. Lindh., that it may be a southern variety of *0. fragilis* of the Upper Missouri, has proved to be erroneous, as they belong to quite distinct sections of the genus *Opuntia. 0. frutescens,* together with *0. vaginata* (vide note 18), is one of the *Opuntia cylindracece graciliores,* and is apparently nearly related to *0. leptocaulis* DC, but is easily distinguished by its strong, white, single spines, while *0. lept.* has three short blackish bristles.

Agave Americana, with several relatives, was found in abundance on this part of the route. *Argemone Meadcana,* white, yellow, or rose-colored, was frequently met with; *Savu>lus ebracteatus* occurred in moist places so far. inland and on such elevations, while before it was only known as a littoral plant; *Malvacece, (Enotherce, Asclepiadacece, Gilice, Solanea, Justieice,* shrubby *Labiatce,* were collected of many different species. But the great characteristic of the country were the shrubs forming the often impenetrable thickets called "chaparrals." They are mostly spinous, very much branched, often with remarkably small leaves, and not rarely with edible [113 (29)] fruits. Among them many rhamnaceous and celastraceous shrubs, and some *Euphorbiaeece,* were particularly conspicuous; as well as some *Mimoseas,* one of which I must not forget to mention, because it is perhaps the smallest shrub in this family, not more than one or two inches high, with diminutive leaflets, but large purple flowers. It was collected near Chihuahua.

One of the most offensive of these chaparral-shrubs was the *Kasberlinia,* Zucc., called here *Junto* (Gre^); a small tree rather than a shrub, about 10 feet high, stem 4 to 6 inches in diameter; wood hard, dark brown with white alburnum; terminal branches green, with a dark brown spinous termination, 1 to 2 inches long, and 1J to 2 lines in diameter; very small subulate leaves soon deciduous; small white flowers in short lateral racemes; fruit not seen; in flower in May. It was frequently aeen from south of Chihuahua to Monterey (and Matamoros, Gregg).

We find here a<rain the interesting *Chilopsis* mentioned above (see note 11), also *Larrea glutinosa* (note 10), aud° another zygophyllaceous shrub, a true *Guajacum** which appears to be an undescribed species; it belongs to those plants that connect the Mexican with the Texan flora, as we find it extending from Parras to Monterey, and from there to the Upper Colorado, in Texas. *Teeoma ttans* reappeared here with smaller pubescent leaves and more alate petiole, though probably not distinct from the larger and smoother plant found below Paso.

The beautiful *Fouquiera splendent* (see note 16), with its panicles of long tubular crimson flowers, rose here above all other shrubs; in some instances it reached a height of from 20 to 30 feet, and perhaps more, always in single stems.

A few species of *Yucca,* together with *Opwniia arborescent* (note 5), formed almost the only trees on the arid plains. . But in the valley of the Nazas occur stately trees of a species of *Algarobia,* distinct from the *A. glandidosa* of the north, with broader legumes, larger seeds, and few or no glands on the leaves.

• QUUACOM AHGCSOTOLIUH, ri. sp.: foliis n M (4-8) jugis glaberrimis, foliolis oblongo-linearibus, wticuUtb; pediodlis et basi calycw pubescentibus; ovario bilobo, pubesccnte; capsnla bivalvi, seminibus 2 ovatis.

About Parras, collected also by Dr. Gregg, who has found the plant common from Mondova to Parras, Monterey, and CamaiBo, • found by Mr. Lindheimer on the Pierdenales river in Texas; flowers in April and May. Shrub or unall tree with very knotty branches; leaflets mostly in 6 or 6 pairs, only on young vigorous shoots 6 to 8 pairs, inertly only 4 lineslong, * to 1 line wide, reticulated on both sides. Purple flowers 6 line, in diameter; seeds yellow, o f t h . ! £ * * £ bean. The hard and heavy yellowish brown wood is called - *Qruja***'' .bout Saltillo, aad used us a sudorific and in venereal diseases (Dr. Gregg).

About Saltillo *Echinocadus Tcxcnsis,* Hpfr. *{E. Lindheimcri,* Engelm., in Plant Lindh. L c.) was found, which extends from here to Matamoros, and to the Guadaloupe and Colorado, in Texas. The pretty *MamilUtria strobiliformü*® grows on rocks near Rinconada. *Uunnemannia fumaricrfolia,* Sweet, was collected near Saltillo, with smaller flowers (1$ inch [114 (30)] in diameter), and near Rinconada, with larger ones (3 inches iu diameter); an interesting plant, the eastern representative of the Californian *Escfocholtzia,* but perennial, with a small torus, a different stigma, etc.

I cannot omit to introduce here a beautiful shrub discovered on the rocks about Agua Nueva and Buena Vista by Dr. Gregg. Depending upon Don's characters of *Cowania* as correct, I must consider this plant as the type of a new genus, which I have great pleasure to dedicate to its indefatigable discoverer, my friend Dr. Josiah Gre^g, whose name has already been frequently mentioned in these pages.[61] *Gregyia rupe&tru* is a lovely, sweet-scented shrub, with flowers resembling roses iu shape and color, so that Dr. Gregg was induced to name it the " Cliff rose."

North and northeast of Monterey we reach the lower country, and with it a different vegetation; here is the home of the shrubby *Cassisac (Parkinsonia, Casparea,* etc.), and *Mimoscce; Sopkora, Diospijros,* some species of *Jihiis* and *Jihammis* are common here, as well as a climbing yellow-flowered *Hircta,* while another erect red-flowered species grows on the table-lands near Parma. One of the most beautiful shrubs of that district is *LcucophylUun Texanum,* Beuth., with its whitish tomeutose leaves and sweet-scented blue flowers. It is common from San Antonio, in Texas, to MODclova, and from Cenulbo to Camargo, but is not seen on the table-lands,

VitU trijrinnata and *V. innxt,* well known in the southwestern parts of the United [115 (31)] States and Texas, were also found here. Kemurkahle herbaceous plants were a *Xicotinna,* an *Orobanche* (on the sea-coast), an *Euatoma,* several *Asclcpimliurcr, Malvacc*, Cvcurbtiactce, Labiatce,* and others. *Lobelia phyllostachya* has already been mentioned above. (See note 41.)

Hasty and imperfect as this notice of the collections of Dr. Wislizenus is, it cannot but impress the botanist with the richness and novelty of the flora of these countries, aud invite the arduous explorer to further exertions.

8T. Locis, *December,* 1M7.

M MAMILLAEU rrROBUJFoRM!*, n. tp.: "implex ovatn-conica, tubcrruli* imbricato-adpraai*, ennicia, applanati*, sulcati a; acaleia recto raduditnw, nub-10 aliudi*, central ilm* 3 fu*a>-atri«, 2 minonbu* turtuiu vertia, tiugulo longior* pomdo; floribtu in vertice lanato rmtralihu*, ovario lanato; arpah* mib-lo Uncenlatia, arutia, tntagria; petalia aub-94 ofato»)anfolatia, mucrunatü, iiiU^j^m vil renua apiceu *enm*»\ 9ti^natil>u< 7 Uavia erpcto-intontibot cxwrtia.

Rinconada, on ruck*; flower* in Junr About 3 inches *hi^U,* and 2 im·be* in diamvtrr brlow; tubercle* in 10 to 13 oblique rows cluavlj adprem^l, m> M to ^*vr* ihf whole pUnt *xhv* ap|norance of a pineapple or cone, tomtotope in the groore and the axil«9 alxxit fi line* lon$_K$»; radul npinen 3 to ft, control ft to 8 lmen lon«; fluweri oentnd, 3 to 5 in t dnater toRKher imbedded in k«m$_K$ an.1 drn»e wool, tU.ut lft hnm 1»n$_k$' «nd wide; |»rUU deep purple.

JF[01]* (; Talrx tubuUua, ft-loboa, imbricatus; petala 5 —^ lMCi iDielta; itomin» Dumeru«i^iiia rum petalU inirru; oraria plura fundo calrcii tnaerU I-, rmrioi 2-ovulata; ttylua rUloaua, deciduua, •ti$_K$ona nudum ; ovulum nupra bmun o?ani plaoenue Utcndi injemuii, tnatiuptUBt achenia vil ioea' ecaoeU; aemen unicum, erectum, embryo ratlicula tnfera.

A Mexican shrub w Uh §llul1 cunwa€ ****** Jwl^« I « ^ ''*** ^ ~ ^ ftipulea, and aoUury nw^colowd or purple sweet-scented flowers.

GREGGIA SUPERTRAS, n. sp. Cliffs about Saltillo, Buena Vista, and Agua Nueva, flowers January to March; several feet high, much branched, leaves about 6 lines long, and at the apex 3 lines wide, crowded; revolute on ibt margin, glabrous above, tomentose beneath; Oowm terminal on abort WancbVu 15 u> I* line* in diameter Noarh' related to Cowania, but distinguished by the imbricate, not valvate calyx, ike ltd, noi jclluv fluwcrs and ike decldonoi, ** persistent style.

III.

PAPERS ON CUSCUTINE^E.

I. A MONOGRAPHY OF THE NORTH AMERICAN CUSCUTINEiE.

FEOM THB AMEHICAK JOtJBNAL OF SCIENCE, VOL. XL1II. No. 2, OCTOBER, 1842.

IN directing my attention to the different forms of Cuscuta of this vicinity, I was surprised to find several distinct species, as well as a remarkable allied genus, while only a single species, the *Cwmta Americana* is noticed in botanical works. Having been induced to examine particularly as well the species of this neighborhood, as the specimens with which my correspondents in different parts of the country have favored me, I offer the result of my investigations to the public, with the view of directing the attention of botanists throughout our wide-spread country to the subject; trusting that thfs neglected tribe of plants may thereby be further elucidated. I therefore avail myself of this opportunity to request botanists in different parts of the country to communicate specimens of the Cuscuto of their vicinity, accompanied by the plant on which they grow.

ORDER CONVOLVULACEJ:, *R. Br.* TRIBE 2. CUSCUTINEJ5, *Link.*

Leaves reduced to scales. Embryo spirally rolled around a mucilaginous albumen, without cotyledons.

This remarkable tribe is appended to *Convolvulaceat,* and bears to that family the same relation 'which *Mmotrope** bear to *Pyrolacece,* and *OrobaruhoB* to *ArUirrMrutB:* these plants, which may be likened to Phanerogamous Fungi, being all destitute of verdure and of proper leaves (bearing scales in place of the latter, but never leafless in the full meaning of the term); while in the structure of their flowers they agree with plants of the highest organization. They are all parasitic on other vegetables • the *Cuscutine** on their stems; most *OrobancJux* on their roots; and the *M<matropew* on their moulding remains: hence they are obviously analogous to the class *Entozoa* of the animal kingdom; and may be termed *Epiphyta,* growing on plant*.

The Cuscutinea are distinguished from other Epiphyta by their growing on and twining around the stems (and occasionally the leaves) of other plants, as well as by their large seeds, resembling those of Convolvulus, but presenting a long and slender embryo, which is spirally coiled around a macs of mucilaginous albumea *Monotrope** and *Ordbandum* have extremely [334] minute seeds, in some respects similar to the spores of Acotyledonous plants. The seeds of Cuscutinea germinate in the ground; but soon finding the plants round which they twine (turning constantly to the left like all Convolvulacese), they strike their papillose roots into the epidermis of the stem, from which they subsequently derive their nourishment; their own original stems soon withering away, so that the plant is no longer in direct communication with the earth.

As in the *Entozoa,* the same species inhabits only the same or some nearly related animal, so in the *Epiphyta,* each species is for the most part restricted to the same or similar plants. This is more constantly the case in *Orobanchecr,,* where the germinating embryo fixes itself at once upon its favorite plant; but in Cuscuta, where the seed germinates in the ground, and the stem afterwards lays hold of the plant which affords its nourishment, it frequently twines around all the plants in the neighborhood, and is capable of extracting from them its food. Some species, however, are more constant in their predilections than others; as, for example, the European *Cuscuta Epilinum,* which never grows on any other plant than Flax ; and our *Lepidanchc Compositarum,* which is confined to *Solidaqo, Helianthns,* and some other *Composite.* Yet several, like the European *Cuscuta Epithymum* and the American *C. Polygonorum,* live promiscuously on most plants within their reach, evidently preferring, however, some particular species or genus, and seldom found except in its immediate vicinity. I have therefore ventured, as far as practicable, to name the species of Cuscuta after the plant upon which they grow ; in accordance with the nomenclature frequently adopted of late iu the case of parasites, especially in the genus *Orobamhe* (Exanip. *Orobanche Galii, 0. Eryiigii, 0. Scabiosce, 0. Saltict,* etc.) —thereby designating an important circumstance in the history of the plant.

Before I proceed to describe the North American species known to me, it may be well to present a general .

Conspectus of the species that have come under my observation,

I. CUSCUTA, *L.* Sepals united into a 4-5-cleft calyx.

(1. *Styles united into one.*

1. C. MOXOGTNA, *Vahl.* — Eastern Europe.

§ 2. *Styles two.*

• *Stignvns filiform. — European.* [880]

f *Flowers generally pentammus.*

2. C EPITBUICM, *L.* Segments of the calyx and corolla aenminate. — Europe.

& C. EPILJNUM, *Weike.* Flower globose: segments of the calyx and corolla orbicular, abruptly acuminate. — Europe.

4. C. PLANIFLORA, *Tenort.* Flower campanulate, open. — Italy.

f f *Flowert generally tetramerovs.*

& C. EUROFJEA, *L.* Lobes of the calyx and corolla ohtiue. — Kurope.

• • *Stigmas capUatt. — American.*

A. Corolla cylindHr, it* remain* covering th» ripening capsule.

f *Flowers gmertUly prntamerxmi.*

6. C. CHILCTSIS, *Ker.* 'Corolla much longer thin the ram|v»nulat«« calyx: anthers sessile. — ChUL

11 *FUrwert generally tetramerouM.*

7. C. CIPHAL49TBL Lobe* of the calyx and corolla ohtuae: anthen with fllamenta. — St Loots.

1 C. COETLL Lobes of the calyx and corolla acute. — St. Louu.

B. Corolla campanula, it* rrmain« pereUtent at the ha*« of the ripening capsule.

t *Flower* generally pentawuroms.*

9. C TULonrAOA. Garinate lobes of the calyx and the lobes of the corolla obtoae. - Vermont to Georgia and Missouri

10. C 8A0BCEL Smooth, lobes of the calyx and corolla ohttue. - Western New York to Mi-oorl

1L C mrTAOOWA. Lobes of the 5-angled calyx iroooth, roondi«h; those of the corolla acuminate. - Virginia.

11 C TimmccoeA. Lobes of the canipanulate calyx rerraroee, roundish; those of the corolla acuminate. - Ttxaa.

ft *FUnten generally tetramertius.*

1* C PoLTOO»O*mL Lobet of the calyx and corolla acute. - .8L Louis.

II. LENDAN'CHE. Calyx cnn*J»ting of 10-15 imbricated atpaie.

1. L. CoMmrrAftuif. Western United States.

(1.) Crsrt'TA, *L.* (DODDER)

Calyx monosepalous, 4-5-cleft, persistent. Corolla canpuuUlt or tuceokte, 4-»-deft. Stylo on* or two. Capsule 2-cellei, 4-seeded.

Twining parasitic plants, bearing the general character of the family. The stem is filiform, sim$_{v}$le or generally b bed, of a whitish, ellowish or o

« Z ! « y, *n* ^ ^ with Mldj le-Vrtt The inflorrwnr<• u• *tyne* (wilh • ^ ^ fc ^ op«ung flfft, ml uilkujr or Utml Bowen, v[illegible] with [illegible] or [illegible] (commonly called panicular,) in other species. [illegible] and pedicels, but they are always easily distinguish-l *Lm* ih* c^{lyx}

The first or central flowers of the inflorescence are mostly 5-parted, but the lateral or secondary ones are in some species regularly 4-parted, in others nearly always 5-parted. The calyx is constantly monosepalous, [336] deeply and somewhat irregularly 4- to 5-parted, and persistent.

The corolla is cylindric, urceolate, or campanulate, with the limb erect, spreading or reflexed, and together with the stamina either persistent at the base of the capsule, or more frequently separated from its insertion and covering its summit. Its texture is in some species nearly menibranaceous, in others thicker and more fleshy.

The stamina are united with the tube of the corolla up to the base of the segments. Near their base, within the tube of the corolla, they bear a scale, which is evidently not a distinct organ, but only an appendage of the stamina. They are present in all the species which I have examined; sometimes consisting only of one or few teeth on both sides of the filament (as in C. Goryli), but commonly forming a distinct lamina. In some they are bifid, in others undivided ; but in all either crenulate or fimbriate, or laciniately or pinnatifidly divided. They are erect and appressed to the tube in several species; while in others they are convergent, closing the tube and including the ovary.

The ovary is always 2-celled, 4-ovulate ; the styles two (in a single species united into one), frequently unequal in length; in a few cases supported by a stylopodium. The stigma is either filiform, as in the European, or capitate, as in the American species.

The capsule is globose or depressed, crowned by the persistent styles and stylopodium (when the latter is present); it is 2-celled, and sometimes 4-seeded ; but more generally by abortion, 3-, 2-, and even 1-seeded. In the European species, it separates by circumscission from its base, leaving the dissepiment persistent on the calyx. In the American, the capsule does not appear to open regularly, but it separates easily from the calyx when ripe.

I have seen very few abnormal irregularities in the flowers of Cuscuta. Sometimes one or more segments of the corolla are partially or entirely changed into a stamen, and the capsule is occasionally 3-4-carpellary, instead of 2-carpellary.

1. CUSCUTA CEPHALANTHI, n. sp.: stem high, branching; flowers somewhat pedunculate, mostly 5-parted ; tube of the corolla cylindric (after flowering ventricose), twice the length of the obtuse spreading segments, and of the ovate obtuse lobes of the calyx; stamens shorter than the limb ; the scales ovate, laciniate, nearly appressed; [337] styles equal to the depressed ovary ; capsule depressed, covered by the remains of the corolla.

On Cephalanthus; also on Vernonia, Aster, BoBhmeria, and other plants (especially Composite), on the margin of ponds and swamps near St. Louis, where it is the most common species. I have observed it since 1833; but have only met with it in the immediate vicinity of Cephalanthus. July to September.

The whole plant is whitish or pale yellow; the stem high and much branched; the flowers sometimes clustered and nearly sessile, but generally more or less pedunculate, and disposed in compact or rather loose cymes. The divisions of the calyx are very unequal, ovate, or roundish, obtuse, rarely with a little point, covering only the lower half of the tube. The tube itself is perfectly cylindrical in the young flower; but afterwords swells by the enlargement of the ovary, and becomes somewhat urceolate. The lobes of the corolla are ovate, obtuse, somewhat auricled at the base, and campanulate or spreading, half as long as the tube, but longer than the stamina. The corolla is menibranaceous, not fleshy. The flowers are mostly 5-parted; but the latest ones of the season are often 4-parted, or even 3-parted. The ripe capsule separates easily from the calyx, apparently without bursting.

2. CUSOUTA CORTLI, n. sp. : stem branching; flowers pedunded, subumbellate, mostly 4-parted ; tube of the corolla cylindric, equal in length to the ovate acutish crenulate inflexed lobes, and the acute carinate segment* of the calyx; stamens a little shorter than the limb; the scales appressed, bifid, consisting of few teeth; styles as long as the ovary with the stylopodium; capsule depressed, covered with the remains of the corolla, crowned by the stylopodium and the reflexed styles, Var. 0. STTLOBA: styles much longer than the ovary, exserted.

On Corylus, in the barrens west of St. Louis, in August and September. 0. On Solidago, in dry prairies near St. Louia.

This species is nearly related to the foregoing, but may be easily distinguished by the shape and proportions of the calyx and corolla, and by the stylopodium on the ovary. The corolla is fleshy, not membranaceous, [338] and finely crenulate; the lobes always erect and somewhat incurved. The scales of the filaments are smaller than iaany other of our Cuscute, and consist of one or two teeth on each side of the filament (where it adheres to the tube), thereby indicating the true nature of these singular "nectaria." It appears to be rarer than the other species, and grows more on dry ground.

3. CUSOUTA VULGIVAGA, n. sp.: stem branched; flowers pedunculate, somewhat glomerate or more lax, generally 5-parted; tube of the corolla deeply campanulate, longer than the pellucid-punctate open (finally reflexed) lobes, and the roundish, carinate, obtuse and slightly crenulate segments of the calyx; scales convergent, fimbriate, united at the base; styles about as long as the ovary (with the tttylopodium) ; the remains of the corolla persistent at the base of the sub-globose capsule.

Var. a. LAXIFLORA : flowers in loose cymes, *p.* GLOMERATA : flowers conglomerate, y. TETRAKEBA : flowers in umbelliform cymes, 3-4-parted.

This species has apparently not only the widest range of all the American Cuscutse, but is less restricted to the same genus or family of plants. Indeed I have scarcely met with it twice upon the same species. Var. a. is the southern and western form: Western New York on Decodon, *Dr. A. Gray;* Missouri on Cephalanthus and Amphicarpsea, and Georgia, on——?, /. *Carey;* Alabama, on Salix and Aster, *S. B. Buckley.* Var. /9. is the northern form: my specimens are from Vermont, on Leereia, and New Hampshire, on Solidago, both from *Mr. J. Carey.* Var. y. Connecticut, on Urtica, /. *Carey.*

The *Cuscuta vulgivaga,* is perhaps in part the Cuscuta Americana of Linnaeus, and of many later botanists. But their diagnoses are too incomplete to decide the point, and different species undoubtedly have been confounded under this name. Even Linnaeus himself (Spec. Plant, ed. 1, p. 124), referring to Gronov. Virg. and to Sloane, Hist. I., p. 20], t. 128, f. 4, confounds two distinct species. Which of them is to be the *C. Americana?* Linnaeus has only the following words: " Cuscuta floribus pedunculatis." Michaux,(I., 175) : "Cuscuta, floribus pedicellatis, pentandris." Pursh (I., 116): "C. fl. pedunculatis umbellatis 5-fidis." Other botanists add, [a] stigmatibus capitatis." [339] Nuttall, gen. (II., addit.) on the other hand has it: "flowers mostly pentandrous and sessile;[91] and Sprengel (Syst Veg. I., 864) brings his C. Americana under the section with glomerate subsessile flowers. While these authors refer to one or more North American species, others apply the name with at least equal justice to a West Indian plant. Linnaeus himself cites Sloane, Hist. I., t. 128, f. 4. After him Jacquin (Stirp. Am. p. 24), Swartz (Obs. p. 54), and others describe a West Indian species. The name may therefore properly be reserved for Sloone's plant, or may be discarded altogether. The only reason I have in supposing that most North American authors give it to *Cuscuta vulgivaga,* is that this is the most common and the widest spread species in the United States, and has generally the flowers longer-peduncled than any other.

This Cuscuta is intermediate between C. Ophalanthi and C. Sauniri. In all three the lobes of the calyx and corolla are obtuse, and the former shorter than the tube of the corolla. But our plant is distinguished from both by the carina of the lobes of the calyx, which is fonned by larger uneven prominent cells, and by the large pellucid dots in the substance of the corolla, which may be mistaken for glands, but are nothing but cells larger than the rest of the tissue. The carina of the calyx are most prominent on the three outer lobes, and sometimes hardly perceptible on the two inner; but even then the large irregular cells are easily distinguished by the lent. The lobes of the corolla are shorter than the tube, as in C. Cephalanthi: the scale* are large and incurved, and the corolla remains at the base of the capsule, as in C. Sauniri. The tube is campanulas, but deeper than in C. Sauniri or C. Polygonorom. The flowers and fruit are larger than in Cephalanthi, and (especially in var. o.) nearly of the tame tile as in C. Sauniri. The styles are in some specimens a little longer, in others a little shorter than the ovary, which appears to be crowned by a ntylopodium: this however it is hardly possible to ascertain satisfactorily in the dried specimens.

4. CCSCCTA SAURURJ, n. «p : utem low, branching; flower* 5-parted, somewhat pedunculate, at length in •piket; tube of the corolla campanulate, equal to the ohtutuinh carapannlate or spreading lobe*, and longer than the obtuse segments of the calyx; Rtamenn an long a* the limb; the scales ptnnatifld-ladniate, convergent, covering [340] the ovary; *tyle* as long as the ovate-globose ovary with the ctylopodium; remains of the corolla per*i*tent at the bate of the tubgloboae capsule.

Margin of lake* and iwampa, in the " American Bottom" opposite St. LouU, on Saurnroa, where it was dieeorered in September, 1841, by my friend, Cb. Oeyer, the indefatigable botanist who hat tignaliittl hi mm; If in the North- ****** Expedition of Mr. J. N. Nicollei in 1839. Alabama, *Dr. A . ProuL* Texaa, on Bcthmeria, Polygonam, Ac[f] *F. Lindhnmmr.* A variety with rather larger calyi-lobe*, in other reapecU perfectly agreeing with the above deeerip- *» was obtain*! by Dr. A. Gray, in Western New York (alio on SauronwT).

Thie specie* heart a great resemblance to C. Polygononun; bat differ* from it in the much stoater item*, U* great «r tbe of the flower*, the larger convergent tca1«s *nd the ttylopodiam on the ovary. The stem* are one-third of a line or more in diameter, and are stouter than in any othtr of oar *pedes. It in the late* tpeciea in blossom, the ! ^ ?o p l 2 * l r i l g Wor* *• beginning or mi<idle of September; while C Polrgwrntm commence* in August, —— C. Cepha..nthi and C. Coryli, which are the earliest flowering species of our neighborhood, are a bloom by the end of July.

5. Cuscuta rillTA * ? u ' * • * : * • * branched; flower* *jmivneato** tobiimbellale, mall, ^parted; lube * the corolla open-c *m**»*l«*> •**** than the long acaminate Inhea, and the emooth, roandbh, <*Mu«* lohe. of U* 5-angled calyx ; a to the globose ova ^ T i T ! ! ^ ** *** *i' ***'' **** i m W l l U ' « ^ T » t ; ft vie. flliform ; about fqt^

On Euphorbia or Tragia, Norfolk, Virginia, *"r. **t;* co««™ic*led by Dr O«y. Alan n~r *Hm*m.T*»* on different low herbs in a wet prairie; flowering i. April. *F. LMknZ.* Beanliowa, Illir^ i. *mmdj*** Ch. Geyer.

This species bears some resemblance to the C. Polygonorum, to which it is related by the campanulate flower and the acute lobes of the corolla; but is easily distinguished by the small size of the flowers, the 5-angled calyx whose lobes are not triangular, but roundish and obtuse. The angles are formed by the margins of the [341] lobes of the calyx and correspond with the petals, while in C. Coryli the five angles formed by the five prominent midribs alternate with the lobes of the corolla.

6. CUSCUTA VERRUCOSA, n. sp.: stem low, branching ; cymes loose, few-flowered; flowers (small) long-peduncled, 5-parted ; tube of the corolla campanulate, shorter than the lanceolate acuminate lobes, and nearly equal to the ovaje subacute segments of the verrucose or somewhat hispid calyx ; scales ovate, fimbriate, equalling the tube ; styles as long as the ovary; capsule globose, surrounded at the base by the persistent corolla.

Var. a HISPIDULA : inflorescence, and frequently also the branches, hispid or glandular-pilose; lobes of the calyx acute, shorter than the tube of the corolla.

0. GLABRIOR : cymes more or less glabrous; lobes of the calyx broader, somewhat obtuse, nearly as long as the tube of the corolla.

Texas: var. a. in dry sterile prairies, west of Houston, on Euthamia, Schrankia, Aster, Ambrosia, Evolvulus, and other low herbs; flowering in April and May, *F. Lindheimer.* £. with the preceding variety, *F. Lindheimer:* on Petalostemon, *Dfummond* (3d collection, No. 247).

This species is the lowest of all the American Cuscuto, and has, together with the foregoing, the smallest flowers. It grows on open prairies, in dry soil. In all these respects, therefore, it takes in Texas the place of *Cuscuta Epithymum* in Europe. Like that species, it is not restricted to a few plants, but appears to creep over everything in its way. It is the only Cuscuta known to me with any appearance of pubescence.

Stem from 4 to 6 inches high, smooth (0) or more or less hispidly pubescent with pellucid vesicular hairs, (a.) especially in the inflorescence; peduncles filiform, many times longer than the flowers; calyx always rough, but the vesicles less hair-like, more glandular, or when dry like warts. In flowering, the calyx is campanulate, or even somewhat turbinate, but soon after assumes a hemispherical shape, which is the one figured in the plate. Lobes of the corolla very acute, spreading, white; after flowering the tips incurved, turning brown. Stigmas globose, purplish-brown.

This Texan species is nearly related to C pentagona: the size of the flowers, shape of corolla and the [342] scales, are the same ; but it is easily distinguished by the loose and few-flowered cyme, and by the tuberculate or hispid campanulate (not pentagonous, smooth, and membranaceous) calyx.

7. CUSCUTA POLYQONORUM, n. sp.: stem low, branching; flowers subsessile, glomerate, mostly 4-parted ; tube of the corolla campanulate, nearly equal to the acute campanulate or spreading lobes and the acutish segments of the calyx; stamens as long as the limb; the scales mostly bifid, laciniate, appressed; styles as long as the depressed ovary; remains of the corolla persistent at the base of the depressed capsule.

On different species of Polygonum, also on Lycopus, Penthorum, and other plants in the neighborhood ; August and September.

This is a much lower plant than C. Saururi, etc., with orange-colored stems, twining round the Polygons in overflowed places, the bottoms of sink-holes, or margins of ponds, west of St. Louis, where in the year 1839 my friend F. Lindheimer—now in Texas, to whose zeal and kindness I owe many specimens from that interesting country — first discovered it In the following year I found it on the banks of Illinois River, near Peru, in thickets formed by immense Ambrosia, with Bidens, Spartina, etc. Whether any Polygonum was there I cannot recollect, having at the time paid no particular attention to this point. The flowers of the specimens from Peru are a little more peduncled, and the very acute segments of the calyx rather longer than the tube of the corolla; but I observe no other difference.

This and C. Saururi are easily distinguished from the others by their orange-colored stems, their larger open campanulate flowers, with the remains of the corolla always at the base of the capsule. The scales of the filaments in C. Polygonorum are intermediate between C. Coryli and C. Cephalanthi in shape, but are more laciniate than in the former. They are appressed to the corolla, so that the large depressed ovary appears naked in the open tube, while in C. Saururi it is covered by the convergent or inflexed multifid scales.

Nora. — 8inoe the manuscript of this article has been communicated to the American Journal, my attention has been directed to one or two tpecies of Cuscuta Indicated by the late Mr. Beyrich, and mentioned by Sir William Hooker in his [348] excellent *Flora Boreali-Amerieana* (Vol. II. p. 77), and in the first volume of the *Companion to the Botanical Magazine.*

C. vmbroaa of Beyrich, in herb. Hook. (PI. Bor.-Am., 1. a), from Canada, the Northwest Coast, as well as the United States, I am unable to determine from the characters given. It may be either my C. Sanrnri, or C. vulgivaga, *fi.* glomerate: the length of the styles does not appear to afford constant characters in this genus.

C. *arvtnBii* of Beyrich, in herb. Hook. (C. Americana t *Hook. Fl. Bor.-Am.,* L a), Is perhaps my C. Tulgtaga, «. laxiflora, According to Hooker, Douglas collected it in Oregon.

C. eoronata of Beyrich, in herb. Hook., is enumerated but not characteriaed in *Hook. Compan.·to Rot. Mag.%* I. p. 178 (New Orleans, Dnunmond, 1888), on the stems of Laurus Carolinensis.

C. BpiUnuwi, Wefhe, has been introduced, with flax, into some parts of this country, especially Chester County, Pennsylvania; *M* DarUngUm, Flora Cestrica,* ed. 2.

(2.) LEPIDANCHE,* *N. Gen.*

Ciilyx consisting of many imbricated scales, persistent; corolla tubular, 5-cleft; styles two; capsule 2-celled, 2-seeded.

Very similar to Cuscuta when younj?, but different in appearance when in flower or fruit. The stem which connects the different clusters of flowers having then disappeared, the latter only remain, consisting of innumerable crowded sessile flowers and scarious scales, spirally and most tightly coiled (with one or Beveral turns) around the steins of the supporting plant, which at a distance appears as if a rope were twisted round it The flowers are so crowded that many are abortive, and as it were strangled, presenting nothing but a bunch of scales, and others, which are apparently perfect, do not mature seed.

The principal difference between this genus and Cuscuta consists in the calyx, which is not monosepalous, but is composed of numerous imbricated scales ; of which the two or five exterior, being much smaller, may be considered as bracts ; while the ten inner, which are nearly equal in size and shape, crenulate, and with reflcxed or stjuarrose summits appear to constitute the proper calyx. The corolla and stamens, with their scales, are entirely similar to the corresponding organs in Cutcuta : so is the ovary; but the unequal styles are generally longer in proportion, and the stylopodium is as large as the ovary proper, or even larger. The ovary is 2-ccllcd and 4-ovulate; [344] but I have never sevn more than two seeds, separated by the incomplete dissepiment; and frequently only a single seed rijiens.

1. LEPIDAXCHE COMPOSITARUM : stem low, branching; flowers closely sessile, conglomerate, 5-parted ; tube of the corolla nearly cylindrical, longer than the oqunrnwe imbricated calyx, which con*i»U of ten to fifteen scales, twice as long as the oblong obtuse spreading or reflexed lobes of the corolla ; stamens equal to the limb, exserted; scales pinnatifidly laciniate, convergent, covering the ovary ; styles twice as long a* the ovary with the stylopodium ; capsule globose, enveloped by the scales of the calyx, crowned by the stylopodiuni and styles, and covered by the remains of the corolla.

Var. a. SOMDAGINIS : flowers smaller ; lobes of the limb reflexed ; stylnpodium half os large as the ovary.

Var &. HKLIANTHI : flowers larger; lol>es of the limb spreading; scales of the filaments united with one another forming a 5-loUil crown in the tube ; Ktylopodiuin larger than the ovary.

This singular plant ap|H>ars to be peculiar to the Western prairie*. I have olwerved it since 1833 in wet prairies around St Louis,[1] on Solidago (also on Wrnonia, *Ch. Geyer),* and Dr. Clapp has found it on Silphium at New Albany, Indiana; the second variety I have gathered on Helianthus since 1*38 in similar localities; flowering in August and Septeintwr. Tbe*e varieties may prove distinct Hpecies, but for the present I am unable to distinguish them bj more important characters than thorn given above.

The flower* are always 3-parted ; the tube U not exactly cylindrical, but a little wider at the mouth than at the base, rather ohronir. The *tyles an* longer than in any of our CUDCUUB, and almost always unequal; they are inserted on a distinct stylopodium, which U larger than in any Cuscuta. The stigma is capitate, as in all American CuscnUft.

EXPLANATION OF PLATE VI. [Reproduced on p.65.]

Figs. 1-6. CCSCUTA CEPHALANTHI. 1. A tetnuuermu ; 2, a penUroerous flower. 3. Corolla laid open. 4. The ovary. 5. Vertical section of a half-grown capsule. 6. Capsule invested by the remains of the corolla.

Figs. 7-11. C. COBTU. 7. A flower, a Corolla laid open. 9. Ormry and sty It* 10. Some of tar. *0.* 11. Cap-•»!• inserted by the remain* of the corolla.

Figs. 13-16. C. VCLOIVAOA. 12-14. Flowers. 15. Corolla laid open. 16. Ovary.

Figs. 17-81. C. 8ACBCEI. 17. The flower. 18 Corolla laid o|*n, with the indexed scale*. 19. Ovtry. 80. Verticil section of the half.«rown capsule. 81. Mature capsule.

Jigs. 28-84. C. TOTTAOOHA. 88. Flower. 83. Corolla laid open. 24. Ovarr.

F|R. 85. C. VBBBCCOBA. Flower.

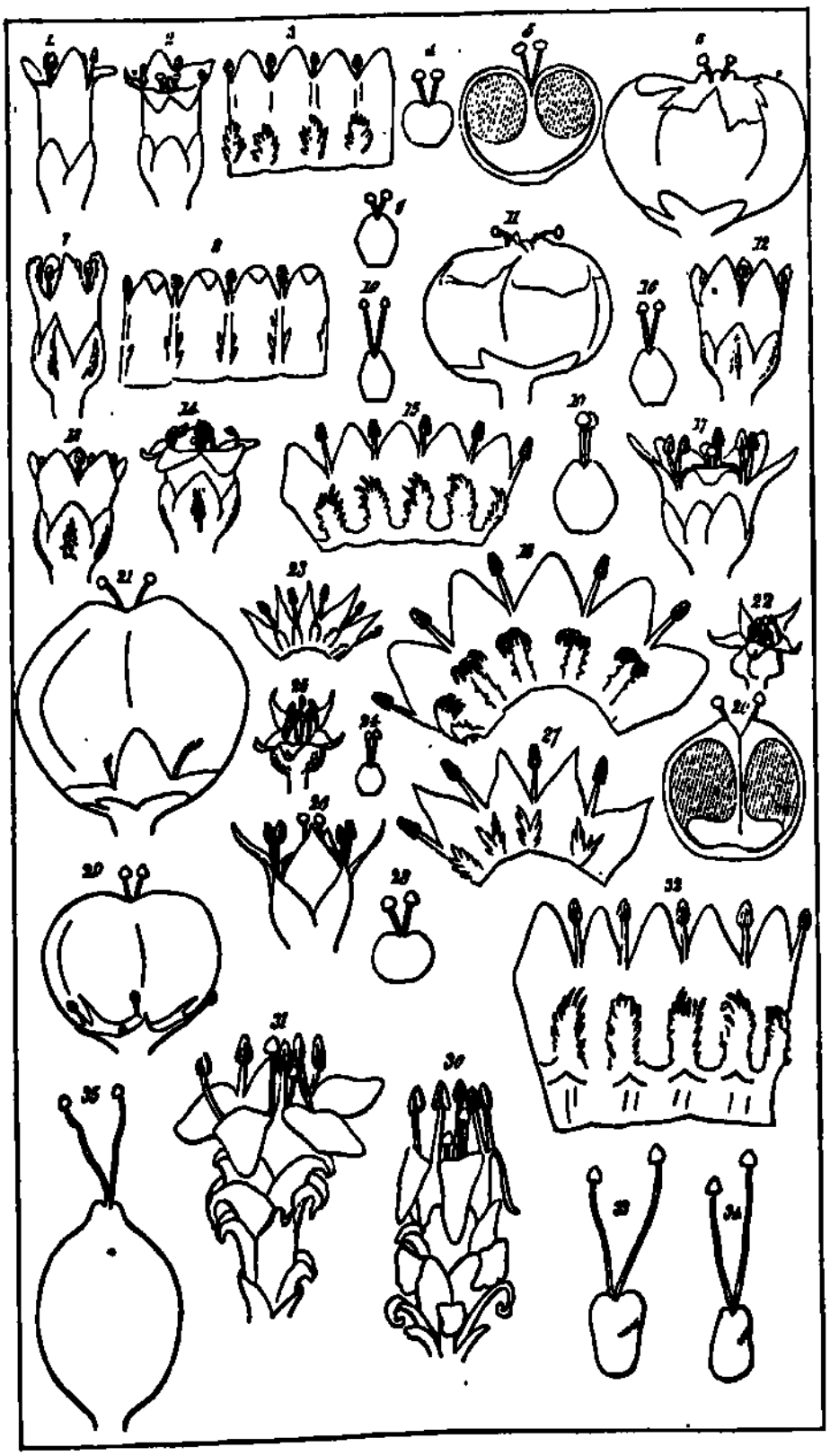
Figs. ^S ?' PoLTOOIIO*CM **• Flower. 87. CoWrfla *Wu* op,-n 2*. Ovarr. 89. Capsule,

Figs. LSMDAVCBB CoMVOfliTAftOM. 30. Flower of var o. 31. Flower of var. 0. 38. Corolliof/I. laid opto. 33. Ovary and styles of vat. «. W. feme of *fi.* 3.Y ('«|»tili>.

N. & The flower represented in fig. 1 i. a line in length ; all the dh.m are enUrjH in the «mc proportion.

[1] From λευις, *a scale,* and ἄγχω, *to strangle* : a scaly plant, strangling those on which it grows.

[2] This is manifestly the *Cuscuta Americana* (from St. Louis) of Hookr* aceooiit of DmttiDood*. coUsctioos, la tl* *Companion to the Botanical Magazine,* I. p. 178 ; of which it is remarked thst "to*, of the .p^rnm. M tohav«all*i flowers abortive and turned into scales, which are excessively crowded, and form a dense wreath a pale straw-color around the branch of some shrub."



DETAILS OF OUBOUTQIU*

IL CORRECTIONS AND ADDITIONS TO THE MONOGRAPHY OF CUSCUTINEiE, IN VOL XLIII. OF THIS JOURNAL*

FROM TUE AMERICAN JOURNAL OK SCIENCE, VOL. XLV. NO. 1, JULY, 1843.

A careful re-examiuation of this tribe during the past season, as well as the increased opportunity of examining specimens from different parts of North America, have discovered some errors, and made some corrections and additions necessary, which I should indeed prefer to withhold for the present, and subject to the test of another season's study, if it were not important to correct such errors as soon as possible. A fuller description of the new species, with figures, I defer to another time.

I am now convinced, that, although many Cuscutae prefer some plants to others, yet there is no constancy in this respect, fiut the same species often grows upon a great variety of widely different plants. I did wrong, therefore, to name them from the genera upon which they grew; and I should much prefer to see the names of *C. Cepiuilanthi* changed into *C. tenuijlora, C. Coryli* into *C. incurva, C. Saururi* into *C. umbrosa,* Beyr. ? *C. Poh/gonorum* into *C. clUorocarpa,* and *Lcpidancht Compositarum* into *L. squarrosa,* if they had not yet been published.

I. CUSCUTA, L.

1. CCSCUTA CEPHALAXTHI. — Mostly 4-parted ; frequently only 3-parted.

2. CUSCCTA CORYLI. — Found in miuiy places near St. Louis, on Hazel, Willow, Desmodium, Teucrium, Solidago, etc. The *long* styles observed in wme *dried* specimens of this as well as other species, are the consequence of a continued vegetation in the plant-praw! The variety 0. must therefore be stricken out. Flowers frequently Sported.

3. CUBCUTA VULQIVAOA.—Certainly the most common species. The stylopodium is very remarkable in the living specimens which I have examined ; and the capsule is oval, even a little pointed, less glol>ose than in any other of our Cuscuta ; but I am not prepared to say that this is the case with all varieties of this very variable [74] species. The stamens and pistils are as long, or rather a little shorter than the corolla, but the latter are elongated alter flowering. *(Cutcuta Americana,* Hooker 7)

4. CUSCUTA SAURCRI. — It is very probable that *Cuscuta umbrota,* Beyrich, ex nooker, is the name ; which name most therefore be substituted for mi no, though not quite appropriate. This plant is very nearly related to the former species, but can always be di*tingui*hed by the more open, earn pan u late corolla, which in *C. vulgivaga* is globose caiupanulate, the thinner texture of calyx and corolla, which is destitute of the pellucid dots, and the oblong lobes of calyx and corolla, which are alwaya more or lew orbicular in C. *vulyivay*. Large, overgrown specimens of *C. vulgivaga* have sometimes the lobes of calyx and corolla as long a* the tube, but ran always be recognized by the above characteristics. Such specimens are those from Alabama and Texas, mentioned in this Journal, Vol. XLIIL p. 340. The true (7. *Saurwri* I have only received from western New York, and from this neighborhood ; where it grows in abundance on Polygoaum, Sanrurus, etc. in a few localities.

I must mention here two specimens of a Cuscuta received from Mr. M. A. Curtis, collected, one in Massachusetts; the other in North Carolina. In their principal characters they agree with *C. Saururi,* bat the flowers are much smaller •ad frequently 4-ptrted ; the linear-oblong, obtuse lobe* of calyx and corolla are rather longer than the tube; the filaments subulate, shorter than the limb; ovary with a stylopodium ; styles short and thick ; capsule 1

An examination of *Wan* compkta •pecinwD* ***1 the living plant* must show whether there is a constant difference between this <*rtOT pl^at and the western *C. Saururi.* Hut I may here remark, that the eastern form of *C. vulgivaga* is also much smaller than our western form, and from Connecticut I have also received a totimmerons *0. ndgivnga!*

5. CUSCUTA T*wcot4.-Under this name I have confound*! two Texan species: the description is chiefly taken from the following specimens, but to the figure one, which was first collected by Drummond and afterwards by Mr. Lindheimer, both times on *Petalostemon multiflorum.* The description must be altered: — C. VERRUCOSA:

* The characters of the new species, etc., here described, have been published in the *London Journal of Botany* for April, 1843, as an appendix to the original monograph, there reproduced. See also a French translation of the first paper, by F. Schultz, in *Archives de Flore,* 1844, I., pp. 66–79. — Eds.

cymes umbelliform, compound ; flowers peduncled (small), 5-parted ; calyx campannlate, verrucose ; segments ovate, somewhat obtuse, shorter than the globose-campanulate tube of the corolla; lobes of the corolla long- [75] acuminate, somewhat longer than the tube ; stamens half as long as the limb; scales ovate fimbriate, rather larger than the tube; ovary globose, depressed, without stylopodiuin; capsule depressed. — The tissue of the corolla is composed of large irregular cells.

6. CUBCUTA HISPIDULA, n. sp.: stem low; cymes loose, few-flowered, hairy or nearly smooth ; flowers very long peduncled (small), 5-parted; tube of the corolla turbinate-campanulate, twice the length of the ovate subacute segments of the calyx, shorter than the long-acuminate somewhat crenulate spreading lobes; stamens half as long as the limb; scales ovate, fimbriate, nearly equalling the tube; ovary with a stylopodium and short styles.

Texas, in dry and sterile prairies west of Houston. Flowering in April and May. Compare the remarks made in Vol. XLIII. p. 341, under *C. verrucosa.*

7. CUSCUTA NEUROPETALA, n. sp.: cymes umbelliform, smooth, flowers peduncidate (large), 5-parted ; tube of the corolla campanulas, nearly equal in length to the ovate-lanceolate acute carinatdQkgments of the calyx, and the ovate short-acuminate one-nerved crenulate spreading lobes ; stamens rather shorter than the limb ; scales ovate, fimbriate, incurved, as long as the tube ; styles rather longer than the ovary with the stylopodium.

Texas, in wet prairies near Houston ; on different Composite, such as Liatris, Solidago, Helianthus, Rudbeckia, and on Myrica cerifera; flowering in August; *F. Lindheimer.*

Flowers rather large, but variable in size; segments of calyx always very acute, ovate or ovate-lanceolate, somewhat shorter or a little longer than the tube of the corolla. Anthers yellow or purple ; stigmas purple.

This and the last species resemble in the structure of the corolla the more northern *C. Coryli;* they have the same crenulated margin, the same fleshy-cellular texture, similar incurved tips of the acute lobes, and the same white color, which is not altered in well-dried specimens.

C. neuropetala is distinguished from *C. hispidula* by its perfect smoothness, its floweTs being twice or three times as large, its more compact, umbelliform cymes; the whole plant is toller (in my specimens twelve to eighteen inches high). The calyx segments, at least the three outer ones, are carinate; the lobes of the corolla are [76] broader, shorter, composed of small linear cells, which are contracted in the middle into a distinct nerve. Stylopodium large in proportion to the ovary. Capsule not seen. The purple anthers and stigmas in the white flowers, give this species a very pretty appearance.

8. CUSCUTA PENTAGONS — Capsule globose, somewhat depressed, without a stylopodiutn. The description is taken from the Virginia plant; the forms from Illinois and Texas constitute two distinct varieties.

£• MICROCALYX : flowers shorter peduncled; calyx not remarkably 6-angled, much shorter than the tube of the corolla.—Illinois.

y. OALTOINA : flowers shorter peduncled; calyx not remarkably 5-angled, longer than the tube of the corolla, which is equal to the acute lobes. — Texas.

This species bears some resemblance to *0. Polygonorum* on one side, and to the three foregoing species on the other; to these by the acuminate lobes of the corolla, to the first by the depressed ovary and pale greenish-yellow capsule ;[1] bat it is distinguished from both by the orbicular lobes of the generally large and more or leas pentagonal calyx. The inflorescence represents little umbels in o. or approaches the glomerulet of *C. Polygonorum* in 0. and *y.* The lobes of the corolla are acute, resembling in shape those of the following species, in the Texan variety; or longer and finely acuminate (similar to *C. verrucosa* and C. *hispidula),* in the more northern forms. Stamens short, only half the length of the limb; tfnthers nearly globose. Scales large, ovate, flmbriate, sometimes exceeding the tube. Ovary and capsule depressed.

This is probably the earliest species in North America; in Texas it has been found in bloom in April and May, and near Bardstown early in July ; while here, one hundred miles further south, hardly any other species begins to open its flowers before the last days of that month.

0. CUSCUTA POLYOONORUM. —Segments of calyx generally as long as the tube of the corolla, mostly snbacute, bat occasionally also somewhat obtuse ; the corolla is thin, membranaceous, composed of a very fine cellular tissue ; stamens broad at base, subulate; scales smaller than any other species, except C. *Coryli.*

II. LEPIDANCHE.

Last autumn I discovered a second species of this genus, which imposes the necessity of altering the generic character. It most now read: Capsule 2-celled, l-4-seeded.

The *facia* of the genus refers principally to the firet species ; the second has more the appearance of a Cuscuta, bat the flowers are also closely sessile.

[1] In all other specie* which are hew mentioned, it it of a brown color, except perhaps in *C. Ctpkalanthi,* where it is also light-colored.

1. LEPIDANCHE COMPOSITARUM. — Stems before flowering orange-colored, soon decaying, *((hucuta glomerata,* Choisy, Mem. Soc Nat. Hist. Genev., ex adnot. A. Gray.)

2. LEPIDANCHE ADPRESSA, n. sp.: flowers sessile, glomerate, 5-parted; calycine scales 7 to 9, imbricated, appressed, ovate or orbiculate, slightly crenulate, the outer ones the largest; tube of the corolla cylindric, a' little longer than the calyx, twice as long as the oblong obtuse spreading lobes; stamens shorter than the limb; scales laciniately pinnatifid, convergent, covering the ovary; ovary with the stylopodium equalling the styles; capsule globose, shortly acuminate, covered by the marcescent corolla; 2-4-seeded. *{CuMcvUa compacta,* Choisy, L c, ex adnot A. Gray. *C. coronata,* Beyr. ap. Ilook. ?)

I discovered this species last autumn in the fertile shady woods on the banks of the Mississippi, amongst a most luxuriant growth of vines and underbrush, on Bignonia radicans, Rhus toxicodendron, Lauras Benxoin, Vitis, Cornus, etc Choisy describes it from specimens collected in Alabama.

The flowers are closely sessile, but distinct, and not in such dense clusters as in *L. eomporitarum.* The glomerules either form a continuouaiine round the stem of the parent plant, or they are separate, consisting of from five to ten or more greenish-white flowers. The filiform stout stems are whitish, and do not entirely disappear at the flowering time. The capsules are generally 2-seeded ; but as they are not so crowded as in the other species, they are also found 3-4-seeded.

Plate VI. Vol. XLIII. — The tube of the flower, fig. 1, ought to be a little shorter. The lobes of the corolla, fig. 18, are too wide at base; they should be more oblong. The ovary, fig. 24, should be depressed like that in fig. 28. The calyx-segments ought to be marked in fig. 25.

IIL UEBER CUSCUTA HASSIACA, Pf.

FROM THE BOTANISCHE ZEITCNO, II. No. 32, AUOUST, 1844. COMMUNICATED BT ALEXANDER BEAUY.

ElN vor wenigen Tagen erhaltener Brief von Dr. Engelmann (datirt vora 28. Mai) enthält nachfolgende Bemerkungen liber die vou Dr. L Pfeiffer im vorigen Jahre bei Kassel aufgefundene und im 41. Stiick der bot Zcitung desselben Jahrcs beschriebene *Cuscuta hamaca,* welche nach deu Mittheilungen von H. Mohl (tx>t Zoit. 1843. 1. Stiick) in demsclbcn Jahre auch bei Weilmttnster in Nassau vom Apotbeker Kudio, und zwar in grosser Menge auf *Medieago mtita* beobachtet und nach einer kilrzlich erhaltenen Mitthetlung vom Apotheker Lehroann auch in der Gegend von Offenbach bei Frankfurt im vorigen Jahro vorgukomtnen ist Ein so plöulichee Eracbeinen einer vorher nie beobachteten Pflanze, gleichzeitig an mehreren entfernten Lokalitäten, musste den Oedanken an Einschleppung durch landwirthschaftliche Samen erwecken, welcher durch Eugelmann's Mittbeilungtn Bestätigung findet. Die Kasseler Exemplare der *C. hassiaca,* auf deren Untersuchung sich Engelmann's Urtheil gruadet, sind mir durch Hrn. Dr. Pfeiffer selbet tur Zusendung an denaelben mitgetheilt worden.

Dr. Engelmann schreibt nun öber diese Pflanze Folgendes: „Die ttberaendete *C. hauiaca* Pt gehort, wie ich auf den ersten Blick sah, xu keiner der hiesigen (nordamerikanischen) Arten, dagegen ist sie ohne Zweifel identisch mit der *Cumda,* welche auf Ewigkleearkern bei Genf gefunden und unter dem Namen C. *CkiUiuU* in verachiedenen Ilerharien aufbewahrt wird Von der wahren *C. ChiUnm* Ker., von welcher ich Exemplare am Chili verglii-hen habe, ist sie tibrigenfi sehr veracbiedeOt und Choisy in seiner Monograpbie der Cuscuten (M<moirai de la social* d'hist. natur. de Geo*vei YoL 9, part 2, pag. 180.) erkUrt sie ftir *C. eorymbom* Ruiz et Pavon, und pel* zugleich an, *(torn* «e auch hei Uyden verwildert Torkomine. ond *d*m* tie zunarlmt aas Memont nach [664] Owf gekommeu set Nach Piemont tei eia mit Samen von *Midimgo mtita,* den man !^ ^S L tT!**f* ^~ Moa Futtorpflaoze gehaltm. gekommea Da Choii/s sowohl, als a [illegible] Beschreibung nigos zu wünschen übrig lässt, in ersterer durchaus weg ist und die Pflanze n.cht ch^kterWrt, ^h. ich .i ^ ^ o«ifar L^ (voo J.ck gesammelt) «adKaMder(von.Pr«ieR9ri mitgetheilt).

CDSCUTA CORYMBOSA, (Ruiz et Pavon sec Choisy): caule subcapillaceo, ramoso; fasciculis flonim subsessilibua, compositis; floribus singulis pedicellatis, pentameris ; calycia semi-quinquefidi lobis obtusiusculis, tubo corolla campanulato-turbinato, calycem subduplo excedeate, laciniis limbi ovatis acutis, apice inflexis, erectis, demum patentibus subduplo longiore; staminibus limbo multo brevioribus, filamentis e basi lata subulatis, antheris oblongo-linearibus, squamis fimbriatis incurvis; Btylis ovariuxn pyriforme (basi camosum constrictum) ©quantibus, crassis, faucem corolla attingentibus ; stigmatibus capitatia ; capsula. . . .

Die Genfer Exemplare haben kleinere Bliithen, klirzere Bltithenstiele, eine etwas weitere Blumenröhre, breitere an der Basis etwas geöhrte Lappen der Blumenkrone, die sich auch an der geöffneten Bliithe noch decken, etwas kleinere, weniger tief zerschlitzte Schuppen und im allgemeinen eine dichtere, festere Textur der Bliitbentheile. Die Kasseler Pflanze hat eine grössere, etwas mehr röhrige Bluinenkrone mit nicht geöhrten, an der Basis nach dein Auf bliihen sich nicht mehr deckenden Lappen, tiefer geschlitzte Schuppen, die aus der Blumenröhre h^vorragen und im Allgemeinen membranösere, zartere Textur der Bliithentheile. Es sind dies Verschiedenheiten, denen kein specifisches Gewicht beigelegt werden kann,wie ich mich häufigan unseren nordamerikanischen Arten im Freien tiberzeugt habe. Die Kasseler Exemplare stellen die mastere Form dar, in einem nassen Jahre erwachsen!—Charakteristisch ist ausser der nicht aufspringenden Kapsel [555] (H. Mohl) und den kopfiörmigen Narben, welche zwei Charactere sie mit alien ainerikanischen Arten, die ich kenne, gemein hat, ganz vorziiglich : Die verkehrt-conische Gestalt der Blumenröhre; die eingeschlagcnen spitzen Zipfel des Saums der Blume; die dicken pfriemenförmigen Filamente; die fast linienrdrmigen Antheren; die dicken kurzen Griffel und zumal die birnenförmige, fast keulenfdrmige Gestalt des Ovariums, dessen oberer Theil die Höhlen für die Ovula enthält, während der untere, eingeschniirte dicht ist. Es ist wahracheinlich, dass die verdorrte Blumenkrone die Kapsel haubenfönnig bedeckt, vielleicht auch sie ganz umgiebt Unterauchung der *reifm* Kapsel und Durchschnitte *desfrischen* Ovariums wären zu wtinschen.

Aus Choisy's Monographie wird man jetzt wohl auch in Deutschland den slidamerikanischen Ursprung der *C. hassiaca* erkannt haben. Es wäre unrecht, wenn sich in Europa eine kopfnarbige *Cuscuta* fände, da die geographischen Grenzen der beiden Abtheilungen der Cuscuten so schön und bestimmt sind. Ganz Europa, ganz Afrika, Asien bis zum westlichen Indien, gehört den fadennarbigen Cuscuten; ganz Amerika, ganz Australien und die Grenzen des stillen Meeres, China und das östliche Indien den kopfnarbigen.

Die Abbildung der *C. corymbosa* in Ruiz und Pavon 1.105. f. 6. kann ich tibrigens leider nicht veqjleichen; es bleibt daher noch einer genaueren Veigleichung vorbehalten, ob Choisy's Bestimmung der aus Chili nach Europa gewanderten Art richtig ist.

Ich fiige diesen MittheQungen meines amerikanischen Freundes bios noch die Bitte an die deutschen Botaniker bei, fernere Beobachtungen liber das Vorkommen der eingewanderten *Cuscuta* mitzutheilen.

CABLSBUHE, den 13. Juli 1844

IV. BEMERKUNGEN UEBER CUSCUTEN.

FROM THE BOTANISCHE ZEITUNO, Vol. IV. No. 16, APHIL 17,1846. COMMUNICATED BY ALEXANDER BRATTN.

Da die Cuscuten, ungeachtet des vielseitigen Interesses, welches sie bieten, zu den verhältnissmäsaig noch wenig gekannten Pflanzen gehören, indera selbst liber die in Deutschland vorkommenden Arten die Akten noch lange nicht geschlossen sind, so scheint es mir nicht unzweckmässig, einige Bemerkungen liber diese Gewächse zur Oeffentlichkeit zu bringen, welche mir mein Freund Engelmann in St Louis in seinem letzten Briefe mitgetheilt hat. Ich weide denselben später einige eigene Beobachtungen anhängen, durch welche ich zur Natuigeschichte der Arten der deutechen Flora einige Beiträge zu liefern hoffe.

NATÜRLICHE ANORDNUNG DER ARTEN DER GATTUNG *CUSCUTA* NACH G. ENGELMANN (JULI, 1845).

I. Cuscuta stigmatibua elongatis, capeulis circumscissis :

A. Ovario conico, stylis coalitis :

a. Stylis omnino coalitis : 1. C. *mcmogyna*, Vahl. 2. *C. astyla,* E.

b. Stylis basi coalitis : 3. *C. macrantha,* Don. 4. *C. pedicdlata,* Ledeb.

B. Ovario globoso, stylis a basi distinctis :

a. Ovario niajorc, stigmatibus cum stylis brevioribus ovarium nquantibus vel eo brevioribus: ft. *C. Epilinum,* Weihe. 6. *C. Euro]*™, Auct. *(major,* C. Bauh., Choi*.). 7. *C. Arabica,* Frescn. — ANMEKK. In diese AUheilung gchuren noch mehrere Formen aus dem siidlichen Europa und von den canaridchen Iuseln, deren specifische Charakterc noch [274] nicht hinreichend ausgemittelt nincl.

b. Ovario niinore, stiginatibus cum stylis squantibus ovario multo longioribus: 8. *C. Epithyrrfum,* Sm. (minor, C. Bauh., Chois.). 9. *C. cupulata,* E. 10. *C. planiflora*^ Tenore (vorausgesetzt, dass die im siidlichen Tyrol auf *ColuUa* wachsende Art wirklich diese ist).

II. Cuscnt» stigmatibus capitatis, capsulis indehisceutibus (baccatis):

A. *Gervntogeoe:* (Die Mehrzahl derselben ist noch nicht hinreichend nntenucht, urn unter die amerikanischen Arten am rechten Orte eingereiht zu wenlen; hierher s. B.). 11. *C. ciliarU,* Kotschy. 12. *C. rulcata,* Roxb.

B. *Americana:*

a. ChlorocarpaD 8. depreasas, ovario sine ftylopodio, gioboso-dcpresso, capsula membranacea, 6 fUvo virescente :

a. Corolla capsulnm niaturnm ral^tra) instnr obtr^pnte:

• Stylis ovarium a^|iiantibus : • 13. C. *Crphalanthi* (i*. *tmuijhrn),* E.

-> •• Stylin ovario longioribiu* : 14. *C. Americana,* L. • 15. C. *cuspidata,* E.

fL Corolla ail UIMJII CAIMUIO} pt»rM»t«»nte :

• StyJi•* ovarium a^u/wtibu* : # in. *C. prntaffnna*^ E. • 17. *C. Poiygononm* (•*. *chlorocarpn),* E. • 18. C. *umbrliata*^ Torr. (nan dein Felncngfbirg, ob idi»ntisch mit der von II u m b o 1 d t so benantiten am Neu»panien, ist noch zweifelhaft). # 19. *C vrrrueom,* E.

•• Stylis ovario multo longioribus : • 21). *C.* CWi/omiro, Choi*,

b. PhKocarpGD ». umU>nata% ovario *tylo|**lio rorotuiU>, plus niiousve umbonato vel nwtrato, [275] capsula hninnni, firm ion*:

a. Con>lU m«»nibninarra, mor^ini>)n« intr-^rin :

• Calycc ganif«i'|ialo, 1»rnrti-i* jwurin rrmoti<i suffuito: • 2 1. *C.* ndjpipsya, R • 22. (\ S.iumn, E. • 23. C. *nttrata,* Rhuttiew. 84. *C. Bouaruusu,* Holt- 25. C. *Chile****,* Rot. R^. 26. C *$ua*oU%** Scr. *(hamaca. Pi.).*

•• CsJyce 5.«*|wli, bractrts sepmloidri*, pluribus wjffulto : • 27. C. *gbm*ruia*% Choit. • ». *C. comptvta.* JUM. • 29. *C. aAprtsm,* E.

fi. Cornlla rarno*a, m«nni<» rrvnulnU. • 30. C. *Coryli* (•. *cmulata),* E. • 31. C. *petata,* E. • 32. *C. kuyutula,* E.

Die Tontehende Uebenicht enthalt blue diejenigen Alien. woloh« von F.np>ltnann selbst notenracht worden; tile ihm noch nicht durch eigene rntemurhung oder nur Dm unvollstandigea ExempUran bekannten rind nicht •uf$_K$eführt Wolchen Zuwnrlw an pnnna untonichiedenen Ciw cuton Nordamerika dorch EngcliiMnna Betnuhun^n in den leUten Juhn-n crlialten hat, ergicbt wch. am der Vergleiehans TOU Bngeitnann'a - ^rono$_B$nl|.hie der nonlatnerikaniaclw-n Cuacnten.' i« *MUtmann,-Am. Jommml.* Vol XLHI (1842). p. 333. H a. mit .len in ohitfcr Aufahlung vorkomttenden (durch em Stemchen beteichneten) in NonUm-rika einheimiachon Artea In *» • ™ » t « n, MoooRnpoM aiod mit Einachluat von *LtpuianeM*. wrk« b« Ualtung Fj^elmiuio '*** Tiel I a T l S l' V* 1 " T f WIO * t ^ 8 Alte » bwehrieben. «abr«nd die h*r n^beM Vebmiebi d « * o «oibait. von •udamenkaniachen Cuacaton, di« to Zahl die nonbmrrikaniwhen wahracbeioli*

uoch weit iibertreffen, konnten wegen mangelhaften Materials nur wenige aufgefiihrt werden. Alle bisher bekannt gewordenen amerikanischen Guscuten gehören in die Abtheilung derer nrit kopfförmigen Narben; nach Clioisy wiirde von dieser Regel *C. micrantha,* Chois. aus Chili, welche in Choisy's Monographie und De Candolle's Prodromus in der Abtheilung der Cuscuten mit verlängerten, fadenförmigen oder keulenfdrmigen Narben vorkommt, eine Ausnahme machen, allein Choisy's eigene Abbildung zeigt kopfförmige Narben. Auch die Cuscuten Australiens haben alle kopfllförmige Narben. Uebrigens sind einige der europäischen Cuscuten mit verlängerten [276] Narben in Anierika eingewandert, so namentlich *C. EpUinum.*

V. SYSTEMATIC ARRANGEMENT OF THE SPECIES OF THE GENUS CUSCUTA, WITH CRITICAL REMARKS ON OLD SPECIES AND DESCRIPTIONS OF NEW ONES.*

FBOM THE TRANSACTIONS OP THE ACADEMY OF SCIENCE OF ST. LOUIS, VOL. I. No. 3, 1859.

THE genus CUSCUTA belongs to the natural order of *Convolvulacece,* to which, indeed, it has been attached by almost every botanist, and from which it cannot be separated, though the embryo is very distinct, being rather a minute plant than an embryo in the usual form, the tip forming a plumula, often provided with alternate scales, and without cotyledons proper. Nor ought such a natural group of plants to be split into a number of genera on subordinate characters, as has lately been proposed, and in some instances, too, upon erroneous observations.

The characters which furnish good grounds for a subdivision of the genus are found in the shape of the styles and stigmata and in the fruit. These same characters, it must be admitted, have been used in separating the old *Convdvuli* into numerous genera, and even tribes; so that analogy would justify or even require a similar division of *Cuscuta*; but even Choisy, the author of many of these new convolvulaceous genera, in his Monograph and in De Candolle's Prodromus, admits the propriety of keeping *Cuscuta* united. Splitting *Convolvulus* into numerous genera may be excused, or perhaps justified by the necessity of separating the large crowd of species into a number of groups. This law of expediency, however, can have no scientific value, and can certainly not be pleaded in regard to such a natural, easily recognized, and not too numerous genus, as *Cuscuta* is.

The subdivisions proposed are based, fcs has been stated, on the shape of the styles and stigmata, and on the capsule.

The *styles,* typically always two, usually are distinct; or they are united in their whole length, or nearly so. They are of equal thickness throughout, or are thicker at base (subulate), or thickened towards the top (club-shaped); they are of equal length in one group, and unequal in another.

The *stigmata* are cylindric, elongated, and of the same thickness as the styles, or thinner; or they are oblong, or oblong-elongated, and thicker than the styles; or they are subulate from a thick base; or we find them capitate (or, as they are often, though wrongly, called, globose), hemispherical, or somewhat flattened on the upper, and flattened or usually impressed at the lower surface at the insertion of the style. In a single species, the stigmatic surface of the dilated top of the style is lobed, and in the centre somewhat depressed.

The *capsule* is either ciicumscissile, opening transversely by a regular joint, with [454 (4)] thickened edges; or it bursts transversely with an irregular, jagged margin; OP it remains closed (it is baccate, as it is termed), and either falls out of the persistent calyx, or it finally falls off with the calyx.

• See also Latin translation by Ascherson, with preface by A. Braun, published under tide " Generis Cascutss species seomkdnm ordinem systemationm dispositsB adjectU in prins jam notas observatbnibns criticu nee non norarom descriptionibus, auotoro Georgio Rngelmann, M.D." Berlin, 1860; pp. 8 + 87. — EDS.

Between both styles of the ripe and dry capsule an opening is observed — the intrastylar aperture — parallel with or transverse to the dissepiment, more or less rhombic, formed by an incomplete separation of both carpels, which compose the capsule. This separation takes place in that triangular and thickest part of the dissepiment which lies next to and below the styles, and which, iii the species with circuinscissile fruit, adheres to the top, while the greater and thinner obcordate or bilobed part of the dissepiment remains attached to the base of the capsule in the bottom of the calyx.

In most instances the stylar portions of the dissepiment, as I will call this part, remain united at base, separating the funnel-shaped intrastylar aperture from the interior cavity of the capsule, and therefore cannot give egress to the seeds, as has been erroneously stated. This is, I believe, the case with most or all American *Cuscutce (Grammica).* In *Eucuscuta* and *Epistignia* the intrastylar aperture does communicate with the cells of the capsule, but the opening is far too small to let the seeds out; nor would this be necessary, as in all of them the capsule is circumscissile. In some few species I find each stylar portion of the dissepiment divided into two halves; in *C. pedicellate** these halves are widely distant from one another and adhere to the opposite halves, so as to form an opening into the capsule transverse to the dissepiment

In *Monogyndla* and *Callianche,* where the styles are united, there is, of course, no intrastylar opening, and in the former the entire dissepiment remains in the bottom of the capsule; in the latter, a small triangular stylar portion adheres to the top of the capsule, but, of course, without any opening.

Des Moulins was the first, in his " titudes," to draw attention to the shape of the seed in general and the direction of the hilum in particular. Where all the four seeds are well developed, they are triangular, with a larger exterior convex and two smaller flat surfaces, the latter facing the dissepiment and the other seed of the same cell; the top of the seed is rounded or acutish; the base, with which it is attached to the placenta (which itself is dilated into a disc, often cup-shaped), is obliquely truncate or somewhat hooked, or rostrate, as Des Moulins terms it. Both flat faces of the seed are equal, or the one directed towards the dissepiment is larger than the other. At the truncate base of the seed, in the centre of a smooth and roundish umbilicus, is the hilum, forming a longer or shorter, narrower or broader linear groove, sometimes reduced almost to a point; it runs [465 (5)] in the direction of the interior angle of the seed *(longitudinal,* DesBl), or at right angles with it *(transient,* DesM.), or it has an intermediate, oblique direction. In some sections I find these characters sufficiently distinct; in others they seem to be less reliable; in the American *Cuscutm* I have often found them intermediate, and variable, often in seeds from the same capsule Wherever only one or two seeds in a capsule come to maturity their shape becomes less distinct, and offers no good characters. It is scarcely necessary to add that only ripe seeds ought to be examined; unripe ones, especially when pressed hard, have led to the strangest mistakes; winged or margined seeds described by authors are such unripe seeds. Nearly ripe seeds are smoother and larger, when soaked, than ripe ones.

The embryo has been supposed to offer good characters; but I have reason to believe that those embryos with one or few circumvolutions (such as the one figured by Webb, Phyt Can. IIL pL 142, fig. 14) are taken from unripe seeds.

Another character which I at one time relied on for generic distinction of *CunUm* is found in the calyx. Usually it is gamosepalous, but in some American species it is formed of entirely distinct and imbricate sepals, not different from the surrounding bracts,—a character which prevails in *Comolvulaam* proper, where only one genus *(WUmmia)* is gamosepalous.

The specific characters of *Cuscuta* are found in the thickness of the stem, but principally in the inflorescence and in the different organs of the flower and fruit

The inflorescence together with the presence or absence of bracts within it offers good characters * less so, the presence or proportion of pedicels.

The shape and proportion of calyx and corolla and of their parts (tube and lobes) furnish important but not unchangeable characters. Their texture must also be studied, and often gives an important clue to the distinction of species.

It is unnecessary to repeat what has been said by former monographers about these points, but it may not be useless to indicate a few facts not so clearly stated by them.

The tube of the calyx, generally more or less campanulate or hemispherical, is angular in some species, the angles corresponding to the commissure, or to the midrib of the sepals. Its lobes are more or less deeply divided, and are often auricled at base, and overlapping; these characters, however, are not very constant and reliable, as they not rarely depend on the rich nourishment and consequent vigorous growth of the parasite. The texture of the calyx is homogeneous in some species, and either fleshy or membranaceous (often very thin, shining, or semi- [456 (6)] transparent, when dry), with a small or large reticulated cellular tissue; or it exhibits, especially along the middle and towards the base an aggregation of warts or tubercles; these, also, are not constant in all the forms of the species. In other species, the tissue shows roundish or elongated pellucid dots or cells (glands, as they are usually called), very distinct in dried and then soaked specimens.

The tube of the corolla is cylindric or campanulate, or rather hemispherical or quite shallow, but never urceolate or ventricose during the flowering period; the swelling of the impregnated ovary, however, often gives it that shape. The lacinias[1] of the corolla are of different shape, and direction, and proportion, and also sometimes auriculate and imbricate at base; their points are occasionally incurved, or their margins revolute, or involute; their margin, usually entire, is sometimes crenulate. The texture of the corolla is similar to that of the calyx, but never, I believe, verrucose, though often glandular. Its cellular structure will yet, I suspect, offer good characters for some species, the cells being of very different size and shape in different species. The corolla, and sometimes the calyx, is occasionally covered with small papillte, which probably represent hairs, giving it a mealy appearance. This character, apparently so striking, is, however, of no more specific value than the pubescence in other plants, as I find papillose varieties of a number of European (C. *plamjhra, C. Babylonica)* and American (C. *decora, etc.)* species, of course with intermediate forms. Of a single species (C. *capitata),* I know only the papillose form.

The calyx is always persistent; the corolla is deciduous only in the Indian *C. re/Uxa*; in all the other species it remains adhering to the capsule, either to its base, or, hood-like, to its top, or it completely envelops it, but it is not properly persistent; it is distended from the swelling of the capsule, but does not seem to grow. The position of the dead corolla is usually constant

The stamens are mostly inserted in the very throat of the corolla, alternating with the lacinio, but often exteriorly covered by their overlapping bases. In *Callianelu* and *Momgynella* their point of insertion is usually below the throat, and the filaments are very short. The filaments in the other *Ciucuim* are more or less flattened, linear, or subulate; of different lengths, but usually much shorter than the lacini*; they are rarely absent The anthers are orbicular, ovate, oblong or linear, cordate or sagittate, blunt, emarginate, or apiculate, large or small; but their [457 (7)] shape or site do not afford good and constant characters in this genus.

The most peculiar organs of the flower are the epistamineal scales, which are found in moat of the species. The simplest form of that organ (in *C. inJUxa, C. ddorocarpa, etc)* exhibit* * few teeth or lobes laterally adhering to the lower (attached) part of the filament These lobes in other species expand into membranes, forming two lateral wing* to the filament, crenukte or Wnged at the tip and outaide; then these wings partly unite at their upper end, thus forming a •ingle bifid scale; finally they unite entirely, forming an oblong, ovate, spatulate or truncate, more

• 1 thill «M Ui« won! *Utinim* for tb» dirWoiw of th« cocolU, u»d fcto for U>OM of U» «lyi.

or less crenate or fimbriate scale. Towards the base the scales are always "adnate in the middle," or, properly speaking, attached to both sides of the adnate filament. Their bases usually connect with one another, forming inverted arches.

In the following species these scales are wanting: *C. grandiflvra* and *C. prismatica* of South America, *C. hyalina* of Asia, *C. Calif arnica,* and *C. Sandwichiana.* In *C. Califomica* the inverted arch alone is present, entire or fringed; in the others I find no trace of scales at alL

These scales are evidently lateral dilatations of the lower (attached) part of the filaments, perhaps of the character of stipules, as Professor A. Braun suggests ; or they are a sort of stamineal crown, attached at base to the corolla, but not a duplication of the same.

The presence, form, aud size of the scales furnish some of the best characters in this genus, but they are not entirely reliable; and while in some species they are very constant, in others they are found to vary considerably. It is doubtful whether a really scaleless form of *C. Europcta* exists; *C. Calt/ornica,* usually without scales, seems to occur also in a variety with scales.

The ovary and pistils are more reliable for the determination of species, just as they furnish the most important characters for the distinction of the sections. The walls of the ovary are of equal thickness throughout, or they are thickened towards the base of the style -(furnished with a *stylopodiuin,* as I formerly designated this form). The ovary is smaller than the tube of the corolla, or it fills its whole cavity, or even protrudes from it The styles are subulate or terete, thick or capillary, and very constant in these differences. Their length, however, is variable; and this character, so much relied on by Choisy in the subdivisions of this genus in his Monography and in DC. Prodromus, is of secondary importance, as the same species sometimes occurs with short or with long styles, and as the styles, included at first, often become exsert [458 (8)] with age. The direction of the styles in the flower and on the fmit furnishes a tolerably good character.

The position of the dead corolla on the capsule has already been mentioned as a pretty reliable specific character. The shape and even the texture of the capsule also ought to be noted, though in several species (C. *Europaa,* for example) its form is quite variable.

The number of seeds which ripen in each capsule furnishes no distinction, though the species with very crowded flowers, and some others with loose flowers also, often develop only one or few seeds. The shape and surface of the seed ought to be studied more, and will yet, it is believed, help to distinguish some species.

As almost all the characters enumerated above are subject to more or less variation, it is necessary to base the diagnosis of a specie* on a combination of a number of characters; but as the value of these characters is necessarily differently estimated by different botanists, some will consider as well-marked species what others will look upon as mere varieties.

The different species often seem to have a predilection for certain plants, or families of plants, rortheir sustenance; and I have myself at times thought I discovered an influence of the mother Plant (or, better, mining plant, nurse) on the form and development of the parasite. But I have ^hll!! F^ i 0 " 1 that •"• infl™n<» » very limited, and probably goes not even farther than **r dlfferw* kinds of toil and manure would *go* with any other plant If some species seem "-ry tantly *Calluna* v^' * *?*" oerUil1 Pbnta to oU*11 <C *""/*. ?*** dM€a>, C '*&"**!••". *C lunulifaT*™^ o€*i*a •*•*•'*• *C. ehloroearpa. rvlvgonum; C. Gnmorii, Crphalanlkus* ; teaiZ^^j t/*^ Ddf tha "^ mMTked •""•I*. *C.* A/nVi^m, the flax fields), it is pmiaUj ™™» uie kind of soil, the humidity or dryness, the shade or sun, and all the circumstances which suit the nous pla^ f Z **ZJ"* With ** **~ito- o" *• *"•• «« *" t ****** dicotyledo. mmmi icmi6 fcw *••*•• P*f" l*r •hrubt or semi-shmbe; and most of the *Monogynella* and a few others a ot larger shrubs and trees, of course penetrating only the tender bark of the smaller limbs.

Cusctitte are found also on acrid or poisonous plants. I have seen them on *Banunculacece,* on *Euphorbia,* on *Cicuta* and other *UmbeUifera,* on *Mus Toxicodendron,* and others. I have seen them also, though sparingly and not very thrifty, on *Monocotyledonece,*— such as *Liliacea, Graminece,* and others,—and even on the siliceous epidermis of *Equisetum.* The fact is that, when once attached to a nursing stem, they throw out their branches and coil around any plant in the neighborhood, and strike their suckers into the tissue, and grow on anything that can furnish [459 (9)] them nourishment, even on their own branches and flowers. This is even the case with the most exclusive species, *C. Epilinum,* which attaches itself to all the weeds growing in flax fields, and may be cultivated on *Vicia, Impatiens,* and many other plants. Rich nourishment on succulent plants expands the organs, enlarges the flowers, increases the whole plant, and thus gives rise to varieties which at times have been distinguished as species. *C. Epithymum* in clover fields becomes what has been called *C Trifolii; C. Europxa* on vetches, *C. Vicia; C. Gronovii* in shaded miry soil, on *Saururus, C. Saururi ;* the oveigrown form of *C. Africana* is *C. Capensis,* eta

The *haustoria* (suckers) of *Cuscuta* deeply penetrate into the tissue of the nurse, and they, with parts of the stem imbedded in this tissue, are able to reproduce the plant after all external vestiges of the stem have been rubbed off. This the gardeners often have occasion to deplore in regard to a variety of *C. Epithymum* which has become a pest to some greenhouses in Europe. I have observed the same fact in different species which I have had under cultivation, especially in *C. inflexa.*

The species of *Cuscuta* naturally arrange themselves in three large groups, distinguished by their styles and stigmata.

1. Those with *two equal styles and elongated stigmata.* They are natives of the Old World exclusively, and have rarely and only temporarily been introduced with cultivated plants into America. (C. *Epilinum* with flax into some of our Eastern States, and *C. Europcea* with vetches in HaytL) They may be termed *Cuscuta* proper. *(Cuscuta* and *Epilinella,* Pfeiffer, Bot Zeitg. III. 673; *Cuscuta, Epilinella,* and *Succuta,* DesM. Et pp. 38-41.)

2. Those with *two unequal styles, and abbreviated, usually capitate, stigmata.* They abound in America and Oceanica, and in the southern and eastern parts of Asia; a few species even penetrate into western Asia and southern Europe, and a single species is found in southern Africa. Cultivation has temporarily introduced one species into Europe *(C. racemosa* from Chili, under the name of *C. suaveolens).* This group may be comprised under the name of *Grammica,*—a genus established by Loureiro in his Flora Cochinchinensis, I. 212, on a species belonging here. *(Engdmannia,* Pfeiffer, Bot Zeitg. III. 673, not Torrey an*(}ray,. nor Klotzsch ; *Pfeifferia,* Buchinger Ann. So. Nat IX. 88, not Salm-Dyck; *Buchingera,* F. Schultz in Jahrb. Pharm. 1847 ; *Cassutha,* DesM. Et 40 *r Grammica,* DesM. BulL Soc Bot France, I. 295; *Cusadina,* Pfeiff. Bot Zeit 1846, p. 461.)

3. Those with *styles united entirely or partly, and with capitate, ovate, or conic stig-* [460 (10)] *mata.* The species-of this group, all distinguished by their large size and thick stems, principally inhabit Asia; two extend into southern and eastern Europe; and two others are found in South Africa and southern North America. This group is Des Moulin's (Et. 39) *MonogyneUa,* with a little altered character.

The modifications in the form of the stigma and the dehiscence of the capsule furnish the basis for a further subdivision of the three principal groups. I will here only *ay that in *Cuscuta* proper the capsule is almost always circumscissile; in *Grammica* it is often so, but more commonly it remains cfeed; in *MonogyneUa* it is constantly circumscissile.

The dead corolla coven the whole or the top of the capsule always, with a single exception *(C. Africana),* in the first; it is found on the top, or at the base of the capsule, in the second; and, if not deciduous, always on its top in the third group.

The following sections are proposed: —

A. *Cuscuia Group.*

1. EUCUSCUTA. Styles nearly as long or longer and ai thick or thicker than the filiform stigmata; capsule regularly dicumsdssile.
2 EPISTIOMA. Subulate stigmata nearly sessile; capsule opening transversely without a regular jointed separation.
3. CLHTOCOCCA. Subulate styles longer thau the short subulate stigmata; capsule baccate.
4. PACHTSTIOMA. Cylindric or oblong stigmata thicker than the filiform styles; capsule bursting transversely.

B. *Grammica Group.*

5. BOOBAMMICA. Stigmata cspiUte; capsule more or less irregularly circumscissile,
6. CUSTOGRAJOUCA. Stigmata capitate; capsule baccate.
7. LOBoenoMA, Top of davate styles lol>ed at the upper stigmatose surface.

C. *Monogipia Group.*

8. MoHOOTTiLLA. Stigmata capitate or ovate, united or distinct.
9. CALLIAJICHK. Stigmata conic, or almost subulate ; corolla large and deciduous.

SECT. 1. EUCUSCUTA.

Styles filiform, terminating in filiform stigmata of the same length or shorter, rarely longer, and of the same thickness as the styles, or thinner towards the end. Capsule regularly circumscissile by a joint, the line of separation being thickened. Usually all four seeds ripen ; they are triangular, with an obliquely truncate bate, the bilura forming a narrow perpendicular line.

The flowers are mostly sessile and densely clustered, forming globose heads in the axils of single [461 (11)] bracts without bracts in the inflorescence. The central flowers open first; the exterior ones are occasionally abortive. *C. Epiihymum* has sometimes short pedicels, and *C. Babyloniea* is always pedicelled. The corolla always remains on top or around the capsule, never at ito base. Epistamineal scales are always present, though sometimes very thin and small, and easily overlooked.

The species of this group inhabit Europe, western and central Aria, and northern Africa to the Canary Islands.

§ 1. Styles longer than ovary.

1. C. BABTLONTCA, Aucher! mas.; Choisy! disc. 174, t. 1, f. 1; DC. Prod, IX. 453. *C. pedutadaru,* Kotschyt in sched.—Well characterized by its pedicelled flowers, truncate calyx and almost entire scales; approaching by to inflorescence to those other Asiatic species comprised in the section *Epistigma.*— Bagdad, Aucber-Eloj! 1480 and 3183; on the Tigris, Noe ! in Kurdistan, Kotschy! 388, a.

Yar. KUDQAKS. C. efeoaiu, Roiss. & Balansa! Diag. Or. II. 3, 129, from the alpine regions of the Taurus, Balanta! 708; scarcely distinct from *C. Babylonia** except by the papillose prettily rose-colored flowers, and by the scales being a little more dentate and somewhat incurved.

S. C. ErrnmiUM, Murray in L. Syst. ed. 13. *0. Enrnpaa, fi.* L. Sp. 180. *0. minor,* Bauo. Tin. S19; DC. 71. fr III. 644 ; DC. Prod. IX. 453. *C. filiformu,* 0, Lam. Fl. fr. 11. 307. —To this well known and common European species some authors have assigned all the different forms I am going to enumerate below, while others have separated several of them as distinct species; others, again, have united with it a number of other forma which I must consider distinct, especially such as I class with *C. planiflara*; some hive even mixed up with it the very distinct C. *Europtta,*

It is certainly difficult to make precise the limiU of *C. Epithymum* and *C. planijloro,* and some forma which I class under var. *Kotsrhyi* of the former, and others which fall under var. *approximata* of the latter, apparently are more closely allied than the extreme* of either species among themselves; while the common *C. Epithymum,* especially the form known as *C. Tri/oHi,* is as distinct as can be from Tenore*s original *C. pianijlara.* I arrange the different form* in the following order : —

Var. *a* VL'LGARIB, the common form of central Europe extending went to Great Britain, north to Scandinavia, south to northern Spain (Bourgeau! 655), northern Italy (C. *acntiflnra,* Rota!), and also [462 (12)] Naples, to the Crimea, and reaching cantwanlly far into A»ia (CWaftUft. Hobenarker! 409 and 1938, Altai, Ledebour! "Orient" Herb. Toitrnrfnit'). It vane* considerably, especially in the site and proportion of the calyx and its lobes, and transition forms, uniting it with the other varieties*, are not rare. I have paid some attention to the proportion of the stigma and style, but 6ml no permanent character in them; the style proper is longer or shorter than the stigmatic portion; and tbi« part is cylindrical or subulate in upecimens not otherwise distinguishable; the stigma is usually pale brown-red, or, when dry, dark red, rarely yellowinh. — C. *Tri/olii,* Babington! sometimes so fetal to whole clover field* *in* England, France, Switzerland, Germany, and Sweden, is a luxuriant form, overgrown at the expense of the succulent herb, whi<*h it defltrnv*. *t*

Var. *fL* MACIA.VIHBRA. *C.* nuunmôWo, HeMr *A* Hart.! in «-h«l.; Bois*.! Diag. Or. II. 3, 186. C. *CmlUop*,* Rsldr. *k* Sail.!; Bnim ! ibid, 128 — Large flowers on very nhart pedicel*; calyx short, iu ovate lobes seamly cowing half of ths tubs of the corulU; lacini» ovate, acuU or obtunuh; anthers oval, large, often longer than the filaments;

scales usually shorter than the tube, sometimes quite narrow. — A southern form, found on the southern declivity of the Alps, in Piedmont, Tyrol, Spain (Willkomra! 62, a), in southern France, in Italy (on the Apennines and in Corsica), in Greece and in the Crimea; I have also seen, in the Kew Herbarium, an English specimen of this variety, on *UUx;* it has made its appearance in greenhouses on *Erica* and other evergreen shrubs; this garden form is *C. xantiumema* of the Paris Jardin des Pluntes.

Var. y. ? ODTUSATA. This very curious form was collected by Funk I (Herb. Cosson and Hb. Reichenbach) the Sierra Nevada of Spain on some shrubby *Genista;* the glomerules consist of 3-5 flowers, only, on pedicels long than the calyx, lobes of calyx and corolla broadly oval, obtuse, shorter than the tube of the corolla; scales largi styles as in the common form. I would at once have acknowledged this peculiar plant as a distinct species, if . second specimen had not come to hand, collected by Heldreich on *Artemisia* near Konkh in the interior of Asia Minor, which approaches more to the ordinary form; flower, similar, but smaller senile, 6-6im a small head; scales narrow; styles ordinary, seeds very small (0.3 line. diam.). The former may be distinguished as var. mocnpotfo, the latter as

V a/,BT TTANTHERA λ, allied to var. *angustiloba,* distinguished by the loose glomerules; pedicels [463 (13)] a. long a. calyx ; l«l«s of calyx obtusish, scarcely as long a. tube of corolla; lacinia, lanceolate, acute; tntheri broadly sagittate; scales huge, crenulate ; styles subulate at base on the capsule almost horizontally d.vaneate—Tunis, Kralik! Herb. Cosson and Herb. Mus. Florent.; the only African form of the group of *Ejnthymum* seen.

Var.,. ANGUSTATA. I distinguish by this name an Italian form, which assumes different shapes, described under different names. It has narrow and elongated lobes of the corolla and usually also of the calyx, which is commonly longer than the tube of the corolla; the flowers aie numerous and sessile, or ordinarily more or less pedicelled. Three sub-varieties may be distinguished.

Var. a. otto, with whitish .ten* smaller flower* membranaceou. calyx. This is the true *C. alba,* Presl! Del. Prag. 87, also of Tenor* and some other Italian botanisto, while most authors apply this name to the original C. *plainft***, fen. fed. d,cri,Um, copied by almost every sul.seq.ent author is very erroneous; but h,s own specimens, on *iiwkv,* proved in hi. collection at Prague, and in the imperi.l Herbarium at Vienna leave no doubt about the Ur of the plant. *C subulata.* Tineo' in Oussone Fl. Sic. II. 888. is exactly the same thing, as also *C. Ouuont,* SS.1l!1nlS:V.tVt 11Z tl occurring principally in Sicily, also about Naples and in Malt.; it is often found on shrubs, and Sie^r! (in Herb. Ledebour) gathered it on an oak.

Var. b, *annusliuiwu* flowers longer than in any other form seen (2J-2J lines long), on short pedicels, with •hort df;,, s, e £ dotted t Joe, narLly lanceolate ruminate lacini., distinctly subulate filament*, and rather •mall Male*. In fields of *Medicago* near Padua, Visiarn! . . . . . . on,- u p «t.«.**^ ir«.l, m

V«. e. r-Wfc., with r*UteL, Urger flower*, red calyx of . thicker textur* Th» » C. ^ - J ^ 5^ ^ 0«m.j DesM. Et. H and many other author*, but not of Tenore. It ha. often been collected in southern Tyrol on *CtUlta, Artemisia,* etc; it also occurs in the Abruzzi and in Corsica.

Var. ζ. KOTSCHYI. *C. Kotschyi,* Des Mo (not *C. Kotschyana,* Boiss.). *C. microcephala,* Welwitsch ! in schel. Flor. Lusitan. nro. 1048. — the original *Epithymum* of the old botanists, as it often occurs on [464 (14)] stems, the small calyx and corolla, and rather shorter style, than the common form of *C. fP**™* ^ZrJTl* Lntain. of the calyx is elongated *rubella.* southern Europe, the Dauphiny, the Pyrenees, the Sierra Nevada and other roottntoill „#» of Spain and PortugJ; in the Abnux. of ««then, luly, in the mounUh. of central Sicily.

Var. *£lS££E:i* * Aragon, Webb, is a papillose form of the same plant.

». C. AB»,H,CA, Rich«tl, Abr«. II. 78, C. *nuxrrtyl*,* Decawne in Herb. Mu* P«i.., wem. to be well di^tinguished by th. abort ^ c k lobe, of Ik. calyx, the very long «id narrow erect Ucin^tbe «nall crften UU. scales, an the rerr Ion. camllarv -vl«t The« even surpass those of the last species, while the other character*, together J T i r J S j S X t S t «owcr.. appn-chTto the next o,«. The typical form was collected on *Lantana;* WOUMT, with shorter ladni* was gathered on a leguminous shrub.

«• C Ft*«rtoM. Tenor*, ^nsu Utiori. This name *tm.* like that of *C. aOa,* suffered^^nndcr the Mri-J ^ ever to U *J2d* to the ««ci« o« which the author originally b«U,w«,l ,t! The difficulty was incwMcd by an incompkU d«ripUon, *Jbfriot.* Teno« hinuelf iwdvertently dbtributing under his new name a form of

[a] Philologists will Man* thU "TO* hybrid*," but daily experience *Vmthm us* and philological twtrcb confirms, that — languages ^ the rkvt. Tb# artud nmariti** of • living people are not bound by such rules of unity, as little as there prevail in th« fonnition of uttiotic, — tbf prMPOt fuhfiotibli» Iheory ≪T |olitioil MtioiulitiM to tlie oontmy Dotwithstanding.

C. Epithymum; even now be preserves in bis own herbarium, under this name, forms of several other species, besides the very specimen described and figured by him as *C. planijlora,* easily recognized by the well-figured *Plantago lanceolate* on which it grows. But this is not the only, nor the principal, cause of the difficulties under which botanists have labored in regard to this plant. It is probably the most variable of all the species of this genus, and appears under a larger number of forms than any other. Well may botanists differ from the view that I take in regard to this species, but it has not been adopted lightly. With 150 to 200 specimens from Europe, Africa, and Asia, before me, I have found it impossible to separate, specifically, the different forms here brought together; and even the subspecies, enumerated below, cannot always be limited satisfactorily. On the other hand I find it difficult to keep this species, or complex of forms, as I am inclined to call it, separate from some allied species. Some varieties approach to *C. brevistyla,* others to *C. Pakutina,* and others again are difficult to distinguish from the alpine form of *C. Epithymum (Kotschyi).*

The long list of synonyms properly belongs to the different subspecies; for the species, as I take it, [465 (15)] no synonym, nor even a name, exists: the one adopted by me is the earliest oue given to any one of the forms.

Synopsis of the forms of C. planiflora.

a. Lobes of the calyx more membraiiaceous than fleshy; lac in ire of the corolla turgid only at the point*; stylet much longer than ovary.

• Calyx copulate, lobes usually broad and short, and, like the short lacini*, cuspidate: Var. *approximate.*

— Calyx more deeply divided, its lobes and th« laciuie narrow, elongated, acute: Var. *Sehiraxiana.*

b. Lobe* of the calyx thick and turgid; lacinia turgid and often cucullaU at tip; style* longer than ovary, usually shorter than or at long at capsule.

• Flowers larger; lobet *of* calyx united abore the middle or almost to the point: Tar. *Wcbbii.*

** Flowers usually smaller; sepals almost distinct

t Flowers smooth: Var. *Tenorii.*

ft Flowers mealy or warty: Var. *papiHota.*

Var. a. APFROXIXATA. *C. approximate,* Babington! Ann. & Mag. Nat. Hist 1844, pi. 4., and 1845, pi. 1.; A. BraunI Berl. bot. Zeitg. 1844, p. 542, and in Jahrb. d. Ver. f. N. K. 5amu, 1851, t 1, f. 1. *C. uruokta,* Kunie! in Flora, 1846, p. 651. *C. cupulate,* Engelm. ! in Bot. Zeitg. 1846, c. 276. C. *planiflora,* Konn! in Flora, 1846, p. 655. *C. Uucotphara,* Boim. & Hcldr.! in sched. (afterwards referred by Boisnier Diag. Or. 1. II. 127 to *0. wrteoiate). C. Asiatic^* Palta! in Herb. II. Bot Petropol. — The name, *approximate,* wan given to this species for the closely approaching halves of the scale*; yet, it more appropriately signifies the dose alliance with the last species, and especially with it* lout mentioned variety. The original C. *approximate* was found in fields of *Medicago* in England, Germany and Switzerland, undoubtedly an imported plant, as Babington already states, probably from India; or perhaps from southeastern Europe or Asia Minor. In this cultivated plant the flower* are larger (1J-2 lines long), more attenuated at base, the scales appressed, abort and often bifid. Similar form*, with numerous large flowers in large and very dense heads occur in Asia Minor (Taurus, Kotschy! 357; Tmolus, fialansa! 414; Smyrna, Balanna! 412; Bithynia, Thirke!), in Greece (Targetus! Panuras! Thrada!), and in Piedmont (Herb. Link! Reichenhtch fil.!). The plants from the southwest seem to be a little smaller; Spain (Willkomm! 263 * 246; Boutgeau! 331 * 1290; Ph. 8chimper I). 8everml specimens from the Canary Islands belong nther to this than to *C. EpimmcMwm.* In the East this spedes has been found in Egypt (Fischer I), in 8yria (Kotschy! 104), in Persia (Kotschy! 58(\ a.), tad in the Himalaya regions (Hiigel! Stocks! Hooker *A* Thomson!). The northern Asiatic form, which I had formerly distinguished under the name of [466 (16)1 *C. eupulata,* occurs in the Caucasus, the Altai, and, as it feemm throughout Siberia (Ledebourl Oodeil Becker! Karelin! 1721, etc.); flowers smaller in dense but small heads; calyx large, loose, almost entire, with broad and short lobea; scales comparatively large and incurved.

Var. 0 · SCHIRAWAJIA, *C.* Sr Ainutina. Boimrier! Ding. Or. I. 9, 86, has loose and fcw-flowered heads, rather membranaceous flower*, with the lohea of the deeply divided ralyi and the larinisj lon^ and acute. The specimen* examined by me, the same that Bni»ier d«*rril*d, wer* cniierifd in Perm by Kntmrhy! and distributed under 118 and 318. In some the lacinia arr larger, in other* shorter; tralni larger and entire; or smaller, truncate and even bifid. — Link fathered a uperimen of this form in Portugal on *VUx* fumiu, which has even longer lobes and *m* mom deeply divided cnlyx than the Pemian plant.

Var. y. WEBDII. *C Rpimmchnm,* Webb Phyt Oanar. III. p. 3* t 141. f. *Epiplommmm.* Webb! in PI Bourgeau, 1130. - This, together with *C.* ro<Vi«K Webh, another form of this aperies, smut to he the only nalive *Cuscute* of the Canary Island*, though the Herloria show the name* of C. *Ernnprnm* and *C. Epiikfmmm* from thrsee; *C. Epilinmm* hat been introduced there. It has hten cnlWud by Webbl Boanraan! IR, 4M. 4M, I49O; D» U IVr-' imndierc! B»>lle! and cithen. I have aeen the aame form fn>ro Pnrtnpil Deakin! Welwitach! IM. — U C. the lobes of the calyi are not an completely united a* in *C. Epiplocn*

Var. d. TENORTL *C. planiflora,* Tenore! SylL FL Neap. p. 128 and Flor. Neap. III. p. 260, t. 220, f. 3. — If I am not mistaken, Kunze (Flora, 1846, p. 655, in Plant Willk. nro. 303) was the only botanist who recognized Tenore's plant; every other author has bestowed the name on some other forms of our plant or on some other species. *C. planiflora,* Koch! Germ. p. 570, and Reichenb. FL Germ. Exsicc nro. 2069, are forms of *C. Epithymum.* — Tenore's plant is most common in Sicily and north Africa, extending to the Canary Islands, to Spain, southern France, Italy and the Mediterranean inlands, to Greece and Egypt, and undoubtedly also to Asia Minor and Syria. It is one of the smallest *CIUCUUB,* the heads are compact, 2-3 lines in diameter, white or rose-colored. The turgidity of the almost oylindric lobes of the calyx and of the lacinia is very distinct even in the dried specimen, and very striking in the fresh or soaked one. Flowers often less than 1 line in length; grains very rough, 0.3-0.4 lines in diameter. — This is *C. alba* of most authors, but not of PreeL *Sueeuta,* DesM. Et. 41 is a genus founded on an immature specimen of the same plunt. *C. Epithymum,* Gussone! Flor. Inarim. p. 212, Cosson! in Plant. Bourgeau [467 (17)] and of many authors on planU of southern Europe. *C. Eurnpaa,* Bov^! in Hb. Mauritan. 149. *C. bracUosa,* Gaspar. I in Hb. *C. mürocephala,* d'Escayrac! in Hb. *C. Godronii,* DesM. I L c. 60, is a form with more acute lobes of calyx and corolla, *C. Sicula,* Tineo *(fide* spec, in the Hb. Cesati) is the same plant with lobes of the calyx a little broader. *C. calycina,* Webb! Phyt Canar. III. p. 37, t 152, has a larger calyx including almost entirely the corolla. *0. Canariensu,* Choisy I Mss. is the same thing. — It occurs in many published collections; besides those already mentioned it has been distributed by Bourgeau! 491, 1298, 1430, a. etc.; Aucher-Eloy! 1418; Huet de Pavilion! Palermo, etc

Var. «. PAPILLOBA is a peculiar form of the last subspecies, which thus far seems to have escaped observers; the whole flower is covered with semi-transparent papilla? ; otherwise, I find no difference in specimens sent from Algiers to the Paris Museum by Balansa! But often the lobes are elongated and acute ; w> in the specimens from Tunis, Kralik! 410, Algiers, Cosson ! Segovia, Hb. Gussone! A specimen from Arabia, Botta! in Hb:Mus. Paris., seems also to belong here. *C. globuUm,* Boiss. & Reut. is very closely allied to this form, and distinguished principally by the very short styles, and the globose corolla, the lobes of which cover the capsule ; this form of the corolla does, however, occasionally also occur in specimens, which cannot be separated from *C. planiflora.*

ft. C. PAUWTINA, Boissier! Diag. Or. I. 11, 86. — This pretty little species is closely allied to the last, to which the author himself subsequently referred it; but it seems to hold its rank with a number of other species of this genus, the limit* of which are so difficult to ascertain. Tournefort (Cor. 45) already distinguished it under the name of *C. Ontiea;* it is also *C. micrantha,* Tiueo! in Gussone FL Sic. Syn. II. 887, not Choisy ; and *0. capillaru,* Reichenb. PI. Crit V. 64. *C. Mbularu,* Bert Fl. it VII. 625, is the same plant. — It grows on small mostly shrubby plants, on arid hills in the Mediterranean region ; in Sicily, Tineo! Morea, Bory! Attica, Heldreich! Creta, Sieber! Raulin! and other Grecian islands, Lefcvre ! etc ; Palestine, Boissier! Gaillardot! Blanche! - Heads only about 2 lines in diameter, flowers 4-1 line long, usually 4-, but often only 3-parted ; only the central or primitive flower of the heads is often ft-parted; calyx comparatively large, with broad and short carinate lobes; top of ladnia cucullate; scales rather large, broadly spatulate, incurved; styles somewhat longer than ovary.

§ 2/ Styles as long as or shorter than ovary.

6. C. BRivwTYLA, A, Bituin! in PI. Scbimp., and in Richard Tent Fl. Abyss. IL 79, is perhaps too [468 (18)] nearly allied to *C. janiflara,* from some forms of which it is scarcely distbguished but by the short styles, which, in fruit become divaricate. In the origin Abyssinian specimens the lobes of the corolla are expanded, in someother. they«re dosed over the capsule. The scales are short, thin and truncateor sometim^ bilobed.-Itho. W found in Abyssinia, Schimper I III. I486 ; on the Sinai, Botta! in Perwa, Kotschy! 580; Afghanistan, Griffith I « 6 ; Thibet, Hooker and Thorns! *C. degam,* Noe I in Herb. 518 (not Boissier), from. the^Tigris, "the same pUnt.

Var.!0L0BUU»A. *Cgkbulo** Boiesier * Reuter iinsched.; W m D^Or. II 3,126 • *C. Baton***, Boise. * Beat in sched. - This Terr pretty form at first sight looks very distinct 5 but Boissier himself already suggests the propriety of uniting it with «*C. alba*" *(plani/bra* and indeed its papillose flowers greatly resemble the var. *papUiaa* described above; on the other hand it approaches *0. capUata,* but more in external appearance than in essential «ha»eteii; the pretty red tinge of its flowers is occasionally found in both of these, and may be in some connection with the development of the papilla*. — The corolla closes over the capnule, giving the flower as well as the whole Wi an obtuse appearance • the scales in the original specimen are bilobed, in the other truncate ; styles very short— Mountain regions of Ask Minor: on the Tmolus, Balansa! 413 ; on the Taurus, the same! 707.

». 0. BUBOFAA, L. 8p. 180, exd. var. *(L* This well-known and wclUharacterized species offers none of the diAealtiM of all the other European *Oucuim;* the obconic calyx with its thick and fleshy and usually elongated base and thin end obtote lob*, the thin corolla with obtuse ladnue, the small and very thin bifid or truncate apprased •*e,tiie laigeofaiyead competitively large capsule with short divaricate styks and bearing the deadleorolk only <• top (not enveloped in it) reedQy itirtV*^it; nor does it vary nearly as much as the others do; the flowers, however, are ae often 6-•* 4-parUd.

This species has given cause to a good deal of discussion in regard to the presence or absence of scales; but though I have examined a number of specimens said to have no scales, among others the original var. *nefrtnt* of Sweden, I have never failed to discover that organ, though sometimes in a very defective state ; I, therefore, cannot doubt that it is always present, but frequently so small and especially so very thin as to escape detection. In dry specimens, soaked or boiled, it adheres to the tube of the corolla so closely that it is scarcely possible to see or to separate it ; but it is readily discovered and detached in the dry flower, if not too much mashed in pressing. The scales [469 (19)] are rarely rounded, oftener truncate, and toothed at the apex, most commonly bifid, and fimbriate or toothed, or consisting of two distinct lateral dentate or entire, often extremely small, lobes.

The capsule is commonly depressed, but a form with an elevated conic capsule, var. *conocarpa,* is not rare. Both often grow together, and cannot lie distinguished otherwise.

Var. *Indica* has more crowded, smaller flowers, and perhaps a little longer styles. A specimen from Sarepta on *Alhagi Canulorum,* in the Herbarium of the St. Petersburg Botanical Garden, has still smaller flowers, but shows no other, to me, appreciable difference.

Var. *Vicicc* has often a more solid texture of the flower and fruit; which last does not open before full maturity, and may thus in herlmria sometimes seem to be imlehiscent, while usually the capsules of dried specimens readily open long before they are quite ripe. A specimen from Hayti has larger flowers, fruit, and seed than any other I have seen.

C. Europaa inhabits the greater part of Euroj* and the mountains of Asia to the Himalaya. I have seen no specimens from Africa, or from Spain south of the Pyrenees, from Sicily or Greece. In Italy it ^rown near Rome! and Naples 1 also in Asia Minor ! on the Caucasus ! in Persia! Afghanistan I Thibet! and on the Himalaya! in general Once only it seems to have been seen in America; Poitcau! in Herb. Keufchatel, gathered it on *Vicia* in Hayti, where it no doubt was introduced from Europe.

The following formidable list of synonyms shows how much this species has exercised boUrmt*: —

C major, Bmih. Pin. 219; DC. Fl. Fr. III. G44 ; DC. I Prod. IX. 432. *C JUiformis.* a. Urn. Fl Pr. II. 307. *C Utranda,* Mcench M-th. 4W. *V ruijarU,* Peru. Syn. I 2*0. *C. tubulnm^* Piwl I Dil. 21 ft. *C Epithymum,* Thuil. FL Par. 85, not L. *Ç KyiunuL^* Bernhanli Thur Gartx. 1814, nn>. 4. *(\ hahphyta,* Frit*! N. Mant. I. 8. *C halopkila!* Sum. Veg. I. 191. *C. mowyyna,* Schmidt, Fl. liohem. and in w>im> her Una, nut V*hl. C. *Ligustri,* Areachoug, Revis. CuscSuec. p. 17. *C Utnuprrmn,* Jan! in mhe«l. *(\ hyahna,* Ifcii**.: in nchiil., not Roth. — *C.* &9<*IM», RoU in Giorn. But Iul. II. 247, and *C. V\cur%* Schultx, a|». 1V*M. an* overgrown and ofon very distinctive forms on fields of *Vicia, Midicago, tic.* — *C Epitripkyllum,* llrrnh. I. c. 1M4, nn». 4 ; *C frkkukriama,* PhifT. UoL Zeit. lH4ft. p 673; *C Europe* var. *nefm** Frim! Sum. Vetf- I. 11M, and var. rar*i (Srtrn. and UHI. Fl. Fr. II. fttM, am names given to • wppoted form without tcal«4. —Var. *I'ontua, i* Koch in La mm* XIX. 19, 1 have not mn. *C bnukf-*•*Wo» C. Koch! in L XXII. 747, in a form with *otlvn \mUihm** Uctniss atnl with conk rapaule. *C cajnUaru,* [470 (ft))] Edge worth! Linn. TratiMct. XX. 6rt, 'u a more *dvwvlr ^U>tuvrmlv* form from the iliniAlarm, wiih abort l«cini« and very ibort bifid ncalm.

8. C. KtBDiCA, n. «|>.: caulibun rapillarri*; fcl*>nirnili< pervi* pour i florin brartea ovaU aruminaU fuJMlit; floribus sa tte teenlibu* pli^iirm|ae 4-HMTU ; cmlrrU frre »1 hesin divi«i \»U» orato-UncroUtit actitu cruuoecolu tubum eorolla enperantibuii; Ucintb ovmto-lancfx>lati« errrtia wu omnivrntilmt (drinum captula arete etnetti adpresso) tohofcre longiortbu*; •UminibuB quam Unu» multo hrvvionUt*, •nthrn* p»nri» mbrotandit apkalaiie filamento m brenoribtu ; iqaamit bm«i tubt affitin pexru hyalinit tmutminiu lninoaU« ; rtyli* OTBHO peiilo, eapeul* depresso BMIIO btcTioribne.

On the Gara Mountain, Kurdistan, Kotebt? PL Al. Kurd. 3MM, b, owlrr the name of *C. mimar,* fide Ckoifjr and *C. alpina,* Hohenacker, in sched ; KuidUtan, J. Brmnt! in Ho. Hnokrr. — In tntur» and habit Mvmbling *C Kmmpm^* but scales even yet thinner; flowers fewer, more closely sessile ; lobes of calyx and corolla acute ; corolla on the fruit globose, closely investing the whole capsule ; etylee wry sliort and •fouli*. tool a« much divanomto *m* in the allied species. — Flowers 1 line long ; scale large in proportion, 0.5–0.6 lines long.

9. C. Persica, Decaisne in Hb. Mus. Par.: caule filiformi ; floribus sessilibus arcte glomeratis bracteis ovatis seu orbiculato subfultis ; calycis campanulati lobis ovatis acutis corollae tubum superantibus ; laciniis tubo vix longioribus ovatis abrupte acuminatis supra papillosis, erectis demum patulis ; staminibus brevibus ; squamis spathulatis laciniato-fimbriatis fuscum aquantibus incurvis ; stylis brevibus subulatis vix ad medium stigmatosis in capsula tenuissima depressa corollis investitis subexsertis.

Ispahan, Persia, Aucher-Eloy! Herbier d'Orient in Hb Mus. Paris, without number, apparently on some species of *Lactuca.* — A very distinct species, of which a single specimen only has come under my observation. The tough corolla totally invests and, as it would seem, supports the extremely thin capsule, just as in *C. capitata,* to which it is also allied by the subulate styles; scales larger than in any allied form, their fringes covering the top of the capsule. — Flowers 1½ lines long ; scale ¾ line long, strongly reticulate.

10. C. EPILINUM, Weihe, Archiv. d. Apoth. VIII. 54 (1824); DC. Prod. IX. 452. G *dcnn/bra,* Soyer-Willem. An. Soc. Linn. Paris, I. 26 (1822), only by name ; description 1. c, IV. 281 (1826). *C. major,* Koch and Ziz., Cat. Pal. 5. *C. vulgarù,* Presl, Cech. 56. *Epilinella cuscutoides,* Pfeiff. Bot. Zeit Oct. 1845, p. 673; DesM. Et. 64. This well-knowu and very distinct species of the flax fields of Europe (Russia! Sweden! Ger- [471 (21)] many! France! England 1 Ireland! Spain! Sicily!) extends into the Canary Islands (Webb! Finlay!) and Egypt (Kralik ! Figari 1), and has also been seen in the eastern parts of the United States! I have seen no specimens from Asia; but Roxburgh's *C aggregate,* Fl. Ind. I. 447, "introduced into the Botanic Garden of Calcutta with flax from Bagdad," is most probably the same thing.

The characters relied on for a generic separation of this species from *Ouseuta* are untenable, or are founded on mistake. The calyx is deeply 5-lobed, not 5-sepalled ; the capsule is constructed exactly as in the allied species ; the dissepiment is complete till, at maturity, the larger, lower, obcordate part separates from the upper substylar portion. The intrastylar aperture penetrates into the capsule only at full maturity, by a slit parallel to the dissepiment, and sometimes by a second transverse one. The stigma is at the flowering period almost tnice as long as the style, and at base of the same thickness, slightly tapering to an obtuse point; only in fruit, when the style is shrivelled, the stigma has the appearance of being club-shaped.

The very short style, the shape of the thick stigma, and the structure of the stvlnr part of the dissepiment indicate a close alliance to the Asiatic species enumerated below, though' all these have pedicelled, and not, like our species, closely sessile flower*. It is not improbable that it originally came from Asia or from Sgypt

SECT. 2. EPISTIGMA.

Styles none, or consisting of a very short knob on each half of the ovary; stigmata cylindric or subulate, usually of the length of the ovary. The capsule separates from the base only at complete maturity, in a ragged line, not by a regular joint • the opening is wide *(C. pedtuMUa)* or very small <G *Arabica, C. pulchtUa);* the emarginato dissepiment riUDiu_Minthebiiseofthe_ca_I«ule,asini?ucuicu(a; the withered corolla closely'coat* the capsule.

The distinctly ped^Ued flowers are disposed in loose or compact umbelbform clusters, few-flowered or crowded, supported by a single l

The species balc^g here are all Asiatic, ft *Arabica* extends into l%ypt, where it seems to be the most oommou Jona^ ^ . ^ ^ ^ ^ . ^ Unk be_tw0en *Buaucuta* and *CaUiancKe,*-another Asiatic form, in which the little reinnanU of the styles are united.

11. C. Kotschy Boi I. 7, 29 (not *C KoUchfi,* DesM.): well characterized by ' the large (2 lines lon^ ^ T w « : i t h ^ f loo.: c u p p e d calyx and acuminate lacinia,; fruit un- [472 (22)] known. - pLfa. Kotochr» 749. I »&' hm a specimen from the Herbarium of the St. Petersbu J outhern Botanic c J 5 E £ £ * J * — I . * * • > ** though the flower, are . little ^uUer and the calyx i. rather more deeply divided.

U. C P0WHMLA, n. «.: nmbellb laxi. paudflori. bwctea ovata acnminata .uffultU; calyci. camori lobi. ovatis acutiTco^Z tabum .utoqoaatib...; UctaiU tubo fen, .quilongi. o*at» acut» papil o.» crenulatu erectu .eu patulis bus rev bd antheris ovati. llUmenta .ubulaU «,»anUb«.; «!«anu. angurtu laucem attim- gentibus fimbriatis incurvis ; stigmatibus O Y « « » globo«H»vata« .pie. .aboomcum .quaimbu.; cp.uk corolla connivente tota involuta apertura parva basilari demum

Var. β. ALTAICA : calyce profundius fisso ; laciniis acutioribus ; squamis minoribus sepe bifidis.

Affghanistan, Griffith ! 688–691, in Hb. Hooker, on *Alhagi, Peganum, Artemisia,* etc. β. Sarepta ! originally from the Hb. of Pallas, and Altai, Sievers! both in the Herbarium of the Botanic Garden of St. Petersburg. Griffith's plant, which may be distinguished as v. *Affghana,* has beautifully bright red stems and flowers, the very fleshy calyx especially is bright colored ; umbels 4–6-flowered, pedicels as long as calyx or as the whole flower ; flower 1½ lines long ; capsule opening late and with a very small circular aperture. — From *C. Kotschyana* it is distinguished ger pedicels, the deeply divided calyx, the ovate and not acuminate lacinim. onstitute *C. Asiatica,* Pallas, but the specimen in Hb. H. B. Petropol., labelled UMU by *himitU,* belong! to *C. flm^on,* w. *apprmmata.*

i. n r j v i vi Ait»fe. I 893 Icon. t. 234; DCL Prod. IX. 453, excl. lyn. —The •malleit 1J C-FBHCttW W * I' FUAUate I * lon flowers species of this section ; flowers scarcely 1 line long, whiti^ of very thin texture ; ^alJ. amall, truncate; styles almost united at base, separating in the ripe fruit ; intrastylar aperture transverse to thin capsule separating from the base with a very large opening, rather irregularly torn ; more closely allied to the next than to both other species of this section, distinguished from it principally by the much smaller flowers and the wide opening of the ripe capsule. I have seen no other specimens but Ledebour's own, collected on the Altai, parasitic on some species of *Galium.* The other specimens referred to this species by authors do not belong here.

14. C. ARABICA, Fresenius! PL jEgypt. p. 165; Choisy! Cusc. 175, t 1, f. 2, and DC. Prod. IX. 453; not of Wight. *Castuta Arabica,* DesM. Et. 72. — A well-marked species, the most common one in [473 (23)] Egypt, and extending to the eastern shore of the Red Sea. It was collected in the former country by Bové! 354; Aucher-Eloy! 1418 ; S. Fischer! Kralik! and before all these by Lippi! — in Hb. Vail Ian t, where it is labelled as " Cuscuta sulphurei coloris iE^yptiuca, flore niveo," etc, — Arabia, on the Sinai, Rueppell! Schimper! nro. 140. — I cannot see how it is possible to ascribe to it capitate stigmata; nor is the capsule exactly baccate. This last error, however, is easily accounted for, as only the fully ripe capsule will separate from the base, and with quite a small opening. — The Sinai plant — the original *C. Arabica* — has shorter pedicels, denser glomerules, cordate-sagittate anthers, and larger, even incurved, scales. Var. *jEgyptiaca* is distinguished by its longer pedicels, looser umbel, rather orbicular anthers, and smaller, often biind scales, which sometimes seem to be reduced to mere teeth. It may possibly be the luxuriant form, corresponding to *C. Trtfolii%* and growiug on cultivated plants.

SECT. 3. CLISTOCOCCA.

This group, represented by a single Asiatic species, is closely allied to *Epistigma,* but distinguished from it and all its other allies by the really baccate capsule, which at maturity separates from the pen* is tent calyx, entirely covered by the closely enveloping corolla. The styles an* subulate, much thicker at base, usually longer than the thin and pointed stigma. Flowers sessile, densely clustered.

15. C. c A PIT AT A, Roxb. Fl. Ind. 1.448. C ro*eo, Jacqueniont! in Hb. — Roxburgh's description, as far as it goes, agrees well enough with the species I take for it, which is, so far as I know, the only papillate Cuncuta in Iudia; bat it seems to be far from common there. It is, on the contrary, confined to the mountain districts, and to an elevation of from 6,000 to 12,000 feet. —The lanceolate lobes of the deeply slit calyx and corolla an* covered with hemispherical or Ruhcylindric papillae, consisting of numerous very minute cells; scales in the lower part of the tut*, not reaching to the middle, rounded or bilohed, dentate ; styles as long an ovary, much shorter than captttle ; capsule very thin and fragile, but strengthened by the dry corolla forming a tough coatiug over it; intrastylar aperture Urge. — Flowen over 1} line* long, often rose-colored ; seed oval, 0.6 lines long.

India " in great abundance on *Crotalaria jutvai',* Roxburgh; ou the Himalaya, on some *ArtrmUia,* Jacquemont! 1550; on *Thymus,* 7,000 to 10,000 feet hi-h, Thorn*m J in Kum.iun, 12,000 fUt high, Strachney and WinterboUom! nro. 3, in part (in some herljoria the Indian form of *C. Eurvptra* is preserved under this [474 (24)] number).

SECT. 4. FArilVSTIOMA.

8tigmaU cylindric or oblong. obtum», thicker than the filiform style*. Capsul** bumting tran*ver*ely, late, and *ot by a proper joint. Seed* coinprvM«*l, iudi*tiuctly triangular, obliquely truncate at Use, with a very abort perpendicular or slightly oblique hilum.

Flowen pedicel 1*1, di*>u*e<l in a *U**e* fascicled inflorvsrtnre ; pedicel* nsnally supported by bracts, only the latest ones naked. Corolla remaining on the top, or, in *C Africana*^ at the base of the capsule.

The three specie* of thin KI«up inhabit southern Africa, and are usually parasitic on evergreen ahnsla. The form of the stigma i* intermediate between that of *Eucuseuia* and of *Grammica,* and the inflorescence i* similar to that of Ua latter.

16. I ^ A * ? 0LATA, *• iP-: «ili»*w filiformibn*; brartei* liiw»ri-lanc*olatis ; ppdicellu capillaeeis flora loogioribus (a—^ 's bpev ^ ramoaiii laie fasriruUis ; calyci* prefunde 5 partili ad commissura* alalo-anjrulati lobt* lato ovatis ob—is tabum cuco^» lja« campanulatuni superantiUi* ; lacinii* curullsj oralW oUitti* demum paioli* aUmina equantibus ; antheris ***"*** *** I * ^ ^ * cnnlati* filamento iuKulmto vii brwioribu*; squami* ovatis flmbtialis tubum fere excedentibus ; ncuryis, pistillits ovario parvo de,»r—rv*!oL*n bi* Wrv* Innioonlms tubrnn tiosdtnUbus stigmatibus cylindricis ^ illbcUTIII»' *y»° ipao brevionbu*. - r *Afrinm^nvibjl* Cysc ITfl, and DC Prod. IX. 484, pro parte, fide spec. ta_HK Cand. et cit. nec descript. *C A/rumm*. t.* Dr^I in scne<l.

Cape of Good Hope, Dutaitskloof, 3,000 feet high, on Stones, Drege! Mund and Maire! Harvey! in Hb. W»% s M ^ ^ L u d — — *Umhn*^ **• Wsawrt - Tb* bfwl and abort fluwm, wilb broatUy oval and obtuse confounded it wUb hk r* " ^ ^ wfal ^ ^ s * distinguish tbis spsdas at first sight frutn b»tb tU alliea. Cboisy ba* specimen in Da CViuJnjy** lu 11 * m "^ ^^ ^ I^IWIO» *° !>»•«•'• *pscim«i bot also bis own label to tbis sam expended ; styles usually 101|ir tki« *%mala, only In m y yooog flower* of the SSJIM length . Pratt and sssd not seen.

17. C. NITIDA, E. Meyer! in sched.; Choisy! Cusc. 177, t. 2, f. 1, and DTP**! IX. 4M.-WrlldMingiiisUd by the broad and acute lobes of the calyx, the narrowly lanceolate acute lacinia, and the stigmata, which usually are much longer than the styles, rarely of the same length ; stamens balf as lusjg as UainMi (47ft (»)J incurved scales as long as, or sometimes longer, than tube ; capsule irregularly circumscissile.

This is *C. Africana, a.* Drege! *C. Africana,* Ecklon *k* Zeyher! 20, 77, 11, and 21,1,11. *CBurmanni,* Choisy! Ciuc 177, and DC. Prod. IX. 454, is the. same plant, as I have satisfied myself by a careful examination of the original specimen in Hb. Delessert This specimen is further interesting as it bears the inscription " *C. Americana,"* it would seem, in ThunbergVi handwriting. This may therefore be the original plant, which Thunberg first took for Linnaus[9] *C. Americana,* and afterwards named *C. Africana,* so that *C. nitida* would be the true Thunbergian *AJricana;* but even if this be so, it will be better to leave the nomenclature as at present established, especially as quite probably Thunberg confounded both species. Another fact bearing on this question is, that in Jussieu's Herb., now in the Museum of the Jardin des Plantes, a specimen of *C. CKinentu* is preserved, labelled " *C. Americana, Thunb. C. B. Sp. Thunberg ded."* So it seems that at one time Thunberg himself took *C. Chinentu* for his *Americana;* but as, so far as known, this plant does not occur at the Cape, it is quite possible that he brought this specimen from India or China, and confounded all those plants under one name. He does not mention *C. ChinemU* or any other *Chucuta* from those legions* .

C. nitida seems to be one of the commonest species at the Cape of Good Hope, and *he** been collected there by almost every botanist. Dr. R. C. Alexander communicated a specimen with firmer red stems; some of Drege's specimens exhibit a granulated, somewhat scabrous, calyx.

la C. AFRICANA, Thunberg? Fl. Cap. 568 and Phyt. Bl. 17 ; Choisy! Cusc. 176 and DC. Prod. IX. 454 pro parte. —I have almve stated my doubts about the identity of Thunberg's plant, and ray reasons, nevertheless, for retaining his name for this species. The older botanists also seem to acknowledge this for *C. Africana,* as I fiud a specimen thus lalwlled in Willdenow's Herb. nro. 3161. Choisy's description entirely refers to this plant, though one of the specimens he cites belongs to *C angulata.*

It is well characterized by the very loose inflorescence, the long pedicels, the capillary styles, which are much longer (often more than twice as long) than the oblong and thick divergent stigmata; calyx short, lobes broad, obtusish, ?errucose, imbricate ; lacinia linear-oblong, obtusish, involute at the margin and at tip, erect or spreading; •csJe* large, often longer than the tube, incurved; capsules, in the only specimen in which I could find any, almost baccate, or opening very late, with the corolla persistent at base, mostly with a single globose [476 (26)] •eed, 0.7 lines long; flower 1-1J lines long. -G *Americana,* Thunb. Prod. 32, not of Linnaeus, is the same as his later *C Africana.* —Our plant was collected by Drege! 7010, and labelled by him G *Africana, d;* it is Ecklon and Zeyher's! 22, 70, 10. *Schrtbera xhinoide*,* L Sp. 1662, is—as the figure in Nov. Act Up*. 1.1. 5, f. 1, shows — this specie* parasitic on *Myriea Africana.* G *fuii/armis,* Willd. Rel. in R and S. VI. 209, referred here by Choky, a misprint for *Cfuniformu,* as spelt in Willd. Herb. nro. 3156, is not a *Ciucuta,* but a *Cauyia* from the Cape, a*8chlechtendal has long since stated.

C. (hpemis, Choisy! Cusc- 175, 11, f. 4, and DC. Prod. IX. 454, is a large form of this species; flowers 2*-2| linen long; calyx smoother and shorter; laciuia longer, somewhat acutish; scales smaller. It bears the same relation to G *Africana* that G TVflWw does to G *EpUhymum.* - Drege! 7833, Dr. Thorn! Dr. Alexander!

SECT. 5. EUGRAMMICA.

Styles of unequal length, suhplate or cylindric ; stigmata capitate ; capsule bursting transversely more or less ***larly, In G *Jalapensu* regularly circumscissile; seeds often only one or two in each capsule, rounded or flattened, **ncate at base, or hooked; hilum forming a transverse or oblique, rarely a perpendicular line, often very short, or reduced to a point

The inflonsoanee U quite Tariab^ forming few-flowered loose cymes, or compound^racemosei or umbellifonn *F** with padicelled flowers, or compact dusters with subsewile flowers, with bracts at the base of each, or at least the primary pedicels or flower*. The corolU remains at the base or on the top of the capsule, or completely tttlops it

Most spades of this section inhabit South America, the West Indies and Mexico. One (C. *umbdlata)* extends *<> tht southwestern part* of the United States and two (ft *cdmUolepu* and ft *appUnata)* are peculiar to that region; two *hert m native* of Ada; one extending to New Holland, the other to ewtem Africa.

f 1. 8ubulate«

Styles thick and short, tubulate from a bmmd bate; flowers mostly large and oPa firm texture > scales wanting in ow (the first) species; corolk en vdoping the whole or the greater part of the ripe capsule in dl but the firtt; capsule °P*aing readily by mow or le» regular circumKission.

• Lobe, of cdyx orbicular, imbricate. [477 (27)]

I* C. iiAirDlFUMu, HBK.I N. Oen. 8p. HL 1M, t- 813; DC. Prod. IX. 457; not Wdlich Cat—Thi. h « * W and striking .ptde. is so well d^cribed by Konth that it S. not nsctsstry U> add a singU Una• He alnady mentions (a/h* also do* In regard to *a Popa^mmM)* U» cucamsdsjiile opening of tha capsule, ignored

by later writers. The *raceme* of flowers on the left side of his otherwise Tery correct figure is imogiuary, as the inflorescence is a loose few-flowered cyme. The flowers have a diameter of full 4 lines, and are 2£-3 lines high ; the subulate filaments are inserted a little below the throat; no trace of scales visible; styles and capsule scabrous or verrucose ; dry corolla at base of capsule; ripe seeds only 0.8 lines in diameter, almost globose, very rough; hilum a mere dot.

This species is peculiar to the Andes about the Equator; New Granada, Humboldt! Purdie! Oondot! Peru, Haenke ! CL Gay! Weddell I 4768 ; Bolivia, Weddell! 4518; Chili, Edmonston!

20. C. ODORATA, Ruiz & Pavon! Fl. Peruv. I. 69, t 105, f. a., not Choisy nor Poeppig. C. *intermedia,* Choisy! Cusc. 179,12, f. 3, and DC. Prod. IX. 455 ; Gay, FL Chil. IV. 447. —After examining the original specimen in Hb. Ruiz, now in the Royal Herbarium at Berlin, and the almost identical one in Hb. Pavon, now in the possession of E. Boissier of Geneva, — which latter is the original for Choisy's description, — I can have no doubt about the identity of these plants. — Flowers 3 lines long, 3-4 lines in diameter, on very short pedicels, forming dense lateral clusters; laciniae rather longer than the shallow tube; scales very large, deeply fringed; corolla surrounding and partly covering the irregularly circumscissile capsule ; seeds triangular-rounded, nearly 1 line long. — In the Flora Peruviana the capsule is already figured as circumscissile ; but the whole figure, especially the details, are not very correct, and rather calculated to mislead.

Peru, Ruiz! Pavon! A. Matthews! 486; Weddell! 4693; Ecuador, Seemann! 852; Chili, Cl. Gay! 38*k*815.— In Weddell's specimen the tube is more cylindrical and longer and the lobes rather shorter, uniting this species with

Yar. 0. ? BOTRYOIDES, from southern Brazil, Lobb! 49, in the Kew Herbarium. — Dense dusters of flowers, arranged in long pendulous bunches resembling grapes ; tube deeply campanulate, almost cylindric, nearly twice as long as the broad, rounded laciniae ; corolla enveloping the widely gaping capsule, the styles of which are shorter and thicker than in (7. *odorata;* stylar portion of dissepiment broad and jagged. — Apparently inter- [478 (28)] mediate between this and *C. Chilensis,* and perhaps specifically distinct.

[20>. C. GLOBIFLORA, n. sp. : caulibos filiformibus crassiusculis; glomerulis paucifloris compactis; [520 (70)] floribua subsessilibus bractea una alterave orbiculata concava suffultis; calycis fere ad basin fissi lobis orbiculatis imbricatis margine tenuissimo ciliolatis tubum corolla ventricosum globoeura subequantibus; kciniis ovato-orbiculatis crenulatis imbricatis erectis seu conniventibua tubo brevioribus ; antheris ovatis filamento brevissimo longioribus; squamis magnis ovatis breve fimbriatis faucem pene attingentibus ; stylis ovario globoso nquilongis.

Cmico, Bolivia, at an elevation of 11-12,000 feet, Pentland! in Hb. Hooker. — Glomerules in the single specimen seen 6-7 lines in diameter, consisting of 2-5 flowers ; flowers with the thick calyx and the surrounding bracts almost globose, 3-3J lines long, a little less in diameter ; corolla really ventricose or urceolate; ovary globose or even depressed ; I could not ascertain whether the styles become subulate ; stigmas small and slightly conic; in the dried state the young capsule seems to be circumscissile even long before maturity ; corolla apparently covering the capsule. Evidently closely allied with C. *odorata,* to which in habit and inflorescence it bears a great resemblance.]

21. C. JALAPENSIB, Schlechtendal! Linnaa, VIII. p. 515. — Though well and carefully described, [478 (28)] and published at early an 1833, this well-marked upecies has been overlooked by later writers. It is similar to the last, but much smaller; flowers, though on short pedicels, much less crowded. Its roost striking character coiuuits in the regularly drcnmiicissile conic capsule, with shorter very strongly subulate styles, whence Schlechtendal not inappropriately calls it " bicornis.[19]

Peculiar to Mexico; Jalapa, Schiede! 152; Linden! 308; near Mexico, Graham! 200; BnsUmentel 83; Oftxaca,Galeotti! 4413.

22. C. CHIUWSIS, Ker, Bot Reg. VII. f. 603; Choisy! in DC. Prod, IX. 455; Gay! Fl. Chfl. IV. 446. *C. odorata,* P«ppig! in Hb. 90. — A common plant in Chili, whence almost every collector sends it; well characterized by the densely clustered almost sessile flowers, cylindric tube, large, linear, almost tettile anthers, and short deeply fringed scales; styles as long as the irregularly circumsctssile capsule, even in fruit scarcely reaching to the throat of the tube ; seed oval, triangular, compressed, 0.7-0.8 lines long, with a small umbilicus marked with radiating lines, which centre in^he small round hilum.

[C. odorata, Cboisy! Case. 180, t % f 4; DC. Prod. IX. 456; Gay! Fl. Chil. IV. 447, not Ruii A [520(70)] Pavon, according to the description and figure of Choisy and the authentic specimens in Hb. De Ctndolk, does not essentially differ. The specimens of Gay, 816 and 817, and of Berlero, 940, have a thinner, more membmnaceons texture than the ordinary *C. ChiUntU,* but Gmudkhmtfd's specimen is absolutely identical with it.]

• • Lobes of calyx acute, £478 ^ j

S3. C. FOTIDA, HBK.! N. Gen. Sp. III. 12S; DC. Prod. IX. 460, not Hook. 6 Arn. Bot Beechy. *C. pyetumtha,* Bentham! PI. Hartw. p. 296. *C. corymbom,* Jumieu! in Hb. JIMS.—Clusters Urge and

compact, J-l inch in diameter; flowers fully 3 lines long; lobes of calyx and of cylindrical corolla very acute or acuminate; stamens very short ; scales much shorter than the tube, in Humboldt's specimen broadly oval, in others narrow; styles strongly subulate, as long as capsule ; seeds 0.6 lines long.

Quito, 8,000 to 10,000 feet high, Humboldt! Couthouy! Peru, Jos. Jussieu! Ecuador, Seemann! Columbia, Hartweg! 1238.

24. C. ACUTILOBA, n. sp.: caule filiformi; cymis laxis paucifloris; pedicellis brevibus bracteis lanceolatis acuminatis suffultis; colycis campanulati lobis triangulatis acutis tubum corullaB profunde campanulatum sequantibus; laciniis lanceolatis acutisaiinis erectis demum reflexis tubum aquantibus seu paulo longioribus; staminibus multo brevioribus, filamentis anthera ovata brevioribus; flquamis spatulatis fimbriatis faucein fere eequantibus; stylis e basi crassa subulatis ovarium ©quantibus inclusis; capsula corolla marcescente tota involuta [479 (29)] irregulariter circumscissa.

At the Bridge of Obragilla, Peru, Alex. Matthews! 661 in Hb. Hooker.—Very nearly allied to the last, distinguished by the loose, few-flowered inflorescence, the small and apparently deep purple (a color not noticed in any other species) flowers, the triangular, not imbricate, lobes, the short tube of the corolla, and the still more broadly subulate styles. By the styles it is distinguished from *C. umbellate,* which it otherwise considerably resembles.—Flowers 1£-1} lines long ; single seeds globose.

§ 2. Obtusilob®.

Styles slender, usually capillary; flowers large or small, usually thin and membranaceous; lobes of calyx obtuse in all but the last species; corolla short in the three first, long and cylindric with short laciniae in the four last species; scales absent in one (the last) species; styles short in the first, very long in the four last species; cupsule opening late, and mostly irregularly; dead corolla enveloping the capsule except in the first species.

• Flowers short.

25. C. APPLANATA, n. sp.: caule filiformi; floribus breviter pedicellatis vel subsessilibus in glomerulos densos eaepe continue* congestis; calycis campanulati tenuis lobis ovatis obtusis tubum corolla late campanulatum depreasum aquantibus; laciniis ovatis obtusis patulis demum reflexis tubo equilongis; antheris oblongis tilanienta brevia subulate esquantibus; squamis maximis crispato-laciniatis faucem excedentibus supra ovarium magnum depressum incurvis; stylis capillaribus ovarium equantibus seu excedentibus e fauce exsertis; capsula depressa corolla marcescente involute irregulariter circumscissa.

In Arizona Territory, south of the Oila River, Chs. Wright! Mex. Bound. Survey, 1623 (541), on some *Nyctaginea,* and 1625 (685) on *Ambrosia;* fl. Sept — Glomerules 3-4 lines in diameter, often strung together like beads; 6-12 flowers in each glomerule, 1-lJ lines long, of thin texture and white color, on short branched pedicels, supported by small obtuse bracts; capsule 1 line in diameter, half as much in height, with a very small intrastylar opening; seeds } line long, oval, strongly verrucose-reticulate, with a short and broad oblique or perpendicular hilum. In aspect this plant resembles somewhat ft *arvensii,* but is abundantly distinct from this and any other species.

26. C. CHINENSIS, Lamarck! Enc II. 229; Choisy! Cusc 183, t 3, f. 4, and DC. Prod. IX. 457. *C. tulcata,* Roxb. Ind. I. 447 ;JVallich ! Cat 1320[1]. *C capillaru.* Wall. I Cat 1321. *C. Americana,* Tbunberg! in Hb. Jussieu. *Grammica aphylla,* Loureiro! Cochin. 171; ed. Willd. I. 212.— A common plant, as it [480(30)] appears, of the tropical regions of Asia and the islands southward, especially Ceylon, extending into Candahar (Griffith! 685) and China (in Hb. H. B. Petropol.! as " *C. fimbriata,* Bunge," which name seems to be •pocryphal), characterized by the strongly carinate rather than sulcate lobes of the thereby 5-angled calyx, with five secondary angles at the commissures; scales rather large, deeply laciniate, and not, as Choisy describe* and figures them, short and adnate below the throat; styles slender; capsule very thin, enveloped and covered by the corolla, opening at base rather irregularly and late, and therefore often termed "baccate ;" Loureiro himself describes the fruit of hit genus *Grammica* as a •• bacca," though his original specimen in the Hb. of the British Museum shows the circumscissile capsule. Flowers 1-1 i lines long; seeds 0.5-0.7 lines long, oval; hilum oblique or usually nearly perpendicular. — Lamarck's original specimen, accidentally raised in the Jardin des#PlanUa of Paris, in 1784, with * « b supposed to have come from China, is preserved in Hb. Juwieu in Mus. Paris.

C. kyaUna, Wight, Ic. 1372; Wallich! Cat. 132O\ not Roth, is a form of this species, with bifid and rather •mall scales.

A form from the island of NawiW, near Madagascar, Boivin! in Hb. Vindobon., has also bifid Males, but in distinguished from all other varieties by the capsule being expert above the corolla, and by the large intrastylar aperture.

Vtr. *H* CARINATA, *C. carinata,* R. Brown! Prod. N. Holl. I. 491, from the tropical parts of New Holland, is the tame species, with more strongly carinate and more obtuse lobes of the calyx, more obtuse lacinio, and almost globose an then.

Var. y. CILIARIS, *C. ciliaris,* Hohenacker! in Pl. Kotechy, Boissier! Diag. Or. II. 3, 129, is a stouter, larger-flowered northern form of the same plant, with shorter and stouter styles ; scales spatulate, or sometimes in the same flower bifid, less deeply and finely fimbriate; flowers 1|-2± lines long. — Mossul, Kotscby! 431; Kurdistan, Grant! in Hb. Torrey. — The specimen of Herb. Wight, propr.! 2408, is the same thing from India. The largest-flowered form is preserved in Hb. Mus. Paris, under the name of *C. angua,* collected at the Selenga River, in Siberia, by Demidoff, a coiemporary of Pallas ; lobes of calyx and corolla in this specimen more distinctly crenulate than in most other forms of the species,

27. C. TINCTORIA, Martius! in Herb.: caulibus filiformibus subfunicularibus ; floribus globosis pedicellatis in glomerulos laxoe umbel liformes congestis; calycis cupulati lobis orbiculatis imbricatis tubum corolla campanulatum aquantibus ; laciniis tubo aequilongis ovatis obtueis basi imbricatis erectis seu demum [481 (31)] patulis reflexive; antheris ovatis filamento subulato brevissimo plerumque longioribus ; squamis late-ovatis fimbriato-lAceris tubum sequantibus seu paulo excedentibus incurvis; stylis filiformibus ovario depresso longioribus fere exsertis ; capsula irregulariter circumscissa corolla marcescente involuta tectaque.

Mexico, usually, as it seems, on trees ; Oaxaca on *Schinus molU,* Karwinski! who relates that the natives use it under the name of " Zaca-tlascalli" as a yellow dye, — and, indeed, the dried specimens tinge water, paper, etc., deep yellow, which I notice also in some other South American *ducutce;* San Luis Potoei, on the same species of tree, Dr. Gregg! in full bloom in December. — Flowers 2-2$ lines long, in loose dusters, of six lines in diameter, which are gathered into long racemes; intrastylar aperture small; seed compressed, rounded, 0.6 lines in diameter. —The Blender style and the shape of the capsule distinguish this species from the similar *C. Jalapeiuu,* the short flower and short style from *C.floribunda,* the circumscissile capsule and larger flower from *C. Gronovii,* and the short filaments from all or them. A specimen, however, in the Hb. H. Bot of St. Petersburg, collected by Karwinaki on an oak " between Victoria and the Rio Blanco," has filaments as long as the anthers.

• • Flowers elongated.

28. C. FLORIBUNDA, HBK.! N. Gen. Sp. III. 123; DC. Prod. IX. 459. — The only specimens of this plant known to me, gathered by Bon pi and! at the Bridge of Irtla, in western Mexico, 3,000 feet high, are preserved in the Royal Hb. at Berlin and in Hb. Willdenow, nro. 3159[9]. They are in rather poor condition, and in ripe fruit only. Enough is left, however, to dhow that the plant is nearly allied to *C. Popayancniii,* as Kunth already states, bot well distinguished by the short and thick, orbicular, deeply divided, broadly imbricate lobes of the calyx ; the deeply divided corolla ; the oblong linear (obtuse, not acute, as Kunth has it) lacinire nearly equalling in length the cylindric tube; large oval scales deeply finibriate-ladniate, reaching to the throat; styles twide as long at capsule, slender, long exsert in fruit; etylar portion of dissepiment elongated, olmont reaching the base of the capsule ; seed 0.8 lines long, narrow, triangular, and very rough. Flower with the lobe* 3, or, when these are reflexed, 2 line* long. From *C. Hncloria,* to which it is even more closely allied, it may be distinguished by the long tube, the narrow lacinto, the long styles, and the long and narrow seeds.

». C. AMERICAHA, L. 8p. 180 pro parte; Jaoq. Am. 30, p. 17; Chow! Cum;. Iflfl, t 4, f. 4; [482 (32)] DC. Prod.IX. 459. *C. graveoleiu,* HBK.! N. Gen. 8p. III. 122. — This is the most common species of the We* Indian Islands, parasitic mostly on shrubs and tree*. It extends to the Pacific coast of Mexico, and on the Atlantic coast of South America from Venexoela to Brazil; rarely, as it would seem, leaving the neighborhood of the sea-coast, though Weddell found it in the province of Goyai, in central Broil. - Well characterind by the mall, cylindric corolla, with abort, very obtuse, almost always erect ladnto slightly protruding over, or sometimes almost enclosed hy, the wide and deep cnpulato calyx ; scales abort, attached to the middle of the corolla, and usuaDy not reaching to its throat; styles very slender, mostly much longer than the rery wnall globoae oraiy, extol only in fruit; capsule late and irregularly circomncksik; ttyia? portion of dittepiment reaching nearly to the hate of the capsule; teedt mostly solitary, filling the whole capsule, roundish, somewhat compressed; hilum forming a very short line, airaott a point.

The ordinary *c. Amman** hat form 1$-1J li$_{nM}$ in length ; .thin, when dry, aMmbnnaeeoMand wy widt calyx; Make uther truncate, eometimce almort bOobed, slightly dentate, or aomewhat flmbriato; atylca anally included daring flowering, mo* or le* enert in frnH. — Martinique, Sieberl 91; Hayti, Poiteaul Ehrenben! Antigua, Wulbchlagel! with larger flower*; Portorico, Berterol 8t Thorny fiidlet Hoi too I Yucatan, Undejl Venezuela, Huniboldtt Kanten! Fendler! *W>; Surinam, Hb. Ac Phil.! Brazil, Oardnert 1776; Blanch*I $_{7M}$. Ooyax, Weddell I 8308.

Different mrietie. may b* dirthtgBfahed Mcording to the length of the padieeb, •» of flower, taxtiw of ealri. shape of aealea, and length of rtyka; bot they ran into one another »that I, with twenty-flr* or thirty andmana *tnm* the whole range of the epedea befor* me, am anable to limit even theea varieties The »..iL 7Z- C MRfHto, Bentham! Bot Snlph. 138, from Acapalco: flower, crowded; aeareely more than 1 line Ion. triangnkr, almoat entire; atylet ahmder. A ateilar plant was collected by Or. Gregg at MaaUan • flown

more slender, calyx narrower than in any other form, and more distinctly 5-angled (angles corresponding to the commissures) ; scales and styles as in the other. *C. leiolepis,* Miquell Linnaea, XVIII. 247, is the same thing from the orange hedges in Surinam, but with shorter styles than any other form of this species examined by me. *C. Surinamenris,* Schilling, de Lepra, pp. 60 and 200, t. 2, also seems to belong here. C. *campanulata,* Nuttall! mas. in Hb. Ac PhiL from the West Indies, bus the scales of this, but otherwise is identical with the ordinary form.

Another form has a thicker, more coriaceous calyx, usually larger flowers (1J-2J lines long), larger [483 (33)] more deeply fiinbriate scales, often exsert styles, and sometimes 2-seeded capsules. This is *C. spectabilis,* Choisy! Cusc. 187, t. 5, f. 1 ; DC. Prod. IX. 459, from Bahia, Salzmann! 351; Blanchet! 85, and *C. globubsa,* Bentham! Bot. Sulph. 138, from Acapulco. The specimens from Surinam, Hostmann! 464, one of Poiteau's! from Hayti, and especially Linden I 1994, from Cuba, the largest of all, may be referred here.

C. Americana, L., and of most authors on the Flora of North America, comprises, besides this, several North American species, especially *C. Qronovii, C. arveneU,* and *C. compacta. C. Americana,* Thunb. is *C. Africana.*

30. C. COBTIMBOSA, Ruiz *A* Pavon, as intended by the authors, is a rare form of a species which, under different names i* common throughout northern South America and Mexico. The species, as here proposed, is distinguished by the cupulate membranaceous calyx, with short and broad very obtuse lobe*, loosely enclosing the lower part of the long cylindrie tube of the corolla; lacini® short, mostly very obtuse, erect or rarely spreading; anthers oval or orbicular-oval, sessile or on very short filaments; scales mostly long and narrow, attached for the greater part of their length, more or less fringed at the sides and apex, always considerably shorter than the tube, rarely quite small and indistinct; ovary small, globular or conic, with very long styles, which generally reach as high as the anthers, and often become exsert as the fruit ripens; capsule very small, often 1-seeded, always opening in its largest diameter, surrounded and covered by the base of the shrivelled corolla; stylar portion of dissepiment reaching nearly to the bottom of the capsule; hiluin reduced to a point Very closely allied to the last species, but readily distinguished by the larger flowers and the larger elongated and exsert corolla.

Var. a. GBANDIFLORA : flowers large, 3-4 lines long ; anthers on very short filaments or sessile; scales long and narrow, almost entirely adnate, rarely bifid; styles reaching the anthers or shorter; ovary and capsule globose or rawly somewhat conic. *C. Popayaneneis,* HBK.I N. Gen. Sp. III. 123; DC. Prod. IX. 460, of which Kunth already mentions the capsule as circumscissile, and speaks of the close alliance to *C. carymbo$a. C. cymaa,* Willd.1 rel. R. 6 Sch. VI. 205, founded on the same specimen. — New Granada, Humboldt! Columbia, Hartweg! 1237 ; Moritz! 489; Coniitan, Mexico, Linden! 291; Caracas, Birchel! Gollmerl Venezuela, Fendler! 946; Peru, Dombey! in Hb. Mu». Paris, under the name of C. *corymbosa.*

The following forms do not seem sufficiently distinct from this : *C. patera,* Benth. 1 Bot. Sulph. 35, [484 (34)] from the Magdalen Bay, Lower California, has rather wider and a little shorter flowers and shorter styles, which reach only as high as the linear scales.

C. tnciiuo, Choisy! Cusc. 179, t 2, f. 2; DC. Prod. IX. 455, from Mexico, Berlandier! 1103. — Similar to the last; styles even longer, but scarcely reaching the throat; anthers sessile. Choisy's figure shows long filaments, and hit description speaks of "stamina bast corolla affixa,* etc., which is perfectly unintelligible. Choisy's figures are bj DO means reliable in the details; as is evident in examining, for example, the scales in his figures of *C. Arabica, Chinenmt,* and others, the ovary of *C. Gronovii, Americana,* etc. This is one of the few *OuscuUe* known to me where there is in the flower in full bloom a slight approach to the ventricone shape.

C. laxifiora, Benth.! Bot. Sulph. 138, from Acapulco, is the same plant, with a somewhat conic ovary and capsule, uniting this with the next form; flowers about 3 lines long, styles not exsert.

C. PopayanentU, Posppig! Hb. is a variety of *C. micrantha.*

Var. *fi.* 8TYLOSA. C. *ttyUm,* Choisy! Cusc. 187, t. 5, f. 2; DC. Prod. IX. 459. — Flowem rarely more than * lines long, slender, with very short calyx; narrow cylindrie corolla; short, narrow scales; filaments as long or shorter than anthers; stylet reaching to the throat of the corolla or above it, often long exsert at maturity of fruit or *«fow; ovary and capsule conic, or rather inversely pear-shaped. The length of the styles is variable, even in the original specimens quoted bj Cboiny; the shape of the capsule would be characteristic enough, if intermediate forms *d not indicate a transition to var. *grandi/bra.* —Found thus far only in Mexico: Andrieux! 73 and 214; Berlandier! ***; Hb. Jtequin! under the name of *C. Americana;* Ohiesbrecht! 186; Toluca, Karwinski! Zimapan, Qtleottil 1419; Jalap*, Linden! 308 in part.

In the Kew Herbarium I find a specimen tent by Botteri from the Oriaba, Mexico (nro. 949), which is this form with scarcely exsert styles, larger flower* (3 line* long), and acutish crenulate lacinia.

Var. y. MioioLBra. *C. corymboea,* Ruii * Pavon! Fl. Peruv. I. 69, t 106, b.9 not Cboisy Cusc nor DC. Prod. —Flowers lf-8 lines long, as often 5-ai 4-parted in the original specimens in Hb. Ruii and in Hb. Pavon, both of which seem In be parts of one and the same specimen: calyx cupulate, with abort obtuse lobes half as long as the w lobes; lachii* ovate, obtuse, nearly one third the length of the tube, erect or patulous; filaments as long as the

broadly ovate-cordate anthers ; scales reduced to very thin and small ovate membranes, with 4-7 or 8 ir- [486 (35)]
regular teeth inserted below the middle of the tube, perhaps sometimes entirely wanting; ovary slightly conic, with styles scarcely reaching to the throat, just exsert in fruit. In the figure in the flora Peruvians the cylindric corolla and the circumscissile capsule are correctly given. — Peru, on shrubs, and on *Medicago sativa,* Ruiz & Pavon! not found since.

It is well known that Choisy, L c, and every author after him, myself included, took the *Cuscuta* — which twenty years ago made its appearance in different parts of Europe, in fields of *Medicago,* said to have been imported from Chili — for this species. The figure, as well as the original specimens, prove this to have been a mistake ; that plant is *C. racemosa,* Mart., as will be shown below. Whether the scales are ever really absent, or only very small and difficult to find, I cannot say. In eight or ten flowers which I carefully examined 1 could not always discover them, especially after soaking the flowers; unfortunately, the specimens are injured by too hard pressing. With the exception of the smaller flowers and indistinct scales, I find nothing to separate this from the other forms, which are more abundant and better developed, but had to yield their specific names to priority.

31. C. PRISMATICA, Pavon! mss.; Choisyf Cusc. 182, t. 3, f. 2; DC. Prod. IX. 457. — A very distinct species, and one of the few without any scales. Choisy's figure as well as description is not very correct. Bracts lanceolate acuminate; flowers subsessile, 3 lines long; calyx elongated, obconic, fleshy, deep red, 5-angled from the decurrent cariiia of the unequal, ovate, acute or cuspidate imbricate lobes; corolla almost cylindric, long exsert, externally granulated, lacinia 4-6 times shorter than the tube, oblong, obtuse, somewhat involute at the margins, crenulate; anthers ovate-cordate, sessile ; ovary turbinate ; capillary styles shorter than the* tube, much longer than the ovary. I have seen no fruit of this plant, but venture to class it here on account of its close affinity with the last species, from which, however, it is abundantly distinguished by all the characters above enumerated. The only specimens seen are from Guayaquil, Pavon! in lib. Boissier, and Hankel in Hb. Mus. Bohem. Pr.

§ 3. Leptolobe.

Styles slender, usually capillary; flowers rather small, membranaceons ; lobes of calyx and corolla acute, often acuminate, commonly narrow and elongated, as long or longer than the usually campanulate tube; scales absent only in the last species; capsule surrounded or covered by the corolla, opening by irregular or rather regular eireumscission.

32. C. ODONTOLEPIS, n. sp.: caulibus tenuiter filiforraibiiR ; floribus breviter pedicellatis bracteatis [486 (36)]
in glomerulos laxiores deniutn decomposites crassns con fort i*; culyci* breviter campanulati profunde partiti nitidi lobis ovato-triangulatis acutiusculis tubum corolla* profunde campanulatum subaquantibue; laciniis ovato-lanceolatis acutis demum patulis reflexisvc tubo paulo brevioribus; ant hen's ovatis filamenta subnlata brevia aquanti-txn; aquamis late ovmtis e tubi twiti oriundi* ail medium adnatis faucem fere attingentibus versus apicem grosse denUtin; atylis capiilaceis ovario dprvs*M>. globoao niultoties longioribus e fauce paulo exsertis demum elongatis; eapsula corolla rudimentis calyptruta rite circumscimui.

Near a deserted Rancho, on a rocky hill-side in Arizona, paramtic on *Amaranhu;* fl. Sept., Ch«. Wright! 1624 (529). — • Whole plant very white." Clutters of the large and showy flowers at last crowded, more than 1 inch in diameter; flowers 2} lines long, on pedicels as Icing or shorter than the calyx, which in one specimen covers the tube, and in another it shorter; scales large, irregularly toothed towards the apex only; capsule globose; readily opening towards the base by a small circular aperture; stylar portion of dissepiment scarcely half as long as capsule ; seeds usually all four developed; oval, about * line long, verrucose, with a small linear vertical or transverse hilum. — In general aspect, as well as in some particular*, this species rery closely approaches to C wrymtao, but seems to be well distinguished by the characters given, especially the deeply divided corolla, its acute lacinia, the broad dentate scales, the small basal opening of the capsule, the seed, etc. It is not impossible, however, that intermediate forms may yet be discovered, which will oblige a future monographer to unite them. On the other hand, the similarity to *C.* tNtoitfeaa-aCalifomian species, which has decidedlj baccate capsules - is so great thai onejuight be induced to doubt the diagnostic importance of this character.

33. C. XAMTHOCHOBTOS, Martins I in Hb.: eaulibus filiformibus; glomerulis sesaiibot globosis mohiflora; bracteis oratk; pedicellis ramosis, ultimis caljee caapaaulato pro/nude fisso brerioribus; lobis ovatis obtusis bad imbricatis margine sape rellexis tubum corolla late campanulaium aquanUbos stu superantibus ; laciniis lanceoktk elongatis acutiusculit tubo multo longioribus patulis reflexisre basi imbricatis; antheris oblongis fUamento subulato subhwvioribus; squamis late ovatis Ambmto-laoeris feocem excede&tibus; stjlis capillaceis demum divaricaiis ovario ormto multo longioribus ; capsula conica corolla rudimento involuU basi regularity- circumscissa.

Porto Alegre, Rio Grande de San Pedro, Brazil, Father Joannes de 8ta. Barbara! in Hb. Martins. —
TVs specimen consists of an intricate mass of deep yellow stems, with few beads of flowers just develop- [487 (17)1
ing; a few half-ripe but already circumscisdle fruits were seen. Flowers 1^—9 lines long. This plant stem to be nearly allied to *C. umbtUaia,* but is distinguished bj more compact heads, larger flowers, broad and

imbricate obtusish lobes, etc. The lacinitt of the corolla, always elongated, are in some flowers acutish, in others almost obtuse.

34. C. PARTITA, Choisy! Cusc 188, t. 6, f. 3; DC. Prod. IX. 460. — Brazil, Blanchet I 3047 ; Gardner I 2684; westward to Bolivia, Weddell! 3483 and 3611 ; and northward to Venezuela, Maracaibo, Kanten! and Curaçao, Friedrichsthal! 375, b; usually low, on herbaceous plants, *LcgumiruwB, Malvacea, Euphorbiaccce,* etc.— Cymes compound, paniculate; bracts ovate-lanceolate, often cr^nate; flowers small, usually less than 1 line long, more or less glandulous, and filled with coloring matter, deep-red when dry, like *C. miniata;* calyx divided almost to the base, lobes lanceolate acute ; lobes of corolla of same shape, at length reflexed with the points incurved; tube of corolla at last ventricose, enveloping the capsule, divided by grooves which correspond to the stamens into five separate externally convex compartments, as it were ; scales as long as the tube or shorter, deeply fringed; capillary styles much longer than the small globose ovary, subexsert, sometimes recurved on the fruit; capsule very thin, hyaline, irregularly circumscissile with a wide opening; seeds 0.5-0.6 lines long, obliquely ovate, or, where only one in a cell is developed, rostrate; hilum linear-oblong, short, in the former seeds perpendicular, in the latter transverse.

The specimens from Bolivia have larger, less glandulous, and paler flowers, 1j-1j lines long, "yellowish-white or rose-colored," but do not differ in any other respect.

35. C. UMBBLLATA, HBK. I N. Gen. Sp. III. 121; DC. Prod. IX. 460. *C. parviftora,* Willd.l Hb. nro. 3163. — This species seems to have been unknown to all later botanists, with the exception of Torrey, who recognized Humboldt's plant in a specimen collected by Long's expedition to the Rocky Mountains. Lately it has turned up from many localities along the United States and Mexican boundary line, from northern Mexico, and from the Antilles. In Brazi a form has been collected which I cannot specifically distinguish from the Mexican plant. — The flowers of this species are arranged in loose compound fasciculate cymes, the ultimate divisions forming umbels of 3-5-7 flower*, supported by a single ovate-lanceolate bract; pedicels usually longer than the flower ; flower, with the lobes of the corolla erect, lf-2 lines long ; calyx broadly campanulate, thin and shining, at least when dry; lobes triangular, acute, as long or loager than the shallow tube of the corolla; laciniae narrowly [488 (38)] lanceolate, elongate, acute, longer than the tube, spreading or reflexed ; scales usually broadly oval, large, longer than the tube, incurved ; styles much longer than the globose-depressed ovary, rarely of same length ; corolla enveloping the small, thin, depressed, almost 4-lobed capsule, which is commonly circumscissile, but in some instances rather irregularly bursting; seeds generally all four developed, 0.5-0.6 lines long, triangular, oblique, with a very short linear hilum.

It is always found in dir pl*»« on low herbs, especially *Porttdaea,* also *KalUtramia, Amarantxu, Atriplex, Polijgonum,* etc., and sometimes even on some prostrate *Euphorbia:* between Queretaro and Salamanca, Humboldt! Saltillo'and Cainargo, Gregg[1] Western Texas, New Mexico, and Arizona, Wright! 1627, 1636, 1639 (371, 510, 605), Bigelow! Schott! Santa *Ft,* Fendler! 659; foot of the Rocky Mountains, James! Jamaica, Broomfleldl Purdie!

Dr. Hays found a specimen on the San Pedro River, Arizona, on *Sweda,* with much more dense inflorescence, greatly resembling a form of C. *Californica,*—which will be noticed below,—parasitic on the same saline plant, and mainly distinguished by the broadly canipanuUte, not turbinate, calyx, the circumscissile capsule, and the seeds.

Some specimens from New Mexico show a tendency to papillose pubescence; and one from Sonora, Coulter! 1010, on some *Euphorbia,* has the unusually small flowers (1 line ong) quite papillose-scabrous.

Var. 0. T DESERTOBUM. *C. dsmtorvm,* Martins! in Hb.: pedicels long; flowers less crowded, smaller, 1 line long; Unceolate-linear lacinia twice as long as tube; scales small, bifid or reduced to two lateral toothed lobes; •tyles shorter than the exsert capsule, which is drcumscissile with a small opening; intrastylar aperture large; seeds only 0.4 line loog.— On *Portulaca* and *Ehrenbvgia,* in the province of Piauhy, Brazil, Martius!—Another similar form, but with longer tube and shorter lacini» and rather larger scales, was collected by Gardner! 2425, in the province of Ceara, in the stme neighborhood, also on *Portulaca.*

A specimen from the island of Antigua in Hb. Martius, Wullscbliegel! 352, seems to belong here, though the (unripe) capsules do not open ; flowers larger and more densely clustered than in the common form, calyx and capsule glandulous, intrastylar aperture Urge*

36. C. QRAOILLIMA, n. sp.: caulibus tanuissime capillaoeis demum deciduis; floribus in fasciculos deoompositos demum dense glomerate* eongestis; bracteis lioeari-lanceolatis; pedunculis nmosissimis; pedicellis capil-*botiM* flora gracili longioribus; ctlycis turbinati lobis Unccolatis s»pe apice recurvis tubum corollas paulo [489 (39)] rapetmtfibus; laciniis lanceolati* subulatis tubo raulto longioribus erecjis apice subrecunris; sUminibus ladnias superantibus, flUmcntu e basi subulate capillaceis, antheris ovmtu; squamis laceris fimhriatis incurvis tubum •xcedentibus; ortrio ptrro globoso, stylis capillaceis longimimis anthers* fere attingmUbus; capsub corolla nidimsnto indicate demum imgulariter traosTerse disrupte; seminibus knticuUribus ISJviusculis, — *C.fmtida,* Hook. & Am.1 BotBs*chy,a04f nooHBK. *0. $*b*Uit,* Chaubtrd I in Hb.

Mexico, Alornayt in Hb. Delessert; Tepic, Beechy! in Hb. Hooker; Jiirgensen! in Hb. Mus. Florent. — The only species known to me with stamens longer than the lobes of the corolla ; distinguished also by the large and dense masses (in one specimen over 1 inch thick and 2-3 inches long) of flowers ; pedicels branched but scarcely umbellate, mostly much longer than the flowers; flowers small and slender, 1j-1} lines long; capsule opening late and irregularly; intrastylar aperture quite small; seeds usually two, 0.5 line long, compressed, rounded, slightly oblique' at base, with a very short transverse or oblique hilum. — Closely tdlied to C. *umbellata;* principally distinguished by the inflorescence, the turbinate calyx, the smoothiah seed. Less important differences are the erect laciniae and long filaments.

Var. 0. SACCHARATA : bracteis pedicellis totoque flore papilloso-adspersis ; laciniis staminibus stylisque brevioribus; seminibus minoribus. — *C. Sidarum,* Liebm.! in Hb.

On the coast of Oaxaca, parasitic on different species of *Sida,* Liebmann! in Hb. Hooker. — Inflorescence the same as in the species; flowers even smaller, l£ lines long; laciniae shorter; stamens shorter; anthers orbicular; capsule readily circumscissile; seeds 0.4 line long.

37. C. LEPTANTHA, n. sp.: caulibus capillaceis ; bracteis ovatis acuminatis; podicellis filiformibuB hevibus unibellato-fasciculatis; floribus 4-meris gracilibus ; calycis granulato-hispidi lobis triangulatis acutis tubo corolla? cylindrico dimidio brevioribus; lacinii* lanceoUtis acutis erecto-patulis tubo multo brevioribus; filamentis filiformibus cum antheris ovatis brevioribus lacinias suboquantibus; squamis ovatis dentato-fimbriatis tubo multo brevioribus ; ovario parvo globose, sty 1 is capilLiribus longissimis demum exsertis ; capeula corolla basi hispidola indusiata calyptrataque drcmnscissa ; seminibus glohoso-triangulatis verruculosis.

Western Texas, Chs. Wright! 1849, nro. 522; prairies of the Leona, in the same region, the same! 1852, nro. 1639 in part (mixed with *C. umbellate),* in both instances on *Euphorbia albo-marginata.* — This is the only *(hucuta* seen by roe with (thus far) constantly 4-parted flowers. Flowers 2-2} lines long, pedicels sometimes twice as long; calyx campanulate-globose, short in proportion, about } line long, as well as the [490 (40)] base of the tube in all the specimens seen, papillose or, in the dry plant, scabrous; tube of the corolla slender, much longer than calyx; corolla enveloping the small capsule and contracted above it, capsule readily opening at base with a wide aperture ; seeds 2-4, almost globose, 0.4 line long, with a very short hilum.

3& C. HTAUVA, Roth! Nov. Spec p. 100, not Wight, nor Boissier. *C. Arabiea,* Wight, Ic. t. 1371, not Fresenius. (7. ocypetoio, Boissier! Diag. Or. II. 3, 130. *C. acutiuima,* Buchinger! mas. in PI. Schimper.— This well-marked species of the tropical parts of the East Indies (Ileyne! Stocks! 478; Hooker & Thomson! and others), extending into Abyssinia (Schimper! 1522), is certainly the plant Roth had in view, as the specimens with Heyne's and with Roth's own labels in the Hb. of the Botanical Garden of St. Petersburg prove. Roth's description, however, cannot bat hare misled all future authors, as he speaks of scale*, no trace of which is present in the different specimens I had oeeaskn to examine, not even in Roth's own, nor are the flower* usually 4-parted, but almost always 5-parted.

BoMer, L e., already mentions that the capsule bursts irregularly. Whether it more readily opens when fully ripe it unknown, but in all the specimens examined it rather adheres to the bane in the calyx, and bunts only when some force is used, the deeply bilobed lower part of the dissepiment remaining with the base. It therefore very properly comes in at the end of this section, uniting it with the next.

With *C. CaHfomiea* this species is dotely connected, and, indeed, is sometimes difficult to distinguish from it; but the texture of all the parts is thinner, semi-transparent, and nhining, at least when dry; hence Roth's name is quite appropriate. The adnato parts of the filament* are distinct, but no trace of scales is visible; the ormry it conic ; the styles are •till more hair-like and on the captnle divaricate; the seeds usually ripen all four, - they are triangular, flattened; with the abort, almost obloiig lillum peipeiidkiilar or trMtrefte, both forms being found in seeds from the tame capsule*

8MT. ft. CLISTOGRAMMICA.

Stylet of unequal length, cylindric, rarely almost abtent; ttigmata capitate. Oaptola nera opening at bate, baccate, persistent with the calyx, or tenanting from it entire; intrettylar aperture often large, bat generally not penetrating into the capsule. Seedt four in each capsule, or fewer, tometimet only one; rounded or usually triangular-flattened, often rostrate; hilum linear, abort or longer, trantrent or oblique or perpendicular.

Inflorescence variable; either an mnbellifonn or toroewhat globose clutter with pedicelled flowers; [491 (41)] or a loose racemiform 'or paniculate cyme, finally more or lett crowded ; or (in the four latt tpeciet) compact and often continuous clutter* of dotely tettUe flowers with many sterile bract*. The corolla remains either at bate or around the capsule or covert its top.

This section is the richest in *peciet, and the most common in North and South America and on the Itlaadt of the Pacific. One specie* *(C. obhuijlom)* it a cosmopolite, being found in North and South America, ru^f— Atia, and Europe ; and one *(0. appendunlata)* in peculiar to South Africa.

{ 1. Platycarpe*.

Flowers pedicelled; sepals united; ovary and capsule globose-depressed, with walls of uniform thickness (in some forms of the last species conic).

• Flowers arranged in single or compound subglobose cymes; styles usually short and thick; withered corolla remaining at base of capsule.

39. C. OBTUSIFLORA, HBK. — Humboldt's plant is the type of a series of forms spread over a great part of the globe. The inconspicuous little species of the Peruvian Andes was not recognized nor sought for in the specimens found in widely distant parts of the globe; these, therefore, received distinct specific appellations, and different ones in different countries. They all are characterized by the bright orange-colored stems (which has suggested several specific names); the loosely globose inflorescence; the obtuse or rounded lobes of the calyx and the-corolla, the lacinin usually equal in length to the tube, and soon reflexed ; the thick and at last subulate styles on the large and depressed ovary, which soon after flowering swells considerably, and, leaving the corolla at base, grows into a large, depressed, almost naked 4-seeded capsule, with a large intrastylar aperture of rhombic shape. Seeds 0.6 or 0.7 or even 0.8 line long, oval, oblique, with a long and narrowly linear perpendicular or transverse hilum running almost across the whole umbilicus. All parts of the flower are often, and the capsule commonly, glandulous-dotted. The principal, if not the only, difference I can discover between the different forms here united lies in the shape and size of the scales.

Synopsis of the forms of C. obtusiflora.

a. Scales ovate or spatalate.
- • Scales imall, shorter than the tube of the corolla: Var..two, from South America.
- t+ Scales large, equalling or exoeecUng the tube of the corolla; all parts of the flower dotted with gUads: Var. *glandulom,* from the West Indies and the southern parU of the United States.
- •«• Lobes of calyx and corolla broadly oval, or almost orbicular; scales Urge: Var. *latiloba,* from India. [492 (42)]

ft. 8cales bifid and often very small.
- • Flower* 6-parted, usually glandulous; scales very small, sometimes almost obliterated: Var. *auttrali$,* from New. Holland and China.
- •• Flowers often 4-parted, scarcely glandulous; scales as in the last: Var. *brtvifiora,* from southern Europe.
- ••• Flowers and scales larger; lobes of calyx and oorolla narrower: Var. *Cesattana,* from Italy and Central Asia.
- *•«+ Calyx large, copulate, lobes somewhat carinate: Var. *Cordtfana,* from Africa.

Var. a. VIRA. *0. obtusi/bra,* HBK.l N. Gen. Sp. III. 122. *C. inodora,* Willd.l Hb. nro. 3164.—Flowers scarcely more than 1 line long; lobes of calyx-very unequal, as in many other forms of the species ; scales spatulate, •ery small and thin, but slightly fimbriate or crenate; capsule lj-1i lines in diameter, dotted with, in the dry state, dark rod gUnde. — Andes of Peru, Humlwldt! Guayaquil, Jameson! 542 ; New Grenada, Hoiton ! 644, a specimen with more slender styles; Triana, Lindenl 168; Autioquia on the Magdalena River, Juris! 1500. This last specimen, with a glandulout corolla and rather larger, more deeply fimbriate scales, forms a transition to the next

Var. *fi.* GLAVDULOSA : calyx, corolla, and capsule dotted with red and shining glands ; calyx shorter than tube in some and quite as large as that in other specimens; scales large, often exceeding the tube, deeply fringed, incurved; flower 1-U lines long; capsule ly-lj lines in diameter. — Parasitic on *Polygonurn* in most of the specimens examined; Georgia, Boykfel Florida, Rugel! 400; Louisiana, Taiuturier! Western Texas, Wright! Bigelow! Schott! Bahama Islands, in Hb. Hooker ! Cuba, Pceppig! under the name of C. *Americana.*

Var. *y* ?. LATILOBA: flowers larger, 1+ lines long, of a more fleshy or, when dry, coriaceous substance; calyx and capsule glandulous; lobes of calyx very unequal; these, the lobes of the corolla, and the large, deeply fringed •cales broadly oval, almost orbicular; styles short, thick. — Martaban, Wallichl Cat 1320* under the name of 0. *tulcaia.* — It seems to differ from *C. abtustfora* by the more fleshy erect lobes of the corolla, and especially by the more paniculate than globose inflorescence, but it certainly cannot be united with *C. suleaia (ChinemU),* where Wallich and Cholsy place it The specimens are without fruit.

Var. ft. AUCTRALIS. *0. australi** R. Brown 1 Prod. I. 491. — Flowers in this, as in all the forms enumerated above, fi-parted, scarcely more than 1 line long, dotted with glands all over; scales bifid or often reduced to one or a few lateral teeth ; styles short, usually more slender than in the American forma. — *C. Mil-* [403 (43)]
•«», Hook. & Arn ! Bot. Beechy, 801, is the same plant, flower rather less glandulous, styles stouter. —
New Holland: Port Jnckaon, R.*Brown! P. Bauer! Caleyl Golbourn River, F. Mueller! Canton, China, MiUetti-Mr. Mueller's •pedmen U almost destitute of glands and also of ncale*. Only here and there single or bifid teach are noticed at the base of the filaments. I can distinguish it from the following form only by its 6-parted flowers.

Viir. #. •MTIFLOSU. Ofcwfts W^VUåm!n.nal«.n.»l. *C. Titui,* Insenga! in Tin. PI. Rar. Sic. p. 14. *0. aurantiaca,* RequieD! in sched.; BcrtoL FL It. VII. 623. *C. ckryocoma,* Welw.! in eched.; Deatt. Et. 71.

C. Rogovitsckunta, Traut. Mel. Biol. II. f} Mart. 1855, ex descr. — Flowers 1-1J lines long, usually 4-parted or 4- and 5-parted in the same specimen, only partially glandulous, or entirely destitute of glands; scales very small, bifid, or commonly consisting of small lateral teeth, or sometimes almost abortive. On the lower Wolga, Liemaschko! 827; Becker! Kiew, Trautvetter; Constantinople, Boissier! Greece, Zuccarini! Berger! Dalmatia, Stalio! Alexander! Naples, Gussone! Capua, abundant in fields of hemp, Bruni! Syracuse, Insenga! Corsica, Requien! Toulon, Quillon! Montferrand, Ramond! Portugal, Welwitsch! — It is often found in gardens on Basilicum, and is probably often propagated and transported with the seeds of that plant. The Basilicum with the parasite is called in the gardens about Naples "basilico con perrucche ;" just as the old botanists used to call the grapes, to which *(X Epithymum* sometimes attaches itself, "uva barbate." — In France this form has often been named *C. Europaa;* and DesMoulins, Et. p. 67, etc., confounds it with *C. suaveolent.*

Var. f. CISATIANA. C *Polyyonorum,* Cesati! in Cat. Sem. Gen. 1849, p. 22, and Linnca XXIV. 199, not Engelm. *C Osatiana,* Bert.! Fl. It VII. 623. — Flowers \\ lines long, 5-parted, without glands; lobes of corolla narrow, longer than the tube ; scales usually exceeding the tube, deeply laciniate and more or less bifid. — Piedmont, on *Polygmum,* Cesati! Cashmere, Jacquemont! 876. — The strange fact, that exactly the same form should be found a native of so widely distant localities, furnishes but another instance of the cosmopolitan habits of this species.— Professor Cesati, 1. c, gives the first correct account of the *apparent* intrastylar dehiscence of the capsule in the following words: "Capeula . . . ob dissepimenti exsiccationem . . . hiana, . . . hine capsulam apice dehiscentem *mentient**

Var. *ff.* CORDOVANA : calyx large, cnpulate, longer than the tube of the corolla; its lobes united above the middle, somewhat cannate; scales as in var. *australu*; stamens and style shorter than in any [494 (44)] other form of the species. — Fezogl, Cordofan, Figari! in Hb. Mus. Florent

40. C. CHLOROCARPA, Engelm.! in Gray Man. ed. 1, p. 350*; ed. 2, p. 337. *C Pdygonmm,* Engelm.! in 801. Joorn. XLIII. p. 342, t. 6, f. 26-29 ; DC. Prod. IX. 461, not Cesati. — Along ponds and wet place*, mostly on different species of *Polygmum,* and aL«o on other plants of them localities; St. Louis, Missouri, Drummond! Lindheimer! Engelmann! Illinois, Engelmann! Wisconsin, Lapham! Indian country west of Arkansas, Bigelow! eastward thus far only in Delaware, Tatnall! — Closely allied to the last specie*, especially to var. *breviflom;* the principal difference lies in the triangular, acute lobes of calyx and corolla. Flowers usually 4-parted, about 1 line long ; scales small, bilobed, or oftener consisting of small lateral teeth, — in a specimen from Delaware they are very incomplete, or sometimes almost wanting; large ovary filling the shallow tube of the corolla; capsule comparatively large, thin, membranaceoos, of a greenish yellow color, — whence the name, which I substituted for my former one, referring to the plants on which it is often found; this color of the capsule distinguishes it already at a distance from other species growing in the same region. Seeds 0.8 line long, oval, compressed, scarcely angled ; transverse hilum rather shorter thn m the la* aperies.

41. C. ARrarom, Beyrich! in sched.; Engelm.! in Gray Man. ed. 2, p. 336. — The different varieties of this species are characteriied by smaller flowers (often less than 1 line long) in more compound dusters, which approach in their form to those of the next specie*; lobes of calyx very obtuse; lobes of corolla almost always longer than the tube, acute or usually acuminate, reflexed and with the point indexed ; anthers broadly oval or rounded; scales large, deeply laciniate-nmbriatr, often exceeding the tube ; styles rather slender, as long as ovary or longer; seeds 0.&-0.7 line long, oval or rounded, compressed, with a rather short, linear, often oblique hilum. The differences in the shape, sue, and texture of the calyx constitute the following varieties.

Var. «. PBITAOOSA. ft *pentagon*,* Engelm.! in Sill. Jonrn. XLIII. p. 340, t. «, f. 8*-84; DC Prod IX. 461. *C.* arw«M, Beyrich! in Hh. *C gUmlaru,* Natt.l in Hb - Calyx thin and tbiniug; lobes orbicular, as long or longer than the shallow tube of the corolla, forming where they join five projecting angles. - Dry barren toil or old fields on different *Compontm* or other plants, sometimes also on shrubs; from Virginia, Ragd! Snlli- [495 (45)] •ant and Gray! to the Carolina*, Schweiniti! Rose! Beyrich! Curtis! Ravenel! and to Florida, Rugell nro. 400, a. and b.

The western form, with shorter lohei of the less distinctly angled calyx, was former^ distinguished fay me as var. *microcalyx.*- In open woods, on dry soil, on *SoHdago, AtUr, CrnnotMus,* efe, Illinois, Oeyerl Misuari, Triad! Riehl! Nebraska, Hay den! Indian country west of Arkansas, Bigelow! The latter hat often at large a calyx as the eastern form.

Var. £ TOBUC08A. *C verruca*,* Engeim. I L e, p. 341, t 6f f. 25; DC. Prod. IX. 461___Calyx shorter than the campanula* tube, fleshy and glandular-verrocow. — On dry prairiea, often on *PeUdo+mm,* but alto on other prairie plants: Texas, Dmmmond! III. 847; Lind heimer! 187; Northern Mexico, Berlandier! 8457, to San Luis

• The original descriptions of aperies characterised by Dr. Eagtimaan to the Manual, etc, will be fond to the collected description* at end of CWn/n matter. — Em.

Potosi, the same! and Porras, Gregg!—Lindheimer's nro. 473 is an intermediate form between this and var. *pentagona,* mixed with a few specimens of the following.

Var. *y.* PUBBSCENS : pedicels and all parts of the flower or only the ovary and the capsule papillose-pubescent. — Western Texas, Lindheimer! Wright! 1635 (574). — Wright's 519 and 523 (coll. 1849) are a transition form between this and the last variety, having the calyx of *verrucota* and the ovary and capsule of *pubescent.*

Var. A. CALYCINA : inflorescence often more compact; flowers rather larger; hemispherical calyx not angled, lobes rounded or oval, usually longer than the tube ; lobes of corolla broader and shorter than in the other forms, and often not longer than the tube. — Texas, Lindheimer! 126 (a form from wet prairies, with smaller flowers); the some! 664; Wright! both on *Dianthera,* in or along water-courses; Martinique, Mad. Richard! 114 in Herb. Mus. Flor.; Herb. Fauch<$! (now in Hb. Boissier); Saskatchawon, Drummond! *C. Americana?* Hook. FL N. A.; Oregon, Geyer! 674.

Specimens from Brazil Eschscholtz! in Hb. Ledebour; Gardner! 6068 in part *(C decora* bos also been distributed under this number) differ somewhat from this variety by stouter and, in fruit, subulate styles ; Gardner's specimens have also a smaller calyx.

• • Flowers arranged in loose compound cymes 5 styles usually slender, as long or longer than ovary; withered corolla remaining at base of capsule or enveloping it.

42. C. TRICHOSTTLA, n. sp.: caule filiformi; bracteis ovatis obtusis; floribus breviter pedicellatis in cyniulan ramosas subglobosos congestis; calycis cupulati fere ad basin divisi lobis ovatis orbiculatisve [496 (46)] obtusis bosi imbricatis tubum corolla campanulatum ©quantibus seu superantibus ; laciniis ovatis obtusin tubo nquilongis demum patulis reflexisve ; ontheris ovatis filamenta subulata brevia aquantibus ; squamis late ovatis fimbriatis incurvis ; stylis capillaribus ovario depresso multo longioribus e tubo vix exsertis.

Parana, Tweedie! Saiitarem, Brazil, on *Hyptis,* Spruce! 854, both in Hb. Hooker. —None of the specimens examined being in fruit, the true position of this species miwt remain doubtfuL The large imbricate calyx, the slender styles and especially the branching inflorescence, distinguish it from *C obtusiflora;* the inflorescence, the shape of the ovary and of the styles, from *C Gronomi* and *C. racemota.* — Flowers 1 j-2 lines long, " white, with a strong odor of hawthorn," Spruce; exterior lobes of the calyx in the Panama specimen towards the tip verrucose-cristate; in the other smooth, thin, and shining ; scales in the former longer than the tube, in the other broader and shorter.

43. C. GTMNOCARPA, n. sp.: caule filiformi; floribus breviter pedicellntis umbellato-glomeratis ; calycis lobis ovatis seu orbiculatis obtuftissimis nitidis tubura corolla ©quantibus ; laciniis triangulatis acutis erectis seu demum patontibus tubo oquilongis; antheris ovato-orbiculatis filamentum breve eubulatum aquantibus; squamis tenuis-mmw late ovatis fimbriatis faucem attingentibus; stylis capillaribus ovurium depressum asquantibus supra capsulom globoso-depresMin e corolla ad basin marcescente longe exsertam divaricatia patentibus recurvisve ; seminibua oblique ovatis tumidis tenuissime sub lente reticulatis. — *C. Sandwicensis,* var. *Mimosa,* Hook. fil. in Linn. Trans. XX. 805.

James Island, of the Galapagos group, in immense abundance on *Mimosa* bushes, Chs. Darwin! in Hb. Hooker. —Flowers about 1 line long, of a very thin texture; capsule 1J-1J lines in diameter, with a very small intrastylar aperture; seeds, in the only specimen extent, light yellowish brown, 0.6 line long, plump, nearly smooth, with a short, oblong-linear, usually perpendicular, hilum.— Much closer to *C. arvensu* than to *a Sandwithiana;* distinguished froin both by the short, broad, and very acute loix* of the corolla, and by the very slender, at last nearly horizontal, styles; from the latter also by the presence of scales and by the naked capsule.

44. C. SANDWICHIANA, Choisy! Cusc. 184, t. 5, f.4; DC. Prod. IX. 458. —Sandwich Islands; apparently the only species growing there; mostly on shrubs; Menzies! Eschscholtz! Gaudichaud! Matthews! Stewart! Maximowitochl 57; Remy! 484. — Inflorescence a compound loosely-flowered cyme; flowers pedicelled, 1-1 \lines long, "pdlkie ochmoei" Maxim., of thin, membranaceous texture ; only in Monties' specimen in Hb. [497 (47)] Banks I find all the parts of the flower dotted with glands; lobes of calyx ovate, acutish; lobes of corolla acute and inflexal at tip or sometimes obtuMwh, often rcflexed, but at last commonly oppressed to the top of *• etptuie, which for it* greater part *w* enveloped by the tube; anthers oval; no trace of ncales; capsule 1}-2 lines in diameter, with a small, almost circular, intraiitylar aperture ; styles stouter than in the last species, somewhat divaricate on capmile ; seeds umi»nally large, 0.8-1.0 line long, verruco*e-reticulate, triangular-ovate, somewhat oblique but not ratrmte, with a short linear-oblong perpendicular hilum on the comparatively small regularly circular umbilicus.

46. C. ACOTA, n. sp.: caulibus subeapillaeeis ; cymis componitis laxifloris umbellulas mentientibas; pedicellis flore breriorflms bncteis ovatis acntis suffultis; calycis late campanulati membranacei lobis triangulatis acutis *eu cuspidatis tubum corolto campuntiktum raperantibuR; laciniis lanceolate acutetis tubo longioribiui erectis seu nul>-patentibus ; antberin ol»|ong»-lin«iribiiH fllamtnto nuhulato fen» brevioribun; ft|uamis ovato-npntulati* lon^e adnatis

faucem attingentibus versus apicem crispato-fimbriatis; stylis capillaceis ovarium obovatum sen globoenm ©quantibus; capsula tenuissima corolla rudimentis ad basin persistentibas indasiata apice libera stylis e basi lata subulatis paulo divergentibus coronata; seminibus 2-4 lenticularibus ragoeo-reticalatia.

Chatham Island, of the Galapagos group; mostly on *Leguminous* common on a low annual *Orotalaria*, but also on trees, such as *Parkinsonia* and *Mimosa,* hanging down in massy festoons, Andenson! — Closely allied with both other Pacific species just described, distinguished from them by the very acute lobes of calyx and corolla and by the subulate styles; moreover from *C. Sandwichiana* by the presence of scales, and from *C. gymnocarpa* by the covered capsule and the direction of the styles; from *C. acutiloba* of the mountains of the neighboring coast and from *C. umbellata* it differs by the inflorescence, by the baccate capsule, etc. — Flowers 1-1} lines long ; scales adnate nearly to the apex, crenulate on the sides, fringed only at tip ; capsule about 1 line in diameter; intrastylar aperture large, forming a transverse slit; seeds only 0.5 line long, dark brown in the specimen before me (perhaps not perfectly ripe) ; and strongly reticulate; hiluni short, oblong-linear, perpendicular or oblique. — The specimens examined by me were all on a low Crotalaria.

« •• Flowers arranged in branching paniculate cymes ; styles slender, as long or longer than ovary; withered corolla surrounding the capsule or covering its top.

46. C. TENUIFLORA, Engelm.! in Gray, Man. ed. 1, p. 350; ed. 2, p. 336. *C. OtphalarUhi,* Engelm.! [498 (48)] in Sill. Journ. XLIII. 336, t. 6, *L* 1-6. — Wet places, often on *Cephalanthus, Saliz, Cbrnus,* and other shrubs, but also on *Vernonia, Aster,* and other herbaceous plants; Missouri and Illinois, Engelmannl Geyer! Upper Missouri country, Hayden! New Mexico, Wright 1 1629 (124); Arizona, the same! 1626 (578). — In young plants just beginning to flower the cymose-paniculate inflorescence is very distinct, — the terminal flowers of the main branches of the inflorescence opening first, and lateral clusters of smaller and ever smaller buds appearing lower down on the peduncles; a little later the fruits occupy the ends of the branches, while more and more flowers and buds are developed on lateral peduncles and pedicels, till at length the whole becomes one large and intricate, and often quite compact, cluster. Short pedicels, gradually swelling into the base of the turbinate calyx ; flowers ordinarily 1 line or less in length, mostly 4-parted, later flowers often only 3-parted ; tube of the corolla slender, much longer than the calyx, and larger than the short ovate obtuse lacinic; scales ovate or spatulnte, shorter than the tube ; capillary styles as long as the depressed ovary; capsule globose, 1-1J lines in diameter, bearing the withered corolla on top, often with only one or two seeds; seeds 0.6-0.7 line long, oval, oblique, carinate on the inside, with a short linear-oblong usually perpendicular hilum. — The western forms collected by Mr. Wright differ from those of the Missouri and Mississippi valleys only by having larger flowers (1.2-1.4 lines long), larger, more depressed, mostly 1-seeded capsules (1J-2 lines in diameter) and larger (0.8 line long) flatter seeds.

•• Choisy, in DC. Prod. IX. 458, wrongly'give* this very distinct species as a synonym of *C. compact^* with which it hat scarcely anything in common but the hooded capsule; from small flowered forms of *C Ortmovii* it differs by the position of the dead corolla and by the structure of the ovary and capsule.

47. C. CAUIOMICA, Choiiiy! Cusc. 183; DC. Prod. IX. 467; Hook. *A* Am. I Bot Beeehy, 864. — Both authors described this plant from Dough*'* specimens under the same name and in the name year (1841); Nuttall, in the Hb. Aead. Pbilad., had named it G *acuminmta.* — Flowers on ilenler pedicel*, loosrlr paniculate ; calyx small, tarbwate with acute triangular, lanceolate or acuminate and sometimes recurved lobes; lacinic very slender, lanceolate-linear, acute or acuminate, met or spreading, in fruit mostly erect or connivent; scales wanting, or indicated hy a membranaceoos inverted arch, with a smooth or craniate margin connecting the adnate parU of the ila-
roenta near the bate of the corolla, - in a doubtful variety the scales are fully developed; styles capillary; [480 (40)] ovary small, usually globose; capsule enveloped by the corolla; seeds often solitary, eubgloboja, slightly compressed, strongly hooked, 0.5-0.6 line long.

The different spedineiis examined vary considerably in the shape and length of the calyx, the proportion of the lacuug to the tube, the length of the flW.y ^.i.g^H, trf rftin, thtr length nf tht Ttyljir -iH ^p t trf theorary.

Var.«. BRIUFLOBA : nowmscarcelj more than 1 line long, on abort ped*** : l*ani» »tber longer than tab., anthers, filaments, and styles short ; aeeda several. - Monterey in flekls Haiiweg! 1883.

Var .*0* oiuciLirLORAilloweri slender, 1|-2| lines long; calyx often thnftar Uis» tub* of corolla; lactnus at long as the tul*, very narrow ; filament* often short, «ir an long or longer than the Unear-obloiig anthen, style* at long or much lonaer than ovary. - California, Douglas f Fremont! 506 ; Billow!

Var. *y.* LOLCOILOBA : flowers i-2J lir*. long ; calyx usually equal to the tube, rarely shorter, •omrtinx* longer , lacini* slender, m>ni<*time9 twice the length of the Uihe ; tabulate ftkmenU *m* long or longer than the oblonff.linear aathen ; style* very lon8 and slender. - California, principally, as it appean, on the coa*t of the sotithenTMite of th^Suu, and commonly on some speefcs of *Mriegamtmt* 8U. Barbara, NuUallf San Diego, Thurfaerl 570 "4 6 3) ; Newlueity f

Var. a. APICULATA : corolla somewhat granulate, ovary and 1-seeded capsule conic, apiculate ; otherwise very similar to the last—On the Colorado, Bigelow! in February.

Var. t. ? 8QUAMIGERA : flowers 2-2J lines long, on pedicels shorter than the flower, or even the calyx, in rather crowded subglobose clusters; lobes of calyx lanceolate, acuminate, as long as the open, funnel-shaped tube of the corolla; lacinia lanceolate, as long as the tube, at last spreading; anthers oblong-linear, cordate at base, on very short filaments ; scales spatulate, fringed, shorter than the tube, incurved; styles as long as the very acute ovarium; capsule apiculate, 1-seeded, lower half enveloped by the tube of the corolla.-The more densely clustered flowers, the presence of scales and the acute ovarium would seem to specifically distinguish this form, but the last mentioned variety appears to unite it with the common form ; perhaps it ought to be classed with the next species. - Saline soil on the Rio Virgen, Utah, on *Suada,* J. Bemy 1 in Hb. Mus. Paris.

) 2. Oxycarpe©.

Flowers subsessile, or pedicelled ; sepals united; ovary and capsule thickened towards the apex, usually more or less conic.

• Flowers subeessile, crowded in rather dense, small or large and compound gloraerules; withered [500 (60)] corolla enveloping or covering the 1-2-seeded capsule.

48. C. 8DBINCLU8A, Durand 6 Hilgard! in Journ. Ac. Phil. III. p. 42, and in Pacif. R. R. Rep. V. 3, p. 11.— This fine and W-flowered species resembles different forms of *C. corymb*™ and *C. otoitioUpU* so much, that I felt considerably inclined to unite all of them as varieties of <* and the same species ; but then the dehiscence or non-dehisoence of the capsule would have to be considered as a character of not even specific importance; there are, however also other differences, so that these species must be viewed as representing different types under a similar external fora. - Flower* 2-3 lines long, on very short priiodi or almost sessile, paniculate^lomerate^t; h* forming large and rather dense dusters: cylindrical tube of corolla longer than the deeply divided calyx ; lobes fleshy, ovate-lanceolate, acutish, imbricate; laciniie ovate, acute, mow or less crenulate, shorter than the tube, erect or patulous; anthers oblonK or ovate, cordate, usually longer than the filaments, or even subsessile ; scales scarcely reaching above the middle of the tube, spatulate-oblong, deeply fringed ; styles slender, much longer than the 2-pointed ovary, at first scarcely exsert ; capsule oval, 1-2-seetied, iis upper ynn wrapped by the withered corolla ; seeds 0.7–0.9 line in diameter, rough, oval or •abdob(»e,obli(iue or almost hooked, with* very small oblong hilum.

On the Teton Pus in the southern part of California, on *Saltx* and *Artemuia,* HeermannJ in the same region on O. « £ il o C l f l L m Nevada, abovVPUcervQle, Remy! Saline marshes on Mare I ^H Bay °f San Fnu.ci.co, o n Z L * Wrightl - It i. renurkable, but in this genus not unusual, thatspwunen. from the h,gh mountain, aw absolutely identical with those from the salt marshes of the coast; the only diflerence I can discover consists in the «ower being* little larger, the ftlaments longer and the anther, shorter.

Var, 1 ABBRIVUTA •. lobes of calyx more niembranaceous, less deeply divided, scarcely imbricate, rather longer than the short funnel-shaped tube of the corolla; lacinuea. long as tube; styles as long as the conic ovary, shorter than the oval capsula which ^entirely enveloped by the eorolla. - Mare Island in San Francisco Bay, on *Arthrocnmm,* Wrightl

49. C. moEAiTHA. Cbofay! Cose. 17ft, 11, f. 3; DC. Prod. IX. 483; Oayl FL ChQ. IV. 44&-A small-flowered and low aped* ptrbap. the low* on. in South America, peculiar toOhUi: Coquimbo' on the shore of th« Ocean, always on Vrimfe. Cl Gay! 538 ; Concon, on *PtoUago, TnfiAxtm,* etc., Pcspmg I 89 under the name of *C. ...* TS. J ^ Dr. PhilippU Be T !-Flower.a^ouelinelongon.hort P edi«.U [501 (61)] ord,uo*.,Jill>Zncom^ clusters ; lobes of calyx and corolla ... triangular, acute, the latter often somewhat craniate: eeales uwally small, ovato or spatulate, attached to the middle of the tube and scarcely leaebiMf to the throat • styles capillary, usually, much shorter than the conic ovary; stigmas rather small but very ! S y J p. L T ^ f t L dUfc-U to undenund how Choisy could place this specie, among those with filiform •tkma. • mnlTowii flair*- though not quite correct, does not bear him out - Capsule oval, 1-seeded, enveloped in the corolla, with top naked; seed <M» line long, compressed obovate, rortrate, rough, with a very .mall hilum reduced to d a o i . prfJt ThkU Choi*, origin* pUnt, from Coquimbo; all the other specimen, cited above belong to

Var ✓LTUFWIA • flower, rather larger, 1*-1i Uneiob K« ^ ^ •P'ead'ng.«»»«<>*** l''*''. «ty»« ^nger; fruit •0* •MB.' 8OBM of PoBppig'a plaaU approach the original specimens by their small flowers and crenulate laciuia).

• • Flown, pedicelled, disposed in rather loose paniculate cymes, which often at last become crowded; withered cotolk uniUy nrekpmng tbe capTule or covering its top, in the three last species inverting only its baa*,

f LoW. of oorolU .cut. or «* obt««, infl««d « corniculrte at the .pel

60 an«a«A.aiiil»«iiteUieiiameofMMJ»eora. Choüy saw only a veiy poor bUckened specimen, wch a. Berlandier was all-flowered variety; but it so happens that this is one of the prettiest species,

so much so, that Scheele has named it *pulcherrima;* I therefore feel justified in the liberty I take with Choisy's name in lopping off its negative *in.* — This is a wide-spread and quite variable species, extending from the United States to Brazil, always readily recoguized by the structure of the fleshy white (lowers, which consist of large convex cells, which make the surface appear rough and the margin crenulate; these cells are on the surface sometimes elongated into oval or cylindric papillae ; inflorescence loosely j>aniculate or in some forms at last more compact; lobes of calyx ovate or lanceolate, acute, of different lengths ; lacunae ovate-lanceolate, inilexed at the acute point, erect or spreading, not recurved ; scales large, broadly oval ; styles usually stout and very unequal, about as long as the conic ovary; capsule enveloped by the corolla; seeds usually several, O.0-O.9 line long, obliquely ovate, rostrate, rough, with a very short, oblong, transverse hilum. The following varieties may be distinguished : —

Var. a. INDECORA. *C. imlecora,* Choisy ! disc. 182, t. 3, f. 3 ; DC. Prod. IX. 457. C. *iituropctala,* 0. [502 (52)] *minor,* Engelm.! in Boston Journ. X. Hist. V. 223: Howurs 1-lJ lines long, on long pedicels, loosely panicled, with very short calyx. — On the Rio Grande, Berlundier I 865 & 2285 ; Texas, Lindheimer! 123, (in some of the distributed collections the numbers 123 and 124, both forms of this species, are transposed). — A papillose-hispid form of this variety is *C. verrucosa,* a. *hispidula* Engelm.! Sill. Journ. XLIII. p. 341. *C. hispidula,* Engelm.I ib. 45, p. 75; DC. Prod. IX. 461; Texas, Berlandier! 956 & 2386 ; Drummond! 248; Lindheimer I 474 ; Wright I Some of these specimens by their larger flowers approach the next form.

Var. 0. PULCHERRIMA. C. *ruuropetalii,* Engelm.! 1. c. 45, p. 75; DO. Prod. IX. 461. *C. pulcherrima,* Scheele I in Linnsoa, 21, p. 750: smooth or rarely slightly papillose; inflorescence loose or sometimes more compact; flowers variable in size, lj-lj lines long, usually broadly campanula^ calyx as long or longer than tube ; styles usually»as long as ovary, rarely much longer; anthers and stigmas yellow or often purple. A form with very large and broad flowers is *C. neuropetaia, y UttoralU,* Engelm. Boston Journ. 1. c. — On wet and dry prairies, from the sea-coast to the mountains, on different shrubs, also on herbaceous *Composite, LcguminoHt,* etc : south-western Illinois, Engelmann I Indian country west of Arkansas, Fremont! 2d Ex p. 485 ; Bigelowl Texas, Lindheimer! 124 (a very large-flowered form) 474, 475 ; and westward, Wright! coll. 1819, nro*. 520, 521, 524, 525; coll. 1851-»52, nrus. 1630, 1633, 1634, 1637, 1638; Sonora, Wright! 1622 ; Northern Mexico, Gregg! 78 and 888 ; Florida, Chapman! St. Marks, Rugel! 1000 & 1001 ; Cuba, Hb. Vind.! Jamaica, McFuddin! Bancroft! a small-flowered, short-styled form; dimming! 95; Alexander! Brazil, Sal/mann! in Hb. Buchiuger ; Gardner! 5036, a form with very long styles, and 6068 in part (C. *arvmtis* var. has been distributed under the same number).

Var. y. SUBNUDA : lower half of capsule enveloped by the tough remains of the corolla, upper part naked ; short styles divaricate. — " Common on the overflowed inlands of the Parana," Brazil, Tweodie! in Hb. Hooker.

Var. & INTEURIUSCULA : calyx shorter than the deeply campanuLite tube of the corolla; lacinuo erect; scales triangular, acutish, thin, almost entire ; style* capillary, shorter than ovary. — Metidozo, on *Epfudra*^ Gillie*!

51. C. INFLEXA. C. *Coryli,* Engelm ! in Sill. Journ. XLIII. p. 337. *C. umbro$a,* Bcyrich! in Hb. reg. BeroL in part, not Hooker ; Engelm.! in Gruy, Man. ed. 1. 351 ; wl. S, am C. *jxinrijtora,* Nutt. ! in Hb. C. *congetta,* Beyr.! in Hb. *C. compneta,* var. *crenuLita,* Choisy in IX? Pnnl. IX. 450. — In open woods or dry prairies [503 (53)] usually on shrubs, *Corylus, Ceanothus, Sympbtrkarpui, Wius, StdLr* ami even on Cbryrt, but also on *Hdianthu$, Solidago* and other Composite, etc. Virginia, Bvrrich! Gray & Sullivant! Georgia, Bevrich! Illinois and Missouri, Engelmann! Riehl! Kansas, Feiidler! 658 ; region went of Arkansas Bigelow! on the Upper Missouri and Yellowstone Riven, Harden!— Flowers 1 line long, or similar structure to the last; dirttinguiahed by the deeper subcylindric, mostly 4-ported corolla, which at last covers only the top of the capsule, the erect, indexed lacinue and the minute scales, reduced to lateral teeth; styles of different lengths, divaricate on capsule ; seeds orate, oblique, thick, 0.&-0.7 line long, with a small, oblong, oblique or transverse hilum.

62. C. APPENDICULATA, n. sp.: caulibus capiliaceis; cymis' (asciculatopaniculatis Uxifloris; calyds bmrissimi basi glanduloso-appendiculati lobis ovatis acutis tubutn profunde campanulaium vel sabcylindricum dimidium vix squantibu* ; lociniU ovato-lonceolatis demum reflexis apice acuto incurris tubo «quilongis; antheris ovato-orbiculatis cordatis ft U men to longioribus; squamis oboyatis crispato-nmbriatis laucem aquanttbas incanris; stylis tenuibus onro acuto sub»iualibus; capsula globosa apiculaU sub-1-spenna exs«U supra meiliom nuda, foramina intnstjlori mogno; seniinilnis ovato-sut>globosis obliquis.

Cape of Good Hope, on *Erica* and other shrubs: Zwellendam, " on dry hills throughout the whole district," Kraus! nro. 1810, under the name of *C. A/ricana;* TeufeLibeiy, in Hb. Fischer I now Hb. II. B. Petropnl. —The only South African species Monging to this section ; distinguished by the very small (scarcely { line long) appendiculato calyx, etc. ; flower* 1-1J lines long ; seeds 0.6 line long.

53 C. BTENOLEPW, n. *p : caulibus capillaceis ; cymis panicnlatis loxis paucifloris ; pcdiccllis elongatis bractea ovmta suffultis; c:dyci» turbinati ^LincluKwi loliin ovatis obtusis tulio comlLe subctlindrico brcvioribus; lacintis labo brevioribus lanciH)latis ivflpxis apice acutiusculo innirvi^ ; staminibu* brevissimis, anthera ovata fUamento subulate aquilonga ; si|uaniis angustiwimis parce Ambriatis faucrm vix attingentibus incunris; stylis ovarium ^nimm

snbaquantibus deraum exsertis ; capsula globosa apiculata sub-l-sperma apice corolla calyptrafonni tecta; seminibus subglobosis aaperatis.

Andes of Quito, Fr. Hall! in Hb. reg. Berol.; J. P. Couthouy ! on a *Dalea* "on the banks of the Mnrh»A 9,500 feet high." — A very distinct species covering loir shrubs with intricate masses of their hair-like stems, with scattered loosely flowered panicles ; whole plant 611ed with a reddish-yellow juice ; flowers [604 (54)] scarcely more than 1 line long.; scales very narrow, linear, irregularly and sparsely laciniate-fimbriate towards the tip ; seeds 0.7 line long.

54. C. CORNICULATA, ii. sp.: caulibus filiformibuB crassiusculis ; cymis bracteosis laxis paniculatis sen magis compactis subglobosis ; bracteis uiembranaceis ovatis obtusis ; floribus pedicellatis ; calycis campanulati ultra medium fissi lobis ovatis carinatis *him* imbricatis obtusis seu cuspide nodoso-incrasaato obtusato apiculatis subinde patulis recurvisve corolla tubum aequantibus seu superantibus ; laciniis tubo aoquilongis ovato-lanceolatis demum patulis reflexisve apice nodigero seu cucullLito corniculatis inflexis ; antheris oblongis filamenta subulata ©quantibus ; squamis late ovatin fimbriato-fissis tubum excedentibus incurvis ; stylis ovarium pjriforme ©quantibus, stigmatibus magnis pileatis ; capsula corolla iuarce8cente indusiata apice nuda, orificio intrastylari magno; seminibus oblique ovatis intus carinatis.

Var. a. RACEMULCWA : floribus laxe paniculato-cymosis; calycis lobis apice nodoso acutiusculis. — Southern Brazil, Sellow! 2489 and 3621 in Hb. reg. BeroL

Var. *0.* sPHiBROCTMA: floribus globoso-cymosis; calycis lobis acutiusculis seu obtusis. — Brazil, Prov. Goyaz, on the campos near the Buixas, Weddell! Venezuela, on the Rio Meta, Ķarsten I

This is the first of a series of intricate, mostly Br.izilian species, which includes nros. 54-58, and which will not be entirely cleared up until carefully studied in their native homes. The inflexed-pointed laciniae and the naked capsule with the large intrastylar orifice seem to distinguish it sufficiently from *C. racemosa.* Whether both forms described above, which seem to differ so materially in their inflorescence, really do belong together, must be decided after a fuller study of this whole group; Weddell's specimen seems to connect them. — Flowers 1-1} lines long ; cymes of one 5-8 lines, glomerules of the other 4-5 lines in diameter ; seeds of the largest-flowered specimen 0.6-0.7 line long, obliquely ovate, with a very short linear-oblong transverse hilum.

55/ C. RACEMOSA, Martius ; spread in several forms over a great part of South America, just like *C. Gronovii* over North America, and *C. pianiflora* over Asia and the Mediterranean regions ; it has been introduced with agricultural seeds into Europe, where it has given rise to many discussions, and has, to some extent, stimulated botanist* to a further examination of this genus. — All the forms of this species are characterized by the loose racemose-paniculate inflorescence ; calyx usually shorter than the deeply campanulate gradually widening tube ; [505 (55)] lacinin commonly short, spreading or reflexed with indexed points; scales large ; ovarium ovate or obovate, the upper part being compact; styles stout with large, depressed, almost peltate stigmas; capsule commonly enveloped by the corolla, with 2-4 light-brown, oval, obliquely truncate or rostrate seeds, 0.6-0.7 line in length ; hilum short, linear, perpendicular or transverse, often with radiating lines on the umbilicus. I distinguish the following forms: —

Var. a. BRASILIA*. *C. racemo$a,* Martius! Itin. I. 286; Choisy! Cusc 181, t 3, £ 1 ; DC. Prod. IX. 456: flowers with few or scarcely any glands, of a rather membranaceous texture and pale color, with very short and obtuse lobes of calyx and obtusish lobes of corolla; flowers usually 1* lines long. —Common about Rio and generally in Brazil, on shrubs and herbaceous plants; Martius! 941; Booz I Gaudichaud! Graham ! Pohl 1 5,100, in port; Riedel, 695. *

Var. *fi.* MINIATA. *0. miniata,* Martius! L c ; var. *minuta,* Choisy! 1. c: flowers of a thicker texture, reddish, more or less glandulous.—Brazil, Martius! 1292; Ackermann! Mikan! Langsdorff! Pohl! 5,100 in part; Vauthier! 252; Lund! 737.

Var. $_{y}$. CHILIANA. *C. Chitetuit,* Bertero! in scbed., not Ker. *C. iuaveolent,* Seringe, Ann. Sc. Phys. Nat. Lyon, 1840; Cl. Gay! FL ChiL IV. 448; DesM. Et 66 (under *Gututha,* and confounded with *C. obtunflora,* var. *brevijtora). C.* eorymfaM, Choisy! Cusc. 180; DC. Prod. IX. 456, not Ruiz & Pav. *C. Hauiaea,* Pfeiffer! Bot. Zeit 1843, p. 706. *Engelmannia* mspratu, Pf. ib. 1845, p. 674. *C. dtaphana,* Wend. Fl. Haw. 364. *C. Popayanetuit,* Pceppig! in Hb. Vind. not HBK. — Flower* larger, 1J-2 lines long, more membranaceous; lobes of corolla with acute inflexed points; scales as long as or ofteu shorter than the tube. — Chili, Bertero! 205 in Hb. DC., 940 ft 201 in Hb. Shuttleworth (nro. 940 in Hb. DC. is *C. ChiUniit);* Pceppig! Cl. Gay! 449; about twenty yean ago it was introduced into Europe, but is apparently now lost; on *Medieago $ativa,* sometimes in wet seasons destroying whole fields ; also parasitic on many other plants growing about such fields; it has been observed in France, Piedmont, Switzerland, Germany, and Holland.

Var. ft. CALYCIHA. *C. tuaveokm,* Lechler! in ached.: flowers as large as in the last, often glandulous, with longer and obtusish lobes of calyx and corolla, both aa long as the short and wide tube ; dead corolla covering the capsule. — Brazil, 8ellow! in Hb. reg. Berol., Weddell! Riedel! Valdivia, Lechler ! 479.

Var. t. iruDA. *C. dtricola,* Schlecht. Linu. XXII. 808? Lobes of glandular calyx orate, Marly as long

as the tube of the corolla; lacini® of same length, reflexed, at the obtusish apex inflexed; styles as long as the conic ovary, at last divaricate; lower part of the depressed somewhat glandulous capsule ófrered by the corolla, upper half free. — Brazil, near Rio, Sellow! 4.99 B. ; southern Brazil, the samel in Hò, reg. Berul.; Riedel! 990 in Hb. H. B. Petrop.; Island of Sta. Catarina, southern Brazil, on *Citrus,* Pabst ex Schlechtend. [506 (56)]

56. C. PARVIFLORA, n. sp.: caulibus capillaceo-filiformibus intricatis ; cyrnis fasciculato-paniculatis laxis paucifloris ; pedicellis flore minuto late" ciun pan ulato longioribus ; calyci* turbinati lobis ovatis obtusiusculis tubum corolla) nquantibus; laciniis ovatis seu lanceolatis patulis apice obtusiusculo inflexis; staminibus brevibus, antberis ovatis filamenta squantibus ; pquarais ovatis laciiiiato-finibriatis conniventibus ; stylis ovario obovato nquilongis. — *C. mieranthoy* Martius! in Hb., not Choisy.

Var. 0. ELONGATA : pedicellis elongntis clavatia ; floribus minoribus ; laciniis acutis tubo subduplo longioribus demum reflexis; filamentis subulatis gracilibus lacinias aquantibus.

Brazil, Minas Oeraes, on *TremNeya,* Ackermann I Villa Rica, on some other shrub; Pohl! 5726; Var. *fi.* Ooymz, Weddelll 2125. — Flowers only $-} line long, smaller than in any other species, with the exception perhaps of the smallest forms of *C. Pakutina;* of a deep red color when dry ; limb of corolla spreading but not reflexed ; fruit unknown. In var. /9. the pedicels are two or three times as long as the M whitish" flowers; lacinic and especially filaments much longer and more slender.

ft Lobes of corolla obtuse, not incurved.

57. C. DKNSIFLORA, Hooker, fil! in Fl. N. ZeaL I. 186, not Soyer-Will. — At Port Underwood, on the middle island of New Zealand, on some *Apocynea,* Dr. Lyall! — Perhaps too near *C.* roamofa, but apparently distinguished by the much finer capillaceous stems, the very short capulate calyx, the short, ovate, obtuse-spreading but not reflexed nor inflexed lobes of the corolla, — which are only about one third as long as the deeply campanulas tube, — and by the solitary glohone seeds of a brown-red color, with a short linear transverse hilum on the radiately marked umbilicus. — Flower lf-2 lines long, dotted with yellow glands, which Dr. Hooker describes as oil-canals ; pistils the same as in (7. *racewu*a* ; dead corolla covering and enveloping the capsule.

58. C. MICROSTILA, n. sp.: caulibus filiforniibus floribusque ^landulosis ; cytmili* laxis paucifloris ; calycis lobis triangulato-ovatis obtusis corolla) tubo profunde cain]wnu1iito brevioribus; laciniis ovatis obtusiuaculis tubum ssquantibu* patulis rtflexisve; staminibus brvvijwimw, antheris ovatis filamenta SBquantibos ; squaniis tenuiseimis ovatis laciniutis faucem attingentibun; ovario magno ovato-conico tubum repleuta* stylis subnnlli*, stigmatibus capitatis pileatis ; capntila conica apice e corolla exuerta. [507 (57)]

On the volcano of Antnco, Chili, Reynolds! 05, in lib. Hooker. — The only specimen seen is very young, with only few flowers open, and a single half-grown capoule. — Nearly allied with *C.* rneemoM, but well distinguished by the krge conic ovary with the thick and rudimentary but nevertheless quite unequal styles ; flower 1J-1J !"»•» long9 thick and flashy, yellow when dry, dotted with darker glands; whole plant furnishing a deep yellow dye.

50. C. CBJTTATA, n. sp.: caulibus filiformibus; floribus breviter pedicellatis cymoso-paniculatis basi obtusis late campanula!!*; calycis cupulati lobis ovato-orbiculatis glandulosU crbuto-caritiatis tubum corolla* squantibut seu auperantibus;, laciniis late ovatu obtusis tubo aquilongit, patentibus seu demum recurvis; sUminibus brevioribus, antherk oblongis filamenta late subulate aquantibim; squamis im« comlla) mlrutiii upatulatis Uciniato-fimbrkUa Cuicem exeedentibus conniventibus ; stylis ovario magno ovato apicuUto brevioribus fere indusia, stigmatibua panrn ; captula deprem glandulosa corolla marcescenU bsidente supra nnda; seminibus obovatii obliquia tub lento ruguloaiM.

Plentiful in the prorince of 8t. Jago de Tucuman, U Plata, Tweedief 1191, in Hb. Hooker. - Flowers on ahott and thick pediceU, wide open, about lj lines long; ovary laiRa, almost filling the tuba, wbglobose with an abrupt stylopodium in the shape of a fleshy ring; stigma very small, pal« yalWwieh; oapauk with a very small intnstylar m,*rtare; seeds brown-red, 0.7 line long, with an oblong, perpandkdar, or oblique hiltm. DtuUngiiialied by the chape of the flower, the pistils, and stigmas from *C.* nuMcta, w. i m k and from 0. Orcnetü, with which it k still more closely allied, and which it seems to represent in Sooth Ai[illegible].

60. C. OROHOVII, Willd.! rel. R. & Sch. VI. SO5; Chôisy! Cuac 185, t 4,13; DC. ProH. IX. 45a *C. tana,* L. 8p. 1*>, and auctt ¥*I.* Am. Bor. in part- C. *ruJ^va^* Entire.! 8iU. Jonrn. K c p. 338, t fl, f. *C. uwtbrota,* Beyrich! in ached, in part; Hooker! PI. Bor. Am, II. 78; Torrty! PI. N. Y. — ThU, the moat North American 'petit**, is characttrued by the lof«*ly.paniculate, rarvly from the An* more compact which at last becomes densely crowded ; by the deeply campanulate tube ; the obtuse, flat, spreading bat scarcely ever refleied laciui*; the larye, oral, deeply fringed scale*; the oral, sightly conic ovary. 8aada 0.JM19 line luog, obliquely oral, rarely rostrate, with an oblong-linear, usually perpendicular ailnm. —The following varieties may be distinguished: — *Amer.* 18-16. common inflorescence, [506(58)]

Var. a. VULGIVAGA, the common form, as described and figured in Sill. Journ. and Chois. Cusc It is Willdenow's original *C. Gronovii,* in his Hb. nro. 3160, a very loosely flowered specimen. — On coarse herbs and shrubs, commonly in moist shady places, from Canada and Maine to Florida, westward to Missouri, Arkansas, and Texas; I have seen no specimens from the Rocky Mountains or from the Pacific coast Flowers lj-l } lines long; lobes of calyx usually carinate, and, like the laciniae, shorter than the very deeply campanulas tube of the corolla; scales mostly shorter than the tube, incurved over the ovary; corolla remaining at base of capsule. Variable in the size of the flowers; a small-flowered form is *C. polyantha,* Shuttlew.! in PL Rugel from Alabama; sometimes it occurs with 4-parted flowers, var. *tetramerit,* Engelm. 1. c.

Var. 0. LATIFLORA. C. *Saururi,* Engelm. 1 Lc.p. 336, t. 6, f. 17-21: calyx more membranaceous; lacinia and stamens of equal length, as long as the shallow tube ; scales narrow and longer than the tube; in eastern specimens the flowers are smaller, in western sometimes larger than in var. a. — From Massachusetts to North Carolina, and westward to Illinois and Missouri.

Var. y. CALYPTRATA. *C. BonarimtU,* H. B. Carlsr. *C. Chilaiu,* H. B. Frib., not Ker.; similar to the first form, flowers even more deeply cnmpanulate, usually glandulous, rather larger, in very loose panicles ; corolla remaining on top of capsule.—Western Louisiana, Gregg! Texas, Lindheimer! cultivated in several botanical gardens in Germany.

Var. a. ? CURTA, *C. umbrosa.* Hook. 1. c. in part: flowers small, lj lines long, glandulous; calyx and short broadly-oval lacinia half as long as the deeply campanulate tube ; anthers triangular-cordate; scales very short, bifil or truncate, appressed to the tube ; styles one third or one fourth as long as the conic ovary; corolla surrounding or covering the upper part of the large oval capsule ; intrastylar opening large ; seeds few and large, nearly 1 line long, compressed, somewhat rostrate, with a small, oblong, transverse hiluiu. — Northwestern America, Douglas I Fremont! 79 (1845). — Perhaps a distinct species, taking the place of *C. Gronovii* on the Pacific side of the continent

61. C. ROSTRATA, Shuttlew.! in sched.; Engelm. 1 in Boat. Journ. N. H. V. 225. *C. oxycarpa,* Engelm.! in schecL — In shady woods, on tall coarse herbs, rarely on shrubs, southern Alleghanies from [609 (59)] Maryland and Virginia to South Carolina, Rugel! Buckley ! Gray & Sullivant! Curtis! —Nearly allied with the last, but flowers larger and wider, 2-3 lines long; scales comparatively small, deeply incised-fringed; ovary elongated, bottle-shaped; capsule, with the elongated 2-pointed beak, 2J-3 lines long; seeds 1-4, when regularly developed l-1£ lines long, obliquely obovate, compressed, carinate on the inside, bluntly rostrate, somewhat reticulate, with a abort oblong-linear mostly transverse hilum.

§ 3. Lepidanche.

Flowers pedicelled or, mostly, closely sessile; sepals free, similar to the surrounding sterile bracts, imbricate ; ovary and capsule more or less conic, thickened and fleshy at the apex ; withered corolla covering the capsule like a hood. — *Lepidanche,* Eng. SilL Journ. XLIII. p. 343.

• Flowers pedicelled, loosely paniculate.

62. C. CUSMDATA, Engelm.! in Bout. Journ. N. H. V. p. 224; Bot. Zeit 1846, p. 277. — Parasitic on 7tw, *Anbro-$%a* and many other herbs, on wet or dry prairies from southern and western Texas, Lindheimer! 125 and 277, Wright! 8chott! Thurber! to the upper Arkansas, Trécul! Fendler! N. Mex. 659, b; Marcy! Bigelow! and to the sandhills of the Plntte, Hayden! — A well-marked and easily recognized species ; inflorescence loosely paniculate, with many rterile hyaline tyacta on the pedicels and at the base of the calyx ; flowers membranaceoua, 1J-2* (mostly 2) lines long; upper bracts and sepals ovate or orbicular, cuspidate or sometimes obtuse; ovary not globose, as I formerly described it, but oval, with a thick stylopodium; capsule thick and glandulous at the apex; seeds rarely more than 0.4 line long, obovate, comprised, rostrate, with a very short oval mostly transverse hilum. The form from Platte river has the amallest flowers, and almost orbicular sepals.

63. C. BRACTEATA, n. sp.: caulibus tenuiter filiformibus; cymis spiciformibus paniculatis ; pedunculis pedicellitqne crania bracteis pluribus ovatis obtuni*, miperioribus lanceolatis acutatis stipatis ; sepalis nimilibus longioribut tcaiuinatU aerriilatis tubum corolla subcylimlricum soquantibus; laciniis lanceolatis acuminatis tubo brevioribnn nflexis; tUminibus multo bwvioribuis antheris oblongo-ovatU filatnento nquilongis ; squamis ovatis crif>iwto-laceris uiedio tubo adnatis faucera attingentibus; stylis capillaceis ovario miuuto multo longioribus inclusis, stigmatibiM ovato-capitatia.

Goyax, Brazil, parasitic on shrub*, Gardner! 3348 in Hb. Hooker. — Similar to the last, but flowers much larger, 2}-3 lines long in a rather contracted inflorescence ; peduncles remarkably thick in proportion [510 (60)] to the stem* ; stigmata oval, almost twice as long as they are thick, a form that I have not seen in any other species. The only specimen examined is barely in flower; the ovary is probably shaped •* in the last species.

• • Flower* closely Mstile, crowded in compact and often continuous cluster*.

4. C. tQUAMATA, it sp,: ctulibos filifonniboft anrantiacis ; glomernlit compact! ; bncteii 2-5 snb flora sin-

gulo arete sessili late ovatis cuspidatis membranaceis adpressis sensim in sepala exteriora similia et interiora longiora obtuaiora tubum cylindraceo-obconicum roquantia transeuntibus; staminibus brevioribus, antheris oblongo-linearibus filamenta subulata aequantibus ; squaniis ovatis laciniato-finibriatis niedio tubo adoatis faucem excedentibus conniventibus; stylis capillaceis ovario ovato-coaico niulto longioribus exsertis; capsula ovata apiculata 1-2-spenna corolla rudimentis calyptrata; seniinibus subglobosis lenticularibusve, hilo oblongo abbreviate*.

Fields and wastes on the Rio Grande, on *Artemisia Ludoviciana, Helianthus ciliatus* and other weeds, from El Paso, Wright! 518 (coll. 1849) and 1628 (coll. 1852), Bigelow! Thurber! down to Presidio del Norte, Parry! — Clusters 5-6 lines in diameter, consisting of 8-12 flowers ; or sometimes small, only 2-3-flowered; occasionally continuous, in the manner of the next species ; flowers 2£ lines long, similar in shape to those of the two last species, but closely sessile, in other respects much like the next, but bracts appressed, not squarrose. Seeds 0.6-0.7 line long; 8ubglobose when the capsule has only 1 seed, compressed when it contains 2, oblique but scarcely rostrate, with a very short oblique or transverse hilum, almost a mere dot.

65. C. OLOMERATA, Choisy! Cusc 184, t. 4, f. 1 ; DC. Prod. IX. 458. *LepidancKe Compositarum,* Engelm.! SilL Journ. XLIII. p. 344, t. 6, f. 30-35. C. *America)\a (numstruosa),* Hook, in Comp. Bot. Mag. 1.173. *C. paradoxa,* Rafin. Ann. Nat. 1820, p. 13, & DC. I.e. 461 ?— Prairie regions of central North America, on *Hdianthus, Solidago, Vernonia, Silphium* and other tall *Composites ;* rarely parasitic on any other plant: from Indiana, Dr. Clapp! to Illinois and Missouri, Dnimmond ! Engelm. ! Riehl! 15 & 16 ; Kansas, Hayden ! the upper Arkansas region, Fendler! 657 ; southward to the Canadian, Bigelow! and to the Liano in western Texas, Lindheimer! Mr. Riehl found it very destructive to the pear seedlings in his nursery. — This, the most striking of all *Cuscutct*$_y$ has been so fully described, that very little is to be added. The glomerules almost always form two parallel lines on both sides of the [511 (61)] stem, wherever it is attached to the stem of the nurse and somewhat flattened, rarely in detached clusters, where the stem is free ; these clusters of flowers run completely together and form at last a continuous spiral coil, 6-10 lines in thickness, and several inches in length ; the orange-red filiform stems have by this time entirely disappeared. — Flowers 2J-3 lines long, surrounded by numerous squarrose bracU; lobes of corolla obtuse, not acute ; stylopodium larger (Sill. J. 1. c. f. 33), or smaller (I. c. f. 31) than ovary proper ; flowers often uterile; seeds 2 or mostly 1 in each capsule, 0.5 line long, oval, more or less compressed, very slightly rostrate, small oval hilum transverse.

Raflneaque was DO doubt the first to distinguish this specie*, and his name, a very appropriate one, would have the precedence over the later ones, if he, by his very incorrect description, had not enveloped the whole iu so much obscurity, that Cboiay's later name is to be preferred.

66. C. COMPACTA, Jussieu ! in lib. ; Choisy ! Case. 185, t. 4, f. 2 ; DC. Prod. IX. 458 ; Engelm.! Rout Journ. "N. Hist. V. 925. *C. rtmotifiora* and *C. Fruticum,* Bertol. Mine, bot X. 29. C. *Americana,* anct. var. *C. imbricata,* Nutt.! in Hb. *C. eonmata,* Beyr.! in Hb. — From the banks of the St. Lawrence in the State of New York southward, and on the Alleghany mountains from Pennsylvania to Georgia and Alabama, almost entirely on shrubs, such as *OuryUu, Ainu, Andromtda,* etc.; only accidentally on herbaceous plants. — Clusters in fruit often {-14 inches in diameter, continuous and thickest where the stem U twined around the nurse, bat also abundant where it is free; tube of corolla slender, lacinia oblong ; dead corolla raised on top of the acutUh capsule, K^{vn}ift >* * pointed appearance ; seeds 1-2, rarely 3-4, in each capsule, 0.8-1.0 line long, oval oblique, lenticular or carinate inside, scarcely rostrate; hilum small, oblong, perpendicular or transverse.

Var. 0. ADPRBBSA. *Lspidaudu adpnua,* Engelro.! in Sill. Journ. XLV. p. 77. *C. acaulit,* Raf. Ann. Nat 1820, p. 13 T—Shady woods in rich bottom-lands along streams in the Mississippi vallry, on *CqJudanOius,* Cbnuw, *Salix, Bigmmia, Vitis, Rkus Toxicodtndron,* Smite, and some herbaceous plant*; western Virginia to Illinois and Missouri, and southward to western Louisiana and Texas.—Tube of corolla wider, more deeply immersed in the calyx, lobes broader, capsule thicker, not so much pointed, and corolla not so much rained above it, so that the dusters, especially in fruit, appear more obtuse ; seeds of same siie as in o., usually 2-4 in a capsule, compressed, scarcely carinate, with a longer, transverse hilum. The difference in the seeds appears to be constant, and proves [012 (62)] again that in this genus not much reliance can he put on characters derived from them.

Bmct. 7. LOBO8TIOMA.

Style* of nearly equal length, clavate toward* the flattened stigmata* top, which is divided into several unequal orbicular lobes, and depressed in the centre ; capsule baccate.

Inflorescence a loose fasciculate cyme, bracts at the base of the long pedicels; corolla enveloping and corering the capsule

The only species of this section is a native of Tasmania.

67. C. TABMANICA, n. sp.: caulibus capillaceiii; cymis laxifloris umbeUato-fanciculatis compositas; pedicellk elongatis clavatis in calycem tnrhinatum profunde fiwiam aheuntibu*; floribun glan«lul<«i*; lobis calyris oblongis oteasis tubum squantibus; laciniis oblongis obtusis patulis sen demum reflexis tubo longioribus; staainibus

brevioribus conniventibus, antheris oblohgo-linearibus filamehto crasso longioribus ; squamis angnstis apice fimbriato bifidis faucem aequantibus ; stylis ovario subgloboso fere longioribus exsertis. — *C. australis,* Hook, til.! FL Tasni. 278 not R. Br.

Hobartstown, Tasmania, Gunn! 1991, in Hb. Hooker.— Well characterized and distinguished from any other species by the shape of the stigma. Fascicles of 4-8 flowers aggregated in larger cymes; flowers lfr-lj lines long, usually 5-parted; anthers turned inward, with a very broad commissure on the back; scales crenulate on the sides deeply fringed and usually bilobed at the tip ; styles nearly as long as lobes of corolla, much longer than the stamens ; stigma commonly with four unequal lobes ; styles in fruit subulate from a broad divaricate base, distant, with a small aperture between them ; no ripe seeds seen.

SECT. 8. MONOGYNELLA.

Styles united entirely or for the greater part of their length, thick and compressed ; stigmata capitate, subgloboee or ovate, distinct or more or less coalescent Capsule regularly circuniscissile, usually 2-seeded ; dissepiment of the shape of the capsule, transparent, with a thicker rim, entire, no part adhering to the lose of the style. Seeds compressed, oblique, more or less rostrate, with a long linear transverse hiluin. Anthers sessile, or on very short filaments, often attached to the tube below the throat.

Stems thick ; flowers comparatively small, always 5-parted, sessile or on short pedicels, supported by bracts, in small cymules, which form a compound spike or raceme ; withered corolla remaining, hoodlike, [513 (63)] on the very top of the large capsule.

Parasitic mostly on ligneous plants. Of the eight species of this section, five belong to the continent of Asia, two of which extend into Europe ; one is peculiar to the island of Timor, one to South Africa, and one to Texas.

68. C. EXALTATA, n. sp.: caule funiculari; floribus breviter pedicellatis seu seasilibus spicato-paniculatis; calycis globosi lobis fere dfejunctis orbiculatis concnvis imbricatis medio verrucosis corolla tubum cylindricum SBqunntibus; laciniis orbiculati* imbricatis tubo multo brevioribus erectis seu erecto-patulis; antheris cordato-orbiculatis ad faucem nessilibus ; squamis bipartitis dentatis tubo multo brevioribus; stylo apice bitido ovario ovato-globoso aquilongo, stigmatibus subglobusis.

Parasitic on *Dio$pyrot Mexicaua, Ulmut crasrifolia, Queretu virens, Juglans, Rhus,* ete., 10-20 feet high, in western Texan, on the Guadaloupe and Cibolo, Lindheimer! 4*2 ; on the Colorado and Blanco, Wright! on the Leona and at the mouth of the Pecos, Bigelow! on the Rio Grande, Schott! — Stems 1-2 lines in diameter; compound panicles several inches in length; flowers 2 lines long, small tube hidden in the large calyx; anthers closely sessile; scales reduced to two dentate wings on the sides of the very distinct attached filaments, united at base; upper fourth of the thick style divided ; stigmas depressed, thicker than the ends of the style ; capsule 3f-5 lines long; seeds lj-1j line* long, somewhat triangular, very slightly rostrate. The large embryo is coiled up in 2-3 rounds; on the upper (thinner) end 3-4 alternate scales may be distinguished. This is the only species of this section where the styles are not completely united. I formerly distributed it under the name of *C. gamostyla.*

60. C. CABBYTOIDB, Nees ah Esenb.! in Linnaea, XX. p. 196, sine descr.: caule funiculari ; floribus sub-•essilibus cymoso-spicatia; calycis globosi lobis orbiculatis concavis imbricatis verrucosis corolla* tubum latum breviter cylindricum includentibus; laciniis ovatis obtusis vix basi imbricatis erecti* tubam oquantibus; antheris cordato-ovatisadfaucenrsessilibus; squamis tenuissimis apice truncato pauci-dentatis tubo brevioribus; stylo ovario ovato-eonieo oqailongis, stigmate capitato bilobo ; capsula ovate; seminibus ovato-triangnlatis tenuiter verraculosis.

Cape of Good Hope; primitive forests of Uitehage, Drege, 8037; Hangklipp, Mund £ Maire; Zeyher II. 3631 (120.5). — Flowers in spiked cymules, 1] lines long, shorter than in the lot species; [514 (64)] scales united at base, ovate obtuse or truncate, scarcely dentate; styles united entirely; stigma divided almost to the base, lobes subgloboee; capsule JM lines long, subglobose; seeds of the same size and shape as in the last species.

70. C. TiMoaiifsrs, Decai<ne! rass.: caule funiculari; floribus racemoso-spicatis seu axi indeterminate apice braeteata spicatis; pedic*llis inferioribiw longioribus brncteatis, superioribus brevissimis nudia, omnibus bnictea ovato-orbiculate concava suffultis; calyci* profunde partiti lobis orhicuUtis concavis imbricatis tubum corolla brevem camptnulatum ©quantibu* ; laciniis ovatis obtiwis -tubo brevinribus erectu seu scpe patulis reflexiuve ; antheris ««*ao-ovatis tubo infm faucem mlnalis ; squamis ad cristulas bin as convergent*! reductis seu subnullis; stylo cum sUgmatibui ovatis comprewds ovarium suligloboiiuni sequante; capsula ovate conica sub-2-8perma; seminibus orbiculato-triangulatu ooniprasb. — *C. rtftexa,* Dne.! in Hb. Timor, descr. p. 66, not Roxb.

Wand of Timor, Leschenault! in Hb. Mu*. Par. — The tendency to a regularly spiked inflorescence, which is obserred in this whole group, is more decidedly developed in this species. The main axis of the inflorescence is ternii-**tod by an imbricately brected bud, never by a flower. The lower lateral flowers open first, and the upper ones in succession ; al^ or only the lower ones, are supported by pedicels bearing lateral flowers; the upper ones often have

shorter pedicels, with two or three sterile bracts; the uppermost ones are commonly quite short and bractless. Flowers 1^-11 lines long; anthers almost sessile a little below the throat; scales very indistinct, consisting mostly of two slight ridges converging toward* the base of each anther ; stigmas of the length of the style and scarcely thicker, oval and compressed ; capsule about 3 lines long; seeds l£ lines in diameter.

71. C. MONOGTNA, Vahl. Symb. II. 32; DC!. Prod. IX. 450, & auctt. in part. *C.* orientate, Tonrnef.l Cor. 45 ; Sibth.! in Hb. Jacq. *C. ´astyla,* Engelm.! Bot. Zeit. 1846, IV. 276. *Monogynclla Vahliana,* DesM.! Et. 65. *C. scandtns,* Brot. Lusit. I. 208 ?? — On shrubs and trees, as *Salix, Tamarix, Pistacia, Vitii,* etc.; also on herbaceous plants, *Euphorbia,* etc.; from southern Europe through middle Asia southeastward: Portugal (?Brot.); southern France, almost always on the grape vine (introduced?), Delisle! Requien! etc.; Roumelia,Frivaldski! specimens often mixed with *C. Europcea*; Crimea, Trautvetter ; Greece, Heldreich ! Orphanides! Asia Minor, Sibthorp ! Wiedemann! Syria, Tounie fort! iu Hb. Banks, Labillardicre 1 Blanche! Caucasus and Georgia, Hohenacker! Prescott! Wilhelms! Frick! Koch! Soongaria, Schrenk! Persia, Buhse! Noe! Kotachy! 713; Afghanistan, [515(65)] Griffith! 682 *A* 684. — Vahl's description, " dentibus corolla lanceolate," etc., does not exactly agree with our plant, nor is Sibthorp's figure, Fl. Gnee. *U* 257, very correct; but the locality of the former and an authentic specimen of the latter (in Hb. Jacq.) leave no doubt that both had the plant in view which I formerly distinguished as *C. aityla,* — The inflorescence is a compound spike, consisting of a terminal and several lateral cymes of 2-3 or 4 sessile flowers; the lowest cymes open first, and are sometimes branched. Flowers 1J-1J lines long; corolla 1-1J lines in length ; laciniso oval or orbicular, very obtuse, delicately crenulate, erect, scarcely more than half as long as the tube, which is entirely enclosed in the calyx; anthers ovate or triangular-ovate, cordate at base, almost sessile a little below the throat; scales attached to the middle of the tube, of the shape of a horseshoe, forming a narrow denticulate or uligUy fimbriate bonier, which is sometimes truncate or even bifid ; style very short, equal in length to the snbglobose bed stigma, much shorter than the oval or globose ovary ; capsule 2-3 lines long, usually oval and obtuse; seed* rarely more than 2, ovate, strongly rostrate, slightly rough. — Afon. *BlancKtana,* DesM.! in litt. ' is a form with a somewhat elongated conic capsule, which occurs in Syria aud Georgia, and which approaches the next species.

72. C. LBHMANNIANA, Bunge! in Lehm. Rel. in Mem. Sav. £t. VII. 396. — Bokhara, on the banks of the Jan-Darja, A. Lehmann ! — Flowers pedicelled in a thynoid inflorescence, nleuder, 2}-2] lines long ; corolla 2-2J linen in length ; Ucinue oval, crvnulate, shorter than the tute, erect or *pn»atling; scales bomenboe-shaped, attached to the middle of the tube, and covering the base of the ovatc-conlate anthem, which are sessile below the throat; style mack shorter than the oval or subglobosc ovary, of the length of the distinctly 2-parted oval stigma; capsule oral. The shape and proportion of the corolla is similar to that of the next specie*, especially of its Asiatic form; the pistil is like that of the last species ; the position of scales is quite peculiar. I class with this a form from Ada Minor:

Var. 0. ISQUAMATA : pedicels an long at, or often longer, than the calyx ; oblong lobe* of the corolla still more distinctly crenat*, not much shorter than the tube, upmwling, on the fruit erect or twisted; anthers still shorter; scales almost entirely adnate, commonly nhowing only a denticulate crvst on bolh side* ; stigma globose or oval, almost sessile. — On *Puiocia TerMttikus,* on Mount Sipyle, near Magnesia, BsJaiisa 1411. — Flowers 2} lines, corolla 2 lines long, more deeply divided than in the allied species.

73. C. LUFULTFOEMm, Kiocker! Silen. I. p. 261, t- 36. *C. numo^na,* aoctt. Fl Oenn. al. - [516(66)] On willows, etc, on the hanks of streams from eastern and northeastern Germany, Sileaia, where it seems to be common on the Oder, Leasing! Ooppert! Gunther! al., Bohemia and Austria, KovaUl to Hungary, Uerenday! and to central Rusm, Kassn, Graff! - Rowers subsmile, or on at last alighlly elongated pedicels; cymes forming elongated spikes, or sometimes more or lens compound racm**, which are alwajs terminated by a Ti a Wiwd cyme; floweri *-** "ati long ; lobe* of calyx oval, obtuse or almost pointed, half as long as tube of corolla; lacima oblong, obtuse, erect, half an long as tube; snlbeni oblonglinear, sessile Wow the throat; scales short, attached to the lower part of the tube, bind or reduc,,l to Wrral emulate wing.; ovary oral, conic, attenuated into the slender style, which is much longer than the globose or oval deeply bilobed stigma, ftpmil* conic, 3-4 lines long ; seed* triangular-oval, rostrate, lj-lJ H_{DM} long.

Var. *fi.* ASIATICA : flower* often longer ^i ^^ tfcoder, on longf>r H>"«[1]*; !•**»*» »«re mnulate and somewhat spreading; anthers on short but dfeinct filaments; scale* entire, broadly ovsl, fimbriate and somrwtut incurved. *C. /lava,* Siev. ap. Pall, probably belongs hm. - On *Tumori*, SaiU,* etc. from the banks of the WoLa, Fischer! Becker! where it teems to join the western form, eastward through th« southern parts of Aniatk Ro-k, Caucasus, Hb. H«*,ker! Soongaria, 8chrenk! 9i9 A 306, b (the laM a form with very slender flowers ami lungish Hi**); Buchtamiiniik, Karelin A Kiriloff! M6; Altai, Lsdebourt Bongs! Oebiarl 180, to the rim Angara, Tiirvjaninol T!

C. lupuliformi,* having been published as early as 1787, has by four years the priority over VahPs name, C. *monogyna,* published in 1791, and must stand for the species with all those botanists who consider both plants aa identical * but it so happens that (7. *lupuliforrnis* properly designates the species which in Europe and Asia extends north of the' 43d or 44th degree, and *C. monogipia* that which grows south of that latitude.

74. C. GIGANTEA, Griffith, Notul. I. 243. — On *Tamarix,* Siah-sung ravine, Afghanistan, 10,300 feet high, Griffith I 1031 (683). — Griffith's specimens corresponding best with his description are all parasitic on *Tamarix,* and not on *Salix* or *Populus,* as he says in his Notula; nor are the stems very thick, but rather filiform. Otherwise his detailed description — especially that of the corolla, the scales, and the stigmas — agrees so well with his specimen in question, that I cannot doubt about hid having it in view ; but he may have confounded it [517 (67)] with *C. mvnogyna,* which he has collected on willows.

The inflorescence forms racemose spikes after the manner of this section, but shorter, only f-} inch long, flowers 2^-2} lines long, raembranaceous, on short pedicels; calyx covering one half of the tube ; lacinia linear-oblong, obtuse, crenulate, a little shorter than the tube, spreading, or reflexed; ovate-cordate anthers very large, subsessile a little below the throat; scales oval, fimbriate, reaching from the base to the middle of the tube ; style as long as the conic ovary and the oblong, elongated, somewhat ligulate (linguiformia, Griff.) stigmas.

75. C. JAPONICA, Choky! PI. Zoll., 1854, p. 130 & PI. Jav. 1858, p. 30.—This species extends in several forms along the whole coast of China and to Japan; all the different varieties are characterized by a very short cupulate calyx, with rounded, mostly cristate lobes, which cover scarcely more than *i* of the corolla; by the oval or rounded, very slightly crenulate, sometimes cuspidate, spreading or reflexed lacini®, which have } or £ the length of the cylindrical or slightly widening tube ; by the oval anthers, sessile or Rubsessile at the throat; by the entire, ovate, fimbriate, incurved scales; by the elongated style, with 2 ovate, more or less conic or subulate, stigmas. Flowers 2f-3 lines long.

Var. a. THYRSOIDBA : flowers subsessile with several bracts at base, in a compact, thyrsoid raceme, often 2 inches long and } inch thick ; scales from the lower part of the tube, reaching almost to the base of the anthers ; styles longer than the conic ovary; stigmas short and conic. — This is Choisy's original *C. Japonica,* and also *C. reflexa,* var. *dentJbra,* Bentham! in Hb.—Japan, Zollinger! 355; Hongkong, Abbe* Furet! Maj. Champion! 457. — *C. tyttyla,* Maximowittch 1 PrimiL Fl. Amur, ined., from the lower Amur, is exactly the same plant, with shorter scales, and rather oval than conic stigma*. From *0. lupuliformis,* var. *Asiatica,* to which it closely approaches, it is distinguished by the •hort calyx and the shape and insertion of the stamens.

Var. 0. PAMCULATA : flowers on short pedicels, scarcely bracted at base, in a loosely flowered panicle, 1-2 inches long and of the same diameter; narrow scales reaching from the base to the middle of the tube ; stigmas conic-subulate, M long at style and as ovary. — *C. colorant,* Maxim.! 1. c. — Pekin, Kirilow! in Hb. Fischer, now Hb. H. B. Petrop.

Var. *y.* I FISSIHTTLA : inflorescence same as last; scales from the middle of the tube, not reaching the base of the anthers, broad and often partly confluent; styles united only at their lower third; stigmas conic — Hongkong, Chas. Wright! U. S. North Pacif. Expl. Exp., nro. 486.

The tubulate or conic stigmas, and the often more paniculate than spiked inflorescence, indicate a [518 (68)] dote approach to the next specie*, which to Mr. Bentbam was so evident, that he considered our plant a mm variety of it; but the structure of the capsule, with the corolla persisting on its top and the dissepiment in its bate, thowt that it truly belongs to *Monogyndla.* The dissepiment it menibranaceout, with a thicker centre, but without the thiak frame-like border of the allied species.

SECT. 9. CALLIANCHE.

8tigmata distinct, elongated, conic or subulate, testile or almost sessile. Gaptule regularly rireomtcittile, usually 4-teeded, dissepiment extremely thin, partly evanescent, ttylar portion small. Seeds compressed, rostrate, angled on the inside, with a long, linear, transverse hilum.

Flowers large, 6-partod, usually on bracted pedioelt in compound loosely paniculate cymulea; corolla deciduous After flowering. The only species inhabits East-India and the adjoining islands.

76. C. RITLIXA, Roxb. Corom. 104; Fl. Ind. I. 446. —This beautiful species bears the largest flowers of any, in different varieties from 3-5 line* long; calyx with oval or mostly rounded, very often cristate or verruoote lobe*, modi •borter than the cyliudric tube of the corolla; lacinia spreading or reflexed, on the margin revolute, much shorter than the tube; anthers oval to oblong-linear, senile or subtessile; Males in the bate of the tube, about} or } its length, with •hort and delicate curly fringes, curved; ovary oval acutish, often attenuated into a short, slightly bifid style, or with setnUe stigmas; capsule tubglobote, about 4 lines in diameter; at maturity, only the lowest part of the thin dissepiment iwnaint; seeds If lines long. — The following forms are specifically distinguished by most authors; Choisy, however, in PL ZolL already suspected their identity, and different at they teem to be at first tight, I can not bat consider them as mere varieties.

Var.&oiAVDiPLOsU. *C.grmdijlora,* Wall Cat nro. 1318, not HBK. *C.macrmtii*,* Don.1 Gen. Sytt IV.

305; DC. Prod. IX. 455. *C. megalantiia,* Steud. Norn. *C. elatior,* Choisy! Cusc. 177. — Flowers of the largest size; laciniae £ or sometimes only \ the length of the tube; anthers elongated, on very short filaments separating from the tube below the throat; stigmus elongate, subulate, divaricate, usually on a very short style. This is no doubt Roxburgh's original *C. re,/lexa,* as his figure and description, "stigmata large, spreading, pointed," [519 (69)] prove. — In the temperate as well as the tropical parts of India, from the Himalaya, Wallich ! 1318 & 1319*; Lady Dalhousie! Jacqueinont! 1109 & 2183; Strachney & Winterbottom! 1 & 2 ; Hofmeinter! Hooker, f. & Thomson ! Sikkim, the same ! Khasia, the same! to the low lands of the coast of Coromandel, Roxburgh, and to Ceylon, Gardner! 616; Thomson! and Java, Zullinger! 2839. — The specimens from the islands are remarkably stout, and have a larger calyx than the ordinary form. It often occurs with vemicose bracts, pedicels, and calyx or even verrucose stems; this is *C. verrucota,* Sweet, Fl. Gard. t. 6, not Engelm.; *C. Hookeri,* Sweet, Hort. Br. p. 290; *C. reJUxa,* var. *vtrrucosa,* Hook.! Fl. Exot. t. 150.

Var. 0. BRACHYSTIGHA. *C. reflexa,* Wallich ! Cat. in port; Edgeworth! in Linn. Trans.; Choisy, DC. Prod. L c; and most authors, not Roxb. *Cpcntandra,* Heyne! in Hb. H. B. Petrop. — Flowers smaller; lacinie J or J the length of the tube; anthem shorter, sessile at the throat of the corolla; stigmas short, conic, closely sessile, erect. —Calcutta, Gaudichaud 1 129, and valley of the Ganges in general, Jacquemont! 149 & 2520, de Silva! in Wall. Cat 1319 \ to the Punjab and the western Himalaya, Hooker, f. & Thomson!

Jacquemont's 149, from Bengal, has the corolla and anthers of var. a., and the short erect stigmas of var. 0.; style distinct, almost as long as the stigmas.

a anguina, Edgeworth! Trans. Linn. Soc. XX. 86, from the Himalaya, is a small-flowered form with more deeply divided tube, otherwise the same as var. 0.

C aphylla, Raf. in Spr. N. Ent. I. 145, and DC. Prod. IX. 461, from the Wabaah, is perhaps the same as C. *glonurata.*

C. Ejnbotryg, Uva barbata or *AmpeUpogon,* is the name given to the numerous capillary stems of a *Cmcuta* which occasionally have been found parasitic on the unripe berries of the grape vine; they often seem to be without flowers; in one instance they have been ascertained to belong to *C. Epithymum.*

a tubuniflom, Koch, in Linna* XXII. 748, from Asia Minor, I have not seen; it may be a depauperate form of *C. brevistyla.*

C. tri/toro, E. Mey. in PI. Drege, from the Cape of Good Hope, is, as well as *Cfuntformu,* Willd., a species of Cuscuta.

VI. COLLECTED DESCRIPTIONS OF CUSCUTA.

[IT has been thought best not to reproduce the accounts of this genus contributed by Dr. Engelmann to Gray's Manual, ed. 5; Botany of California, I.; Botany of Wheeler's Expedition, 1878; and Gray's Synoptical Flora of North America, II. part 1, — as they add little to his earlier papera. But descriptions of new species contained in them are included in the following pages. — EDS.]

FK>M IifOBuumi ARD OUT* Puirra LUDHUMMUK*. (Bono* JOCEX. HAT. Hnrr. You V. ISO.)

1 » CCBCCTA HIUROPRALA, Engelm. in 8U1. Jouro. XLV. p. 76, $ MITO*. A mlkr, MtUar [S» (lft)] flowering form, graving in drier placet, mortljr on *Pttoiotttmm nuUi/bnim,* bat alao on *Liaim,* and *exm <m EqpkoMacncUata.* It tppmebo *C hi^iduU m>* inneh that not improbably Anther tewrtiptioi. oflWng planU ma7 prore both to be only varied*, of a «n«U ^eci«, for which tha name of *C* jm^ym<VM «onld b. moat appropriate, at all the form, that wbrid belong to it an dirtinguiihed bm orer; otlm known North Aiueatean enedea by the purplithbrown atigmaa. Another nmaritabk variety ia

It4. C. mvBoriTALA, Engelm. *y.* unosALit: cymie peakaUtk; loribna majoriboa Hunlatfa; tabo eorolh* late eampanulato calyde eegmenU late ovate acatinamk eobcarinate at laeiniaa limbi enerviaa ovatet •brapta aenminatat erenulatat pitentet nbe^MnU; .qtumfa tnbim enbaqttntibN. - 8aaBbon of Qalvaalon baud, on *Lfei*m CmMmanum, Bcmchim fmlmcuu, /«• /Mmuu,* ate. Flowtn in May. Different from the [illegible] form by [illegible] ..wers, expanding in spring; by the hardly carinate, broader, and not so

acute sepals, and the broad lobes of the corolla, which are rarely somewhat nerved; stigmata also purple, [224 (16)] and anthen purple or yellow.

125. C. CDSPIDATA, Engelm. n. sp.: caule filiformi ramosjssimo ;. floribus pedunculate in cymas 1**^ bracteosas di8po8itis 5-fidis; tubo corollas cylindrico sepala usque ad basia libera ovata concava (exteriora cuspidata) et lacinias limbi ovatas acutiusculas uninervias erectas s. patentes superante; staminibus limbo brevioribus; squamis ovatis fimbriatis tubum subequantibus; stylis filiformibus ovario (minuto) globoso pluries longioribus; capsula globosa corolla marcescente obtecta.

Var. *a,* PBATENBIS : floribus minoribus ; calyce bracteis paucis involucrato; tubo corolla subcylindrico calycis et corolla) segmentibus paulo longiore; staminibus limbi laciniis ovatis acutiusculis duplo brevioribus; stylis ovarium parvuni duplo superantibus. — Dry prairies west of the Brazos, on *Tephrosia, Bradburia, Ambrosia,* etc June.

Var. *&.* HUMIDA : floribus majoribus ; calyce bracteis pluribus involucrato; tubo corolla infundibuliformi calycis et corolla segmenta duplo superante; staminibus laciniis limbi lanceolatis acutis paulo brevioribus; stylis ovarium minutum quater superantibus. Bottom lands of the Colorado, on *Iva ciliata, Ambrosia trifida,* etc. August, 1844 (No. 276 infra).

A remarkable species. The stems are very much branched, filiform; inflorescence loose paniculate, pedicels with many cuspidate bracts, some of them surrounding the calyx like an involucrum, similar in shape but smaller than the sepals; sepals somewhat lacerate or crenulate, ovate, carinate (the carina less distinct in the var. £.), cuspidate, interior ones rather obtuse, all concave, loosely imbricated. Lobes of corolla thin, membranaceous, with a strong middle nerve, formed by large oblong or linear cells; when dry, convolute; the exterior ones generally somewhat cuspidate, the interior ones obtuse; at the bane the lobes are dilated and cover one another more than in any other North American species. Styles remarkably slender and long, about the length of the stamens, but elongated after flowering, when the corolla assumes an urceolate shape, and finally covers like a hood [225 (17)] the upper part of the globose capsule. — It appears to be an intermediate form between *Cuscuta* proper and *Lepidanche.* The var. 0. has larger and thinner flowers, of paler color, and the lobes of the corolla lanceolate and acute.

126. C. PENTAGONS *p.* CALTCINA, Engelm. Wet prairies. June.

127. C. VERRUOOBA, Engelm., L c. Dry prairies. July.[1]

[1] An undeecribed North American species, collected in the Alleghaniee of Virginia and North Carolina by Dr. Gray and Mr. 8ullivant, in the autumn of 1843, is here appended. (This wms named *C. oxycarpa,* n. sp.; but juat aa these sheets are going to press, Dr. Engelmann writes that Mr. Shuttleworth has distributed the same plant from Rugel's collection, with a printed label, under the name of *C. rodrata,* which he therefore now substitutes for his own. — A. GB.)

C ROSTRATA. *Shuttle*, in coll. Rugel:* caule ramoso; floribns pedunculatis cymoeo-umbellatU 6-partitia; tubo corolla* globoKHsampanuUto calycis atgmente ovaU obtuaa kriter erenulate et ladniae limbi ovates obtuaas patentee (demnm reflexae) guplo raperante; staminibos limbum sub•quantibfu; equamie fimbriatia (conveigentibiis T) basi inter ae oonnatis; stylis filiformibus pvarium stylopodio ejuadem loogitodinis eoronatum pyriforme subsquantibus; corolla »areeeeente ed basin capsule) (maxima)) acutetas persùh' tente. - Allegheny Mountains from Virginia to 8outh Carolina *(Mr. Buckley/* 1842), *Prof. Gray* and *Mr. Sulliwmt!* 1848. — August to October. — Particular localities recorded by Heeara. Gray and 8ullivaiit are: Grandfather and Negro Mountains, N. CaroL; Tygarfe Valley, Va.; and "common fai moist, shady ravines in western Virginia." The specimen* "Nea came under my observation grow on *Urtica, Rubus, **", SolHaga, Rudbeckia,* and eome other plants.

K After repeated and careful investigation, and with some "rtatlott, I have admitted this mountain plant as a distinct •Pi** diffcreat from *C. vutymga.* The large pointed cepmwoiiMseemtoeharMsterlieltatonoe; but *C.wlgipaga*) so many different forme and eiaee of the capsule, that characters were Moemarj; and they are found in the ·<f the ooroUa, which ie em deatitute of the large pellucid dots constantly observed In *C. tulgimga,* bat is composed, especially about the tube, of regular, somewhat elongated, hexangular cell*, easily distinguishable in dried apecimena with a common glass. In the common species the cells are linear, mostly much elongated, interspersed with the large air-cells which have been frequently mentioned. The flowers are mostly twice as large as in *C. vulgivaga,* but of the same shape and proportion, about 2 and sometimes (especially in Tygart'a Valley specimens) 8 lines long; but the elongated ovary, whoae atylopodium is nearly aa long though only half aa thick aa the ovary proper, distinguishes it at once even from those forma of *C. vulgiwiga* where the atylopodium is unusually large. The filiform styles are at first about the length of the stamina, but soon after they are long exserted. The capsule is very large, fully 3 lines long, globose, attenuated to a bifid point; it is larger and more acute than in any other known American species. — During the aame journey the following species waa abundantly collected; —

C. (LEPIDANCHE) OOMPACTA, *Choity:* caule ramoao; floribus aeasilibua glomeratia 6-partitis; aepalia etib-novem leviter crenulatis orbiculatia concavis adpraaaia, interioribua niinorilrae; tubo corollas cylindrico calycem et laciniaa limbi lineari-oblongaa obtuaaa duplo auperante ; staminibua limbo brevioribus; aquamia pinnatifido-lariniatia; ovario cum stylopodio atylos aubequante ; capaula globosa subecuta corolla marceecente obtecta 1-4-apennA. — North Carolina to Alabama, in the mootrfeina, on ahraba, frequently on evwgreena; on *Corylui rodrata.* Buncombe Co., N. Carol.; on the eame, and on *Andrxmsda axillaru'* or qrifttOoao, on the sides of Negro Mountain, K. Carol., *Pro/. A. Graf* end *Mr. W. 8. SuUivmU;* in Alabama, on *Pr'mmgUAw, Dr. Omtm (Btrk Gray).*

This is dearly the *Cutcuia wmp*da* of Chtrfay's monograph (and of *DC. Pnir.* easel. *».), described after sped-

FROM THE BOTANISCBE ZEITUNO, VOL. IV. No. 16, APRIL 17, 1846.

C. CUPULATA, Engelm. in litt. : caule capillaceo; glomerulis multifloris, capitatis, sessilibus ; floribas arete ses- silibus, pentameris; calycis cainpauulati, cupulati lobis transversiiu ovatis, apice carinatis, abrapte cuspidatia ; tubo corolla campanulato, calyce breviore, lacinias limbi ovatas, acutiusculas, erectas, demmu patentes ©quante ; fitaminibus limbo brevioribus, filament is filiforniibus,antberis orbicularibus ; squamulis truncatis, apice fiuibriatis, convergentibus ; stylis cum stigraatibus ovarium gluboso-depressmn duplo superantibus, apice tVvergentibus; stigwatibus styloruin longitudine ; corolla circum capsulam globosam circumscissam marcescente.

Diese, der *C. Epithymum* naher als der *C. Europvta* verwandte Art, wurde von Godet am Caucasus, von Ledebour am Altai gesammelt. Choisy begreift sie mit Unrecht uuter *C. major.* — A. BRAUN.

FROM GRAY'S MANUAL, ed. 1, Boston and Cambridge, 1848.

2. C. CHLOROCARPA, Engclm. : low, orange-colored ; flowers almost sessile, clustered ; *corolla* mostly 4-cleft, *opcn-bdl-$hapcd, the tube about the length of the acute lobes and calyx teeth,* remaining persistent around tbe base or the depressed pod, the scales cut-fringed or cleft (rather small); stamens as long as the lobes. (C. *Polygonorum, Engelm.)* — Low grounds, covering *Polygona* and other herbs, Ohio and westward.

3. C. TENCIFLORA, Engelm.: much branched, twining high, pale-colored; flowers at length peduncled and in rather loose cymes; *tube o/ the corolla cylindrical* (ventricose after flowering), *twice the length of the obtum* [351] *spreading lobes* and of tbe ovate obtu.se calyx-lobe.**, in fruit borne on the summit of the depressed pod ; scales ovate, cut-fringed; stamens shorter than the lobes of the corolla. *(C. Cephalanthi, EngAm,)* —.Swamps, common through the Western States, on *Cephalanthus* and various tall htrbs.

FROM CRAY'S MANUAL, 5 ed., New York, 1868.

3. C. rNPLEXA, Engelm. : flowers peduncled, in umbel-like cymes, 1" long ; *tube of the mostly l-cleft corolla* [378] Of *long as ths ovaU acutish and minutely crenaU erect inflexed lobes* and the acute keeled calyx loijes ; scales *minuU and fiw-toathea* appressed; pod depressed, somewhat umbonate, of a thicker texture, brown, its top covered with the remains of the corolla. (C. *Coryli, Engelm. C. umbrosa, Beyrich,* and Ed. 2.) — Prairies and barrens, in rather dry •oil, on Hazels, *Ceanothus,* and other shrubs or herbs ; from Western Virginia and Illinois southward and westward.

FROM PARRY'S BOTANICAL OBSERVATIONS IN SOI'TIIKRN UTAH, NO. 5. (AHER. NAT., YOU IX. 1875.)

905. CCSCCTA DBNTICULATA, n. sp. : iitenui very slender, hair-like ; flowers few, in loose glomeniles, on [348] short pedicels,small (scarcely one line long), white ; lobe* of tbe deeply divided globular calyx almost orbicular, overlapping, concave, thinly meuibranaceoun, denticulate, covering the short campanula**, (finally urceolate) tnbt of the comlU; lobes broadly oval, obtuse, threading, at last refloxe*l,sii long at the tube ; scales narrow, denticulate, reaching to tht bast of the ovate, almost sessile anthers ; styles slender, as long as tht conical, pointed ovary, bearing slightly thickened (scarcely capitate) stigmas ; capsule covered by tin; withering corolla, indehiscent (?), enclosing one or two tttds. — St George, Utah, on shrubs and herbs *(CoUogyne, BiscutMi)* in arid soil; the first addition to oar Cascate- floirn since my synopsis was published, 16 yean Ago. Apparently allied to C. *applanata,* Eng.f of Arixona, bat with Bach smaller flowers and an acute, not depre^e.1 ovary, different calyx, etc.

*HL *C. California,* W. Otptamipra, Engelm. Cane. p. 499. On *Suada diffuse,* Watson. Originally found in tht Mm* region by ferny and in Aruona by Dr. Palmer, always on saline herbs ; no collector hat obtained tht fruit •tysjt

FROM THE BOTAXT OF CALIFORNIA, VOL. I. Catubridgs, 1876.

!_* *• ?!i[8A]^[IAf] ?[Dgelm,] [n] *: item< ^nder; flowers (1J to 2| lines long) pedictlkd in loose cymts, [686] tnorter and wider than in tht next [C. *subindHsa];* lubes of the cmlyx ovtit-Unceolatt, acate, at long

mtsjs eoUecUd in Alabama sad Georgia ; ths notios *iu* 8iUiman's Journal Vol. XLIV. p. 196, must therefure kt etrrsctsd. - It is very near *CustuU (Lepidanche)* adpressa, which that *tu* hss ooly hssn Ibaad ta the bottom lands of ths Mis»is«ppi sod UUnoi. Kifew. ThU *^*7Zt\. this instance of two nearly sllisd spsciss; oat growing in ths moaBttiaoos rsgioa of ths Southern 8ut^ ths othsr la tat wtsssra lowlands. Analogies offer la *Buptisi* mlb** tad leucantha, Phacelia fimbriata and Parishii, and others. Ths mountain spsdss is diftingoisbsd froeo its wsstern rtUtirt bythtelosVnsadd eonpscter gloomls*, and ssieh *wmn* tltsj. der sad mostly smaller flora*. Tht tabs of tht oomlk txeseds tht compact seslss of tht eslyx eoaskletmblr, sad Is much narrowtr la proportioa to Its Itagth; It gi7t% tfcsft- *fot%* to tht. tmpsalt which it eorers a mach mom pointtd spp««rsBc^tho«î||fith«cs|Mleit»irUiH^yg)obQss. This sppfojaaos of tat vettigM of tht eorolls oa tht mpwlt da> tingaisass this spsdet from C. #4>nm Jart sfW totwiag. Ths etralk tpptait to bs aort —mVrsmoomn that la tht t Ora to tht vsstern spseift. tnd romsias whitish »bta «t0 tmsfTtd hi thshsrhsriom; tht other mmUy tarn itddW-hrowm:

as the ftimilar but mostly broader and overlapping denticulate lobes and as the shallow campanulate tube of the corolla *; filaments about as long as the oval anthers; fringed scales mostly shorter than the tube, sometimes incomplete ; styles as long as or shorter than the pointed ovary ; capsule conical, surrounded (not covered) by the withered corolla, mostly 1-seeded. — *C. subincluta,* var. *abbreviate, & C. California!,* var. (?) *tquamigera,* Engelm. **1. c** [Tr. St. **L. Acad. I. 499,500].**

Saline marshes, on various Qfenopodiaceous plants, especially *Salicornia:* Bay of San Francisco, *C. Wright,* fiolander, Kellogg. Also extendii^lo British Columbia *(Lyalt),* and in the interior to Arizona and southern Utah! In many respects intermediate between the preceding *C. Californica]* and the following species *[C. subindusa]* : but distinguished from the former by the presence of infrastamineal scales and the larger flowers; from the latter by the less crowded flowers, with shorter, more delicate, and open corolla.

FROM THE BOTANICAL GAZETTE, VOL. II. 1877.

A new Cuscuta, new at least to North America, comes now from California. A great wan- [69] derer is this *C. corymbosa,* which nearly forty years ago stirred up the botanists of Europe, and the agriculturists not less. This interesting plant has quite a little history of its own. At the period indicated, between 1839 and 1843, an unknown *Cuscuta* made its appearauce almost simultaneously in different parts of western Europe, and, singularly enough, always in Lucerne fields. In Germany it was described as *C. suaveolens, C. ITassiaca, C. diaphana,* and *Engelmannia migrans,* until Choisy, in DC. Prod., recognizing its American origin, took it for C. *corymbosa,* R & P. In my monograph of Cuscuta, 1859, I established the identity of the immigrant with the South American *C. racemosa,* Mart, which had been introduced into Europe with the much-vaunted Chilian *Alfalfa,* in reality the old established European fodder plant, the *Lucerne,* and which proved very destructive to its nurse-plant. After ten or fifteen years the energetic measures of the farmers, together with wet and cool summers, in which the seeds did not mature, seem to have eradicated the plant entirely, and as far as I am informed, it has not been heard of again in Europe. But now, lo aud behold, our wanderer makes its appearauce in northern California, and, precisely as before in Europe, in Alfalfa fields, " proving very injurious." It has been, without doubt, here also imported from ChilL

Rev. E. L Greene, who has found so many new native plants in the Shasta Valley, sends also this troublesome newcomer. How long it has been there or whether it has appeared in other parts of California, where under the well-sounding name of Alfalfa the Lucerne is frequently cultivated, is as yet unknown, nor whether it will establish itself permanently. It may be well to direct the attention of the farmers, who cultivate Alfalfa, to this dangerous enemy and to urge them to destroy any dodder which may show itself in their fields, before it can spread or mature seeds. *C. ractmosa,* Hart, belongs like our common *C. Oronovii* to the section *Clistogrammica,* characterized by two styles of unequal length tipped with capitate stigmas and a not-opening (baccate) capsule. Ovary and capsule are thickened towards the apex and somewhat pointed; inflorescence loosely paniculated with longish pedicels; flowers 1J-2 lines long, of thin texture, tube of corolla deeply campanulate, widening upwards, spreading lobes indexed at the acute tip; scales nearly the length of the tube; capsule commonly enveloped by the corolla. The variety, *Chiliana,* Eng. Cusc. p. 505, to which this form belongs, has larger and more delicate flowers than the original Brazilian type.

The "new" *CtucvXa racetnota,* the Alfalfa-Dodder, was after all not new to Prof. Thurber [80] and to the readers of the " American Agriculturist." By an unpardonable oversight his article in the number of December, 1874, of that journal, adorned with a cut, was overlooked not only in the notice published in the " Gazette " of January, but also in the Flora of California, published last summer. It teems that the parasite made its appearance in California at least three yean ago on kuerne fields, and its nature and dangerous character was recognized by Prof. Thurber and the means indicated to eradicate it The little notice of this plant in the January number of the * Gazette* has elicited the information from California that the parasite is "now well naturalized* bare (about San Francisco Bay), and is a great pest among the Chili clover."

FROM WATSON'S CONTRIBUTIONS TO AMERICAN BOTANY, XI. (PROC. AMER. ACAD. ARTS AND SCL, VOL. XVIII. Auo. 1883.)

C. POTOSINA, Schaffner mas.: stems capillary; the flowers minute (scarcely a line long), short-pedicelled [124] in small, rather loose clusters; calyx-lobes triangular, acute, scarcely equalling the deeply campanulas corolla-tube, which is rather longer than its erect, ovate, acute, somewhat inflexed and at last connivent lobes; stamens short, the subglobose anthers nearly as long as the filaments; scales broad, deeply frinja^slightly exceeding the tube; capillary styles nearly as long as the depressed ovary ; capsule covered by the mareBcent corolla, extremely thin, easily tearing off from its base, but not circumsciasile, 1-seeded — One of the smallest-flowered species, closely allied to *C. arvenńiy* from which the very fragile, l-seeded capsule, covered by the hood-like corolla, principally distinguishes it. — Near San Luis Putosi (779 Schaffner); growing on some labiate, probably a *Scutdlaria.*

C. MIT&GFORMIS, Eugelm.: stems thick; flowers short-pedicelled, crowded in large glomerules; calyx-lobes orbicular, unequal, the outer carinate, fully as long as the short-campanulate corolla-tube; lobes of the corolla as long as the tube, broadly oval, rounded, at last spreading or reflexed; subulate filaments as long as the linear-oblong anthers; scales very broad, deeply fringed, exsert, incurved; ovary with very short subulate styles; capsule large, exaert, 2-horned with the broad-spreading conical styles, regularly circumscissile. — Between San Luis Potosi and Tampico, in May; Dr. E. Palmer. Flowers 3 lines and capsule 4 lines long; clusters in fruit 10 to 12 lines thick. Nearly allied to *C. Xatapeniis,* but distinguished by its much larger flowers and fruit, and by its abort, thick, almost conical styles.

IV.

PAPERS ON CACTE.E.

I CACTEiE OF EMORY'S RECONNOISSANCE.

FROM A Lrrra *n* Nona or A MIUTABT RECOXNOIUANCX FROM FORT LEATKKWORTH, IN MISSOURI, TO SAN DIBOO IN CALIFORNIA. . . . Br W. H. EMORY. APPENDIX NO. 2. Washington, 1848.

Ox the occasion of my report on the botany of Dr. Wislizenus's voyage, I have made [1571 a careful investigation of the Cactacea,—of which he brought home with him more than twenty species,—and have been enabled to elucidate several points which had been unknown or obscure before; no doubt because in the hothouses of European gardens these curious plants, though they thrive pretty well, rarely produce flowers and fruit: so that from eight hundred species of Cactacea at present cultivated in Europe, perhaps not one fourth is known as to its flowers, and a much smaller proportion in fruit

I have ventured to describe some of your species from the drawing; my description, however, and the names given by me, must remain doubtful till we are able to obtain some more data to characterize the species. I have written it more for your information than for publication; but if you choose to append it to your published report, I have no objection to it, but must request you to make such corrections or alterations as your notes or your recollection of the plants will enable you to do, — for example, as to size, as in some of the drawings no size is mentioned ;• in which case I have assumed them to represent the natural size. I have, for convenience' sake, numbered the different figures, and shall now proceed to copy for you the descriptions and remarks following my numbers.

1. MAMILLARIA. Oct. 18, 1846. Hetd wafers of the Gil*, 6,000 feet above the sea. Proliferous in the [k]fcl»* degree, forming hemispherical masses often of a diameter of ty feet, which are composed of 100-800 different htdt or stems. Single heads conical, apparently about 4 or 5 inches high and 2f-3 inches in diameter; color bloish-g«en ; spines white or reddish.

This species appears to be allied to *M. vivipam,* bnt is distinguished by the conical heads and the hemispherical tuAn, while *M. vivipara* has hemispherical or even depressed heads, and forms flat and spreading masses. It may be *A undescribed species; in which case the name of *M. aggregate* appears to be most appropriate.

*• MAMILLAEIA. Oct. 86, 1846. Rare; on the Gila, 3,000 or 4,000 feet above the MA. Apparently a *MamMana,* though the habit of the plant is more that of an *Eckinoeereui;* but all *Echinoctrti* have the bunches of •ptoes disposed in vertical ridges, which is not the case in the figure in question. Stems irregularly cylindrical, with divers eontnctioos and swelling!, about 4-6 inches high and 1j-1j inches in diameter, many (in the figure 8) from one baat.

The name of *M. Jàsciadata* would indicate the peculiarity of this species.

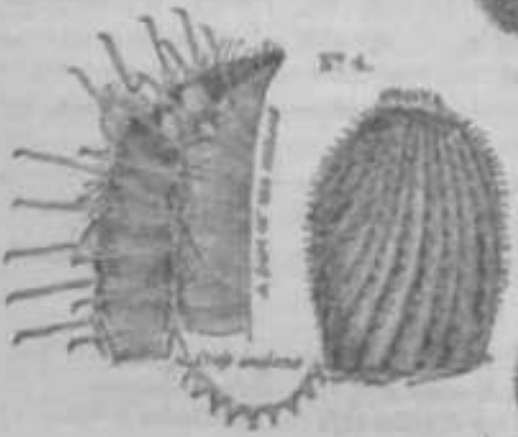
• Where the size is not mentioned, the original drawings are the size of nature. — W. H. E. [The amapaiyhg tares are reduced. — Eds.]


N° 1


N° 6.


N° 3


N° 7


N° 4.


N° 8


N° 5.

3. MAMILLARIA. NOV. 4, 1846. Abundant. Several (fig. 3) oval stems from one base, 1f-2} inches high and 1^ inch in diameter; tubercles in about 13 rows ; spines whitish, short; one small obovate red berry toward the apex not more than lj line long.

If the figure is correct, this aperies ought to be distinguished by the name of *M. microcarpa,* as I know of no other *Mamillaria* with such a small fruit

4. ECHINOCACTUS WISLUENI, Engeliiiann in Wislizenus's Report. Oct. 26, 1846. In addition to the description in Dr. Winlizcmis's Report, which I have drawn up from dried specimens, I observe in this figure that the specie* has twenty-one oblique ribs, is of an oval shape and bluish-green color; the ribs *ire* acute, but not compressed, according to the representation of a section, and the grooves corresf>onding.

6. ECHINOCACTL'S. Oct. 25, 1846. 18 inches in diameter; height equal to the diameter; shape ventricose, contracted toward* the vertex, therefore somewhat urceolate; with 21 straight sharp ribs; spines apparently 8, straight, brown, color of plant bright green; vertex whitish (tomentose?); fruit 1 or 1± inches long, oval, yellowish or reddish. Seed obovate, obliquely truncated at base, full 1 line long, black, opaque, slightly roughened; embryo curved or hooked, cotyledons nccumbent, partly buried in the large farinaceous albumen.

This species U distinct from all other New Mexican species examined by me, and is most probably undescribed. I propose to name it after it* zealous discoverer, — who has, surmounting numberless difficulties, though occupied by aevere and arduous duties, found leisure to do so much for the advancement of our knowledge of the wild countries traversed by him, — *Echinocactus Emoryi.*

6. CERECS. NOV. 21, 1846. 3 feet high. There can be but little doubt that we have here a species before us, which I hnve received from Dr. Wiwlizenus and from Dr. Gregg, from the neighborhood of Chihuahua, [158] and which 1 have described in Dr. Wislizenus's report by the name of C. *Greggii,* — erect, branching, with ft compressed ribs, dark green, with whitish areolaj, and about 8 short dusky spines.

The specimen figured here is very remarkable on account of the fruit, which was unknown to me. Provided the drawing U correct, we have here a smooth oval acuminate fruit, crowned with the remains of the corolla, and supported by a distinct stipe of a bright crimson color. A stipe, as well as such an acumination, I have not seen in any other fruit of a cactus. Fruit, with the long acumination, 2} inches long, J to 1 inch in diameter, stipe about *i* inch long.

7. OPUNTIA. Very abundant on the Del Norte and Gilo. No date nor statement whether the figure represents the natural sixe or is smaller. The species belongs to the section *elliptic** of Salm. It is ascending, older steins prostrate, branches and younger joint* erect, 8-10 inches high ; joints orbicuiar-obovate, rounded, obtuse or sometimes acutish, of a bluish-green color, 1J-2* inches long and little less wide; spines short and whitish ; berries obovate, •cartel, only about 3 or 4 lines long. If the figure represents the natural size, this species ought to bear the name *0. microcarpa.*

8. OPUNTIA. Oct. 28, 1846. Common on the Gilo. Much branched, sub-erect, joints obovate, often acutish, purplish, with 2 or 3 longer brown spine* directed downwards; fruits obovate, red. In the figure the joints are 1H ^cbes long and 1-lJ wide ; fruit about 3 lines long.

There are several *Opuntia* known with purple-colored joints, but none in the least resembling this, and I must consider it as rdistinct specie*, to which I would give the name of *0. violacta.*

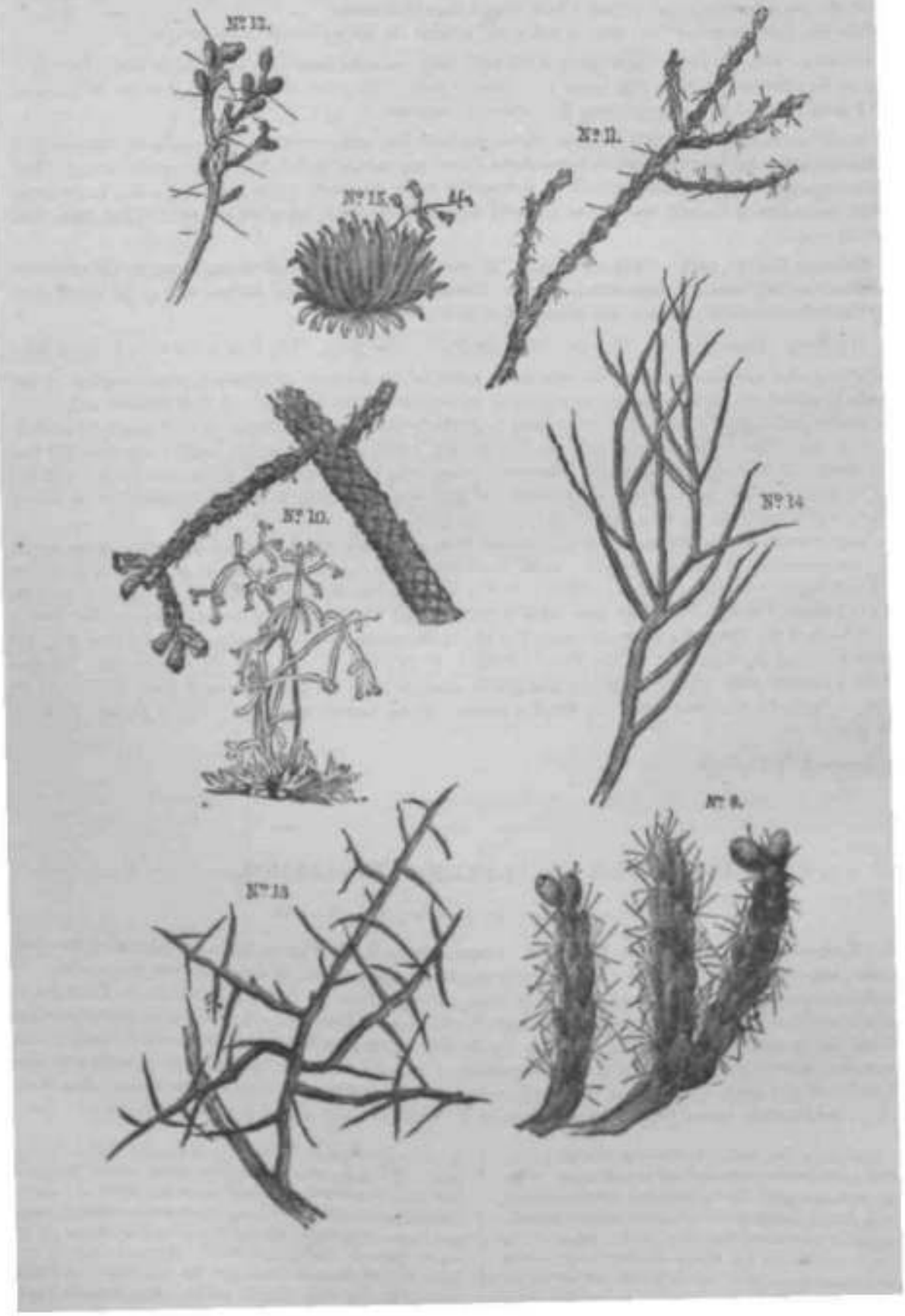
9. OPDNTiAf Oct. 22, 1846. Abundant on the Del Norte and Oila. A remarkable plant, apparently more like a *AfamiUaria* than like an *Opuntia.* The fruit is also r*pres«iited without areol© or tubercles, exactly like the smooth fruit of a *MamiUaria;* but this may be an oversight in the artist. The habit of the plant suggest* the belief that it is an *Opuntia* of the section *cyliniraaa.*

Joints or brunches asoending, cylindrical, tuberculated, 4-6 inches long, 1-1J inches in diameter; tubercles ver> prominent, with about 8 long (1-1* inchw) straight spines ; fruit obovate, umbilicate, scarlet, towards the top of the branches, about 9 lines long and 8 in diameter. It is a distinct specie*, which I am gratifiM to dedicate to the akllful artint who has drawn all these figures, — Mr. J. U. Stanly. I therefore propose for it the name *Opuntia Stanlyi.*

10. OruvTlA NOT. 3, 1846. 4 feet high. Stem erect, with vcrticiilate horizontal, or somewhat pendulous branches 5 branches cylindrical, strongly tuberculatwl, ahtrat « *Vine** in diameter, with short spines on the tubercles; fruit pale-yellow, ciarmU, tuberculrtte, umbilicate, 1-2J incht* long, fr-8 linen in diameter.

This is probably the *Opuntia arbon****, Engelmann in WMiwnui's Report, though the npines are represented as Wag shorter than in my specimens of 0. *arbor**** from New Mexico and Chihuahua.

11. OPTOTU. NOT. 8, 1846. Sorotwhat rwembling the last, but forming "low, wide-spreading buphes* Joints more slender, only about 4 or 5 lines in diameter, alternating (not opposite nor Terticillate), forming with the


N° 12.
N° 11.
N° 15.
N° 14
N° 10.
N° 13
N° 8.

stem an acute angle, sub-erect, tubercles more prominent, areota whitish at their lower edge, with 3 dusky deflexed spines; fruit clavate, tuberculate, pale yellow, 1 inch long, 4 lines in diameter.

I believe this to be an undescribed species, and would propose the name for it of 0. *Californica.*

12. OPUNTIA. Oct. 10, 1846. Abundant; 3 feet high, with spreading branches ; the same in circumference.

I can see no difference between this figure and a plant which 1 have received from El Paso by Dr. Wislizenus, and which I have described in his report under the name of *0. vaginata.*

Nos. 13-15 are'no Cacti. In 13 I recognize the *Kasberlinia,* Zuccarini,—a shrub common in the chaparrals of northern Mexico, which has been collected in flower about Parras and Saltillo by Dr. Wislizenus and Dr. Gregg. The fruit is unknown so far. The specimen figured is, however, in fruit; the berry (?) is globose, f-1 line in diameter, crowned with the rudiment of the style. It was collected Oct. S3, 1846, and is described as a shrub 3 feet high, with low, spreading boughs.

14. Collected Nov. 15, 1840. 4 feet high; rare. Is perhaps another species of the same genus, but the entire absence of flower or fruit makes it impossible to decide. Branches similar, straight, leafless, ending in robust dark spines, but much elongated and sub-erect, not horizontal, as in No. 13.

15. Is entirely unknown to me. Perhaps it is an *Amaryllidaceous* plant. The fruit is said to be 5 inches long.

A gigantic cactus was observed along the Gila River, about the middle part of its course, at an elevation [159] of from 2,000 to 4,000 feet. It is frequently mentioned in the report from the 1st to the 9th of November, and figured on several plates (pp. 72-79). It most probably is a true *Cereus.* I judge so from the seed, which fortunately has been preserved. This is obovate, obliquely truncate at base, black, smooth, shining, small (only about 0.7 line long); the embryo is hooked, the cotyledons foliaceous, incumbent; no albumen. If it is a constant fact that the cotyledons of the seeds of the genus *Piloeereui* are thick and globose and straight, the plant in question cannot belong to that genus, which comprises the most gigantic of the Cactus tribe.

The large *Cereus, 0. Peruvian*,* is vastly different from our plant, which I would propose to name *Cereus giganteus.* Unfortunately, I can say but little about the character of this species. The stem is tall, 25 to 60 feet high and 2 to 6 feet in circumference, erect, simple, or with a few erect branches; ribs about 20, oblique or spiral (?); no spines (?) (Emory's notes, — probably only below without spines) ; fruit produced toward the top of the stem or branches. (None of the fruit was procured, being too late in the season, but the molasses expressed from it by the Indians was procured in abundance at the Pimos village.) It is called *Pitahaya* by the California™; but this appears to be a general name applied in Mexico and South America to all the large columnar Cacti which bear an edible fruit, — especially to *Centu wriabilis,* which is common on the eastern coast, but i* widely distinct from our California giant

ST. Loun, Feb. 13, 1848.

II. CACTEJE OF PLANTJE FENDLERIANiE.

FaoM MIMOIIS AMERICAN AOADIMY, YOU IV. 1849.

S44. MAXTLLABIA YITIFAJU, Nutt sub Gacto. Common from Bent's Fort to Santa Fe\ on rocky hills [40] •ad elevated plains; flowering in July. — " Heads mostly single, often in pairs, rarely cwpitoee from the ramifications of the subterraneous stem;" not proliferous, as some specimens from the Upper Missouri are. — There can be little doubt that thb is the true *Cactus viviparus* of Nuttall, although the flowers do not appear to be entirely central I have living specimens from Santa ¥i and from the Upper Missouri, and shall be able to decide their identity after having seen them flowering. — I possess also a living specimen of Nuttall's *Cactus mamiUans* (Gen. p. 205). and have obsemd its flower and fruit. It 1% as has bean long suspected, entirely different from the West Indian *MamxUaria simplex,* DC.[1] and is nearly related to *M. mmilit,* Bngelm. in PL Iindh. I have named it after its discoverer.[1]

[1] M. KOTTALLII, ap. nor.: simplex (an temperf), globosa, axillis tabarculoniai ovato^ylindrironiin sapra leviter sulcatorum subtomentods; areolis jnnioribos albe-tomentods; ***** reetb albidia, radialibm 18-16 rabinsqoalibiia ettacda, centrali poneeto robustiofe; floriboa ex axillia tabarcnlorum hornotinonun otntralihoa (ei rubello flavicanUboa); aepalia P^albqoe obloago.UiioaoUtia; atpalia 10-18, bfevioriboa eiterioribot dllato.flmHriatb obtadaamlk, Interioribos apica lamia acatfe; petalis 20-28 intfyrris brevitar abrupt* mucronatia; atylo supra stamina (rubella) panlo exserto, stigmatihos circa 6 brevisdmis erecds adprtsds viridlbus; bacds Uteriibaarabglobodscocdneia. *CactwmammOlmrii,* Nutt, non Linn. — On high, dry prafrfaa, about Fort Pierre, on the Upper Miaaonri; flowering In May. — My apadnmn ia 1* inch high, and of the same diameter; the tabercles 6 or 7 lines long, in 8 ipiiml rows, sllghUy silicate. Radial spines 4 or 6;

246. M. PAFTRACAXTHA, sp. nov.: ovata, prolifera, aculeis omnibus planis chartaceis flexilibus albia, radialibus brevibus 8 central ibus 3-4 multo longioribus, 2-3 superioribus sursum curvatis, singulo inferiore longiore latiore deorsuni flexo ; floribus central ibus (albidis) ; sepalia 12-16 ovatis acutis integris ; petalis sub-13 lanceolatis acuminatis integris ; stigmatibus 5 suberectis exsertis albidis. — In a valley between the lower hills, near Santa Fe\ in loose, red sandy, though fertile soil: found only once ; flowering iu May. — About 2 inches high and 1(inch in diameter ; the tubercles in about 8 spiral rows ; lower ones proliferous ; their shape not well distinguishable in the half-rotten specimen before me. Spines silky-white, shining, of the consistency of stiff paper. None of the 8 radiating spines (1j or 2 lines lonç?) are directed upwards, but all laterally or downwards; the 2 or 3 central curved [50] spines are directed upward*, and 6 to 8 or 9 lines long, the middle ones shorter or wanting. The lower central spine is the longest (10 to 14 lines) and broadest, being from 1 to 1| line wide. Flowers pearly white, 12 to 13 lines long and 12 to 15 lines in diameter. Lower sepals membranaceous; the upper herbaceous in the middle. Petals about two lines wide.

246. CEREUS VIRIDIFLORU8, Engelmann in Wislizenus's Report, note 8, sub Echinocereo. Eastern mountains of Santa Fe\ on sunny, rocky declivities ; flowering in May and June. — I have seen specimens brought from other)>aita of New Mexico of much larger size than those of Fendler or Wislixenas ; some of them If inch in diameter and 3 to 4 inches high, some with stout central spines, others entirely destitute of them.[1]

247. C. COCCIXEUS, Eugelm. 1. c, sub Echinocereo. Higher mountains about Santa Fe ; often in large [51] dusters of 8 or 15 heads ; flowering in May. —The areolas are hardly oval, but almost orbicular, and are distinguished fruni those of most related species by their large size. — Among a number of plants of this family which Mr. Fendler sent from Santa Fé in a living state, but which unfortunately were all dead when they came to hand, are some specimens which appear to be varieties of this specie*, namely: — 0. MKLAKACAHTHUB : aculeis radialibus 10-12 cinei-tii, centrali lougissimo atrofusco porrecto recto seu leviter deorsum curvato. — *y.* CTUNDRICUB: subsimplax cylindricus; aculeis 8 radialibus, singulo robustiori porrecto.

248. C. TRIOLOCHIDIATU8, Engelm. 1. c, sub Echinocereo. Higher mountains about Santa Fe*; also in gravelly soil on the lower hills ; flowering in May and June. — To the description given in Wislixenus's Report I will add We that the spine* are often somewhat curved ; the ridges are sharp, but the grooves between them very wide and shallow; the areola widely distant from one another (often over lj i&c°) I *ud the expression "orsoìu *gpmniif* in the chancier, ought to be changed to *anolu distantibut.*

Ik* central one ft to 6 linca long; the young ipinn at the apex •tightly hmmtah. Flowers aii inch long, and, when fully expanded, of the same diameter; petali about 2 lines wulis [illegible] milcrDnilta '• •tigman only from J to f of a *a*** long, erect. The fruit ripen* the following spring, an<l, as well as the stsd, U very aimilar to that of *M.* jimi/u. but «dj half as lair, althougn the pita of the globoie bUck aeed are of the same aiie.

[1] Altar a cartful revision of the characters which <li,tinguish my genus *Echinocereus* (Wisl Rep. note 7) from *Cereus* proper, I think it meet natural to' oniu, the two. EchhT cereus will then constitute the first acrtion of d m . »,J comprise those of low stature and mostly of cumpitose tk flowers with short tubes (and almost straight •moiyo^ with very small cotyledons). It appears to comprise Prince Salm Dyck's (imed.) first two sections, namely: 1. *Lophogoni*, and 2. [illegible] but perhaps not all of the latter. Those known to me as belonging to New Mexico, Chihuahua, and Texas, may be divided into two sections, namely: —

11 /v*_ . . **

11. COSTATI: eamle i-lOnxjeUto? aculeis radialibus pl. m. porwctia MO peetiaaib; areolis orbiculatis.

A. r-

L C PBOCVMsnis, ape aor. teed.: tuberculis 4-5-serialibus; aculeis brevibus tenuibus, 5-6 radialibus, 1 centrali. — Matamoras.

C. coccixeus, Engelm. la Wlal. Be* lot I Costis Mil aculeis radialibus 9-10, centrali 1 recto.

3. C. roLTACAJTars, Ebgelm. L e. not 28. OoatislO; < raflialibns 10-12, ceatr. 4 reetk.

4. C. ROCMKRI, sp. DOT. IneiL: eostls 7-0; aculeis radialibus 8, centrali 1 recto. — Western Texas,

ft. C. FEXDLEBI, sp. nor. suprat oostis 9-10, aculeis radialibus 7, centrali 1 currato.

e e *AeuUis compremis, mtyUitii.*

6. C K9!fKACA3rnira, Eogelm. 1. c not 41 Costis 10; asmIrU rvlialibos 8, centrali 1 recto.

7. C. TBIOLOCWDUTCS, EogeJm. L c not 9. Gbstis 6-7| aculeis 3-<J sabcimraUs.

I *• BCLCATI : caule linubu 10-24 param IndaU svleato; areoia pL m. elosfatiei acaL rad. pectinato-connatis.

&> C. nASTACAimics, Bofeba. L e. aot kX Beptdec.-octodecin . ralcatM; aculeb radiaUboa rabpometla, esmtraliboa radialea «b»qoanUbtu, plttHhoa deielk.

A A^ ^mm^^^^^^^mmmm fl^^^^ I ^ e&4^ ftt VTaM^a^a^avBk.AaAlAav^enai • v. v* iivwinvi. •Dgem. i e« sot* • ! • VW^HM*^M^H^I aculeis rad. subpectinis variegatis elongatis, centrali [illegible]

la C Ajwsrra, lafelsi. U M L V L Titdtatat-U a| aculeis rad. pectinatis albidis adnatis, centrali nulle seu 1 robusto. Tbt last form Is * BAJMAJBi *(Echinocereus radians,* Ingelm. L e. not »\

11. C vraimvLnnra, Engelm. L e. tjes. 8. Trededa-sulcatus; aculeis rad. pectinatis variegatis, centrali nulle seu 1 robusto.

II C ncnVATOe, Beheeiw. *mh* Echinocereto; Engelm. L i nat. 46, sub Echinocereo. Costis 13-sulcatus; aculeis radialibus 8-10, centrali 1 recto.

III *Cemmatm,* Isftls^ la PL Uadh. Tredecim-18-sulcatus; aculeis rad. pectinatis, [illegible]

249. C. FKNDLERI, Pp. noy.: globoso-ovatus, simplex vel e basi proliferus, caspitosus; costis 9-10 obliquis tuberculatis interruptis; areolis orbiculatis approximate; aculeis basi bulbosis robustis, radialibus sub-7 comprensis subincurvis fuscis demum cinereis (tribus inferioribus longioribus, superioribus brevioribus, summo nullo); aculeo centrali robustiore longiore teretiusculo sursum curvato atro-fusco; floribus campannlatis; tubo pulvillis sub-30 albo-tomentosis stipato, inferioribus àculeos setaceos alboe apice aduetoe 8-12 radiates et singulum centralem, superioribus aculeos sub-3 robustiores longiores curvatos albos gerentibus; sepalis interioribus 12-10 lineari-lanceolatis acntiii; petalis oblongo-liiiearibua, acutis vel obtusis 16-24; stigmatibus 12-14 viridibus stamina numerosissima viz superantibus. — 0. PAUPEBCULUS : aculeis robustis abbreviatis, radialibus 5-7, centrali subnullo. — Santa Fe*, on elevated suidy plains; flowering in June. — The specimens before me are 2} inches high, and at the base of the same diameter; tbe areola from 4 to 6 lines distant; the lower radial spines 7 to 10, the upper from 3 or 4 to 6 lines long ; central spine somewhat erect, curved upwards, 10 to 15 lines long. In var 0. the spines are all from 3 to 6 lines long. The upper spine is wanting in all my specimens, and the opposite lowest one is longer than any except the central spine. Flowers from 2| to 3| inches long and wide, violet-purple. The spines on the lower part of the tube are from 2} to 3, and on the upper from 3 to 5 lines long. Petals variable in shape.

250. OPUNTTA PHAACANTHA, sp. nov.: diffusa; articulis obovatis sen orbiculato-obovatis compressis ;• [52] areolis orbiculatis fusco-setosis margine inferiore aculeos robustos 1-5 rectos compreRsos inoquales fuscos apice pallidiores plerumque deflexos gerentibus rariusve nudis; ovario obconico areolis sub-30 tomento pallide fusco instructis, superioribus albo-setosis; sepalis interioribus sub-20 late obovatis retusis seu emarginatis; petalis 10-13 obovatis retusis seu emarginatis; stigmatibus 5-7 suberectis stamina vix superantibus; bacca obovato-pyriformi nuda. — On rocky hills about Santo Fe\ and on the Rio Grande, very common ; flowering in May and June. This appears to be the most northern form of the Opuntiss with yellow or brown and flattened spines, which belong to the section of 0. *Tuna.* Another species, with larger joints and larger fruit, occurs in Texas. — Some specimens before me are prostrate, with ascending branches; the joints 5 or 6j inches long and 3} or 4 wide ; areolae an inch distant from each other, most of them bearing stout spines; the lower sometimes only 1, the upper from 2 to 5, but mostly 3 or 4; one or two are directed upwards, the other and stouter ones more or less downward. Larger spines 1* to 2 inches long, dark brown with lighter tips; the smaller from } inch to 1 inch long, whitish. — Another specimen has larger, more orbiculate joints, from 6 to 8 inches long and 5 or 6 wide; the spines fewer, all directed downwards, or on many areola none at all. The flowers which have been distributed under this number are 2 or 2* inches in diameter; ovary about 1 inch long; sepals yellow with red; petals yellow; stamens red or yellow; stigmas apparently green. The fruit which Mr. Fendler says belongs to this species is about half an inch long, red, smooth, apparently juicy when fresh ; the seeds often 3 lines in diameter, margined like those of *0. vulgari**. — Several other Opuntis) with compressed joints, some of them with fleshy, others with dry and spiny fruit —some of them very spiny, and others almost destitute of spine*, - have been collected by Mr. Fendler about Santo F*; but for want of more complete materials, a description is not here attempted.

251. 0. CLAVATA, Engelmann in Wmliienus's Report, note 12. Plains around Santo F£, —never found on the mountains; flowering in June. — I add to the description already published, that the areoiac are very large and closely approximate. From 9 to 11 smaller aud narrower spines are directed upwards or radiating; about 6 of them are turned downward, and ate larger and longer 5 the former are from 2 to 4, or even 6 or 8, lines long; the latter are from 6 to 14 tines long. The joints form • large and spreading, level-topped mass, which attains the diameter of ssveral fett

852. 0. ARBOUBOim, Engdm. 1. c, note 5. Hills and elevated plains, from Bent's Fort, on the Arkansas, to Banto Fe; flowering in June. — About 5 feet high, sometimes as much as 5 inches in diameter [53] below; the older steins and branches terete; the younger joints strongly tuberculated. Spines often an inch long; generally from 15 to 25 in each fascicle.

I11 CACTKE OF ENGELMANN AND GRAY'S PLANTS LINDHEIMEBIANiE.

PART I. FROM BOSTON JOURNAL OF NATURAL HISTORY, VOL. V. 1845.

244. OPCNTIA FRAGIUS, Nutt, var. FRCTEBOENS. O. frutescens, Engelm. mss. Near the Mnskit- [245 (37)] thickets *(vide* No. 233), on the Colorado; often acquiring the height of 4 or 5 feet, with a branching ligneous stem, covered with light gray bark, and sometimes with lichens. It bears bunches of small capillary spines, with one larger one (4-5 lines long) ; these disappear from the older stems. The wood is hard and close-grained. The younger branches are green and terete (or angular when withered), and bear the ultimate articulations, which are about an inch long, and very easily break off. These bear when young, like other Opuntue, short terete subulate leaves, with a single spine in their axils, and above this a bunch of small ones. The specimens are not in flower, but are covered with the obovate umbilicate scarlet fruits, which are about 8 lines long, fleshy, but not juicy, and contain *rery* few (2-5) white, compressed seeds. What is most remarkable, these fruits are often proliferous, and bear from 1 to 4 or 5 new branches from the upper bunches of spines. The fruit either falls off with these branches, or else dries up, persists, and finally forms part of the stem.[1]

[1] Mr. Lindheimer has sent seven other Cacti, mostly in living specimens, namely : — [246 (38)]

1. OPVNTIA, sp.: without fruit or flower; probably *0. vulgari**. It attains the height of several feet, with large obovate joints and a fsw spines.

2. O. MISSOURIBNSIS f Perhaps *0. vulgarity* but very spiny.

3. MAMILLAEIA SIMILIS, n. sp.: caespitosa ; axillk tuberculorum juniorum paulo tomentosis demum glabris; tuberculk ovatk supra leriter aulcatis (sulco basin versus siibtomentoao) spies spiniferis; spinis (circ. 12) s*|ualibus rertw radkntibus albidk, juaioribas puberal is bssique toroento circumdstk; baeek spamis globosk eoccineis. — Sandstone rocks, near Indastry. EvideaUy near *M. timpUx,* — at least to Nuttall's plant of that name, — but catapitose, forming tuft* often a loot in diameter. Flowers not seeii. Berries scarlet, of the site of a Urge pea. Seeds numerous subgloboae, scrobiculate, bkek, with an elongated white hilum. I have living plant*, hat they have not yet flowered.

^ 1 M . SVLCATA, a. sp.: caspitoaa; tubereulk oratooaloagk solos aabiads apioem versus prolifero superne eza»stk apios spiaiferk; spinis rsctis mdiantibus cinerek e to«»sato slhMo dsctdoo (in plantk adultt* apina centralis sabroearva majore) ortk; floribas centralibus taari◂ulati« e tomeato ortk gUherriiak. tabo brevi; »paJk lanoeolatU acuminatis virl^.fcv^saUba. margins integerrimis; petalis longioribus lanceolatis apicem versus ciliato erosis cuspidatis sordide flavis ad basin intus filas^ tUqn. brsvibn. rnWcnn. dis ; stylo supra stamina «s»rto; atigmatihaa 7-10 flaris; baccis oblongis virescentibus. — Ith the preceding. Flowers opening for two or three days, in direct sunshine, 2 inches or . On account of the central flowers, this should form, with *M. vivipara,* a distinct section. From that species it abundantly differs, not only in the color of the flower and the spines, but in the entire and smooth sepals, denticulate petals, etc. [This pretty species has also flowered in the Cambridge Botanic Garden.]

I. EcaiKocAcrcs siTisninTS, a. sp.: •aha^ohosaa, spies ;,:osas; co»tk plornmqne IS acatk aahobliqnk; smlek 15-18 CucicuUtk teaaibus fleinosk nsviraaU.fo.rk, aaperioribus *IS* sloagstM, 1 S eentnlihaa loagiaatmk ertvtk, cartark rsdiantibas; floribus minutk soliurik e maraU rsHsfasatiaa tapra fasdcalos sculeorum ortk; srpalk ia tabam oaarrHls. saicihas UberU Uu ovatk atamlastk acmrkok margiM Amhrktk; fraetibaa . . . ; aeminirios ovatk aigrk opaek miantim taharealslk. — Moakit-thirkeU, oa tho Cnlorado River. Near *K.* <r»»ua«»iu, link 4 OtU, from Bfasil. Our specimena are about 2 inches in diameter and 1) inch high, with pretty sharp ribs separated by deep grooves. The longest spines are 15 lines long; flowers about 6 lines long.

6. E. LINDBUMEKI, n. sp.: hemiapherieo-depreaaus, vertice tomentoao ; ooatk 21 verticalibus acutia aubnndulatk; apinis a cicatrice ovato-lanceolata tomentoaa ortia (aaciculjitia comprraaia cinerso-rubvllia tranaversini annulato-atriatia, extorioribua 6-7 insstinalibos radiantibus subrectk centrail recurvaU multo brevioribua ; floribua e vertice drprcsso tomentono rx axillit faariculonun spinamm hornotinornm pfovcnientiban conftrrtiasimiii; srpalU (80-100) in tnbom brevsm infnndibuliformpm lanomim malitia Unceolatia spinoao-aristatia, intrrioribns margine fimbriatu; [247 (S9)] peUlia (40-60) lineari-oUoogk margine fimhriatoUccriH a|>u-e bilidk ariaUtia; atajninibns nuinerosksimk ««iuahbii8 fD◂ luais e toto tubo ortia stylo oom|irvsso brsviorlbuj; stigniate inrgulariur 14-17-fido. — On deserted anthills, nrar the Colorado River. Often a foot in diameter: oar specimen* are 8 or 9 fncbss in diameter and 4 or 6 inches high. 8pinea strongly annuls**, stoat, ths kffer ottss often 2 incbea long. Flowvrs aboai 2 inches In length, twclts or more afQrrrgatrd in the woolly centre. The petals at the bate are srari«*t, verging to orange, from which s pals *mr]Ae* or violet midrib extends to the spas, and k prolonged into s deli.<au» hrUtk of the asm color, while the upper part of the petal is pearly white, with feathery margins, Ths flowsrs remain for thrw days, sipsnding only in bright soashiDS.

7. TskKt's cAsrrrosi'*, a. sp.: ovalo-globosaa demum eyliadricus, amc« deprasso-umbiUoataa; coatk sub-16 s tuberrulk conflueatibua ortk rsctk; scaWk aumsrosk si arroia oblongis albo-tomentosis demum glabratis radiatis nunc ftrarvk. Islmlibits loagMbas ; floribas ex axUlk tahareaiorum snni prftork Islstmlibas; ovario ohloago tubercuik s Una villoaa spiaigtrk stipato; srpalk 40-60 s|4ot spiak ertifbrmibas vilkiqas ooroaatk virsaeeaUbas. intimk laar«oUtk acaa^aato-o^klalk giabrk oolstalk: psaatk 10-40 a pi* eem versus ciliato-denticu*tis, exterioribus subito acuminatis, iatsrioribas obtask es^rXlatk; stoiaiaibas iarlask stylo brtviorihas; stigmau viridi IBJfundibuliformi 12-partito. — OraT»lly soil, asar Cat•Aftiag. wsst of isa Felipe. A singular reduced CVrvoa, qaiU rsf|4Uf^ sad sevn proliferous eccasionally, la list maoaer of Opaatk. Wciaaiag m flower whoa oaly 2 iarhas high, sad smrrely taJWr thaa broad, bat attaiaiag tho hoigat of st bast 0 iarh*» ; the ribs from It to 17. It k ia flower for two dart; tb* flown abaal 2 lacbs* bmad «h#a fWfy eipsaiM. Teula rosswi purple. roddkh at th# bats, yellow al the summit.

PART II. FROM BOSTON JOURNAL OF NATURAL HISTORY, VOL. VI. 1850.

Mr. Iindheimer has again sent many living specimens of Cactace® from New Braunfels, San Antonio, the Pierdenales, and the Liano. Among them I not only recognized all the species described in Plant Lindh. (Boston Journal, VoL V.), but found also a number of new forms. From other sources I have obtained other species from the lower Rio Grande. All these will be enumerated here in order to complete, as far as possible, the catalogue of the Texan Cactaceae. A correspondence with Prince Salm Dyck, — than whom none is better acquainted with these curious plants,—and his examination of living specimens of most of the species, enables me to give this revision an authenticity not otherwise attainable.

MAMILLABIA.

{ 1. FRDCTU VIRIDI, OVALI ; COBOLLA PBHSISTENTE; MSTA BEMINUM PRROAMENTACEA FUSCA; FLORIBUS xx ^TTTT.TR TUBEBCULOBUM HOBNOTINOBDM.

M. CALCABATA. *M. tukata,* Engelm. PL Lindh. L c^ non Pfeiffer. Near *M. $evlymoidu,* Schdw., but sufficiently distinct, according to Prince Salui. — Rocky and hard, clayey soil, on the Upper Guadaloupe. My [196] specimens from there are mostly densely cwspitose; tubercles in thirteen oblique rows; proliferous groove producing the buds always near its upper end. Flowers 2 inches long and 2 to 2£ inches in diameter; sepals (or rather outer firmer perigonial leaves) 2i>-35; petals (inner more delicate petaloid perigonial leaves) 30-36; yellow (dirty yellow only when lading), reddish at the base.

M. OOMPACTA, Engelm. in Wisliz. Rep. note 32, from the mountains of Chihuahua, is mentioned here only in order to add to the description of the plant that of the flower, which I have had occasion to examine in the living •tate.- Floribus in vertice dense lanato centralibus; sepalis (17-19) lanceolatis acutis integris (rufescentibus, interioribos margine llavis); petalis (28) oblongo-lanceolatis mucronatis versus apicem denticulatis (sulphuteis) ; stigmatibus 7_a cuspidatis flavicantibus supra stamina (sulphurea) paulo exsertis. — Flowers at the end of June and beginning of July (in St Louis). Flower-bud dark reddish-brown; flower about 15 lines long and of the same diameter! Petals 6 lines long and If Unas wide. Stigmata 2 lines long, cuspidate, as in *M. vivipara,* while all other species known to me have obtuse stigmata.

M. RADIOHA, n. sp. • simplex s. parce prolifera, ovaU seu cylindrica; tuberculis teretibus supra plus minus sulcatis apice ex tomento albo aculeatis; acnleis rectis numerosis valde iinequalibus, plurimis (20-30) radiantibus tenuiorihus albidk centralibus 4-* robustioribus fuscis s. rarius flavis, 3-4 suwum directis, singulo deflexo; axillis nudis,sulcosubtomentoso; floribus (violaceis) ex axillis tuberculorum homotinomm ortis sparsis (nee centralihu*); aepalis petalisque lineari-lanceolatis acuminaUs arisUtis ; sepalis (40-50) arachnoideo-fimliriutis, exterioribns brevioribus adpressiTinterioribus longioribus recurvatis ; petali- (30-40) integris s. basi subciliatis patentibus; staminibus (violaceU)numerosissimisii).iualibu«; stylo longe exserto; stitfnaiibus 7-9 (vioWin) er^ti* obturis; bacca oUonga viridi floris rudimento coronata; seminibus fulvis ovatis scrobiculuto-punctutis.-Sterile, sandy soil on [197] the Pierdenales • flowers (in 8t. Louis) about the middle of Juue, The flowers open for three days, in direct sunshine onlj and later than most other Cactace*,—namely, from twelve or one till three or four o'clock. Stems 1-4 inches high, about 2 inches in diameter, dark green; tubercles in 13 oblique rows;* radiant spines 3-4; central spines from 4-6 lines long; flowers I*-** inches long, and about the same diameter when fully open, of a lighter rTiolet color or of a splendid dark purple; stigmas deep velvety purple. - Very near *M. tivipara,* Haw., which hat been found from the Upper Missouri to Santa Ft This, however, is distinguished by its low, mostly caspitose growth, by the smaller number of radiant spines (14-18), the absence of the deflexed central spine, the smaller *central* flowers, the apiculate stigmata and smaller seeds; it alto flowers earlier (in St Louis about the middle of May), but, like if. ruKoso, opens the flower* only after twelve o'clock. In *M. vivipara* the youngest tuliercle* produce in their axils the flower* which timear central, and mnain so till after fructification, whereupon new tubercle* are developed in the centre, and the touhfffroit is punned aside and becomes more and more lateral. In AT. *radiom* the flower-bod, *m*: nffroit is punned a bl f the seawn but are immediately pushed aside by a continu also formed in the axils of the first young tubercles of the seawn, but are immediately pushed aside by a continuous growth of more tubercle*; the buds, as well as the flowers and fruits, are therefore lateral. *M. vivipara* has not yet beea found in Texan, though it may be expected iu the mountainous regions bordering New Mexico.

• It will hwfy b. Mewr to mentioa that tbm «• •mnldUfrraatMtaorraMortabmelMobvrmhl*; lwtow Mt U OMully Bon dbtinot than th* otWm. Th^rd^nd on the sin of the plant, and tbt numb*, siss, and closeness of the tubercles. It is well known that in different specmens of the sains special they tarn ID dthsr side, right or left.

§ 2. FBUCTU COCCINBO J COROLLA DBCIDUA.

• *Fructu davato elongate; seminum testa pergamentacea, fiuca; eauU rimplici, iueeo laeteo; floribus ex* [198] *axillis tubereulorum anni priori*.**

M. APPLANATA, n. sp.: simplex, depressa ; tuberculis elongato-pyramidatis subquadrangulatis apice ez tomento albo lanoso deraum evanescent* aculeiferis ; aculeis rectis 15-20 tenuioribuB inoqualibus radiantibus, singulo centrali rolmstiori erecto ; axillis nudis ; floribus sonlide albidis s. rubellis ; ovario glabro, sepalis 8-13 lanceolatis; petalis 12-18 lanceolatis mucronatia, intemis versus apicem fimbriato-denticulatis; stigmatibus 5-8 stamina brevia paaca flavMa longe excedentibus flavis; baccis elongato-clavatis; seminibus sub^loboso-ovatis scrobiculatis ragulosis parvis. — Rocky plains on the Pierdenales; flowers (in St. Louis) in May. Flowers forming a circle or wreath, ift the larger specimens, of 1-1} inches diameter, around the growth of tubercles of the siune yeqr, while the scarlet fruit is frequently still persistent, and forms an outer circle. Plant 2£ to 4A inchef in diameter, 1-2 inches high, with an almost level top and depressed vertex; iu larger specimens 34, in smaller ones 13 or 21, spiral rows of tubercles are most conspicuous. Radiating spines 2J-6 lines long, whitish ; the 3 or 4 outer or lower are stouter and very light brown ; the central spines erect, or rather somewhat inclined upwards and inwards, 2-4 (mostly 3) lines long, light yellowish-brown. The innermost tubercles of the preceding year appear to produce the inconspicuous flowers, which are from 9 to 12 lines long, urceolate when not fully expanded in bright sunshine. Berry 8 to 15 lines long.

M. HEMISPHERIC A, n. sp.: simplex, hemiaphtcrica; tuberculis elongato-pyramidatis subquadrangu- [199] latis apice ex tomento albo brevi mox evanido aculeiferis ; aculeis rectis, 9-10 tenuioribus innqualibus radiantibus, singulo centrali robustiori porrecto; axillis nudis ; floribus sordide albidis s. rubellis; ovario glabro; sepalis sub-13 lanceolatis acutis vel obtusiusculis; petalis sub-13 oblongo-lanceolatis rnucronatis integris s. versus apicem denticulatis; stigmatibus 5-8 ex flavido rubellis supra stamina numemsa rubella exsertis; bacci* elongato-clavatis ; seminibus elongato-ovatis rugulosis minutis. — Below Matamoras, on the Rio Grande; brought home by the St. Louis Volunteers in 1846 ; flowers (in St Louis) in May. Wry similar to the last species, but well distinguished by the hemispherical shape, the much smaller number of shorter spines the less woolly areobr, and the much smaller, leas rough, and lighter-colored seed. I can see no essential difference in the flower. Body of the plant 3-4} inches in diameter, 2-3 inches high ; flowers 10-15 lines long and about the Mme diameter when fully open in the forenoon sun, urceolate in the afternoon. Radial spines 2 or 3-4, the central spine 2-3 lines long.

M. QUMMinciu, Engelm. in Wisliz. Rep. note 33, has now flowered with me, and proved, as was expected, similar to the two foregoing species. I add here the description of the flower. — Fluribus rubellis; ovario glalwo; sepalis sob-13 oblongo-linearibus obtuniusculis timbriatis; petalis 16 lanceolatis breviter acuminntU denticulato-enafc; stigmatibus 6 stamina brevia rubella longe excedentibus petala suhsxinantibiis virescentibus. — Flower 15 lints long, 5-18 lines wide when fully open, brownish-red ouUide, the petal* reddish-white, with dark red in the middle. Flower larger than that of *M. applanata,* much darker and more elegantly colored; style longer, etc. Fruit not seen.

• * *Fruetu svhgkboso; seminum testa dura nigra; cnult prvli/ero (an sempsrt), sueco aqueo; floribus em* [illegible] *tubsreuhnm* [illegible]

M. NUTTALLII, Engelm. in Plant. Fendl, from the Upper Missouri. The only specimen I possenstd [«00] wat unfortunately destroyed. - *MamiUaria simUis,* Engelm. in Plant Lindh. 1. c.[f] first discovered *by* Mr. ^"Whe>"w near the Bram, has since bem found by him w>uth of the Ouadal.mpe, abont New Bmnnfela, and on the PMrdende*, in several forms. It has frequently flowered with me, and annually produces abundant frail I substitute the following character and description.

M. *iiuiu** : subsimpkx s. plerumque caspitosa; tuhertulis ovato^ylindnuwis supm plus minus sulcatin (sulco in junionbus br«n versus toiuentoso ss^pe prolife^) axiiU tnmentosis ; tiroU albo-tomentost demum nuda; aculeit l(>-ia rectis albidis rmliantibus tenuioribus s^tulibms centrali nullo s. sin-ulo mbustiori ; floribus ei axillis tubtrcu-lorum nornotinoram suhcentralibus s. dtmum latt-mlibus (flavin s. ex mbello flavkantitHis); sepalis peUlisque Un«ri-biiesolaUs acuminato-aristatiii; ^ptlu 15-J5 ciliato-ftmUrUlis ssipe plus minus recurvis; pitelis 80-30 finttgris a. \mi subciliatis; stigmatihus *M* vif^cenUlms supra mmiiia numeimiesimm exsertis; baecm obovmto^ubgloUism cocanea; seminibus nigris suhglobosk soobiculatis majoribua,

[0] It has been stated ovtr snd over agOa tkat all the *C** *tacem partdUlm* (with cotyMoos parallel to U» mort or U* eoupresspd sid^ of th« sesd, ste Wislii. Rqk pp. 91 ami PS) prod** tks flowers from ths ssms ysar's giowtli, sod tb. *Oadntmm etmirnrim* (rotyMons rootrmry to tks *tnm*[illegible] sidoiaf thotoM.) from that of tfcs lost ptosstllnger [illegible] years. la Wlslls. Bqk 1. c, I have sUtH that sottt Mamfl-larks ptnbably *hnmd* an fxcvplioa to that mlt. Wbal wat a supposition tbfn I havt *>inc«* asmtainsd to W Ibt łact Tbforfrwsporioi, *homwrrr.* art tbs onl ? OMS in vkidl I fcm at yel ohssmd this *xorptio*.

a. CA8PIT08A: gracilior; aculeis radiantibus sub-12, centnli subnullo; sepalis 16-20; stigmatibus sub-5.

0. BOBUSTIOB: subsiniplex; aculeis radiantibus sub-10, centrali robustiori; sepalis 20-26; petalis 26-30; rtigmatibus 7-8. Flowers (nt St. Louis) in May. —Stems 1J-2J inches high, obovate, of smaUer diameter; tubercles in a. 8, in 0. often in 13 rows ; spines 3-4, in 0. 4-8 lines long; central spine, when present, 6 lines long. Grooves proliferous towards the upper or the lower end. Flowers 1J-2 inches long, and of the same diameter when fully open, radiating like stars with their pale yellow, silky lustre, giving this species a most beautiful appearance when several open on the same morning ; petals 12-16 lines long and 2 lines wide. Berries 3-6 lines in diameter.

ECHINOCACTUS. [201]

The specimens described in the account of Liudheimer's plants under the name of *E. $etuptnu$* were the most northern and rather diminutive fonns*>f this beautiful species ; the flowers were incorrectly described from a withered bud adhering to one of the specimens. Numerous plants have since been sent by Lindheimer from San Antonio, and by the St. Louis Volunteers from the lower Rio Grande.

E. BEK8PINU8, Engelm. L c.: ovato-subglobosus s. oblongo-cylindraceus; costis 13 acutis sepe undulatis s. subinterruptis plus niiuus obliquis; areolis reniotis, junioribus flavido- s. albido-tomentosis; aculeis radiantibus setifonnibus 10-16, suminis longioribua imisque flavicanti-fuscis, lateralibus albidis, centrali subsingulo robustiori fusco flexuoso s. apice uncinato; floribus solitariis nudis infundibuliformibus, tubo glaberrimo; sepalis inferioribus bnsviorU>us obtucis s. cuspidatis 26-40, superioribus elongatis lanceolatis 16-26 omnibus raargine membranaceis basi auriculato-cordatis tenuiter ciliatis; petalis 20-30 (cum basi miniata flavw) oblanceolatis acutis integris s. denticulatis; stylo supra stamina rubella longe exserto; stigmatibus 6-8 sulphureis recurvis a, erectis; bacca pulpoea globosa rubra rudimentis sepalorum infimorum membranaceis stipata.

a. HAMATDS : major, subovatus; acuieis radialibus 10-12, centrali robustiori hamato. *E. Kamatut,* Muhlenpf. *E. MuhUnpfordtu,* Fen.

p. 8BTACBU8: minor, subglobosus; aculeis radiaUbus 14-16, centralibus 1-3 setiformibus flexuosis. *E. utispinut,* Engelm. 1. c — Texas, from the Colorado to the Rio Grande. Flowers from April or May to October, and therefore, on account of iU beautiful flower, one of the most valuable species for cultivation. — Plant 2-4 inches in diameter and l*-6 or 8 inches high ; flowering when quite small, simple or (in cultivation at least) sometimes proliferous at base. Var. a. is the larger southern form, with fewer, stouter, and longer spines (radial 6-16 lines, central 12-16 lines long). Var. 0. is the smaller, more northern form, with more and thinner spines (radial 6-10, central [202] li-16 lines long). Flower from 20 to 36 lines long and 24-30 in diameter when fully open; petals then often somewhat recurved; flowers open two days, only in bright forenoon sunshine. My specimens from the Rio Grande have 6 erect stigmata and a longer flower; all the others have 6-8 spreading or even recurved stigmata and a shorter flower-tube. Berry about 4 lines in diameter. Withered flower finally deciduous. Fruit often bursting, when the filamentous red pulp and the black, thimble-shaped, verrucose seeds are seen. This pulp is formed by the ckvate, elongated, twisted funiculi, which most probably form the pulp of all the soft Cactus fruits; but they do not always remain as distinct as in this species.

E. Tixnren, Hcepf. *E. Lindheinuri,* Engelm. 1. c Mostly depressed, but sometimes globose. Common from the Colorado to the Rio Grande, and from thence to Saltillo (Dr. Greg*). Near New Braunfels it prefers the so-called-Mtukit-flat*, or fertile level places with muskit-trees, overflowed in the rainy season. My specimens have several times fructified. Berry subglolwse, pulpy, red, about 8 or 9 lines in diameter, covered with spiny bristles and soft wood, crowned by the woolly remains of the flower; seeds reniform, compressed, large, smooth, and shining. Ribs in smaller specimens 13-14, in larger mostly 21, sometimes 24. Areola about 6 lines long and 12 lines apart. 8pines from 6-10 lines long in some, 16-26 lines in others; sometimes the central spine is 2 or 3 lines broad. Floweis ail open within a few days, in May (in St. Louis) ; unlike the last-mentioned species.

CEREUS.

402. 0. C«Pm»C8, Engelm. Plant. Undh. 1. c. Common about New Braunfels; in flower in May. — This plant has been cultivated in Europe, as Prince Salm informs me, under the name of *Echinopsis Rntkm-*taMma, Hortul., and has been confounded with *C. pectinate.* Compare Wisliz. Rep. Appendix, note 46. [803] This species hs* also been sent from 8altillo by Dr. Gregg. Mr. Lindheimer has sent from the granitic region of the Ti-jA a beautiful varietj with chestnut-brown spines. 0. CABTAVBUS. — The characters given in Plant Lindh. to this species have been corrected in Wisliz. Rep. 1. c. I add here only that the fruit of this, as well as of •U the other northern Cerei seen by roe, ripens within a few weeks, - contrary to what is observed in our Mamillarbs and Opuntia, — and mostly bursts open longitudinally when ripe. — I cannot omit sn interesting morphological observation made on this species. The usual structure of the flower of all Cerei observed by me is the

following. The ovary is covered with very short and (for the greater part) adnate sepals; the adnate part forms a protuberance (tubercle) ; the free port is mostly very small, often only a minute deciduous scale. In the axil of the scale we find the *areola,* covered with a short tomentuma, long wool, and almost always with bristles or spines. All this together forms the *pulvillus* of authors. Next in order follow those sepals which form the tube of the flower. The lower of these are entirely similar to the sepals on the ovary. In the upper or interior sepals the tip, or free part, becomes larger and larger, more herbaceous, and finally more or less petaloid; the wool and bristles become scarcer, but the latter longer, and are produced from an areola which is almost always situated in the axil of the sepal, where its free part separates from the common tube. Now, in *C. caspitosus* the free upper part of these sepals of the tube is more and more elongated, somewhat terete, not foliaceous, and bears the areola with its wool and bristles just below the subulate or (in the innermost sepals) somewhat foliaceous tip, reminding us almost of the tubercles of a *Mamil-*" *laria.* The descriptions given in Plant. Lindh. and in Wisliz. Rep. have to be corrected accordingly.

C. PROCUMBE38, n. *p.: humilis; caule subtereti s. angulato articulato ramosissimo; tuberculis aculeiferis dbtinctis 4-5-fariis ; areolis parvis orbiculatis, junioribus breviter albo-tomentosis; aculeis brevibus tenuibus [804] albidis apice fuscis, 5-6 radiantibus, centrali singulo erecto paulo longiore ; floribua diurnis; ovario tuboque brevi pulvillis sub-40 albido-villoris setas spinescentes breviores fuscas C-9 gerentibus stipato; sepalis interioribus sub-15 lineari-lanceolatis acuminatis; petalis 18-20 oblongo-linearibus acutis mucronatis Bubintegris (violaceis); stigmate viridi infundibuliformi 10-partito stamina (pallide flavicantia) paulo superante. — On the lower Rio Grande, below Matamoras, collected by the St. Louis Volunteers in 1846. — Plant spreading, 3-5 inches high. Joints or branches 1J-2 inches long, } inch in diameter, much contracted at the base. Tubercles 4 or 5 lines distant from one another, —often in 4 rows, whence the plant derives a distinctly quadrangular appearance ; or in 5, when it is more cylindrical. Radial spines 6, or mostly only 5, the uppermost being frequently abortive, 1-4 lines long; central •pine 1}-2} liues as long, stouter, directed upwards. Flower 3 indies long, and as wide when fully expanded, of a delicate purple color; petals 4 lines wide, often, in a bright noonday sunnhine, recurved. Bristles on the tube about twice as long as the wool, below 1J-2, above 2f-3 lines long. — We have in gardens in St. Louis a similar species in cultivation under the name of *C. Deppii,* but, as Prince Salm informs me, widely different from the true *C. Deppiu* It is not known whence it wan obtained. It is distinguished from *C. procumbent* by the larger, thicker, more cylindric limbs. Tubercles elevated, very distinct, in 6 or 6 rows ; spines weaker and longer ; 6-6 radial spines'5-6 lines long; ventral spine from 5 to 14 lines long; flower with a shorter tube, fewer pulvilli, with shorter wool but longer and weaker bristles.

C. Roucni, n. sp.: oratas, e bad ramosus; costis sub-8 (7-9) tubemiLitis interrnptis; areolis orbiculatis, junioribus breviter tomentoiis; aculeis albidis s. flaviduli* demum cinereis teretibuft, rarlialibus sub-8, eentndi singulo lobmtiori pometo; floribus diu noctuque apertis infundibulfennibus, limbo ereetiuscnlo; sepalia ovarii at tuW 17 squamoms in axillis ez tomento albo bi*vis*imo setas spinescentes albidas 3-5 gerantibus; sepalis [S05] interioribus 8 ovato-oblongis carinatis obtusis mucronatis; petalia 10 obovato-epathnlatia obtusis integriscon-cavis chaitaceis (coccineis); stylo longe supra stamina numerosisnima eiserto; stigmatibus 7 aentiascnlia erocto-petulis Yiridibus.—Granitic region about the Liano; (lowers (in St. Louis) in May. — Named after my friend Dr. P. Roemer, of the University of Bonn, who was the fin* to explore the geology of western Texas, and brought the first specimens of this species. Sent also in numerous specimens by Lindheimer. Heads 3-4 inches high, l ^ t" * * « in diameter, single, or mostly 3-5 or even 10 from the same base; ribs interrupted; areobs 4-8 lines distant from one another; ladial spines 5-12 lines long; lateral spines longest; upper ones usually shortest; central spine 10-15 lines long. Flower open by day and night for four or five, and in oool dondy weather as much as six or seven days, S inches long and 1 wide; petek 8-0 lines long, 5 lines wide, stiff; bristles on the tube 8-3 lines long. — The stiff and almost per-gamentaceons petals are uninfluenced by sunshine or darkness like those of most other Ckctacee. 8everal other northern species most probably agree in this particular, as especially C. *eoedneus* and *C. trigloehidiahu* of New Mexico, while other nearly related species have certainly diurnal flowers. — *C. cocrituui* diffen by the more numerous riba, more numerous spines, larger and more crowded areola, etc *C. polyaeanthus,* Engelm. in Wislix. Rep., has more numerous spines, and 10 ribs; *C. enntacantkui,* Eugelm. 1. c, is larger, with the tubercles less distinct; 10 ribs; spines larger, angular.

C. VAUABiua, Pfeiff., with its beautiful white nocturnal flowers, delighted oar volunteers in their camps on the lower Rio Grande. Young plant* are procumbent, with terete or rather clavate branches; adult plants several (3-10) feet high, mostly triangular, with very long and stotit, or sometimes quite short spines. Fruit large, luscious, with red pulp; seeds large, smooth, shining.

OPUNTIA. [206]

$ 1. APPLANATA.

O. if ACBORRIZA, n. sp.: prostrata; articulis obovato-orbiculati. planiusculis j pulvillis setis fuscis et tape sculeis ringalis binisve instrnctis ; aculeis teretibus validis porrectis s. paulo deflexis basi apiceque fuscis ceterum albidis cum adventitio inferiors graciliore reflexo wepe deficiente; floribus sulphureis basi intus rubellis; ovario sepalis subulatis deciduis 13 in axillis setulas fuscas brevissimas gerentibus stiputo; sepalis interioribus 15-18 subulatis et (internis) ovatis acuminato-cuspidatis; petalis 8 sepnla superantibus late obovato-spathulatis obtusi* cuspidatia eroso-denticulatis; Btigmatibus 5 olitusis, adpressW, stamina nunierosa nquantibus; bacca subpulposa clavata glabrata; seminibus marginatis. — Naked, stirile, rocky place* on the Upper Guadeloupe. Flowers (in St. Louis) in June. Root a large and fleshy tuber, sometimes 2 or 3 inches in diameter; joints 3-4 inches long, about 2J-3$ wide, hardly attenuate at the base. Leaves subulate, about 5 lines long; areoLe f-1 inch distant, more crowded toward the base and on the edges; spines (often wanting) 1 inch long, the smaller 4-6 lines long. Flower 3 inches in diameter; ovary 1$ inch long; petals 1 inch wide, 1} inch long, pale yellow, red at the base. Fruit 1* inches long; the strongly margined seeds comparatively few, 21 lines in diameter.—I have found the same plant in similar situations in western Arkansas; and it is possible that it may be one of Nuttall's new species (0. *maacantha, 0. ta$pUota,* or *0. humiftua)* of which I cannot find a description. — Nearly related to *0. wlgamt.*

O. INTERMEDIA, Salm. The species mentioned in Plant Lindh. L c. No. 1, has since produced abundant flowers and fruit, and proves to be the above plant It is near *0. vulgarit,* but more erect or ascending; the joints much larger; flowers larger (4J-6 inches in diameter) ; ovary more slender, 2-2* inches long, with 20-26 subulate sepals; petals obcordate ; stigma 6-lobed, erect; fruit 2* inches long, 6-« lines wide at the top, deeply umbili- [207]
cate. Iindbeimer's specimens are from Industry, south of the Brazos. I believe I have seen die same species near Natchitoches, ou Red River.

0. LINDHEIKERI, n. sp.: erecta, robusta; caule lignow; articulis (niagnw) ellipticis basi attenuatis planis; pulvillia remotis ad margines confertioribus griseo-tomentosis, setis flavidis aculeisque paucis instruct!* 1-3 compressU validis deflexi. vane divergentibus stramineis, nunc cum 1-2 aculeis adventitiis gracilioribus; flore • . bacca clavata elongate subpulpo* gl.br.ta; seminibus late marginatis. - About New Braunfels • Plant erect, often 6-8 feet high; •tarns terete ligneous,sometime. 6 inches in diameter, with gray bark, and very light, spongy wood. Larger joint. 9-12 inches long 5-7 broad. AreoUo 1f-2 inches distant on old joints; bristles on them 1-3 lines long. 8pines all P«le yellow, much compressed, indistinctly annulated, i-1 inch long, various; the 3 longer spines, or the 1 longer, with I or 8 shorter spinea. The froit which Lindheimer ha. sent as belonging to this species resemble, very much that of *0.wharU.* 8-2* inches long, slender, with a deep umbilicus, very different from that of the following species. Seed. 2-2iUne. in dUmeter, not numerous. Young planta grown from this wed have the same compressed spines, but are brown at the b«e; the lower areol. produce no spines, but a quantity of long, coarse hair. -1 add here the fidlowing specie., though not properly belonging to the flora of Texas, because I suspect that it » also found at the moathof theRfo Grande, within the limit, of Texaa. There, and especially on the barren sand islands at the Brazos, ^PobtlJEl^TSN2IvoLteer. found large «d impenetrable thicket, formed by anOpuntiawith Luge jotata, covered with almct glol«- fruite, with innumerable small seeds and a very luaeiou. deep red pulp. The fruit •ad seed ar. before me, but unfortunately I did not obtain a living .pecimen.

O. EHOEfMAHHi, Salm *mm.:* erecta; articuli. orbiculatc-obovati. planiuscnli.; pulvilli. remotU ad [806]
margin- eonfertioriTu. gri^o-tomentosis Mti. flavidU aculei^ue paucu compress anc,P.t,bu. inrtruct^ W TdMhwpe in^oaUDU. plus minus defied. Tarie divergentabu. b*. rufis ceterum -trammel- cum adventitio infirno gr^orealbidr.sn>edeneiente; «________baccaovatasubglooosalate umbibcatapulvillupluribustomento«HStipata; ^ Z n ^ Z Z T ^ - F i - n , BP^toChW™, indigenous and cultivated (Dr. WUlbenus). No donbt *Z r d t J i M e* of the Rio del Norte. - Erect, 5-6 feet high . Upper and larger older joint. 18 inches Ions bv 9 broad Areol. 1f-2 inchesdirtant; bristle. 2-6 lines long; spines 1-1f inches long, very steut FWi i H f t t h S t a i H - dimeter; umbilicus ^<.»™NJ->. f- . ^ on the fruit about 5 lines di-tant. Seed, very numerous about half a. large a. *0. mlgam,* 1*-1f line, in diameter, of an irregular shape. - Neat 0. *DiUtmi* and *0. polvmti*, u* Pri»« *Stim* infom, me-

{ 2. CTLINBBICiB.

O mmenL Enoelm in Plant Lindh. L c under *0. fragilU,* from which it widely differa, stand, near *0.* ^ U. (^d «Sn Mexican a-ds). but b . * M r * * * * * * ** * ^ f ^ m rf th d« *rnt* often sterile -1 bad oecaaion to observe this .pedes in blowom, and add the description of the flowers t

ISTrit . x ramU^TS orf rovri inb ovrfo cUvato ba« 6^ono ^p.li. .ubnUtb .ub-13 stipate« «palis interiorfbus 8 lanceolatisZ XwJpbureis petalis 8 obovate-lanceolati. c»pid.ti. (wlphur«. a. «bvi™*e»tibu.)S

staminibus numerosis (40-50) inaqualibus (externis majoribus); stylo ezserto; stigmatibua 5 adpreeais albidis. — The flower cannot be distinguished from that of the *Opuntüz applanaUB,* but it is only 8-10 lines in diameter; ovary 9-12 lines long. Flowers (in St. Louis) July and August.

O. ARBORESCENS, Engelm. in Wisliz. Rep., is recognized by Prince Salra as identical with his 0. *sUllata;* but as no description of his plant has ever been published, he adopts the above name. [209]

IV. NOTES ON THE CEREUS GIGANTEUS OF SOUTHEASTERN CALIFORNIA, AND SOME OTHER CALIFORNIAN CACTACEiE.

FROM THE AMERICAN JOURNAL OF SCIENCE AND ARTS, SKCOND SERIES, VOL. XIV. Nov. 1852.

IN Emory's "Notes of a Military Reconnaissance," published in 1848 by order of Congress, I have ventured, from the data furnished by Colonel Emory, to describe one of the largest Cacti ever known. Since then several travellers have met with this giant of the Gila country, and have confirmed the extraordinary accounts of the first discoverer. But no further scientific details were obtained till Colonel Emory — now again in those regions as the chief of the scientific corps of the United States Boundary Commission — had occasion early this spring (1852) to send an expedition down the Gila River. Dr. C. C. Parry, who was connected with this party, paid particular attention to the Cacti of that region, and made it an especial object carefully to examine the *Cereus giganteus.* From his very full notes, kindly communicated by Colonel Emory, I have completed the description of the plant, with the exception of the flower and fruit, the account of which rests as yet on the verbal information obtained by Dr. Parry.

Clftius GIGANTEUS, Engeim. in EmoryV R<*p. p. 138 : erectun, elatuit, simplex, ssrpiua parce ratnosus; [33G (2)] nunis erectis eaule cylindrico versus apicem sengim attenuate brevioribu* ; Venice parum depreaao lanato ; coatia ad basin IS Terras apicem 1H-2O rectia cotnprmin obtusiusculis (versus basin obtuaiavimi*) eubrepandia; atnabna profandia angoatia; areolii proniinpiitibus orbiculatis alhido-tomentosis; aruieia rectia, radiolibua 11-17 brevioribna •etaeeie albia, eentralibus 6 robust iori bus longinribus (quorum imaa mhu*tis*imua deflexu*) tenuiter aulcatia'albtdia bfjai bnlboam nigria apice rabellis ; floribu* . . . barra . . . seminibus oblique oboTatis nigrie heribua lucidia.

Dr. Parry found thin splendid speriea, which the Indians name "Suwarrow," in rocky crevicee and on gravelly tabte-lande, from Tucson north to the Rio Oila ; he learned thai it also occurs in Central Sonora, near the heads of streams which empty into the Gulf of California. Colonel Emory otanred it in 1646 from the middle towards the lower Oila; and Dr LeConte, who explored California in 1850, inform* me that he found it "common along the Oila to within thirty miles of its mouth, where it suddenly disappears." It in no doubt the same plant of which Humboldt makse mention in his work on New Spain (II. p. 225), where he aaya that the Spanish missionaries found •I the loot of the California* Mountains nothing but aaud or rocks, on which grew a cylindrical Cactus (Organoa del Tunal) of extraordinary height

Sterna 25 to 00 feet high and 1 to 2 feet in diameter, not absolutely cylindrical, but thickeat about the lower third, where generally the few (mostly g-3) alternate or sometimee opposite branchea start, and from thence alightlj tapering toward the aummit. Sterna and branchee marked by superficial traverse furtowa, indicating, aa it seema, the annual periods of growth, forming rings of 4 to 8 inches in height Branches unequal, and always of leas height than the main stem, mottly 5-10 feet long, with 12-18 riba.

Theatem consists of an exterior fleshy aubatanoa, M incbee in thickness. This enclose a cird. of bundles of lig^Qbr^comaponding with the infrrd. between the riba. Th«. bundle, are of a *loom* textur,, but tough and elastic, and form continuous columns or sticks of J to 3 inchee in dJanttor, frequently anaatonoaing. increasing in thiekneaa ti>wanla the base, and swelling into irregular, knotted, horiiontally spreading roota. Thia frame-work remains after the decomposition of the fcehy parta. Tha exterior fleshy Useue paaaea between the btndlee, and furms in the centre of the stems the pith, of 4-6 inchee diameter.

The riba are moatly Tertical, at the bate about 12 in number, broad, rounded. 4 inches or more wide, with broad and shallow intervale (alao 4 or 6 inches wide), worn, and destitute of epinea. UpwanU fW7 (J)| ts^»»WcilriUiiM;reaseab,WfufcalionforaildiU riba originate in the intervals. There tU riba » - efcarply roun.le4l," 1| inch wide, with deep intenrak 2| inchea wide, densely set with pins*. Anolsj

elevated, circular, an inch distant from each other. Radiate spines f-f inch long ; central spines stouter and longer ; the lowest deflated, 1J-2J inches long, the two next lateral, the three upper ones pointing upwards and outwards! and shorter.

Dr. Parry was informed that the flowers were produced in May and June, from the summit of stem and branches ; they are said to be white, with a red centre, and 3 inches iu diameter. The fruit matures in August, and is set with small spines; it is obovate, lj inches in diameter, red, pulpy, of sweet taste. The seeds obtained by Colonel Emory and by Dr. LeConte have already been noticed in Emory's Report; they are 0.7 lines long, obovate, obliquely truncate at base, black, smooth, shining. Embryo hooked, without an albumen; cotyledons foliaceous, unequal, incumbent

My opinion that our plant is a true *Cerewt,* and not a *Pilocereus,* which was based on the structure of the seeds (the foliaceous, not globose cotyledons), appears to be further confirmed by the fact that this Cactus bears no hair-like pines, and no *cephalium,* or distinct woolly head, and that the fruits are (as is said) spinulose and not scaly. It is by for the largest *Cerexu* known, and only some *PUoeerei* approach it in size.

The only *Cadacece* thus far known to grow in California were those vaguely noticed by Humboldt (the " Organos del Tunal" and some Opuntiae); the *JEchinocactus virideacens* and *Cereus Californicus* discovered by Nuttall in 1834; the Cacti found on the Gila by Colonel Emory in the fall of 1846, and mentioned in his report; *MamUlaria Goodrichii* — lately described by Scheer — of Kew; and *Echiiwcactus Californicus* of Monville.

Dr. Parry has, in the years 1849 and 1850, when he was also attached to Colonel Emory's corps in the survey of the Mexican boundary, examined and described ten or eleven distiuct species of Cactacea, all found along the southern boundary of California, from the sea-coast to the mouth of the Gila. He, as well as Dr. LeConte, states that much farther to the north no species of this family are found except an Opuntia, cultivated and now naturalized about the missions.

I subjoin here a short memorandum of Dr. Parry's Califomian Cactace®, reserving a fuller description for a more extended memoir.

1. MAMILLAEIA TBTRANCISIRA, n. sp.: subglobosa; aculeis radialibus brevibu's albis numerosis, oentralibus 4 longioribus cruciatis nncinatis ; floribus centralibus parvulis flavido-rubellis ; stigmatibos 3; [338 (4)] laeca coednea pyriformi; serainibus nigris hilo upongioso fusco auctia.

Prom San Diego to the junction of the Gila with the Colorado.—*M. Qoodrichii,* Scheer, obtained on the inland of Cerro, on the coast of California, is distinguished by the lower central spine only being hooked, by much smaller tubercles, etc

8. ECHINOCACTUS VIRIDBCKNS, Nutt: depressed; berry subglobose green, coated with lunate membranaceous i. On dry hills and ridges near San Diego.

3. E VTRIDEBCENS, *$.?* CTLHCDRACEUS, is distinguished by its oval or cylindrical shape, larger size, longer spines. Found near San Felipe, on the eastern slope of the California Mountains.

*Not** _ R CAUFOUTICUS, Monv., is the name of young plants raised from seed in Europe. I am informed that neither the identity nor the native country of these seedlings is satisfactorily known.

4. Ciuus EXORTI, n. sp.: canle prostrate; ramis erectis cylindraceis 15-costatis; acnleis radialibus 4Q-W, centrali rfngulo robnstiore porrecto; bacca globoaa spinulosa.

In thick patches, on dry hills near the nea-shore, about the boundary line. Erect branches 6-0 inches high.

5. C. EMQILXA9VI, Parry in litt.: caulibos pluribns pedalibus ; costis 13 tuberculatis; aculeis 4 centnlibus iMqualilms radiates tenaiores unpeimntibas; hacca ov*li aculeata pulposa.

Mountains about 8an Felipe, on the eastern declivity of the Cordilleras.

NoU. — C.J CAUFORVICUS, Nutt. in Torr. and Gray's Flora, is raort probably a cylindraceous Opjmtia, with - snail yellow Jlowen," which I cannot now identify.

6. OFUVTIA EVOBLMAHKi, Salm. 8an Dlejjo, on dry hillsides, in patches, 4 to 6 feat high. Originally discovered about Chihuahua, this species appears to extend westward to the Pacific

7. 0. TDVA, MOL, in cultivated for fences, and naturalued about the missions; called " Tuna.* It k 10-15 feet Ugh; the fruit Urge and edible.

a 0. raournu, nap.: eanla ««*> ligneo; nmulit cjlindrids tubercular dhrufaatis; aculeis fusqis vaginatb; bacca spinulosa.

San Diego, on arid hills and in dry creek beds. Plant 3-8 feet High, forming impenetrable thickets. Near 0. *arboraccru* of Mew Mexico ; but the red flowers smaller, the berry spinous, etc.

9. 0. BERPENTINA, n. sp.: procumbens; articulis cylindricis elongatis tuberculatis; aculeis 7-9 vaginatis; bacca sicca hemispherica aculeatissima.

Dry hillsides, San Diego.

10. 0. RAMOSISSIMA, n. sp.: caule erecto ligneo divaricato-ramosissimo ; articulis gracilibus cylin- [339 (5)] dricis tuberculatis caesiis ; aculeis subsolitariis' saccato-vaginatis ; bacca sicca tuberculata aetosa et aculeata.

Gravelly soil near the Colorado, and in the desert Plant 2 feet high; the joints J inch in diameter. Approaches the Opuntia cylindracec graciliores.

11. O. PARRTI, n. sp.: caule prostrato; articulis adncendentibus tuberculatis; setis fuscis; aculeis brevibus albidis, singolo longiore deflexo; bacca subglobosa setoso-aculeuta.

Eastern slope of the California Mountains, near San Felipe. Joints 4 to 8 inches long; the longest spines (inch long. Flower 1J inch in diameter, yellowish green. Approaches the Opuntia cluvat*.

Mr. Charles Wright, well known to the botanical world by his collections made in the south-west, now also attached to the Mexican Boundary Commission, has, under the instruction of Colonel Graham, made large and interesting collections of Cacti in western Texas and southern New Mexico, and sent them to me for examination.

It is impossible here to give as full an account of them as would be desirable; but most of them are now in cultivation, and will be described hereafter. Most of the Cactacese discovered by Wislizenus, Fendler, and Gregg are among them, together with a considerable Dumber of new species. I will here only state that my doubts in regard to the fruit of *Cereus Greggii,* expressed in my account of the plant in Emory's Report, have been entirely dispelled by Mr. Wright He says that the plant is large, much branched, has a very large fleshy root, generally implanted in hard stony soil, and the pulpy scarlet fruit is just as figured in Emory's Report, — stiped at base and attenuated above. The seeds he sends are black and opaque, rugose and pitted, about 1 line in diameter. They have germinated well with ma This same plant has been sent from Chihuahua to Kew by Mr. Potts, and has been described by Prince Salra as *Cereus Pottsii,* — which name, however, must give way to the prior name, *C. Greggii.* It is every way a very singular plant, and though found from western Texas and Chihuahua to El Paso, the copper mines, aud the lower Gila, appears to be rare everywhere,

[The following observations, sent in as a substitute for a sentence on p. 339, but received too late for insertion at that place, were printed on p. 446 of the same number. — Ens]

The curious *Cereus Greggii,* E., has been noticed from the Pecos River east to the Mimbres Mountains west of El Paso, and from Chihuahua towards the mouth of the Gila, but always in isolated specimens, very scattering and rare. The fruit which was figured in Emoiy's Report is deep scarlet, succulent, with short spines on the pulvilli; it is oval, acwile, and attenuated at base, and *not $tipitaU9* but long acuminate, and with the long tube of the flower curved downwards, remaining attached to its point The seeds are black and opaque, rugose and pitted, and about 1 line in diameter. The root is large, turnip-shaped, and produces many stems, 2-4 feet high. The yonng plants raised from seeds are dark purplish, triangular; root not yet enlarged.

Collections of Cactace© have also been recently made by Dr. John M. Bigelow of the Boundary Commission, who has sent them to me for examination. My collection under study includes about 12 species of Mamillaria, 8 Echioocacti, 12 Cerei, and 12 Opuutia, most of which are new forms.

ST. LOUIS, Sept. 7,1852.

V. FURTHER NOTES ON CEREUS GIGANTEUS OF SOUTHEASTERN CALIFORNIA WITH A SHORT ACCOUNT OF ANOTHER ALLIED SPECIES IN SONORA.

FROM THE AMERICAN JOURNAL OF SCIENCE AND ARTS, SECOND SERIES, VOL. XVII. MARCH, 1854.*

SPECIMENS of flowers and fruit, together with interesting notes and drawings communicated by Mr, George Thurber, and specimens of ribs of the plant with spines presented by Dr. Parry, enable me to perfect the history of this giant Cactus. Mr. Thurber travelled through the Gila country and Sonora, as one of Mr. Commissioner Bartlett's party, in the summer of 1851, and is believed to be the only scientific gentleman who has seen the plant in question in flower. These materials enable me to furnish the following detailed character.

CBREUS QIOANTIEU8, Engelm: erectus, elatus, simplex, s. ramis pancis erectis caule cylindrico versus apicem sensim attenuate brevioribus candelabrifonnis; vertice applanato tomentoso; costis ad basin caulis sub-12 versus apicem 18-20 recto obtusis (vetustioribus ad caulis basin obtusissimis) subrepandis ; sinubus ad basin caulis latissimis versus apicem profundis angustioribus angustissimiaque ; areolis prominentibus ovato-orbiculatis junioribus albido-tomentoeU ; aculeis rectis basi valde bulbosis tenuiter suicatis angulatisque albidis demum cinereis, radiulibus 12-16 imo summisque brevioribua, lateralibus (prrocipue inferioribiw) longioribus robuntioribus subinde cum aculeis adventitiis paucis setaceis summo areola margini adjectis ; aculeis centralibus 6 robustis albidis basi nigris apice rubellis demum totis cinereia, 4 inferioribus decussatis quorum infimus longissimu* robnstissimus [232 (2)] deflexus, 2 snperioribti* latcralibus brevioribus ; floribus versus apicem caulis ramorumque sparsis, tubo ampliuto breviusculo pcUisque patulis ; ovario ovato sepaiis 26-30 squamirormis triangulatis acutis in axilla fulvo-•illosis stipato; sepaiis tubi sub-30 orbiculato-subtriangularibus mucronatis, inferioribus in axilla lanigeria, superioribus nudis, sepaiis intimis 10-15 spathulatis obtusis carnosis (pallide viridibus albescentibus); petalis sub-25 obovato-•pathulatis obtusis integris crispatis coriaceo-carnosis crassis (flavescenti-albidis) ; staminibus numerosissimis, filamentis superiori tubi parti adnatis (inferior* nudo); stylo stamina paulo superante; stigmate multifido; bacca obovaU squamissepaloideis triangularibus caroosis minutis ad axillam fulvo-lanatis stipata, pericarpio duriusculo carnoeo, demum valvia 3-4 patentibus reflèxisve di-hiscente; eeminibus numerosissimis in pulpa saccharina nidulantibos oblique obovatis lnvibus lucidis exalbuminosis; embryone cotyledonibus foliaceis incumbentibus hamato.

Thin species ranges from north of the Gila River southwardly into Sonora, to within 20 miles of Guaymas on the Californian Gulf. It doubtless also occurs on the Peninsula of California ; where, according to Vanegas in his history, published about one hundred years ago, the fruit of a great Cactus forms an important article of food to the natives of the eastern coast, the harvest time of which was a season of great festivity. The flowers are produced in May and Jnne, and the fruit ripens in July and August. Mr. Thurber collected the lost flowers and the first ripe fruit in the beginning of July. He has collected abundance of seed, and will be pleased to communicate it to those who take an interest in the cultivation of Cacti. The youngest plants Mr. Thurber noticed were three or four feet high, with narrow furrows and long spines; the smallest flowering, plants were about 12 feet high, and the tallest specimens observed appeared to reach the elevation of 46 or 50 feet.

The ligneous fascicles correspond with the intervals between the nba, and not with the ribs themselves; of which Dr. Parry has fully satisfied himself, and which indeed ia the case in all ribbed Cacti. From between these bandies ligneous fibre* radiate horiiontally towards the ribs, and especially to the areole.

At the bane of the stem the ribs are broad and obtuse, with wide and shallow intervals; upwards the rib* are •omewhaft triangular, rounded or obtuse, with deep and acutish grooves between them ; towards the top of the plant the ribe an equally obtuse, but quite computed, and the grooves are deep and narrow.

The elevated areola are 7 lines long, nearly 6 lines in diameter, about an inch distant from one another, sometimes more cloavly approximated.

Lowest and tipper radial spinet 6 to 12 lines long, sometimes the upper ones with a few additional, [233 (3)] shorter, flexuoui, setaceous spines : lateral ones 12-18 lines lonjfc the lower ones longest; the four lower central spines straight or very ulightly curved downwanls, 20-30 lines long; the two upper central spines 15 to 18 lines long. The stoutest npinet are on« line in diameter, their bullxms base being fully twice as thick. The old spinea together with the whole areola readily come off in one bunch, but generally the 6 central spines fall off first, leaving the radiating ones appressed to the stem, till finally they also fall away.

•8et this Journal New BerW*. vol. xiv., page 335, NovMnbw, 1852. A translation of th«e notes appears in the Botanbch* felting for ISM, pp. 616-620. — Kne.

The flowers are produced near the summit of the plant, but not on it, and the fruit is usually 6-12 inches from it. The dried flower communicated by Mr. Thurber is 3 inches long; but the drawing represents the floweTs as fully 4 inches in length and diameter. The ovary in the dried specimen is j of an inch long; the lower naked part of the tube 1 inch, the upper staniiniferous much widened part $ of an inch long. Upper sepals fleshy, greenish white, } of an inch long, below 2, above 4 lines wide. Petals of a light cream color, an inch long, 0-7 lines wide above, very thick and fleshy, and very much curled. Filaments light yellow, adnate to the upper half of the tube: anthers 0.8 to 0.9 of a line long, linear, enmrginate at the base and apex. Style not seen ; the drawing represents the numerous (15-20 ?) stigmata as half an inch long, suberect, of a green color. The flowers appear to be open night and day, and probably for several days in succession.

The fruit Bent by Mr. Thurber (in alcohol) is obovate 2} inches long, by \\ in diameter, beset with about thirty scales, having short brownish wool in their axils, but entirely destitute of spines. Mr. Thurber informs me that this specimen is unusually long: the fruit, he says, is usually 2 or 3 inches long by 1J to 2 in diameter; the color is green, reddish towards the summit; the remains of the flower fall off, leaving a broad and convex scar. The pericarp has the hanlneas of a green cucumber, somewhat softer towards the apex, and is about 2 lines thick: it bursts open on the plant with 3 or mostly 4 irregular, interiorly red valves, which spread horizontally, and appear like a red flower when seen at a distance, which accounts for the report of this species having red flowers. The crimson-colored and rather insipid pulp has the consistency of a fresh fig ; it completely separates from the rind, and drying up from the heat of the sun, falls to the ground, or is beaten down, when it is collected by the natives and rolled into balls, which keep several month*, or is pressed for the thick molasses-like saccharine juice which it contains. The innumerable seeds are 0.7 to 0.8 lines long.

Another, apparently nearly allied species, was collected in Northern Sonora. From the half of a flower before me, together with Mr. Thurber/s meagre notes (other specimens unfortunately having been [234 (4)] lost), I have ventured to make out the following description:

CIEJCUS TRURBERI, n. sp.: erectns, elatior, e basi nmosos sub-14-costatus, sulcf* parnm profnndis, aculeis brevibua nigricantibus; floribus tnbulono-campanulatis virescenti-albidis; ovario globoso sepalis 80-100 caniotts •quamiformibus triangularibus acutis imbricatis ad axillam villoaia ttipato, nepalis tubi inferioribus 24 lanceolatis acutiusculis axilla nndia, superioribus 20-25 orbiculato-obovatis obtufii*; petalis 16-20 obovato-tpathuUUs obtusis cnanif.

Collected in June 1851, in a rocky canon near the mountain ptim of Bacuachi, a small town on the road to Arispe, in Sonora; afterwards found with *Ctreus giganUus,* near Santa Cruz : it abounds abo near Magdalena and Urea. Santo Cnu appears to be the northern limit of this species, which does not extend to the Gila Hirer. Stems 4 to 19 feet high, miny from the mine base, 6 to 10 inches in diameter, sometimes articulated, occasionally branching above, with about 14 ribs and shallow grooves. Flowers greenish-white, borne about a foot below the summit of the stem. Dried flower 2| inches long ; the tube narrower, and more elongated than in *V. giganUus ;* the globose ovary and the naked and •tominiferous part of the tube each about | inch long ; free part of petals of the mine lengthy and 4 lines wide. Anthers much larger than in the foregoing upede*, 1.3 to 1.4 line long. 8tyle not seen.

I hare dedicated this to the collector, Mr. George Thurber, of Rhode Uland, an excellent botanist, who has kindly furnished me with the materials for this article.

Cereus I*mim and C *giganUu$* appear to be closely allied spedee. They hare high and erect Hem*, flowen ^? *JLJ* hont hllf rf Which U ***** tbe ftUmenU *occupying* only the upper half of the tube; both have short and flethy sepals on the orary, with short wool io their axib, unaccompanied by any bristles or spinee ; in both tbe prfali are whitish, obtuse, and fleshy.

Both, and especially *a nimtou,* «tond Yerjr near the *Pibemi* on account of the great height of «he item, the short ii T ! ^ tob6 of *• *"*r imd the Aick P*** k* the J *hm* D0C lhe *lm** Wtafai o' • *«pkMm* (or woolly bewl) nor of any particular development of wool; their flower* upring *(torn* the axib of tbe ordinary and '' '' tr* «|*4»;^and the seed is quite different, at lea* from *th*t o(Pdocw m*M* ^ TM**J H*** <* *tb*t &***, I believe, which has been well examined ; these ««li art m*l to be obliquely thimble-iuprd, densely dolled, tnd to Have an embryo with thick globose cotyledons. It is al<> mid that the AlamenU c o w tbe whole inride of t h e i n \ f h fl of the flower, and even the fee upptr p*rt of tbe ovary. In all tbe M and *Bckimxtdi* [835 (ft)] examined by me, I find the lowest pert of the tube free, the filaments being adnate to some diiUnce abote the ovary. It is not improbable that the Chilian velvety *0*n(VduHm,* Pr. Mm.) « to be cbmed netr our ipedee. The flower of what appean to be Cimu aitaMit, pf-f obuioeil *nmx* Valpmieo, and figured by the artift of the D. 8. Exploring Expedition, greaUy membles that of C 7WWi': it ii a little larvrr, but hae the mme shape and the •ame closely imbricated sepals on the onry ; the tube hat about 100 eepab, and the white petals an eoife-whelW ieAj or not ii uncertain.

VL SYNOPSIS OF THE CACTACEiE OF THE TERRITORY OF THE UNITED STATES AND ADJACENT REGIONS.

FROM PROCEEDINGS OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES, VOL. HI. 1856.

THE only Cactus known to Linnaeus from the countries north of Mexico was his *Cactus Opuntia (Opuntia vulgaris).* Long after him, more than forty years ago, Nuttall, the pioneer of West American botany, discovered two *Afamillarice* and two *OpurUim* on the Upper Missouri, and again, twenty years later, in California, a new *Echinocactus.* About ten years ago we became acquainted with numerous new Cactaceae, in Texas through Mr. F. Lindheimer; in New Mexico through Dr. A. Wislizenus; and in northern Mexico through the same explorer and Dr. J. Gregg: some others (and among them the giant of Cacti) were indicated in the Gila country by the then Lieutenant W. H. Emory. Soon afterwards Mr. A. Fendler collected several new species about Santa ¥6. Mr. Charles Wright, a few years later (1849), discovered in western Texas and southern New Mexico still other undescribed Cacti.

. But the greatest addition to our knowledge of the Cactaceae of the southern part of the United States was made by the gentlemen connected with the United States and Mexican Boundary Commission, at first under Colonel Graham, and subsequently under Major Emory. Science is indebted principally to Dr. C. C. Parry, Mr. Charles Wright, Dr. J. M. Bigelow, Mr. George Thurber, and Mr. A. Schott, for valuable collections of living as well as dried specimens, and for full notes taken on the spot About the same time, M. A. TrtScul of France, and after him Dr. H. Poselger of Prussia, traversed southern Texas and northern Mexico, collecting many Cactaceae, and increasing our knowledge of this interesting branch of botanical science.

The Pacific Railroad expeditions since 1853 have opened fields not before explored; [260] and Dr. Bigelow, the botanist and physician of Captain A. W. Whipple's expedition along the 35th Parallel, availed himself of these opportunities in a most successful manner; while Dr. F. V. Hayden, almost unaided in his adventurous expedition, has extended our knowledge of the northernmost Cactacea in the regions of the Upper Missouri and Yellowstone Rivers.

* The last, but by no means least addition, was made in 1854 and 1855, by Mr. Arthur Schott, during the exploration under Miyor Emory of the country south of the Gila River, known as the Gadsden Purchase.

Most of the materials brought together by these different explorers have come into the hands of the writer; but few of the discoveries made since 1847 and 1848 have been given to the public, — partly becai^e the material on hand very often was incomplete, and partly because it seemed desirable to publish the whole in an elaborate form with the Reports of the Boundary Commission and thoee of the Pacific Railroad Surveys. These reports are now in preparation; but the splendid plates which an to illustrate the natural history of these plants cannot be finished for some time; it is therefore deemed advisable now to publish short descriptions of the new species, and systematically to arrange them with those before known.

CACTACEJE.

TRIBUS I. TUBULOSiE, MIQUSL.

Sobtrib. 1. PAIALLIL*. — Cotjledonet margine hilum veiras spectantee, lateribus aeminis panllal*.

I. MAMILLARIA, Haw.

Ovarian battaqne lms. Semin* fere eudbaminois. Cotyledon* abbreviate, plerumque mete, eubcon- PUnt* mMiiiMft$_A$.ftnh$_m$nUt» • inllhroeoentia latenli a* vertieall

Subgen. 1. BuMAMiLLAmiA. Floree ex azillia taberculorum anni prioria nonqnam euleatoram: orarium pleromque immeraain rentu frnctua maturiutem emergent.

§ 1. POLYACANTIL£, Salm.

1. M. MICROMERIS, E. in Bound. Comm. Rep. : purvula, simplex, glol>osa; tuberculis nunimis verrucaeformibus confertissiinis ; areolis junioribiis solum laiia luxa veatitis ; aculeis setifonnibus cinereis pluri- [261] seriatis, in plantia junioribus sub-20 anjualibus lineum longis, radiantibus in tuberculis florifem 30-40 undique stellato-ponvctis, superioribus 6-8 longioribus clavatis ; floribus minimis subcentrulibus.

Var. /3. GKEGGII : major, tubenulis inajoribiis aculeis paucioribus rigidioribus.

From El Paso eastward to the San Pedro River. Var. 0. near Saltillo. From J to 1J inches in diameter ; 0. often 2 inches or even mure in diameter ; tubercles J-l line long, spines J-l£ lines long, in 0. 1-2 lines long ; uppermost spines of each areola in the fully developed plant 3 to 4 times as long as the others, and strongly clavate, surrounded by long and loose wool, which, together with the up[>er part of the long spines, breaks or falls off after fructification. Flowers (and even fruits) nearly central, 3 lines in diameter, light pink. — Near *M. microthele,* Muhlenpf. which, however, has 2 central spines.

2. M. LASIACAXTHA, E. 1. c. : painila, simplex, globosa; tuberculis teretibus ; aculeis setifonnibus pilosulia s. denudatis 40-80 pluri-seriatis omnibus radiantibus; floribus lateralibus albidis.

On the Pecos River, in Western Texas : fl. in May. — Plant } to 1 or even 1} inches high, and scarcely less in diameter; tubercles 2-3 lines long, spines 1J-2J lines long. Flower whitish or very pale pink, 6 line* long.— *M. Schiediana,* Ehrenb. seems to be similar, but is much larger, and has large tubercles with woolly axilla), etc.

§ 2. CRINITJE, Salm.

A. *AcuUis centralibus rectis.*

3. M. PUSILLA, DC., Tar. TIXAVA, E. 1. c. : ovato-globosa, prolifera, caspitosa; tuberculis teretibus axilla longelanatis; aculeis pluri-seriati*, extimis 30-50 capillacei* crisputia, interioribus 10-12 rigidioribus brevioribus albidis, intimis 6-8 longiohbus rigid.* rectis versus apicem fuscatis; floribus lateralibus rubvllis.

On the Rio Grande, near Eagle Pass and southward : fl. April-June.— Plant 1-2 inches high ; spines 3-6 lines, flowers 7-10 lines, long. — Seems scarcely distinct from the well-known West Indian *M. pusilla.*

B. *Aculeis centrtdibus uno altrrovt uncinato.*

if H. BARBATA, E. in Wisl. Rep. : aculeis radial i bus biseriatis, centrali singulo deorsum hamato ; floribus tubeentnlibus; seminibus tenuiter scrobiculatis.

Cosiqniriachi, west of Chihuahua. This species has borne flower and fruit with me, and ray notes [282] and my recollections indicate that they were central: hence the mark of doubt above, as to the proper position of this species here, where all the other closely allied form* belong.

5. M. raiLLoapuuiA, E. in B. C. R. (M. tetrancintra, E. in part, Sill. Journ. Nov. 1852) : ovata, subdmplex; toberculk teretibus axilla lanata setigeris ; aculeis radiantibus 4<MJ0 biseriatis, exterioribua brevioribtu tenuioribus, eentnlibus 3-4 robuntioribus atrofuncis inferion*. n. pluribus hamatin; floribus lateralibus; baeca pyriformi subdoca eoeeinea; seminibua glubosis rugosU nigris tuasaa fu»ca suberona niajore arillifurmi auctis.

From the Oik to the Eastern slope of the California mountain* — The name originally given had to be altered, became very rarely, if ever, are 4 hooked spines seen. In the original description this and the next specie* were confounded. —PUm 8-4 inches high. Radial npirn* 4-fl line*, central onea 5-9 lines long. — Apparently near JT. *mKtstroidm,* Lem.f which, however, has the radial spines all homogeneous.

6. M. GftAHAMi, E. L e.: subglobosa, simplex a. demum e basi ramoaa ; tuberculit ovatit, axilla nodit; aculeis ndiantibm « « 0 uniseriatia, entndi amtum hamato rucato, additis sepe 1-2 •uperioribus rectia; floribus lateralibus nlMomdia; baeea ovata viraeaiita; ieminibu. mioatit scrobiculatit nigris.

Mountains from El Paso southward and wwtward to the Oil* and Colorado, and up the latter river : fl. from June or July to August - Plant 1-3 inches high ; hooks much longer than the radial spines, which art 3-« lines long. Flowers below the top, nearly one inch in diameter, ferry and seed small, the latter only 0.4 line long.

7. M. WRIOHTII, E. 1. c : dqmsso-globoaa, simplex ; tubercolU tmtibns axilla mdis ; aculeis radiantibus sobIS albidis ; centralibus sub-binis nncfiiatis hsds vix longioribns; floribos latetalibus (0 purports; baecm subglofaosoovata majuflcula; seminibus scrobicnlatis nigris.

New Mexico, on the Pecos and near the Copper Mines. — Plants if* inches in diameter. Spines 4-4 Unas long. Flowers fully one inch in diameter, bright purple, with narrow acuminate petals. Berry large and purple: sasd a7 line long.

a M. GOODRICHTT, Scbeer: ovafto-globosa, sibsteplax; tubsrculis bmri-ovatis axilla lanate aHfeerb • [283] aids ndiantibus 11-15 albidis, centnUboa 9-4 fuaocHatris, inferior* paalo *Umaon* deorsum *ULMZL*

San Diego, California. — Two or three inches high. Radial spines 2J-3J lines long; the lower central spine a little longer. Flowers apparently yellowish-white, and half an inch in diameter.

§ 3. SETOSJE, Salm.

9. M. BICOLOR, Lehm.: depressa, ovata, s. cylindracea, prolifera; azillis lanatis; tuberculis parvulis conicls; aculeis exterioribus 16-20 tenuissimit recurvato-radiantibus, centralibus 2-4 rigidis, majoribus albis apice nigris interdum subpollicaribus, supremo plerumque longiasimo incurvo; floribus parvulia purpureis ; stigmatibus 5.

Abundant on the calcareous hills of the Rio Grande below Laredo, Texas, Dr. Poselger : fl. June and July. — Plant 3-12 inches high, the larger specimens 2-3 inches in diameter; radial spines 1-2, lower central ones 4-5, the upper 6-10 lines long. Flower about 9 lines long.

§ 4. CENTRISPIN*, Salm. (All our species are simple and have a milky juice.)

10. M. HETDERI, Muhlenpf. (1848): simplex, depresso-globosa; tuberculis elongatis pyramidatis subquadrangulatis; aouleis radiantibus 10-20 rectis, inferioribus longioribus, centrali singulo breviore; floribus lateralibus sordide rubellis; baccis elongato-davatis; seminibus parvis rugulosis fulvis.

Var. a, APPLAXATA (M. applanata, E. in PI. Lindh. 1850): vertice applanato a. depresso, aculeis radialibu* 15-22.

Var. 0. HBMISPMRICA (M. hemisphamca, E. 1. c.) : vertice convexo, aculeis radialibus 9-12.

From San Antonio and New Braunfela, Texas, to Matamoras and westward to El Paso: fl. April, May.— Var. a. is the Northern and Western, and 0. the Southern form. - If. *declivis,* Dietr. seems to belong here ; but I have never met with a description of this plant.

11. M. MEIACANTHA, E. in B. C. R.: hemispheric ; tuberculis quadrangulato-pyramidatis compressis; aculeis paucis (5-9) rigidis rectis a. recurvatis, inferioribus paulo longioribus, centrali singulo erecto s. sursum flexo et cum cateris radiante; floribus et baccis procedentis.

Western Texas and New Mexico. — Very similar to the last; but tubercles larger, mow compressed, more loosely twanged; the spines fewer and stouter; perhaps only a variety of it.

12. M. OUMMIFERA, E. in Wish Rep. Similar to the last two, but rtouter ; flower larger, darker, but [264] otherwise little different. Radial spines 10-12; the lower ones much stouter and longer than the upper ones : central spines 1 or 2, shorter.

15. LONOIMAHMJB, Salm.

18. M. SPHAUCA, Dietr.: proliferm cwpitosa; tuberculis ovato-elongatis acutatis; aculeis setaceis radialibus 12-14, central! singulo subbreviore vix robustiore; floris magni tubo supra ovarium emersum constricto elongate; petalis flavis acuminato-arisUtis.

HilUides on the Rio Grande near Eagle Pass; also Corpus Chnsti, on the Gulf. —Single specimens clavate, but often forming dense hemispherical masses. Tubercles 6-8 lines, spines «lines long. Flower 1 *-2 inches long. Fruit not seen.

Subgen. 2. OOBTPHAVTHA. Floret e bad tuberculonim homotinonxm aculeiferorum auicatomm, vel in vertice ipso oriundi: ovarium emersum.

11. ALBXFLORA

14. M. PA——ANTHA, E. in PI. Fendl. (Mem. Amer. Acad. 1849). This interesting plant has been collected otdyina.i«urb^me^ near Santa Fé, which, together with the dried flowers, is in my possession. Shape of tuberoles not weUdi^Iffuishable,doubtful whether sulcate or not; the lower ones proliferoua. Spines compressed,flexible, of the eonsbtency of tiff paper; 8 radiating and 3 or 4 central; the lowen one of the* longe* and teoadet. Flowers white, ci itsal,^an inch or more n t and width. Fruit not .een*

12. FLAVUXORA.

• Lanifera. (The originally central flowers are pushed aside by the continuous development of new tubercles.)

16. M. NUTTALLII, E.: simplex * prolifera, owpito* ; aculeis radialibu. 10-17^-eUcei. «ctis plerumque puberuli. albidis, central! dngub robustiore -spius deftciente; ^palis flmbxiati. et petah. flavidu apice I ^ J ^ ^ J ^ Uneeaktb, •. liMarManee«lati> •eotb; rtigtMtibani 18 erectis vel patalis; buoca tabglobo* tabmulia eoeefami; wminilmiglobori*KrobiealaU*nigm

V«r a. MIUUI (M. NutUlii, E.Lc Ctetai nuumlUru, Nutt. Oen, 1818, *no** I.): mbnmplax; aenltu

V« i o Z w ^ (MTrfmilto, E. to PL Ltodh. 1846) : *umgiUm*; aenleb nduUbot 18-16 paberulu, [MO] etBtnUpknaqntd^danta; floribui Uccif •«uinibMqa« nuyoribiu ; rtignutibot 6 j«tali..

Var. y. ROBUSTIOR, £. in PI. Lindh. 1800: subsimplex; tuberculis longioribus laxioribus, aculeis robustioribufl Iamïbus, radialibus 10-12, centrali singulo ; floribus majoribua; stigmatibus 7-8 patulis; seminibus ut in 0.

Plains east of the Rocky and New Mexican Mountains. Var. a. on the Upper Missouri ; &. from Kansas River to New Braunfels in Texas; y. from the Canadian River to the Colorado of Texas. The heads are one or two inches in diameter ; the caespitose masses of £. often a foot broad; spines 3-8 lines long. Flowers 1-2 inches long and wide, of a greenish or reddish or pure pale-yellow color. Seeds 0.8-1.1 line in diameter, more regularly globose than in most other Cactacea.

16. M. SCHEERII, Muhlenpf. 1847; 0. ? VALID A, £. in B. C. R.: magna, ovato-globosa, subsimplex, glaucescens ; tuberculis remotis patulis magnis e basi lata subcylindricis supra eulco profundo glandulis paucis munito (juniore lanato) subhiiobis ; areolis junioribus dense lanatis ; aculeia 10-20 rectis robustis basi bulboeis albidis s. citrinis apice fuscatis, radiulibus 9-16 ; centralibus 1-5 validioribus an^ulatis ; floribus flavis ex axillis junioribus tomentosissimis.

Sandy ridges in the valley of the Rio Grande neitr £1 Paso : fl. July. The largest of our Northern Mamillarin, 7 inches high and 5 in diameter ; tubercles 1-1J inches long; spines 10-18 lines in length, very stout, especially the central and lower radial ones. Flower 2 iuches long, yellow. Fruit not seen. — *M. Scheerii* from Chihuahua, according to Prince Salm's description, is a smaller plant, with single central spines one inch in length, and 8-11 much shorter radial spines; the areols are described as naked : — nevertheless our plant is probably only the Northern form of this species.

17. M. ROBUSTIBPINA, A. Schott, in litt. : simplex s. caapitosa; tuberculis patulis teretibus magnis sulcatis; areolia junioribus dense tomentoeis ; aculeis radialibus 12-15 robustis inferioribus robustioribus rape curvatis, superioribos rectis fasciculatis paullo tenuiuribufl, centrali singulo valido compremo recurvato, omnibus subpollicaribus corneis apice atratis; floribus luteis ex axillis junioribus tomentosissimis; seminibus magnis obovatis fusci? tavibus.

Sonora, on grassy prairies : fl. July. Tubercles nearly an inch long, and an inch distant from one an- [266] other; spines 9-15 lines long. Flowers 2 inches long, characterized by a very slender, constricted tube, very different from the wide tube of the foregoing species. Seeds fully 1 i lines long, larger than those of any other Mamillaria examined by me : embryo with some albumen, curved ; cotyledons foliaceous! approaching the structure of the seed of most Ecbinocacti.

18. M. RKURVI8PINA, E. in B. C. R.: simplex, deprewo-globosa ; tuberculin ovatis profunde sulcatis confertii; areolia obliquis ovatis, aculeis radialibus 12-20 ri^idis recurvis intertcxtift albidis rorneisve, aculeo centrali tingolo (raro binia) robastiore longiore decurvato ; floribus flavicantibu* extus funcatia ex axillis junioribns villosimimis.

Sonora : fl. July. Single beads 3-8 inches in diameter ; tubercle* 5-6 linen long; tpincs 4-9 lines long, upper OMS often a little longer than the lower one* ; centra] spine 6-10 lines long, darker. Flowen 1 f inches long. — This pint bean the closest resemblance to the next species, and mutt perhape be classed with it; but in the dry specimen before me the flowen are not exactly vertical, ai in that specie*.

• • *Ditmjbrm.* (Flowen and fruit remain central in the very woolly vertex of the plant, DO new tubercles being devdoped before the fruit falls off; berries of all the species known to me oval, green ; seeds brown, smooth.)

19. M. COMPACT*, E. in WU1. Rep.: simplex, depreeso-globosa; tuberculU abbreviato-conicts sulcatis confertie ; areolis oYato-lanceolalis, aculeis radialibua 13-16 rigidis recurvi* intertextis albidis corneisve, aculeo centrali erecto pleramqae deficient*; floribus flavis extus fascatis minoribns.

Cosiquiriachi, west of Chihuahua : fl. June and July. Plant 8-4 inches in diameter; distinguished from the last species by the acutish (not obtuae) tuWrcles, the more elongated areola, the erect central »pinc>, which however is wanting in most specimens, and principally by the smaller and truly vertical flowers. Spines 5-10 lines long; flower l j-l J inches long and wide ; seed 0.7 line long.

90. If. PICTI5ATA, E. in B. C. R. : simplex, glohnsa ; tabercnlis eonids sbbrevutU, sommis flariferie lereitbns lungioribiw sulcatis ; afeolis oblong; aculeu 16-24 rigidi* rpcunris intertextis sobvqaalibos s. In tuberculis summit •uperioribus longioribns lasciculatw omnibun raiiUntibu/i enmeis s. albidis ; floribos magnis stilpbnivis.

On the Pecos River, in Wentern Texas : fl. July. — Plant 1-8 inches in diameter. Lower tubercle* 9-3, [987] florifcroos ones 5-6 lines long; spines 3-5, upper fasciculated ones 6-0 lines long. Flower 9|-3 inches b diameter ; seed 0.9 line long.

91. If. ECBIVCS, E. 1. c : simplex, globma; tuberculU tereticonici*; sreolU orlikalaUs ; acoleu rectk s. paullo earntis intertextis albidU ; radiantibus 16-0i) nuniini* paullo loiigioribuit, cfotndibiis 3-4, infer*** *^[illegible]TifTrim^ subdato porrecto, tuptrioribut 2-3 et cum raduntibui rrcctis ; dtribos magnts.

With the former. — PUnt *l^-ii* inrbc* in dumrter ; tabcrcks 5-6 lines long; lower and lateral spines 4-4» vppsr ones 6-10 lines long; upper central spines of the same length, and the lower central one a lillle shorter. This lasl one is unusually stout, tubulate from a very thick base, and perpendicular on the ceoln uf the plant, whisk gifM fc a very peculiar aspect Fluwert sppamnlly abuui l| or 9 inches long.

22. M. BCOLYMOIDES, Scheidw. (1841) : globoea 8. ovata, subsimplex; taberculis conicis, superioribos elongatis incurvis imbricatis ; aculeis radian ti bus 14-20 rectis s. plemmque recurvis albidis B. cornėw, superioribus longioribus, eentralibus 1-4 longioribus obscurioribus curvatis, superioribus snnum versis cum radialibus implicatis, inferiore robustiore longiore decurvo.

South of the Rio Grande; not yet discovered in our territory. — Plant 2-3 inches high ; tubercles 5-8 lines long ; radial spines 5-10 lines, the central ones 9-16 lines long. Flowers yellow, 2 inches long. — Perhaps this and both the foregoing species are only forms of the Mexican *M. cornifera,* of De Candolle. Only a close examination of these plants in their native wilds will enable us to decide this point.

23. M. CALCARATA, E. in PL Lindh. 2,1850 (M. sulcata, E. in PL Lindh. 1,1845. M. strobilifonnis, Muhlenpf. ? non Scheer): globosa, proiifera, ccspitoaa ; tuberculis e basi dilatata ovatis conicis; aculeis albidis, radialibus 8-10 rigidis subulatis rectis s. paullo recurvis, additis subinde ez summa areola aculeis adventitiis 3-6 fasciculatis tenuioribus, centrali singulo robustiore subulato recurvato, in plantis junioribus deficiente; floribus magnis sulphureis intus basi rubicundis.

Texas, from the Brazos to the Nuecee rivers : fl. May. — Larger heads 2-2} inches in diameter; oespitose masses a foot or more large ; tubercles spreading, or in older flowering plants often somewhat adpressed and imbricate, 7-0 lines long ; spines 4-8 lines long. Flower 2J-2J inches long, and of same diameter. Seeds a line long. [268]

§ 3. RUBRIFLORJL

• *Sepalii integerrimis.*

24. M. GONOiDtA, DC. (M. strobiliformis, E. in Wisl. Rep. non Scheer) : found only south of the Rio Grande.

« • *Sepalii fimbrůUis.*

25. ? M. POTTBII, Scheer: cylindrica, subramosa ; tuberculis ovatis obtusis levissime sulcatis, axillis sublanuginosis; aculeis radialibus numerosissimis gracilibus albis, centralibus 6-12 validioribus expansis basi nodulosis apice sphacelatis ; floribus magnis e viridi rubellis; baccis roseis.

Texas, on the Rio Grande, below Laredo, and from there to Chihuahua.—I have not seen this plant; the description is taken from Salm and Poselger.

26. M. TUBIBCULOSA, E. in B. C. R. : ovaU s. ovato-cylindrica, simplex s. ad basin parce prolifera ; tuberculis • bid rhomboidea ovatis abbreviatis obtusis profunde sulcatis demum suberosis persistentibus confertis, axillis villosis-•imis; aculeis exterioribas 20-30 rigidis albidis, interioribus 5-9 robustioribus csesio-purpureis sphacelatis, superioribus longioribus erectis, infimo breviore robnsto porrecto ft. deflexo ; floribus in vertice densissime tomentoso centralibus pollicaribus dilute roseis ; baccis elongato-ovatis rubris; seminibus minimis scrobiculatis.

On the mountains near El Paso, and eastward : fl. May and June. Plant 2-5 inches high; tubercles 2f-3 lines long, dry and hard, not fleshy unless very young, nor shrivelling when old, but losing the spines and covering the lower part of the plant like corky protuberances, Outer spines usually 2-4, rarely 5 or 6, lines long ; interior spines 4-0 lines long; those of the upper tubercles forming a tuft of grayish-purple color on top of the plant Flowers •wy pale purple, one inch in diameter. Berry red, three fourths of an inch long, one fourth of an inch thick, crowned with the remains of the flower. Seeds short, thick, about half a line long. —The short, corky tubercles, with very deep grooves, «d very woolly when young, together with the long red fruit, distinguish our species from all the tUied forms.

27. M. DASTACAITTHA, E. in B. C R.: simplex, suhglobosa ; tuberculis teretibus laxis leviter tulcatis; [269] axillis eubvillosis; aculeis rectis tenuibus setaceis patulis, exterioribus 25-35 albidis, interioribus 7-13 longioribus purpareo-fasds, oentndi infero •quilongo; baccis centralibus ovatis; seminibus obovato-globosis nigricantibut MoUeobtk

El Paw and eastward. — Specimens before me are l*-2* inches nigh and a little lean in diameter; tubertlee 4-5 lines long; spines more slender and toft than in the allied species, often capillary, spreading, bat not radiating, *-U lines long, only the lower exterior ones a little shorter. Seeds about half a line long. Very nearly allied to the next

2a M. TTTAPAKA, Haw.: simplex ft. csspitoaa; tuberculin teretibns laxis leviter sulcatis; aculdn rectis rigidis, exterioribas patentMrae radUnUbus albidis 12-36, centralibus 3-12 robustioribus longioribus obscarioribos, dugalo vobaatiore porrecto deflexove, oeteris fursum divergetitibui; florihus subcentralilms purpnreis magnis; baccis subiatenUime ovatis viridibos; •eminibni oboratis scrobiculatis fulvin.

Var. •. n u : deprteso-dobosm, simplex a. pleromqae prolifera, CMpiton; aculeis ndialibna 14-20, centralibnaS-a

Var.? ß. RADIOSA : ovaUs, wbcylindrka,aimpbna. eban ramosa; aeoleiavadiaUbos li-M, eentndibaa8-12.

Subvar. a. RADIOS A BOREAUS : subgloboea; acoleis radialibus albidis 12-20, centralibus 3-6 purpureo-maculatis; floribus miuoribus. — *b.* RADIOSA NEO-MEXICANA : ovata; aculeis radialibus albidis 20-36, centralibus 3-12 snpra purpurascentibus sphacelatis ; floribus inajoribus. — c. RADIOBA TEXANA : ovato-cylindrica; aculeis radialibus albidis 20-30, centralibus 4-5 flavis 8. fulvis ; floribus seminibusque inagnia. *M. radiosa,* E.in Plant. Lindh. 2,1850.

In the Western plains and on the Rocky Mountains: var. & on the Upper Missouri and Yellowstone riven; &. *a.* in northern New Mexico; £. *b.* from western Texas to New Mexico and Sonora ; 0. c in Texas, west of New Braunfels. — The extreme forms ore certainly very unlike one another, but the transitions are so gradual that I cannot draw strict limits between them. Even the proliferous growth of the original AT. *vivipara* is not constant, and I have seen many simple specimens from the Upper Missouri. The simple ones seem to flower better than the proliferous ones, which are often sterile. — Plants from 1 to 5 inches high, 1J-2 inches in diameter ; tubercles 4-6 lines long; spinet always rigid, 3-10 lines long. Flowers different in size, 1J-2J inches in diameter, beautifully purple, with numerous narrowly lanceolate acuminate petals. Seeds J-l line long.

29. M. MACROXERIS, E. in Wfoliz. Rep. (M. dactylothele, Lab.): simplex s. e basi ramosa, ovata; [270] tuberculis magnis patulis, laxia, tenuiter ultra medium suicatis ; aculeis tenuibus elongatis rectis a. paullo curvatis exterioribus 10-17 albidis, centralibus sub-4 longioribus robustioribus subangulatis, fuscis s. nigricantibus; floribus ex areolis supra-axilkribus in tuberculo ipso oriundis inagnis; bacca subglobosa viridi; seminibus parvis hevibus fuse is.

In the valley of the Rio Gninde, from southern New Mexico to the middle course of the river near Presidio, and even lower down: flowers July and August. —A most remarkable specie* in many respects, and forming a transition to Echinocactus, though the mamillnte form is so very striking. Plant 2-4 inche* high ; tubercles variable, 6-8 or 10-12 and even 15 lines long. Radial spines J-lJ inches long ; central ones often l}-2} inches in length. Axils always naked. Flower springing from the lower end of the groove, which runs down about two thirds of the tubercle, 2|-3 inches in diameter, rose-colored or purple; not rarely with a few sepaloid scales on the ovary (and fruit). Seeds thick, bat only 0.6-0.8 line long.

Subgen. 3. ANHALONIUM. (Gen. *Anhalonium,* Lem. *Ariocarpus,* Srheidw.) Floras e basi tubercnlornm homotinonim triangularium subinennium vel in vertice ipao oriundi: ovarium emenum.

30. M. FI88CBATA, E. in B. C. R.: simplex, flqprtw4>-glnl>o«A n. appianata; tuforculi* e liasi appionata crastis ertus infraque tovibun, supra sulco centrali villoao loteralihiimiuc \;*UW** profunde quailripartitis sulcisqne transvenalibos superfieialiter multifidia, inermibus ; flnribti* e villo longn sericeo centmlibas rosei*; btccis ovaiis viresoentiboa in kna deosa oecultis; seminibus nigrin tnberculatin.

On the limestone hills, near the junction of the Pecos with the Rio Grande: flower* October. Head* 3-4) inches in diameter; tubercles 6-10 lines long ami a little lem broad ; cent ml longitudinal groove in the very young ones bearing dens* rilky wool over \ inch long, which by age become* dirty and matted, and finally duappeftra entirely in the vwy old one*. The lower end of the groove, which only externls down an far an the rough or verrucose part of the tubercle goes (about two thirds downward), beam the flower and fruit, very mnch like the floriferoos areola of the last-mentioned specie*. Flower about 1 inch long and wide. B«*I very roughly tubercnlatcd, difleireut from thai of any other *MomMmia* examined by UM, but quite similar to thai of other *AnkaUmia.*

n. ECniXOCACTTS, Link. *A* Otto. l«71]

Ovarium emenam baccaqne svpdis ttipata. JVmina *mrm* albnminoM. Cotyledonee plus minus foliaces) plemmque hamate. • Plante sobgjobos^ eosute; infloraeentk vmiodi.

§ 1. HAMATI, 8«lm.

i^1# ^ ^J.0,,11111, Mm : g»obosns s. ovatua; eontis 13 obtums interniptis; lobmulis supra ad medium sulcatis; araleis radialibos 15-18 sttacM, eentraUbus a-l tnguUti* varicgris, superioribus rtctis longioribos sumum riivancatis, inferior* robustaore bnviore hammto; iarilms mimmbus flsvo-viraeenlibus; *b*x** vireseeiito; ssmfinibus fiiseis.

AbontE^kPfe«,(mUi«IUoOnuide: flowm Angmt to October. - A *ma** elcgut liuk «p«ek«, l|-tiadi« high; higtr tpiiM* black and white nriegatod; mltel ontt 3-fl. eratnl ones «-li HUM long; flurifefoua an»h united by • groore of 1-S| lino* *n* length with the *wfbm,* rtetmbling the groove of the OrpkoiitU, tmddlj o/ HtMiUnnc *macromtn**. Qnen flower 1 inch long, much \m in diameter.

2. E. BMTMUMATva. E in B C.R.: oborato^loboM; eo*k 13 comprarit oUa.it interraptk; tahermlfe Npn veqiie ad b»nn mleatie; ataJeb ndUibw It taretibw alUdia, e«ntraUbna 4 enmplanatit, latonlibM itcth [redacted]- paallo longioribu, H U M debOion et iaflao ralniitkn deoiMa banMto btcTturibo*[redacted]

On the San Pedro, and about Eagle Pass: flowers April. — Very similar to the last, bat larger, 3-4 inches high, with fewer spines, the lower central usually hardly longer than the upper radial ones> about 1 inch long; lower radial spines shorter, and upper central ones longer. The rose-colored flowers are 12-16 lines long, much less wide. Fruit unknown.

3. E. WHIPPLBI, E. & B. in Pacific B. R. Bep.: ovato-globosus; contis 13-15 interrupts; aculeis radialibus 7 compressis albidis, centralibus 4 longioribus robustioribus compresso-quadrangulatis, summo latiore longiore, infimo robustiore deorsum hamato ; seminibus magnis nigris.

On the Colorado-Chiquito, in western New Mexico. — Plant 3-5 inches high ; exterior spines 6-0 lines, upper central spine 12-18 lines long, and J-lJ lines broad; other central spines a little shorter. Seed very [272] large, over 1} lines in the longest diameter. — Principally characterized by the few radial spines and the very broad upper central one, which with the former forms an almost regular circle.

4. E. POLTANCBSTRUB, R & R L c . : ovatus, s. ovato-cylindricus; costis 13-17 interruptis; acnleis radialibus tub-19 complanatis albis, superioribus latioribus lougioribus, inferioribus setaceis, centralibus difformibus, summo compianato elongato sursum curvato albo, reliquis 5-10 teretiusculis purpureo-fuscis, superioribus 2 rectis, ceteris uncinatis.

Eastern slope of the California mountains, at the head of the Mojave Biver. — Plant 4-10 inches high, 3-4 in diameter; radial spines J-2 inches long; upper central spine 3-5, the others lf-ty inches long, the lowest shorter' than the others. The number of the hooked spines varies from 3 to 7, according to age and development.

5. E UNOINATU8, Hopf., var.? WBIOHTII, E. in B. C. B.: glaucescens, ovatus; costis 13 interruptis; tuberculis usque ad basin sulcatis ; aculew radialibus 8, inferioribus 3 uncinatis fuscis, reliquis 5 rectis, centrali singulo angulato eomplanato flexuoso hamato elongato erecto stramineo apice fusco; floribus fuseo-purpureis minoribus.

Near El Paso and on the Bio Grande below: flowers March and April. — Plant 3-6 inches high, 2-3$ inches in diameter ; the tuft of long, erect, straw-colored spines is very characteristic. Lower hooked radial spines about 1 inch long; upper ones a little longer; central spine 2-4 inches long. Flowers 1-1 i inches long. Berry fleshy, scaly. Seeds much compressed. — The Mexican *E. uncinatoi* has 7-8 radial spines, similarly arranged, and 4 central spines ; the three upper ones not much longer than the upper radial ones and straight, the lower one elongated and hooked. The flower and seed differ aLso to some extent.

6.' E. SITBPIKUB, E. in Plant Lindh. 1845 : globosus, ovatus s. subcylindrfcus; costis 13 compressis acutatis angulatis; tuberculis brevissiine sulcatis; aculeis radialibus 10-16 setaceis; centrali subsingulo robustiore terete fusco uncinato s. flexuoso curvato; floribus magnis flavis intus coccineis; bacca piaiformi coccinea ; seminibus tuberculatis.

Var. «. HAMATUS : aculeis radialibus sub-12, centrali hamato robusto. — £ *hamatut,* Muhlenpt *E. Muhlenpfordtii,* Fen.

Var. *fi* BBTACBUS: minor; aculeis pluribus, centralibus 1-3 tenuionbus vix hamatis.

Texas, from the Colorado to the Bio Grande, and westward as far as the San Pedro Biver: flowers April [273] to October. - It is unnecessary further to describe this well-known and well-characterized specie*, which is now frequently cultivated; the compressed ribs, setaceous spines, small red berry, and tuberculatod seeds easily distinguish irfrom all its allies.

7. E. smrtJATOT, Dietr. (1851): globosus; costis 13 compressis acutiusculis interruptis; aculeis ndialibns •etaeeis, 3 superioribus el 3 inferioribus rectiusculii fuscatis, lateralibus 2-6 tenuionbus albidis flexuosis, rarissime hamatis; eentnlibus 4 robustioribus, 3 superioribus rectis purpureo-variegatis, inferior© compresso sen canaliculate elongato' flexuoso vel hamato stramineo; floribus magnis flavis; bacca ovate viridi ; seminibus minutissime punctatis.

Country along the Bio Grande near Eagle Pans, and from there eastward. — Intermediate between the foregoing and the next specie*, and considered by Dr. Poselger a connecting link between them; but easily distinguished from the former by the larger size, thicker ribs, flattened central spine, and by the shining, finely dotted seeds; from the latter, to which it approaches much more closely, by the more compressed and less strongly tuberculated ribs, the •mailer number of stigmate (8-12), smaller fruit, and much more finely dotted seed. — Poselger eonaiden this a •arietyofj.tduw,mi*. His *E. mtUpinui,* var. ro&urftu, has the same seeds, and no doubt also belongs here; itisatid to have all the four central spines, and some of the radial ones, hooked. *E. Tnculianut,* Lab. belong! here, or ptrtape to the next

8. E. LOVonutfATUS, Oal: wbgloboros; costis 13-17 obtosis tnberenUto-iiitamiptk; tuberculit broiler ericatb; aculelt ndialibas rigidU lubteretllms, infimis snmmisque tends, lateralibus 8-6 loogioribna; eentnlibos 4 robots angulatkannuUtii, qoomm inflmus deonom hamatus rectna ten flexoosna, addilit fubindt 2-4 saptrioribos

cum radialibus superioribus fasciculatis ; floribus magnis flavis ; stigmatibus 15-18; bacca oblonga virescente squamosa; seminibns lucidis exsculptis.

Var. a. CRASSISPINUS : aculeis robustiasimis Tadialibus 8-11, centralibus 4 angulatis, infimo flexuoso plus minus hamato. *E. JUxispinus,* E. in Wializ. Rep. *non* Salin.

Var. *p.* ORACiLispiNCs : aculeis gracilioribus 16-20, exterioribus 12-14, centralibus 4-8, infimo elongate hamate. *E. hamatocanthusj* Muhl.

Var. *y.* BREVISPINUS : aculeis gracilioribus radialibus 8-11, centralibus 4 teretibus cum infimo hamate [274] radiales viz superantibus.

East of El Paso, near the Pecoe and San Pedro Rivers, and along the middle course of the Rio Grande: var. *a,* south of the Rio Grande. Flowers July and August. — Plants from $-2 feet high ; the larger ones ovate; areolee distant. Spines very different in size in the different varieties ; radial spines 1-3}, central spines 1J-6J inches long. Flowers 2 J-3J inches long. Seeds similar to the last, but with much larger pits.

§ 2. CORNIGERI.

A. *HeUracanthu*

9. E. WISMZENI, E. in Wisliz. Rep.: giganteus, globoso-ovatus ; costis 21 compresms crenatis; areoiis elongatis; aculeis radialibus summis infiniiaque 6 robusti* rectis seu curvatis, lateralibus 14-20 (additis subinde summis brevioribus fasciculatis) tenuibus elongatis flexiioris; centralibus 4 robustis angulatis annulatis rubellis, 3 superioribus rectis, inferiore canaliculate deorsum hamate ; fluribas flavin ; bacca ovata squamosissima ; seminibus reticulatis.

Valley of the Rio Grande about El Paso, and thence to the Upper Gila: flowers July and August. — Plant 8-4 feet high ; diameter smaller. Radial spines 1-2, central ones 1J-3 inches long. Flowers 2| inches long.

10. E. LECOTTEI, E. in P. R R.: giganteus, obovato-claviformis; costis 20-30 compressis crenatis; areolis elongatis; aculeis radialibus summis infimisque 6-10 robustis angulatis plus minus curvatis, lateralibus 10-16 (addidis subinde summis brevioribus fasciculatis) tenuibus elongatis flexuoais, centralism* 4 robustis compressis annulatis corneis, 3 superioribus snniim inferiore subinde subhamato deorsum curvatis; floribus flavis; bacca ovata squamosa; seminibus scrobiculati.«.

On the lower parts of the Gila and Colorado River*, and in Sotiora: flowers August and September. Very similar to the last, hut a more slender, often quite clavate plant; largrr specimens 3-4 feet high, and of only one third that diameter. Arrangement of npinea m'milar, hut generally A (not 3) radial npines below the lowest central one; central spines more cnmprtfuied, upper ones curved, lower one rarely somewhat booked. Flower, fruit, and seed [illegible]; seed more oblong and pituwl.

E. raorat, Zucc, in the number and arrangement of npinea, is the simple type of our more northern [275] species. It has on the oval areoUe 4 stout cruciate central »pines, 3 upper and 3 lower radial ones, and only 1 slender lateral spines. Seeds smooth. The flower seems to refer it, however, to the *Erioearjn.*

B. *Ifommacantki.*

e *Ltpidoearjn.*

11. E. EMOITI, &, in Emory's Rep. IMA, ami B. C. R.: grand)*, ovttun; co*U 13-80 obtnsb tubercnlatk \ exeqUs oratb; aculeu isdialibns 7-6 rabaqtulihtu robuntiii nuheiiguUtiii annuUtfc. peallo reeumtit rubtllis 1-1 polHoartDos, ceotndi dngnlo reenrvo s. subhamato penllo mbasUore; fl<iribat *nu^nx** purpanscentihos.

Lower Coloiedo, and principally fin 8onort: flowem Aoffnrt and September. Ur^r plants 1^3 feet high J spines t[illegible] T*^7 1-2 * ^ ^ a k v § P * ^ « f r o m O w y i ^ n ~ l r 3 inches long. Rowew about 3 inches long. FMt unknou[illegible]

12. E. VIRIDESCENS, Nutt.: globosus, simplex sen mro rtmosu«; emtU 13-11; smleis robustis compressis annulatis plus minus curv[illegible] rubellis [illegible] infl«« brevier* magis curratn; centralihits 4 angulatis robustioribus longioribus, mflmo *action* longiow; floribos TiieeosnUbo. ; bercm sqtumoa ; sesntnibo. minutissimis scrobiculatis.

San Diego, Calif

3 upper central ones a l[illegible] •we longsT» aad lower eentt»l spine Ift-lft UMS long. Flower 11 incbe* long.

13. E. CYLINDRACEUS, E. in Sill. Journ. 1852: ovatus seu subcylindricus, plerumque e basi ramosus ; costis 21 vel pluribus; aculeis robustis compressis annulatis plus minus curvatis flexuosive rubellis, radialibus sub-12, aculeis adventitiis sub-8 gracilioribus supra supe adjectis, infimo hamato, centralibus 4 angulatis robustissimis crenatis, superiore latiore rarum recto, inferiore decurvato ; floribus flavis ; bacca squamosa.

San Felipe, on the eastern slope of the California mountains: flowers in June. — The largest specimens seen were 3 feet high and 1 foot in diameter; the branches or young single plants are globose. Radial spines 1-2 inches long; central spines 1-1J lines broad, about 2 inches long. Similar to tfre last, but well distinguished by the characters indicated.

• • *Eriocarpi.* [276]

14. E. POLYÇEPHALUS, E. & B. in P. R. R.: ovatus seu demum cylindricus, e basi ramosus; costis 13-21 acutw; aculeis robustis compressis annulatis plus minus curvatis rubellis, radialibus 4-8, innmo deficient*, superioribus (si ezstant) gracilioribus; centralibus 4 angulatis compressis, superiore latiore suberecto vel sursum curvato, inferiore loDgiore decurvo; floribus flavis dense lanatis; bacca sicca; seminibus magnis angulatis.

On the Mojave, Colorado, and Gila rivers : flowers February and March. — Single only when young, forming bunches of 20-30 cylindric equal-sized heads when older ; the largest seen were 2-2} feet high and about 10 inches in diameter. Exterior spines 1-2, interior ones 1J-3J inches long. — Shape very much like the last, but the flower very distinct.

15. E. PARRTI, E. in B. C. R.: simplex, globosus vd depressus; costis 13 acutis; aculeis robustis angulatis annulatis albidis, radialibus 8-11, rectis s. paullo curvatis superioribus gracilioribus, innmo deficiente, centralibus 4 paullo longioribus robustioribus, infimo longiore decurvo; bacca sicca dense lanata.

West and southwest from El Paso. —Plant always single; largest specimens 8-12 inches high by 10-15 in diameter. —Very similar to the last, but apparently distinct by the manner of growth and the white spines. Unfortunately, no seeds were collected.

16. E. HORIZONTHALONIUB, Lem., var. CENTRISPINUB, E. in B. C. R.: glaucus, depressus seu demum ovatus ; contis 8 obtusissimis latissimis; areolis orbiculatis basi truucatis; aculeis robustis compressis annulatis recurvatis rubellis demum cinereis, radialibus fr-7 superioribus debilioribus, infimo deficient*, centrali singulo robustiore decurvato; floribus purpureis dense lanatis; bacca sicca lanata; seminibus magnis angulatis.

From Donana, above El Paso, to the Pecos, and southward : flowers April and May. — Plant 2-8 inches high tnd 3-6 in diameter. Spines J-1J inches long, nearly equal. Flower 2} inches long, but partly enveloped in dense wooL The original *E. horizonthabniut* is said to have no central spine, and linear-lanceolate acuminate pale rose-colored petals: in our plant the petals are oblong-lanceolate and obtuse.

17. E. TEXIKSIS, Hopf., *E. LifidKeimin,* E. in Plant Lindh. 1845: depressus; costis 13-27 acutis [277] ondulatis- areolis cordatis; aculeis robustis annulatis, plus minus curvatis rubellis, radialibus 6-7 infimo deficiente/eentrali singulo robustiow compresto decurvato; floribus roseis dense lanatis; petalis laciniatis aristatis; bteca ooccinea lanata * seminibus lovibos lucidis.

Southern Texas Lid northeastern Mexico, from the Colorado to Saltillo ; not westward beyond the San Pedro River: flowers April and May. — Heads 8-12 inches in diameter, flat, or very old ones sometimes globose; spines from 4-2 inches long. Flowers about 2 inches long.

I 3. THELOIDBI, Salm.

18 K BIOOLOB, Gal, var. ScHarm, E. in R C. R.: ovatus; costis 8 obtasis interrupt*; aculeis radialibus 15-17 rectus »nminis 2-4 longioribua latioribus compressis, centralibus 4, lummo latiore longiore; floribus majoribui purpureis* *

Mier, on the Bio Grande: flowers September. - Plant 4-6 Inches high, 2-3 in diameter. Upper radial spines •bout 1 inch, upper eentml one 1ft inches long; lower radiall and central spines reddirt, -negated. Flower 8-3 inches long, bright purple or rose-colored. - Distinguished from the Mexican *E. Ucolor* principally by the larger number of ndtel apfcat, and the greater length of the upper central spine, which is carinate underneath.

| 4. INTIBTKTI.

19 B nruffiXTca, E in B. C. R.: minor, ovato-globoras; costis 13 acutis interraptis; taberculis sulcatis; •euWs rigidis rubellis apice fuseatis, radialibus 16-26 arete adpressis, superioribus 8-« tenuioribus subfasdculatis, Innmo robuato breri • eentraHbus 4, supntoribus 3 radiales superi«rei ezcedentibus cum iis iinpUoafu, inferiore slngulo abbreviate porrecto;'floribus parvis in yertice dense lanato eongertis roeeis; bacca vix squamata sieca; seminlbua lucidis scaphoideis.

VaTji. DAOTACAimroB, B. L c: oratus; aculeis setaceis longioribus purpuretxasiis, radialibus patulia, centraU inferiore ceteris paullo breriore.

Prom B Paso to the Limpio, and southward to Chihuahua: var. /S. more common about El Paso: flowers March and Anil —Plant 1-4. th« w.*eren 6 inches high, 1-3 in diameter. Spines S-6, central ones l-« lines long; in /3. (T ^ (^ ej ase 9-11 lines ong. Flower about 1 inch long. Fruit 4 lines in diameter.

E. UNGUIFERUS, E. in Wisliz. Rep., from the country between Chihuahua and Parras, belongs here. [278] The fruit described as belonging to this species is that of *E. uncinatus*.

Subtrib. 2. CONTRARLE. Cotyledones facie bilum versus spectantes, lateribus seminis contraîls.

III. CEREUS, Haw.

Ovarium baccaque sepalis squamiformibus in azillis plerumque pulvilligeris stipat®. Stamina tubo floris breviori seu elongato infundibulifonni gradatim* adnata. Semina fere exalbuminosa. Cotjledones abbreviate sen foliaces, plerumque hamate. — Plant® costata, inflorescentia laterali.

Subgen. 1. ECHINOCEREUS, E. in Wisliz. Rep.: ovarium aculeolatum: tubus floris abbreviatus, subcampanulntus: stigmata crassa viridia: semina tuberculosa: cotyledones subexecte. — Plant® humilea, rape subglobosflB, e basi ramossD vel ramoeissim®.

§ 1. PECTINATI, multicostati; areolis confertissimis plerumque elongatis, aculeis rigidis brevibus pftimtit.

• *Viridijtori.*

1. C. YIRIDIFLORUS, E. in Wisliz. Rep.: ovatus seu demum cylindricus, simplex vel parce ramosus;*coetia sub-13; areolis ovato-lanceolatis ; aculeis arete radiantibus 12-18 cum superioribus 2-6 setaceis, lateralibus csrteris longioribus, inferioribus plerumque purpureo-fuacis, c®teris albidia, centrali plerumque nullo, subinde singulo robustiore variegato ; floribus versus apicem lateralibus e flavo virescentibus niinoribus; baccis ellipticis parvis; seniinibus tuberculatis.

Var. «. MINOR : subglobosus ; aculei* gracilibus brevibns.

Var. *fi.* CTLINDRICUS : major, elongatus ; aculeis rigidioribus longioribus.

Throughout western Texas and New Mexico. Var. a. about Santa Fé* and northeastward : 0. east of El Paso. Flowers May and June. — The small form is 1-2 inches high, with spines rarely more than 2 lines long; the larger form £. is 3-6 or more inches high, its spines 2-5 or 6 lines long ; central spines, when present, longer and stouter. Flower about 1 inch long.

2. C. CHLORAXTHCS, E. in B. C. R.: cylindricus, simplex, seu parce ramosus; costis 13-18 ; areolis ovatis; aculeis laxe radiantibus 12-20 cum superioribus 5-10 setaccis plerumque albklis; centralinm 3-5 [279] snperioribas 2 brevioribus purpuraaceulibus, iuferioribus 1-3 longioribus deflexis albidit; floribus in caule inferiore lateralibus e flavo virescentibus minoribus ; hacci* parvis; seminibus iuberculato-scrobiculatis.

Common about El Paso : flowers April. — Stems 3-10 inches high, 1|-2 inches in diameter; radial spines S-6» central ones 9-15 lines long. Flowers very similar to those of the last species, but seeds different

• • *FhtviJhrL*

3. C. DASTACACTHrs, E. in WïHÏZ. Rep.: suhcylindriciin, simplex vel e basi raroosns; costis 16—SI ; areolis oratis; aeuleis 20-30 patulis cinerein apice wrj* mbellis interioribus a-8 paollo robostioribos deflexis; floribos •nUenninalilms magnis; bacca sul^lobona; setuinibus taberculatis.

*V*ar. *$** Mivon : aculeis paugoribus ; bacca minore.

Common about El Psso: flowers April. — Plant 5-12 inches high, densely covered with numberless spines. Flowers 3 inches wide, yellow, —an uncommon color in O n. Fruit an inch in diameter; in var. 0. only half as large,

4. C. crooiraš, E. in a a R.: snbsimplex, ovate*, l&-costatas; afeolis lanceolatši; acnleši albidia, radiaHbus 14-20 pe — 2-3 uaiearlatis brevibus; floribus magnis.

Eagle Pass on the Rio Grande: flowers June. - PUnt 2-4 inches high, thick in proportion ; spines 1-4 Hnet long, riower Urge. — Similar to the last, tmt distinguished by the character* given, which, with the exception of the jeuow nowtr, bring it dose to *C. petmotm.*

• • • *Rubryflori.*

5. C. PECTINATUS, E., *Echinocactus pectinatus*, Scheid. : ovato-cylindricus, 18-23-costatus; areolis lanceolatis ; aculeis radialibus 16-20 subrecurvis pectinatis apice rosois, eeolnlibus «-6 brariMmk uuwktfc; tobo floris purpurei pulvillis 60-70 aculeolos rigidos 10-15 gerentibus stipato.

Var. ß ? ARMATUS, Poselg. : costis 15-16 ; aculeis radialibus 16-20, centrali singulo ceteris longiore.

Var. γ.? RIGIDISSIMUS, E. in B. C. R.: costis 20-22; aculeis e basi bulbosa subulatis rigidissimis albidis seu rubellis 15-22 centralibus nullis ; floram subverticalium tubo pulvillis 80-100 dense stipato.

South of the Rio Grande, Chihuahua, etc. — The var. ß from Monterey may belong either here or to the [280] next species. The var. γ. from Sonora, without [illegible] and with very rigid radial ones, 1-4½ lines long, is not yet sufficiently known to decide about

6. C. C^BPITOSUB, E. in Plant. Lindh. 1846: ovatc-cylindricus, 12-18-costatus • areolia radoahbus 2MO rectis seu subrecurvis pectinatis albidis, centrali unicum validum, purpurei pulvxlhs 80-100 aculeolos capillares 6-11 obscure lanamque longam cine*** g S S t a ta* noeolatis ; aculeis aimo ; tubo floris pato.

Var. a. MINOR : aculeis brevioribus gracilioribus non intertextis; floribus minoribus.

Var. 0. MAJOR : aculeia longioribus robustioribus intertextis ; floribus majoribua.

Var. y. CASTANEUS : aculeia rubellis seu castaneis.

From the Canadian near Delaware Mount, to the Rio Grande, and south to Monterey; west not farther th*n *th* San Pedro River: flowers in May and June. - This species, now* not rare in cultivation seems. J T h « ? £ ^ distinct from the preceding, and may always be recognized by the characters indicated •ufficiently

K _ J /DOTTTO» E-in Wisliz- &*.: ovatus, lfc-15-costatus; areolis ovatis seu ovato-lanceolatis bus 16-20 adpressis albidis apice adustis, lateralibus inferioribusque longioribus, sumrnis setacei. brev nulloseuvalidoporrectoatrofuBca orev , aculeis radialissimis, centrali

centrafsT^118 We8t of Chihuahua: flower and fruit unknown- - *Echinocereus radians,* E., is the form with stout les.

8.? C. RCPI8PINUS, E. I.e.: ovato-cylindricus, 11-costetus; areolis lanceolatis ; aculeis radialibus 16-18 aapressw mtertextw, lateralibus catena multo longioribus fuscis recurvatis, centrali singulo valido fusco Doractn. fl infundibuliformi, tubo subelongato, Kmbo patulo; stigmatibus 8 tenuibus albidis. nore

Mountains west of Chihuahua: flowers in May. — Stem 4 inches high; radial spines 4-9 lines central on an inch long. Flower different from that of all other *Echinoeerei* in the length of the tube (over 2 inches lon half as wide) and the whitish stigmata. Seems to form a transition to other sections of the genus

9.? C. LONOMETU8, E. in B. C. R.: subsiraplex, ovato-cylindricus; costis 11-14 tuberculatiu; areolis orbiculatis ; aculeis setaceis albis, radialibus 18-20, centralibus 5-7, quorum 3 inferiores elongati deflexi TSSn

8anta Rosa, south of the Rio Grande. — Stem 6-9 inches high ; tubercles well marked; lower radial •pines 5-7 lines long, much longer than the upper ones; lower central spines 1-2 inches long. Flower said to be red

§ 2. DBCALOPHI.

• *Purpurei ; fiorxbut diurnu.*

10. C. FMTDLIM, E. in PL Fendl.: ovato-cylindricus; costis 9-12 ; areolis subconfertis; aculeia bad bulbosir radialibus 7-10 rectis seu curvatis albidis et fuscis, inferioribus robustioribus, centrali valido sursum curvato atrofas^ plerumque elongato; floribus sub vertice lateralibus magnis; seminibus obliquis tuberculato-scrobiculatis.

New Mexico, from Santa *F6* to below El Paso, and from east of the Pecos to Zuni: flowers in May and June — Stems 3-8 inches high, not many from the same base; spines very variable, but always very bulbous at the base and •ome of them white, some deep brown or Mack, and others party-colored; radial ones $-1 inch, and the central 1-* inch* long. Flower 2f-3* inches in diameter, of a deep purple color. Berry 1-1J inch long edible. Se^i <M*ply and irregularly pitted by the confluence of many of the tubercles, unusually oblique.

11.1 C. MOJAVBNSIB, E. & B. in P.R.R.: ovatus, dense ca»pitosus, glaucescens, 10-12-costatus • aw*K. ^«« to; aculeis validi* curvatis, radialibus 7-8, lateralibus robustioribui, centrali singulo lunum *mUL* clongato.

Var. *fi.* I ZUKTIHSIB : lO^ortatus; aculeis debilioribus 4-angulatis bulbosis rectis Tel flexuosis. radiaUbm ft. iommo longiore robuttiore; centrali reclo seu sursum curvato longiore, omnibus bulbosis.

On the Mojare River in California, and 0. farther east, on the Colorado Chiquito. Ovate heads 2-3 inch** forming dense ca*pitoee masses ; upper and lower spines 9-15 lines, lateral ones 15-25 lines Ion*, central ™nT inchet long, dnaky. Var. *fi.* is dirtinguiahed by having the upper radial spine almost as stout and lona *BB* The •pine, the former being 1W8, the latter 18-24 line. long. Both seem to be distinguished from tL neari *C. FmuUeri* by having the lowest spines weakest, while in that species they are the stoutest of the exterior o^l The resemblance to *C. Fendleri* induces me to place this species here, though the flower remains unknown. high, 1J-2J central y allied [2821

.1*. C. imnucAiTTHUS, E. in Wislit Rep.: ovato-cylindricus, viridia, empitoeus, 7-10-costatis- aculeis wetia, ndialtbot 7-12 (plerumque sub-8) albis, inferioribus longioribus; centrali singulo (rarius 2^3) basi bulboao teretiueculo seu compresso anguUto albido vel stramineo ; ovario pulvilli» 25-35 aculeoloc 6-12 flerentibm atiimftn . ••ttiiiibua tuberculatis. »wpaw f

In the Rio Grande valley from El Paso to Laredo, and lower down, and far into Mexico: flowers April and Mav — A very e^piu» pbmt, of a wrinkled or withered appearance ; 3-6 inches high; spines above 3-5, below 8-16 W wng; uteral ones intermediate; central spine extremely variable, in smaller specimens terete, in very •Ijmgated, flattened, 8 or 10-lfrar 20 line. long. Flowers W inchet long and equally wide: ovary and with nunmotu bunches of ^ n « . Fruit about an inch long, edible. perfect ones tube covered

13. C. 6TRAMINEU8, E. in fi. C. R.: ovato-cylindricus, caespitoso-conglomeratus, ll-13-costatua, late viridis; acaleis radialibus 7-10 rectis vel curvatis albis sub&qualibus, centralibus 3-4 angulatis elongatis saepe flexuosis ; floribus magnis purpureis; ovario pulvillis 30-40 aculeoloe subsingulos gerentibus stipato ; bacca magna fasciculi* aculeolorum elongatorum stipata ; seniinibus tuberculatis.

Mountain slopes, from £1 Paso to tbe Pecoe and Oila Rivers: flowers June. Often from 100 to 200 heads in one hemispherical mass, each 5-9 inches high ; radial spines mostly 8, J-1i, central ones 2-3£ inches long, younger ones dirty yellow and brown, like old straw. Flower 3-4 inches long, very full, bright purple. Berry 1J-2 inches long, luscious.

14. C. DUBIUS, E. in B. C. R. : ovato-cylindricus, ueapitosus, pallide viridis, 7-9-costatus; aculeis radialibus 5-8 albidis, superioribus rope nullis, centralibus 1-4 angulatis plus ininus elongatis ssepe cnrvatis; floribus pallide purpureis ; ovario pulvillis sub-20 aculeolos 1-2 gerentibus stipato ; bacca minore aculeolata ; seminibus tuberculato-scrobiculatis.

Sandy bottoms of the Rio Grande at El Paso : flowers May and June. Stems 5-8 inches high, somewhat cospitose, of a pale green color, and a soft flabby texture : ribs broad, fewer ; radial spines 6-12 or 15 lines long ; central spines 1£-3 inches long, flowers 2} inches long, with fewer and narrower petals. Fruit 1-1 f inches long, covered with bunches of spines which, as in the last species, on the flower are indicated only by few and short [283] bristles. Seed with tubercles confluent, and leaving pits between them. Nearly allied to the two last, but •umcientry well distinguished by the characters given.

15. C. ENOELMANNI, Parry in Sill. Journ. 1852 : ovato-cylindricua, U-13-costatus ; aculeis radialibus sub-13 albidis, superioribus c&teris multo brevioribus, centralibus 4 longioribus angulatis rectis, 3 superioribus fulvis arrectia, inferiore longiore albido porrecto seu deflexo; floribus lateralibus ; seminibus tuberculato-scmbiculatis.

Var. *fi.* CHRY8OCENTRU8, E. & B. in P. R. R.: aculeia nidialibus 12-14 albidis, centralibus 3 superioribus validis vitellinw erectia, inferiore albo compresso deflexo.

VAR. *y.* VABIEQATU8, E. 4 B. I. c. : aculeis radialibus aub-13 albidis, centralibus 3 superioribus recurvatis divaricatis nigris coraeo-variegatiA, inferiore longiore albo decurvo.

Lower Gila, Colorado, and wftttwnrd to the California mountains : flower* June and July. — Stems 5-10 inches high ; radial spines slender, 3-6 lines, central one* 1-2 inches long. Fmit neitr the top of the plant. — Dr. Bigelow collected a little farther north, on Bill Williams'* Fork, the two forms which I have put under *fi.* and y.9 though they differ from the specie* by having the fruit lower flown on the plant; the arrangement of the spines, however, is entirely identical. Var. *fi.* has very stout central spine*, 2-3 inches long, of a de*p golden-yellow color, and the lower one shorter. In var. y. the central spines are only 1-2 inches long, much curved, and the upper ones whits and bUck mottled.

• • *Coceinei ; JloribuM diu noetuque apertis.*

16. ? C. OOSACAXTHC8, E. <& B in P. R. R. : ovatu*, sulwimplei, 7-cosUtus ; areolts remotis; aculei* robuatis angulatit ssspe curvatis, radialibtm 8 flavidis *ef>e bwi oUcuru, summo cvteris multo major* centnlem multanguUtum Talidum ivpe flezuosum •ub«i¡iiunte.

Near Zuni, in western New Mexico, under cedan. — Radial spines 8-15 lines long, upper one and central spine 1$-8| belies long, remarkably stout, angular and channelled — I have not seen the flower of this plant, but place it bare from its resemblance to the next upecie* ; on the other band, it ween* to be allied to *C. MojavcnsU.*

17. C. TMQLocHiDUTua, E. in Witlis. Rep. : ovato-cylindricus 6-7-costalus, parce raoicMUs; areolis remotk; acuWia 3-6 robustis anguUtin compirniiin rectis seu curvatis laxe radiantibus ; lloris coceinei ataminibna [884] patala obtoaa auba«|iianUbua ; «U(rmatibuii 8-10.

Northern New Mexico, at Santa Fe\ and *in* the ea*t and wentwanl: flowers June. — Sterna 4-6 inches high, 2-3 in dianet ... and ... Fruit ... rigid.

18. C. FH«icroa, E. in P. R. R., *C.* WW^MI, E. in Wulii. Rrp non Adm.: ovattw ieu subglobniua, obtuiu*, wpiU)aua,»-ii^oatataa; areolia OTakM>rbiculati. subrunfertia ; aculeis aeUreu rectu, radulibua 8-1i albidia, tuperiortbua esHeria paullo brerioribw, eentraliboa M bad bulboaia teretibua paullo roboatioribus ; sUniniban pttalfc DM-vioribw; atigmatibus e-8.

Northern New M«|co, from tbe upper Peeoa to Santa Fe, Zuni. and the San Francbco mountaina : iowtn Ma/ and ... more ... Fruit unk: ... 3-6, central ones 5-10 lines long. When there are several, the lowest one lot ... of a foot or

0. 00WOIWU1, E. A. B. L a. : ovatus, ... radialibus 10-12 gracilibus rigidis, ... centralibus 3-6 infimo ...

Rocky places on the Upper Pecos, and perhaps Son Francisco mountains. — Heads 3-4 inches high, few, of unequal height from one base; upper radial spines 2-5 lines, lateral ones 6-15 lines long; upper central spines hardly longer than the lateral ones; lower one 1-3 inches long, angular and often compressed. The Mexican *C. acifer,* Otto, seems similar, but is a higher plant, with much stouter spines. *C. Rcmeri,* Muhlenpf. A. O. Z. 1848, from Western Texas, may belong here or to *G. enneacanthtu.* A specimen among Dr. Bigelow's collections seems to unite this form with *G. phceniceus,* where for the present it is perhaps best to leave our plant as a variety or sub-species.

19. C. POLTACANTHUS, E. in Wisl. Rep.: ovato-cylindricus, casspitosus, subglaucescens, 9-13-costatus; aculeis robustis rigidis rectis albidis seu rubello-cinereis, centralibus 3-4 bulbosio paullo robustioribus equilongis seu longioribus, junioribus rope fuaco-variegatis ; stigmatibus 8.

Common about El Paso, and thence to the mountains of Chihuahua : flowers March and April. — Heads [285] 5-10 inches high, 2 J-4 in diameter; upper radial spines i, lateral and lower ones j-1 inch long; central spines , hardly longer, or the lower sometimes 1J-2J inches long. Flowers 2-3 inches lung, profusely covering the plant for four or six weeks. Seed the largest of any *Echinocerei* known to me, 0.8-0.9 of a line long.

20. C. R<EIIBRI, E. in PL Lindh. 1850: ovatus, cwspitosus, bete viridis; costis 7-9 tuberculatis interruptis; areolis orbiculatia, junioribus breviter tomentosis ; aculeis teretibus robustis albidis seu junioribus flavidulis demum cinereis, radialibus sub-8, centrali singulo robustiore porrecto; floribus lateralibus iufundibuliformibus limbo erectiusculo ; pulvillis ovarii tubique 16-18 albo-tomentosis aculeolos 3-5 gerentibus ; sepalis interioribus 7-8 ovato-oblongis carinatis obtusis mucronati* ; petalis 9-12 obovato-spathulatis obtusis integris concavis rigidis suberectis ; stylo longe supra stamina albida suwum roseu exaerto; stigmatibus 6-7 petala eequantibus erecto-patulis viridibus acutiusculis.

In the granitic region about the Llano River, western Texas: flowers May : fruit unknown. —Often 5-12 from the same base, densely owpitose; single heads 3-4 inches high, 2-2J in diameter; areola 6-8 lines apart; radial spines 5-12 lines long, upper ones usually a little shorter than the rest; central spine 10-15 lines long. Flower 2 inches long and only one in diameter, remaining open day and night for a whole week, if the weather is not too warm. — Allied to the last species ; but distinct by the shorter heads, fewer ribs, fewer and paler spines, and smaller flower, with less numerous parts.

21. ? C. PAUCIBPINUS, E. in B. C. R.: ovato-cylindricus, parce ramosus vel simplex, 5-7-costatus; areolis remotis; aculeis robnstis 3-6 radiantibus fuscatis, centrali nullo vel raro robusto subangulato.

Western Texas, from the San Pedro to the mouth of the Pecos. — Stem 5-9 inches high, 2-3 in diameter; spines 9-16 lines long, dark-colored, the central one almost always wanting. Flower and fruit unknown.

22. ? C. HBXADBUS, E. A B. in P. R. R. : ovatus subsimplex, 6-costatus ; areolis remotis; aculeis rectis rigidi* tenuibus angulatis, radialibus 5-7 flavo-rubellis, inferiore breviore, centrali paullo robustiore (juniore fuscato) saepe de6ciente.

Near Zuni, in Western New Mexico. — Heads few in each plant, or single, 4-6 inches high, 2-2J inches in diameter. Radial spines mostly 6 lines, lower ones 6-10 lines, upper ones 8-15 lines long ; central spine, if [286] p«ent, 18-16 line. long.

§ ^ pBHTAtOpHI>

23. C. BBRLANDTBRI, E.in B.C. R.: humilis, perviridis; caule diffuso snbtereti articulato ramosissimo ; tuberoulb conicis 5-6-fariis; aculeis 6-8 setaceis brevibus radiantibus albidis, centrali singulo raulto longiore fusco; floriIma magnin; petalis angustis recurvatis; seminibus tuberculatis.

On the'Nueces, in southern Texas: flowers May and June. — Stems lf-6 inches long, one inch thick; radial •pines 4-0 lines long, central one 6-12 lines long, toward the base of the branches shorter. Flower 2-4 inches long.

24. C. PROOUMBENB, E. in PI. Lindh. 1850 : humilis, perviridis; caule diffuso subtereti 4-5-angulato articulato ramosissimo; aculeis 4-6 radiantibus albidis, centrali nullo vel singulo paullo longiore obscuro; floribus magnis; petalis obovato-spathulatis patulis seu subrecurvis; seminibus tenuissime verrucosis.

On the Rio Grande, below Matamoras: (lowers May and June. — Similar to the last; but more slender, 6-8 lines in diameter ; radial spines 1-2 lines long, central one, if present, 2-3 lines long. Flower above 3 inches long.

§ 4. GRACILES.

85. C. TUBBB08U8, Poselger : e radice tuberosa tenuissimus, teres, sursum incrassatus, demum articulatos, 8-cosUtus ; acaleis minutis setaceis, 9-12 radiantibus, centrali singulo longiore sursum adpresso ; (lore nubterminali; seminibos minntis scrobiculatis.

Between Laredo and Mier on the Rio Grande. Tuberous root J-l J inches thick. Stem above 4-8 lines thick; radial spines hardly 1 line, central ones 2-3 lines long. Seed smaller than in any other *Eckinocertxu,* 0.4 line long, with the tubercles confluent

8ubg«L i. BOOBBBDB* Cbnlis elongatus: frscicnli aculaorum steriles et florigeri similes: floris tubas donffotas. iwiiMiMi AmlAAlk ~»*ni«^« monitas: •tigmaU pallida: semina lssria sea mio ragosm: smbryo hamata*.

26. C. EMORTT, E. in Sill. Journ. 1852: prostratus ; raxnis adscendentibus 15-costatis ; areolis confertis ; aculeis setaceis ri^idis flavis, radialibus 40-50 stellatis, centrali uuico longiore robustiore ; floie flavo brevius- [287] cnlo ; bacca aculeatissima ; seminibus magnis lucidis.

On hills near San Diego, California, growing in thick patches. — Stems several feet long ; branches 6-9 inches high, 1J inches in diameter. Fruit very spinose, with seeds over one line in length.

27. C. VARIABILIS, Pfeiff. : erectus, 3-4-angulatus; areolis remotis; aculeis 4-6 brevibus radiantibus, 2-4 interioribus validis elongatis inaequalibus divaricatis, centrali deflexo ; flore magno albo nocturno ; bacca coccinea aculeolata; seminibus magnis bevibus.

On the lower Rio Grande : flowers in May and June.—Well known from all parts of tropical America. Stem 3 to 10 feet high, 2 inches in diameter ; larger spines 12-18 lines long. Fruit 2-3 inches long, nearly 2 iuches in diameter.

28. C. OREGON, E. in Wisliz. Rep.: gracilis, e radice crassa napiformi erectus ; ramis 3-6-angulatis, rufeatentibos; areolis confertis ; aculeis e basi bulbosa abrupte subulatis brevissimis nigricantibus, radialibus 6-9, centrali bus 1-2; floris elongati albidi tubo aculeolis capillaceis flexuosis munito ; bacca sessili obovata apice rostrata ; seminibus rugosis. Var. o. CISMONTANUS : areolis elongatis; petalis latioribus. Var. /9. TRANSMONTAUCS : areolis ovato-orbicolatis; petalis angustioribus.

From Western Texas to Sonora, and south to Chihuahua : flowers May and June. — Root a large fleshy tuber, rometimes 6 inches in diameter. Steins 2-3 feet high, 9-12 lines thick, usually 4- or 5-angled; spines f-1 line long, very sharp; lower ones longer. Flower 6 or 8 inches long, 2-2} wide. Fruit 1-1} inches long. Seed l±-1i lines long.

Subgen. 3. LEPIDOCERECS. Caulis elongatus : fasciculi aculeoruui steriles et florigeri similes : floris tubua brevior squamosus: phylla numerosissima : stigmata pallida : semina laevia: embryo bamatus.

29. C. oiOANIEUb, E. in Ernor/s Rep. 1848: erectus, elatus, parce erecto-ramosus, 18-21-contatus; aculeis 12-16 radialibus inaequalibus, centrali bus «ub-6 robustis basi bulbosia corneis basi uigris oeteros fluperantibus, infimo longiore deflezo ; floribu* frabterminalibns albidis ; bacca obovata detnnm 3-4-valvi.

From the lower Gila north to Willianis's River (better known among Western travellers as Bill Williams*! [288] Fork), and south into Sonora: flowers May-July; fr. July and August. — A now well-known plant to traveller* and botanists,30-60 feet high, 1-2 feet in diameter; central spines l}-2} inches long. The yellowish-white flower3-4 inches long. Fruit 2-3 inches long, often pear-shaped, and opening with 3 or 4 irregular recurved valves.

90. C. THURBIRI, E. in Sill. Journ. 1854: caulihus erpctis vel adscendentibus pluribus elation bus articulatis l&-14-costatis; aculeis 7-15 gracilibus fusco-atris volde inoKiualiUis ; ovario tuboque imbricato-squamato ; bacca globosamagna.

Sonora, west of the Sierra Mad re: flowers June and July. — Stem* 5-15 from one root, 10-15 feet high, 4-6 inches in diameter; spinet slender, flexible, from 5-18 lines long. Flowers 3 inches long, white. Fruit like a large orange, of delidous flavor.

8ubgen. 4. PILOCEREUS. Caulis elatus : fanciculi aculeorum Aterile* a floriferis tennioribnt longioribat diitincti: flora tabus brevis squamosus : phylla pauciora: stigmata jwlliila -. aemina bevia: embryo hamatus (in specie nottrm !).

31. C. SCBOTTII, £. in B. C. R.: caulibus eirctin vel ailscendentibus pluribus elatioribun articulate 4-7-cosUiif; areolis in artkulit sterilibus remotis ; acnleui birvilmn robust^ radialibus 4-6, central!' unico ; arcolin in articulb florifera eonfertis ; aculeia 15-25 longioribus seUceia flexuosis e rubello cinereb; floribus carneis minoribiw, tubo gracili decarvo; bejxa p v n

8onora, towards SanU Magdalena: flowers July. Stems 8-10 from the tame bate, often growing in dense clutter*, 8 or 10 feet high, with *-4 trticuktiont, 4 or 5 inches in diameter. Spine* of the uterile part of the pUni3-4 lines long, on the fertile joiDU 1-4 inches long, pendnlons, forming s reddish-gny be«H, in which the flower (not 8 inches long) is somewhat hidden. Seeds Urge : cotyledons hooked, exactly ss in the la* two species. This is evidently a *Pilcc* ru,* but with the seed of a true Orti», thus reuniting the former with the UtUr.

TRIBUB II. ROTATE MIQUIU

Apbylto seu folios*. Flora tubo abbreviate tubrotati. Cotyiedones fade venuj hHom spectantes semiui* laten contraris (incumbentes).

IV. OPUNTIA, Tourn. [889]

Ovmrium sepalis subulatis eaducis axilU pulvilligeris instraetam. 8emina msgna, comprasa, diseoiiUa, ssrpe sMrginata, albida. Cotyl^lones foliaces, circa albumen cunratc, plerumque incumheutes. — PUnt« artkalatsi; articuiis eomplanatis seu tervtibus plus minus tubetculatis; fuliis subulalis caducit ^«iiu pulviUo, *mumm* nlii---us [illegible] sxulaU a ^ isjUmom U^iUk. F—^»H

ANALYSIS.

I. Petala parva, subnlata, miberecta, — Subgen. L STECOPUWTIA.

II. Petala lata, obovata seu obcordata.

1. Articnli complanati: embryo circa albumen parcnm spiraliter convolntns. — Subgen. 2. PLATOPUVTU.

A. Bacca succosa: margo semiunm plerumque angustior *(Sareocarpea).*

a. Qlabra. • Bacca parva subglobosa. — J 1. *Microcarpea.*

* * Articuli magni: aculei pauci compress!. — } 2. *Grande*.*

• • • Articuli minores: aculei setifomies. — § 3. *Setispina.*

• • * • Articuli minores: aculei pauci, robusti, terete*. — § *4. Vulgares.*

b. Pubescentes. — § & *Pvbucentes.*

B. Bacca sicca: margo seminum plerumque latissimus. — § 6. *Xeroearpeas.*

• 2. Articuli cylindraoei: embryo circa albumen copiodui iubcirculari*. — Subgen. 8. CTLIHDBOPUIITJA.

A. Articuli abbreviate clavatL — f 1. *Clavate.*

B. Articuli cylindracei, elongatL — (2. *Cylvndrkm.*

Subgen. 1. STENOPUNTIA, **E. in B. C. R. Articuli complanati: flores parvi: petala subulata: stigmata pauca.**

1. 0. BTENOPETALA, **E. 1. c.: prostrata ; articulis magnis; aculeis 1-3 cum minoribus 1-3 ancipitibus deflexis atrofuscis ; ovario pulvillis confertis Btipato ; sepalis petalisque subulatis suberectis ; stylo inflato ; stigznate siiuplici.**

On the battle-field of Buena Vista, south of Saltillo. Nearly allied to the Mexican *O. grandis,* Hort. Angl., which has very similar flowers, but is an erect plant, with few and white spines, and 2 or 3 acute stigmata.

Subgen. 2. PLATOPUNTIA, **E. 1. c Articuli coroplanati: flores magni: bacca pulposa yel rarius sicca: [290] seniina late marginata: embryo pluaquam circuLuis circa albumen parcum spiraliter convolutus: cotyledones semper contraria.**

§ 1. MICROCARPM **: suberecto : aculei plurimi, colorati: bacca parva subglobosa.**

2. 0. STRIOIL, E. in B. C. R.: Buberecta, articulis ovatis orbiculatisve; pulvillis confertU; aculeis 5-8 rodiantibus deflexis rufis apice flavis; bacca parva late umbilicata rubra ; seminibus parvis anguste marginatis.

Between the Pecos and El Paso. — Plant 2 feet high ; joints 4-6 inches long ; spines an inch or less in length. Fruit 6-7 lines long.

§ 2- ORANDES **: erect* seu procumbentes: articuli magni: aculei pauci^ validi, compressi, plerumque colorati: bacca major vel magna, plerumque ovata.**

• *Subinernus.*

3. 0. FICUS-INDICA, **Mill: cultivated south of the Rio Grande, under the name *Nopal CastiUano.***

• • *Flavupinx.*

t *Erectas.*

4. 0. TUNA, **Mill: cultivated about the old missions in the southern parts of upper California, under the name *Tuto.* Specimensgathered at Beaufort, on the coast of South Carolina (probably introduced), may belong here.**

5. O. ENQELMAinn, Salm: erecta, grandis; articulis obovatis; pulvillis remotis setas stramineas rigidas inoquales aeuleosque 1-3 compressos stramineos basi rufos gerentibus; floris flavi intus rubelli ovario subgloboso; stitfinatibueS-lO; bacca obovato late umbilicato; seminibus minoribus.

From the Canadian River to the mouth of the Rio Grande, and westward from the Gulf to Chihuahua and El Paso; flowers May and June. - Plant 4-6 feet high ; joints a foot long or lew; leaves subulate, 3-4 lines long, larger spines 1-U inches long. Flower 2J-3 inches in diameter. Fruit usually 2 inches long, 1* in diameter, juicy, but of a somewhat nauseous taste. Seeds lf-2 lines in diameter. A plant observed by Dr. Blackie on Bayou Been!; western Louisiana, 51 feet high, joints 9 inches long, reddish-yellow flowers, is probably this species.

***0. IAndkelneri,* E. Plant. Lindh., is partly this same plant, partly a hybrid form between it and perhaps [291] 0. JtySnopMt, with narrow clavate fruit.**

O. EVGBLMAnn, var. t CTCLODES, E. & B. in P. R. R.: articulis orbiculatis; aculeis validioribus snbtingulis; baeca parva globosa ; seminibus majoribus.

On the upper Pecos, in New Mexico. Joints 6-7 inches, and fruit 1 or lj inches in diameter.

0. DULOB, **E. in B. C. R., is a doubtful plant, of which we have not material enough. It has been found near the nUdb come of the Rio Grande, near Presidio del Norte, ete. It is similar to *0. Sngdmanni,* and may be a form oftt; but it is lower, more spreading, with a similar but very sweet fruit, and small rsgnkr seeda.**

The following may be considered as a subspecies: —

O. OCCIDENTALS, E. *k* B. in P. R. R.: erecta, patulo-raraosisaima; articnlis grandibus obovatis vel rhomlioideia; pnlvillis remotis setas graciles confertas et aculeos 1-3 validos compressos deflezos albidos basi obscuriores et inferiofe* paucos graciliores gerentibus; floris flavi intus rubelli ovario obovato; bacca obovata late umbilicata; seminibus majoribus.

On the western slope of the California mountains, near San Diego and Los Angeles: flowers June. — Plant 4 feet high, forming large thickets; the joints 9-12 inches long; pulvilli with very fine closely-set bristles ; spines about an inch long. Apparently distinct from 0. *Engdmanni* by its manner of growth, the very fine bristles, and the larger seeds.

There are also some indications of another form, growing on hills and plains near San Diego, California, and on the neighboring sea-beach, with higher and more upright growth, and coarser bristles on the pulvilli, but which I cannot well distinguish from *0. Engdmanni.* I have seen no fruit or seed of it.

6. O. CHLOROTICA, E. & B. in P. R. R. : caule erecto aculeis flavis numerodissimia fasciculatis nrmato; articulis orbiculato-obovatis pallid is ; pulvillia subremotis setas difformes confertas aculeosque 3-6 innquales compresson stramineos gerentibus; floris flavi ovario pulvillia confertis stipato; petal is ppatbulatis.

Western Colorado country, between New Mexico and California, from the San Francisco mountains to Mojave Creek. — Plant 4-6 feet high, forming large and sometime* spreading bushes ; the trunk covered with [892] spines 1-2 inches long; joints 8-10 by 6-8 inches in length; spines J-1J inches long. Ovary with nearly 50 pulvilli, while the foregoing species have not more than 20.

f f *Procumbent**.

7. 0. PB0CUMBE58, E. & B. 1. c.: prostrata ; articulis orbiculato-obovatis grandibns pallide viridibus; pulvillis remotis setas stramineas rigidas valde inoquales et aculeos 2-4 validos compressos angulatos stramineos basi obscuriores gerentibus.

San Francisco mountains to Cactus Pass, in western New Mexico. Joints 9-13 inches long, always edgewise ; pulvilli lf-2 inches apart; spines 1-2 inches long. Similar to *0. Engdmanni,* but prostrate, with more distant pulvilli and stouter spines. No flower or fruit seen.

& 0. A3GC8TATA, E. & B. 1. c.: prostrata vel adscendens ; articnli* elongato-obovatis versus basin angnstatis; pnlvillis remotis setas fulvas graciles aculeosque pauco* (2-3) validos compresses stramineos seu albidos versus basin *trio** deflexos gerentibus ; bocca oWata tuberculata ; seminibus niagnis.

From Zuni, west of the Rio Grande, westward to the Cajon Pass, in the California mountains. — Joints 6-10 inches long, only 3 or 4 wide. Spines similar to those of the last species ; bristles much more delicate. Fruit 1} inches long ; the umbilicus flat, but immersed. — Well distinguished by the shape of the joints.

• • • *Fulvispinm.*

•. O. MACBOC15TRA, E. in B C. R.: adtcendenii; artirulis niagnis suborbiculatis tenuibus; pnlvillis subremotis sets* graciles breves fulvas gerentibn*, eummis toliim aculeos 1-2 pnelongos subcompressos fusco-atros proferentibus ; fcris flari ovario ovato; stigmatibus 8 ; seminibo* msjusculis.

Sand-hills on the Rio Grande near El Paso : flowers May. — Two or three feet high, with very striking round joints, 5-6 inches in diameter, and blackish spines ss much as 2 or 3 inches long. Nearly allied to the next species,

•!?' ◦: *VUM^CAXn^* E to Plant. Fendl.: diffusa, adscendens ; articnlis oboratis crassis giancesctntibns; pulvinis subremotis •Mas graciles straminea* sen fuscstan longiom gmntitraa, plerisqne sculeos 2-* pins minus compressos fusco* proferentibus ; floris flavi ovario abbreviato ; ttigmaUbos 8; bacca cuneata pyrifcinni; seminibus msjusculis.

• Vsr. •. moniCAHs: acnleis brevioribn. acnte sngnlntls et niKriantitas. [203]

Yar. *fi.* BIUWJIIA : pnlvillk temotioriWiis; acnleis lonffioribu. obtnse si^nlalis Kranneis snimn sJhUis.

Var. y. MAJOR: snborhienlau; paMUis remotis; scaleis brrvioribos rmodoribns pallidiorihos.

New Mexico: lowrn Msy. Tar. «. U found on the Rio Grande near 8anU Fe; ». in dmflar sandy locations J 7 i El P L T ; pnd ^ *in* mounulllotl « wrfons near SejiU Fe. - Joints 4-4, or in *y.* em 8 inches lot*; spines mostly 1-8 tncbes in length. Flower ahmil 2 faiehes in diameter, with s short ovary. Fruit 1 Hi *«*»*• long, slender, much contracted at base so a. to appe« ahno* ^ipiute.

0. MojATmsm, E 4 a in P. R. R : pwatnia; articulis gimdibos soborbicukU.•, pdnUk remotis; seik fulvu; aculf is £-6 ralidis infra fuscts.

th
fc«s4^faL^Mc!^ west of the Colorado. — The material is too scanty to make out where it belongs ; but perhaps it

11. 0. CAMANCHICA, £. & B. in P. R. R.: prostrate; articulis adscendentibus majusculis suborbiculatis; pulvillis remotis plerisque armatis; setis stramineis fulvisve parcis; aculeis 1-3 compressis fuscis apice pallidioribus, Buperioribus elongatis suberectis, caeteris deflexis; bacca ovata late unibilicata; aeminibus majuBculis angulatis hilo ezcisis.

Llano Estacado, on the Upper Canadian River. A large, extensively spreading plant; the joints 6-7 inches long; spines 1J-2 or even 3 inches long. Fruit large, juicy. Seeds 2-3 lines in diameter, very irregular and deeply notched at the hilum.

12. 0. T0RTI8PINA, E. & B. 1. c: prostrate; articulis adscendentibus majusculis suborbiculatis; pulvillis subremotis; setis stramineis seu fulvis; aculeis 3-5 majoribus angulatis sape tortis albidis cum 2-4 gracilioribus; bacca ovata late umbilicata; seminibus majusculis orbiculatis.

On the Cainanche plains, east of the elevated plateau of the Llano Estacado. —Similar in size and habit to the last species, its western neighbor, with more numerous spines than any other of our *Opuntiue* with juicy fruit Seeds regular, and only very slightly notched at the hilum.

§ 3. SETIBPIN* : adscendentes : articuli plerumque minores: aculei pauci, teretes sen vix angulati, graciles, [294] flexile*, pollidi: bacca minor.

13. O. TENUISPINA, E. in B. C. R.: articulis majusculis obovatis basi attenuatis late viridibus ; pulvillis subapproximafe setas graciles breves fulvas gerentibus plerisque arroatis ; aculeis 1-2 elongatis albidis cum 1-4 brevioribufl inferioribus ; floris flavi ovario clavato; petalis obovatis retiwia ; bacca oblonga profunde umbilicata; seminibut miuoribus.

Sand-hills near El Paso: flowers May. — Joints 3-6 inches long, 2-4 wide ; leaves very slender, hardly 2 lines long; upper spines suberect or spreading, 1 J-2£ inches long. Flower 2£-3 inches in diameter. Seeds less than 2 lines in diameter, very irregular. — Similar in many respects to *0. phaaeantha,* which grows with it; but readily distinguished by the spines and fruit.

14. 0. BETMPrNA, E. in Salm, H. D.: articulis suborbiculatis parvis glaucis; pulvillis confertis setas flavidas gerentibus, omnibus armatis; aculeis 1-3 longioribus subangulatis et £-7 brevioribus plus minus deflexis, omnibus gracillimis.

Pine woods in the mountains west of Chihuahua, Dr. Wislizenus. — Joints not over 2 inches long; pulvilli only 3-4 lines apart; longer spines 1-1$ inches long, very slender, like bristles. Flower and fruit unknown.

15. 0. FILIPENDULA, E. in B. C. R.: glauca; radicibus nodoso-incrassatis ; articulis minoribus orbiculatis sen obovatis seu oblanceblatis tenuibus; pulvillis apprbximatis setas virescenti-flavas graciles numerosas gerentibus armatis •el inermibus; aculeis, si adsunt, 1-2 elongatis subangulatis cum 1-2 minoribus, omnibus albidis ; floris purpnraecentia ovario gracili; stigmatibus 5 5 seminibus minoribus turaidis.

Alluvial bottoms of the Rio Grande near El Paso, and eastward on the Pecos : flowers May and June. —The long knotted roots, the small bluish joints, with the very small leaves and very long bristles, together with the purple flower, and thick very narrowly margined seeds, distinguish this species from all others. Plant 6-12 inches high ; joints 1J-3 inches long, 1-2 wide; pulvilli 4-6 lines apart; lower spines 1-2 inches long. Flower 2} inches in diameter. Seed hardly 2 lines in diameter.

I 4. VoLQAAU: procumbent*! vel adscendentes: articuli plerumque minores : aculei validi, subteretes vel [205] nulli, albidi vel obscuriores: bacca clavate.

16. 0. RAFINESQUII, E. in P. R. R.: diffiwa; radice fibrosa; articulis obovatis vel suborbiculatis perviridibus, foliis elongatis patulis; pulvillis subremotis setas graciles rufas gerentibus plerisque inermibus; aculeis paucis nmrginalibus validis rectia singulis erectis patulwve, uno alterove minore deflexo subinde adjecto, rufo variegatis; alabastro acnto; ovario clavato pulvillis 20-25 stipato ; petalis 10-12 ; stigmatibus 7-8; bacca clavata.

Var. MICROSPIRMA : subinermis; seminibus minoribus angustius marginatis.

Sterile, sandy, or rocky soil in the Mississippi valley, from Kentucky to Missouri, and from Minnesota southward : flowers May and June. —Joint* 3-5 inches long; leaves &-4 lines long; spines 9-12 lines long, sometimes entirely wanting. Flowers 2^-3j inches in diameter, yellow, often with a red centre. Seed 2} lines, or in the variety 1MS than 2 lines in diameter. — This species had been confounded with the eastern 0. *vulgariu* by all our botanists, with the exception of Raflnesqne, who pretended to distinguish three species,—namely, *0. humifusa, 0. catptom,* and *0. nmaeanika* (sometimes erroneously accredited to Nattall), — which cannot be made out, and which I have again united under their author's name.*— The following is probably only a southern variety of this species: —

• The following extract is from s note by Dr. Engdmann In the " Bulletin of the Torn? Botanical *ton* V September, 1871, II.p. 14.-IDS,

I have now had Professor Wood's specimen of *OpunHa* from Westcheftar Co:., one from New Jersey sent by Mr. Mtshtn, and a third from New England, probably Mimifiinsstts,

O. GRANDIFLORA, E.: subadscendens; articulis majusculis; pulvillis remotis; setis tennissimis; aculeis subnullis ; floris grandis ovario elongato; petalis sub-10 latissimis ; stigmatibus 5 ; bacca elongata clavata.

On the Brazos, Texas. —Joints often 5-6 inches long; pulvilli nearly an inch apart. Flowers 4^-6 inches in diameter, red in the centre ; petals 2 inches long or more, and l£ wide.

Dr. Bigelow collected, on his tour from Arkansas to Santa Fe*, several forms, which, though somewhat distinct, are perhaps not entitled to be considered species. The true *0. Rafinesquii* does not seem to occur west of the western line of Missouri and Arkansas. The western forms or subspecies are : —

O. CTMOCHILA, E. & B. in P. R. R. : diffusa; articulis orbiculatis; pulvillis subremotis stramineo-seu fulvosetosis plerisque armatis ; aculeis 1-3 robustioribus albidis basi fulvis patentibus deflexieve, additis sspe 2-3 m in on bus ; stigmatibus 8 ; bacca obovata; seminibun undulato-marginatis majusculis. [296]

Var. ßL MONTANA : subinermis; stramineo-setosa.

Along the Canadian River east of the Llano Estacado, and on that plain. Var. *fi.* near Albuquerque. — Joint! 2J-3 inches in diameter, in 0. larger ; longer spines 1-2 inches long. Fruit short, pulpy, sweet. Seed 2$ lines in diameter, with a very sharp irregularly wavy or twisted border. — The var. £. seems to unite the common *0. Rafinesquii* with this fonn.

0. 8TENOCHILA, E. & B. 1. c : prostrata ; articulis obovatis; pulvillis remotis strainineo-setosis, guperioribus solum armatis; aculeis singulis albidia patulia, 1-2 minoribus deflexis a&pe adject is; bacca obovata clavata; aeminibus craasis anguste marginatis.

Zuni, western New Mexico. —Joints 4 inches long and 3 wide ; spines 1-1J inches long. Fruit green or pale red, very juicy, \\ or sometimes even 2J inches long. Seeds quite peculiar, regular, much thicker in proportion than those of most other *Opuntiv,* and with a *very* narrow edge. — Another form, with smaller and rounder joints, more spines, smaller fruit, but similar seeds, was found in the same neighborhood.

All the forms described above have fibrous roots. The following are principally characterized by their bulbous or tuberous roots, but can hardly be otherwise distinguished from the forms already described. Both are found westward of the range of 0. *Rafinesquii* proper, and may be considered as subspecies, the peculiarities of which are readily propagated by seeds.

0. MACRORHIZA, E. in Plant. Lindh. part 1 : proatrata, rape aducendens, radicibus tuberosis ; articnli* obovato-orbiculati* penriridibus ; pulvillis subremotis rufo-setosiH, superinribus aolum armatis; aculeis singali* validis tttpe •ariegatis patulis, 1-2 gracilioribus deflexis subinde additis; alabaMro acuminato; petalis circiter 8 sulphareis bad miniatis; stigmatibus 5 ; bacca obovata basi clavata, umbilico lato ; aeminibus subregularibus compreati* minoribns.

Sterile, rocky places on the upper Guadaloupe River, in Texas: flowers May and June. — Roots in young spedmens fusiform, in old one* enlarged to fleshy tubers, sometimes 2 or 3 inches in diameter. Joints 2}-3| inches long ; the leaves and bristles the same as in 0. *R*ifiru*qu\i.* Flowers 3 inches in diameter. Fruit green or pale purple, •miller and sweeter than that of 0. *Rafimsquii.*

0. FUSIFORM*, E. A R 1. c. : subprostrata ; radicibus elongato-fusifonnibus ; articulis orbiculatis ; pul- [807] •fltis setaaelongataa vireacentifuiica* gerentibo*, pie risque vel solum auperiorilms armatift; acute:* 2-3 gracilibus albidis deflexis sea patentibu* ; floribus minoribus ; stigmatibus 8 ; bacca ovata ; seminibus majusculis subregularibaa. ^^Kanaas and Nebraska, in the regions of the Cmss-TimUni, from the Canadian to the Big Bend of the Missouri — «oots elongated tnbert J-l inch in diameter; joint* about 3-4 inchc* long ; tpiue* an inch or a little more in length, wwdewr and paler than in 0. *Rafin^jnii.* Flower* 2-2» inchea in diameter. Seed 2 j line* wide. This plant baa bt^o^r^tedbymeiir^t* name of *Opuntia bulbosa.*

17. 0. Fusoo-ATIA, E. in P. R. R : diffnaa ; articniis orbiculato-oboraU* tobercnlati*; rmlrillis tubranoda ^Jf^0^^STM^60^^*^011^****..mferioribn* solum inermibos; setis numerosi* robuati* longinscoli* fu*riji; acnleia snbaingnlis roseus fo»^co^n* roberectia,aJtero breviore defleio *s»pe ailjecto; flor'u flavi orario conJco pulviUos 12-18 fulvovillosos et fusco-setosos gerente; stigmatibus 5.

-j . J T L T L ^ ^ places in we rf Howto<>< Ten.: flowen Mar. - The *Hoot* brown, or *Aon* «lmo* Uaek *fbm,* and tbe thick bnnchct of *tawullj* Mont brow* bmtlw on the «u*ll joinu, gin this piut a *nrj* dirtlact appMnaM.

furnished by Professor Gri , side by side in cultivation with our Missouri and Illinois *0. Rafu*

J tiny, and sometimes tU So««r b MMlltr UM» in «or plant. tattUdcapgnea color, Ux km« eprcdi ng \«ave«, and the right brown bristles, especially on the older joints, on which they increase in number and length to considerable bu- are characteristic of the plant. With them I hav the true *0. vulgaris,* stol *hf* Dr. Sckott *bum* ib* bUka tf th# Potomac, and probably Mil foand »©fth of Cbitapsake Ikr. with tbiektr liffbl r^n joints, short*, tblektr, rnor* •dprwd Uartt, and small bonrb« of •bort, thin, grvraiab*y*\Um* briatlos. ThU b 0* |4anl wkicb U e«ltiv«Ud is Enrop* vnd*r tbat nam«. and *hm* bran» Mtamlnwd la nortbm Italy, aad which I ban dowibsd «a4 ig«W at

Joints 2f-3 inches long; pulvilli 6-9 lines apart; bristles 2-3 lines long; spines 1-1£ inches long, the lower one, when present, about half as long, but hardly less stout Flower nearly 3 inches in diameter ; ovary an inch long, rather slender, its pulvilli .covered with long grayish-brown wool, and the upper ones with a few bright-brown bristles.

18. O. VULGABIS, Mill.: diflusa, prostrata; radice fibrosa; articulis obovatis seu suborbiculatis crassis late seu pallide viridibus pleramque inermibus ; foliis ovatis cuspidatis fere adpressis; pulvillis subremotis parvia subimniersis setas paucas abbreviatas virescenti-stramineas gerentibus; aculeis rarissiiuis singulis robustis variegatis suberectis ; alabastro subgloboso-obtuso; ovurio clavato pulvillie sub-10 stipato; petalis sub-8; stigmatibus 6; bacca obovata clavato; seminibus regularibus crassis crasse marginatis.

From the southeastern coast of Massachusetts to Georgia and Florida; apparently only in the low countries east and southeast of the Alkghanr Mountains, generally not far from the sea-coast: flowers May and June,—Joints 2-4 inches long and 2-2* in diameter, rather thick and fleshy. Leaves 2-2* lines long, generally appressed, only in very vigorous specimens more patulous: spines, when present, less than 1 inch long, but stout [298] Flower about 2 inches in diameter, pale yellow. Seed 2* lines in diameter. It seems to be well distinguished from *0. Rafi^un* (which grows only west of the Alleghauies) by the smaller size, paler color, small pulvilli, usually the absence of spines, the smaller flower, with all the parts less numerous, and especially by the short, thick, and more or less appressed leaves.

S 5. PuBKSOBimcs : erects seu proeumbentes: articuli pubeucentes: folia minuta: aculei subnulli.

• *Flaviflora.*

19 0 MICRODASYB Lehm : erecto-patula; articulis oblongis obovatis seu orbiculatis pubescentibus late viridibus; foiiisminutis; pulvilli.conferti.inermibuslanamflavidamsetasque'nnmerosasgracillimasflavasgerentibus.

Only south of the lower Bio Grande, near Rinconada, etc.- Plant 2-4 feet high; joints 2-3 inches long, lfr-2 wide; pulvilli J-J of an inch apart.

SO Q RUFIDA, E in B. C. B.: erecto-patula; articulis late-obovatis seu suborbiculatis pubescentibus; foliis longe ac'uminatis; pulvilli. confertis setas rufidas gracUes numerosissimas gerentibus inennibus; floris flavi ovario obovato pulvillis numerosis instructo ; stigmatibus 7 in capitulum conge**"-

Common about Presidio del Norte, on the Bio Grande: flowers May - Stem 2-4 feet h,gh much branched; joint. 3-6 inch*, w • leaves 21 lines long. Flower 2* inches in diameter, with 40-50 pulvilli on the ovanum. - Appar- *Hi SZ iZbiSZ* 2d 0 JSL» ; dirtinguirfied from the former by the rounded joints, larger leaves, and red- the pulvillus. Further investigation, an nece«ary to decide about these closely allied forms, as about most specie, of tbi. intricate genus.

0 • *Rubriflora.*

21 O BA8ILABB E. 4 B L *c* ' humilis; articulis obovatis seu triangularibus glaucescentibus pubescentibus e basi proliferis: foiiisminutis; pulviiis wibconfertis fulvo-villosis setas gracillimas demum numerosissimas fulvida. •t subinde aculeolo. setifonne. caducos gerentibus; floris purpurei ovario obovato pulvillis plurnis instructo; ^ L i i t i S J T congestis; obovaU late umbilicata (siccat); seminibus nugni. cra«i. sub- [299] reguli bus.

SB WiUiain». River, the Colorado, and the Mojave, and down to the Gila: flowers April and May. - Habit very different from any other of our *Of****;* the stout obovato or fan-shapedjoints (6-8 inches long) originate from a sort of rosette. Leaves only one line long, 4-6 lines apart; pulvilli red-brown, somewhat Z^^ow^Lt^inle^ ovary w * U M » pulvilli. Fruit apparently dry, thereby approachins the next lection. Seed 3 lines in diameter, 2 lines thick.

Mr. 8chotThas observed, on the dividing ridge of the California mountains, west of the mouth of the Gila, and again in the Santa Cruz Valley, Sonon, a very similar but suberect species, 3 feet high, spineless, inclined to assume a purplish hue, which he seems toTve confounded with 0. *Uuilaru.* Can it be 0. ruWo, ir i. it - und«cribed •pedest

$ 6. XnocABMM : diffuw: articuli raborbicúlati vel tumidi: aculei plorimi: bacca ncca aculeolato: wrnina ebumea, magna, pleramque latiarime marginato.

• *Articuli eompnm whotirieulaH.*

M n „ « . , „ . . F A B L c • diffusa; articulis obovatoorbiculati.; pulvilli. subconfertis seta, pallidu *r*J*.* i r'S ^ ^ d b't tmati.; aculei. M ^perioribn. validi. elonpi. angulati. a« **!*** ^ feiia. inf^hn/L? ™riHoribai radiantibu.; bacca ovata aculeolata, umbflico planiusculo; sainnibus manmu.

W^ S S SiS T T F J G - C Ó mountaim-Joint. 3-i.inche. long; pulvilU W line, apart, unusually large; longer spines 1½–3 and even 4 inche. long, browniah; lower rating o»- white, 4-9 Una. long.

Fruit an inch long; upper pulvilli with 4-6 bristly spines. Seeds 3} lines in diameter, among the largest in this genus.

23. O. MISSOURIENSIS, DC. *{Cactus ferox,* Nutt. Qen.) : prostrate; articulis obovatis vel suborbiculatis tuberculatis; foliis minutis; pulvillis subconfertis straniineo-setosis, omnibus annatis ; aculeis 5-10 exterioribus radiatntibus setiformibus albidid, 1-5 interioribus robustis albidk seu rufescentibus; floris iiavi intus aurantiaci ovario obovato vel subgloboso spinuloso; stigmatibus 5-10 viridibus; bacca spinosa, unibilico piano; seminibus magnis irregularibus.

Var. **a** RUFISPINA, E. & B.: articulis orbiculatis ; aculeis interioribus 3-5 validis fuscis; bacca ovata. [300]

Var. *fi.* PLATYCARPA, E.: articulis obovatoorbiculatis; aculeis iuterioribus subsingulis validis fuscia; bacca depresso-globosa late umbilicata.

Var. *y.* MICBOSPERMA, E.: articulis acuieisque pracedenti9; bacca ovata breviter aculeolata; seminibus minoribus anguste marginatis.

Var. & 8UBINEBMI8, E.: articulis elongato-obovatis, pulvillis subremotis inferioribus inermibus, superioribus aculeos paucos breves gerentibus.

Var. f. ALBISPINA, E. & B.: articulis late obovatis ; aculeis 6-12 omnibus albis gracilioribus; bacca ovata.

Var. *C* TRICHOPHORA, E. & B.: articulis ovatis ; pulvillis confertis; aculeis 10-18 setiformibus (in articulis vetustis numerosioribus) capillaceis flexuosis ; bacca ovata; seminibus maximis.

From the upper Missouri to the Canadian ; principally occupying the western plains, but also on the mountains towards Santa Fé and west of it. — The last-mentioned variety (which I would consider a distinct species, were it not for the var. *albispina,* which seems to unite it with the others) has been found only on the mountains near Albuquerque : all the other forms occur on the upper Missouri, and *a.* and c. also on the Canadian. Other and intermediate forms of this variable but nevertheless well-characterized species will no doubt be found in the wide territory inhabited by it. It flowers in May and June. — Joints 2-4, rarely 4-6 inches long, and 2-3} inches wide, light green ; leaves 1f-2 lines long; larger spines 1-1$, rarely 2 inches long, in & not more than 3-6 lines long. Flowers 2-3 inches in diameter, with short green stigmata forming a compact head. Fruit 1-1£ inches long, with shorter or longer spines, and a rather shallow umbilicus. Var. 0. has a remarkably large flat fruit. Seed generally about 3 lines, but in *y.* only 2 lines, in diameter.

24. O. BPHAROCARPA, E. & B. 1. c.: diffusa; articulis orbiculatis tuberculatis; pulvillis confertis stramineo-•etoris pkrisque inermibus, summis solum aculeos 1-2 deflexoe patulosve majores gerentibus, adjectia sepe 1-3 brevioribos; bacca globosa vix aculeolata; seminibus meriiis.

Mountains near Albuquerque, New Mexico. — Joints 3 inches in diameter, strongly tuberculated; pulvilli 4 or 5 lines apart; spines 6-12 lines long, reddish-brown, often single or 2 or three together, with or without [301] mailer ones, which never occurs in any form of *O. MuscurUnsis,* where a large number of small setaceous spinet is found, whether larger ones ore present or not. Fruit 9 lines in diameter, with a small flat umbilicus. Seeds 2} lines in diameter.

• • *Artxadi tuntidi ovati.*

85. O. UUVACIA, R A R L c : adscendens; articulis ovatis sea teretiuscalis; pulvillis confertissimis omnibus armatifl; aculeis 6-10 gracilibus rubellis, 3-5 elongatis; bacca ovata aculeolata; seminibos magnis snbregularibns.

Near the Mojave, between the Colorado and the California mountains. — Joints S-2} inches long, 1-1J broad, and f-f thick, sometimes almost cylindrical, densely covered with Urge white pulvilli, which are only 2-3 lines apart. Spines 6-14 or even 90 lines long, slender-but stiff. Fruit an inch or more in length. Seeds nearly 3 lines in diameter.

96. O. ABBKABIA, E. in B. C. R : admndens; articulis obovatis compressis sen teretiuscnlis tuberculatis; foliis minntis; pulvillis subconfertis pallide setosis; aculeis 1-4 robustioribus albidis fuscstisve, cum inferioribas bravinri-1ms 2-6 albis; floris sulphurà ovario obovato; petalis emarginatis; stigmatibus 5; bacca oblonga spbulosa; unibilico infundibnlifornij; seminibus magnis irregalaribns.

Sandy bottoms of the Rio Grande near El Paso: flowers May. —Spreading 2-3 feet, f-1 foot high ; roots stout, creeping horizontally; joints 1f-3 inches long, 1-8 inches wide, and H thick, more strongly tuberculated than the allied species; leaves only a line long; pulvilli 3-5 lines spurt, very bristly, especially on the old joints; upper spines £-15 lines long. Flower 2-2} inches in diameter. Fruit about an inch long. Seeds 2^-3 lines in diameter. This is the only one of our Cactacea on which the Cochenille has been found.

27. O. FRAGILIS, Haw. *(Cactus fragilis,* Nutt.): subdecnmbens; articulis parvis ovati! sabcompremis tumidis Tel snbglohosis rix tubercnlatis nitide ṽiridibus; foliis minutis; polvillb subconfertis magnis albo-tomentosis. ᵛii sertuloẽw; aculeorum 1-4 robnstionim summo valido angulato foscato porrecto, ceteris debilioribos ptUkUoribos ptᵗnlis seu radiantibo«; scnleis inferioribus 2-6 gracilibos albis radiantibus; floribos minoribus; bscca onto vix [illegible] junh[illegible] bus paucis magnis subregularibus.

Fertile prairies, or sterile places, on the upper Missouri and Yellowstone, to the mountains and south to [302] Santa Fé\ — Size and shape of the joints variable; fruit-bearing joints compressed, 1J-2 inches long, l-1£ wide, and £-f thick; others smaller and more tumid. Leaves a line long, hardly longer than the large pulvilli, red. Pulvilli 4-6 lines apart, bristles very few, short, whitish, on the old joints a little more numerous, coarser, dirty yellow. Lower radiating spines 2-4 lines long ; central spines 6-10 lines long, the other interior spines 3-8 lines long, often similar to the smaller lower spines. Fruit rather fleshy through the winter, getting dry in spring, nearly an inch long, with 20-25 pulvilli, of which only the upper ones bear a few short spines. Seeds few, usually only 6 or 6 in each fruit, 3 lines in diameter, with a wide and thick obtuse corky margin. — Often sterile, but abundantly propagated by the fragile joints.

28. O. BRACHTARTHRA, E. & B. L c.: adscendens ; articulis ovatis orbiculatisve tumidis ssepe subglobosis tuberculatis ; pulvilli8 confertis parce setulosis; aculeis 3-5 validioribus 1-2 fuscatis patulis vel suberectis, caeteris deflexis; floris parvi ovario subgloboso pulvillos 12-15 vix aculeolatos gerente ; stigmatibus 5.

Inscription Rock near ZunL — The short and tumid joints (10-15 lines long) resemble the joints of a finger; the pulvilli 2-4 lines apart, even in the oldest parts of the plant with very few bristles; longer spines 9-12 lines long, terete. Ovary less than half an inch long. Flower apparently an inch in diameter. — Perhaps too near *0. frogilis*; but in the absence of good flowers and fruit, it is impossible to say whether it does not belong to even a different section, perhaps to the *Glomerate,* Salm.

Subgen. 3. CTLINDROPUNTIA, E. in B. C. R. Articuli cylindracei: flores magni vel parvi: bacca plerumque sicca: seuiina immarginata seu vix marginata: embryo circa albumen copiosius subcircularis; cotyledon** contrari© seu obliquae, subinde parallel©.

§ 1. CLAVATJE : prostrate : articuli breves, clavati, adscendentes, textura lignosa laxe reticulata: flores flavi majusculi: bacca sicca, pulvillis numerous setosissimis stipata, floris rudimentis persistentibus coronata.

89. 0. CLAVATA, E. in Wisliz. Rep.: articulis breviter davatis late viridibus; tuberculis ovatis ; foliis subulatis minutis ; aculeis albidis scabrellis, interioribus 4-7 complanatis, inferioribus deflexis latioribus supra [303] Btriatis subtus carinatis, superiore triangulato erecto; aculeis exterioribus 8-10 gracilioribus undique radiantibus; bacca pulvillis setosissimis; seminibus rostratis,

Santa Fe* and Albuquerque, on the plateaux : flowers in June and July. — Dense spreading masses, with joinU 11-2 inches long; tubercles 6-8 lines long; larger spines 6-15 lines long, and the broadest one |-1J lines wide. Flower 2 inches in diameter. Fruit yellow, 1J-1| TM*he* lon & ftn inch in diameter, covered with 30-50 large pulvilli. Seed 2J-3 lines in the longest diameter. Cotyledons mostly oblique, or, as in most other *Opuntia,* incumbent. (The expression is not etymologically correct, but I use it to designate the direction of the face of the cotyledons towards the radicle.)

30. 0. PARRYI, E. in Sillim. Journ. 1852 : prostrata ; articulis ovatis basi clavatis; tuberculis oblongo-elongatis; setis paucis; aculeis angulatis scabris rubellia demum cinereis, interioribus sub-4 validioribus compressis, •rterioribus 4-S divergentibus, extimis 6-10 gracilibus radiantibus; bacca ovata pulvUlis sub-40 setosistiniis stipata; •eminilras erostratia.

On the Wojave, west of the great Colorado. — Joints 2J-3 or 4 inches long, attenuated below and somewhat so above; tubercles 0 lines long; inner spines 12-16 lines long, and the larger ones somewhat flattened, but lest than a line wide; exterior spines 3-8 lines long, in two series- Fruit 1* inches long. Seeds about 2 lines in diameter. — The original specimens of Dr. Parry were found farther south, near San Felipe. He describes the joints as 4-8 inches taitf. with shorter whitish spines or tubercles 6-12 lines long, and the flower as greenish-yellow. The Mojave plant is «**rly allied to the last species, but may be distinguished by the shape of the joints, the narrower, darker-colored, more numerous spines, and the smaller and more regular seeds.

31. 0. EMORTI, E. in B. C. R.; articulis qrlindricis basi clavati* glaucis; tuberculin oblongo-linearibos elong*tis; setis panels; acuiein plurimis ruñs, interioribus 5-9 validioribus triangulatis, compressi*, exterioribus 10-80 pinriseriatis undiqne radiantihim ; florihns flsvis extus rubellis; bacca pulvillos 35-50 netosisiüinoii inferiors aenfeotaos gmntibus ; serai nibu* vnlrie iii»iualibus irreffuUribus.

Arid soil, from El Pa*> thmu$_K$h Sonora to the desert of the Colorado : flowen August and September. — The stoutest species of this section. Joints 4-6 inches long, curved, 1-1| inches in diameter; tubercles [304] 1-H bushes long ; longest spinen \\-*2*\ inches long, |-1 line wide; the exterior spines gradually smaller, and less angular. Fruit * 2 | inches long, partly armed with spines 4-8 lines long. Seeds from 2± to 3* lines in diameter. Cotyledons oblique or acenmbent

St. 0. SCHOTTO, E. L c : artkulis clavatis; tnbercnlis elongatis; pulvillk pavei-setosis; aculeis nibelUa

scaberrirais, interioribus Bub-4 cruciatis, soperiore triangulate, cieteris supra planis eubtus convexis, latioribus; exterioribus 8-10 radiantibus gracilibus; bacca ovata pulvillos 35-40 pauci-setosos gerente ; seniinibus rostratis.

On the arid hills near the mouth of the San Pedro and Pecos, western Texas. — Distinguished by the broad and very rough spines, which are dirty red,—the larger ones with a white margin, —and by the smaller number of bristles both on the pulvilli of the joints and of the fruit, where they are mostly turned upwards. Joints 2 inches long ; tubercles 8-9 lines long ; spines l£-2 inches long ; the radiating ones only 4-9 lines long. Seeds 2 lines in diameter. Cotyledons oblique.

Dr. Gregg has collected a similar plant near San Luis Potosi, which at present I know not how to distinguish from *0. Schottii.* The spines are stout, perhaps less rough, and narrower, 12-15 in number; some of them borne on the upper margin of the pulvillus, which I have never seen in 0. *Schottii.* Tubercles an inch long.

33. O. GRAHAMI, E. L c. : radicibus fusiformihus ; articulis clavatis ; tuberculis oblongis; foliis ovatis cuspidatis; setis demum plurimis; aculeis gracilibus rubellia, interioribus 4-7 teretiusculis angulatisve, exterioribus 4-6 brevibus; bacca pulvillos sub-30 setosissimos gerente ; seminibus erostratis.

Sandy bottoms of the Rio Grande near £1 Paso : flowers June. — Joints 1J-2 inches long; tubercles 6-7 lines long; leaves thicker and in proportion shorter than in most other species, nearly 2 lines long. Fruit similar to that of *O. elavata.* Seed 2£ lines in diameter or more. Cotyledons regularly incumbent.

34. 0. BCLBISPINA, E. 1. c.: radicibus fusiformibus ; articulis parvis ovatis sepe ex apice proliferis fragilibus; tuberculis ovatis brevibus ; pulvillia parce setosis; aculeis teretiusculis scabrellis basi bulbosis, interioribus 4 cruciatis, inferiore longiore, exterioribus 8-12 radiantibus.

Saltillo, Mexico. —Spreading masses with joints an inch long or less; tubercles 4-6 lines long; interior [305] spines 4-6, exterior ones 1J-3 lines long. Apparently near the South American 0. *jnuilla,* Salm, and perhaps belonging to the *Opuntue glomerate* rather than here. Fruit unknown.

I 2. *CYLISDBICM :* adscendentes vel erect*: articuli lnngiore*, ovato-cylindrid sen elongati: textura lignos acompacta, tubum reticulatum vel truncum compoctum formaTM: flores magni geu parvi, purpurei vel raro flavi: bacca sicca Tel subcarnoea, floris rudimenta plerumqoe dejiciens, aculeata wu incrmis.

• *Polyacantha:* lignum plerumque reticuluto-tulmlosum : articuli crassiores distincte tuberculati: aculei piures sea plurimi : flores plerumque rubri : seniina immarginata.

f *Humilwre$:* diffuse rainow : articuli subclavati: flores pleninKjuc flavidi : boccc »icc«, aculeate.

35. O. DAVTBII, E. *A* B. in P. R. Rep.: caule dense lignoao ramoaitwimo divaricain ; articulis junioribos erectis elongatis basi attennatis; tuberculis oblongo-linearibua; aculeis interioribus 4-7 subtriaogularibus rufis vagina straminea laxa induaiatis divergentibus ; aculeis inferioribu* 5-6 gracilibus; bacca ovata pulvillia suh-25 aculeigeris stipata.

On the Llano Estacado, near the upper Canadian River; common. — Spreading and somewhat procumbent, about 18 inches high ; the ouly one in this section with dense wood. Joint* 4-6 inches long, rather slender; tubercles 7-8 lines long. Interior spines 1-1 \ inches iu length; lower ones 3-6 lines long. Fruiu (all sterile, and perhaps not properly developed) an inch or more in length.

36. O. •CHITOCARPA, E.4B.1. c: erectiutcula ; ramis numerosis patentmimis ; articulis ovatis bad davatis; tuherculis ovatis confertis ; aculeis majoribus suh-4 albidk rtramineo-vaginatit, 8-16 minoribus undique radiantibus; flora flavo (0; bacca g)obosa depressa seu hemisphsrica late profundeque umhUkaU pnlvillis siib-40 acukatisummia •iipata; seminibus late commissuratis.

, .J **BR. B. MAJOR**: eUtiior; articali- A " * * ; aculeis longioribus laxius vapnalia poud.ciUu; baecis glohodi pulvillos paudorea (25) gmntibiis.

In the valley of the lower Colorado ; *ft.* in Sonont - Var. «. is a low thrub, 6-18 inches high; joints [806] 1,,2# mches "ng; tubercles 4-5 lines long; spines not over an inch in length. Flower apparently yellow, about 1| inches in diameter and somewhat persistent on the fruit. Fruit very shallow, saucer-ahaped, with few large seeds. Var. £ is 4 or 5 feet high ; joints fcMO inches long; interior spinea 1-1| long. Fruit globose, or even oval* with 25 pulvilli. Seeds the same in both.

37. O. SKBPECTIHA, E. in Sillim. Joura. 1852: erectiuacula sen subprostrata; articulis elongatk cylindricis • tuherculis ovatis ; aculeis 7-9 albido- seu ruftdo-vagiiiatis; HOTS flavo extus ruhello; bacca subhemispbmca late at profunde umbilicate villosa aculeatissima,

Near the sea-coast about San Diego, California. — Sometimes 4-5 feet high, but often prostrate • joints 6-12 inches long; * pines lew than an inch long. Flower cup-bap*!, U inch wide. Fruit apmrentlv like thit *It* th* *Imi* SJMCH but " long woolly - and with fewer pulvilli, also often crowned with the peninU-nt flower 8e*d unknowr

said to be large. — Closely allied to the foregoing species. Can this be Nuttall's *Cactus Californicus (Cereus,* Torr. & Or. EL), with cylindric branches, yellow flower, and spiny fruit?

ft *Decidua:* arborescentes: articuli tumidi, perfragiles: tubercula depressa: flores purpurei: baccro saepisaime 8teriles, prolifero.

38. 0. PROLIFERA, E. L c. J ramis divaricatis; articulis ovatis sea ovato-cylindricis perviridibus versus ramorum apicem congestis ; tuberculis obovato-oblongis pronrinulis; aculeis 8-10 obscuris Btramineo- sea rufo-vaginatis, singulo centrali, caeteris patulis; flore rubro ; bacca ovata aculeolata pleruinque sterili prolifera.

On arid hills about San Diego, California, forming extensive thickets. — Stems 2-4, and sometimes even 6*7 inches in diameter, 3-10 feet high ; joints 3-6 inches long and 1J-2 in diameter; tubercles about 6 lines long; spines 6-14 lines long, the lower ones shorter. Flowers red, salver-form, 1$ inches in diameter.

39. O. FULGIDA, E. in B. C. R.: ramis divaricatis; articulis ovatis seu ovato-cylindricis glaucescentibue versus ramorum apicem congestis; tuberculis ovato-oblongis prominulis; aculeis 6-9 subaequalibus laxe vaginatia undique stellato-porrectis ; flore purpureo parvo ; bacca ovate inernii vix tuberculata; seminibus parvis rostratis.

Mountains of western Sonora: flowers July and August. — Plant 6-12 feet high; joints 3-8 inches long; tubercles rather elongated, 6-7 lines long; spines l-1j inches long, hiding the whole plant with their [307] lustrous sheaths. Flower about an inch or less in diameter. Fruit fleshy, l-1£ inches long, usually sterile. Seeds smaller than in any other Opuntia examined, 1-1} lines long.

4a 0. BiQBLOvn, E. in P. R. R.: ramis erectis adscendentibusve; articulis ovato-cylindricis pallide virescentibus congestis; tuberculis subhemispharicis depreąsis confertis ; aculeis fr-10 robustioribus et totidem gracilioribus inferioribus; ovario tuberculato ; bacca tuberculate subinde (sterili ?) aculeolata; seminibus parvis.

On Williams's River, of the Californian Colorado. — Stem 3-4 inches thick and 10-12 feet high, the branches forming a dense contracted head, with joints 2-6 inches long; tubercles 3-4 lines long; larger spines about an inch long, smaller ones 4-7 lines long.

The three foregoing species represent this subsection west of the California mountains, and east of them both south of the Gila and north of it, and seem to be well distinguished from one another by the characters indicated.

ttt *Orůtatm:* frntescentes vel arborescentes: articuli cylindrici: tubercula plerumque cristate prominula: flores purpurei: baccn incrmes seu rarius aculeate.

41. O. WHIPPLEI, E. *A* B. in *P.* R. R.: caule erecto seu rarius subprocumbente divaricato-ramoso; articulis cylindricis; tubercnlis ovatis confertis; aculeis brevibus cinereo- sen stramineo-vaginatis, 1-4 majoribus, 2-8 breviori-bu* deflexis vel radiantibus ; flore rubro; baeca subglobosa tuberculate flava inermi; seminibus regularibuB.

Var. a. LAVIOR : humilior, aculeis paucis deflexis.

Var. 0. 8PINO8JOR : elutior, aculeis plurimis radiantibus.

From Zuni westward to Williams's River (o.), and south of the Gila 05.) : flowers in June. —The first state i» from a few inches to 3-6 feet high ; the second forms small trees 8-10 feet high. Joint* f-J inch in diameter; tubercles about 6 lines long; spines very variable, between 3 and 9 lines long. Flower (of var. £.) 1^-1 J inches in diameter. Fmit about an inch long.

42. 0. ARB0M8CKX8, E. in Wislix. Rep. (0. *tteUata,* 8alm): arborescens; ramis Terticillatis horizontelibus Tel pendulin 5 articulis rerticillatis cylindricis ; tuberculis cristatis prominentibus ; aculeis 8-50 stelUto-divaricatis; flora purpureo magno ; bacca subhemispbaerica tuberculato-cristete flava inermi; seminibus regularibua.

From north and east of Santa F6 and the Llano Estecado, to Zuni; extending southward deep into [308] Mexico: flowers May-July. — Northward 5-6, south 10-20 or more feet high; easily characterized by the horizontal and verticillate branches, etc

43. O. AC4MTH0CARPA, E. ft B. in P. R. R.: arborescens; ramis altemis adscendentibus; articulb cylin-dricu; tuberculis elougatis; aculeis 8-25 stellato-divaricatis; bacca subglobosa tuberculate aculeate; seminibus multengulatii.

Mountains of Cactus Paw, between Santo *Ft* and the western Colorado. — Stems 5-6 feet high; branch* few, alternate, and separating from the stem at an acute angle. Joints (as in the preceding) 4-6 or 8 inches long, about an inch in diameter; tubercles £-10 lines long ; interior spines 1-1J inches, exterior ones 4-10 lines long. Spines of fruit on the depressed jutfercles 3-6 lines long. Seeds large, unlike those of any other Opuntia seen by me.

44. 0. MAMILLATA, *k.* Schott in litt, B. C. R.: arborescent, divaricato-ramosissima; articulis crassis abbreviate pwriridibus; tnberculis tumidis; aculeis 4-6 brevibus plerisque deflexis; flore parvo purpureo; bacca obovate Inermi; saminibus parris.

Sonon, on the Sierra Babuquibari, in fertile soil: flowers July and August. — Steins 5-6 feet high; joints 3-4 inches long, 1J inches in diameter; the swelling tubercles very prominent; spines 3-9 lines long, sometimes almost wanting. Flowers an inch or less in diameter.

45. 0. THURBERI, £. in B. C. R.: frutescens, erecta; articulis cylindricis gracilibus elongato-tuberculatis; acnleis 3-5 brevibus divergento-deflexis ; flore miniato.

Bacuachi, Sonora: flowers June. — Much more slender than any species yet enumerated in this subgenus. Joints half an inch in diameter; tubercles 9 lines long; spines 3-8 lines long, the lowest one the stoutest Flower l£ inch in diameter.

* * *Monacantha:* lignum densum: articuli graciliores obscure tuberculati: aculei singuli: flores flavi seu rubri: semina plus minus marginata.

46. O. WRIOHTII, E. 1. c : frutescens, erecta; articulis cylindricis gracilibus elongato-subtuberculatis; aculeis subsingulis porrectis vel subdeflexis ; flore miniato.

On steep mountain-sides, from the Limpio to the Pecos, and in northern Mexico: flowers June and July. —Shrub 2-4 feet high, 1-1 £ inches thick. Joints 4 lines in diameter; tubercles depressed, 7-9 lines [309] long; spines 8-10 lines long. Flower about 1-1£ inches in diameter.

47. 0. ABBUSCULA, E. 1. c: arborescens, erecta, capitato-ramosissima; articulis laete viridibus elongato-subtuberculatis ; aculeis subsingulis porrectis vel subdeflexis; flore flavo-virescente.

On the lower Gila, near Maricopa village: flowers June. — A truly arborescent form, with a solid trunk of 4 or 5 inches in diameter, 7-8 feet high ; joints 2-3 inches long, about 4 lines in diameter; tubercles indistinct, about 6 lines long ; spine 9-12 lines long, often with 1 or 2 smaller ones under it. Flower l£ inches in diameter.

48. O. VAGINATA, E. in Wisliz. Rep. (partim): frutescenn, erecta; ramis erectiusculis; articulis snbtuberculatis; aculeis subsingulis; bacca obovata tuberculata coccinea.

Albuquerque, New Mexico, and southward. — Shrub 3-5 feet high, 1-]} inches thick; joints 3-4 lines in diameter; tubercles rather distinct, 6-9 lines long. Fruit 8-9 lines long. Seed about 2 lines in diameter. Perhaps a stout form of the next species.

49. 0. FRUTESCENS, E. in Plant. Lindh. 1845: frutescens, erecta; ramis erectiusculis; articulis teretibns; aculeis subsingulis ; flore parvo virescente ; bacca obovata baud tuberculata coccinea.

Var. a. LONGISPINA : articulis nascentibus stipitatis; aculeis validioribus longioribos laxe vaginatis.

Var. /& BREVI8PINA: articulis nascentibus sessilibus; aculeis gracilioribus brevioribus arete vaginatis.

From the Colorado of Texas to Matamoras and Saltillo, westward to Sonora and the Ceiiforniin Colorado: flowers June to August. — Var. a. is the usual western form; 0. occurs only in Texas and eastern Mexico. — Shrub 3-5 feet high, stem 1-1J inches thick; joints 2-3 linen in diameter; indistinct tubercles 3-5 lines long; spines in a. 1-2 inches, in 0. 4-6 lines long. Flower 7-9 lines in diameter. Fruit 5-9 lines long. Seeds few, usually 1} liues in diameter.

50. O. nsiLLATA, *0. ramotiuima,* E. in Sillim. Jonrn. 1852: frutescens, erecta sen diffusa, divaricate ramodasima; articulis gracilibus tessellato-tubercnlatis cneiis; tuberculis 5-6 angulatis planis inennibus seu aculemn elongatam paucosqne minntns gerentibns; flore purpunscente psrva ; bacca setosisrima sicca.

Valley of the lower Colorado from Sonon to the California mountains: flowers May to September. — [310] Stems 8-6 feet high, at the base 1-3 inches thick; joint* 3-34 lines in diameter, ashy gray; the singular flattened and angular tubercles 2^3 lines long; spines l*-2 inches long, crowded together at the upper end of each year[9]* growth, very loosely sheathed. Flower purple, half an inch in diameter. Fruit 9-10 lines long, covered with reddish-brown bristles. Seed 2 lines or less in diameter.

•/ The material for the present study of our *Cadacea* is not as full as would have been desirable in the examination of so difficult a family. Hence it may sometimes have happened that what I have endeavored to distinguish as species are forms which properly belong together- or I may have combined as one species incomplete specimens of quite distinct plants. The°fear of confusing heterogeneous plants under one name, and the desire to indicate to future explomn all the different forns known to me, combined to induce me to proceed as I havet done.

For those who naturally may be horrified at the idea of 117 species of *Cactacece* in a territory where a few years ago scarcely half a dozen were known, I will indicate how the mass of material may be comprehended under fewer types.

Of *MamUlarice* the species 1-9 are quite distinct, and can in no manner be united; 10-12 might perhaps be considered as forms of a single species; 13-17 are all very distinct; 18 and 19, 20-23, 25 aud 26, 27 and 28 may possibly be forms of only 4 types, instead of 10, as I have enumerated them, — thus referring my 30 species to 22 types.

In the genus *Echinocactns* the following species might be united: 1 and 2, 7 and 8, 9 and 10, 12 and 1-3, 14 and 15, —leaving 15 instead of 20 types.

The following species of *Cereus* will perhaps bear reduction: Nos. 1 and 2, 3 and 4, 5-7, 10 and 11, 12-14, 16 and 17, 18-22 (though some of them, of which I do not even know the flowers, may prove to belong even to different sections!), 23 and 24, — thus reducing my 31 species to 18 types.

Opuntia is a still more difficult genus, and mistakes are here most easily made. Many of them are as yet very incompletely known; and without being able to compare a great number of living specimens in their native state and in all stages of development, it can hardly be [311] expected that any one should know beforehand what constitutes the specific characters in these plants. I have tried to unite the forms which seemed to justify such a proceeding (see, e. g., *0. Rafinesquii,* here made to comprise quite a suite of forms as subspecies). Still it may be thought that a greater reduction was yet desirable; but with our present data this would involve great danger of jumbling heterogeneous materials together. Nos. 5 and 7 (of which latter neither flower nor fruit is known) can perhaps be united; also 9 and 10, 11 and 12, 13 and 14, 16 and 17, 19 and 20, 22-24, 25-28, 29 and 30, 31-33, 35-37, 38-40, and 48 and 49, — leaving 31 types, 29 of which are indigenous to our territory, and two cultivated.

GEOGRAPHY OP THE CACTUS REGION OF THE UNITED STATES.

The localities where our Cacti grow are so little known to those who have not made the geography of the West a particular study, or are not familiar with the publications of our Western explorers, that it seems necessary to add a few explanatory remarks.

Texas, as at present organized, is bounded southeasterly by the Gulf of Mexico, into which the following rivers mentioned in the foregoing pages empty, following the order from east to west: the Brazos, the Colorado with the Llano, the Guadalupe with the Pierdenales and San Antonio, the Nueces, and the Rio Grande. The latter forms the southern and southwestern boundary as high up as El Paso. On it are the towns of Matamoras (not far from its mouth), Mier, Laredo, aud (higher up) Presidio del Rio Grande; then Fort Duncan or Eagle Pass (southwest of which is Santa Rosa, in the State of Coahuila). Next comes the mouth of the San Pedro or Devil's River (a small river, or rather torrent, running southward); aud not far from it the mouth of the Pecos or Puerco, which ri8es at the north-northwest in the upper parts of New Mexico. Between the mouth of the Pecos and El Paso we notice only Presidio del Norte, San Elizario, and a " cafion" below the latter. The valley of the Limpio—a little more to the northward, between the Pecos and El Paso—is a remarkable locality; probably because there porphyritic rocks take the place of the cretaceous formation of the more eastern districts.

Chihuahua is the well-known capital of the Mexican State of the same name, south of El Paso.

The Canadian River is a southern tributary of the Arkansas, running eastwardly very [312] **nearly under** the 35th degree of latitude, and bounding on the north the elevated plains known **as the** Llano Estacado, in the northwestern parts of **Texas and** the adjoining **regions of New Mexico.**

The upper Bio Grande runs through New Mexico from north to south. The capital, Santa Fé, is not far from the river, in lat. 35 J°; and the town of Albuquerque is a little below. Dofiana is a small place on the river, above El Paso. El Paso itself, where the Bio Grande breaks through the mountain ranges, changing its heretofore southern to a southeastern course, is the central point of our Cactus region, partly from its geographical position, and partly because many of our explorers have made it the centre of their operations.

The present southwestern boundary of the United States runs from El Paso irregularly westward through the former Mexican State of Sonora to the Colorado " of the West," or " of California," which comes from the South Pass in the Eocky Mountains, and runs southwestward and southwardly. Its principal tributaries rise in the east. Those most important to us are the Little Colorado, or Colorado Chiquito, under the 35th and 36th degrees of latitude; Bill Williams's Fork, or Williams's Eiver, as it is lately styled, farther south; and in lat 33° the Gila River, which rises near the " Copper-mines," northwest of El Paso.

Proceeding from Santa ¥6 westward, we find the Indian town of Zuni, on the head-waters of the Little Colorado; then the San Francisco mountains, the Cactus Pass at the head of Williams's Eiver, and this stream itself. All this territory is at present included in the political organization of New Mexico, though uninhabited by whitea

West of the Colorado, in lat. 35°, is the Mojave or Mohave Eiver, rising in the Sierra Nevada near the Cajon Pass. Lower down, opposite the mouth of the Gila, the country is a sandy desert, extending westward nearly to San Felipe, on the eastern slope of the California Mountains in the same latitude. On the western sea-coast the town of San Diego is the only interesting point for the plants under review.

GEOGRAPHICAL DISTRIBUTION OF THE CACTACKfi IN THE TERRITORY OF THE UNITED STATES.

As to the geographical distribution of the *Cactacea,* our territory may properly be divided into eight regions, namely: —

1. THE ATLANTIC EEGIOK, which has only a single *Opuntia,* and that peculiar to it [313] Along the southern coast some West Indian species may yet be expected

2. THK MISSISSIPPI BEGION, including the Western States, produces another *Opuntia,* which, in different distinct forms, extends into the third, fourth, and fifth regions.

3. THE MISSOURI BEGION ; namely, the Northwestern or Upper Missouri Territory to the Bocky Mountains. It furnishes two *Mamillarim* of the subgenus *Caryphantha,* both extending into the fourth and fifth region; and three *Opantict,* one of which only is peculiar.

4 THE TEXAN BEGION ; namely, the eastern and inhabited parts of Texas, westward to the San Pedro, and northward including the territory south of the Arkansas Biver. This region produces five *MamillaruB,* two of them peculiar to this district: three *Echinocadi,* none of which are found in any other of our regions:[1] six *Ccrci* (five *Echinocerci* and one *Euccrcus),* all of them peculiar to this district: and six *Opuntim,* of which only three are restricted to it; among them is only a single cylindric *Opuntia.* This region contains therefore altogether twenty species, fourteen of which are peculiar to it

5. THE NEW MEXICAN BEGION ; namely, western, uninhabited mountainous Texas, and eastern New Mexico to the eastern head-waters of the Colorado of California. This region is our richest Cactus district. It has furnished sixty-five species, fifty-five of which are peculiar to it, namely: nineteen *MamillaruB* (eight *EumamUlaria,* ten *Coryphantha,* and one *Anhalonium),* of which sixteen are peculiar: nine *Echinoeacti,* all of them belonging to this district only: sixteen

[1] Alwiji exoeptiDg Mexico ittelf, aoiith of tht Rio Gnude, foto which many, if not most, of ov tpteUt txtad

Cerei (fifteen *Echinocerei,* fourteen of which are peculiar, and one *Eucereus,* common also to other legions): and twenty-two *Opuntice;* of these twelve are flat-jointed, four clavate, and five cylindrical ones; seventeen of these species are peculiar.

6. THE GILA REGION, comprising the whole valley of the Colorado south of lat. 36°, [314] and the country of the Gila, its large southern tributary. This has thus far furnished, thirty-six Cactaceae, namely: five *Mamillarice,* three of them peculiar species: six *Echinocacti,* none of them found elsewhere: seven *Cerei,* representatives of each of our four subgenera, and five of them peculiar: eighteen *Opuntice,* of which six (all peculiar) belong to the *Platopuntice,* two to the clavate and ten to the cylindric *CylindropurUioe ;* one of the former and nine of the latter peculiar.

7. THE CALIFORNIAN REGION— namely, California west of the Sierra Nevada, and comprising the southwestern part of the present State of California — produces six *Cactacece,* five of which are peculiar. They are one *Mamillaria:* one *Echinocactus:* one *Cereus* of the section *Eucereus:* and three *Opuntice,* one of them a *Platopuntia,* — probably only a form of a more eastern species, — and two peculiar *Cylindropuntioe.*

8. THE NORTHWESTERN REGION, comprising the northern parts of the State of California, the Territories of Utah, Oregon, and Washington. This region has so far furnished only a single *Opuntia* (from eastern Oregon), common also to the Missouri region. — Mr. Geyer, in his account of his expedition to Oregon in 1843, mentions two *Mamillarice* and a *"Melocactus"* (?), which latter he has not seen himself, nor are there any known specimens in existence.

CORRECTIONS AND ADDITIONS.

Page 267 = 131. *MamiUaria $cdymoUUs* has been collected by Mr. Wright, on the Pecos, in western Texas.

Page 286 = 139. *Cereus Berlandieri* is very near *C. pentalophus,* DC., but Prince Salm, who has cultivated both •ide by side, considers them well distinguished.

Page 300 = 146. *Opuntia Miuouriensit* has been sent from Clear Water, on the Kooskooskie, in Oregon, by the Rev. Mr. Spalding.

CORRECTIONS AND ADDITIONS TO THE SYNOPSIS OF THE CACTACEJE OF THE UNITED STATES.

On p. 279 = 136 the var. *minor* of *Cereui datyacanthui* should be cancelled, and after *C. Umgiutu$,* [345] p. 280 = 137, the following added : —

9J. (TROTTERI, E. in B. C. R.: ovato-cylindricus, 10-12-costatus; areolis ovato-orbiculatis; aculeis e basi bulbosa subulatis-rubellis apice obscuris ezterioribus 10-15, interioribus 2-5 robustioribus sub-brevioribus; [346] fluribus sabterminalibus magnis purpureis ; bacca subglobosA; seminibus tuberculatis.

El Paso, southwaid to the Sandhills: flowers April. —Stem 5-6 inches high; spines 4-8 lines long; flower fif-3 inches long. Similar to *C. datyacanthui,* from which it is distinguished by the fewer ribs, fewer and stouter •pines, purple flowen, smaller fruit, and larger seed. This species is intermediate between the *PecHnaH* and *Dtcalopki.*

After *Opuntia sttlupina,* p. 294 = 143: —

O. PES CORVI, LeConte, mss.: articulis parvis teretiuBcuhs; pulyillis subconfertia setas paucas breves graciles flavidulas gerentibus plerisque armatis; aculeis binis ternisve gracilibus snpe basi compressis tortisque; flora flavo minore.

Sandy coast of Georgia (Major Le Conte), and Florida (Dr. Chapman). —Joints not much over an inch long, and half as thick ; spines 1-1} inches long, straight and slender. Flower \\ inches in diameter. Oraiy only with 5 areola; stigmas 5. — In the shape of the joints this curious little species resembles *0. fragilii,* but in other respects U semsinkcmediaU between *0.* wfcam and 0. *Unmtpina.*

VII. DESCRIPTION OF THE CACTACEiE COLLECTED ON EOUTE NEAR THE THIRTY-FIFTH PARALLEL, EXPLORED BY LIEUTENANT A. W. WHIPPLE Itf 1853, 1854. — BY DRS. ENGELMANN AND BIGELOW.

FROM REPORTS OF EXPLORATIONS AND SURVEYS FOR A RAILROAD FROM THE MISSISSIPPI RIVER TO THE PACIFIC OCEAN. VOL. IV. 1856.

MAMILLAKIA, HAW.

I. EUMAMILLARIA. Engelm. in Synops. Cact

1. MAM. WRIGHTII, Engelm. in Rep. of Bound. Com.: Flowers and fruit were unknown until specimens [27] brought from the Pecos flowered in Washington. From these the following description was drawn :—

" Sepalis exterioribus triangularibus obtusiusculis fimbriatis sub-13, interioribus margine petaloideis acutis sub-8, petalis (purpureis) lanceolatis acuminatis aristatis sub-12 ; bacca succosa majnscula purpurascente floris rudimentis coronata; seminibus obovatis basi acutis scrobiculatis nigris. (PI. J.) I am not certain whether the flower is actually lateral and the gennen immersed; whether, therefore, this species actually belongs to the true *MamiUaria* or to the subgenu* *Caryphantha.* I am, on the contrary, inclined to consider at least the germen immersed. I nevertheless think it best to leave this species with the *CriniUB* — to which it seems to be so nearly allied — till more complete observations establish the contrary. The flower is about one inch long, petals and margin of inner sepals bright purple ; berry large and purplish; seeds about 0.7 line long.[19]

High plains near the Oallinas. Hills and rocky places near Anton Chico, on the Pecos, Sept. 25,1853. Santa Rita del Cobre mountains ; near Lake Santa Mario, Chihuahua. Wright and Bigelow, in boundary collections.

2. M. GRAHAMI, Engelm. in Rep. Bound. Com. Sand and gravelly banks of streams. Williams's River to the Colorado Grande, Jan. 26, 1854.

3. M. PULLI8PERMA, Engelra. in Synops. Cact. *(M. Utranciitra^* Engelm. in Sillim. Journ., November, 1852): la'ving specimens of this and the preceding species have been brought to Washington, and are now growing in the Congressional Garden. Few specimens only show more than one of the four central spines hooked. The manifestly improper name previously adopted had therefore to be altered. " I have substituted for it a name derived from the peculiar spongy or corky appendage of the seed, which greatly resembles that of the seed of *PoUntitta qaradora* M*tt." —(Engelmann). Sandy banks of streams, Colorado Grande and Mohave, Feb. 4-2% 1854. The Arternal habit of this plant very much resembles that of *M. Grahami,* and was collected in nearly the tame localities.

4. M. MEIACANTHA, Engelm. in Rep. Bound. Com.: Distinguished from *M. apptanata* by the fewer and stouter •pines ; central spine often wanting. Cedar plains near the Llano Estacado to the Pecos, Sept 23-27, 185a

II. CORYPHAJTTHA. Engelm. Synops. Cact

5. M. NUTTALLII, Engelm.: var. y. *robuitior* aculeis tovioribus radialibus sub-12, centrali robusto. The [28] northern and Texas plants have pubescent spines.

Plains on the False Washita and Canadian, near Fort Arbuckle, Aug. 22-29, 1853.

6. M. VTVTPAJU, Haw.

0. NBO-MBXICAHA, Engelm. in Rep. Bound. Com. Found in many different form*, from the plaint of the Canadian, in longitude 100°, to the Axtee moonUiu in longitude 112° wert. The forms mostly belong to the vsr. ßL *Neo-Maricana.* One of the specimens brought to Washington bore abnormal flowers, qnite intmsUng in a morphological point of view. The ovary is 4-6 lines long, covered with 8-12 flmbriate sepsis (or scales), much like the ovary of an *Eckinocactus,* the ovules deformed or wanting; styles irregularly divided to the Use, or nearly to, in 8-10 parts, stigmatose at the.upper part; other parts of the flower normal. This plant occurs in the greatest variety of altitudes through 12° of longitude. Specimens of it were collected on the top of the Sandia mountain!, near Albuquerque, upwards of 13,000 feet above the level of the sea, Sept. 4, 1853, to Jan. 17,1854.

ECHINOCACTUS, LINK.

No specimen of this genus was found till the Colorado Cbiqnito wai reached. From there to the California mountains five species were observed, two only of which — £. *UcafUii* and £. *Swwryi* — hid beibrs been sun snywhsrs else*

1 E. WHIPPLEI, sp. nov.: globoawmitus, coetis 13-15 (s»pe obliquis) interruptis tuberculatis, areolis orbiculatus approximate aculeis rodialibus compressis albidia, infra brevioribus, supra deficientibus; aculeis centnOibUB 4 radiales superantibiu, suramo complanato recto albido, ceteris plerumque longiore compresso^Tiadrangulatis ftweo-atoi. demum cinereo-rubellis, 2 latewlibus rectw sureum divergentibus, inferior* robustaore deorsum hamate; florel baccaJ seminibua oblique obovatis opacis minutim verrucoso-tuberealatis. (Plate I.)

This species was discovered on Lithodendron Creek, near the Colorado Chiquito, about nine* mile, west of Zufii, in sandy plains, Dec. 3-1,1853. At first only dead specimens were found; afterwards young living ones were collected. It was not seen after leaving the valley of the Little Colorado. We have named th* very pretty specie, in honor of Captain A. W. Whipple, the »salous and talented commander of this expedition.

Our plant is from 3 to 5 L i e s high, and 8 to 3 or 4 in diameter. The outer spines are straight or slightly recurved, *I** line, long; the lower ones shorter than the others. The two lowest M ^ The upper central almost form, cross with the two upper dark central spine.; the * « ^ 2 d l t ^ and ¥ line base, and mostly straight, and spine is tl circle of which it seems to complete. The three other directed 1

central spines are a little shorter, 12–15 lines long, nearly equal among themselves, quadrangular compressed, often somewhat curved, dark. brown or black when young, with lighter tips; afterwards reddish, and finally of an ashy color. The lowest one has a sharp recurved hook, which is whitish on the convex side of the curvature.

Among the débris of the dead specimens preserved, a number of seeds were found which no doubt belong to this species. They are large, 1.6–1.7 lines long and 1.2 lines in diameter, very little compressed at the upper part, narrowed down to an acute point below the large orbicular hilum, and sharply carinate on the lower part of the back (opposite the hilum).

E. Whipplei evidently belongs to the section *Hamati*, found in numerous forms on the middle and lower Rio Grande, With *E. polyancistrus* it is, so far as at present known, the only representative of this section west of the Rocky Mountains. It is more nearly allied to *E. brevihamatus Engelm.* from Eagle Pass, the seeds of [29] which are as yet unknown. It is, however, easily distinguished by the arrangement of the spines: the eastern •pecie* has 11 terete radial spines all around, and 4 central ones, the uppermost one being smaUer and narrower than the lower hooked one.

^ j A M n m onhrvlindricas, costis 13-17 obtasis tabercuiatis interniptis;

8. E. POLTAKCISIBCB ,.p.nov.: ^ ^ ^ ^ S r u s f u l v o - t o m e n t o s i s ; aculei. radialilm. J L » anolisorbicnktis..cumareolaflonferarj^"^! ^nrioribu. .pice adusti*. latmlibus bnsvioribua, rnferiori- comp^isalbi^summodenciente, . i p e n o r i b u . I j g j j ^ J ^ ^ b i n i ! ( ) ^ . p ^ ^ ^ ^ ^ bus brnmnu. .ub^tacei.; .cute. ccnt~^b~f"^J^0 te^tiusculi. s ,suUngulati. purpureo-fuscis, 2 superior^ eongate albo apice adusto sursum - 7 ^ "Jj™ ^ uncinati. • floribu. in axilli. .ummis solitariis; sepali, stigmatibus 9–10.

(Plate I. figs. 1–2.)

On gravelly hills and Mndv plains at the headwaters of the Mojave, on the eastern slope of the California Cordilleras, one day's £X&£L»« the (>jon te This elegant «J striking species w« collected March 15, 1854, with young flower-bu.1^ The plant is 4-10 inches h^h and 3-4 in duuneter; are„l» 4hnes » diameter and (from ce /MS^emtre^ 7-» line, distant from one another, the younger ones covered with a reddwh- yellow wool. -The 4 t lateral one. H, and lowest ¥ inches long. The upper central spine is 3–5 inches lo sometime. a -eond rimikr but mailer one i. see. above or beride it All the other central £ i X £ * ^le-brown, the upper ones longer (2-3 or even 3* inches long), the other, gradually shorten, the Swert^ot more than 1H I inch« lon«- The tWo u^TmoBt brown *?"» ™ <>*** •t~gh». ** sometimes, lil T ^ T Tow n " .hiply hooked, the hook, being turned in different direction.; the convexity of the book is of a paler color. ^e young or «alle.t .pecimen. we find only8brown .pine., .11 hooked, one in the centre of the others; in others i 17 -\ brown hooW qnne, u. counted, one central to the other* or dl in a aeau- circle, the upper part of the central circle always (roed white spine.

The flower buds were just forming in the a f-grown spines. Those glandular organs which divide floriferous from the spiniferous areolæ in *E. setispinus*, and other species, seem to be very partially only and incompletely developed in this species.

3. E. LECONTEI, Engelm. in Bound. Com. Rep.: ingens, ovatus s. ovato-cylindricns, costis 80-30 compresiis sub-obtusis interruptis, areolis elongato-o usque robustioribus 8-10 Walati. .ubannulati. plu. minusve recurvatis, aculei. extimi. latemlibu. aummiaque 10-16 tenuioribus I a c * ra*2; aeuW. eentiibu. 4 oompr-ai. carinati. annulati. 3 .up.nonbu. aomm .nfanor. deo«.» c m « . ; llaribtt. plurimi. .ube«t»libua, ovario aquami. 30-40 reniformibo. tjcto, «pal» taM oUongu « 0 ^ pMalis SMt> angortb rolphtireu; rtylo ad medium in rtigmaU .ub-14 bneana rabaonto diviao; boeca globow

sicca squamosa floris rndimentis coronata, seminibus oblique obovatis conipressis sublucidis minutissinie scrobiculatis. (Plate I. figs. 3-6.)

This gigantic species was first noticed by Dr. John L. Le Conte, on the lower Gila, where also Dr. C. C. Parry saw it. Both took it for the New Mexican *E. Wislizeni,* to which, indeed, it bean a great resemblance in habit as well as in botanical characters; but the seed that I received from the first-named gentleman at once satisfied me that I had a distinct species before me. Subsequently Dr. Bigelow met with this remarkable plant, abundantly, from the Cactus Pass, at the headwaters of Williams's River, down this stream to the Colorado, and west of it till *E. polycephalui* took its place. — (Engehuann.) It grows on rocky or gravelly plains and ravines, and often in crevices of perpendicular rocks, to the height sometimes of 5 feet, by 2 feet in diameter. The ribs are somewhat interrupted by a transverse incision between the areolse. These areolse in the specimen before us are 8 lines long by 4 wide, and [30] only £ inch distant from one another. In some specimens of *E. JVislizeni* the same closeness is observed; while in others, especially young and vigorously growing ones, they are often over 1 inch distant The four principal central spines are 2-2 J inches long ; lateral ones more quadrangular ; the upper and lower ones flat and flexible, the former carinate above, the latter below. This lower one is rather the longest, and 1£-1f lines broad, almost straight or somewhat curved, but never (in the specimens brought home) hooked. The other spines are 1J-2 inches, the lowest are only about 1 inch long. Five radial spines are arranged below the four central ones and throe to five above, three of which are often pushed into the centre by the flexuous bristly spines which occupy the space between the upper and lower radial ones and the uppermost part of the areola.

At the upper end of the areola, and l>etween it and the floral areola, we meet with the same obtuse cylindric ligneous (when young, fleshy) glands which divide the spiniferous from the floral areolce in several of our species of *Echinocactus,* 3-5 in number in the species before us, about 1 line long.

We had the good fortune to collect a single specimen of the fruit (the only one found), which is globose, } inch in diameter, and, together with the persistent remains of the flower, about 2 inches long. Dr. Le Conte has noticed "a crown of yellow fruits on the plant, about 2 or 2J inches long." The dissection of the dead flower indicates a structure very similar to that of *E. Wislizcni;* petals apparently fleshy and narrow; stamina numerous, very few from the base, the majority from the middle and the upper thickened end of the short tube ; style 10 lines long, divided nearly down to the middle into fourteen sul>-crect filiform stigmuta; seed black, oblique-obovate, compressed, carinate on lower part of lack, somewhat shining, and very lightly pitted (under the glow), 0.8-0.9 line long ; hiluni small, oval; albumen rather small; embryo ovate, straight, with short hooked cotyledons. Mr. Schott has found this species abundantly in western Sonora and the Gadsden purchase. The flowers are yellow, and similar to those of *B. Widizeni,* but rather smaller; the stems are generally much higher and thick, and of a clavate shape; lower central spine sometimes almost hooked.

EehinoeactHt IFidizeni is distinguished by the less flattened, less flexible, stouter spines, the lower central one being channelled above and strongly hooked ; by having only three lower radial spine*, etc The distinction indicated by the spines is confirmed by the shape and structure of the seeds ; and thus the plants of the Colorado and of the Rio Grande are distinct representatives of the some type on both sides of the Rocky Mountains.

4. E. WKLIZINI, Engelm. in Wislix. Rep. (Plate III. figs. 1-2). — This plant is very abundant in the neighborhood of El Paso, where it was first found, many years ago, by Dr. Wiblizenus.

The fruit and seed of this plant were collected by Captain Whippie, in the neighborhood of the *Cereui gigantcui,* while engaged in surveying the Gila, on the Boundary Commission, in 1852. There possibly may be some doubt about its growing in that region, however, from the fact that Captain Whipple's finite were labelled - *Cenu$ gigantau,"* and were not collected by a botanist.

In our present expedition, when I first found a giant *Echinocachu — E. UCmiti* — at Cactus Pass, I was sure, in common with Dr. Parry and Dr. Le Conte, that it was *E. WidiMmi,* which I had often seen before at Dofia Ana. I was most happy, however, in being able to secure even a single specimen of the fruit and seeds of that plant, by means of which, with the spines I collected, it has been identified and confirmed bj the acute observations of my friend, Dr. Eiigtslmaiin. It may be well to observe here, that the figure of this plant, in Major Emory's Report, was made from a specimen seen on the headwaters of the Gila, near the mouth of the Axul branch, not far from Santo Rita del Cobre, or Copper Mines *&d at least four degrees of longitude east of the place where I first met *E. LeCmtei.*

5. E. EMORYI, Engelm. in Emory's Report, 1848: globosus, costis 13 tuberculatis, tuberculis prominent!- [31] bus obtuiia di«tnntibtis ; areoiifl ovatis; aculei* suboqualibus robust is annulatis siibcoroprtssis recurratis A. rectiusculis fuscis ven»ns apicem corneis, reel in li bus 7 (lateralibus G, sin^ulo inferior© breviore) s. addito summo rarius 8; centrali aingulo teretiore paulo longiore robtistioreque, porrecto s. demum defleio curvato s. subundnato. (Plate III. fig. 3.)

Collected west of the Colorado, in the valley of the Mojave, mixed with *E polyupkalu**,* and therefore not

further noted. The only specimen preserved is 9 inches in diameter, snbglobose, below contracted, pear-shaped, or almost stiped.

On the lower part of the plant the areoloe are elevated on distinct ovate or subcylindric tubercles, which higher up become connected in 8 and on the upper part of the plant in 13 ribs ; tubercles on this part of plant }-} inch in height and diameter; areolro l£ inch distant, \ inch long, a little less wide; the floral areolee smaller, closely connected with the former, separated from it by 1-3 subglobose glandular bodies, half or mostly hidden in the tomentum. Radial spines 1&-2 inches long; the four upper lateral ones longer and stouter, the two lower ones more slender; the lowest spine the shortest (1-1 £ inch long), secured like the others, or rarely hooked, similar to the shape of that spine in *E. viridescen**.

An eighth upper radial spine, similar to the others, is sometimes observed. The stouter central spine is about 2 inches long, at the point strongly recurved, or often almost hooked. Spines of a reddish-brown color, lighter horn-colored, and somewhat transparent at tip.

This is probably the plant collected and figured by Major William H. Emory, in General Kearny's expedition to California in the fall of 1846, and then named after him. We collected only one young specimen, probably on the lower Colorado, from which this description is taken. Mr. Schott has found the plant abundantly south of the Gila River, and it is known to extend to the Gulf of California. We procured a large specimen in San Francisco (said to have been brought from Guaymas), which is now flourishing in the Public Garden at Washington. This species has, when full grown, a height of 3 and a diameter of 2 feet, and 18-21 ribs. The large flowers are deep red, similar in form to those of *E. IVUlizcni.*

6. E. POLYCEPHALUS, sp. nov. : globosus, demum ovatus cylindricusque, multiceps (e basi ramosus), vertice dense tomentoso, costis 13-21 acutis ; areolis ovate-or biculatis junioribus tomentosissimis ; aculeis 8-12 robustissimis compressis annulatis plus minus recurvatis junioribus puberalia cinereo rubellis apice nudatis rubicundis; aculeis radialibus 4-8 infimo deficiente, superioribus si extant gracilioribus; centralibus 4 robustisnimis 4-angulatis compressin, superiore latiore suberecto s. sursum curvato, inferiore longiore decurvo; floribus in vertice congestis; ovario lana nivea ex axillis sepalorum 90-100 linearum demum spinescentium orta densissime vestito, sepalis tubi infundibuli-formis 100-120 lineari-knceolati aculeato-aristatis purpurascentibus, iuterioribus margine petaloideis, petalis laciniato-fimbriatis herbacea-aristatis sub-30 flavis, stigmatibus 8-11 linearibus acutis; bacca globosa sicca flore coronata, lana densa involuU ; seminibus magnis irregulariter angulatis minutim (sub lente) verrucosis, opacis. (Plate III. figs. 4-6.)

Stony and gravelly hills and dry beds of torrents from 20 miles west of the Rio Colorado to about 150 miles westward up the Mojave ; found in fruit in the beginning of March. This distinguished species is simple only when quite young. Even the small globose plants show several heads from one base, and older cylindric stems have as many as twenty or thirty heads, all pretty nearly of the same size. The globose ones are 6-9 inches in diameter; the ovate heads are 12-15 inches high by 8-10 in diameter ; and the largest cylindric stems seen were 2-2J high by less than a foot in diameter. The number of ribs varies; in old specimens it is generally 21. Areol© about \ inch in diameter, and J-J inch distant from one another; floral areolflo smaller, without the ligneous glandular organs noticed in others. The spines in a young 5-ribbed living specimen before us are 7 radial and 1 jcentral one. Very soon, however, the 4 upper larger spines become central, and 4 lower spinet are arranged radially. Even in old and [32] full-grown specimens sometimes not more than these 8 spines are found, the 4 upper one* (which are in this case perbapf Tather improperly designated as central) stouter and cruciate, and the 4 lower ones arranged around the lower half of the areola. (fenerally, however, 2 upper radial spines, weaker and less curved than the 4 lower ones, make their appearance; and in a few specimens before us we find 3-4 upper radial spine*, the uppermost ones being quite slender.

In the field we noted as many as 15 spines occasionally, when no doubt 7 occupy the place of upper radial ones. The central spines an always very stout, but very different in size; in some specimens we find them 1 J-1j, while in others they are 2-3$ inches long. They are nearly straight or very much curved ; the upper one is often 1} to 2 lines wide, the lower one the longest

The yellow flowers seem to make their appearance in February, as the fruit ripens in March. The ovary and the frnit are enveloped in dense pure white cottony wool, which originates from the axis of the lower nepalt, and through which only the dark reddish-brown spinulose points of the sepals are visible. The incomplete description of the flowers was made from withered specimens adhering to the fruit Tube of flower funnel-shaped, short and vapidly widening towards the upper end naked (without free stamina) at the lower part Petals about 1 inch long and 2 lines wide. Style 1-1} inch long; stigmata 4 lines long. Fruit dry, 8-10 lines in diameter, together with the iwnnanta of the flower about 2 inches long, open at base when falling off; like the fruit of many if not most of our *EMmocaeH,* seeds 2 lines long, 1) line broad, irregularly shrivelled, appearing rugose and angular, much like those of the nearly allied *E. kuieottahu (horizonthalon'uu, Lem*). Hilum transversely oval; embryo curved, the cotyledons taricd in the large albumen, accuinhent, Pometimes obliqne.

This species is very nearly allied to *E. Parryi,* Engelm. Synops. Crtct., of the neighborhood of £1 Paso; but this latter species is depressed globose, much smaller, simple, with only 13 ribs, whiter, less flattened spines. Fruit and seed are said to be the same, but unfortunately have been lost, and cannot be compared. No doubt, satisfactory diagnostic characters will be discovered in the seeds. The fruit of *E. horizonthalonius* and *E. Texenri** is also tdmilar; the latter, however, though woolly, is not dry.

Very different in flower and fruit, but very similar in shape, in the many heads, numerous ribs, and stout curved annulated spines, is *E. cylindracexu,* discovered by Dr. Parry a few degrees farther south, on the eastern slope of the Sierra. We shall repeatedly have occasion, especially among the *Opuntive,* to indicate the remarkable analogies in the external form or in the more essential character of *Cactacea,* in different geographical divisions of the southwest.

CEREUS, HAW.

Subgen. ECHINOCEREUS.

1. CEREUS VTRiDiFLORtrs, Engelm. in Wisliz. Rep., sub nom. *Echinocereus.*

On the plains east of New Mexico, near the 100th degree of longitude, to the mountains of the Rio Grande, Sept. 12, 1853.

2. C. Ofisprrosus, Engelm. in Plant. Lindb. 1. c The most eastern of all onr *Cerei I* and only found in the plains. It was first seen about 170 miles west of Fort Smith, near the 96th degree, about the same longitude where Mr. Lindheimer first discovered it on the Brazos, four degrees farther south. · Its western limit seems to be near the 100th degree, where the range of *C. viridifl&nu* commences.

It may not be uninteresting to observe that this i» the first time that this interesting genus has been recogniied within the boundaries of the United States under the acquisition of Louisiana.

3. C. FENDLERI, Engelm. in Plant Fendl. Seen first on the high plains 50 miles east of the Pecos, about [33] tfie 105th degree, and extending from there over the mountains *of* New Mexico westward to the Aztec mountains, near the 113th degree. Southward it has been seen as far as El Paso.

The ovate or mostly elongated cylindric heads are simple or few together, and of a dark green color. They are characterized by the dark central spine, which is very bulbous and curved upwards, and by the lower radial spines being by far the stoutest, the lowest being 4-angular. Flower and fruit have been described elsewhere.

Var. 0. PACPERCULUS, with only about 6 spines, the central one assuming the place of an upper radial spine, was also found near the Pecos. It hardly deserves the designation of a distinct vaoety, as occasionally complete bunches of spines occur on the same plants with the depauperate ones.

4. C. MOJAVE58I8, sp. nov.: ovatus, dense cflespitosus, KMl-costatus, glaucescens; areolis orbiculatis junioribus dense albo-tomentosis distantibus ; aculeis basi bulbosis teretiusculis a. subangulatis robustis elongatis curvatis, nditlibus 7-6, infimo soperioribusque debilioribos, Utenlibus longioribua, centnli singnlo angnlato sursum incorvato. (Plate IV. fig. 8.)

Var. 0. ? ZUNIEN8K: dense caespitosis 10-co*tatus, areolis paulo minoribus, aculeis tenuioribos bad bulbocw quadrangulatis rectis s. paulo curvatis flexuosisve, radialibus 8 infimo graciliore, summo robustiore longioreqae, centiali singulo robustiore longiore recto s. snrsuni incarvo. (Plate IV. fig. 9.)

Found between the Rio Colorado and Mojare Creek, with *Eckinoeadui polycephalus* and *Opuntia mmaaa,* etc, a region rich in rare *Caetacem.* The oval heads, 2-3 inches high and lJ-2 inches in diameter, form dense cavpitose masses much like *C. phonic***. The areola are 3 lines in diameter, 6 lines or more distant from one another. The long and very bulbous spines are curved and interlocked so as almost to hide the body of the plant Upper and lower radial spines 9-15 lines, the uppermost one wanting or weaker than*the rest; lateral spines 15-2B lines long, ashy-red when young; central spine more angled, lfr-2| inches long, dusky ; all spines ashy-gray when old.

C. Zuniemii seems to form an intermediate link between this and the next species, but reaemble* most the former, to which for the present, not knowing flower and fruit, we doubtfully draw it as a variety. It was found near Canon Diablo, on the Colorado Chiquito, about 120 miles west of Zuni. Its manner of growth and whole appearance is very much like that of the Mojave species. The spines are weaker, rtnightar, and more angular; the principal difference consists in the stqut upper radial spine, which is similar to the centra) spine. Young areola) nearly 3 lines in diameter, 4-6 lines distant. Lowest radial spine 6-9 linen, lateral ones 9-16, and upper one 12-18 lines long; central spine 1J-2 inches long, very bulbous at base. Young spines straw-colored, old ones asby.

C. *Alojaveiuis* seem* to be nearly allied to *C. F**Aln\ (in both the spines are very bulbous at base, the central one single, angular, and curved upwards), but the ccspitone growth, glaucous color, longer radial •pinca,—tnt lowaft one of which is weakest, — seem to distinguish it. The exumination of numerous tprajnena ta *loco,* and tbe Sowar and fruit, only can decide here wnttbtr they art distinct, or form* *ot* a single apsdes; and tnia, indeed, is tie cast with all

those *Caetaeem* the fruit and flower of which are unknown to us. *C. Zunientis* was collected Dec. 18,1852, and the Mojave plant March 4,1854.

5. C. GONACANTHUS, sp. nov.: ovatus, simplex s. e baei parce ramosus, costis 7 intemiptis, areolis magnis orbiculatis distantibus, aculeis robustis angulatis rectis s. varie curvatis flexuosisve, radialibus 8, inferioribus lateralibusque quadrangulatis flavidis baai et saepe apice obscuris, infimo breviore, summo elongato robusto [34] multangulo obscuro erecto aculeuin ceutralem similem multangulatem erecto-patentem subeequante, rarius excedente. (Plate V. figs. 2-3.)

On high sand-bluffs, covered with scattering cedars, near the natural well, about 40 miles west of Zuñi, near the 109th degree ; only seen in that locality. This species resembles, in its growth and the character of its species, C. *triglochidiatiu.* It is simple, or has 2 or 3 heads, 3-5 inches high. The young areola are very tonientose, 3-4 lines in diameter, and 6-10 lines distant from one another. The lower radial spine is 8-12, the others 10-15 lines long, pale or dirty yellow when young ; the.upper radial spine is much stouter and longer than the others, and resembles the central spine in shape, size, and color; in the few specimens at our disposal we find it from lf-2} inches long; sometimes it assumes a more central place in the areote, the two upper lateral spines almost closing above it, — very rarely a small tenth spine appears above it The central spine is lf-2} inches long, 1 line in diameter, deeply furrowed, and 6- or 7-angled ; it is longer, equal to or rarely shorter, than the upper radial spine. Both those spines are almost black or mottled yellowish and black when young, and become, with all the others, gray when old. Collected Nov. 29, 1853.

6. G. TBIOLOCHIDIATUB, Engelm. in Wisliz. Rep., sub Echinocero. In rocky cañons at the Rio Gallinas, east of the Pecos, and from there to the Sierra Madre, near Mount Taylor; not noticed farther west; always with few branches, or nearly simple. Major Brooks, the commandant of the fort at Santa *Ft,* informed me that the fruit of this species is edible, like many other allied species. Collected Sept. 28,1853.

7. C. HEXJBDRUS, sp. nov.: ovatus, simplex sen e basi parce ramosus: costis 6 obtusiusculis subinterruptis, sulcis latis superfidalibus, areolis orbiculatis distantibus; aculeis tenuioribus rectis rigidis subangulatis basi bulbosia, radialibus 5-7 e flavido rubellis, inferiore breviore, summo sope robustiore, centrali robustiore longiore acute-angulato juniore fuscato, saepe deficients (Plate V. fig. 1.)

On sandy hills, under cedars, about 15 miles west of Zufii. Few. heads, 4-6 inches high, 2-2J in diameter, with 6 obtusish ribs, separated by wide and shallow grooves. Areola tomentose when young, only \\ line in diameter, 6 or 8 lines distant Spines slender but stiff, quite bulbous at base; lower ones 5-10, upper ones 8-15 lines long; mostly 6 radial spines, without a central one, the uppermost being the stoutest, longest, and darkest one, but •mailer where a central spine is present. In a single instance we found 7 radials, and in another one 2 compressed central spines; central spine usually 18-15 lines long. From the nearly allied, more southern *Cereut pauciqtnut,* Engelm. ined., this northwestern form is principally distinguished by the slender and angular spines. But as of neither of them we know the flower and fruit, we cannot form definite conclusions as to their specific distinction. These forms and *C. triglochidiahu* have a smaller number of ribs than any other species of this section. Collected Nov. 28,1853.

8. C. PH<ENICEU8, Engelm. in Synop. Cact., *E. coccinetu;* Engelm. in Wisliz. Rep., non De C. nee Salm. (Plate IV. Qg. 1.) Found from the upper Pecos to Albuquerque and Santa Fe*; also 5 degrees further west, on the San Francisco mountains. The specimens perfectly agree with the description given in WislizenuVs Report The numerous heads, 2-3 inches high, about 2 inches in diameter, form dense cespitose masses, often 1 foot or more •cross. Areoto fr-4 lines distant, large. Spines slender, almost setaceous, with very slightly bulbous base, 8-12 radial ones 3-6, 1-3 central ones 5-10 fines long; upper radial spines much shorter than lower ones.

The following form seems very distinct, especially in its manner of growth ; but we have seen intermediate forms which seem to indicate the necessity of nniting both. Such questions, however, can only be solved satisfactorily by careful examination of flower and fruit, — which are as yet unknown, — and by extensive observation of these plants in their native wilds.

fc SuBBraons C OOKOIDIEUS : ovatos, versus apicem conoideo-acutatus, parce e basi ramosu*, costis [35] *-U tuberculatis, areolis orbiculatis s. subovatus junioribus albo-tomentosis,. aculeis basi bulbosis, radialibus 10-12 tenuibus rigidis rectiusculis, summis brevibus, latenlibus inferioribusque longioribus, centralibus 4 (rare 3-5), •uperfailMi ndiales viz supenntibus infimo multo longiore 4-angulato sape complanato porrecto s. deflexo. (Plate IV. figs. 4-5.)

On rocky and mountainous localities on the Peeos. *Cer. Roemeri,* Mnhlenpf., not Engelm., from the San Saba, in Texas, seems to agree well with our pknt, but the description is not full enongh to decide about the identity-

Heads S-4 inches high, single or few, of unequal height together; remarkable on aooount of their conical or acutish •ktpt uniformly observed. Aroobs 4-6 lines distant. Spines white or ftraw-oolored, larger central one often

dusky when young; radial spines slightly bulbous at base; upper ones 2-5 lines, lateral ones 6-15 lines long, and lower ones hardly a little shorter ; central spines very bulbous; upper ones not much longer than the lower radial ones; lower central spine sharply quadrangular, mostly compressed, often deflexed and curved, 1-3 inches long.

On the San Francisco mountains a specimen was collected with 11 ribs, 8-9 radial spines (4-12 lines long), the uppermost shortest, and 3-4 reddish-gray central spines, very bulbous at base, the lowest longest (12-20 lines long) and angular. In superficial appearance this plant resembles *C. Mqjavensis ;* but it must be referred here, and seems to indicate a range of this form through seven degrees of longitude.

A specimen from Anton Chico, on the Pecos, seems to unite *C. conoideus* with *C. phccnicevu.* Areoto more distant than the latter; spines longer ; 3 central spines, lower one somewhat curved and angular. Collected Sept 28 and Dec. 18, 1853.

10. C. ENGELMANNI, Parry, var. VARIEGATUS : ovato-cylindricus, simplex s. parce e basi ramosus, 12-costatus, areolis orbiculatis approximates, aculeis exterioribus sub-13 gracilibus rigidis albis apice sphacelatis adpressis lateralibus longioribus, summia deficientibus ; aculeis central ibus 4 cruciatis (raro 5) plus minus curvatis infinio elongato angulato albo decurvato, ceteris brevioribus teretiusculis nigris corneisque variegatis ; floribus ex axillis areolarum vetustiorum inferiorum; bacca ovata sicca pulvillis numerosis setas tenues albidas plurimas gerentibus stipata ; seminibus obovato-subglobosis compressis rugoso-tuberculatis opacis. (Plate V. figs. 4-7.)

Var. (&. ? CHRYSOCENTRUS : cylindricus, parce e basi ramosus, 10-12-costatus, areolis magnis ; aculeis radiulibus 12-14 albis superioribus setaceis brevibua, inferioribus longioribus robustioribus angulatis compressis rectis s. paulo incurvfs, centmlibus 4, superioribus rigidis robust is basi bulbosis angulatis rectiusculis elongatis, erectis vitellinis, inferiore angulato compresso albo recto paulo breviore deflexo; floribus ex infeiiore plants parte; bacca ovata pulvillis paucis aculeos setosos longiores albos gerentibus stipata. (Plate V. figs. 8-10.)

On the Cactus mountains and at the head of Williams's River; degrees 113J longitude. Heads 4-8 inches high, single or few, not more than 4-6 together; areolse 2-4 lines distant Radial spines 3-5 lines long; upper central spiues 3 or sometimes 4, black on the upper and horn-colored on the lower side and towards the point, 1-1J inches long; lower central white, 1£-2 inches long. Position of fruit on lower half of plant much like that of C. *chloranthui,* Engelin. ined., only 6-8 lines long, crowned with the remains of the (red ?) flower. Seed 0.6-0.7 line long, compressed ; tubercles sometimes irregularly confluent, and leaving pits between the ridges; lower part of the back with a smooth carina ; hilum oval.

Var. 0. CHRYSOCENTRUS— named after its deep golden-yellow spines — is probably not specifically distinct, though the straighter, stouter, and less divergent spines give it a very peculiar appearance. It was found where *C. variegatut* disappears on the lower part of Williams's River, and was seen from there to the Mojave Creek, and up that stream to the Sierra Nevada. Stems 5-10 inches high ; areolas 6-7 lines distant, young ones 2J-3 lines in diameter. Upper radial spines 3-5, lateral 5-7, and lower ones 7-12 lines long, the latter flattened and often curved up; upper central spines 3 or sometimes 4, 2-3 inches long, bulbous and angular at base, terete [36] above; lower central spine \\-2\ inches long, flattened. Spines on fruit 3-8 lines long, fewer and stouter than in the other form.

Cereus Engclmanni, Parry, has been found abundantly by Mr. A. Schott on the lower Qila. A specimen brought home evidently seems to unite them, and consequently C. *variegatus* and C. *chrytocentrut* are to be considered forms of it.

I am acquainted with the *habihu* of about fifteen or sixteen species of the submenus ECHINOCEREUS. All of them are of low growth (I write of those only with which I am acquainted), never more than 12, seldom more than 8, and often less than 5 inches in height. All also are more or less cawpitose, or branching from the root; some of them slightly, others very much so. *Cereut viridiflorut, chloranthus, datyacanthui, ctenoid*, ccupitotw, longiutou, Fendleri, gonacanthut, hexadnu, paucupinut,* and *Engeltnanni* grow in small irregular tufts or masses, some of the joints or stems being much taller than others. Some of them, such as C. *viridiflorut, datyacanthiUy etenoidu, ccttpitotut,* and *FcndUriy* are often nearly simple, or having but few branches ; while others, such as *C. chloranthui, longimtu*, gonacanthus, hexadrui, paucispinus,* and *Engelmanni,* have usually 8-90 joints. *C. polyacanthut, phmkeut,* and *enneacanthus* are much branched, and grow in somewhat flattened mnonfi), sometimes with a circular outline, but not always, all the joints being of nearly an equal height *C. ttramineut* always forms a dense hemispherical mass, of a perfectly regular contour, — the central joints being the oldest and longest, — 9-12 inches high, gradually subsiding towards the circumference of the mas* until the extreme outer stems are not more than 2 inches high. C. *Mojovensii* often grows similarly, but I have also seen it in much broader mas*es, containing 5Q0-800 heads or joints; in such cases it is always flattened on the top. Where this state occurs, the central joints are as high as in the hemispherical maiwrs, but the hemispheric contour is destroyed by the longitudinal extension of the joints, forming masses sometimes 4 or 5 feet in diameter. C *pkctniatu* and *C. eomrideut* — two forms which Dr. EngeLnann has united into sub-species—are quite different in their manner of growth. *C. phonic*™,* as stated above, grows in irregular flattened , whilt *C. cwwidtus* has the more titrated and somewhat hemispherical shape of C. *$tromm$ui.* On account of

the unfavorable season of the year (October — March) daring our journey through regions of these cacti, we were unable to procure the flower or fruit of any of these plants. In our friendly correspondence with Dr. Engelmann, I insist that *C. phamiceus* and *C. conoideus* are distinct species; and (from analogy only) I assume that when the flower of *C. conoideus* is obtained, it will be found to be a *purple,* while that of *C. phaniceus* is *crimson.* Time and observation, however, are the only decisive arbiters of such controversies.

Subgen. EUCEREUS.

Of *Cereus* proper only one Rpecies was seen, namely :

11. CEREUS GIGANTEDS, Engelm.: Williams's River to the Colorado of the west, Feb. 4 to Feb. 22, 1864. This is the most northern true *Cereus* that we have, being found as high as latitude 34°, while *G. Greggii* and *C. Emoryi* are found only a little above latitude 32°. This plant has a considerable range, extending south from this place to near latitude 28°, in the vicinity of Guaymas Sonora. The fruit under the Mexican name of *pitajaya* — pronounced pit-a-zi-ah or pit-ai-yah — is a great source of sustenance to the Mexicans and Indians of the regions where it grows. Conserves and molasses, or syrup, are made from them, which are preserved during the winter season for future use. They are very pleasant to the taste in a fresh state. As the fruit grows near the top of the tree, at an altitude of 26 to 60 feet, and being very large and pulpy, if permitted to ripen and drop to the ground they burst and are almost rendered unfit for use. The Indian mode of collecting them is to take a long light pole, make a fork at the top by tying a short piece to it, by which they contrive to bring them within reach. Birds and every kind of animal and insect that can reach them are so fond of them that many of them are thus destroyed. My friend, Mr. Schott, [37] of the Mexican Boundary, who has lately returned from that desolate but rather interesting region, informs me that still farther south this interesting plant is replaced by another not so large, but still a great cactus. This is very probably the one collected by Mr. Thurber, described and named by Dr. Engelmann, in Silliman's Journal, *C. Thurberi.* The pitajaya of this species, according to Mr. Schott, is the principal support of the Papigo Indians. It is much larger, sweeter, more juicy than that of the *C. giganteus.* The color of the pulp is also of a much brighter red.

In consequence of the remote and inhospitable region of this curious and interesting cactus, our acquaintance with it became very gradual. Dr. Engelmann thinks that Baron von HuniboWt, in his work on New Spain, must have had reference to this plant; but this is quite uncertain, because no characteristics are given of his cacti (organos del Lunal) except size and edible fruit, and many other large species of both Cerei and Opunti© are long and well known to yield them. In 1846 Major Emory first collected seeds and made figures of it, which, on being presented to Dr. Engelmann, he was unable to pronounce it a true *Cereus,* and at that time very appropriately named it. Subsequently (winter and spring of 1862) Dr. Parry, under Major Emory, visited that region, collecting spines, wood, etc., and making copious notes on the ground, enabled Dr. Engelmann to give a good diagnosis of it. Still Dr. Parry was unable to procure the flower or fruit on account of the lateness of the season. It was reserved for Mr. Thurber, who repassed this region in the summer of 1852, to collect complete sjiecimens; and Dr. Engelmann, in a subsequent number of Silliman's Journal, has given a complete description of it. *(Vide* Amer. Journ. Vol. XVII. 2d Series, March, 1864.)

To the several excellent accounts given of this tree by Dr. Engelmann, little of interest can be added. Ai noticed by Dr. Parry and Dr. Engelmann, the number of ribs at the base is about 12, and they «increase upward, by bifurcation and addition," to the largest circumference of the tree, which is about 15-18 feet from the ground, and where also usually the few branches are given off. Here the ribs sometimes number 30, and from this point upward they decrease in number to 18-20. The wood at the base of old specimens becomes a perfect hollow cylinder; and from thence upward to the first branches, instead of being solid, it becomes a reticulated network of bundles of wood continuing the hollow cylinder, as is seen on a smaller scale in the wood of *Opuntia arborescens.* These trees in abundance give the landscape a very peculiar appearance, and from their novelty and entire dissimilarity to any others, at first is not only curious but pleasing; but as the eye becomes accustomed to it, a gradual transition takes place in one's feelings, and from being pleasing, they at last become monotonous and repulsive. This feeling, however, may be. somewhat accounted for by the sterility of the surrounding land. As far as the eye can reach, in the valleys or on the mountains, little else but rocky boulders, and the stately yet awfully sombre aspect of the *Cereus giganteus,* can be seen.

OPUNTIA, TOURN.

Subgenu* 1. PLATOPUNTIA, Engelm.

1. OPUVTIA EWOILMANXI, 8alm. At Delaware, about 170 miles west of Fort Smith^ a specimen of tbii plant was observed about 4 feet high. This seems to be the northern limit of a species which is widely spread from lower Mexico to the mouth of the Rio Grande, and on both sides of that river, northward and southward. In the southern regions it grows much taller than in the north.

8. O. £NGELMANNI,'/3. ? CTCLODES : erecta, articulis orbiculatis, pulvillis remotis tomento griseo setisque stramiueis rigidis insequalibus instructis; aculeis subsingulis rectis validis compressis stramineis basi fuscis deflexis, adjectis rope 1-2 inferioribns brevioribus pullidioribus; bacca globosa late umbilicata, seminibus late undulato-marginatis. (Plate VIII. fi<r. 1.)

About the mouth of the Gallinas, into the Pecos, near Anton Chico, New Mexico; collected in fruit in [38] September. Plant 4 feet high ; joints orbicular, or even transversely oval, about 7 inches in diameter ; pulvilli 1 inch apart, large, with a semicircle of large, coarse bristles, 3-4 lines long at the upper edge, and a single stout spine, 1£-1| inch long, on the upper pulvilli, often with 1 or 2 additional ones, 4-9 lines in length. Flower not Been. Fruit globose, 1-1J inch in diameter, of a purple color. Seed 2.0-2.3 lines in diameter, with a broad and thick acutish undulate rim. The circular joints with fewer spines, and the small globose fruit with large seeds, distinguish this form from *0. Enydmanni,* as it usually appears farther south.

3. 0. OCCIDENTALS, *p. nov. : erecta patulo-ramosissima, caule demum lignoso tereti corticato, articulis grandibus obovatis rhomboideisve, pulvillis remotis griseo-tomentosis, setis flavis s. flavo-fuscis gracilibus confertis, aculeis 1-3 valid is compressis angulatis rectis deflexis divergentibusve, uno alterove ad articuli marginein superiorem erecto, albidis corneisve subannulatis basi flavo-fuscis cum adventitiis 1-2 gracilioribus pallidioribus deflexis; flora flavo intus aurantiaco, ovario obovato pulvillis fusco-villosis vix fulvo-setosis sub-25 notato subinde parce aculeo-lato, sepalis (extus rubellis) 10-12 dilatato-obovatis cuspidatis, petalis (8 ?) obovatis obtusis subintegris; bacca obovata late umbilicata succosa, seminibus niajoribus irregularibus undulato-marginatis, crenulatis. (Plate VII, fig*. 1-2.)

On the western slope of the California mountains, from Quiqual Gungo, east of Los Angeles, to San Pasquale and San Isabel, northeast of San Diego (A. Schott), at an elevation of 1,000 to 2,000 feet, in immense patches often as large as half an acre. Flowers in June. Stout ligneous steins, with innumerable branches, sometimes over 100 joints, spreading far, and then often bent to the ground ; joints 9-12 inches long, 6-8 inches wide; pulvilli 1J-2 inches distant, with slender and closely set (much more so than in 0. *Engclmanni)* bristles, only 2-3 lines long on the upper part of the pulvillis ; spines 1-lJ, smaller ones $-j inch long. Flower yellowish and orange, deeper colored inside at the base, 3-3 J inches in diameter ; ovary 1J inch long, not 1 inch in diameter, pulvilli pretty equally distributed'over it (not as much congregated toward the top as in *O. Engelmanni)* ; sepals short and unusually broad ; petals only 9 or 10 lines wide by 15 lines in length, rounded, and iw>t eniarKinate in my specimen, nor mucrouate. Fruit 2 inches long, Ij-lJ inches in diameter, " very juicy, but of a sour and disagreeable taste." Seeds 2£-2f lines in diameter. The young plants, raised from the seeds which we brought home, fail to exhibit the very hairy pulvilli which all the young of *0. Engclmanni* show; they bear only the numerous bristly spines seen in most young *Opuntia,* at least of this section.

To Mr. A. Schott, who has considerably enriched our knowledge of the vegetation of the countries along the boundary line and in the Gadsden purchase, is due the credit of having discovered the flower of this plant, heretofore unknown, and of many valuable notes about its general habits.

The plant mentioned iu SillinWs Journal, November, 1852 (Dr. Parry's collections), an being common [M] on the hill-sides and plains near San Diego/' and which Mr. Schott seems to have also found " on the sea-beach near San Diego,"[9] may be a fonn of *0. Enrjdmunni,* as suggested in the above publication ; or it may be a naturalized wild •late of *O. Tuni,* which is cultivated aUut the mission* there. Enough material has not been obtained to decide about it At all event*, it seems to I* distinct from the plant of the western mountain slopes.

4. O. CHLOROTICA, sp. nov.: erecta, gnindi*, caule deroum-iignoso terete, cortice cinereo-fulvo aculeis flavis nnmeronssimis fasciculatit armato; articulis orbiculuto- obovatis niagnis pall id e flavo-virescentilms s. subglauću; pulvillis tubremotis griseo-tonientosis, setis atramineia diffonnibus txteriorihii* brevioribus tenuioribus subnqualibut confertis, interioribus, uniaeriatis robustioribus longiorihut ; aculeis in pulvillis inferioribut 1-3, in •uperioribut 3-6 insqualibut stramineit plot minus comprestis (nee acute angulati*) pleriaque deflexis interior* brevior* rabinde erecto; flore flavo, ovario tnbercnla pnlvilli-gera conferU sub-50 perente; sepalis tubi »ub-*> oblanoeo- [39J latu ewpidatis, petalia sub. 10 obovato tpathnUtui, obtuait mucronatia, atigmatibui 8 patulii; bacca obofaU tnbercnloaa pn>fande umbilicata. (Plau VI. ftp,. \^*my*

On both sides of the Colorado, from the 8an Francisco mountains to the bead waters WiUiama's River — sometime* called - Bill William* Fork " - and to the Mojave Cr«ek. The only erect, flat-joint«l *OpunHa* in this section of country, 4-5 and sometimes €Ten 7 feet high, forming large baahw, on one of which upwards of 100 joinU were counted. The large trunks have a scaly, grayish, or light-red brown bark ; the pulvilli are not obliterated on it, aa tb^y are on O. *Engelmanni,* but are largely developed, 4-« lines in diameter, pulvinate. densely covered with a thick brown tomentum, surrounded by numberless •famw-colored br•wtlet, 4 lines in length, and bearing 80-30 or more y^Uow compressed spinet, often 1-2 inches in length, tUllately radiating in every direction, and covering and shielding I* whole surface of the stem. The only *Opuntia* which I And described at having a similarly armed ctem It a *KmnmmMata,* Stim, which U tmid te have 18-iO grey spinet on the oldett pulvilli.

Joints 8-10 inches long by 6-8 wide, always of a very pale glaucous, or rather more yellowish-green color, which is strikingly characteristic, even at a distance, and which has procured our name for the plant; pulvilli about 1 inch apart, strongly pulvinate. Bristles twofold and distinct, the upper and outer, and by far the most numerous ones are shorter and thinner, and cover the upper semi-lunar area of the areola; iiiside of them is a semicircular row of stouter and longer bristles, 4-6 lines long, which unite with the outer and shorter spines of the outer and lower margin of the areola. This arrangement is most distinct on the upper and more fully developed pulvilli; among our *OpuntUB* it is only seen again, as far as known, in the obscure *0. dvlcti* from Presidio del Norte. Spines proper 1-1 £ inches long, pale straw color, with faint transverse markings, hardly darker at base; shorter spines 4-9 lines long.

The description of the flower was drawn from an old withered specimen gathered in winter. It seems pale yellow, between 2 and 3 inches in diameter ; sepals and petals remarkably narrow, the latter about 1 inch long, and not half as wide. The ovary and fruit (all the specimens found were sterile) are quite tuberculous; pulvilli crowded, bearing brown wool and short yellow bristles. Specimens of sterile fruit seen 1j-1\ inches long.

6. 0. PROCUMBENS, sp. nov.: prostrate, articulis orbiculato-obovatis grandibus pallide viridibus, pulvillis remotissimus griseo-tomentosis, setis flavis robustis valde insequalibus, aculeis validis 2-4 subinde (in articulis vetustioribus ?) 7-9 compressis angulatis inoqualibus, stramineis s. pallidioribus versus basin obscurioribus, saepe rufis fnscisve, deflexis. (Plate VII. figs. 4-5.)

From the San Francisco mountains to the Cactus Pass, at the head of Williama's River, in rocky localities. Joints 9-13 inches long, 7-9 broad, prostrate, always on edge; pulvilli 1J-2 inches apart; bristles 2-4 lines long, comparatively stout; spines 1-2 inches long. No flower or fruit seen. Very similar to 0. *Engelmanni,* but prostrate, with even more distinct pulvilli, and stouter and often more numerous spines.

6. 0. ANODSTATA, E. A B.: prostrota s. adscendens, articulis elongato-obovatis versus basin sensim angustatis •oberectis ; pulvillis remotis griseo-tomentosis, setis fulvis gracilibus ; aculeis paucis (2-3) validis compressis albidis s. sframineis, versus basin rufis s. fulvis, adjectis sspe infra 1-2 debilioribus omnibus deflexis; bacca obovata, tuberculata rubella, late profundeque umbilicata pulvillis 24 stipata seminibus magnis subregularibus late marginatis. (Plate VII. figs. 3-4.)

From the foot of the Inscription Rock, near ZuSi, to Williams's River, and westward as far as the Cajon Pass of the California mountains. Prostrate in the first and last mentioned localities, but sub-erect in the bottoms of Williams's River. Joints 6-10 inches long, and at the upper third 3-4 inches wide, gradually narrowed downwards, rounded above ; pulvilli over 1 inch apart, oblong, quite strongly pulvinate, 3 lines long, bearing [40] •lender brown bristles; spines in the specimens collected east of the Colorado sharply angular, pale straw-colored or whitish, brownish only at the very base, 1-1* inch long; sterile fruit obovate-subglobose, 1-1J inch long, with large pulvilli crowded toward the upper end of the fruit, covered with grayish-brown wool and bright brown bristles. The specimen from Cajon Pass has brighter colored spines, with the lower half red-brown, not so angular ; •ome erect spines, at the upper end of the joint, almost terete. On this specimen a ripe fruit was collected, from which the above description has been taken. It is 1} inch long, nearly 1 inch in diameter, with the wide and flat umbilicus immersed about half an inch ; pulvilli on tubercular elevations about 14 on the upper part of the fruit and 10 along the rim ; seeds 3 lines or more in diameter, much compressed, with the brood rim almost curled. Some of the seeds have germinated, and the young plants grow vigorously.

This plant cannot be confounded with any other single species. Some southern *Opuntia* have similar or even more elongated joints, bnt are erect and almost unarmed, such as 0. *structa, 0. tuberculata, 0.* lanceolate, etc 0. *polyantha,* from South America, seems to be similar, but has smaller and more spiny joints, etc

7. 0. PHJEAOAKTHA, Yar. MAJOR, E. in Plant Fendl. Mem. American Acad. IV. p. 62.

Near Zufii. — As both Mr. Fendler and ourselves failed to collect the fruits of this form, it remains doubtful whether it has been justly referred here, or whether it is more closely allied to *0. Camanchica.*

O. MOJAVXNSIS, E. 4 B. : prostrata, articulis grandibus suborbiculatns, pulvillis remotis, setis grandibus fulvit, acnleis M validis' compressis acute angulatis elongatis plus minus curvatis, fuscis versus apicem pallidioribus annulatis, adjectis infra 1-3 minoribus tenuioribus pallidis; bacca pulvillis 20-25 fusco-eetosis stipaU. (Plato IX. [illegible] 6-8.)

On Mojave Creek. At the time it was considered identical with the following species, and no further notice taken of it; only a few fragments were brought home, together with a sterile fruit Spines 1-2$ inches long, stout, bright brown; fruit 1| inch long, oblong; pulvilli crowded toward the upper end. It is possibly a distinct species, bat the material too incomplete to permit us more than merely to indicate it.

8. 0. CAKAKCHICA, «p. nov.: articulin adscendentibns majuscnlis obovato-orbiculati* pulviUi* remotis orbiculato-ofitb tomentnm griaeum setanqne paucas ntnunineas fulvasve (in pulvillis terminalibas demnm elongati* rigidiorts)

gerentibus pierisque armatis; aculeis 1-3 B. ad marginem pluribus compressis fuscis 8. atro-fuscis versus apicem pallidioribus superioribus elongatis suberectis ceteris deflexis gracilioribus flore ? Bacca ovata late umbilicata atro-rubente succosa pulvillis remotis obsoletis seminibus niajusculis irregularibus angulatis late marginatis. (Plate IX. figs. 1-5.)

On the Llaño Estacado, at the base of the hills, in rather fertile soil, from the eastern slope of that elevated plain to the Tucamcari hills, near the upper course of the Canadian River. A large plant, spreading extensively, with lar^e rounded joints 6-7 inches long by 5J-7 wide ; pulvilli about l£ inch remote; bristles diity yellowish, greenish, or brown, inconspicuous except at the upper edge, where they often become elongated and stouter. Only the lowest pulvilli are spineless; the others bear 2-3 and the marginal ones 3-6 spines ; larger ones l£-2 and in some specimens almost 3 inches long. Flower unknown. Fruit very characteristic, distinguishing this species from the nearly allied *O. phceacantha;* it is oval, not narrowed or constricted at base, 1J-2 inches long, 1-1 £ inch in diameter, with a large flat umbilicus j-1 inch in diameter, considerably resembling the fruit of *0. Engelmanni,* of a deep red color, and a very sweet juicy pulp. Seeds 2J-3 lines in diameter, very irregular, angular and often twisted, with sides impressed, mostly with a broad and thick acute or obtuse rim deeply notched at the hilum.

9. O. TORTISPINA, sp. nov. : prostrate, articulis niajusculis adscendentibus obovato-orbiculatis, pulvillis [41] subreraotis stramineo s. fulvo-setosis; aculeis 3-5 majoribus compressis angulatis subinde canaliculatis scope spiraliter tortis, albis basi apiceque saepe corneis, adjectis infra aculeolis 2-3 gracilibus albis ; flore——; bacca ovata areolis sub-20 parvulis notata, late umbilicata, seminibus mnjusculis regularibus crams. (Plate V. figs. 2-3.)

On the Camanche plains, near the Canadian River, east of the plateau of the Llaño Estacado. Similar in growth to the more Western *0. Camanchica.* Joints rounded, 6-8 inches long; pulvilli 1-1J inches apart; bristles short, except on the edges, where they are 2-3 lines long, but rather slender; spines more numerous than in any other of our species, with juicy fruit, often *6-8,* lower smaller ones £-1 inch, larger ones H-2J inches long, entirely white or yellowish horn-colored at base and tip ; on the upper areolae 1 erect spine, the others spreading in different directions, lower ones deflexed. Fruit similar to that of last species, large, oval, not contracted at base, perhaps leas juicy and with a somewhat smaller and deeper umbilicus, 1 j-2 inches long, 1-1 \ in diameter. Seeds 2-3 lines across, thick and quite regular, with a very slight indentation at the hilum.

I had observed that sometimes two plants are produced from the same seed. This I found to be the case occasionally with *Opuntia occidental*, Engdmanni,* and *dulcis,* one of the young plants always much larger und more vigorous than the other. In examining different seeds of this species, I succeeded in finding one with two embryos, (see figure), one spirally coiled around the other, both together appearing like one large one.

10. O. RAFIXESQUII, Engelm.: diffasa radice fibrofto, articulis mediis 8. majusculis obovatit s. rahorbiculatis per-viridibus; foliis subulatis elongatis patulis pulvillia Hiibremotia albido-a. griseo-villosis setas graciles rufas demum elongatas gerentibus plerisque inermibus; aculeis paucis plerumque solum tnarginalibas validis teretibos Metis sJbidit SBDpe basi apiceque rufescentibas erectis s. patulis, ttingnlis a. uno alterove graciliore deflexo adjecto; florii alabastro conico acuto, ovario clavato pulvillis 20-25 griseo-villonis rufo-setosis instracto; sepalis tubi tub-13 oblaneeoUtis acuroinatifl, interioribus late petaloideo-marKinatis cuwpidatis; petalis 10-13 late obovatis eroso-denticuUtis, sub-marginatis sulphureis basi intos miniatis, stigmatibuA 7-6 erectis adpressis fluro-albidis ; bacca ovata basi angustaU clavata subnuda pulposa purpurascente, umbilicoinfundi buliformi immeno; seminibas subrcgiilaribus compressis! margine plerumque lato conipresso sub-acuto. Var. *mierotperma* sabinennis seminibus minoribus regularibus angustins marginatis. (Plate XT. figs. 1-3.)

In sterile, sandy, or rocky (consisting as well of sandstone as of limestone) localities in the Mississippi valley, Illinois Missouri, Arkansas, and north to Wisconsin, east to Kentucky, and south probably to Louisiana and Texas; westward it has not been found west of the western boundary of Missouri and Arkansas. Flowers in May and June; fruit ripens in the same season, but remain* on the plant till the following spring. Joints rather large, orbicular 3-4 inches in diameter, or obovate 4-5 inches long by 3 in width ; a small variety with orbicular joints only 2 inches in diameter occurs on sandstone rock in southern MiMSouri. The color of the plant is dark or fresh green. Leaves 2J-4 lines long, diameter about one-fourth of the length ; pulvilli 9-12 lines apart, with nhort whitish or grayish wool, and bright red-brown bristles conspicuous even in the younge*t joinU. Spines rarely none, generally few in var. *microiperma,* sometimes disappearing entirely in fertile soil in garden*, etc. ; mostly only on the upper part or the edge of the joint, single or rarely 2-3, 0-12 lines long, rather stout, white with a darker tip, and sometimes alto darker base. Flowers 2J-3J inch*** in diameter, sulphur-yellow, niontly with a red centre. Fruit J J—2 inches long, lens than half that in diameter, narrowed at base, the seminiferous cavity not extending to the bane ; umbilicus funnel-shaped, but with shallow bottom, much wrinkled and scarred ; naked by the disappearance of the bristles of the pulvilli; and edible, somewhat acid or sweetish. Seed* 2| lines in diameter, hardly more than 1 line in thickness ; rim [42] rather narrow, thick, but acutish. Var. *mierotperma* has seeds only 0.8 or 0.9 line in diameter, more compressed! with quite a narrow rim.

This species has, by western botanists, generally been considered identical with the eastern *0. vulgari.* Riddell mentions it as occurring in Kentucky and Illinois; Torrey & Gray in their Flora do not give any locality in the Mississippi valley; but Rafinesque had already observed it in Kentucky, and in his usual careless manner had indicated three species : *Cactus humifusus* (which, growing " from New York to Kentucky and Missouri," probably comprised both *0. milgaris* and our species) ; *0. cmpitosa,* from Kentucky and Tennessee; and *0. memcantha,* from Kentucky to Louisiana. As it seems impossible, from bis incomplete descriptions, to make out what he meant by three different names, and as we know only one species in those States of the Mississippi valley, I take the liberty of discarding, those names, and of substituting the name of the author for the western species. It is not improper to state here that Rafinesque's vague and partly erroneous descriptions have found their way into Seringe'8 Bulletin (1831, page 216), into the Linnoea (Vol. VIII.), into Pfeiffer's Enumeratio Cactearum (page 146), and into other works, but with the substitution of Nuttall's for Rafinesque's name as authority. The "rounded joints" have, in these works, been taken for "globose" or "cylindric" joints, and our plant has been classed with the *Opunticeglomerate* from Chili and Mendoza.

A large, form of *0. Rafinesquii* was collected near Fort Smith, on the western border of Arkansas. Farther west, where no true *0. Rafincsquii* has been found, several forms were met with which, though they exhibit some distinctive characteristics, are perhaps not sufficiently different to constitute distinct species. The flowers of most of them are unknown, as well as the leaves; but fruit and seed were carefully preserved, which not only furnish important characters, but also the means to propagate, cultivate, and further to study them. We append them as sub-species.

1. RADICE FIBROSA.

a. 0. CTMOCHILA: diffusa, articulis orbiculatis pulvillis subremotis griseo-tomentosis stramineo s. fulvo-setosis, pleri*iue armatis; aculeis 1-3 robuHtioribus elongatis teretibus s. subcompreasis tortisque albidis basi wepe rufescentibus, patulis deflexisve, add it is rape 2-3 gracilioribus radiatim deflexis; flore? stigmatibus 8; bacca obovata umbilico piano s. parum depresso pulvillis 20-24 griseo-tomentosis parce setulosU, deinum nudatis; seminibus irregularibus angulosis margine undulato acuto. (Plate XII. figs. 1-3.)

On the Camanche plains east of the Llano Eatacado, near the 100th degree of longitude; and from there to Tucuracari hill, 80 miles east of the Pecos. Jointe 2J-3 inches in diameter, orbicular or very slightly obovate ; pulvillis 6-8 lines apart; the very light yellowish-brown bristles numerous, and conspicuous only on the older joints. Only the lowest pulvilli of a joint unarmed; upper ones with 2-5 spines; 2 or 3 larger ones, often reddish-brown at lower half, 1-2 inches long; lower, smaller, paler one* 3-9 lines long. Fruit oval, 1-1* inches long, about 10 lines in diameter, purplish, pulpy, sweet, and edible, less contracted at base than *0. Rafinesquii.* Seed remarkably irregular and twisted, 2} lines in diameter, with a wavy or twisted very sharp rim, whence the name which indicates the undulated bolder.

The orbicular joints, the numerous spines, the oval not clavate fruit, and curiously twisted seed, seem to distinguish this form sufficiently from *0. Rafinesquii;* but these characters may not be sufficiently constant or important to constitute specific difference. The characters of *Opuntics* are not yet sufficiently studied to permit us to form satisfactory conclusion* about their diagnostic importance; so we find a form collected on the Sandia mountains, near Albuquerque, which in habit and appearance does not differ from the common form of *0. Rafinesquii,* but which has the seeds of *Q.eymockila.*

0. CTMOCHILA, 0. MONTANA : articulis orbiculatis majonbus merinibus s. margine superiore solura aculeatis; puivillis remotis stramineo-setosis; aculeis singulis binisve validis albidis infra fuscis; bacca obovata [43] subdavata leminibus irregularibus acute undulateque marginatis. Joints 3-4£ inches in diameter; pulvilli 0-12 lines apart; spines 12-18, smaller ones 4-0 lines long, on some plants entirely wanting. Fruit 1$ inches long, much contracted at base, with a much depressed, almoBt funnel-shaped umbilicus. Seeds cannot be distinguished from those of the plant of the plains.

6. 0. BTENOCHILA : prostrata, articulis obovatis, pulvillis remotis stramineo-setosis superioribus solum armatis; aculeis singulis albiriis patulis, 1-2 minoribu* deflexis s»pe adjectis; bacca obovata clavata pulposa, umbilico lmto parum immerso, seminibus reguluribus crawv anguste obtuBeque marginatis. (Plate XII. figs. 4-6.)

At the caffon of Zufii.. Jointo 4 inches long and 3 wide, flaccid or often lying flat on the ground (in November); pulvilli 12 lines apart, small, with yellowish or greenish bristles ; larger spines 1-1J inches long, smaller ones less than half as long. Fruit green or pale red, very juicy, li inches long, but sometimes much enlarged, even more juicy, and 2-2$ inches long and 1 inch in diameter above, long clavate toward the base. Seeds quite characteristic, about 2} lines in diameter, U line thick, regular, with a very narrow and somewhat obtuse rim, whence the name.

In the same neighborhood another plant was found with similar seed, but smaller, more rounded, and somewhat more spinoos joints, fruit 1m clavate, smaller, seeds similar, but a little smaller.

2. RADIOS TUBEROSA.

c. 0. FCSIFORXIS : diffusa s. adscendens, radicibus fusiformibus elongatis, irregulariter incrassatis; articulis suborbiculatis majusculis, foliis elongatis subulatU patulis pulvillis subremotis griaeo villosis, setas elongatas virescente-fuscas gerentibus, plerisque s. sol urn supmoribus armatis; aculeis 2-3 gracilibus ineequalibus deflexis s. patnlis, albidis; floris minoris flavi (basi rul>elli ?) ovario pulvillis 25 stipato, stigmatibus 8, bacca ovata basi viz clavata demum nudata, pulposa rubella, umbilico immerso subinfundibuliformi; seminibus subregularibus cruasis majusculis acute marginatis. (Plate XII. figs. 7-8)

Cross-timbers longitude 97°-99° ; west of the region inhabited by *0. Rafincsquii,* and east of that of *0. cymochila.* Also collected by Dr. Wislizenus in the same longitude, but farther north, on Cow Creek and the Little Arkansas (on the road from Inde(iendeiice to Santa Fé); and by Dr. Hayden, of the United States Army, on the Missouri, Mow the Bi;£ Bend. Flowers in May. Roots form elongated tubers, attenuated at one or both ends j-1 inch in diameter ; joints 4 or even 5 inches in length ; leaves 2|-3£ lines long ; pulvilli 9-12 lines apart, with numerous stout yellowish-brown bristles, often 2 lines long; spines 1 or 2, 1-1J inches long, with a smaller one of half the length, more slender than in most other allied forms. Flowers 2-2} inches in diameter ; yellow, apparently with red base ; smaller and with fewer sepals than *0. Rafinesquii.* but the same number of stigmata. Fruit l£ inches long; umbiUcus } inch wide. Seed rather larger and thicker than in *0. Rafinesquii,* 2} lines in diameter and l£ thick. The description of the flower is from the specimens collected by Dr. Wislizenus.

O. MACRORHIZA, Engelm., of Texas, also belongs here as another tuberous-rooted form in the wide circle of *0. Rafinuquii.*

11. 0. BA8ILARIS, sp. nov. : bnmilis, arficulis obovatis 8. subtriangnlaribus giaucescentibus pubescentibus adscendentibus e basi proliferis, fere rosulatis; foliw subulatis minutis erectis rabellis tomentum axillare vix superantibus ; pulvillis subconfertis fulvo-tomentosis setas gracillimns demum numerosissimas breves fulvidas et snbinde aculeolos setiformes caducos gerentibus ; floris purpureis ovario obovato pubescente pulvillis plurimis (40-60) confertis fulvo-tomentonis instructo, sepal is 20-25 exterioribus oblanceolatis acuminatis, interioribus late obovatis cuspidatis, petal is sub-10 obovato-orbiculatis retusis «. obcordutis scpe tenuiter mucronatis, stigmatibus 8 brevi- [44] bus in capitulum conicum congest is; bacca (sicca *X)* breviter obovata late umbilicata, seminibus magnis crassis •ubregnlaribus. (Plate XIII. figs. 1-5.)

On hills and in ravines from the Cactus Pass down the valley of Wiliiams's River to the Colorado and to Mojave Creek. Mr. Schott met with it on the lower Gila; and both he and Mr. Albeit H. Campbell obtained the beautiful purple flowers of this plant in April and May, 1855. The habit of this plant is very different from any other of our *Opuntut,* as the stout obovate or often fan-shaped or sometimes almost obcordate joints originate from a common bate, and form a kind of rosette resembling somewhat an open cabbage-head. Among thousands of specimens observed none deviated from this peculiar manner of growth, none was proliferous in the shape of the other elliptic *Opmntim.* Joints 5-8 inches long, \ inch in thickness, minutely pubescent. Leaves only 1 line in length, slenderly subulate, smaller than any other of our species ; next in size are the leaves of *O. Mu$ourien*u, 0. fragQu,* and 0. *JUipenduia;* the largest leaves are produced by the, cylindric *Opuntue,* some of which have them 10 lines long.

Pulvilli somewhat immenwl, 4-6 lines apart. Flower of a beautiful and rich purple color, about 8) inches in diameter; ovary nearly 1 inch long, crowded with 40-60 elevated areolae, with light brown wool and brighter brown bristles; filaments not very numerous, leaving the inner base of the tube naked ; stigmata about 2 lines long or less, Apparently gnen. Fruit seems to he perfectly dry, short, and thick. Seed* 3 lines in diameter, nearly 2 lines thick, with a rather narrow but very thick rim, regular or sometimes quite irregular.

[18]« 0- HYBTRicniA, sp. nov.: diffiiMi, articulis obovato-orbiculatiis compressis, pulvillis subconfertis magnis Rriseo-tomentosis setas pallidas rutilasve gerentibu*, omnibus armatia aculeis 5-7 inferioribus gracilioribus brevioribus albidis deorsum ndiantibus, superiorilms 5-8 elotigatis validioribus angulatis stipe tortis flezuosisve 3-4 defltifc albidis, uno siterove longissimo, ceteris 2-4 superiorihus patulis suberectisve sepe basi s. ad medium fuscatis; flora—— bacca obovsia subdavsla, umbilico jwrum immerso planiusculo, pulvillis 25-30, inferioribus iaermibos, supenonbiis ennfertis aculcolos paaoos gerentibiu ; seminibus mmximus imgulmribus *Uu* crsssequs margiDatis. (Plate XV. figs. 5-7.)

This beautiful species was found abundant from the Rio Grande westward to the Sin Francisco mountains, mixed with *0. MimmnemiM,* to which it is nearly allied. The specimens before us were obtained at the Colorado Chiquito and on the San Francisco mountains. Joint* 3-4 inches long and nearly as broad ; pulvilli 5-6 lines apart, unusuallv large. Lower radiating spinet 4-9 Unas ; the others lfr-3 and even 4 inches long, irregulariv arranged, at we generally find it in this species. We notice many specimens where 3 or 4 larger spines are placed above the lower •bort radiating ones ; the uppermost one of them is nsually the longest Somewhat above these are 2-4 other spinet, tke lower one of which is the darkest, and offen not mnrb shorter than the one just mentioned ; the others era shorter M* whitish, or dark only at the beat. The bristles ait yellowish in aone and brawn in other specimens ; some-

times we find short pale and longer darker bristles together. The fruit is 1 inch long and half as thick, with a very shallow umbilicus; only the upper larger pulvilli bear 4-6 spines (2-6 lines long) ; the lower ones on the contracted part of the fruit are very smull, distant, and unarmed. Seed among the largest in this genus 3£ lines in diameter, the thick and broad rim acutish. The nume indicates the porcupine-like armature of this species.

13. 0. MISSOURIENSIS, DC.: prostrata, rod ice fibrosa, articulis obovatis suborbiculatisve tuberculatis compressis late viridibus adscendentibus, foliis subulatis minutis patulis, pulvillis subconfertis albo s. griseo-tomentosis stramineo — setosis omnibus armutis; aculeis in pulvillis inferioribus gracilioribus paucioribus, in superioribus 6-10 exterioribus minoribus radiautibus albidis, 1-6 interioribus robustis teretiusculis longioribus patulis, rarius suberectds, albidis R. nifescentibiu ; floribus sulphureis basi intus a»pe aurantiacis, ovario obovato subgloboso, pulvillis 26-36 albo tomentosis aculeulatis instructo; sepalis tubi sub-13 exterioribus oblanceolatis, interioribus [46] obovati* cuspidatis petaloide-marginatis, petalis sub-13 obovato-orbiculatis emarginatis s. obcordatis crenulatis a»pe mucronulatis; stigmatibus sub-8 viridibus in capitulum globosum s. conicum confertis; bacca ovata s. subglobosa, ambilico parum depresso, pulvillis 25-36 albo-tomentosis setos albidas stramineas s. rufescentes aculeolosque numerosos breves s. elongates gerentibus; seuiinibus magtiis pleruinque irreguloribus late subacuteque marginatia. (Plates XIV. and XV. figs. 1-10 and 1-4.)

This variable species extends from the country north of the upper Missouri River to the regions south of the Canadian and of Sunta Fe\ latitude 48° 36'; and from longitude 99° east of Fort Pierre, on the Missouri, to 112° on the San Francisco mountains. It has not been found south of Albuquerque, along the Rio Grande, nor in the Salt Lake valley, Utah, as far as at present known. Flowering in May; fruit same fall. Nuttall discovered this common western species on the upper Missouri in 1811, and described it under the name of *Cactus ferox;* he noticed " 8-10 greenish stigmata" and the "dry spring fruit." The deep purple fruit, 4< as large as a hen's egg," attributed to our species, on the authority of Dr. James, by Torrey and Gray, in their Flora, perhaps belongs to our *0. Camanchica;* it certainly cannot belong to *0. Miuouriensis.*

It forms large spreading masses, much dreaded by travellers and their animals. Joints mostly suborbicular, 2-4 inches long and 2-3} wide, light green, somewhat tuberculated from hemispherical elevations which bear the leaves and pulvilli, 4-6 lines apart; leaves 1^-2 lines long, hardly more than } line in diameter at the base, nearly twice as long as the wool in their axils. Numerous small white spines radiating downward and laterally, sometimes a few rather longer ones obliquely upward, mostly 3-6 lines long, rarely more elongated; central spines in the Missouri specimens mostly 1, rarely 2; in the southern ones often 2-4, 1-1i, or even 2 inches long, terete or somewhat •ngular, white, or mostly with a reddish base when young, entirely brown-red, with lighter tips. On the lower pulvilli the stouter spines are mostly wanting; in some Missouri specimens I find few and weak spines on the upper, and none at all on the lower part of the joint*; in other plants from the same region all the pulvilli are nearly equally anned with 6 weaker (2-3 lines long) lower deflexed, and 6 inner stouter (4-6 lines long) spreading spines. Flowers 2-3 inches in diameter; ovary, with subulate sepals, similar to the leaves ; spines already present, but not as long and stiff as in the fruit. Petals yellow towards the base, or sometimes almost entirely rose-colored, orange, or brick-colored, sometimes only the margin remaining yellow. Exterior filaments much the longest, deep red ; interior ones paler, shorter. Pistil pale-yellowish, thickened below the middle, as in almost all the species 0! this genus. Stigmata united into a small subconic head.

Fruit ovate, or sometimes globose; umbilicus shallow; spines on the pulvilli numerous, 6-12 usually short, 1-4 sometimes 6 lines long. Seeds about 3 lines in diameter, sometimes larger, in one form much smaller, mostly fagular, twisted, angular, much compressed, with a broad and thick but rather acutish rim. Embryo of different •hapee conform to the shape of a seed, always with a small albumen.

The following forms, we think, must be included under this species, though the whole history of most of them if not known; some of them may not even be constant varieties.

o. BuriaprNA: articulis orbiculatis 8. transversis setis pards rnfescentibus, aculeis radialibus 6-8 albidis rnfowiegatis, interioribus validis fascia apice pallidioribua, 2-4 deflexis, singulo patulo s. suberecto robuttiatimo; bacca OTata. (Plate XIV. figs. 1-3.)

This 11 the shortest form of our species, and greatly deserves Nuttall's original name " ferox." It was collected <* rocky placet on the Pecos; Dr. Hayden has also sent it from the Yellowstone; and it no doubt is met with in all the intervening territory. Joints 2-3 inches in diameter, pulvilli 4-6 lines apart; bristles fewer, bat longer and darker than in other forms; central spines lfr-2 inches long. Fruit 1 inch long, half as thick, with shallow umbilicus; about 30 pulvilli, spines on the upper ones 4-6 lines long. Seeds 2J-3 linen in diameter.

& FLATTGARPAJ articolis obovato-orbicuLitis, setii parcia stramineis, aculeis exterioribus 6-10, inferiori- [46] but albidis, superioribus roboatioribua rufetcentibus centrali tubsingulo robusto fosco patulo t. deflexo ; bacca depreaeo-globoea, nmbilioo lalo piano, pulvillii sub-26 aculeolos 6-10 breves gerentibus. (Plato XIV. fig. 4.)

Sent from the Yellowstone by Dr. Hayden. A stout form. Joints 3 inches long, 2J-2J wide; pulvilli 4-6 lines apart; the dirty yellowish bristles visible only on the older joints. Central spines single, or only on vigorous specimens on the upper pulvilli 2, mostly brownish, deeper colored on the margin. Fruit 8-9 lines long, umbilicus of the same diameter; spines only 1-3 lines long, deflexed. Seed 3 lines in diameter; rim rather narrower than in the first-mentioned form.

y. MICROSPERMA : articulis ut in pracedente; stigmatibus 5; bacca ovata, umbilico paruni depreaso, pulvillis, 20-30 setosis et breviter aculeolatis, seminibus anguste acuteque marginatis. (Plate XIV. figs. 5-7.)

On the Missouri, about Fort Pierre; brought down ten years ago by the fur traders. Very similar to the last form in the general appearance. Also with only 1, or at most 2, central dark spines ; flowers only with 5 stigmata, otherwise same as the one described above ; fruit short, oval, with 10-20 very short spines on the numerous pulvilli; 6eed only 2 lines in diameter, more regular, thicker in proportion, with a narrow and acute rim. It might be supposed that these characters were important and constant enough for a specific difference, if we did not know the great variability in this genus, and if we did not find among Dr. Hayden's plants seeds of intermediate shape and size.

& bCBiNERMis: articulis elongato-obovatis, pulvillis subremotis, inferioribus, inermibus, superioribus aculeos paucos breves gerentibus.

Brought from the upper Missouri by Dr. Hayden ; remains constant in three years' cultivation. Joints 3J-5 inches long, half as wide, gradually narrowed down at base ; leaves entirely similar to those of the common form; pulvilli 6-9 lines apart; spines entirely wanting, or on the upper pulvilli 2 or 3 short and slender ones, rarely one or the others more robust, £-} inch long. Flowers not seen.

c. ALBISPINA : articulis late obovatis, setis stramineis, aculeis omnibus albis gracilioribus, exterioribus 6-10 setaceis, interioribus in pulvillis superioribus 1-3 robustioribus elongatis deflexis s. patulis; bacca ovata, seminibus magnis. (Plate XIV. figs. 8-10.)

Sandy bottoms and dry beds of streamlets on the upper Canadian, 250 miles east of the Pecos; on the Sandia mountains near Albuquerque; also on the upper Missouri. This was the first form of this species met with in travelling up the Canadian; the stouter and more compact forms were found farther west, in higher elevations. Joints 3-4 inches long, 2$-3 wide; pulvilli 4-6 lines apart; spines all ivory white, rarely with a yellowish tinge, larger ones 1-1£ inch long; fruit with very shallow umbilicus, and very slender and short spines ; peed 3-3} lines in diameter, irregular, rim broad acutish. A form from the Sandia mountains — with pulvilli more remote, spines longer, more slender, some of them flexuous — seems to unite this with the next variety.

f. TRICHOPHORA : articulis ovatis, pulvillis confertis parce albo-toinentosU setas stramineis demum albidas breves gerentibun, omnibus armatis ; aculeis 10-18 setiformibus albis, exterioribus 8-12 brevioribus radiantibuf, interioribus longioribus deflexis, rariuft singulo suberecto; pulvillis in articulis vetustioribus lignoais confertissimis •etas numerous aculeosque 15-25 capillaceos elongates flexuosos gerentibus; bacca ovata, umbilioo parum immeno pulvillis 35-40 albo-tomentoais straroineo-setosis fasciculum aculeolorum 12-18 plerumque deflexorum gerentibus; seminibus maximis valde compressis irregularibus latisnime acuteque marginatis. (Plate XV. figs. 1-4.)

Only on the volcanic rocks about Santa Fe*, and on the Sandia mountains. The hoary appearance of the older joints is very characteristic, and reminds one strongly of *PilocereuM $enilu.* These hairs are from a few lines to 2 or 2} inches in length, and of the appearance and about as fine as an old man's beard. The older joinU [47] become thick and of a solid ligneous substance, younger joints 4} inches long, 2j inches wide, or larger; pulvilli 4-5 lines apart; exterior spines 3-6 lines, interior ones 9-18 lines long. Fruit ovate, 10 lines long, 7 in diameter; very slender and numerous spine*, 3-6 lines long. Seeds, with those of 0. *hy$tric\na,* the largest known to us, 3} lines in diameter, sometimes larger; rim large, almost of the thickness of the seed itself. This is perhaps a distinct species, and must be further studied.

14. 0. 8PHJCROCARPA, sp. nov.: diffusa, articulis orbiculatis transverseve tuberculatis ; pulvillis conferti* albo-totnentosi*, setas stramineas breves gerentibus, pleriaque inermibus, sunimis solum et marginalibas aculeos 1-2 reflexoti s. patulos, adjectis subinde 1-3 brevinribiw gerentibus; bacca globose, umbilico minor* piano, pulvillis sub-25 tomentosis setosis vix aculeolatis, seminibw mediis acute marginatis. (Plate XIII. figs. 6-7.)

On the eastern declivity of the Sandia mountains, near Albuquerque. Joints in the specimen before us 3 inches wide, less in length, strongly tuberculateri ; pulvilli 4-5 lines apart Spines on the upper lateral pulvilli mostly single, deflexed, (inch long; on the middle or lower ones none; on the uppermost and marginal ones mostly 2, rarely 3 line* long, reddish brown, with darker tip ; 1-3 smaller additional spines, 2-4 lines long, also reddish. Fruit perfectly globose, 9 lines in diameter; umbilicus 5-4J lines wide; pnlvilli bristly, but only the Upper ones with 1 or a few small spines. Seeds 2} lines in diameter, very imgoUr, with a rather narrow but sharp rim.

The arrangement of the spines is so different from any form of 0. *Mimmnetms* — which always shows the

numerous slender radiating spines, and always has spiny fruits — that we feel obliged to separate this plant as a distinct species. The seeds brought home by the expedition have germinated, and are growing vigorously.

15. 0. ERINACEA, sp. nov.: diffusa, adscendens ; articulis tumidis ovatis s. teretiusculis, pulvillis confertissiuiis ovato-orbiculatis albo-tomentosis demurii stramineo-setosis omnibus armatis ; aculeis 3-5 gracilibus elongatis e cinereo-rabellis 1-3 superioribus brevioribus sureum porrectis, centrali longiore patulo vel declinato, ceteris deflexis, additis 2-4 minoribus inferioribus ; bacca ovata umbilico infundibuliformi pulvillis 30-40 setas stramineas et aculeolos 12-20 gerentibus ; seininibuu magnis subreguluribus late acuteque marginatis. (Plate XIII. figs. 8-11.)

West of the great Colorado, near the Mojave Creek. Joints 2-2J inches long, 1-lJ inches wide, and about i-J inch thick, sometimes elongated, almost cylindric, densely covered with the large white pulvilli, which are only 2-3 lines apart, and numerous reddish-gray spines with red points bristling hedgehog-like (whence the specific name) in every direction. Spines 6-14 or in old joints even 20 lines long, with smaller ones very slender, flexible, but stiff. Young plants cylindric, covered with bunches of 15 or 20 or more white hair-like spines. Bristles dirty-yellow, even in young joints present, in old ones densely crowded and 2-3 lines long; in a dead flower a 6-parted stigma was noticed. Fruit 1-1£ inches long, about £ an inch in diameter, with a deep funnel-shaped umbilicus; pulvilli crowded, prominent, white-tomentose with yellowish bristles, and numerous, mostly deflexed spines, 3-6 lines long. Seed nearly 3 lines in diameter, much compressed, more regular than in the three foregoing species.

16. 0. BRACHTARTHRA, sp. nov. : prostrata s. adscendens, articulis ovatis s. orbiculatis tumidis rape subglobosis, tuberculatis ; pulvillis confertis magnis albo-tomentoeis parce setulosis plerisque armatis ; aculeis 3-5 albidis 8. fuscatis patulis; 1-2 validioribus sursum versis, cseteris minoribus minimisque subdeflexis; floris parvi; ovario subgloboso, pulvillos 12-15 tomentosos setosos superiores aculeolatos gerante, sepalis tubi exterioribus obovatis cuspidatis stigmatibus 5. (Plate XII. fig. 9.)

At the foot of the Inscription Rock near Zuiii, under pine-trees; only seen in that single locality.
A singular-looking plant, with short tumid joints (10-15 lines long, 10-12 wide and nearly the same in thick- [48]
ness), one growing on the top of the other, so as to resemble somewhot a jointed finger. In the absence of ripe fruit we are unable with certainty to class this species. The shape of the joints and the somewhat spinulose fruit seem to bring it very near to *0. fragilis,* and it may possibly be a small and compact form of this specie*, though the appearance is very different; on the other hand, the subglobose joints seem to refer it to the section *Glomerate,* Salm.

Pulvilli 2-4 lines apart, large, white or when old grayish tomentoae, with very few short yellowish bristles, even in the old joints; spines 9-12 lines long, rather stout, terete, often with 1 or 2 short ones not more than 1-2 lines long. No ripe fruit was found (November), — which is also often the case with *0. fragilu,* — but many remains of flowers, with globose-ovate fleshy sterile red ovaries, 3-4 lines long, some of them becoming larger and probably proliferous ; generally only some of the upper pulvilli bear a few short spines. The flower seems to have been about 1 inch in diameter, with about 5 sepals, 8 or 9 petals, and style with 5 stigmata.

0. FRAGILIS, Haw., — the seed of which we give a figure of (PI. XXIV. fig. 5), — grows on the upper Missouri and Yellowstone, and probably down to Santa Fe\ The joints are small, ovate, compressed or turned, or even terete ; 4 larger spines on the upper fully developed pulvilli cruciate, the upper one suberect, stouter and longer than the others, mostly yellowish-brown; on the lower margin 4-6 small white radiating spines ; bristles few. Fruit apparently somewhat fleshy, getting dry much later, with 20-28 pulvilli, almost naked, only the upper ones with a few short spines. Seeds few, large, regular.

Subgen. 2. CTLINDBOPUNTIA, Engelm.

f 1. *ClavakB.*

17. 0. CLAYATA, Rin Wislii. Rep. (PL, XXII. fig. 1-3). Found from Santa F6 to Albuquerque,—where Wislizenus and Fendler had already collected it, —and nowhere else. A remarkable and well-characterized species, the type of this section. We add to the characters previously published (Wislizenus's Report, note 12, and Plant* FendleriansB in Mem. Amer. Acad. Vol. IV. p. 49), that the leaves are long and subulate, 2-2* lines long; the broadest spines were lj lines wide ; fruit lj-1f inch long, lemon-yellow, almost covered with 30-50 hemispherical pulvilli, which bear innumerable.white slender bristles, spreading ray-like in every direction. Seeds large for this section, and, as in all the allied species, transverse or broader than high, 2}-3 lines in the longest diameters, rostrate, somewhat angular; commissure (which in the cylindric and clavate opuntia replaces the rim of the flat-jointed ones), impressed, linear or a little wider ; cotyledons, in several seeds examined by me, oblique.

18. 0. PARBTI, E. in Sillim. Journ. Nov. 1852: articulis ovatis basi clavatis, tuberculis oblongo-elongatis pulvillis albo-tomentosis setas paucas rigidns jierentibus; aculeis angulatis scabris rubelio-dnereis, interioribus validiorihns snb-4 triaQgulato-eompressis, exterioribus 5-8 angulatis supra infraque divergentibus, extimis 6-10 gracilibus

rigidis radiantibus ; bacca ovato basi clavata pulvillis sub-40 setosissimis stipata; seminibus regularibus latins coiuinissuratis. (Plate XXII. figs. 4-7.)

On the gravelly plains thirty miles west of the Colorado, near the Mojave River; southward to the eastern slope of the California mountains, near San Felipe, Dr. Parry. Joints 2$-3 or 4 inehes long, 1J inch in diameter, attenuated not only below but also somewhat above in the specimen before us. Tubercles about 9 lines long ; pulvilli small; bristles few, coarse and long. Spines very numerous, in three series : the 4 inner ones 12-16 lines long, £-} line broad, the lower one somewhat flattened, the others triangular; the next series consists usually of 2-3 upper ones and 3-5 lower ones, angular, more slender and shorter than the first, 4-8 lines long; the third or external circle consists of 6-10 bristly slender spines, 3-4 lines long, some above, but most of them lateral or inferior. Young [49] ppines reddish-gray, with paler margins ; older ones ashy. Fruit l£ inch long. Seed rather regular, 2-2£ lines in the transverse diameter, less than 2 lines high, not beaked; commissure broader and more distinct than in any other of this section examined by us. Cotyledons in all the seeds examined oblique.

This description refers to the plant brought by the expedition from the Mojave River. Several yean before, Dr. Parry had described a plant discovered by him " on the hills and plains about San Felipe, on the eastern slope of the California mountains," which had been named after the discoverer. We presume that both plants were identical; but have to remark that Dr. Parry's plant is much larger, having joints of 4-6 inches in length, with tubercles 6-12 lines long ; spines whitish, half an inch long. He describes the flowers as 1$ inch in diameter, greenish-yellow, with green stigmata. Fruit not mentioned. Further investigation will be necessary to clear up those doubts.

From 0. *clavata* (which grows 8 or 9 degrees east, and on much greater elevation) the Mojave species is distinguished by the shape of the joints, the color, much narrower more numerous spines, and the smaller more regular seeds, with the broad commissure.

§ 2. *CylindriccB.*

19. OPUNTIA DAVI8H, sp. nov.: caule dense lignoso ramosissimo divaricato adscendente, articulis junioribus erectis elongatis, basi attenuatis; tuberculis oblongo-linearibus prominulis, setis stramineis teuerrimis ; aculeis interioribus 4-7 subtriangularibus rufis apice pallidioribns, vagina Ptraininea laxa ful^ida indusiatis divergentibus s. deflexis, aculeis gracilioribns inferioribus 5-6 ; bacca ovata pulvillis sub-25 setas stramineas aculeolosque paucos gtrentibus ; nmbilico lato. (Plate XVI. figs. 1-4.)

Common on the upper Canadian,^ eastward and westward of Tucurocari hills, near the Llafio Estacado. A very much branched, shrubby, som^^^jprocumbent plant, with erect joints, about 18 inches high ; wood dense and hard. Joints 4-6 inches in length and \ an inch or more in thickness; tubercles not very prominent* 7-8 lines long; very slender brittle*, forming a thick brush at upper end of pulvillu*. Interior spines 1-1$ inches long, covered with a very loose glistening membranaceous sheath, which makes the plant an object of remark for a long-distance ; lower spines 3-6 lines long. All the fruits seen on the route were sterile, and most of them elongated, 1-1$ inch long ; on many pulvilli 1-4 sheathed spines were observed, which possibly are peculiar only to the sterile and proliferous fruits.

We have named this well-marked and pretty species after our enlightened Secretary of War, Colonel Jefferson Davis, under whose auspices the expeditions fur the exploration of a proper route for the Pacific Railroad were organised, and were enabled to accomplish so much, not only for this specific object, but also for the elucidation of the natural history of this hitherto almost unknown country.

90. 0. ICHINOCARPA, sp. nov.: caule reticulato-lignoso erectiuaculo, ramis numerosis patentissimis tubiude pene deenmbentibus, articulis ovatis baai cluvatin, tulicrculis ovatis promiiieiitibus confetti*, setis pauci* stramineis; aculeis albidis stramineo s. albido-vaginati*, majoribua »ub-4 craciati*, cetvri, minoribus 8-16 undique radiantibus; floris fUvi (?) ovario pulvillis 30-40 villosis subaculeolatisque confertis stipato, sepal is nub-13, exterioritras ovatis acutis; interioribus obovatis mucronatis, petalis sul>-8 obovatis obtusiss. subemarginatis denticulatis, fttigmatibns 6; bacca globosodepresta s. hemispheric*, Ute profundeque umbilicaU pulvillis snb-40 aculeolos vaginatos elongaloa 8-12 gerenUbus dense stipaU floris, radimento subpenutente coronaU; semiuibuf sabregolaribus a. angulatis, crasiiB, late commiasuratin, cotyledonibos parallelis.

In the Colorado valley, near the mouth of Williams'* Hirer. Mr. Sehott found a stouter form farther south. The more northern plant forms a low shrub 5-18 inches high, tpreading, and often partially prostrate; [50] the cybndnc tubular wood is reticulated with short me*)**. Joints 1-2J inches long, lest than 1 inch thick ; tubercle* not more than 4 or 5 lines long; bristles few and rather coane- Spines 12-20 ; the 4 largrr one* are somewhat central, 9-12 lines long; the others radiating 4-0 lines long; the smaller ones, a* in all these Opnntia, barfly rajfinate. Flower described from a withered specimen found attached to a fruit, to which it somewhat adhered, bat perhaps held more by the long intricate spines than by an organic attachment Flowe? 1f-1f inches in diameter, apparently yellow, which is uncommon among the *Cytimdric OpunHm;* petals about 9 lines long and 8 braid; *igma*a about 2 lines long. The fruit is very peculiar, and, with the stcd, chancteriaet this tpedta well ThewfcU

umbilicus on the shallow fruit gives it the appearance of a saucer, and the seeds find their place more around the edge of the umbilicus than in the body of the fruit. Spines on fruit from 4 to 10 lines long. Seed 2 lines or more in diameter, with a broader commissure than any of the allied species; cotyledons always ; all the specimens examined regularly accumbent or parallel (the only species, so far, where this regularly is the case) ; albumen unusually large.

0. terpentina, from San Diego, is very nearly allied to our species, but seems sufficiently distinct by its elonoatod cylindric joints and different growth.

21. 0. BIGELOVII, Engelm.: caule arborescente erecto crasso reticulato-lignoso, ramis erectis adscendentibusve numerosis congestis, inferioribus denmra refractis, articulis ovatis s. ovato-cylindricis tumidis tote s. pallide viridibus fragilibiw; tuberculis subhemisphericis depressis confertis; pulvillis immersis ovatis setas pallidas penicillatas et aculeos 6-10 robustiores pallidos stramineo-vaginatos, 3 deflexos, ceteros divergentes et 6-10 graciliores inferiores ladiantes gerentibus; ovario tubercnlis plurimis stipato parce aculeolato; hacca ovata profunde umbilicata tuberculata pulvillos immersos 60-70 setigeros inermes s. aculeolos sub-3 vaginatos gerente; seminibus parvis. (Plate XIX, figs. 1-7.)

On Williams's River, a branch of the Colorado ; 10-12 feet high, rtem } inch in diameter; skeleton forming a large hollow tnbe, much reticulated with numerous small roundish or somewhat rhombic meshes in 13 or 21 spiral rows ; branches forming a dense head. Younger joints erect, adpressed very fragile, often shaken off by the wind and covering the soil around, taking root everywhere, or sticking to the clothes of the passers-by like burrs ; the joints on the older part of the stem are often persistent and reflexed, becoming withered and brown. Joints 2-6 inches long 1-2 inches in diameter, light fresh green, covered with the small, almost hemispherical and not very prominent tubercles] which are 3-4 lines long, and arranged mostly in 13 spirals ; the areola is immersed at the apex of the tubercle, and surrounded by an elevated paler or almost whitish ridge, having the appearance of 2 lateral glands. Larger spines about 1 inch long. Flower or complete fruit not seen. An ovary or young fruit before me is clavate, 1 inch long, and has a few spines on the pulvilli. Some empty (sterile?) fruits brought home are ovol, 1j-1f inches long, 1 inch in diameter, strongly tuberculated, and spineless ; others again are even larger, with more numerous tubercles, and the pulvilli beset with 3-6 sheathed spines 4-7 lines long; these are evidently undergoing a change into joints. Proliferous seeds, said to be small; but most unfortunately the specimens were lost, so that we were unable to compare them with those allied species found farther south *(0. fulgida)* and on the Pacific coast (0. *prolifera).* Our plant ia distinguished from these forms by its short tubercles, immersed pulvilli, and large tuberculated and somewhat •piny fruit.

[I have thought proper to consecrate this remarkable species, so conspicuous in its desert wilds, to my colaborer pp. J. M. Bigelow, through whose intelligent exertions and indefatigable assiduity so many new Cactacete, described ift this report, have been discovered and brought home. — O. E.]

22. 0. WHIPPLEI, sp. nov.: caule erecto s. rarius patulo s. subprocumbente, reticulato-lignoso, divaricato »moso, articulis cylindricis ; tuberculis ovatis confertis, pnlvillis pulvinatis parce tomentoais vix setosis; [51] aculeis brevibus cinereo s. stramineo vaginatis, 1-4 majoribus divaricatis, inferiore longiore deflexo, minoribus 2-8 solum ad inferprem pulvilli marginem deflexis s. undique radiantibus; flore rubro, ovario ovato tubereulato pulvillis 20-30 tomentosis setas stramineas et aculeolos paucos mox deciduos gerentibus stipato sepalis tnbi sub-8 orbiculatis cuspidatis, petal* 8-10 spathulatis cuspidatis; bacca subglobosa leviter tuberculata subcamosa flava inenn umbilico infnndibulifonui seminum subregularium commissura lineari.

o. LJCTIOB, humilior, aculeis brevioribus paudoribus, seminibus minoribus.

£ 8PIN08I0H, elatior, aculeis plurimis longioribus, seminibus majoribus. (Plate XVII. figs. 1-4.)

From the elevated country about Zufii to the head of Williams's River; at first seen only 8-15 inches high, subprostrate, afterwards 20-30 inches, and sometimes even 5-4 feet high. Var. 0. was found by Mr. A. Schott south of the Oik River; and he also discovered the flower of this plant, which, like the flowers of all the other new species, remained unknown to us, unless winter remains were picked up here and there. Ligneous skeleton tubular, with •mall mathes, dense at base of stem; joints elougated, 2-4 inches to a foot long, } or f of an inch in diameter; tubercles ovate or sometimes almost rhombic, about 5 lines long. Spines very variable in number, sometimes only with 1 larger and 2 or 3 smaller ones; in other instances, especially in var. 0., with 12 or 14; spines £-9 lines long; bristles few, generally only on older joints. Flowers 1*-1 i inches in diameter; ovary 6-9 lines long, with 20 or 85 pulvilli. Fruit about 1 inch bug, a little less in diameter, somewhat fleshy and sweet, with 25-35 not very promijwnt tnbeidas. Seeds with linear or almost linear commissure, 1j-1| lines in diameter ; cotyledons regularly incumbent or sometimes oblique; the seeds of 0. are 2 lines in diameter.

This it easily distinguished from all the allied species by the slender elongated branches, the short crowded tubercles, and the short spines. We have dedicated this Opuntia — characteristic of the desert mountains under the tt& <Wgm, between the Rio Grande and the Colorado—to Captain A. W. Whipple, the commander of the expedition,

who, by his zealota and liberal co-operation, afforded every facility in his power in the various collections of natural history. (Plate XVII. figs. 5-6, and Plate XVIII. fig. 4.)

23. O. ARBORESCENS, Engelin. Found first 200 miles east of the Pecos, and from there abundantly as far west as Zuñi, where other cylindric *Opuntice* take its place. In this region it does not grow higher than 5-8 feet, and can scarcely be called arborescent. It is always well characterized by the verticillate often somewhat pendulous branches, the cristate-tuberculate spineless fruit, and the smooth seeds with a distinct and broadly linear commissure* Seeds of specimens collected at Zuñi smaller than others, only 1} line in diameter.

24. O. ACANTHOCARPA, sp. nov. : caule arborescente erecto reticnlato-lignoso, ramis adscendentibus divaricatia articulid cylindricis tuberculatis pallide virescentibus, tuberculis oblongo-linearibus pulvillis ovato-orbiculatis breviter tomentosis vix setosis, aculeis numerous s. plurimis (8-25) stramineo-vaginatis undique porrectis, stellatis; bacca subglobosa late umbilicata tuberculata; pulvillis 12-15 tomentasis parce setosis aculeolis validis 8-10 munitis; seminibus raagnis multangiilis late conimissuratis. (Plate XVIII. figs. 1-3)

On the mountains of Cactus Pass, about 500 miles west of Santa Fé. Stout; stem 5-6 feet high, wood forming a hollow reticulated tube, solid at base ; branches few, never verticillate, separating at acute angles. Joints 4-6 inches long, 1 inch in diameter; tubercles 9-10 lines long ; pulvilli, in some with 1 central and 6 or 8 exterior spines, in others with 3-7 interior and 10-20 exterior stellately radiating spines. Central spines 1-1$ inch, exterior 4-10 lines long, with a yellowish or brownish sheath. Fruit 1 inch long, with a large but not deep umbilicus and 12-15 rather shullow tubercles ; spines of fruit stout, 3-6 lines long, stouter aud more crowded toward the top of the fruit. Seeds unlike any other of our Opuntia, 2J-3 lines in diameter, with rather broad commissure, often spongy on the margin, and on the sides with many even or concave faces separated by sharp ridges.

This peculiar species cannot be confounded with any other, but comes, in the arrangement of spines, [52] nearest to *O. arborescent,* from which it is easily distinguished by its manner of growth, its elongated tubercles, and especially the much less tuberculated and spiny fruit and the peculiar seed.

25. 0. TESSELATA, Engelm.: caule frutesccnte erecto s. diffuso, dense lignoso, ramosissimo, ramis divaricatis, articulia gracilibus teretibus, plano-tulwrculatis ctesiis, tuberculis 5-6 anguintis coiifertissimis depress*, planiusculis ; pulvillo lineari tomentoso vix wlis pauris decùluis inatructo, inermi s. inedio s. versus basin aculco elongnto porrecto s. subdeflexo albido fluviilo s. fulvo vagina laxi lwi constricts flava B. e flavo fulva induftiato, singulo s. nirisftime binis; aculeis paucis brevibus setaceis infra fuepc a/ljcctin ; floris purpurei ovario ohnvnto s. clavatn pulvillis 30-50 villoto-tomentosis inermibus 8. parce aculeolotis dense stipato ; sepalis tubi sub-8 obovato-orbiculatin cuHpidatis petalis 5 late obovato-orbiculatis emarginatis ; filament!* exterioribus latioribus pcr*istentibua, rtigmatibu* 5 brevibus ovatis adpressis; bacca ovata bosi apiceque contracta sicca pulvilli* villosis aculeo-latiwimis confertis*imi* stipata, floris rudimentis corunata ; Bernini bus subivgulnribus margine *pongio8o crasso parum prominent* cinctis. 0. romotuftma, E. in Sillim. Journ. November, 1«52. (Plate XXI. fi^s. 1-7.)

Valley of the lower Colorado, and from thence to the California mountains. First discovered by Dr. Parry in the Colorado desert ; afterwards found by Dr. Billow from the valley of Williams'* River to 70 miles east of Cajon Pass, in the California mountain*. The flower was fir*t noticed by Mr. A. Schott, in western Sonora, toward the lower Colorado. Flower* May to ScptvmlxT. Stems 2-6 feet high, mostly branching fh>m the base below, 1-3 inches in diameter, covered with a dark-gray ncaly bark ; wood of young branches reticulate, very soon becoming solid, but even then the reticulated structure remains visible in the different layers of wood. Annual layers not as distinct as the medullary rays, but more so than in *O. frutevens ;* in a rtcm of near 2 inches diameter we counted 33 annual layers, 8 or 9 of which lielong to the alburnum. Branches numerous and Mender, of an ashy or grayish-green color; younger ones 3 or 3} lines in diameter, well characterized by the remarkable flattened tubercles, which, by closely crowding together, become 5 or 6 angular, diamond-nhaped. The artola in linear, extending down to the middle of the tubercle; its short tomentum usually extends upwanU between the next adjoining tubercles. Tubercles 2J-3 lines long, and a little less in diameter. Spin* 1J-2 inches long, usually from the middle or at least above the hone of the pnlviUua, generally only on the upper tubercle* of each year's "growth, which gives the whole plant a singular appearance, showing the fasciculate spines at nome, and having no npines at all on other parts of the appa* entlg h TM ° S * ncoat **»"<**»: »beath contracted at bane, ami firmly adhering to the spine, loose and saccate above; small bristly spines at tbe base of the pulvillua, *-3 sometime* even A in number, 1-4 lines long. Flower purple, about 6 lines in diameter, lowest part of the tube naked. Fniit IMO lines long, resembling mocb the fruit of tbe *LlavaU Opuntvg* in nhape, being contracted above, with a narrow and de*p umbilicus, and retaining tbe dead remains or the flower, of which the broad, scale-like exterior filaments air most conspicuous; pulvilli large and woolly, almost entirely covering the fruit, and beset with 30 to 50 reddish-brown, brirtly. flexuous spines, S-3 lines long. Seeds fcw$_f$ regular, nearly or quite 2 lines in diameter.

. * ! · °" ^i 11 * TM, EnK*lm.: canle frutese+nte eArto dena* lfcnoao, mmin rirgatis demnm t^Hibtu junioribos tubercuU ohlongo^longau subprominentia gentjUbtis ltjto riridibos; f.4iis snlmlaUs polrillis orbiculaUs magals

breviter albo-tomentosis, setarum Btraminearum penicilla paro brevi, aculeis ex iino pulvillo singulis elougatis corneis 8. fascia laze straniineo s. aurantiaco-vaginatls, odjectis subiiide supra aculeis minoribus 1-2 ; bacca ovata tuberculata pulposa flava pulvilloa 15-20 majusculos allio-tomentosos setosos gerentibus, umbilico angusto iimnerso, seminibus subregularibus marginatis. (Plate XX. fig. 1.)

About Albuquerque, where Dr. Wislizeuus had already collected it in 1846 ; apparently extending into [53] Mexico, as Dr. Gregg collected what seems to be the same species about San Luis Potosi. Shrub 3-5 feet high ; lower part of stem 1-1& inch thick, covered with scaly, light-yellowish-brown bark; older branches smooth terete, younger ones 3-4 lines in diameter, strongly tuberculated; tubercles 6-9 lines long. Leaves slender, about 3 lines long, and apparently somewhat persistent, as they are sometimes found adhering, though withered, even to fruit-bearing branches, which, of course, are over a year old; the same, though to a less extent, is sometimes seen in *0. fruU$cent.* Pulvilli unusually large ; bristles in the young ones forming a small but distinct bunch at the upper edge of the areola, but disappearing on the older joints, — contrary to the usual occurrence, when the bristles become stouter and more numerous in older joints. Spines 1-2J inches long, dark, with very loose aud glistening sheaths; second or smaller spine sometimes lateral, but usually above the principal one, not below it, as in most others. Flower unknown. Fruit ovate, 8 or 9 lines long; the pulvilli often bear 2-5 obtuse bodies, almost hidden in the tomentum, apparently glandular, but of a fibrous structure. Seeds 12-15 in each fruit, about 2 lines or a little more in diameter; commissure broad, prominent, forming a distinct, somewhat spongy rim. (See Plate XX. fig. 1, and Plate XXIV. figs. 1JM5.)

In Dr. Wislizenus's Report the long-spined form of 0. *frttiacens* was confounded with this species. It is possible, however, that *0. mginata,* as described here, may be a stouter, tuberculated form of *0. fruUscem,* with lighter-colored, tuberculated fruit and larger seed.

27. 0. FRUTBSCENS, Engelm. This well-known species was observed from Laguna Colorado, 60 miles east of the Pecos, to Willinms's River, a branch of the great Colorado, always with the same characters. The bark is scaly, almost papery, with a nilvery reflection; the wood shows the medullary rays very distinctly, especially 5 of them ; much less the annual layers. Fruit deep scarlet, smooth, small, sometimes almost obliterated pulvilli, 5-9 lines long. Seeds 5-10, about 1} lines in diameter, with a narrow and often acute margin. The forms collected on the expedition belong to var. a. *longlupina;* the var. 0. *brtvUpina* has been observed only in Texas and northeastern Mexico. (See Plate XX. figs. 2-5, and Plate XXIV. figs. 16-19.)

EXPLANATIONS OF THE PLATES OF CACTACEJE.

Plate I. EcHncocACTUS WHIPPLII, E. * B.: fig. 1, whole plant; fig. 2, bunch of spines of the usual fixė; [54] fig. 3, some, uncommonly large and broad 5 fig. 4, same, lateral view; fig. 5, same, very young; fig. 6, seed, -a natural •ice, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the tuberculated appearance.

Plate II. figs. 1-2. ECHINOCACTUS POLTANCISTRUS, E. A B.: 1, upper part of a rib, with older and younger bunches of •Pinei, the youngest one with a flower-bud in the axil; 2, one of the largest and most fully developed bunches of spines.

Figa. W. ECHIKOCACTUI LICONTEI, E.: 8, I«rt of a rib, with 2 bunches of spines; 4, a single bunch of spinet from another specimen ; 5, seed, — *a* natural size, *b* magnified 8 diameters, *c* part of the surface still more magnified to exhibit the oval pita.

PlatelH. figs. 1-2. EcHi*0CACTU8Wi8Ll«wi,E.: 1, side view ofa bunch of spines; 2, seed, —a natural size, (magnified S diameters, *e* part of the surface still more magnified to exhibit the reticulation. This specie., collected by Captain Whipple 011 the Gilo, and common about El Paso, on the Bio Grande, has been introduced here to show those chancteriaties which distinguish it from the nearly allied *B. U&mUi* on the foregoing plate.

Fig. 8. EcHiNOCAortra EMORTI, E.: two bunches of spines on part of a rib.

Figs. 4-6. EcHiNOCACTtrs POLYCEFHALITS, E. *k* B.: 4, part of a rib, with 8 bunches of abort, stout, and strtightish •Pint*; ft, a young bunch of spines of unusual dimensions and much curved, with a woolly fruit in the axil; 6, seed, — a natural •*», *b* magnified 8 diameters, *c* part of the surface more magnified to show the warty appearance, *d* tred after the removal of the outer integument, embryo, together with a considerable quantity of albumen in the endopleura, « embryo curved with bent cotyledons.

Plato IV. figs. 1-8. CERIU8 PHdNicEua, E.: 1, upper paij of a head bearing a flower; 2, a btneh of spines of the usual tin; 8, part of a rib, with 8 bunches of spines from an uncommonly large form.

Figs,4-fi. Cusut rwnnesus, rabtp. OOKOIDIUS, E. AB.: 4, upper port of ahead; 5, port of a rib, with 2 bunches of spines.

Figs. 6-7. CEREUS TRIOLOCHIDIATUS, E.: 6, upper part of a large head, with a flower; 7, part of a rib of another specimen, with smaller curved spines.

Fig. 8. CEREUS MOJAVENSIS, E. *k* B.: part of a rib, with 3 bunches of spines.

Fig. 9. CEREUS MOJAVENSIS, E. *k* R, var. ZUNIENSIS : part of a rib, with 2 bunches of spines.

Plate V. fig. 1. CEREUS HEUDRUS, E. *k* B.: upper part of a head.

Figs. 2-3. CEREUS GUN ACANTHUS, E. 4 B.: 2, part of a rib, with 2 bunches of spines; 3, another fascicle of spines,—the 3 bunches of spines show all a different proportion of the central and the upper radial spines.

Figs. 4-7. CEREUS ENGKLMANNI, var. VARIEGATUS, E. *k* B.: 4 and 5, 2 bunches of spines, showing a different arrangement of central spines ; 6, fruit; 7, seed, —*a* natural size, *b* magnified 8 diameters, c part of the surface still more magnified to show the irregular tiiberculation.

Figs. 8-10. CEREUS ENOELMANNI, var. CHRYSOCENTRUS, E. &B.: 8, part of 2 ribs, with numerous spines; 9, a single bunch of spines ; 10, fruit, sterile and perhaps not fully developed.

Plate VI. figs. 1-3. OPUNTIA CHLOROTICA, E. *k* B.: 1, joint with a flower, — the flower to be reconstructed from a withered specimen collected in January ; 2, sterile and probably undeveloped fruit; 3, fragment of the bark of the lower [55] part of the plant, with several large bunches of spines.

Figs. 4-5. OPUNTIA PROCUMBENS, E. 4 B.: 4, part of a joint; 5, larger bunch of spines from another specimen.

Plate VII. figs. 1-2. OPUNTIA OCCIDENT A US, E. & B.: 1, joint of the usual shape and size; 2, fruit

Figs. 3-4. OPUNTIA ANGUSTATA, E. *k* B.: 3, a large and less spinous joint, with a sterile degenerate spinous fruit; 4, *A* smaller, more spinous joint, with a full-grown ripe fruit.

Plate VIII. fig. 1. OPUNTIA ENOELMANNI, var. CYCLODES, L k B . : with ripe fruit

Figs. 2-3. OPUNTIA TORTISPINA, E. *k* B.: 2, fragment of a joint with fewer spines and ripe fruit; 8, part of a more •piny joint.

Plate IX. figs. 1-5. OPUNTIA OAMANCHICA, E. & B.: 1, a joint with shorter and lighter-colored spines; 2, a joint with larger and darker spines; 3, fragment of a joint with more numerous and crowded spines; 4 and 5, ripe fruit of the smaller and largest size.

Figs. 6-8. OPUNTIA MOJAVENSIS, E. 4 B.: 6, a younger bunch of spines; 7, another from the oldest part of the plant; 8, a sterile and degenerate fruit.

Plate X. figs. 1-2. OPUNTIA YULOARIS. Mill.: 1, a young joint with leaves, —the older one has a tingle qfoe %nd bears a flower-bod; 2, a single leaf magnified 4 diameters. The figures of this species have been introduced to exhibit the diagnostic characters and its difference from the next species.

Figs. 3-5. OPUNTIA RAFINESQUII, E.: 3, an older joint with a flower and a bud, and a younger half-grown joint with leaves, — this represents the spinous form common in Illinois, Missouri, and Arkansas; 4, an older joint of the variety with few spines, bearing numerous fruits of different shapes, as they often occur in the same plant*; 5, two leaves of different sizes magnified 4 diameters.

Plate XL fig. 1. OruxnA zUriNBSQUii, var. MINOR, E.: the larger joint spineless, the upper one spiny on the margin.

Figs. 2-3. OPUNTIA RAFINESQUII, var. ORAXDI FLORA, E.: 2, a joint with flower; 3, fruit

Fig. 4. OPUNTIA PUSCOATRA, E.: a joint with a young fruit just after flowering; fragment of an older, very bristly joint visible.

Plate XII. figs. 1-3. Onnrm OYMOCHILA, E. 4 B.: 1, a joint; 9, a single bunch of spines; S, ripe fruit

Figs. 4-4. OPUNTIA STENOCBILA, E . 4 R : 4, a joint; 6 and 6, a smaller and Urge fruit

Figs. 7-8. OPUNTIA FUSIFORMIS, L"t B . : 7, a joint; 8, a fruit

Fig. 9. OPUNTIA BRACATARTHRA, E". C B . : I whole plant, with 2 withered flowers,

Piste XIII. figs. 1-5. OPUNTIA BASILARIS, L A B . : 1, a joint somewhat shrivelled as it appears in winter, a late young joint near its bam appears more plump and fresh ; 2, flower; S, style; 4, undeveloped startle fruit; 5, a whole plant reduced in size to show the singular manner of growth.

Figs. 0-7. OPUNTIA SPHJIROCARPA, E. 4 R: joint and fruit

Figs. 8-11. OPUNTIA BRINACBA, E. 4 a: 8, joint of the usual shape (only pertly finished); 9 and 10, bunches of spines; 11, fruit.

Plate XIV. figs. 1-! OPUNTIA MIMOCEIF.XSIS, var. RtmspnrA, E. 4 B.: 1, a joint (only partly completed); * a very full bunch of spines ; 3, fruit

Fig. 4. OPVNTIA MISSOCRIENSIR, var. PLATTCARPA, E.: fruit

Figs. 5-7. OPUNTIA MISSOURUNSIS, vsr. MICRO* PIE MA, E.: 5, joint (unfinished) with flower; 6, bonch of spines; 7, fruit

Figs. 8-10. OruffTU Miesopftinisis, var ALBJSTINA, B. 4 B.: «, Joint (anfinisbed); 9, bnaoh of spines; 10, fruit

Plate XV. figs. 1-4. OPUNTIA MISSOURIENSIS, W. TRICHOPHORA, E. & B.: 1, part of an old stem showing the thickness and hairy spines, upper younger joints (unfinished); 2, bunch of spines from a younger joint; 8, same from an older part of the plant; 4, fruit. [56]

Figs. 6-7. OPUNTIA HYSTRICINA, E. & B.: 5, a joint (unfinished); 6, a large bunch of spines; 7, fruit.

Plate XVI. OPUNTIA DAVISII, E. & B.: 1, a branch showing the structure of the older parts, an older and young joints with two fruits; 2, a tubercle with its bunch of spines, the membranaceous sheaths partly torn, showing the spine itself; 8, a degenerate sterile spiny fruit in its transition to a branch, as it is ofteu seen in this species and others, especially cylindric opuntia; 4, the whole plant reduced.

Plate XVII. figs. 1-4. OPUNTIA WHIPPLEI, E. & B.: 1, a branch of the more common form of the plant covered with ripe fruit,-at *(a)* the fruit is undeveloped, probably not different from the ovary of the flower, only more shrivelled; 2, branch of a larger specimen, spines more numerous, fruit larger;.8, a single bunch of spines of thin specimen; 4, whole plant reduced.

Figs. 6-6. OPUNTIA ARBORESCENS, E.: 6, a stout branch, with numerous spines and large fruit; 6, a bunch of spines of same.

Plate XVIII. figs. 1-3. OPUNTIA ACANTHOCARPA, E. & B.: 1, an older branch with fruit; 2, a young branch; 3, whole plant reduced.

Fig. 4. OPUNTIA ABBOBISCEKS, E.: whole plant reduced.

Figs. 6-10. OPUNTIA KCHINOCABPA, E. * B.: 6. a branch of th. plant den«Jy covered with the .heathed .pine.; 6, 7, and 8, bunches of .pines; 0, fruit, dde view; 10, same, top view.

Plat. XIX. OPUNTIA B.OBLOV.I, E.: 1. a single joint; 2 .nd * tubercle* *fd. bunche. of .pine.; 4 young undeveloped fruit; 6, an apparently full-grown fruit, sterile, and perhaps degenerrfing into a bmnchj; ^jpart of the ligneous skeleton, fomnng a wide tabe, and showing in th. reticulated structure th. trwe. of the tubercle, and branche.; 7, an entire plant reduced, - on the left of the main .tern is a younger shoot, with vigorous erect joints.

Plate XX. Opuntia vaginata, E.: 1, an older joint, bearing two fruits, and a young vigorous shoot.

Figs. 2-3. Opuntia frutescens, E., var. longispina: from Williams's River of the Colorado; 2, a branch with fruit; 3, the sections show the structure of the dense wood.

var. brevispina: 4, a branch with fruits, most of them sterile, one producing yonng branches from it. upper areola; 5, a flower.

Plate XXI OPUKTIA TBSILLATA, E.: 1. • branch with fruit *a a,* and a withered flower » / 2 and 8, flower, a. they ^ J ^ ^ J ^ t ™ « £ £ * ^ ™ > ; *. a »all joint n^iflrfw a. to .how dUtinctly the appearance of the tuberde. « d ^ U ,5 tJrt of the .tern with a aection of the wood above and a fracture below, *m* a. plainly to .how the Z ™ £ ^ - 7 ESof £ yTnger br»ches exhibit. ?e tested(surface, while in the older trunk it i. let in th. irregular Kale.; 6, llgneou. Aeleton of a young branch; 7, a whole plant reduced.

Plate XXII. fig*. 1-&. OPUNTIA CLATATA, E.: 1. joint with a ripe fruit; 2, one of the upper bunch., of .pine.; 3, part of the cen

Fig *. i******™-, >. » ⊥ * - ^ -de^; •, another font view; 7, part of the central spine magnified 4 diameter*.

The remaining figure. of thi. and all the two following tfate. reprint «ed« and their detail, of almost all the *OpunNm* descri Wr*l7*t.* ™*JT Vh,* TienreMiiU a dd. riew of the »eed, natural die; *b,* Nme, 4 time, magnified, a. an all the follow£ L ^ T S ⁻ e w T «t.rioi new;* * vertical -ction of «ed, exhibiting the portion and proportion of the embryo an embryo. The oUierletteri *,<,*, etc., will b. expired wherever they occur.

Figs. 8-9. Seeds of O. Engelmanni, var. cycloides. [57]

Fig. 10. Seed of O. occidentalis: one of the embryos, g, shows the cotyledons in an oblique, almost incumbent podaon.

Fig. 11. Seed of 0. AHOUITATA.

FJgHS-18. 8W. of 0. CAMAHCHICA, of different sue. and atop*.

Plato XXIII fin. 1-6 Seed, of 0. TOBTIWIKA : 1-8, teed, of different dm and stupe, j 4, two embryo, in one md; Hk diff.r«tv^'X^nbryc.tc^erMth.yUyi^he^ iinUnorjay^andJexUrior-ndle^bryo; », g-mination of a double embryo, - two young plant, from one Ned, the larger one stall bearing the .hell of th« seed.

5g*Mr8e1a.°c^Tm«im...d^ofit-v^and^^ede.: 7, usual **form from Missouri (see Plate X.** fig. 8X *Ti k* gemination m dlffewnt rtage. of development, I Nedhng with three cotyledon*

Fig. 8. Small seed from the fruit (specimen U t e X n g 4•) •

Fig. 9. O. stenochila.

Figs. 10-12. O. cymochila: It .ill, **different forms of the usual variety; 12, seed of the variety montana.**

Fig. 18. Setd of 0. TVLOABIS.

Fig. 14. Seeds of 0. BASILARIS : an irregalar and a very regular one from the same fruit

Fig. 15. Seed of 0. HYSTRICINA.

Figs. 16-19. Seeds of different forms of 0. MISSOUKIENSIS ; 16, Tar. BUNSPINA ; 17, Tar. PLATTCABPA, *h* seedling of. same; 18, Tar. ALBISPINA ; 19, Tar. TRICOPHORA.

Plate XXIV. figs. 1-2. O. MISSOURIENSIS : 1, Tar. with smaller fruit and seeds from the upper Missouri; f, Tar. MICROSPERMA. (See Plate XIV. figs. 5-7.)

Fig. 3. Seed of 0. SPHJBROCARPA.

Fig. 4. Seed of O. ERINACEA : the embryo *g* shows considerable obliquity of the cotyledons.

Fig. 5. Seed of 0. FRAOILIS : from the Yellowstone River.

Fig. 6. Seed of 0. CLATATA : the embryo *g* oblique.

Fig. 7. Seed of 0. PARRY I: embryo *g* nearly accumbent

Fig. 8. Seed of 0. ECHINOCARPA : one of the seeds quite regular, (he other irregular; embryo *g g* always regularly accumbent; *h* and *i* seedlings with the very narrow and thick cotyledons crossing each other, one of them bearing the shell of the seed.

Figs. 9-10. Seeds of 0. WHIPPLEI : 9, seed of the plant represented in Plate XVII. fig. 2, seed larger, commissure perfectly linear, cotyledons oblique ; 10, seeds of the other specimen, Plate XXII. fig. 1, seeds smaller, of different shapes, commissure a little wider, cotyledons oblique, in i somewhat separated, in *k* three cotyledons, of which *I* is a transverse section* A seedling with very narrow and long cotyledons.

Fig. 11. Seeds of O. ACANTHOCARPA, of different shapes, all from one fruit.

Fig. 12. Seeds of O. ARBOREBCENS, of different shapes, belonging to the plant figured Plate XVII. fig. 5, smaller than those sent by other collectors, embryo *g* regularly incumbent

Figs. 13-15. Seeds of 0. TAOINATA : 13, 14, seeds of different sizes, from the plant Plate XX. fig. 1, — the smaller one if empty, and perhaps not fully formed; 15, seed of the same species, collected in Mexico by Dr. Gregg. Cotyledons regularly incumbent.

Figs. 16-19. Seeds of 0. FRUTEBCENS : 16, Tar. LONOISPINA, from the Llano Estacado (Plata XX. fig. S); 17, tame from Mexico, Dr. Gregg; 18, same from Williams'* Hirer, branch of the great Colorado; 19, Tar. BRITISPINA, from Texas, Iindbeimer. In all these the cotyledons of the embryo are regularly incumbent

Fig. 20. Seeds of 0. TESSELATA : embryo oblique or almost accumbent

All the figures are of natural size unless the contrary is expressly stated. They were drawn with the greatest accuracy, partly from living and in part from dried specimens, by Mr. Paulus Roetter, of St Louis, under the personal [58] superintendence of Dr. Engelmann. The drawings made on the spot by Mr. H. B. Mollhausen, the artist of the expedition, greatly aided the work, and were made use of, and even partly copied, especially in the plates exhibiting the Cylindrie OpuntiA.

VIII. — CACTACE2E OF THE B0UNDAKY.

FIOM REPORT OF THE UNITED STATES AND MEXICAN BOUKDAIT 8umriT, UNDER THE ORDIR or LIEUT.-COL. W. H. EMOIT, MAJOI FIBJT CATALBT, AND UNITED STATES COMMISSIONER. II. PART L pp. 1-78. Washington, 1859.

I. MAMILLARIA, HAW.[1]

Subgen. 1. ECMAJULLAJUA.

Plant, simplic*. atu caapitoto, tubercular, aculeigero. [3]

Tobeitok plot minus tmtia tea angulaU, nunquam sulcaU.

ANOISI floriJm axilUm, ab areolit aculeiferis penittu distinct*, noda ten Tillota, none tetom

Flora « axillia tubroulorom anni priori* antocedentiumva orti, pknunqn* panri iooonspicui.

Ormnum pknunquo ImaMnam: baeca TOIUS matnritatem tolom (anno tccando in plorimk) emcrgeM, toe «mp«r diTaU, oocdnf*.

[1] I leave the character of the genus, as heretofore, generally circumscribed. Lemaire's genus *Anhalonium*, however, — a species of which is found in our E[illegible]tory, cannot be separated from *Mamil.*[illegible] as ****tht ***** character is founded on the orgmt of taetMntta. and not on the external shape [illegible] e expression "Inflorescentia verticalis," which I *urn* [illegible] relation to tht nhgenera *Coryphantha* and *AnXaUniym* tad to tht genus *Echinocactus*, although in common use, is not strictly «rrect. Thf flowers appear on the vertex of the plant, indeed, but not on the prolongation of the main axis. TVytr^a. In all Cactacem, properl- 'ateral, but produced by tlit Totag growtli of tb* mme yL, while in all other Cactaa- tbly *Iff** fro- *. gmwtbof tho preceding or former y [illegible] nsequently make tktb appearance more or *Urn* oa tbt Alt of tba plant, or, If on tht top, only *m* older branches or joints.

Semina minute, plermnqne rugulosa sea scrobiculata, larissime verruculosa, viz laevia, fulva, fusca, seu nigra.

Most *MamiUaria* heretofore known and cultivated belong to this subgenus, which is well characterized by the lateral position of the flowers.

1. M. MICROMERIS, sp. nov.: parvula, simplex, globosa, vertice depresso; tuberculis minimis verrucaeformibus confertissimis; areolis solum junioribus lana laxa longa vestitis; aculeis plurimis pluriserialibus ininutis ex albido cinereis, in plantis junioribus et in tuberculis inferioribus plantarum adultarum sub-20 eequalibus lineaui longis radiantibus, in tuberculis floriferis (verticem plant® adults versus) 30-40 stellato-porrectis, superioribus 6-8 cseteros bis terve superantibus versus apicem clavatis acutis, parte superiore denium deciduo; floribus minimis subcentralibus; sepalis petalisque 5; stigmatibus 3 stamina cequantibus ; bacca elongate clavata coccinea floris rudimehta dejiciente; seminibus paucis oblique obovatis basi acutis nigris lucidis sub lente levissime verruculosis, hilo elongato ventrali." (Tab. I. and II. fig. 1-4.)

Var. *p.* QREOGII : major, tuberculis globoso-ovatis paullo mnjoribus; aculeis rigidis 2*3 seriatis, interioribus [4] 5-7 brevioribus robustioribus, exterioribus 15-18 paullo longioribua, omnibus radiantibus; seminibus paullo minoribua leviter verrucosis. (Plate II. figs. 5-8.)

From £1 Paso to the San Pedro River; also in a single locab'ty east of this river; in naked places on mountain tops or sides, only on limestone, never in the porphyritic region: C. Wright. Var *fi.* was collected by the late Dr. J. Gregg on a mountain ridge between Azufrora and Penos Bravos, near Saltillo, Mexico. — Small globose plants, depressed at top, simple, or very rarely (and probably only after an injury to the top of the main plant) branching. Heads usually i to 1 inch in diameter ; in largest specimens seen 15-18 lines in diameter. Plants densely covered by the delicate ashy-gray spines. Tubercles about £ line long, only 1-1± lines distant from one another, older ones shedding the spines, and giving the base of the plant a very pretty tuberculated appearance ; in the larger plants 21 or 34 spiral rows of the tubercles are the most distinct. Spines not pungent in several series, usually about 1 line long ; on the younger tubercles of the fully-developed plant (those, I suppose, which may bear flowers in their axils) the 6-8 upper exterior spines are 2-3 or sometimes even 4 times as long as the other spines (2-4 lines long), thickened or clavate toward the end, with an acute point These spines are the first to appear in the nascent tubercle (as indeed is the case in all *MamiUarim* where the uppermost radial spines are always developed before the others), mixed with loose wool of almost the same length. These elongated superior spines form a small tuft in the vertex of the plant, which includes and partly hides the flowers and fruit When they get older, apparently after the second or third year, the upper part of these long spines breaks off, leaving them of the same length as the others but always distinguishable by their ragged end. These peculiar spines, of which I have not seen any analogy in other species, are wanting in younger plants.

The position of the flowers in this plant is rather a doubtful one. I have not seen living specimens in flower; but the structure of the tuft, the position of the berries in the dead specimens before me, and the note of Mr. Wright, "flower* central,[1]" would seem to indicate that they really appear in the new growth of the same season. In that case this species would be an anomalous small-flowered and small-tubercled *CoryphantKa.* But I am yet inclined to consider the flowers as only *nearly central,* and borne in the axils of the last tubercles of the preceding season ; all the analogies, at least, are in favor of our plant being a true *Mamillaria.* Flowers reduced to the simplest type of *Cactacem,* namely, — 3-5 sepals, about 5 petals, two or three times as many stamens, and a style with 3 stigmata; diameter of flower about 3 lines; petals whitish or very light pink. Fruit an elongated clavate red and somewhat juicy berry, V6 lines in length, without the remains of the flower on top, somewhat persistent on the plant, finally shrivelling up; obovate, grey, and hid in the tuft: so it is found in the specimens brought home. Seeds only C-12 in

• I look at the seed always in such a position that the ndide of the embryo points downward and the cotyledons upward, or, when curved, upward and forward to the left All the seeds figured in this Report are represented in this position, unless otherwise stated. We have then one *tide* or *face* (produced by the always more or less distinct compression of the seed) toward the beholder, the *bam* below, and the *ventral* pert or edge of the seed to the left, and the *darmU* pert to the right

The hilnm is large or small, circular, oblong, oval or elongated, mostly more or lest basal, but not rarely subventral or ventral It Is usually surrounded by a tumid rim, formed by the thickened testa, smoother than the other pirts of the •ted. The albumen, when present, or the trace of it, - which Is indicated by a ncrer-wanting thickening of the en» dopleon, — Is alwiys found on the ventral part of the seed. The back or dorsal part of the seed is often more cr lets carinate, especially toward the bane. The testa of the seed is pergamentaceous, yellowish or brownish or black; or it is hard, crustaceous, and then always black ; or it is whitibh, and thick and bony (only in *Opuntia).* The surface of the seed is smooth, ofteu shining; or it is rugose, or pitted, or covered with very minute or larger warts or tubercles. These tubercles are distinct, or more or less concatenate or coufluent, leaving irregular pits in their interstices. Smooth or pitted seeds I find in most *Hamilton** and *Eckinocadi;* irregularly rugose ones in some *EcKinocadi* and *Oerei;* tuberculated seeds ouly in *Aiihalonium,* the single *Echinocndus ictispinus,* and all *Eehinoeeni;* while the species of the other sections of *Certus* known in our Flora generally have smooth seeds. Of the quite peculiar, Urge, flat, and bony seeds of *Opufdia,* I shall find occasion to speak hereafter.

each fruit, comparatively large, 0.7 line long, 0.5 in diameter, with a very large umbilicus; testa hard and brittle, though thin.

Var. *Greggii* is larger and coarser in all its parts. The specimens before me are 1-2 inches in diameter; tubercles 1-1£ line long; exterior spines 1J-2 lines, interior stouter ones £-1 line long. The 6-9 upper elongated spines on the younger tubercles ore 3-4 lines long, thicker at base, very slender in the middle, and thickened [5] again toward the very acute point. Fruit about 9 lines long. Seed smaller than in the more northern form, 0.6 line in length, and more distinctly tuberculated.

Mamillaria microthele$_y$ Muhlenpf., seems to be closely allied to our plant, but is distinguished (to judge from the descriptions) by its cespitose growth, and its distinct 1 or 2 central spines. No allusion is made in the descriptions to the remarkable vertical tuft, though the small pale rose-colored flowers are mentioned. The name, *M. micromeris,* refers to the siuallness of all the parts of this species.

2. M. LASIACANTHA, sp. nov. : parvula, simplex, globosa seu ovato-globosa ; tuberculis cylindricis hete viridibus; axillis nudis ; areolis junioribus albido-lunatis ; aculeU 40-80 pluriseriutis omnibus radiantibus maxime in&qualibus brevibus setiformibus olbis rectis seu paullo recur vat is ciliato-pilosulis vel denudatis ; fluribus lateralibus parvis; sepalis 13 obtusis, exterioribus niucronatis; petal is 13 fere uniseriatis oblongis obtusis emarginatisve; stylo stamina brevia longe superante; stigmatibus 4-5 ovatis brevibus ereçtis convergentibus ; Wca elongata clavata coccinea; seminibus numerosis obovato-subglobosis scrobiculatis nigricantibus, hilo basilari ovali.

Var. a. MINOR : caule minore ovato; aculeis puueiuribus brevioribus dense pilrsulis. (Tab. III.)

Var. 0. DENUDATA : caule majore globoso; aculeis plurimis longioribus subnudis. (Tab. IV.)

About Leon Spring and Camanche Spring, west of the Pecos, on low limestone hills, among herbage; C. Wright Flowers April and May. — A pretty little species, covered with and almost entirely hidden under the innumerable soft, more or less pubescent spines. The smaller form is 9-12 lines high and 6-9 lines in diameter; tubercles in 8 or 13 spiral rows, 2 lines long and nearly 1 line in diameter; areolae l£ line distant from one another; spines 40-60, 1J-2 lines long, the upper exterior ones a little longer than the rest, the innermost ones often not half as long as the others. The larger form, var. 0., is 1-1} inch high, and of almost the same diameter; tubercles 2J-3 lines long, in I3or21 spiral rows; spines 50-80, almost or the old ones entirely naked, 1J-2J lines long, the innermost usually much shorter. The flower is half an inch long, and when fully open of the same diameter; petals white, with a red ftreak in the centre, which at base forms a red circle around the yellow stamens; style yellowish, with 4 or 5 yellowish-green stigmata, which form together a short globose head. Fresh fruit 6-10 lines long, without the remains of the flower, somewhat persistent and finally shrivelled up, greyish, obovate-clavate, deeply imbedded and hid between the tubercles. Seeds 10-25 in each fruit, smaller than in the last secies, and altogether different in *hape and surface, •boat 0.5 line long, very conspicuously pitted, hard and brittle. I have named this species *M. Uuiucantha,* from the usually very soft pubescence of the spine*. It is evidently closely allied to *M. Schudeana,* Ehrenb.; but this ia a much larger plant, with larger tubercles, very woolly axils, and its spinet forming a silky brush. Both this and the last specie* belong to Prince Salm's § 3, *Polyacantka • • aeuUis faUtUMmu adpnms.* The ponition of the flower, however, seems to indicate that they are widely separated from each other, though the external appearance of the plants is very much alike.

3. M. FUSILLA, DC., var. TIXAVA : ovato-globosa, prolifera, cntpitom; tuberculin teretibus versus apicem conicia, axilla longe-lanatis setoeisque ; aculeis pluriseriatia, extimis numerosiasirai* (30-50) capillaceis elongatis flexuosis vel crispatis albU, interioribus 10-12 sensim rigidioribu* brevioribus rectiuscolis puberulis albidis, [6] intimis 5-8 longioribus rigid is rectis pubescentibun basi bulhosia infra nlhidis sunum rufis fuscisve inaqualibus ; florum lateralium ovario subemerso ; sepalis 9-12 ohiongo-linearibus obtusiusculis ten niter tiinbriati»; petal is 13-10 fere aniseriatis oblongo-linearibus obtusis vel emarginatis sape mncronatis ; stigraatibus 5 flavid*s longe supra stamina exsertis; bacca elongata clavata s. sub-cylindrica coccinea floris rudimentis involutis coronata; teininibus plurinii* obovatis scrobiculatis nigris lucidis, hilo basilari lineari. (Tab. V.)

From Eagle Pass to Santa Rosa, Dr. Bigelow; and, according to Dr. Poeclger, common on the Rio Grande below. Flowers March to May. — Heads 1-1 \ inch in diameter, 1-2} inches high, usually covered below with young branches, and finally densely cespitose; tubercle* 3J-4.J lines long, dark-green; axilto quite woolly, with several coarse twisted bristles mixed with the wool. Exterior hnir-like spine* covering the whole plant as with a coarse wool, often 6-8 lines long when straightened ; interior spines slender, but stiff and pointed, 3-4 lines long, in young or weakly specimens whitish, with dark tip*, in robust ones yellow at base, brown upwards, and almost black at tip. Flowers 7-10 lines long; petals dirty yellowish-white, with a r&ldish streak in the middle. Fruit A I •out 0 Hues long. Seeds 0.6 line long, bard and brittle, *rerj* similar to the seed of the last-mentioned species, only a little larger and with narrow hilum.

M. jnortfa, from the West Indie*, is so near our plant that this one must necessarily he referred to it The only difference teem to consist in the smaller number of radial spinet (iS-20) in *M. pmiUa,* and in the grtyitb-green color of its tubercle*.

4. M. PHELLOSPERMA *(M. Utraneutra,* E. partim in Sillim. Journ. Nov. 1852) : ovata sea ovato-cylindrica, simplex sea rarius e basi ramosa; tuberculis ovato-cylindricis; axillis lanatis setigeris demum nudis; aculeis radialibus numerosissimis (40-60) biseriatis, exterioribus tenuioribus brevioribus albis, interioribus robustioribus longioribua apice fuscatis, centralibus 3-4 robustioribus longioribus ex basi pailidiore atrofuscis, superioribus 2-3 rectis seu UDQ alterove hamatis, inferiore validiote sursuin hamato ; floribus versus plant© apicem lateralibus; sepalis 16-17, exterioribus ovatis obtusiusculis ciliatis, interioribus oblongo-linearibus; petalis sub-12 acuininato-aristatis ; stigmatibus 5; bacca obovato-clavata late umbilicata corollum marcescentem dejiciente tenui coccinea vix pulposa; seminibus magnis globosis rugosis, ad hilum inassa suberosa semine ipso majore triloba fusca arilliformi auctis. (Tab. VII.)

Dry gravelly bills about the base of the mountains east of the Californian Cordilleras, near Son Felipe, Dr. Parry; also on the lower Gila, Dr. l# Conte, A. Schott; on the lower Colorado, the Mojave, and east of the Colorado toward the Cactus Pass, Dr. Bigelow. — This interesting species was fint noticed by Dr. Parry, and was described from his notes in Silliman's Journal, L c, under the name of *M. tetrancistra.* Specimens brought home since by several collectors leave no doubt that this and several other species had been confounded ; and, moreover, that hardly ever all the four central spines are hooked. The original name had therefore to be altered; the one selected for it indicates the peculiar corky structure of the enlarged base of the seed.

Our species is often simple; not rarely several stems are seen coming from one base, or an older stem bears young branches at its lower part Young stems almost globose; older ones ovate, and even cylindric, 2 to 4 or 5 inches high, 1 *i* or 2 inches in diameter. Tubercles 4-7 lines long ; not so much crowded as in the allied species, in 8 or at most 13 spiral rows. The axils of the young tubercles produce loose wool, with a few long spiny bristles, which disappear only after several years. In the smallest specimen before me I find 14-18 exterior radial spines 4-6 lines long, and 12-16 interior ones 6-6 lines long; in other specimens I have counted from 60-60 radial spines. The upper [7] central spines in my specimens are mostly 6-7 lines long; sometimes I find 1 or 2 of them longer and hooked, and sometimes all 4 are said to be regularly hooked; the lower central spine is stouter and longer than the others, 6-0 lines long, with the sharp hook always turned upwards. Flower apparently about an inch long; fruit clavate or pear-shaped, 6-12 lines long and 4-6 lines in diameter, with a thin scarlet-colored integument, torulose from the pro-. trusion of the large seeds; the withered flower falling off leaves a wide circular umbilicus. Seeds large, visible through the thin pericarp, attached to conspicuous white funiculi; seed proper 0 6 or 0.7 line in diameter, with the appendage 1.2-1.6 line long; the curious spongy or corky appendage is larger than the seed itself, and buries its lower Part, as it were, in a bluntly 3-lobed cup. Embryo almost globose, 0.6 line long, 0.6 line in diameter; cotyledons onalli but perfectly distinct and visible; no albumen.

Apparently near *M. ancisttvides,* Lem., with 30-40 radial and 4-6 central spines; flower and fruit unknown. The radial spines are said to be homogeneous and the axils naked.

G. M. GRAHAMI, sp. nov.: globosa seu demum ovata, simplex seu e basi ramosa; tuberculis ovatis basi diktat'*; axillis nudis; areolis orbiculatis seu ovato-orbiculatis ; aculeis radialibus uniseriatis 16-30 albis seepe apice foacatis nudis seu puberulis, suminis brevioribus, lateralibus longioribus; aculeo centrali singulo robustiore longiore sursuin hamato, sape 2 rectis sursuin divergentibus adjectis, omnibus e basi pailidiore fusco-atris ; floribus sub vertice lateralibus rubicundis; sepalis sub-13 lineari-oblongis obtusiusculis ciliolatis; petalis sub-13 lineari-oblongis roseatis, exterioribus mucronatis, interioribus obtusis retusisve; stylo stamina brevia longe superante; stigmatibus 6-8 elongatis filiformibus smberectis; bacca ovata (viridi ?) floris rudimentis coronata; seminibus oblique obovatis scrobiculutis rigris. (Tab. VI. fig. 1-80

Mountainous regions from El Paso, Charles Wright; southward and westward to the Gila, Dr. Parry; and Colorado, A. Schott; and up this latter river as far as Williams'* River and Cactus Pass, Dr. Bigelow. Flowers from Jane or July to August. — Stems 1-3 inches high, 1-2} inches in diameter, simple or somewhat branching from the base, and thereby sometimes slightly cespitose. Tubercles 3 lines long, and when old of a corky texture ; persistent when dead and dry, like those of *M. tuberculou;* disposed in 13 or 21 spiral rows. Radial spines in some smaller specimens 26-30, in larger ones often only 20-26, and in some Sonora specimens only 16-18 in number; the lateral ones are the longest, about a-4 lines or in the largest specimens even 6-6 lines long; lower spines shorter, upper ones the shortest and most slender. In smaller specimens only 1 central spine is observed, generally much longer than the wdial spines, 3-8 lines long, with a wide or sometimes a narrower hook, always curved upward ; in many specimens one or two upper spines are found, neither so stout nor so long as the lower hooked one, and always straight. Flower 9-18 lines long, rose-colored. Fruit a small oval berry, about half an inch long, apparently green when ripe. Seeds among the smallest in this genus, only 0.4 or rarely 0.6 line long, slightly pitted, with a small and narrow hilum.

This pretty species has been named for Colonel J. D Graham, of the United States Corps of Topographical Engineers, under whose auspices many of these species were collected.

6. M. WRIOHTII, sjV nov.: globosa seu depresso-globosa, basi obconica, simplex; tuberculis teretibus; axillis

nndis; aculeis radialibus sub-12 albidis summis 3-5 paullo robustioribus apice funcatis, lateralibus sublongioribuft, inferioribus gracilioribus; aculeis centralibus plerumque binis divergentibus uncinatia fusco-atris radiales sub-SBquantibus ; floribus lateralibus (?); sepalis exterioribus 13 triungularibus obtusiusculis fimbriatis, interioribus 8 acutis margine petoloideis; petalis 12 lineari-lanceolatis acuminatia aristatis purpureis ; bacca inajuscula ovato- [8] globosa snccoaa purpurascente floris rudinientis coronata; seminibus obovatis Iwsi acutis nigris scrobiculatia, hilo subventrali parvo angusto. (Tab. VIII. fig. 1-8.)

New Mexico, near the Coppermines, Wright; near El Paso, Parry ; and on the upper Pecos, east of Santa Fe\ Bigelow. — Stems 1£-3 inches in diameter, hemispherical above, flattened or depressed in the centre, and top-shaped below; simple, as all the *Mamillarice* of that form usually are. Tubercles 5-6 lines long. Spines 4-6 lines in length, shorter in the southwestern, longer in the northeastern specimens; uppermost radial spine stouter than the others, with a brown tip, or smaller and slender, or entirely wanting; central spines usually 2 side'by side, diverging laterally or rarely one above the other, — sometimes only 1, or not seldom 3, the third one being below the two others; the hooks usually turned downward or in different directions. The flowers seem to be lateral, but very near the vertex ; the fruit is moved more outward by the continuous growth of the plant; flower about an inch .long and fully aa wide ; petals and margin of inner sepals bright purple. Berry large, nearly an inch long, puqriish. Seed similar to that of *M. Grahami,* but much larger, and the very small and narrow hilum ventral; length of seed 0.7 line.

This species I with pleasure dedicate to my friend Mr. Charles Wright, to whose indefatigable exertions botany owes so many new discoveries along the Mexican boundary line, and lately in more distant part* of the globe.

7. M. GOODRIDOII, Scheer: globosa seu ovata, subsimplex ; vert ice tomentoso; tuherculis ovatis abbreviatis; axillis junioribus lanatin setigeris demum nudutis; aculeis radialibus 11-15 (plerumque 12-13) albidis apice sphace-latis intertextis, centralibus 3-4 (in plantis junioribus Rubsingulin) fusco-atris, superioribus divergentibus rectis seu rarissime subunciuatis, inferiore paullo longiore rohuatiore sursuin haniato; florihu* in vertice laternlilms pan-is; petalis lanceolatis acuminatis sordhle flavidulis medio rubellw ; stigmatibui 3 virescentibus. (Tab. VIII. fig. 9-14.)

Dry ravines near San Diego, California, Dr. Parry ; originally brought to England from the Island of Cerro, on the California coast. — One of the specimens of Dr. Parry, from which the above description was drawn, is 2 inches high and 1} inch in diameter ; the other is globose and rather depressed. The tutarcles are 1J-2J lines long, and of a somewhat corky texture, like those of *M. Grahami,* so that the dead one* retain their shape and do not shrivel up. The axils produce a very dense wood, and in it 5-8 stiff bristles, which often reach the length of the tubercle. The radial spinea are 2J-3J lines long, the uppermost one present or wanting ; the upper central Hpinea, 2 or 3 in n timber, are straight, or rarely, in my specimen is with a tendency to form A hook ; the lower central spine is the lnnpfwt our, 4J-5 lines long, — the narrow or rarely wide hook is turned upward or sidewise. Flowers 6-9 lines long, 6 lines wide, dirty-yellowish ; the petals with red midribs.

8. 11 HBTDBRI, Muhlenpf. —of which my *M. applanata* (Tab. IX. fig. 4-14) and *M. Kemupharica* (Tab. IX. fig. 15-17), published ia [M] Plant* Lindheimeriana," are different forms — is common throughout the southern parts of New Mexico, and may even extend into Sonora, according to Mr. Schott's notes, unless what be has seen is a fonii of If. *gummifera* (Tab. IX. fig. 18-20), brought by Dr. Wislixenus from the mountains west of Chihuahua. The Sonora plant is stated to have 13 radial spines; the inferior ones are 6-8 lines and the superior ones 2-3 lines long; the stout central spine is of the length of the latter.

9. M. MHACA5THA, sp. nor.: simplex, beminphmca sen vertice depress*, bad obconica, lactiflua; tuber- [9] colis pyraniidato-quadrangulatis compressis bad productis axilla nndis; areolis junioribus alUdo-villoaia mox nndatis; aculeis paucit (5-9) rigidis rectis vel reenrratis albidis sen flavidis (demum ciuereis) apice sphacelntia, inferioribus paullo longioribns, centrali singulo robnsto breviore porrecto seu snrsum flexo et cum coteris radianto sen rains nnllo; floribus aordide albidis rabellisqne; ovario nudo; sepalis 12-14 lanceolatis; petalis 14-16 lineori-lanceolatis acutis subintegris ; stigmatibua 6-7 stamina brevia vix excedentibus flavidulis; bacca elongato-davaU incurva floris rudimenta dejiciente ; seminibns minuti* obovatis reguloais fulvis. (Tab. IX. fig. 1-3.)

Throughout Xew Mexico, from where it was firat brought home by the Missouri Volunteers in 1847 ; often col-lectod since by the different explorers of the botany of those regions. Flowers May and June. — Very nearly allied to the foregoing species ; distinguished by the fewer, more lowly arranged tubercle*, — which rise from a much broader base,—and by the fewer, shorter, and stouter spines. Plant* 3-5 inches in diameter, with a broad, top-ahaped base, terminating in the large fleahy root; tubercles 7-9 lines long, strongly quadrangular, somewhat compressed from above, arranged in 13 spiral rows. Spines, as indicated by the name, fewer than in the allied upti·it*, — 5-0, Usually about 6, lowest ones mostly a little longer than the lateral ones, 3-5 linos King, stout, and strong v nul»ulat<*, often curved in different directions ; upper spine wanting or often replaced bv the 8 ton tor and a little shorter central spine, which is then turned upward ; flpine* in robust specimens dirty-yellowi*h with bmwn (mint*, central one darker than the rest, —in young and weakly specimens they are whitish . Flower* 12-14 line* long, nomemhat tirrpoUte. Exterior petals longest, entire; interior ones a little shorter, entire or slightly denticulate; all whitiah, with a broad

colored line in the centre. The ovary does not exude the milky fluid which the tubercles and other parts of the plant contain. Fruit ripening the second spring and summer, till then hidden between the bases of the surrounding tubercles, and for the greater part buried in the tissue of the plant; in spring the young fruit suddenly (in one or two weeks) grows to its full size, 9-12 or even 15 lines long, protruding far above the tubercles, and forming an exterior scarlet circle around the inner circle of rose-colored flowers. Seeds 0.5 line long, subglobose-obovate, with a narrow sub-basilar hiluin, yellowish-brown, rugose, and somewhat pitted.

10. M. SPHJERICA, Dietrich : e radice crassa obovata seu clavata, proiifera et demum densissime ccespitosa; tuberculia ovato-elongatis versus apicem acutatum conicis, axilla lanatis ; areoli9 junioribus breviter tomentellis ; aculeis setaceis basi bulbosis rectis seu curvatis albidis, radialibus 12-14, centrali eingulo recto subulato subbreviore vix robustiore; flore subverticali magno flavo; tubo supra ovarium emersum constricto elongato; petalis sub-18 acuminatis aristatis integris ; stigmatibus 8 linearibus patulis.

Hillsides on the Rio Grande, near Eagle Pass; Schott Flowers from March throughout the season.—Dr. Poselger's specimens were collected at Corpus Christi, on the coast of Texas. Dietrich's description, taken from them, well agrees with Mr. Schott's plants and with specimens now frequently cultivated at St. Louis, from l>oth of which the above character is drawn. — This species is remarkable on account of its exsert ovary and large flower, by which characters it closely approaches to the next subgenus ; but the flowers, though apparently nearly vertical, come from last year's growth. Specimens before me are 2 inches high, 1} inch in diameter above, narrowed below, the old tubercles withering, aud leaving a short clavate scaly stem. The tubercles soon become proliferous, and the [10] branches increase and reproduce often in such a manner as to form large and dense hemispherical masses. Tubercles 6-8 lines long ; spines 3J-4J lines long. Flowers l£-2 inches in length, and fully an widely open in bright sunshine; tube slender, funnel-shaped, remarkably constricted above the oval ovary. Fruit not seen.

Subgen. 2. CORYPHANTHA.

Plant® simplices seu csspitoss, tuberculate, aculeigerae.

Tubercula plus minus teretia, florifera facie superiore longitudinaliter sulcata, in stirpibus junioribus nondum Jloribundis sulco breviori notata, vel penitus esulcata.

Areota florifene axillares seu iu tuberculo ipso supra-axillares, cum areolis aculeiferis sulco villoso plus minus profundo demum nudato subinde glandulifero juncto, tomentosao.

Flores ex areolis tuberculorum hornotinorum adultorum (inde laxi) seu vix evolutorum (inde congesti) oriundi, plerumque magni, speciosi.

Ovarium emersum: bacca plerumque anno primo, rarissime anno secundo, maturescens, ovata seu subglobosa, viridia seu raro coccinea, sapissime floris rudimentis coronaU.

Semina plerumque majuscula, fulva, fusca seu nigra, l©via sen scrobiculata, nunquam tuberculata.

This Bubgcuus, characterized mainly by the vertical position of the flowers, principally comprises species from the northern border of the Cactus region, most of them until lately unknown, or imperfectly known, to botanists. All the *MamiUaru** of the upper Missouri, and most of those from Texas and New Mexico, with which I had become acquainted, have grooved tubercles and showy vertical flowers, which fact I indicated as early as 1845 in the "Plant© Lindheinierianoe," and again in 1848 in Wislizenus's Report. Dr. Poselger, who in his travels in Texas and Mexico had the best opportunity of studying these plants, further verified this fact, and first noted that all the top-flowering *Mamiltarim* had grooved tubercles, at least in the fully developed parts of the plant; and he justly inferred that all *MamillaruB* with grooved tubercles (the section *Aulacothec*)* belong here. But he went further, and removed them from *Mamillarta* to *Echinocachu,* solely on account of the vertical flowers. Now some *Mamillarue* of this section (e. g. *M. robrutupina)* do approach *Echinocactui* in the shape of their embryo, as do others (e. g. *M. macronuru)* by having an occasional sepaloid scale on the ovary ; while some *Echinocacti* (e. g. *E. utispinus, E. hvrizonthalonius)* have a straight embryo with very short connate cotyledon*, and others have few and somewhat fugacious sepaloid scales on the ovary (e. g. *E. inttrUxtui, E. tetupinus).* Still, I think that a safe line of distinction can Ins drawn between them, and that *Coryphantha,* though forming a transition to *Echinocachu,* much rather belongs to *Mamillaria.* But it must be admitted that the characters distinguishing most genera of Cactacea are almost as difficult to define as those of the specie*

11. M. NUTTALLII, ft C«PTTOSA (AT. Wmtfo, E. in Plant Lindh. 1845), has been collected by Mr. Wright and ©then in the same part of Texas where Mr. Lindheimer had originally found it, — namely, from the Brazos to Austin and San Antonio. It has since also been brought from the Kansas River, but does not seem to extend into the mountains of western Texas. (Tab. LXXIV. tig. 7.)

12. M. 8CHURII, Muhlenpf. 0f VALIDA : magna, robnsta, ovato-globosa, simplex seu ad basin parce prolifera, glaucotaunt; tufamulia magnia rauotii patulif e basi laU subcjlindricus supra tulco profundo glanduU singuk

paucisve munito (juniore lanato) subbilobis; axillis latis, junioribus dense tomentoao-lanatis ; areolis orbico- [11]
latis villosissimis demuni nudatis ; aculeis 10-20 rectis seu subinde curvatis robustis rigidis basi bulbosis albidis
seu citrinis apice fuscatis, radialibus 9-16 (3-5 inferioribus lateralibusque aequilongis robustioribus compressis, 7-11 siiperioribus debilioribus teretioribus), centralibus 1-5 validis angulatis paulo longioribus pallidis citrinis sen rubicundis, singulo validissimo porrecto ; floribus in vertice tomentosiasimo laxis flavis; sepalis 16-22 lanceolatia, inferioribus ciliatis ; petalis 16-20 oblongo-lanceolatis versus apicem denticulatis niucronatis ; stigraatibus 6-10; bacca viridi.

Sandy ridges in the valley of the Rio Grande, from £1 Paso to the Cañon ; also at Eagle Spring and on prairies at the head of the Linipia : Charles Wright. Flowers in July. —A stately plant, by far the largest of the northern *Mamillari'w.* Largest specimens before me 7 inches high, 5 inches in diameter without the spines. Tuliercles loosely arranged, in the smaller specimens in 8, in the larger ones in 13 spiral rows, at base j-1 inch in diameter, suddenly contracted and almost cylindric, 1-1 £ inch long and 5-7 lines in diameter, spreading, ascending; tubercles on the lower part of plant shorter, more conic, and somewhat imbricated. Groove very deep, with 1-5 orbicular depressed or hemispherical warts or glands of nearly a line diameter. Central spines 10-18 lines long, mostly yellow ; lower radial about 9-15, upper 5-10 lines long, — when young mostly red at base, paler in the middle, and dark purplish-black at tip, sometimes yellowish ; when old, all the spines become ashy-gray with dark tip. Flowers 2 inches long, yellow ; ovary 5-6 lines long. Young and small specimens have smaller tubercles, and about 6-8 radial spines 6-9 lines long, with a single straight or recurve*I much stouter central one an inch long.

AT. *Schecrii,* from Chihuahua, is distinguished from our plant, according to Prince Saint's description, by the shorter and fewer (H-l 1) radial spines, and the single " much longer, 1 inch long," central spine. It is globose, 3-4 inches in diameter ; flowers of some size as ours, with apparently entire (?) sepals and red-streaked yellow petals. The areol® are described as naked, while in our plftnt we find the young ones very thickly covered with long wool, which disappears by age. Nevertheless, I consider ours only as a northern form of the Chihuahua species, with more numerous and stouter spines, which character very often distinguishes northern and southern varieties of one and the same species.

13. M. ROBCSTISPINA, A. Schott in litt.: robust*, simplex sen cmpitosn; tuberculin magnis patulis subteretibus sulcatis; areolis magnis orbiculatis, junioribus dense tomentosis; aculeis radialibus 12-15 robustis rigidis, inferioribus robustioribus ohscurioribus rectis seu dconuim cnrvatis, siiperioribus rectis fasciculatis paullo tenuioribus; aculeo centrali singulo valido compreaflo deorsum recurvato, subinde nltero miperiore rectiore odjecto, aculeis omnibus coraeis apiee atratis suhpoUicarihua ; floribus e basi tuberculorum juniomm villosissima campanulatis lute it; tubo supra ovarium ovatum constricto tenui, intus ad basin usque filamentoso ; sepalis lanceolatis, inferioribus ciliolatis; petalis numerals; ttigmatibu* 9-10 patulo-erecti*; bacca viridi; scminibus magnis oblique obovatis circa hilum parvum linear* centrale curvatis fusci* ; cotyledonibus dirtinctis foliact-is. (Tab. LXXIV. fig. 8.)

On grassy prairies on the south side of the Babuqnibäri mountains, in Sonora; A. Schott. Flowers July. — A large plant, cespit<*e, perhaps from the effects of prairie fires as Mr. Schott suggests. Tubercles nearly an inch long, and about an inch distant from one another ; areola 3f-4 lines in diameter. 8pines 9-15 lines long, lower ones stouter but a little shorter than the upper ones, dark on the upper and lighter colored on the lower surface; central spines 1 or sometimes 2, stouter but not much longer than the others ; base of lower or principal central [12] spine nearly 1 line wide. Flowers lf-2 inches long, well characterized by the slender tube, which is contracted above the ovary, and quite similar in that respect to the flower of *M. tphariea* (see above) ; petals " saffron-yellow ;• filaments from the base of the tube, leaving no naked space abore the ovary, as is the case in most species. Seeds 1.5-1.6 line long, and fully a line in diameter, the largest of any *MamiUaria* examined by me ; albumen more distinct than usual in this germs; embryo curved, with somewhat foliaceous accumbent cotyledons, resembling much more the embryo of some *Echinoeachu* than that of any *MamiUaria* known to me. The plant is evidently nearly allied to the foregoing, and also somewhat to the next specie*, but is distinguished by the very stout spines, and especially the slender and constricted tube of the flower. In *M. Scheerii* the filaments leave the lowest part of the tube free.

14. M. RECCRVISPI5A, sp. nov.: simplex, globosm stu depraso-giobos*; tuberculis ovatis obtusis profanta sulcatis confertis subimbricatis ; artolis obliqnis ovatis; acnleis ndialibu* 12-90 basi bulbosa compressis rigidis recurvifl flexitopiave nlbidi« seu eorneis apice wpe adusti* intertextis; aculeo centrali singulo (interdum secuiido superiors adjecto) rnbtmtior* longiore obnctiriore decurvato sen raro rectiuscnlo ; floribus in axillin villo*u«imb tuberculorum juniomm subverticaiibus roajusculis flavicantibus extus fuscatis; sepalis knceoUtis acuti* intcgria; petalis eroti*.

Eastern parts of Pimeria Alta, in Sonora, especially in the Sierra del Pajarito; A. Schott. Flower* June to August — Heads single, mostly depressed, "4-8 inches in diameter" (a living specimen before me has only 3 inches); tubercles in my specimen in 13 spiral rows, ft-6 lines long, ovate, somewhat compmted from above; amtlst my oblique, ovmU, 2-2* lines long, white woolly when young. Rarlial spines in my living spcdnMn 14-16, in * dried ooo

as many as 20, according to Mr. Schott's notes 12-14: one spine is distinctly superior and one inferior; the others are closely arranged along both sides of the areola, 4-9 lines long, upper ones often a little longer than the lower ones. Central spine 6-10 lines long, dark, mostly strongly recurved, adpressed, so that the plant can easily be handled without hurting; much like *M. compacta* from the mountains west of Chihuahua, to which it bears a strong resemblance. It seems to be fully distinguished, however, by the arrangement of the flowers, which in ours originate from the base of full-grown tubercles, and are scattered over the top of the plant, being pushed out by younger tubercles bearing new buds; while in the Chihuahua species they come from the axils of young, just growing tubercles, and are crowded on the densely woolly top. Flowers about 1} inch long and of the same width; petals lemon-yellow, darker, and with a brownish tinge outside along the midrib.

15. M. PECTINATA, sp. nov.: simplex, globosa;· tuberculis e basi quadrangulata conicis, inferioribus abbreviatis, smnmis floriferis teretibus longioribus sulcatis; areolis orbiculato-oblongis; aculeis 16-24 omnibus radiantibus plerumque subaequalibua seu summis fasciculatis longioribus, e basi bulbosa lateraliter compressa subrecurvis, pectinatis luteo-albidis demum cinereis apice ssspe sphacelatis intertextis; floribus e vertice tonientosissimo centralibus flavis; ovario globoso; tubo brevi amplo; sepalis sub-30 acutis aristatis, exterioribus lanceolatis apice recurvis, interioribus oblanceolatis adpressis; petalis sub-30 pluriserialibus oblahceolatis seu intimis obtunis retusisve, omnibus herbaceo-aristatis; stigmatibus 9-10 linearibus luteo-albis stamina longe superantibus; bacca ovata viridi floris rudimentis coronata; seminibus elongato-obovatis compressis losvibus lucidis fuscis, hilo parvo ventrali. (Tab. XI.)

On gentle slopes of the limestone hills on the Pecos, and at Leon Spring; abundant at the latter place: [13] Charles Wright. Flowers in June and July. —The globose heads are lj-2i inches in diameter. Tubercles in 13 spiral rows; lower ones 2-3 lines long, and somewhat broader at base, not grooved, or with a very short groove near the spines; upper tubercles 6-6 lines long, and grooved all the way down. Spines on lower part of plant nearly equal in length on each tubercle, 3-4J lines long, as stiff and pointed and almost as closely and regularly set as in *Cerau pectinatui,* whence the specific name. On the flower-bearing tubercles the upper spines are elongated, mixed with a few stouter ones, and fasciculated; lower ones 5-6 lines long, and upper ones, forming a tuft about the apex of the stem, 6-9 lines long. Flower over 2 inches long, and 2f inches in diameter when fully open, between 11 and 12 o'clock, closing already about 1 o'clock though exposed to the full glare of the sun; ovary 3-4 lines long; exterior sepals reddish-green, interior ones yellow, with a darker midrib; petals of a beautiful sulphur-yellow, broadest in the upper third and obtusish; filaments reddish, short, covering the whole base of the tube, leaving no naked space. Fruit about half an inch long, ripening on the vertex, and not pushed aside by succeeding young tubercles, as it seems that no new ones are developed till the fruit is fully ripe, or probably till the succeeding spring. This is the case with several allied yellow-flowering species, but not with other red-flowering ones, hereafter to be described: in these, though the flower (or at least the flower-bud) be vertical, the succeeding rapid growth pushes them aside; and still more the berries, which finally appear quite lateral. Seed 0.9 line long, elongated, compressed, rounded at the back, quite sharp at the anterior or ventral edge, on the lower part of which, in a slight curvature, the small and narrow hilum is situated.

16. M. ECHINUS, sp. nov.: simplex, globosa seu subconica; vertice dense tomentoso; tuberculis in plant* adulta teretibus apice conicis supra sulcatis; areolis orbiculatis; aculeis rectis sea paullo curvatis cinereo-albidis apice •»pe obscurioribus, radialibus 16-30 pectinatis, superioribua longioribus fasciculatis, centralibus 3-4 validioribus e bari bulbosa suburatis, superioribus 2-3 sursum versis et cum radialibus superioribus implicatis, inferiore validissimo subulato recto (seu rarissime paullo recurvo) porrecto; floribns verticalibus flavis; sepalis 20 lineari-lanceolatis mucronatis integris, petalis 20-30 angustis; stigmatibus sub-12 stamina longe superantibus; bacca centrali oblonga •iridi floris rudimentis coronata; seminibus ut in prwsedente. (Tab. X.)

On limestone hills in the region of the Pecos, Wright; and from Presidio del Norte to Santa Rosa, Bigelow. Flowers in June. —A very striking plant, characterized by the unusually stout and subulate lower central spine, which, together with the globular shape, gives it the appearance of some Echinite, — whence the name. Specimens before me 1(-2 inches in diameter; tubercles 5-6 lines long, in 13 spiral rows. The numerous slender but very stiff whitish radial spines, laterally compressed at the thickened base, are densely interwoven and closely adprased; lower ones about 5 lines long; lateral ones somewhat shorter, UDJKT ones 6-8 lines long; upper interior spines stouter and rather longer than the upper radial ones, but otherwise hardly distinguishable from them; the lower central spine is •Iso about 6 or 8 lines long, very regularly subulate from a thick base. Flowers between 1 and 2 inches long; to judge from the shrivelled specimens seen, yellow. Fruit over half an inch in length. Seeds about 0.9 line long, entirely mmilar to those of the last species, to which this, perhaps, too closely approaches. ' All the specimens from the Pecos have wy straight central spines; but some from Presidio del Norte, not otherwise different, [14] have somewhat recurved and darker born-colored central spines.

17. K. SOOLTMOIDM, Sohefidw. A small slender-spined form was collected by Mr. Wright on the Pecos, end

by Dr. Bigelow about Santa Rosa. Tubercles compressed, incurved, imbricated. Radial spines on the upper ones about 20, with 4 longer and darker incurved central ones ; the upper ones bent upward, and almost mixed with the upper radial ones ; lower one mostly over an inch long. This species and the two precediug may possibly be forms of De Candolle's *M. comifera.*

18. M. CALCARATA, E. in Plant. Lindh., has been collected by Mr. Wright as far west as the Nueces River. His specimen** have only 8 or 10 radial spines, 4-6 lines long; central spine of the same length, but stouter, often (in young specimens ?) entirely wanting. Lindheimer's original specimens from the neighborhood of the Colorado and Guadaloupe Rivers have 10-12 radial spines, 8-9 lines long ; central spine stouter but shorter, sometimes wanting; seeds similar to that of *M. pectinate,* but larger and very obtuse at base; 1.1 to 2 lines long. (Tab. LXXIV. % I-)

19. M. TCBERCULOSA, sp. nov.: ovata seu ovato-cylindrica, simplex seu ad basin ramosa; tuberculis e basi rhomboidea ovatis abbreviatis obtusis, subcompressis, profunde usque ad axillam villosissimam sulco villoso exaratis confertis imbricatis, demum nudatis suberosis persistentibus; areolis orbiculatis, novellis albo-tomentosis; aculeis exterioribus 20-30 rigidis gracilibus albidis nunc apice sphacelatis radiantibus intertextis, interioribus 5-9 robu»tioribus sursum caesio-purpureis apice sphacelatis, quorum HU peri ores longiores erecti versus caulis apicem in contain aggrogati, inferior brevior robustus porrectus deflexusve ; floribus in vertice densissime tomentoso centralibus pollicaribus dilute roseis; sepalis 16-18 lanceolatis arachnoideo-fi mbriatis; petal is 10-13 lineari-lanceolatis aristatis subintegris; bacca ovata elongata floris rudimentis breviter convolutis coronata rubra; seminibus subgloboso-obovatis scrobiculatis fuscis, hilo ovato minuto ventrali. (Tab. XII. fig. 1-16.)

From the Pecos to Leon Springs, Eagle Springs, and El Pa*o, on the higher mountains, Wright; especially on the rocky summits of the " Flounce Mountains," below El Paso, Billow. Flowers in May and June. — A very pretty and well-defined species of the mountain region. Steins 2-5 inches high, 1-2 inches in diameter, often with globose branches at the base ; tubercles mostly only 3 lines long, and of the same width at base, often shorter, rarely and only in very vigorous plants 4 or even 5 lines long ; in 13, or on the lower part of old plants in 21, spiral rows, like the whole body of the plant, of a corky texture nnd substance, almost dry, and therefore not shrivelling when old, but, after shedding the spines, persistent and covering the older parts of the stem as grey, corky tuberosities, whence tbe name. The deep, densely woolly groove, and the very woolly axilla, which loses its coating only after several year*, an quite peculiar to this specie*. Radial spines usually 22-26, rarely less than 20, and never in the numerous speci- mens examined by me more than 30, very slender but stiff, usually 2-4 lines long, lower and a few upper ones 2 lines, most upper ones 3-4 lines long, uppermost rarely 5 or even 6 lines in length ; lower stout central spine 3-4, upper ones 5-7, and in a few specimens even 8 or 9 lines long ; thcwe of the uppermost tubercles crowded together, erect, forming a purplish gray tuft, which surrounds and partly hides flowers and fruit. Flowers very pale purple, about 1 inch in diameter; berry oval, elongated, and sometimes almost cylindric, red, and by both these characters distinguished from the fruit of the allied species ; remains of flower not irregularly shrivelled up at in those [15] species, but forming a regular, conic, whitish head on the red fruit Seeds 0.4 or 0.6 line long, unusually thick, with a very small oval, not linear, hilum.

SO. M. DASYACA2ITHA, sp. nor.: simplex, nubglohojia ; tuberculis teretibus leviter usque ad basin sulcatis laxis; axillis snlcoque snbrillosis mox nudatis; areolis orbiculatis novellis, albo-tomeutosts; aculeis gracilibus vix spine- scentibos rectis patulis, exterioribus 25-35 capillaceis albidis apice spharelatis, ioterioribas 7-13 seUceis loogioribas infra peilidioribus sursum purpnreo-fuscis apice stratus centrsli singulo aquilongo porrecto nunc defidente ; flonini pexvorum centralium sepalis arachnoideo-fimbriatis; baccis rerticalibus ovatis parvis; seminibus obovato-globosis angnktis scrobiculatis nigricantibus ; hilo lineari snbrentrali. (Tab. XII. fig. 17-22.)

El Paso and Eagle Springs; Wright. — The few specimens before me are from 1 (-2) inches high, a little less in diameter; tubercles slender, 4-5 lines long, in 13 spiral rows; grooves slightly hairy when young; axils more or less villouA, soon becoming naked Spines not strictly radiating, bat loosely spreading, much more slender than in the last and the next species, often even capillary; exterior ones 3-6 or even 9 lines long; interior spines forming a drcie corresponding with the exterior ones, bat darker, stiffer, and longer; upper ones 8-12 lines, lower ones 6-0 lines long, or in some specimens shorter and slenderer; central spine single, erect, 6-10 lines long, often wanting. The dry and shrivelled fruit found on the tomentose vertex was only 3| fine* long; seeds thick, sometimes triangular, with a Terr broad back, 0.4-0.6 line long, almost black ; bilum quite different in shape and position from that of the next species, to which this is closely allied. The plant so much resembles *Echinocactus inUrUxtou,* var. *dasyacontkui,* that at Ant sight it might be taken for it

21. M. VIVIPAEA, Haw. *Cactus vivipanu,* Nutt Oen. This sptdes is found only on the northwestern phhw along the upper Missouri and Yellowstone rivers, and up into the Black Hills and Rocky Mountains, h is alow plant, either simple or usually profusely proliferous and cespitose; ^ooto siwsys from the hs<s of the groort oo tbe

tubercle or the axil proper, while in *M. ealcarata* they come from the upper part of the groove, just below the spines. Radial spines 12-20, stiff, white, often brown-red at the top, 3-4 lines long; central spines 4 (3 pointing upward and the stoutest and shortest downward), but sometimes less, and often more, as many even as 8, usually 4-6 lines long. Flowers central, large for the size of the plant, about l£ inch long, and even more in diameter when fully open (which is after one o'clock, later than in most other Cactace®), with 30 or more delicately fimbriate recurved sepals and 25-40 narrow acuminate purple petals, which are naked or fimbriate at base; filaments whitish or purplish, almost from the base of the tube ; anthers orange ; style long-exserted, with 6-10 linear pale or purple stigmata, which are pointed with a short mucro. Berries becoming lateral, being pushed aside by the continuous growth from the apex of the plant, oval, $-| inch long, pale green, juicy, and slightly acid, full of yellowish-brown seeds. These are 0.7-0.8 line long, obliquely obovate, somewhat concave on the compressed ventral portion about the small oblong-linear hilum, pitted; albumen more distinct than in most other *Mamillarùe;* embryo straight, linear-oblong, with very short connate cotyledons. (Tab. LXXIV. fig. 3.)

The following form, from Texas, which formerly I thought I could distinguish from this northern species, seems to be connected to it by numerous intermediate forms found in the geographically intermediate region of New Mexico : —

Subep. 0. RADIOSA : ovata seu demum subcylindrica, simplex seu e basi ramosa; tuberculis teretibus laxis leviter sulcatis ; aculeis radialibus numero maxime variis (12-40), superioribus longioribus robustioribus, cen- [16] tralibus, 3-12, quorum superiores robustiores, radialibus longiores, inferior robustus porrectus brevior; floribus in vertice demum lateralibus ; sepal is 30-40 lineari-lanceolatis arachnoideo-fimbriatis apice recurvis squarrosis; petalis totidem linearibus sen6lm acuminatis integris seu exterioribus basi fimbriutis; stigmatibus 5-10 obtusis purpureis patulis; bacca ovata floris rudimentis coronata viridi; seminibus obovatis scrobiculatis fulvis, hilo erecto parvo lineari ventrali.

Var. o. BOREALK : ovata seu subglobosa, subsimplex; aculeis radialibus 12-20, centralibus 3-6 purpureo-maculatis; floribus minoribus; sepalis sub-25; petalis sub-30 ; seminibus minoribus ventre concavis. *M. vivipara,* var. E. in Plant FendL in Mem. Amer. Acad. (Tab. LXXIV. fig. 4.)

Var. *0.* NEO-MBXICANA : ovata seu ovato-cylindrica, s©pe e basi ramosa; aculeis radialibus albidis sub-30 (20-40), centralibus fr-9 (3-12) infra albidis suisum purpurascentibus apice atratis; floribus.majoribus ; seminibui majoribus ventre subconcavis.

Var. *y.* TEXANA (AT. *radian,* E. in Plant. Lindh.) : ovato-cylindrica, subsimplex; aculeis radialibus 20-30 albidis apice adustis, ccntralibus 4-5 flavis seu fulvis; floribus majoribus; sepalis 40-50; petalis 30-40 ; stigmatibus 7-9 ; •eioinibus magnis ventre subconvexis. (Tab. LXXIV. fig. 5.)

Var. a has been collected in northern New Mexico and about Santa Fe* by Wislizenus and Fendler: 0 in the western parts of Texas and the southern parts of New Mexico by Wright and Bigelow ; by the latter also on the upper Peeoe, and in Sonora (a form with more spines than any other) by Schott. Var. *y* was sent by Lindheimer from the Pierdeoales, a tributary of the Guadaloupe in western Texas. Flowers in May and June. — Var. *y* is the lai^est form, 2-5 inches high, with flowew 1J-2J inches in diameter when fully expanded, and seeds fully 1 line long. — Var. 0 is an intermediate form, 1J or 2 to 4 inches high, 1-21 inches in diameter; tubercles 3-6 lines long. Spines very variable in length and number; in smaller younger specimens the exterior spines are 2-4 lines and the interior 3-6 lines long; in laiger ones the former are often 3-8 lines and the latter 5-10 lines long. Seed 0.7-0.9 line long, almost straight on the side of the hilum, or usually somewhat concave. — Var. a approaches very near to *M. vivipara* of the north. The spines, however, are stouter, the flowers smaller, and the tubercles rarely proliferous; seeds as large as in the last, and of similar shape.

22. M. MACEOMiRiB, E. in Wislii. Rep.: simplex, seu ex sulcis tuberculoram inferioram prolifera et demum caspitosa, ovata seu cylindracea, bete viridis; tuberculis inagnis e basi dilatata elongatis teretiusculis supra sulco Quniore villoeo) ad medium ultrave usque ad areolam floriferam tomentosam supra-axillarem producto exaratis adscendentibus patulis laxis seu rarius plus minus imbricatis; aculeis gracilibus elongatis teretibus sen robustioribus s»pe angulatis compressisve rectis seu paulo curvatis, exterioribus sub-12 (10-17) patulis albidis seu junioribos mririnde rabellis apice sphacelatis, inferioribos s»pe paulo brevioribus; aculeis centralibus 4 (in plantis junioribus a»pe 1-8 raro deficientibus), longioribus robustioribus hasi bulbosis plerumque nigricantibus, raro roseis fuscisve; floribus supr»-axillaribus magnis e coccineo purpureis; ovario nndo seu squama una alterave sepaloidea munito; aepalit tubi 20-30 lanceolatis, inferioribus fimbriatis, superioribus integriosculis; petalis 20-25 oblongo-lmnceolatia •w«tti apicem denticulatis mucronatis; stigmatibus 7-8 supra stamina longe exsertu ; bacca ovafto-subglobosa nnda sea squamis paucis ciliatis inttructa viridi; semiuibus globoso-obovatis laevibus fulvis, hilo oblongo-lineari [17] TtttrioaU; albamine paroo; embryone recto ; cotyledouibun minutis. (Tab. XIV.-XV.)

In the ralley of the Rio Oimndep from Dofia Ana, atove El PSJO (Winlizenus), to the canon below that town (Wright), and to the mouth of the Peon and to Eagle Pass (Bigelow); and lower down, mostly in loose sand, on hillocks

confined by the roots of *Algardbia.* Flowers July and August. — A splendid and very interesting species, 2-4 inches high. Tubercles very different in size in different specimens, from 6 or 7 to 10 or 12 and sometimes even 15 lines long, generally arranged in 8 spirals. The groove is absent in the tubercles of the young plant; in the older ones it shows itself slightly, and only near the point of the tubercle from the spines downward. In more fully developed tubercles it becomes longer ; till in the flower-bearing ones it reaches downward to the lower third, but never to the axilla. There it enlarges into the flower-bearing areola. —Radial spines 6-20 lines long, whitish on the upper ones or all rose-colored when young ; central spines 1-2J inches long, the lowest one longer and stouter than the rest, mostly black, in some specimens paler, straight, or sometimes curved or twisted. Flower 2J-3 inches long and of the same diameter; deep rose-color or carmine verging to purple ; darker along the centre and toward the tip. Fruit 8 to 10 or 12 lines long. Seeds different in size, 0.7-0.8 line long, short and thick, with a decidedly ventral hilum. Albumen distinct, more so than in most other *Mcmillaria,* but the embryo quite similar to them. The scales on the ovarium indicate an approach to *Echinocactus,* though the habit of the plant is decidedly that of a *MamiUaria.*

M. daetylothele, Lab., is a variety of this species.

Subgen. 3. ANHALONICM.

Plant® simplices, tuberculatao, subinermes.
Tubercula subfoliacea, triangularia, laavia seu supra verrncoBO-fissurata.
Areols florifene supru-axillares (an semper?), jubato-villoftissimte.
Flora ex areolis tuberculorum hornotinorum nascentium oriundi, in vertice congesti, mediocre*.
Ovarium emenum : lucca floris rudimentis coronata, plerunique anno primo maturescens.
Semina majuscula, nigra, tuberculata.

These very curious plants, some of them looking more like some *Aloi* than like a *Cactus,* can nevertheless not be separated from *Mamxllaria.* The seed is the only part of the organs of fructification which seems to offer any character, by having a hard, roughly tuberculated testa in ours, as well as in another Mexican species which I had the opportunity to examine. Our species (and probably all the others) has the flower and fruit sessile upon the lower part of the tubercle, and elevated above the axil, much as in *M. macwmerit;* but, unlike that plant, the lower part of the tubercle is entirely distinct from the upper one.

23. M. ri&suiUTA, sp. nov. : e radice crassa napiformi simplex, depresso-globosa seu applanata ; vertice denaissime villoso; tuberculis e basi applanata diluUta crami* trianguUribus inennibus extus iufraque lcvibus seu versus mafginem crenulatum rugous, supra sulco centrali villoso luteralibuaque 2 nudis profunde quad ri parti til et snlcis transvenalibus in tubercula irregularia angu]o*a nuijierosa multifidU; floribun e villo longo sericeo centralibus breviter tubulosis; sepolis sub-20, inferioribus lineari-lanceolati* integris carnoois albidis, superioribus spathulatis cutpidatis ; pttalis sab-12 spathulatis versus apicem obtusum mucronatum integriusculis seu laceris roseis; stigmatfbus 5-10 evecto-patulis; baccis ovatis pallide virescentibus in lana densa occultis ; seminibus obovato-globosis tuber- [18] eulalis nigris opocU, hilo basikri trausveno ; embryone obovato erecto. (Tab. XVI.)

On hard, grnvelly, limestone bills, near Fairy Springs, not far from the mouth of the Pecos, and between that lifer and the San Pedro, Schott, Bigelow; and higher up on the rocks of the caSon of the Rio Grande, Parry. Flowers September and October. — The lower part of the plant is top-shaped, covered with the scale-like remain* of earlier tubercles; the upper part is hemispherical or depressed and flattened, hardly elevated above the sur&c* of the ground, 2-4} inches in diameter. Tubercles in my specimens 0-10 lines long and a little less broad, or sometimes the upper warty part M j inch long and 1} inch wide," in 5 or 8, or rarvly in 13 spiral rows; lower part of tubercles flattened, acute at the edges, slightly carinate, more on the upper and less on the lower surface, smooth; upper and exposed part of tubercle triangular in outline, convex, carinate and almost smooth below, convex and variously issured and thereby verrucose above, sharp and crenate on the edges. The principal groove on the upper surface is a longitudinal one corresponding to the groove of the different species of ftryptaUfo, and like that villote; towards its base (at the base of the upper or warty part of the tubercle) it expands into the floriferous areola; upward it ceases just under the acutish point of the tubercle, without any trace of an acnleiferous areola or of spines. In the young tubercle it is coated by dense, long and straight, white or yellowish, silky wool (about an inch long), which from being exposed to the weather gets matted and dirty, and after several years entirely disappears. Two lateral grooves run parallel with this, and, together with the many transverse Assures, cut up the npper surface into numerous angular tubercles or warts. Flowers central or vertical (in the sense of the term as explained before), borne on die lower smooth part of a very young tubercle, which when bearing flower and fruit is somewhat thickened, and takes the shape and functions of a short peduncle, bearing laterally the upper part of the tubercle like a small bract; the axils even of these young tubercles are entirely naked, the long wool which coven the lower part of the flower and entirely hides the whole fruit being produced entirely from the areola and the central groove. Flower about an inch long, an* of the —ft diameter when fully open ; ovary 3 lines long oval; tubs 4-6 lines long; 12 exterior sepals whitish, flash? 8 ins*

ones spatulate, mucronatc, with rose-colored edges 6-9 liues long, 2 lines wide; petals about 12 in a single series, 0 lines long, 2 lines wide, rose or pink-colored; stamens numerous, white, with orange anthers; style white, expanding into a funnel-shaped irregularly 5-10-parted light-yellow stigma. Fruit oval, crowned-with the remains of the flower, about 5 lines long, juicy. Seed 0.8 line long, strongly tuberculated, the transverse and somewhat truncate hilum basilar.

IL ECHINOCACTUS. LINK & OTTO.

1. E. SCHEERII, Salm: e radice tereti elongate parvus, globosus seu ovatus; costis 13 obtusis interruptis; tuberculis ovatis obtusis supra ad medium sulcatis ; areolis ovato-orbiculatis junioribus albo-tomentosis; aculeis radialibus 15-18 setaceis rigidis rectis seu plerumque paulo recurvatis ulbiclis stramineisve apice fuscatis, summo interdum elongate, centralibus 3-4 angulatis variegatis fusco-atris, superioribus rectis sursum divaricatis longioribus, inferiore porrecto hamate breviore ; floribus in vertice laxis ; sepalis exterioribus 13 squamiformibus, inferioribus appendiculato-auriculatis morgine membranaceo laceris oiliatia, superioribus ovatis integriusculis, sepalis interioribus 8 lineari-oblongis obtusis; petalis 13 lineari-lanceolatis acutis flavo-virescentibus; stigmatibus 8 linearibus flavis; bacca virescente indistincte equamata; seminibus oblique obovatis compressis minutissime tuberculatis [19] fuscis, hilo ventrali circulari magno. (Tab. XVII.)

About Eagle Pass, on the Rio Grande; Schott, Bigelow. Flowers in April.—A most elegant little species, 1J-2 inches in diameter, and of the same height. Root long, terete, rather fleshy, white, about ± inch in diameter, such as I have not seen in any other of our *Cactacea.* Tubercles more distinct and less plainly arranged in ribe than in the other species of this genus ; they are 4 or 6 lines high, somewhat compressed, of the same transverse diameter, and a little longer in the other direction. Areola about 1J line long, a little less broad, extending upward into a tomentose groove, 1-2* lines long, which terminates in the floriferous areola half-way down to the axil, as the transverse incision in the rib may be designated; this groove is much shorter or almost wanting on the tubercles, which bear no flowers. The exterior spines, with their bulbous compressed bases, are closely and regularly arranged all around the areola, and are strictly radiating: in younger plants I find 11-13, in older flower-bearing tubercles always 15-18 radial spines, 3-5 lines long, of almost equal length, or the lateral ones a little longer than the rest; the uppermost radial spine, however, is often somewhat stouter and longer, ranging rather as an upper central spine when only 3 of these are present The upper central spines (2 in my specimens from Eagle Pass, 3 in Salm's original plant) are stouter, somewhat compressed and angled, brown or black on the upper and whitish or mottled on the lower surface, or they are lighter throughout, with black tips, —they are 8-12 lines long; the lower central spine is 2 or 3 lines shorter, black on the upper side, especially at bane, and at the hooked point white on the lower surface and again on the outside of the curvature. The green flowers are about an inch long, much less in diameter even when fully, open. Fruit and seed not seen by our collectors. The former is said by Dr. Poselger (who has sent me a good specimen of the plant, entirely agreeing with my specimens) to be a small green and almost naked berry. His «eeds are large, about 1 line long, 0.8 line in diameter, with very minute and flattened tubercles, *brovm* (the only *Eekinoeaetui* with seeds of that color known to me) ; hilum large and circular, surrounded by a thick rim ; albumen very small; embryo curved, but cotyledons small, connate, more like those of a *Mamillaria,* separating on the curvature, and not at the end of the hook, as in all other hooked embryos of *Outacea* known to me.

S. E. BRiviHAMATUB, sp. DOV. : e radice turbinata fibrosa globoso-obovatus, atro-viridis ;«costis 13 compressis tubercukto-fnterraptis; sulcis acutis profunde incisis; tuberculis supra ad basin usque tomentoso-sulcatis; areolis orbiculatis junioribus breviter albo-tomentosis; aculeis radialibus 12 teretibus rectis albidis seu sordide flavis apice adust!*, tuperioribus longioribus; centralibus 4 complanatis albidis apice atratit, lateralibu* sursum divergentibus netis seu paulo recurvatis aculeos radiales superantibus, eummo debiliore et infimo porrecto seu deflexo deorsum hamate robustiore eos subaquantibus; floribus infandibuliformibus roseis; sepalis inferioribus (ovarii) 5-7 reniformibns scarioris dliatit, superioribus (tubi) 8 ovato-oblongis mucronatis obtusisve; petalis 13-14 lineari-lanceolatis acutis mucronatis integri*; stigmatibus 10-11 radiatis flavis stamina rubella paulo excedentibus. (Tab. XVIIL, XIX.)

On the San Pedro, Wright; and not rare about Eagle Pass, Bigelow. Flowers March and April. —The specimen* sent by the gentlemen of the Boundary Commission were from 2 to 4 inches high and 2-3 in diameter, of a very dark green color, and remarkable from the tuft formed on the apex by the upper central spines, in which the numerous flower* aie almost entirely hidden ; the lower hooked central spines stand out from the mass of the other spine*, the hooks turned downward. All the specimens grew well at first, one flowered abundantly, but all soon died [20] from an internal *>t; just as all the specimens of *E. vnrinatot* did, though they were treated like the other (*bfiUum horn* the tame region, which are doing well. Areola 2 lines in diameter, 8-12 lines distant, connected with tht floriferow areola in the axils of th* tubercles by a tomentose groove of 4 or 5 lines in length. Radial spines alamt alwajt 12, very rawly 1 or 2 more, 5-10 lines long; upper ones longer than the lower and light-colored, lateral

ones darker when young, but difference of shade soon lost. Upper central spine 8-10 lines long; lateral ones usually 14-22 lines in length, always exceeding the upper and lower one, — this last one is the stoutest and broadest of all, 9-14 lines long, mostly yellowish-brown, darker on the upper, lighter on the lower surface, and with the hook brown or black; rarely 1 or 2 additional central spines are noticed. Flower 12-16 lines long, only 9 or 10 lines wide when fully open at noon ; petals 7-8 lines long, 2 lines wide, pale rose-colored, with a deeper colored midrib. Fruit and seed unknown. — Near the last species ; distinguished by the larger size, the very different root, the smaller number of radial spines, the shortness of the upper central spine, and the red color of the flowers. Other differences will no doubt be found in fruit and seed. Name from the shortness of the hook, by which the species is distinguished from most other allied forms.

3. E. CNCINATUS, Hcepf., var. ? WRIGHTII : glaucescens, ovatus ; costis 13 compressis tuberculatis supra usque ad basin sulcatis; areolis ovato-orbiculatis, junioribus albo-lanatis; aculeis radiulibus 8, inferioribus 3 brevioribus teretibus uncinatis purpureo-fuscis, csoteris 5 compressis rectis infra strainineis sursura rubellis apice fascia, summis longioribus latioribusque, centrali singulo compkmato basi angulato flczuoso elongato hamato erecto stramineo apice fusco; floribus ex areola peiiitus axillaxi ortis; sepalis inferioribus 25-30 imbricatis squam«formibus e basi longe auriculata triangularibus hyalinia, mediis 15-25 ovato-orbiculatis cordatis acutis purpurascentibus, superioribus 18-20 lineari-oblongis obtusis purpureo-fuscis, sepalis omnibus margine membranaceo albido ciliatis ; petal is 20-30 linearilanceolatis obtusiusculis purpureis, intern is mucronatis denticulatis ; stylo supra stamina numerosissima exserto stigmatibus 10 carneis suberectis; bacca ovata rubella; seiuinibus curvatis oblique obovatis tuberculatis; hilo circulari basilari. (Tab. LXXIV. flg. 10.)

Near El Paso, and on the river below; also at Eagle Springs, on stony hills and nearly to the top of the mountains, commonly in tufts of grass or hidden among low bushes : Wright, Bigelow. Flowers in March and April. — Oval, 3-6 inches high, 2-3} inches in diameter, with a long tuft of the whitish hooked central spines which are at first difficult to distinguish from the surrounding bunches of dead grass. The adult plants have generally 3, very rarely 4, lower hooked radial spines, j-1j inch long ; 5 lateral and upper radial spines, 1-1} inch long, paler and flattened, the uppermost one longer, broader, and whiter than the rest. Sometimes I find 6 upper spines, when the 3 outer and more slender ones appear radial, and the 3 inner and stouter ones assume the position of 3 upper central spines,— there are then 6 radial and 4 central spines ; the hooked central spine in 2-4 inches long, and not annulatcd. Young plants have 6-7 radial and 1 central spine, all terete and purplish, with darker tips, all }-1 inch long; in older specimens the central spine elongates, and finally becomes flattened and whitish. Groove on the tubercles 2-3 lines long, so that the *axillary* flower is distant thus far from the spines. Flower 1-1) inch long, dark purplish-red, opening at midday in bright sunshine ; filaments at least 1000, yellow below, orange at tip. Fruit ovate, 8-12 lines long, pulpy-red, setting off the white membranaceous sepaloid scales. Seed 0.7-0.8 line long, remarkably curved and [21] contracted at the base, compressed (more so in the ventral curvature), carinate on the back, tuberculate; the small circular hilum surrounded by a very tumid, smooth, and shining rim ; albumen large; embryo hooked, with foliaceons cotyledons.

The Mexican *E. uneinahu* — of which I have seen spines and seeds collected by Dr. Poselger between Saltillo and San Luis Potosi, and flowers found by Dr. Gregg near Parras — has 7-8 radial spines (the 3 lower ones of which an hooked) and 4 central ones, the lowest one flattened and elongated ; lower sepals 36, upper ones about 14, oblanceoiate, arista£, margined ; petals 25, linear-lanceolate, acuminate, aristate ; 8-10 stigmata. Seeds 0.6-0.7 line long, very much compressed, curved, almost cochleate, smoothish and shining; circular hilum almost ventral; albumen and embryo same as in the other. (Tab. LXXIV. fig. 9.)

4. E. smspisus, E. in Plant. Lindh. Many forms have been collected by the Commission, all characterized bj 13 narrowly compressed ribs, slender flexible spines, small bright-red globose fruit, and globose-obovate oblique strongly tuberculated seeds, with an almost circular basilar hilum. The heads are globose, or usually lengthened and almost cylindrical when old, but sometimes depressed. Spines short or long, the central spine usually somewhat longer than the other*, but in some specimens from the Rio Grande shorter; in others from Eagle Pass much longer than the others, and erect, sometimes hardly curved. Seed usually 0.6 line long ; in the above-mentioned *Decim«i from Eagle Pa* 0.8 line in length.

The geographical range of this species is from the Brazos south to the Rio Grande — whence Berlandier has sent it under the name of *Caehu bicclor* — and west to near the San Pedro. (Tab. XX.)

5. E. 8I5UATUS, Dietr. *(E. mtupinu* y tinuahu,* Poselg.): globosns, lete viridis; costis 13 obliqois compressis acutatis interrupt!* ; tuberculis breviter sulcatis; areolis orbiculatis, junioribus si bo- seu griseo-vdlosis • aculeis ndialibus 8-12 setiformibus flexiiibus, 3 inferioribus et 3 superinribns purpureo-fuscis rectittsculU, Uteralilme S-6 tenuioribus longioribus scpe compressis runs seu interdnm flemomn hamatisve albidis; aculeis centralibos 4 quorum 3 superior** Krariies compreasi seu sub-angulati ererti pieramque itcti, infimus Utior compressta* sen caneJicnlatns flexuosus elongatus stnunineas basi pnrpuiascens apice snbhamatiis; floribus sb areola aculiilm n - u

distantibus; sepolis inferioribus 20-30. cordato-auriculatis, superioribus 15-20 lanceolatis basi auriculatis maxgine membranaceis; petalis 20-25 lanceolatis sulphureis; stylo longe supra stamina exserto; stigmatibus 8-12 apiculatis erecto-patulis; bacca ovata squamis 7-10 munita viridi; seminibus obovatis seu lenticularibus hilo oblonffôsub-basilari excisis lucidis sub lente minutissime punctatis. (Tab. LXXIV. fig. 11-14.)

On the Pecos, San Pedro, and Rio Grande rivers; Wright, Schott — I have above given a careful description of this plant, because it is so nearly allied to the foregoing and especially to the next species, which Dr. Poselger thinks it connects. With the former it has in common only the compressed ribs and the setaceous radial spines, but is distinguished by its size, the central spines, the fruit, and especially the seed. From the next species, which it much more closely resembles, it is distinguished by the compressed ribs, the slender radial spines, the smaller number of all parts of the flower, the small fruit, and the smaller very finely punctate seed. My specimens are 4 or 5 inches in diameter, while Dr. Poselger's were 8 inches thick. Areolae 8-10 lines apart; 3 lower spines smooth, purplish-brown, lighter at top, j-1 inch long; lateral spines puberulent, straw-colored, 1-1 £ inch long; central spines puberulent] 3 upper ones yellowish, generally darker nt base, 1J-2 inches long; lower central spine much stouter and longer than all the others, and flattened or even channelled, pale-yellowish, often purplish at base, flexuous, [22] more or less hooked, sometimes straight, 2-4 inches long. Flowers 2-3 inches long, yellow, apparently without the scarlet base of the petals, which I always find in both the allied species externally greenish. Fruit oval, 8-9 lines long, with 7-12 scales ; green when ripe. Seeds 0.4-0.6 line long. Dr. Poselger describes another form under the name of *E. utispinus d. robustus,* which is said to have all 4 central, and often the 3 lower radial spines also, more or less hooked. The seed which he has sent to me leaves no doubt in my mind that it is a form of *E. sinuatus.* In my specimens only the lateral spines sometimes are flexuous, or hooked, or almost curled.

6. E. LONGEHAMATUS, Galeotti: subglobosus seu demum ovatus, laete-viridis; costis 13-17 snpe obliquis tuberculato-interruptis latioribus obtusis; tuberculi* ovatis supra brevissime sulcatis ; areolis ovatis seu suborbiculatis distantibus; aculeis junioribus pleriaque purpureis, adultis demum tods cinereis ; radialibus 8-12 rectis curvatis flexuosisve patulis, superioribus gracilioribus pallidioribus, infimo brevi, lateralibus longioribus subannulatis ; aculeis centralibus 4 (1-4 superioribus adventitiis subinde adjecti*) angulatis compressis annulatis, quorum superiores recti seu curvati seu contorti sursuni versi, infimus robustior plerumque longissimus seepe flexuosus plus minus uncinatus porrectus vel deflexus ; floribus ab oreola aculeifera vix sejunctis infuiidibuliformibus, limbo patulo; ovario ovato ; sepalis scarioso-marginatis ciliatis, inferioribus 30-60 squamiformibus reniformibus, mediis 10-20 obovato-spathulatis,' superioribus 15-26 demum oblongo-obovatis obtusis cuspidatis ; petalis 20-30 oblanceolatis obtusis vel retusis denticulatis cuspidatis seu mucronatis sulpbureis ima basi coccineis et sspius dorso rubellis; stigmatibus 15-18 obtusis sulphureis patulis; bacca ovata squamosa viridi; seminibus globoeo-obovatis hilo ovato subbasilari oblique excisis scrobiculatis lucidis. (Tab. XXI.-XXIV.)

Var. a. CRASSISPINCS. *E. jtetiipinus,* E. in Wisliz. Rep. non Salm.: aculeis robustissimis, radialibus 8-11, centralibus, 4 angulatis, infimo flexuoso plus minus hamato.

Var. *fi.* GRACILISPINUS: aculeis gracilioribus 16-20, exterioribua 12-14, centralibua 4-8, infimo elongate hamato. * *hamatocanthus,* Muehlenpf.

Var. y. BBEVISPINUS: aculeis gracilioribus, radialibus 8-11, centralibus 4 teretibus cam infimo hamato radiales •ix superantibus.

Along $e middle coarse of the Rio Grande and near the Pecos and San Pedro riven, on the mountains of the Linipia, and near Presidio del Norte, and southward into Mexico, but not as far west as El Paso; Wright, Bigelow. Flowers Jane and July. — Heads 4 to 2 feet high, but flowering often when not more than 2 inches high ; ribs usually 13; areola roundish in younger, more elongated in older specimens, often only 6-10 lines, but in vigorous plants 1-1J inch apart Spines glabrous, or only the lower central one scabrous pubescent; lateral spines whitish ; all the other* purplish or variegated, with paler Bemitransparent tips. The forms 0. and y. are those which occur in our territory ; they differ in the length and number of spines, but not at all in flower and fruit. In var. £ the lower and upper radial spines are 1-3 inches, the lateral ones 2-3J inches long; upper central spines 2-5, and lower one 3-6J inches long. Var. y. is perhaps the young plant, as these plants often flower when yet quite young, and before the character of the mature plant is yet fully developed. This in a very marked degree is the case with *E. uncinahu,* •ar., which begins to bloom while the central spine is yet quite short and terete. Lower radial spines in var. *y.* i-U inch, upper ones 1J-2 inches long ; lateral ones 1j-1$ inch, and central spines nil 1J-2 inches long. Flowers form a groove just above the spines, separated from the spiniferous areola by 2-5 obtuse cylindric glandular bodies, which when young exude a clear viscous liquid. I find them also in *E. setitpinus, E. Emoryi,* and [23] numerous others, and they correspond, no doubt, with the glands in the groove of *MamiUaria Scheerii* and others. They appear with the flower, and are noft and fleshy at that time ; afterward they become hardened, of the texture of the npinet themselves and are persistent. Flower* 2j-3i inches lon_K, externally greenish-yellow and nil, internally yellow, with a red base. Fruit 1-2 inches long, coated with 25 or 40 or more tcalm, crowded with the

remains of the flower, green and very acid (Bigelow), or insipid or sweetish when fully ripe (Parry). Seed larger than in the last species, 0.7-0.8 line in the longest diameter, deeply and distinctly pitted under the lens.

7. E. WISUZENI, E. in Wisliz. Rep., has been often collected, by the different gentlemen attached to the Commission, between Doña Ana and El Paso, and probably on the upper Gila, but not eastward. Small specimens show only 13 ribs ; full-grown ones usually have 21 or even as many as 24 ribs. Areolae from J to 1J inch distant from one another ; on older plants closer than on half-grown ones. Three lower radial spines annulated, stout, &-20 lines long; 3 upper ones somewhat slenderer, but also annulated, 1 i—2 inches long; in younger specimens these latter are wanting, in old ones they move more toward the centre of the areola and become surrounded by the upper bristly spines; lateral bristle-spines 15-20, l£-2£ inches long, often twisted, spreading horizontally. All the stouter and annulated spines are ml, with paler seinitransparent points ; the weaker spines are yellowish-white. Ovary and fruit imbricately covered with 60 or 80 scales ; fruit rather fleshy but not juicy, and soon hardening. Seed oblique obovate, 1.0-1.2 line long; hilum small, broadly oval, *ul>bas>ilar, or sometimes Almost ventral ; surface of the seed finely reticulated under the lens; curved foliaceous cotyledons partly buried in the large albumen. (Tub. XXV.-XXVI.)

8. E. LE CONTEI, E. in Pacif. R. Report. This fine species, which was discovered by Dr. Le Conte on the lower Gila, and found again by Dr. Bigelow higher up on the Colorado, has been observed frequently by Mr. Schott in the western part of Sonora, where it flowers in August and September. The flowers, which had not been seen by any other observer, may be described thus :

Floribus plurimi* subcentralibus ; ovario squami* 30-50 wpaloideis reniformibus munito, sepalis tnbi inferioribus 20-30 ovato-lanceolatis acutis ciliati*, supcrioribus 10-20 margine petalnidei* obtnsiusculis cuspidatis ; petal is 20-30 lineari-apathulatis obtusis inciso-fimbriatis niucronati* sulphureis; tubobasi intus nudo; stylo stamina superante ad medium in stigmata sub-14 linearia faaciculata divino. (Tab. XXVII.)

Mr. Schott'8 specimens were 3-4 feet high, clavate, and usually only one third as thick. Dr. Bigelow's specimens were not as slender. Flowers 2 inches in length, " somewhat cam pan u late ;" petals " lemon-yellow," with a brownish tint along the midrib ; tube naked for about one line above the base of the style.

9. E. EMOBTI, E. in Emory's Rep., 1848 : grandis, ovatu*, glancescenft ; coetis 13-21 rectis oliliquisve obtusis tuberculatis ; areolis ovatis junioribuM dense sordideque tomentosis ; aculeis 8-9 subaqualibus robust is subangulatis annulatis panlo recunris rubellis demum funcis apice sub pellucido comeis, radialibus 7 sett (interdum adjecto aculeo tenoiore summo) 8, lateralibu* sublongioribun, centrali singulo recurvo seu snbbamato paulo robtittiure ; floribut magnis purpureo-variegatis ; sepalis ovarii 25 reniformibus ciliolatis, sii|>erioribu8 spathulatis lanceolati* acutis ; petalis sub-25 lanceolatu acaminatis versus apicem fibriato-fissis; stylo stamina viz superante profunde [24] 18-20-partito. (Tab. XXVIII.)

On the Gila, Emory; the lower Colorado, Bigelow; and in Sonora, at Punta de Agua, 8iem del Pajarito, Siena de la Union, and Sierra de Sonoyta, Schott. Flowers in August and September. — Largest plants 30-36 inch** high and 19-14 inches in diameter, with 90 or more ribs, smaller ones a foot in diameter and globose, only 13-riMied. Ribs strongly tuberculated ; tubercles quite dUtinct — especially on the younger plants—and rounded, on oM |>lonts> more confluent Areoto 6-10 lines long, l$-2 inches apart, oral, separated from the contiguous tat smaller floral areola by 8-5 terete obtuse finally ligneous glands. Radial spines mostly 1-2 inches long, — in a very large specimen from Guayniaa, on the Gulf of California, procured by Dr. Bigelow, and BOW in the Congressional Garden in Washington, nearly 3 inches long; the 4 upper lateral spines are the longest and stoutest j the lower ones, and if present the uppermost radial spine (in the specimen from Goaymas sometimes 2), are shorter and slenderer than the others. Flowers aggregated near the vertex, about 3 inches long, dark brown-purple outside; petals red, with yellowish margins; filaments rising from the thick and fleshy upper part of the short tube, leaving its lower part naked, extremely numerous; style thick, at long as the longer (exterior) stamina, divided to the middle into 18 or 20 filiform stigmata. Fruit and seed as yet unknown.

10. E. YmrDncnia, Nutt: globosus seu depressns, simplex sen e bast rammms ; Ttrtiee dejmwo tmnentmo • cortis 13-21 compressis rix tuberculatM ; areolis orbiculatnovatis junioritms tomentnW; aculeis cntnpmsis annulatis plus minus enrratis e virescente rubeHfe, radialibus 9-13 (lft-*\ ex Parry) infttno robuKo hwviore deomum eorvatn, centralibus 4 robnttioribus 4-angnlatis compressis cruciatU, inferiore latiore longiore minus rtirrnto ; florihus mibrerticalibiuj e flaro Tirwcentibus; ovario globono squamis sppalonletii 25-40 semiiunatis n.nifonjarnisrf dmtirolntk imbricatin «ti|*to ; sepalis tubi 2^-30 ovatis obiongisve obtu«i^ ; petalis 20 oblongis oUusts crmwleiitirnlatis • stylo usque ad medium in stigmata 12-15 linearia erecU albida divino; bacca OTaU sen snhgiobnsa sqnamaU rirtnvnte floris radimentifl comnata ; seroinibus oblique oboratis dorno carinatis minutisaime scroliiculatis. hilo nrK>^ni.»« MVV •obrentrali. (Tub. XXIX.) ^ --- oroicuiaio panro

8an Ditfgo, CAlifcimia, on dry hill* and ridges, Niittall, Parry; on the sta-htuch, Schott. — Airradi ng to Nuttall, this species is about 1 foot high, and has Q or 10 inches diameter Dr. Parry *tmuA* t U , ii. J , 4 or 8 inches

high (above ground) and 6-7 inches in diameter. They are usually simple, but sometimes, " only when wounded or burned over by fires," they branch from the base, forming in favorable situations quite a pile of prickly balls. In a young specimen brought home by Dr. Parry, about 2 inches in diameter, with 8 ribs, I find only 9 radial slightly recurved spines, the lowest and most curved one 4-6 lines long, the 2 upper ones 6-8 lines and the 6 lateral ones 8-9 lines long ; the 4 central spines are much stouter, more distinctly angular, compressed, and annulated, 10-16 lines long, the uppermost one more curved, the lowest one almost straight Schott, in his notes made on the spot, states the number of radial spines to be 13, much shorter than the central spines ; Parry describes the radial spines of the adult plant as 18-20, not more than 6-9 lines long, while the longest central spine is about 18 lines long. Flowers disposed in a circle around the vertex, greenish, 1} inch long, 1J in diameter; tube inside naked at base ; stamina short; style about 1 inch long, more deeply divided than in other species. Fruit 8-10 lines long, of the shape and taste of a gooseberry ; bluish-green, in Parry's specimens with 26-30, in Schott's with 35-40 scales. Seed 0.8 line long, very minutely but distinctly pitted. [26]

11. E. OYLINDRACBUB, E. in Sillim. Journ. 1852, sub *E. wndeteenU:* ovatus seu ovato-cyliudricus, simplex *eu pleramque e basi ramosus ; vertice breviter tomentello ; coetis 21 seu pluribus rectis seu obliquis obtuse tuberculatie; areolis ovatis ; aculeis robustis compressis annulatis plus minus curvatis flexuosisve rubellis apice conieia, radialibus 12 seep© cum aculeis gracilioribus sub-5 summn areota insertis, lateralibus tenuioribus, infimo robusto brevioii decurvato-hamato; aculeis centralibus 4 robustissimis 4-angulatis compressis cruciatin, superiore latiore sursum sub-erecto, inferiore deorsum curvato; flore flavo; bacca subglobosa carnosa pallide virescente sepalis semilunatis fimbriatis stipata, floris rudimentis coronata. (Tab. XXX.)

Rocky ravines near San Felipe, on the eastern slope of the California mountains, in latitude 33°, Dr. Parry ; also seen by Dr. Le Conte. — Young plants globose, older ones ovate and cylindrical; the former have 13 ribs, the latter from 20 to 27. The largest specimens seen were 3 feet high and 1 foot in diameter. They often branch out at base, which by Dr. Parry is ascribed to the action of fire crippling the original stem. Ribs somewhat interruptedly tuberculated 5 tubercles flattened horizontally. In the youngest specimens are found already 7 radial and 4 central spines, the lower radial spine much the stoutest and quite curved ; the. 3 upper central spines almost radiating, the lower one erect, all stout, and 1-1 \ inch long. In older specimens (the one before me is globose, 4 inches in diameter, with 13 ribs) the areola are 6-8 lines long, 3J-4 lines wide; the radial spines (together with the 3-5 slender additional ones on the upper edge of the areola) 12-18, — the lowest one is stout and much hooked and the shortest of all, the others are from 1J-2 inches long. The 4 central spines are 1-1J line broad and about 2 inches long. In the most fully developed bunches of spines the 3 upper radial spines are pushed into the inner circle, so that then the number of centrals appears to be 7. The upper central spine is the broadest one, almost straight and erect; the lower one has mostly a strong downward curve. The fruit is described by Dr. Parry as a green, juicy berry, about an inch in diameter, in the axils of the uppermost spines, with yellow remains of the corolla; seed black, " intermediate in aiae between that of *E. viride$cen** and *E. Wi$lize*i."*

I was inclined to consider this plant as a form of *E. virukicens,* but Dr. Parry, who has seen numerous specimens of it, is satisfied that it is quite a distinct species. It is characterized by the cylindrical growth, more obtuse ribs, more numerous, longer, and more curved spines, of which the upper, not the lower one, is the largest and broadest. It is quite remarkable that we have three so similar species on both sides of the California mountains as the two just mentioned and *E. polyxpKalus$y—the* western one globose, the two eastern ones cylindrical and many-headed; these entirely dissimilar in flower and fruit, and one of the eastern and the western one so much alike. It is an interesting observation that similar but quite distinct species occur on both sides of the mountain*, not only in this genus, but also in *Mamillaria* and *Opuntia,* and that no species crosses that mountain range.

IS. E. FOLYCEPHALUS, Engelmann and Bigelow, in Pacific Railroad Report; found by Mr. Schott on the Gila and lower Colorado. He notes the cespitose growth, and the heads 6-8 inches in diameter, 10-15 inches long, with 10-15 ribs. Dr. Bigelow's specimens from the Mojave River were much larger; but the fruit sent by Mr. Schott leaves no doubt about their identity.

13. E. PARBTI, sp. nov.: simplex, globosus seu depressus; costis 13 acutis tuberculato-interruptis, sape obliquis; areolis orbiculatis, sen areola florifera contigua minore addita ovatis albo-tomentosis; aculeis omnibus robustis annulatis plus minus compressis albidis, radiidibus 8-11 rectis seu paulo cnrvatis, superioribus debilioribua, lateralibus robustioribus, infimo deficient; aculeis centralibus 4 validioribus, 3 rectiusculis sursum vends, infimo valido longiora curvato deflezo; bacca sicca oblonga squamis aristatis spinescentibus tomentoque denso albo vestlU floris rndimentM coronata. (Tab. XXXII. fig. 6-7.) [26]

Desert region southwest of El Paso toward Lake Guzman, over an area of sixty or eighty miles in extent; found by Parry with old fruit in January, and by Wright and Bigelow without flower or fruit in AprIL — I h a * before me only a few bunches of spines; the other data are all obtained from Dr. Parry's notes. The plant is 8 or 12 inches k%h by 10 or 15 inches in diameter, alwayi simple; the ribs interrupted; upper tubercles less distinct, flattened side-

wise, lower older ones transverse and very distinct; grooves between the ribs about an inch deep; areola of the spines J inch in diameter, orbicular, or with the closely adjoining floriferous areola oval, about { inch long. Radial spines in my specimen 8 or 9, "often as many as 11;" lower ones divergent stoutest, upper ones more slender. Central spines 4, stouter and 1J-2 inches long, somewhat bulbous at base ; upper and lower one, especially the last, stoutest and longest

This species is nearly allied to the last; but even in the absence of seeds we can distinguish it by the simple globose or somewhat depressed heads and the white spines. I have named it after Dr. C. C. Parry, who, by his intelligent observations and copious notes about the *Cactacea* of the Boundary, has greatly assisted me in their elucidation.

14. E. HORIZONTHALONIUS, Lemaire, var. CENTRISPINUS : glaucus, depresso-globosus (vetustus ssepius ovatus nmbilicatus) ; costis 8 obtusissimis latissimis ; sinubus Riiperficialibus acutis ; tuberculis sulco transveroo inconspicuo vix distinctis ; areolis orbiculatis basi truncatis prominulis, j union bus albo-lanatis; aculeis 6-8 robustis compressis annnlatis recurvatis rubellis demum cinereia, radialibus 5-7, superioribus debilioribus, infimo deficiente, centrail singulo robustiore latiore deorsum flexo ; floribus ex vertice densissime lanato centralibus campanulatis ; ovario tuboque lana longa dense vestito; sepalis exterioribus 60-70 subulatis linearibus et lunceolato-linearibus spinoso-arUtatis atropurpureis nudis ex lana copiorissima axillari vix exsertis ; sepalis interioribus sub-15 obovato-knceolatis mucronatis axilla nudis ; petalis sub-36 oblongis obtusis eroso-dentatis roeeo-purpurei» ; stylo supra stamina numerosissima flava exserto rubello; stigmatibus 6-3 bx-evibus erecto-patulia ; bacca rubra succosa mox d&ticcata lana densa involute floris rudimenti8 spinescentibus coronata a basi fere pereistente circumscissa decidua ; seminibus subglobosis rugosis minutissime tuberculatis nigris opacia, hilo transverso ventrali; embryone exalbuminoso suberecto clavato; cotyledonibas brevissimi*. (Tab. XXXI., XXXII., fig. 1-6.)

Stony soil on the summit of bills, from the Pecos to El Paso, and north to Doña Ana; Wislizenos, Wright, Bigelow, Parry. Flowers April and May, and " continuing to put out its beautiful flowers till July." — Easily distinguished by the broad obtuse ribs. The numerous specimens examined by me are all depressed, 1^-4 inches high and 2J-6 inches in diameter, but old specimens are said to be sometimes 6-8 inches high, oblong, and even cylindric. Ribs in very young specimens, 5; in all the flowering plants which I have seen, 8 and "sometime* 10"; in young plants the ribe are scarcely interrupted, but in older ones they are divided by more or less shallow grooves into very broad tubercles. Areola 6-10 lines apart, covered with long wool when young. Spines mostly 6-8, rarely 9, £-1} inch (and usually 1 inch) long, nearly equal in length, very variable in shape and thickness, sometimes long and slender and almost terete, in other specimens short, stout, and broad. Flower 2f inches long, of the [27] tame diameter, open only in bright sunHhine, light purple or pink; tube lighter colored; ovary very abort (3 lines), globose; tips of sepals dark purple, protruding from the dense white wool which envelope the whole flower; stamens of a flower, counted by Mr. Wright, 1266. Berry juicy, but drying up very soon, and finally breaking oft transversely, leaving the base with raont of the seeds hidden in the thick wool. The seeds, even when fully ripe, look shrivelled, and are 1.2-1.5 line long; the large circular (or rather truncate and transverse) bilum it deeply immersed; embryo almost without albumen, and quite straight, with thick, very abort, erect cotyledon*, and a taper-pointed radicle.

Our plant seems to be a variety of *E. honzonOiahnius,* which if described as having 7 straight radial spines, the lowest one a little longer than the others, and the flower pale rose-colored, with lanceolate-acuminate petals. Prince Balm's var. 0. *curvispinu** seems still nearer to our plant, which has a decidedly central but no lower radial spine, just like the last and the next species; the space for the lower radial spine is covered and filled by the strongly deflexed central spine.

15. E. TEXIVBU, Ho»pf. Not observed farther west than the San Pedro and Pecos riven. Fruit red and juicy, drying up very soon; eeeds 1.2-1.4 line long, somewhat reniform, with a deep indentation including the circular hilum; testa smooth and shining, rarely (in Berlandier's specimens from MaUmoras named by him *Milocactou ladniatus)* indistinctly tuberculated; embryo curved or hooked, with the foliaceons cotyledons buried in the lane albam*n (Tab. XXXIII.)

16. E. BICOLOB, Oaleotti, var. SCHOTTTT: simplex, oratu* vel ovato-cylindricus; costis 8 obtusis tuberculatis interruptis; areolis orbiculatis; aculeis radialibus 15-17 rectis, inferioribus brerioribus teretineculis bad bulbosis rubellis vtriegatii, summis 2-4 longioribus latioribus compressis albidis; aculeis centralibus 4 albidis, summo latiore longiore supra piano infra carinato recto sen paulo sursum curvsio, ccteris comprestis sen subteretibus brevioriboa rectis; floribus magnis in vertice tomentoso subcentralibus; ovario squamis eepaloidcis 10-12 rtnifonnibus marjdne eiliatis imbricate, sepalis tubi 40 sensim majoribus obtusis margins pallidiore ciliatia, eummis oblonaiA nrtmlk purpureis; stigmatibus 8 suberectis. «wng»; pew»

On eretaeeous hills, covered with chaparral (thorny bushes), near Mier, on the lower Rio Grande • BelntfL I» flower in September. -Stem 4-6 inches high, 2-3 in diameter; grooves rather shallow; floral areok d m t o *•

spiniferous one, without the intervening glands which are BO conspicuous in *E. longehamatus* and others, and which I find also in the Mexican forms of *E. tricolor.* The 4 upper radial spines al>out an inch long and flat; all the others rounded, red, paler at both ends; the lowest is the weakest and shortest one, and often somewhat curved : upper central spine 15-20 lines long ; the three others shorter; the lower one flat above, rounded below, often reddish like the lower radial spines. Flower between 2 and 3 inches long; petals bright-purple or rose-purple, gradually paler in fading ; filaments springing from the whole tube down to its base.

The original Mexican *E. tricolor* is distinguished by the more globose form, also by the smaller number of radial spines (10-11), and by the upper central spine not being connate nor longer than the others.

17. E. INTERTEXTUS, sp. nov.: minor, ovato-globosus; costis 13 acutis interruptis subobliquis; tuberculis supra breviter tomentoso-suluitis; areolis ovatis (in planta juniore angustioribus) approximatis ; aculeis brevibus rigidis e basi albida rubellis apice fuscatis, radialibus 16-25 arete adpressis intertextis, superioribus 5-9 setaceis [28] albidis rectis, laterulibus rigidioribus paulo longioribus infimoque robusto brevi scepe paulo recurvatis ; aculeis centralibus 4, superioribus radiales excedentibus sursum vereis, inferiore brevissimo poiTecto robusto ; floribus parvis in vertice dense lanato congestis purpurascentibus ; ovario brevissimo 6-6-squamato; sepalis tubi 20 late ovatis cuspidatisalbo-marginatis; petelis 20^25 oblongis mucronatis; stylo stamina nuineroeisaima vix superante; stigmatibus 7-8 purpureis erectis; bacca globosa sicca squamis eva^eacentibus subnuda basi subpereistente circumscissa; seminibus reniformibus circa hilum magnum orbiculare ventrale curvatis tenuiter verruculosis lucidis; albumine parco; embryone curvato; cotyledonibus foliaceis brevibus. (Tab. XXXIV.)

Var. *p.* DASYACANTHUS: ovatus seu conoideus; aculeis gracilibus longioribus e purpurascente cssiis, radialibus 19-25 setaceis pluriserialibus, superioribus 7-9 gracilioribus brevioribus albidis fasciculatis, centrolibus 4 vix robustioribus, superioribus 3 sursum versis reliquos excedentibus, inferiore porrecto paulo breviore. (Plate XXXV. figs. 1-5)

On stony ridges from the Limpia to El Paso, Wright, Bigelow; and westward, Parry; also toward Chihuahua,' Wislbenus. Var. 0. common about El Paso. Flowers March and April. - Stems 1-4 inches high and a little less in diameter; areola 3 or 4 lines apart Upper setaceous spines pale, 2J-6 lines long; lateral spines 4-7 lines, lowest only 8-4 lines long; upper central spines 5-7 and even 9 lines, lower one 1 or rarely 2 lines long: in young plants the 13-15 radiating spines are more equal in length, and several or all of the central spines are wanting. Flowers about an inch long and wide ; sepal* dark purple with paler margins; petals similar, outer ones deeper, inner ones gradually lighter colored; stamens more than 650, half as long as petals. Fruit about 4 lines in diameter, tipped by the withered flower, usually with a few dried scales, with or without some wool in their axils ; the base usually persistent for some time, while the upper part comes off, separating more or less regularly. Seeds nearly or quite 1 line long, with a very large hilum.

Var. A has the flowers and fruit of var. a., but is a larger plant, with much longer and slenderer spines; lower central spine almost as long as the others. Spines in var. a. appressed so that the plant resembles somewhat, and has been confounded with, *Cereui viridiflorui.* In var. *fi.* the spines are loosely patulous, forming a tuft on the top. The whole plant is very similar to *M. datyaeantha;* the entire similarity of flower and fruit, and the intermediate forms of the spines, leave no doubt of both plants belonging together, though their external appearance is so very dissimilar.

III. CEREUS, HAW.

Subgen. 1. EOHINOCEREUS, E.[8]

1. C. VIRIDIFLOBUS, E. in Wisliz. Rep., 0. CTLIKDBICUS : ovatus seu plerumque cylindricus, subsimplex; cortis sub-13 acutis fere interruptis; areolw confertis ovatis seu ovato-lanceolatis, junioribus albo-villosis mox [29] denudatis;* aculeis 12-18 ladiaiibus brevibus pectinatis rigidis, adjectis plerumque supra aculeis adventitiis

• This subgenua, which was iudictted by me in the Appendix to Wislixenus's Report as a genus distinct from *Ceretu,* and which Prince Salm, in the latest edition of bis " Hortus DyckentU, - my properly reduced to a eection of that genoa, is well characterised by the peculiarities of the flower and frail pointed out in the work above mentioned. The numerous species since discovered confirm this character• The •eeds especially are distinct from those of any other *CacUue** examined by me. They are rather small, n e w so much as 1 line (between 0.4 and 0.9 line) in length, obliquely obovate or subgloboee, more or less compressed, and with a circular or oblong basilar or sub-faatilar hilum; testa black, hard, and brittle, always tabtftmlatod; its tubercles Urge or small, equal or unequal, distinct or more or less confluent, and then leaving irregular depressions, so that the seed appears pitted, or pitted and tuberculate together; embryo with little or no albumen, almost straight, or very slightly curved ; the short, though distinct, and ercn somewhat foliaceoua, transvene cotyledons more or leas bent, inclined to form a hook.

* This *Umentum* or *villut* on the young or nascent areola is so universally present, always disappearing with age, that it ceases to be a character. The differences consist only in the greater density or looseness of this tomentam, and in its color, which is almost always white, bat occasionally yellowish, gray, tawny, brown, or almost black. I shall only make mention of it where it varies from the ordinary -form.

8-6 brevioribus setaceis, lateralibus longioribus, inferioribus purpureis demum fuscis, superioribos pleramque albidis, rarius omnibus purpureis ; aculeis centralibus nullis seu rare siugulo robusto recto vel subinde curvato apice seu toto pnrpureo-fusco, rarissinie altero graciliore superiors adjecto ; floribus versus apicem lateralibus e flavo virescentibus ; ovario tuboque pulvillos 25-30 (aculeolis infra 8-12, supra 3-5 albidis beu rubellis niunitos) gerentibus ; sepalis interioribus lineari-oblongis 10-15 virescentibus fuscatis ; petalis 12-15 lineari-oblongis acutiusculis; baccis ellipticis virescentibus; seuiinibus par vis obovato-subglobosis tuberculatis, bilo basil an suborbiculato. (Plate XXX VI.)

On the Limpia, and thence toward £1 Paso ; Wright. Flowers in May. — This is a taller form than the original species, described in YVislizenus's Report, from the northern parts of New Mexico, with stouter spines and acute petals. A handsome plant, not so much on account of the inconspicuous flowers as from the beauty of the purple and white spines, which are particularly bright when first developed in spring, and look like flowers. Stems 3-6 and sometimes even 8 inches high, 1-2 inches in diameter. Spines usually 3-5 or nearly 6 lines long; central spines, if present, 6-10 lines in length, — more common on the smaller northern var. a, rarely present in the southern form. In a single specimen collected by Dr. Bigelow on the upper Pecoa I find on some of the areolea all or most'of the spines purple, and the central spine sometimes curved upward, sometimes white, with a purple tip, or purple to the base. Flower 1 inch or less below the top, 1-1J inch long, not quite as wide even when fully open; petals 2-3 lines wide. Fruit &-6 lines long, crowned with the withered corolla, as in all *Echinocerci.* In some rather dry fruits the corolla is quite persistent; in the more juicy ones it, as well as the spines on the fruit, are deciduous when the fruit is quite ripe. Seed 0.5-0.6 line long, tuberculated, but the tubercles somewhat confluent, very slightly in the northern form, a little more in ours, so as to show pits between the warts; seed somewhat compressed, and keeled on the back.

2. C. CHLOBANTHua, up. nov.: cylindricus, simplex seu e basi parce ramoaus; costis 13-18 subinterruptia; areolii confertis orbiculato-ovatis; aculeis 12-20 laxiu* radiantibus setiformibus albis, lateralibus longioribus apice aspe purpurascentibus, adjectis supra aculeolis 5-10 brevioribus setaceis; aculeis central ibus 3-5 quorum 2 snperiorea breviores pleramque pnrpurascentes sursum divergentes, 1-3 inferior** longiorea divergentes deflexique alUidi; floribus in caule medio vel in fen ore lateralibus virescentibus extua rfins; ovario pulvillos sub-21 (aculeolis 14-18 setaceis munitos) gerente; sepalis tubf sub-18 lineari-lanceolatis, inferioribus aculeolos axillure* 3-5 gerentibus; petelis 15-18 lineari-oblongis mucronatis; filanientis Htyloque sulphurei*; stigmatilms 8-11 viridibus adpressis; bacca aubgkbosa aculeolata; seminibus parvulis tuberculaUwcorbiculatis. (Tab. XXXVH.-XXXVIII.)

Common on stony bills and mountain sides near El Paso ; Wright, Bigelow. Flowers April. — Stems 9-0 or 10 inches high, 1J-2 inches in diameter; areola 3 or 4 lines apart, not so much elongated as in the last species, and often almost orbicular. Radial spines slender, patulouM, not utrictly radiating, pectinate or adpresaed to the plant; lower lateral ones the longest (as in all these *Pectinati),* 4-5 lines long, inferior ooes shorter, upper ones shortest. No central spines are present in young plants, next 1-3 appear, and well-developed flower-buaring planU have [30] always 5; the upper darker and shorter ones are about 6 line*, the lower ones 9-12 or even 15 lines long; the lowest one is the longest, and regularly deflexed, so that the plant, seen from above, shows as many rays formed by these spines as there are riba. Spines mostly white, the lower lateral and central ones often tipped with purple, upper central ones entirely purple; a specimen has been sent with all the spines almost entirely white. Flowtn yellowish, green, always low down on the plant (usually below the middle, often in the lower third), forming a circle around the stem; flowers an inch long, funnel-shaped, not fully opening even in bright sunshine, Mr. Wright — to whose careful examinations and full notes I am indebted for many date — found the stamina about 400 in number and half an long as the petals; stigmata green, much exsert Fruit half an inch or less in thickness, crowned with the conic remains of the flower. 8eed 0.5 or 0.6 line in diameter, orbicular, compressed and carinate; tubercles confluent, so as to form pits; hilum linear-oblong or oval, batilar. Name from the color of the flowers.

3. C. DASTACANTHUS, E. in Wislix. Rep.: ovatus seu •ubcylindricut, simplex seu e basi parce ramoftns, sub* catpitftsus; costis 15-21 rectis seu obUqnit subinterruptis; areolit confrrtb ovatis; aculeis 80-30 rcctis rigid!* natulta stellalim undique porrectis intertextis dnereis apice sape rubellis vel adu»ti«, in plantis debilioribut albidis, exteriori but 1G-84 quorum laterales longiore*, superior* breves gracilea, inferior*, intermedit, interioribus 3-8 robustioribus" floribus sub Tertice ipao rabterminalilma magnia flavis; ovarii pulvillis 35-45 villoaii aculeolos 15-18 albidos sen aniot rubellos gerentibus; sepalis tnbi late campanulati inferioribus 80-30 aculeoliferis, auperioribus 15-80 neUloidrk oblanceolatis acutis seu cuspidatb; petalk 15-85 spathulatiwibUnceaUUs mucronatis seu interioribus plerumque obtusis muticis; steminibua numemsissimia; stylo exaerto ralicUvato; aUgmatibus 13-18 viridibus erectis ; lucea inagDA subglobosm aculeolate; seminiboa ftubglobosis tuberculatia. (Tab, XXXIX., XL, XLI, fig. l-g.)

About El Paso, and down to the cañon of the Rio Grande; common on rocky hills and the edge of gravelly table-land*, where Dr. Widuenus first found it in 184*» and where the gentlemen connected with U> e Boundary Commission have since abundantly collected it in flower and fruit, and in numerous living specimens, — Th ographical nafa of this species aeemt quite limited, aa it hat not btea sent from any other locality but theiLT yu Ttowmia April and May; fruit rip, m Junt—Stems 5-18 inches high, 8 or 3 or trtn 4 iniJ^ u ^ ! ! !' . : ^ ^

covered by the innumerable ashy-gray or reddish spine*. Lower lateral spines somewhat bulbous and compressed at base, 6-7 lines long, upper ones 3-4 lines, and lower ones about 5 lines long; upper central spines shorter than the lower ones, — these are the stoutest, and of about the length of the lower external spines, or a little longer. Flowers large and numerous from the upper axillae of the past year's growth, before the growth of the same spring is much advanced, so that they appear terminal or central at first glance, as they cover the top of the plant This is the case with many spring-flowering *Echinocerei;* others (*«. g.* the last-mentioned species) produce their flowers lower down on the plant from older axillae. Flower 3 inches or more in length, and of the same diameter, very showy, externally greenish-yellow, with the centre of sepals red; petals bright-yellow; stamens, counted by Mr. Wright* over 1,700, with yellowish-green filaments; pistil stout; stigmata thick, erect Flower (like those of most *Echinocerei)* open in bright sunshine only about the middle of the day, closing in the afternoon, but reopening the next or even the third day, unless the weather be very hot, when all the functions of the flower are performed in one day. Fruit [31] rabglobose, 1-1$ inch in diameter, green or greenish-purple; when fully ripe, "delicious to eat, much like a gooseberry." Seeds 0.6 line long, subglobose, very little oblique, with an oblong basilar hilum, strongly and distinctly tuberculated, like those of *C. cctspitotus;* embryo almost straight, or rather the cotyledons slightly bent forward.

4. C. CTENOIDR8, sp. nov.: suhsimplex, ovatus; costis 15-16 obliquis subinterruptis; areolis lanceolatis confertis; aculeis rigidis albidis demum cinereis intertextis, radialibus 14-22 pectinatis basi bulbosa lateraliter compressis arete adpressis saepe subrecurvis, lateralibus longioribus, summis brevissimia, centralihus 2-3 raro 4 uniseriatis abbrevktis robustis basi bulbosis; floribus versus apicem lateralibus campanulatis flavis; ovarii ovati pulvillis sub-40 aculeolos 12-16 breves setaceos albidos sen apice fuscatos gerentibus; tubi caniponulati sepalis inferioribus 30 squamiformibuH ad axillas setis 3-10 munitis, sepalis interioribus 12-15 lanceolatis acutis, intimis obtusis, omnibus mucronatis; petalis 25-30 spathulatis obtusis retusis vel obcordatis denticuiatis flavis basi angustata virescentibus; filamentia numeroaisimis vinaoentibns brevibus; stylo albido; stigmatibus 10-12 obtusis erecto-patulis viridibus. (Tab. XLII.)

From Eagle Pass to Santa Rosa (Bigelow) ; on the Peooe (Wright). Flowen June and July (in St Louis). —- Stems 2*4 inches high, lfr-2J inches in diameter. Aspect of plant very similar to *C. pectinatus,* to which I allude by the Greek name of the same meaning. Areoto about 1 line long, also about 1 line apart. Spines whitish or ashy, and in some specimens with light-brown tips. Sometimes I find only 14-16 radial spines (1 upper, 1 lower, and 6-7 pain of lateral ones) ; the older and larger ones have 7-9 pairs of lateral spines, 1 lower one, and often 3-5 small bristly upper spines. Upper spines J-1 line, lower one 1-2 lines, and the others 3-4 lines long; central spines in a single longitudinal series one above the other, 1-3 lines long. Flower bright yellow, with a lightgreen centre and dark-greeu stigmata, open from eight or nine till one o'clock, 2J-3J inches long, 2J-3J inches in diameter, the broad and obtuse petals forming an even uninterrupted margin all around; ovary with 38-44 pulvilli, scales obsolete, wool •hort, bristles about 15 in each bunch, 2-3 lines long; pulvilli of tube 25-35, with green fleshy sepals, the lower ones with 8-10 short, and the upper ones with 3-4 longer (5-6 lines long) bristles; petals 1j-1f inch long, | inch wide, lower part of the tube narrow, and for about 1$ line, naked inside; filaments veiy numerous and very slender; anthere fmall, pale-yellow; stigmata rather slender, 3 lines long.

Our plant looks distinct enough from *C. datyacanthus,* which is taller, has a larger number of ribs, rounder and shorter arooln, patulous and usually more numerous spines, and more and longer central ones, also flowers almost vertical, wit)) stouter spines on their tube; but it may, after all, be only a form of it, just as *Echinocactui inierUxhu* hud *E. 'datyacanthui* belong together, and as *C. viridipnu* and *C. chloranthtu* may be joined: intermediate forma, kowever, have not yet been observed. It has already been stated that the floweriess plant so closely resembles *0. pecUnatoi* that it can hardly be distinguished from it except by the fewer ribs. The color of the flowers, to be sure, h very differeht; but though no instance is yet known among *Cerei* where yellow and purple flowen are found in the •aue species, this may not be impossible, and we may possibly have to unite all these forms.

5. C. PECTINATUS, &, var. ? RIGIDIBSIMUS : ovato-cylindricus; costis 20-22 interrupts; areolis lmeari-lanceolatis oonfertimmw, junioribns parce lanonis; aculeis omnibus radiantibun arete adpressis subrecurvis e basi bulbosa rabn-latit aoatitaimis rigidiseimis albidis flavidis rubellisve subpellucidis, lateralibus 12-16 longioribus robustioiibua, infimo aingulo vix breviore, supcrioribus 3-6 setaceis brevibus fasciculatis; floribus sub vertice lateralibus; [32] ovarii pulviUlt 50-00 aculeolos 8-12 rigidos gerentibus; sepalis tubi 40 inferioribus subulatis ad axillam aculei-feria, superioribua 20 lanceolatis acuminatis; petalis sub-20 spathulatis acutiusculis indso-dentatis purpmeis; stigmati-bostab-12; bacca ovato-globosa aculeolata; seminibus tuberculatis.

In the 8ierras of Pimeria Alta in Sonora, and farther west (A. Schott). Flowen June and July. —Sterna 4-6 inches high, 2 inches in diameter. Areoi* 2-2$ lines long in the larger full-grown specimens, 3 or 4 within 1 inch of the rib; in a small specimen, with only 15 ribs, smaller aroolo, and smaller and more numerous spinet (30-35, only M} li_{De} long)$_t$ 12 or more bunches of spines are crowded within the same iptce. Spines all radiating and

interlocking, extremely rigid and acute, variegated, the latest ones of each season being rose-colored, and the earliest ones a pale yellowish, thus forming variegated rings around the stem ; lateral spines 3-4$ lines long, lower one 2 lines long, upper ones still shorter. Flowers near the depressed vertex, just on the outer edge of the rounded top, 2J-3 inches long, bright-pink or purple. Fruit subglobose, nearly an inch long, pulpy and edible ; the fleshy part of the stem is also eaten by the inhabitants, who call this plant "cabeza del viejo." Seed (not quite ripe) 0.6 line long, strongly tuberculated, closely resembling that of *C. ccupitosus.*

I can distinguish this plant from *C. pectinatus* only by the greater rigidity and thickness of the radial and the entire absence of the central spines. The forms allied to *C. pectinatus* are very difficult to distinguish, and it is quite probable that they may run into one another, as Dr. Poselger—who has seen thousands of them in Texas and northern Mexico — is inclined to think. I find that *C. pectinatus* has always a distinct single inferior spine, which is only a little shorter than the lower lateral spines ; while *C. cvspitosus* has generally several of the lowest spines much Bhorter and weaker than the lateral ones. *C. adustus,* the flower of which is not yet known, has fewer ribs, oval areota, and the lowest spine much as iu *C. pectinatus.*

6. C. CiBSPITOSUS, E. in Plant. Lindh., which extends from the Arkansas River to Saltillo, has been found by Mr. Wright as far west as the Nueces and the Son Pedro. The loose darkish wool and slender bristles on the extremely numerous (80-100) pulvilli of the flower-tube, and especially the position of these pulvilli, — not in the axil, but considerably above it, on the sepal, just below its foliaceous tip, — distinguish this species from the nearly allied *C. pectinatus,* as well as from oil other *Echinocerei* known to me. This structure of the sepals seems to imitate and explain the morphology of the tubercles in *Mamillaria,* demonstrating them not to be a branch or an axis, but the fleshy petiole of an abortive or depauperate leaf, which sometimes is indicated by an indistinct scale above the fasciculus of spines, or by the point of the tubercle of an *Anhaknium.*

This species has 12-18 ribs, 20-30 radial spines, rarely with 1 or 2 central ones here and there; flower 2-3 inches in diameter; petals sometimes though rarely curly, as in our figure, mostly plain ; stigmata 12-18 ; fruit 9-10 lines long, oval, generally bursting irregularly; seed 0.6-0.7 line long, obovate, oblique, sometimes almost globose, very strongly tuberculated, with an oval hilum. The name *C. caspitosus,* which would apply much better to a number of other species of this section, was given before any of these were known. It not inaptly represents a common state of the plant when it make* 5-12 heads, but not rarely it is almost or quite simple. (Tab. XLI1I.-XLIV.)

7. C. LONOISETUS, sp. nov.: subsimplex, ovato-cylindricus; cost is 11-14 interrupts tuberculatis ; areolis orbiculatis; aculeis setaceis flexilibus albis patulis, rmlialihus 18-20 rectis basi bulbosa compressis, superinrihus [33] tenuioribus brevioribus, inferioribus longioribus, centralibus 5-7 bulbosw, quorum superiores radialibus vix longiores, 1-3 inferiores elongati divaricati deflexi sope flexuosi. (Tab. XLV.)

Mountains about Santa Rosa, in Coahuila (Bigelow). — Stems simple, or somewhat branching at base, 2-3 inches in diameter, 6-0 inches high ; ribs fewer, more distinctly tuberculated, and less compressed than in most other species, and easily distinguished thereby, and by the orbicular areoto, from the otherwise similar-looking, pale-spined forms of *C. MorwUkus.* Upper radial spines 2J-3 lines, lowest and lateral ones 6-7 lines long; upper central spines hardly longer than these ; lower central ones always 3 in well-developed plants, 1J-2 or even 2} inches long. Flower and fruit of this peculiar and pretty plant as yet unknown ; the former said to be red. Name from the length and slenderness of the spines.

8. C. RaCTTBRi, sp. nov.: ovato-cylindricus; costis 10-13 interrupts; areolis ovato-orbiculatis subconfertis; aculeis e basi bulbosa subulatis rubellis apice obscuris demum cinereis, exterioribus 8-15 additis anpe supra aculeis setaceis, lateralibus longioribus, infimo singulo brevioro; aculeis centralibus 2-5 robustioribus pleramque sub* brevioribus; floribus sub vertice lateralibus mognin purpureis; ovarii pulvillis 20-24 aculeolos 10-15 albidos fuscatosve gerentibus; sepalis tubi inferioribus aculeoligeris sub-15 triangulari-lanceolatia, superioribus 8-10 oblanceolatis spathulatis; petalis 8-12 spathnlatis ; tubo intus basi nudo; stigmatibus 10-12 viridibus suberectis stamina iiumerosissima brevia longe superantibus; bacca subglobosa ; seminihus oblique obovatis compressis inoqualiter tuberculatis subscrobiculatisque, hilo hosilari parvo oblongo. (Tab. XLI. fig. 3-5.)

Sandhills south of El Paso (Rigelow); near £1 Paso or Front era (Wright). Flowers April. — A single living specimen, preserved in the Congressional Garden in Washington, is 5 inches high and 2} in diameter, and has 12 ribs. Areolae in this and the dried specimens are 4-6 lines apart Lower lateral spines 5-7 or 8 lines long, lowest one a little shorter, upper ones 2-3 lines in length; central spines usually only 4-6 lines long, rarely one or the other longer, always stouter than the others, and with very thick and bulbous bases. Flowers 2J-3 inches long, purple, very similar to the flower of *C. Fendleri* or *C. enneacanthus;* fruit 8-10 lines long and rather less in diameter; seeds 0.7 line long, strongly but irregularly tuberculated ; tubercles here and there somewhat confluent

In the arrangement of its spines this species considerably resembles *C. dasyacanthus,* and I have formerly taken it for a smaller variety of that specie*; but it differs from it by the smaller number of rib*, the fewer and stouter spines, —which place it almost intermediate between the *FeetimUi* and the *Deealophi,* — the red flower, the small

fruit, and the larger and irregularly tuberculated seed. I take great pleasure to acknowledge my indebtedness to the modest and faithful artist, Mr. Paulus fyetter, who has adorned this memoir by his skilful pencil, by naming this species after him.

9. C. FENDLERI, E. in Plant. Fendl.: simplex, seu pawe e basi ramosus, ovatus seu ovato-cylindricus, perviridis; costis fM2 rectis seu obliquis tuberculato-interruptis; areolis orbiculatis, junioribus dense tomentoflis subconfertis ; aculeis bosi bulbosis, radiaJibus 7-10 rectis seu ssspe curvatis, inferioribus robustioribus, infimo 4-angulato albido, sequentibus 2 obscuris, caeteris albidis seu s»pius fusco-variegatis, superioribus tenuioribus pallidis, surnmo deficiente seu robusto elongate curvato; aculeo centrali valde bulboso teretiusculo elungato fusco-atro sursum curvato rarissime deficiente ; floribus niagnis purpureis subverticalibus ; ovarii tubique pulvillis 25-36 aculeolos 3-12 albos siepe adustos gerentibus; sepalis interioribus 12-15 lineari-lanceolatis seu spathulatis acutis seu [34] cuspidatis; petalia 16-24 oblongo-linearibus seu obovato-spathulatis acutis seu obtusis mucronatis rape erosodenticulatis; stigniatibus 12-16 stamina numerosissiina vix superantibus erectis; bacca ovato-globosa ex viridi purpurascente pulvillis aculeolatis 18-20 stipata ; seminibus oblique obovatis curvatis paulo compressis scrobiculatis (tuberculis irregulariter confluentibue), hilo ovato seu subcirculari basilari; embryone paulo curvato. (Tab. LI.-LIII.)

In various situations, among rocks or in alluvial river-bottoms from Santa F^ (Fendler) to the canon of the Rio Grande below El Paso (Wright, Bigelow), and from the country fifty miles east of the upper Pecos westward to Zuñi and the Aztec mountains (Bigelow) and to the Copper-mines (Thurber). Flowers May and June. — Stems single or few together, 3-8 inches high, 2-3 inches in diameter, not many together, and those usually of unequal height, not level-topped, like *C. phamiccus* and others; areolro 4-7 lines apart. Spines very variable, but always characterized by their bulbous base, by the lower ones being stouter and longer than the upper ones, partly white and dark, and by the long and dark central spine, which is always curved upward. Radial spines mostly 7 ; a white and angular one below, 6-12 lines long ; the two next ones hardly longer, more terete, black on the upper and usually white on the lower surface; then conies a pair of white pr rarely variegated spines, scarcely shorter; above them two weaker, whiter, and shorter spines, 3-6 or 7 lines long. This is the usual form, especially in the north ; often, however, two more upper spine* are found, and sometimes a slender, or oftener a stout and dark-colored spine, not rarely 12-15 lines long, is placed on the upper edge of the areola, similar to but always smaller than the central spine. All these forms are occasionally seen on the same specimen. In some southern specimens I observe now and then a few small additional upper spines. The form which I have described in *Plant. FendlenaruB* as 0. *pauperadui,* and which Dr. Bigelow collected also on the Pecos, has mostly only 6 spines, — 5 lower and lateral radial ones and the central one, which more or less assumes the place of the absent upper radial spine. This, however, is not a constant form, as transitions to the usual arrangement of spines are often seen on the same specimen. Central spine very much thickened at base, almost terete, black, often with a lighter tip, curved upward, 1-2 inches long. Flower 2|-3J inches long and wide, not fully open before noon, closing again after two o'clock. Spines on the ovary 2J-4> on the upper part of the tube 4-8 lines long, distinctly bulbous at base, and often angular; petals 4-7 lines wide, acute or obtusish ; stamina about J,600 in a specimen examined by Mr. Wright, only from the upper and wider part of the tube, the lower and narrow part 3-4 lines long, naked. Fruit 1-1$ inches long, purplish-green, edible. Seeds 0.7 line long, very oblique, irregularly pitted, by the tubercles, as it were, running together in twisted lines.

10. <T ENNEACANTHUS. E. in Wisliz. Rep.: ovato-cylindricus, obtusus, late viridis, simplex seu pleromque dense caespitosus; costis 7–10 obtusis infra dilatatis sursum compressis tuberculatis sulco transverso saepe interrupto, sinubus profundis acutis ; areolis orbiculatis remotis ; aculeis rectis, radialibus 7–12 (plerumque 8) albis subpellucidis, inferioribus longioribus, centrali singulo (raro 2 superioribus tenuioribus additis) basi bulboso teretiusculo seu plernmqne plus minus compresso triangulatoque albido stramineo seu obscuriore radialibus longiore ; floribus subterminalibns sea lateralibas; ovarii pulvillis 25-35 in squama? triangularis axillis villosis aculeolos 6-12 albidos sea ftweau* gerentibus; sepalis tubi inferioribus 18-20 cum aculeolis longioribu* paucioribus, superioribus 10-18 oblanceolatis acutis ; petalis 12-15 oblongo-obovatis erosis obtnsis acutisve ; stigmatibus 8-10 viridibus elongatis metiusculis; bacca sabgiobosa e purpureo vircscente; seminibus minutis obovatis subobliquis tuberculatis, hilo [35] oblongo. (Tab. XLVIII. ftg. 2-4, et Tab. XLIX.)

Along the Rio Grande, from El P<wo (Wright, Parry) to Eagle Pass (Schott, Bigelow), and into Mexico (Wisli«nns). Flowers April and May. — A widespread specie*, aMuminR many forms, sometimes approaching the next. Stem* generally branching and ceapitoae, 3-6 inches high, lf-2 or 2£ inches in diameter, frwh green, in winter often reddish, even when in full growth appearing flaccid or shrivelled ; areolas 6-10 lines apart. Spines remarkably transparent, much smaller on the lower part of the plant than on the upper one, all bulbose at base, especially the central ones; tipper radial spines 3-5 linen, lateral ones 5-12 lines, lower ones 8-16 lines long, all usually leas than 1 inch ; in some upecitnens the radial spines are almost equal in length, in others they differ very much. Central •pme extremely variable in color, sue, and shape ; when young usually yellowish or brownish, at last ash-colored ; in

younger plants terete ; in perfectly developed ones triangular and flattened, 8 or 10 to 15 or 20 lines long: sometimes we find one or two additional shorter and angular central spines above the principal one, diverging upward. Flowers 2-3 inches long, and of the same and even greater width when fully open. The smallest were obtained at Eagle Pass, bright purplish-red; these have more numerous as well as slenderer aud shorter spines on the ovary, and bloom earlier. The larger flowers come from El Paso and Chihuahua, from larger plants with longer spines. Berry 10 or 12 lines long, greenish or purplish, pleasant to eat Seed 0.5 line or less in the longest diameter; its tubercles very prominent and distinct.

11. C. STHAMINEUS, sp. nov. : ovato-cylindricus, versus apicem attenuatus, laete viridia, caespitosus densissimeque agglomerates; costis 11-13 sursum compressis obtusis tubercuLitis transverse sulcatis; areolis orbiculatis remotis; aculeia radialibus 7-10 (plerumque 8) rectis seu paulo curvatis basi bulbous teretibus sen inferioribus subinde angulatis albis subpel lucid is subsqualibus; aculeis centralibus subquaternis basi bulbosis angulatis elongatis radiales lunge excedentibus rape flexuosis stramineis fuscatis, nascentibus saepe roseis seu purpureis, superioribus sursum divergeutibus, inferiore latiore porrecto seu paulo deflexo; floribus lateralibus grandibus; ovarii squamis 30-40 triangularibus et sepalis tubi late cainpanulati 20-30 inferioribus oblongis abrupte cuspidatis in axilla villosa aculeolos paucos flexuosos elongatos gerentibus ; se|>alis superioribus 10-15 oblongo-obovatis obtusis seu cuspidatis ; petalis 15-18 late obovatis obtusis eroso-denticuiatis; stigmatibus 10-13 elongatia erecto-patulis ; bacca ovato-suhglobosa magna purpunscente aculeolis elongatis numerosis deciduis arniata; seininibus otovatis obiiquis tubercuLitis; bilo oblongo parvo; cotyledonibus subcurvatis. (Tab. XLVI.-XLVII., et Tab. XLVIIl. fig. 1.)

On high gravelly table-lands and on the mountain slopes about El Paso, extending east to the Pecos and west to the Oik (Wright, Bigelow, Parry). Flowers June; fruit ripe in July and August- —A most remarkable plant, on account of the immense masses it forms, one plant often consisting of 100 or 200 heads in a regular hemispherical mass, which is covered and defended by the long, flexuous, straw-colored spines: these have suggested the specific name of the plant Single heads 5-9 inches high and 2-3 inches in diameter, tapering toward the top, at base closely impacted together; areolc in vigorous plants f-i inch apart, in older plants becoming more approximate. Radial spines f-1j inch long, on the lower part of the plant shorter; central spines 2-3 or even 3j inches long, straight or variously twisted, and the younger ones red or brown. Flower 3 or 4 inches in length, and spreading as wide or wider, appearing very full from the broad (8-12 lines) and numerous petal* of a bright-purple or deep-pink [36] color, inclining to crimson. Ovary with only few spines (2-4 lines long) on each pulvillus ; the spines on the tube more numerous and about twice as long. These spines increase in number and length during the growth of the frail, so that aft maturity we find 8 or 10 in each fascicle, 4 to I inch in length. Fruit 1|-2 inches long, 1+ inch thick, readily shedding the spines; purple ; of a delicious taste, intermediate lwtween a strawberry and a gooseberry. The nail saeds (0.5-0.7 line Ion-) cannot be distinguished from those of the last species. The tubercles are large for the aiae of the seed, and very distinct.

If. C. PUBrtJS, sp. nor.: ovato-cylindricois palLde viridi*, caspitopos; costis 7-0 obtusis tubercuktis; dimboa latis param profundis; areolis orbiculatis remotis ; aculeis albidb subpelluddift, rarfiaiibaa 5-6 teretibus sea subangulatis, superioribus snpe deflcientibua, centralibus 1-4 bulbosis angniatie elongatis rectis sell incurvk; ioribna lateralibos; ovarii pnlvillis 20 in squama triangularis axilla parce villosa acnleoina paucos breves gerentibns; sepalis tubi inferioribus 16-20 ovato-lanceoiatis com aculeolis 1-3 longioribas; sepalis superioribus sub-10 oblongo-updthulatis obtnsis; petalis sub-10 spathuiatis obtarás pallide purpureis; stigmatibus 8-10; bacca subgloboaa virejcente-porpurea fasciculi* aculeolorum 8-12 elongatorum decidoia armata; seminibus globoso-obovatis obliquis confluento-tubercuiatia, hilo circulari. (Tab. L.)

8andy bottoms of the Rio Grande, and from El Paso (Wright, Bigelow) to below Presidio (Pftny, with AlgaroWa, Fouquiera, and Lama). Flowers Jane and July. — Stems 5-8 inches high, not so densely cespitose as the last one, of a palA-green color and soft flabby texture; ribs few, broad ; grooves shallow. Radial spines 6-12 or 15 lines long, lower ones longer than upper ones, or the upper spines very commonly entirely wanting, and replaced by the 3 upper central ones; central spines 1J-3 inches long, the lower one somewhat stouter and longer than the upper ones. Flower 2} inches long, of the same diameter; petals fewer and narrower than in the last species, only 6 lines wide, paler (mte-colored), and mortly quite obtuse and almost entire; ovary in this as in the last species remarkably small and undeveloped while the flower is fully open, it* spines few and short, growing afterward in length and numbers more than is noticed in any other species. Ripe fruit 1-1| inch long, with 20-24 pulvilli, on each of them 9-12 brirtlj spiut* 4-0 lines long; fruit green or rarely purplish, insipid or pleasantly acid. 8eed larger than in the two last species, 0.6-0.7 line long, pubgloboue-obuvate, with a circular hiluni; the tubercles not distinct a* in the others, bat confluent, and forming pit* in the interstices.

Thcee three §*x\tx are very nearly allied, but are said to be easily distinguished in their wild state. The characters given above are said to be quite constant, and seem to establish them as good species.

13L C Kvoiuuyyi, Parry in SUlim- Joan. 1852, n. ser. 14, p> 838: ovaio-cylindrictu, e beei pane [redacted]

eottis 11-13 interruptis; areolis orbiculatis subconfertis, junioribufl villosis; aculeis radialibua 13 sab-angulatu albidis apice adustis rectis seu paulo curvatis, lateralibus 6 longioribus, inferioribus 3 vix brevioribus, superioribus sub-4 parvis; aculeis centralibus 4 angulatisgracilibus rectis multo longioribus, inferiore longiore albido porrecto aeu deflexo, superioribus fulvis arrectis; floribus sub apice lateralibus; ovarii pulvillis sub-30 aculeolos rigidos 8-14 gerentibus; sepalis tubi inferioribus 15-20 ovato-lanceolatis ad axillain villosam aculeiferis; petalis purpureis; stigmatibus 12 erectis viridibus; bacca ovuta; seminibus oblique obovatis tuberculato-foveolatis, hilo aublwsilari oblongo. (Tab. LVII.)

Mountains about San Felipe, on tbe eastern declivity of tbe California Cordilleras (Parry); common in tbe [37] Gila valley, especially near the Casa Blanco, above the Pimas village (Schott). Flowers in June.—Loosely cespitose, not more than 4 or 6 or at most 8 stems together; stems 5-10 or even 12 inches high, 2-3 inches in diameter. Kadial spines 3-6 lines long; central ones 1-S inches long, upper one the shortest, lower one the longest Flower rather low down on the plant, between 2 and 3 inches long. Fruit at last naked, fleshy, 1J inch long, 1 inch in diameter. Seed 0.6-0.7 line long, similar to that of *C FendUri,* its tubercles running together and forming irregular pits.

14. C. POLTACANTHU8, E. in Wisliz. Rep.: ovato-cylindricus, plerumque ramosissimus, caspitosua, glaucescens ; coetia 9-13 aubcompresaia obtusia interruptis; areolis suborbiculatis remotiusculis seu demum confertis; aculeis teretibus robuatis rigidis rectis albidis seu e cinereo rubellis apice obscuris demum totis cinereis, exteriorilms 8-12 parum bulboeia, lateralibus longioribus, centralibua 3-4 bulbosis paulo robustioribus aequilongis seu longioribus, junioribua aspe corneo-fuacoque variegatis; floribus sub vertice lateralibaa diu noctuque apertis; ovarii pulvillis 16-20 tomentoeis aculeolos 6-15 variegatot gerentibna; sepalis tubi inferioribus 10-12 triangulari-lanceolatis aculeifaria, superioribus lineari-lanceolatia sen oblanceolatis spathulutisve mucronatia aeu summiB obtusia; petalia 18-22 •palhulatia obtusia integria aeu erosis chaxtaceia coccineia baai pallidioriboa erecto-patulis; tubo intus baai nudo, •taminibua brevibua; atylo ezaerto; atigmatibua aub-8 erectia; bacca aubgloboaa; aeminibna majusculis irregulariter tubereulatia ; hilo aubbaailari parvo angnato ; embryone parciaaime albuminoeo ; cotyledonibua brevibua iucurvia. (Tab. LIV.-LV.)

A common plant at El Paao (Wright, Bigelow, Parry, Thurber), and aa fiir aouth as the mountains west of Chihuahua (Wialiienus), on table-landa and mountains, and alao on aand-ridgea or atony hills. Flowew in March and April; fruit in June.—Heads 5-10 inches high, 3J-4 inchea in diameter, pale-green or glaucoua; areole f-1 inch apart 8pfaei very variable; exterior onea not atrictly radiating, but spreading; upper ones about 6 lines, lateral and lower onea 9-12 linen long; central apinea in young apecimena single, in older and more perfect onea always 3-4, - in some hardly longer than the radial onea, 9-12 linea long, but uaually longer, and sometimes 2 or even 2* inchea long; lower eential spine always longer than the othera. Flowera 2-3 inchea in length, spreading not quite so wide, remaining open day and night, often for four or five days, and profnaely adorning the plant for four or six weeks in succession; petola rigid and somewhat concave, rounded, of a deep-red or blood-color; the base of the tube inside naked for 3 or 4 linea; stamens about 600; berry Hi ^ch long, greenish-purple, of a pleasant gooseberry taste. Seeds larger than in any other *Echinocereut* known to me, 0.&-0.9 line long, oblique; hilum small, subbasilar; embryo with some albumen (which ia not common in tbia genua), large, a little curved; cotyledona almoat foliaceoua, approaching the form observed in tbe cylindric Am.

lft. C. PAUcrornrua, sp. nor.-: oratus aeu orato-cylindricua, perviridia, simplex, aeu parce ramoaua, coatia 5-7 btemptia; anlcia latis sureum acntia; areolia remotia; aculeis 3-6 aeu rariua 7 robuatia basi bulboaia rectia aea •obwcwvia radianUbua, inftmo pallidiore, c«teria rufia fuaciave, omnibua demum nigreacentibua, centrali nullo aea rarius aingulo robnato aubangulato atrofosco anranm verao aeu porrecto; aeminibna obovatia obliquia aubconfluentotobàmilatia, hilo badlari eUiptico. (Tab. LV1.)

Fhnn the 8an Pedro to the mouth of the Peçoa, on rocka and gravelly limestone hilla (Wright, Bigelow).—•terns 5-9 inchea high, 2-4 inchea in diameter, not oeapitoae like the last species, to which it aeema to be allied, [38] bit either simple or with few branches from near the base; riba few, grooves wide and ahallow; areola 8-10 lines apart; spines few and dark-colored, fr-15 lines long, upper one often shorter, and central apine when present 15-80 lines long; flower and fruit unknown. The seed sent by Mr. Wright ia similar to that of *C. polyacantkw,* 0.7-0.8 line long, oblique, with alightly confluent irregular tubercles, and a large and wide hilum.

This specks on the Pecos aeema to take the place of tbe more western *C. polyacanthtu,* which farther east is represented by *C. Raumi,* and farther west by *0. ptemceui.* From all these it is distinguiahed by the few riba and the few dark spines.

16. C. BERLAKDIIBI, sp. nov.: humilia, perviridia; caule aubtereti articulato-ramoaiaaimo; tubercnlia conids diattocOa 5-6-briia; areolia parvis orbiculatis; aculeis tenuibos aubsetaceia, 6-8 brevibus ndiantibas albidis, 1 centrali plerumque multo longiore roscato; floribus lateralibus roagnis purpureb; ovarii pulvilHa sub-90 breviter albotomentoaia acnleolos capiUaoeos bad bulbosoa 8-10 longiores albidos et 1-2 robustions fuacoa gerentiboa; sepalis tubi

exterioribus 8-10 aculeoliferis, superioribus 13-16 oblongo-linearibus acuininatis seu cuspidatis; petalis 14-18 late linearibus seu lineari-oblanceolatis elongatis fere loricatis mucronatis apice denticulatis patulis demuin reflexis; stigmatibus 7-10 viridibus; bacca ovata viridi subsicca ; seiuiuibus parvis obovato-subglobosis tuberculatis, hilo circulari. (Tab. LVIII.)

On the Nueces, Berlandier. Frequently in cultivation in St. Louis, Cincinnati, etc., under the wrong name of *C. repens* or *C. Deppii,* doubtless introduced from southern Texas. Flowers in May and June. — A spreading and procumbent plant, with erect branches contracted at base, and thereby articulated, l£-6 iuches long, f-1 inch thick, either terete with distinct spirally disposed tubercles, or the tubercles arranged in 5 or 6 ribs. Areola 4-6 lines apart. Radial spines bristle-like, weaker than those of the next species, 4-5 lines long, sometimes a stouter and darker one at the upper end of the areola; central spine yellowish-brown, shorter on the lower part of each branch, longer toward the top, from 5-6 to 10-13 lines in length. Flower 3-4 inches long, or when fully open spreading almost 4 inches, and only 2 inches in height; bristles of the tube below 2-3 lines, upward 4-6 lines long, the tomentum white and short; petals long aud narrow, 3-4 or rarely 5 lines wide, bright rose-purple; filaments short, pale rose-colored; stigmata long and suberect Berry about 9 lines long, densely covered with the elongated, mottled, hair-like spines. Sefds 0.5 line long, strongly and distinctly tuberculated, contracted at base. Nearly allied to *C. pentalophut,* DC, which', however, is an erect plant.

Named for Dr. J. L. Berlandier, who made known this as well as many other plants of the lower Rio Grande.

17. C. PROCUMBENS, E. in Plant Lindh. 1850 : humilia, perviridis ; cmile subtereti seu 4-5 angulato articulato-ramosissiuio ; tuberculis distinctis spiralibus seu 4-5 fariis ; areolis parvis orbiculatis ; aculeis rigidis brevibus albidis apice fascia, 4-6 radiantibus, centrali nullo seu singulo paulo longiore obscuriorc; floribus sub apice ramorum lateralibus magnis ; ovarii pulvilli sub-25 albido-villosis aculeolos rigidos 6-9 breves variegatos gerentibus; sepalis tubi exterioribus 12-15 aculeoliferis, superioribus sub-15 lineari-lanceolatis acuminatis; petalis 18-20 lineari-spathulatis acutis seu obtusis, integris seu plerumque eroso-deutatis patulis demum recurvis violaceis basi flavidis; stigmatibus 10-14 stamina flavicantia superantibus ; bacca ovata viridi irregulariter dehiscente ; seminibus parvulis lenticulariboa basi hilo oblongo tmncatis verruculosis. (Tab. LIX. fig. 1-11.)

On the Rio Grande below Matamoras. Flowers in May and June. — Similar in habit to the last, but more slender. Branches i to 3 or 4 inches in length, 6-6 lines in diameter; tubercles 4-5 lines apart, in 4 rows [39] when the branches appear acutely quadrangular, or in 5 rows when they are more terete. Radial spines 1-2 lines long; central oue on lower part of joint wanting, or hardly longer than the radial ones ; on the upper part 2-4 lines long. Flower about 3 inches long and of same width ; petals often reflexed, 4-6 lines wide. Fruit 6 or 8 lines long. Seed between 0.4 and 0.5 line long, much compressed, with a narrow hiluin ; its tubercles very much smaller than in the last species.

Our plant bears a close resemblance to the last-mentioned one, but may always easily be distinguished by the characters enumerated.

18. C. TCBERoaua, Poselger: e radice tuberosa tennissimus, teres, lignomu, annum tenaim incraaaatua, cylindrieus, demum articulatus parceque ramosus, debilis, erectus sen geniculatus et reclinatns; eostis 8 vix prominnlia; areolis parvis confertis, j union bus parce sordide tomentosis ; aculeis 9-12 radiantibus panrulis snbulatis albidis rectis adpressis, inferioribus paulo longioribus, centrali singulo e basi crassa subulato longiore toto seu versus apicem fuseo snrsnm arrecto; floris subterminalifl (?) tubo brevi; pulvillis squamatis albo-lanatis aculeolatis ; sepalis superioribus 8 lineari-lanceolatis; petalis 16 oblanceolatis acuminato-aristatis roseis patentibus; filainentis brevibus; stylo elongato; stigmatibus 8 viridibus; bacca subsicca villosa setosaque floris rudimentisque coronata; seminibus minntia oblique obovatis compressis tuberculato-rugosis scrobiculatis. (Tab. LIX. fig. 12.)

On the Texan side of the Rio Grande, between Reynosa and Camargo (Dr. Poselger); on the Chacon hills, three miles below Laredo, and also near Mier, on arid rocky ridge*, always among shrubs, " which support its weak and otherwise almost decumbent stem" (A. Schott). — Tuberous root globular, J-lJ inch in diameter. Stem 1-S feet high; lower part ligneous, scarcely as thick as a quill; upper younger part and branches 4-8 lines in diameter; young branches few, clavate; ribs very little prominent; areola 1-2 lines apart. Radial spines a line long or less; central spine 2-3 lines long, in weak specimens whitish, in robust ones the upper half or the entire ipine brown or black, rigidly erect and appressed, generally reaching to the second areola above. The flower—which I ha're not myself seen — is described by Dr. Poselger in a letter as being terminal, [M] so that the ovary is a complete continuation of the stem." I suppose that it rises from the upper, but certainly not the recent arcola; and that it cannot be truly terminal, — i. e. a continuation of the axi*, — which would be in opposition to the character of the whole family. Schott also figures the plant as bearing fruit at the end of the branches. Flower over 2 inches long and of the i n * diameter, opening for several day*, but only in bright noonday sunshine; ovary and tube covered with very woolly pulvilli in the axil* of reddish wale*, with 6 or 8 long white or black bristles; petals rote-colored or purple, about an inch long. Fruit covered with long wool and Uack and white brittle*, resembling very much that of C. emplectus.

Seed smaller than that of any other *Cereut* examined by me, —only 0.4 line in the largest diameter, — rugose from confluent tubercles, which leave large pits between them; albumen none; embryo almost straight, with, distinct transverse cotyledons.

Flower, fruit, and seed identify this species with the *Echinocerei,* — thus furnishing another instance, if such were still needed, of the importance of the organs of fructification in the study and arrangement of the *Cactacea,* and of the fallacy of expecting the external shape of these plants to furnish characters for generic or subgeneric division. Without the knowledge of the flower and fruit, *C. tuberotut* would no doubt have been classed with the *Cerei articulati;* while in reality it is the slenderest *Echinocereut,* connected with the ordinary ovate or globose forms through *C. Berlandien* and *C. procumbent.*

Subgen. 2. EUCEREUB.* [40]

19. C. EMORYI, E. in Silliin. Journ.: caule cylindrico 2-3-pedali prostrate ; ramis adscendentibns sen erectis ; costis 16 tuberculatis ; sinubus acute incisis ; areolis confertis orbiculatis, junioribus fusco-tomentosis; aculeis rectis rigidin gracilibus aciculatis e virescenti flavis numerosissimis intertextis, exterioribus 40-60 tenuissimis stellatim porrectis, centrali singulo robustiore multo longiore; floribus subterminalibus flavis; tubo breviusculo aculeolato ; bacca globosa aculeatissima; seminibus magnis obovatis acute carinatis basi acutis lucidia minutissime sub lente tuberculatis, hilo ventrali angusto; cotyledonibus foliaceis bamatis incumbentibus. (Tab. LX. fig. 1-4.)

On dry hills and mountains, near the coast of California, about San Diego, growing in thick masses, and covering patches of 10 or 20 feet square (Dr. Parry); not north of the boundary line (Dr. Le Conte).— Prostrate stems 2-3 feet long; branches 6-9 inches high, 1| inch in diameter; flowers abundant near the top of the branches, rather short, yellow, 2 or 2J inches wide. Fruit 1} inch in diameter, densely covered with numerous pulvilli, each bearing 20 or 26 stiff yellow spines, from 2 to 6 lines in length, 3 of them stouter and longer than the rest, often about an inch in length ; some indistinct remains of the dead flower are hidden among the spines. Seed 1.2-1.4 line long, with a very prominent keel and linear hilum. The short aculeolate flower, persistent on the spinose fruit, would seem to refer our plant to *Echinocereut,* but the seed and embryo permit no doubt about its position. I have seen specimens of a fruit of a columnar *Cereut* from the Pacific coast near Mazatlan, sent by the late Dr. J. Gregg, which is a gigantic representative of our California fruit, and suggests the idea that on the western coast of our continent several species exist of a still unknown section of *Cereut.*

This plant, peculiar to the western termination of our boundary line, fitly bears the name of the energetic and distinguished commissioner under whose auspices the greater part of the interesting plants here described have been collected.

20. C. VARIABILIS, Pfeiff., a tall species, 3-10 feet high, common to the east as well as west coast of tropical America, extending northward to the mouth of the Rio Grande, and up that stream toward Matamoras. — Full-grown •terns &-4 angled, with few and stout spines, but young shoots with 8 ribs and numerous slender spines. Flowers white, nocturnal; fruit oval, about 3 inches long, spinose, crimson externally and internally. Seeds obliquely obovate, compressed, nearly smooth, and shining, 1.6-1.7 line long; hilum subventral, narrowly oblong or linear, albumen almost none ; embryo much curved; cotyledons large, foliaceous, incumbent. (Tab. LX. fig. 6-6.)

21. C. GRBGGII, E. in Wislia. Rep.: e radice crasaa napifonni erectus, gracilia, 2-3-pedali*; ramis paucis erectis 3-6 angulatia atro-virentibuj rope rufescentibua; costis acutis; sulcis latis pkniusculis; areolis oblougo-linearibus tonfertis sea Bubconfertis, junioribus lana e cinereo nigricante demum decidua vestitis; aculeis e basi [41] bulbota crassa abrupto subulatis acutissimis brevissimis nigricantibus, vetustis cinereis, radialibus 6-9 subrecurvis, inftmis 3 tenuioribus longioribus, centralibus binis superimpositia brevibus, rarius singulo; floribus lateralibus albidit sea ochroleucis (nocturnis ?); ovarii ovati pulvillis orbiculatis obscuro-villosis vix aculeolatis; tubi elongati •epalis 40-60 aquamiformibus liueari-lanceolatis acuminatis, inferioribu* aculeoloe paucos breves, superioribus plures capilkres gerentibus; aepalis interioribus 16-20 et petalis totidem lanceolati« acuminatis; stylo stamina equante; atigmatibus sub-10 erecto-patulis albidis; bacca ovata basi contracta apice rostrata floris rudimentis eiccis recurvis demum deddnis coronata pulvillis aculeoligeris mox nudatis munita coccinea pulposa; seminibus magnis oblique obovatig rugosis tenuissime tuberculatis; hilo subbaailari circulari; albumine parcissimo; embryone cotvledonibus ibliaceis incumbentibus hamato.

• This section is proposed here only as a receptacle for our few *Cerei* not included iu the other subgenera. It is not impossible that the greater part of the species of this genus will have to be referred here; but it is more probable that a careful examination of the flower and fruit of the numerous southern *Cerei* will necessitate the formation of several other •nbgensim. Not being familiar with the great majority of the species, I refrain from characterising *Sueereut.* I will only state that the few species referred here have an elongated stem; spines on the flower-bearing and sterile part of the plant not different; tube of the flower elongated, and beset with hairy or spiny pulvilli; stigmata whitish; berries usually with deciduous (or persistent f) spines; dry remains of the flower usually at length deciduous; seeds mostly smooth and shining, and the embryo hooked, with curved foliaoeous cotyledons.

Var. a. CISMONTANUS : areolis elongatis; floris tubo minus gracili aculeolis brevioribus munito; petalis latioribue. (Tab. LXIII. LXIV.)

Var. *p.* TRANSMONTANUS : ureolis ovato-orbiculatis; floris tubo graciliori aculeolis longioribus tenuiter capillaceis flexuosis muuito; petalis lineari-lanceolatis longe acuininatis. (Tab. LXV.)

From the San Pedro in western Texas (Parry, Wright, Bigelow), to the Gila (Emory) .and Sonora (Thurber, Schott); and from the Rio Grande south to Chihuahua (Gregg, Wislizenus); in gravelly or hard clayey soil; nowhere a common plant. Flowers in May and June. — Root a large fleshy, dirty-yellowish tuber, often 4-6 inches in diameter and 6-10 inches long, generally producing but 1 stem, 2-3 feet high, with erect branches; stem thin at base, rather terete and ligneous, upward 9-12 lines in diameter, usually 4-5, angled. The acute ribs at first sight seem crenulated, the pulvinate areola being separated by a slight depression, and the spines being scarcely visible without a close examination. Areolse 1-1J line long; in younger shoots 5-6 within 1 inch of the rib; in older plants about 3 areoltt in the same space. Spines remarkably short and sharp from a disproportionately thick base, only J-l line long : the 3 lowest spines are the longest, and run into a line bristle-like point, often somewhat curved, and not rarely crossing each other; above them 2 or usually 3 pairs of lateral spines, point* of the lower ones diverging downward, and of the upper ones rather upward ; central spines mostly 2, very short and thick, the lower one turned downward, the upper one upward. The spines seem to grow in size for several years, as on the older part of the stem they are twice as thick though not any longer than the younger ones ; they also become irregular, some of the smaller apparently dropping out, while the larger ones crowd into the vacant space (see figure). The flowers have been seen by only Dr. Gregg and Mr. Thurber ; they seem to be nocturnal, as the latter gentleman collected them in the early morning hours, commencing to fade. Ovary £-12 lines long, whole flower 6-8 inches long, about 2} inches in diameter; bristles at base of tube 1-2 lines, or upward 4-6 lines, and in var. 0. 6-10 lines long; style not reaching above the large anthers ; stigmata about 10, subereci. Berry ovate, l|-1£ inch long, an inch in diameter, slightly contracted at base, but not atiped nor even clavate, — as I formerly was induced to believe, — somewhat roRtrate at the upper end, bright scarlet, fleshy, and edible. Seeds 1.2-1.5 line long, 1 line thick, with a large hilum ; the warts of the testa are flat and very minute, but the large wrinkles are very distinct to the naked eye. The young seedling has quite short cotyledons, which finally form a thickened rim around the base of the young stem ; this stem is always triangular, of a reddish-brown color, the edges showing an almost continuous line of the characteristic small and sharp spines; the root very soon swells, as our figure shows, and assumes the shape of a small carrot, almost as large as the [42] •tern itself; in old specimens the root is very much larger than the whole stem and branches together.

Bubgen. 3. LEPIDOCERKUS.[9]

tt. C. OIGAHTIUB, E. in Emory's Rep. 1848: erectoa, elatoa, cylindrical versus basin apkanqne tensim •fttennatat, simplex sea parce ramosua, candelabrifonnii; nmis paucit metis caule bttrioribni; ratio* applanato tomentoso; coatis infra sob-13 tarsum 18-21 rectia, vetustia (versus caulit basin) obtuiit obtusiaaimiaqtie, auraum a bati lata acotatis acie obtusatis tubrepandis ; sinubas ad basin caulia latiasiniia vertus apicem profundit acutis angostioribus anguatiauniiaque; areolia proroinentibus ovaio-orbiculatia, junioribus albido-tnnientoais; aculeis rectii bati valde bulbotis tenuiter sulcatis et snhangulatis albidia seu stramineis demum cinereis; radialibas 12-16, ituo tammisqae brevioribus, lateralibus (precipue inferioribaa) longioribus robuatioribua, subinde acaleis adventitiit pancit seUceia summo areolaj margini adjectfo; aculeis centralibus 6 robustis tlbidis ban nigris apice rubellis demum totia cinereis, 4 inferioribus cruciatia quorum infimus longiaaimus validissimus deflexua, 2 su|*rioribus brevioribua, latemlibut sarsam divergentibua; floribas versus apicem caulia ramorumque aggregatta ; ovarii ovati aepolia 30-40 aquamifonnibus triangulatis acutis ad axillam albido- seu fulvo-villosam aculeolum unnm alteruiuve nigricantem decidoum gerentibos; sepal is tnbi ampliati breviuaculi 30-40 orhiculato-subdeltoideia niucronatia, inferiorilma in axilla lanigeri*, Buperioribus nudia; sepalia intimia 10-15 spathulatia obtuaia camoaia (pallide viridiboa albetcentiboa) ; petalia aub-25 oborato-apaihalatia obtuaia integria criapati* coriaceo-carnosia cramia (ochroleacia ten albidia); ataniinibot nameroaiaaimia superiori tubi parti adnatia, inferiore nudo; atylo stamina paulo auperanto; ttigmatiboa 14-18 ftlifonnibua faaciculatia; hacca obovata sea aepe pyriformi squamia triangulate carnoaia parvia ad axillam lanatia manita, floria rudimentis deciduia; pericarpio duriuaculo coriaceo demum valvi* 3-4 iirpgulariboa patulia reflexiave dehiac«nte; •eminibua nameroaiaaimis in pulpa aaccbarina coccinea nidulantibua oblique obovatia Uevibua lucidis exalbuminoaia; hilo oblongo baailari; cotyledonibua foliaceis incumbentibaa hamaUa. (Tab. LXI. LXII. et tab. front)

[9] This anfagtnna U propoaed for the two tall wcatmi upectta with vniform apinca, abort flowera, orary and tube with numcr-«M amU-lika imMemtad aapala, flaahy patala, pala atiinuata, aaioath aaada, and hooked ambrro. Probably C. *CkiUntis, nd* perhapa other specks from the Pacific slope o/ the ooaUnent, will find their place here. A drawing of C. *CkiUniia,* among the papers of the United 8talea Exploring Expedition, repraaenta a (lower almost identical with that *at C. TkwrUri.*

In rocky valleys and on mountain sides, often in mere crevice* of rocks, from the valley of Williams's River, Lit. 3$° (Bigelow), to Sonora, lat. 30° (Thurber, Schott); and from the middle Gila (Emory) down to near it£ mouth (Parr}-). I cannot find that it has been collected west of the Colorado, though it is probably also an inhabitant of the California peninsula. Flowers from May to July; fruit ripe in July and August. The *Sutearrow* or *Saguaro* of the natives. —Young plants, as Dr. Bigelow observed, are almost always found under the protecting shade of some shrub, especially of Frémont's "green-barked Acacia" *(Cereidium Floridanum),* so characteristic of the barren wilderness ; and not rarely the dead stems of this plant are found near the older *Cerei.* Young plants retain their globose shape for several years; a specimen in my possession, 5 or 6 inches high, is supposed to be between eight and ten years old. It flowers at the height of 10 or 12 feet, but grows up to four or five times that height. Stems have been measured 46 feet high, and higher ones are stated to occur ; so that the first statement of Colonel Emory is not at all improbable, — namely, that this plant sometimes has been found 50-60 feet high. The stem is thickest in or a little above the middle, and tapers upward and downward; one was found by Dr. Bigelow to be at 1 foot [43] above the ground 13 inches, and 10 feet higher more than 23 inches, in diameter. The fleshy part of the plant is, as he notes, bitter, and not acidulous, as in most species of Cacti. The ligneous skeleton consists of thick (1-2 inches thick) and somewhat terete perpendicular bundles of fibres, corresponding in number and position to the grooves of the stem. In younger plants and on the upper port of the older ones these sticks are distinct, and sway in the wind like so many reeds, but at the lower part of the older stems they are reticulately connected with one another by ligneous tissue, the open meshes corresponding (j[U8t **in tae cylindric *Opuntia)* with the bunches of spines or tubercles ; in the oldest stems the inner cavity becomes nearly filled by the same tissue. Stems mostly simple, older ones often with a few erect branches; they are rarely much branched, but specimens have been observed where 5-9 branches sprang from the same part of the main stem ; the primary branches very rarely produce secondary ones ; the branches usually drop off from the skeleton of the dead stems, but in very old specimens they remain, and present a view like the one in our landscape plate opposite the titlepage, which is taken from an accurate sketch made on the •pot by Mr. Mcellhausen. Ribs at the base of the stem few (12-15), broad, obtuse, often almost obliterated, aud generally without spines; higher up the number of ribs increases to about 18-21 ; they are triangular with an obtusish edge, separated by deep triangular acute grooves; toward the top of the plant the young ribs are narrowly compressed, with obtusish edges and narrow grooves,between them. The somewhat pulvinate areolae are 7 lines long, nearly 6 lines in diameter, about an inch distant from one another, sometimes more closely approximate ; at first they are covered with a thick yellowish or tawny tomentum. Lower and upper radial spines 6-12 lines long, sometimes a few additional shorter flexuous setaceous spines are placed above ; lateral ones 12-18 lines long, the lower ones longest; the 4 lower central spines straight, or very slightly curved downward 20-30 lines, the 2 upper central spines 15-18 lines long, diverging upwaixl. The stoutest spines are 1 line in diameter, their bulbous base fully twice as thick. In old age, and toward the base of the stem, the 6 central spines fall off first, leaving the radiating ones appressed to the stem; finally these also come off, together with the whole areola. The flowers are produced in abundance near the summit of the stems and branches; the fruit is usually found 6-12 inches from the centre of the top. Specimens of flower* have been sent by Mr. Thurber and by Mr. Schott: those of the former are not over 3 inches long, the others have a longer tube, and are between 4 and 5 inches in length and 3-4 inches in diameter ; the flowers are probably open day and night. Ovary 1-1 i inch long; lower scales of the tube triangular; up|>er •epals fleshy, greenish-white, |-1 inch long, lower ones 2, upper ones 3-4 lines wide ; petals of a light cream color, 1-U inch long, 6-8 lines wide above, very thick and fleshy, and very much curled ; filaments light yellow, adnate to the upper naif of the tube, its lower part for the length of 1 or H inch naked ; stigmata over half an inch long, deader, tttbexect, of a greenish-yellow color. Fruit 2J-3 inches long, 1J-2 inches in diameter, oval or obovate, or often narrowed at base and almost pear-shaped (perhaps where many are crowded together); the remains of the flower felling off leave a broad convex scar; the color of the fruit is green, and towards the upper end reddish. The pericarp bat the haidnens of a green cucumber, somewhat softer towards the apex, and is about 2 lines thick; it bunts open on the plant with 3 or usually 4 valves, which are red on the inside, and when spreading horizontally, or somewhat "curved, look like a red flower. The crimson-colored sweet but rather insipid pulp has the consistency of a fresh fig; it completely separates from the rind, and, drying up from the heat of the sun, falls to the ground. [44] The innumerable black seeds are 0.7-0.0 line long. Those brought by Mr. Thurber, and largely distributed in this country and in Europe, have well germinated; the cotyledons are short and acute; the seedling plant is globose, grows very slowly, and is rather delicate.

S3. C. THURBBRI, E. in Sillim. Journ.: caulibos erectis sen adscentibus elatioribus fascicnlatii articulatis 13-14-costatis ; sinnbus pianiusculis ; areolis subremotis pulfinatis griseo- seu fulvo-tomentosis ; aculeis 7-15 gracilibus lectis flexaotisve futco-atrin demum cinereis valde inoqualibus irregulariter fasciculatis; floribus infra caulig apicem lateralibos aggregatit; ovarii squamis sepaloideis 80-100 pluribusve friangularibus imbricatis axilla lanam eopfotara albidam vel fulvam sapeque aculeolos paucos nigricantes gerentibus; sepalis tubi sub-50 olivaceit, inferioribu* acutfaicnlift, ftupelwibus obovato-tpathulatis obturis; petalis obtusis carnosis albidis; bacca magna globoaa

aculeolata demum nuda olivacea intus coccinea ; seminibus numerosissimis oblique obovatis dorso carinatis lsviusculia (sub lente minutissime tuberculatis) lucidis exalbuminosis ; hilo oblongo subbasilari, embryone cotyledonibus foliaceis curvatis incumbentibus breviter hamato. (Tab. LXXIV. fig. 15.)

In a rocky cañon near the mountain pass of Bacuachi, Sonora (Thurber) ; on all the sierras of Sonora westward of the Sierra Madre, and more common southward (Schott),—called there *Pitahaya.* Flowers in June and July; fruit in July and August — Stems 5-15 from one root, fasciculated, erect or ascending, " curved tnuarrf," 10-15 feet high, articulated ; lower joints 2-3, upper ones 5-6 feet long, 4-6 inches in diameter; ribs 13-14, very slightly prominent. The skeleton of this species, according to Mr. Schott's observations, consists of flattened bundles of wood, very loosely connected by transverse fibres, so as to form a kind of hollow tube. Areolae pulvinate covered with brownish, or ashy wool, only about 3 lines in diameter, 12-15 lines apart. Spines irregularly fasciculated, 7-10 according to Mr. Schott's notes, but 15 in the flower-bearing bunches before me. (Might not the flower-bearing spines be more numerous and perhaps more slender than the others, indicating a transition to *Pilocereus T)* Spines slender, flexible, almost setaceous, very unequal in length, 5-18 lines long in the same bunch, partly deciduous. Flowers usually 6-12 inches below the top of the plant, about 3 inches in length ; ovary very densely imbricate with sepaloid scales, which bear dirty wool and often short bristly spines in their axils; in some specimens they are wanting, in others they also invest the fruit, but are easily brushed off at maturity. Fruit 3 inches in diameter, like a large orange, of delicious taste, the crimson pulp dotted with numerous black seeds; these are 0.9-1.0 line long only, —a little larger than those of the last species, which they very much resemble,—and very minutely tuberculated. The seed* germinate like those of *C. gigantcus,* with very short acute cotyledons, and grow up with a globose head like the *Echinoceni,* while all the *Eucerci* which I have seen germinating at once grow up in a cylindric or prismatic column.

Subgen. 4, PILOCEREUS.[1]

24. C. SCHOTTII, sp. nov.: caulibus suberectis elatioribus fasciculatis articulatis 4-7- (plerumque 5-) costatis flavo-viridibus ; areolis in caulibus sterilibtis remotis aculeos radiales 4-6 robustos breves cinereos [45] obscuros singulumque centralem breviorem obscuriorem gerentibus, in caule superiore florifero confertis lanam cinerascentem aculeosqne 15-25 setiformes elongutoe flexuosos angulosos nibello cinereos declinatos ct quasi pendulos ferentibus; floribus in aculeorum borba pene occult is cameis; tubo gracili supra ovarium globosum lO-ftquamatum constricto decurvo intus bosi nudo sepalis 10-12 lanceolatis instracto ; petal is 10-12 ohlongts obtusiusculis ; stigmatibus 5-6 fasciculatis; bacca parva globosa squamoaa pulpona coccinea floris nidi mentis coronate ; seminibus oblique obovatis carinatis kevMsimis lucidis, hilo anguato subventrali ; albumine parcissiiiio ; embryone hamnto cotyledonibus curvatis foliaceis incumbentibus seu nubinde obliquis. (Tab. LXXIV. fig. 16.)

Sierra di Sonoyita, and southeast toward Santa Magdalena, Sonora, where it is named Ztna, or *Sina,* or *Sinita* by the inhabitants (Schott). In August with flower and ripe fruit. — Stems ft-10 or more from the name base; 8-10 feet high, ascending at base, and when full grown always curved outward at the top, the reverse of *C. 7%urberu* Often many plant* together, forming thicket*, and covering a large space of ground ; not rarely associated with the just-mentioned species. Stems of 2-4 articulations of 4 or 6 inches diameter; lower part entirely denudated of the quite deciduous spine*. Spines of the sterile joints, or young plants, 5-7, not over 3 or 4 lines long; areoto of the flowering joints 3 lines in diameter, covered with a dirty-whitish tomentum, 2-3 lines apart; spines irregularly fasciculated, 10-25 in number, and from 1 to 4 inches long, flexuous and pendulous. Flower somewhat hidden in this reddish-gray beard, and its tube evidently bent downward by it; length of flower lj-l| inch ; sepals without any wool in the axils, olivaceous, lower ones triangular, acute, upper ones lanceolate ; petals dirty flesh-color; stamina comparatively few, leaving the top of the ovary and the lower part of the tube naked; stigmata 5-6, filiform, broom-shaped, exactly like those of *C. gigantcut* or *C. Thurberi.* Berry scarlet, 3 or 4 lines in diameter. Seeds very similar to those of *C. giganUui,* but larger, 1.0-1.2 line long; germination very much like that of the last two species; cotyledons of seedling plant acute, short, spreading ; head globose, but soon somewhat elongated, while both others remain globose for a long time.

C. Schottii is closely allied to *Pilocertui* teopan'uj, Poselg., from Vera Crux. This, however, is a larger plant, 20-25 feet high, 1 foot in diameter, with 12-15 ribs on the sterile, and 20-25 on the flowering part. I have named this interesting species, the only *PUoetreut* of our Flora, after its zealous discoverer, whom I have often had occasion to mention in these pages, and who, with all hi* other arduous duties in the field, still found leisure and inclination to study the Botany of the Boundary from the Pacific to the Gulf of Mexico.

[1] *Cereus Sckottiii* described in the text (evidently s *PU*+ *mrtu**, as that genui bin been established by Letnaire), leaves 10 doubt in my mind about the propriety and nere*aity of a rsualon of the'[1] Old man Coitus" and iU allies with *Cereus.* An a Mbgenna, *Pilocereus* would be characterized by the difference of the sterile and the flower-bearing part* of the plant (the latter having more numerous, longer, and thinner, often hair-like spines), and by tb* smaller flowers with all the part* reduced in number. The other charactm asrribfd to *Pilocrrtus* (Women* from the whole surface of the tab*, and even from th* top of the ovary, and «f»d*llr tbe short and globose cotyledon*) are not found in oar apeeioa.

IV. OPUNTIA, Toum, MILL.*

Subgen. 1. STENOPUNTIA.

Articuli complanati. Acnlei non vnginati.
Flores parvi. Petala parva, subulata, erectiuscula (auiantiaca).
Stigmata pauca (1-3), acuta.
Bacca ? et Seinina ?

The habit of the two species — the only ones yet known — is entirely that of the next subgenns; but the [46] small flower (less than 1 inch in diameter) has numerous very small and narrow petals, and few and acute stigmata. *0. grandi*,* the only other species known, has 2 or 3 stigmata, and *0. tUnopetala,* only one stigma. I must remark here that all the ovaria I have opened contained no ovules, and not even a cavity. May not the acute single style (an unique and anomalous case in this family) be in some connection with this sterility, and may these flowers not be abortive or staminate forms ?

1. O. 8IBNOPETALA, sp. nov.: prostrata; articulis magnis craseis; pnlvillis ad marginem confertissimis fusco-setalosis; aculeis sub-3 compress ancipitibus curvato-deflexis sea patulis, adjectis rape 1-3 minoribus, omnibus atrofuscis; floribus ex areolis fulvo-villosis; ovarii obconici tuberculati pulvillis 30-40 confertis albido-tomentosis setosis ; sepalis tubi petulisque sub-25 lineari-subulatis acuminatis aristatis aurantiacis erecto-patulia; ·iroo tubo nudo ; stylo medio globoso-ventricoso apice indiviso acuto staininibiw sub-breviore. (Tab. LXVI.)

Common on the battle-field of Buena Vista, south of Saltillo, Mexico (Dr. J. Gregg, 1848). Flowers in July. — The specimens before me consist of dried segments of joints, bearing flowers. Joints apparently large, perhaps 7 or 8 inches in diameter; pulvilli about lj or 1} inch apart on the surface, but much crowded toward the edges, with much dirty-white wool, short dark brown bristle*, and very dark, almost black spines, lighter at the tip. The stouter spines 1J-2 inches long, flat on the upper, rounded on the lower surface, often much curved. Floriferous pulvilli very woolly; ovary about 0 lines long; leaves (or sepals) on the tubercles deciduous, very slender, 2-2J lines long, sepals aril petals 4-6 lines long, not more than 1 line broad at base, very slenderly acuminate, fleshy; sepals greenish-red, petals orange. Stamens numerous, half as long as the petals; style very much inflated in the middle, and to all appearances (I have carefully examined about six flowers) with a single pointed stigma. No fruit or seed was obtained; nor is it probable that these flowers would have ripened fruit, as no ovula could be found. Cannot this curious plant be obtained living? It is interesting to find in the Mexican *0 grandis,* mentioned above (which has long been cultivated in European garden*, but has only lately for the first time flowered in Prince Salm's collection), a very similar species, confirming this subgenus: this is an erect plant, with smaller joints, two white spines on the pulvilli, and 2 or 3 acute stigmata.

• Brides its strictly differential characters (namely, the rotate corolla and the flat bony seeds with large foliaceous cotyledon*), this genus is distinguished from the other Cac-<**» by its suhterete, tubulate, nnd deciduous leaves, and bj its barbed spiuea, which I do not find in any other plant of thin family. These spines render *Opuntia:* HO much more diwaiwabhrand even dangerous than other *Cndi.* In several species (0. *frtvriliM,* 0. *Biqelovii, 0. frut*«xn*%* and others) the joints easily serrate from the stem, find adhere by their barbed spines to the nkin or clothe* of the passer-by, —the aoat annoying bun. Besides these n|iinea,—which are usually, altuougU uot in every species, present, — biistlen are almost invariably found on each pulvillu*, usually small (less than * ot 2 lines long; sometimes longer), and very numerous mixed with soft wool. These bristles are extremely sharp, •nd barbed hack ward like the apines, and are loosely attached •* their insertion; consequently when touched they come off fcon the plant uid adhere most annoyin$_K$ly to the skin or clothing. Both the *areola aeufei/era* and the *arwla JUri/era* are united in this genus into one circular or oblong *pulvillh** in the axil of the deciduous leat The spines occupy the www and the bristles the upper part of this *pu hill us;* be-tween the bristles, and surrounded by them, and always above the apitiea, ts» young shoots or dowers origins*. These bru*l«s correspond with the bristles and wool in the axils of Rumouilla % and with tht tomtntum of the florifer-ous areola in *CoryphatUha* and *Echinocactus,* but are quite distinct, morphologically, from the spines themselves. In *Eumamillarim* the aculeiferous and floriferous areolie are entirely separate; in *Coryphantha* they are united by a long groove; in *Echinocadus* by a short one, or are quite contiguous, although always distinct; in *Ccreus* we do not observe a persistent floriferous areola, — the flower, as well as the young bud, bursts the epidermis above and dose to the spiniferons areola, where a kind of floriferous areola is formed, and continues till soon after the fall of the fruit, when it gradually disappears. In all these plants the floriferous areoU occurs only on the fully developed part of the plant capable of bearing flowers. But in *OpuntuB* the pulvillua (which in ita lower part is the spiniferous and in its upper part the floriferons areola combined) is the same in all stages of development; only it is smaller on the lower part of each joint, and bean fewer or often no spines, and rarely if any flowers or new shoots, while the uppermost *pulvifli* have the longest and moat numerous sirine*, and bear the flowers as well at the young branches. The *pulvilli* of *Opuntim* continue to grow 'year after year, and the bristles become longer and more numerous, and in many species the spines themselves grow stouter. Sometimes new spines are developed between the bristles, indicating a low degree of continued vegetative activity on the rudimentary axis represented by the florifertms areola.

Subgen. 2. PLATOPUNTIA. [47]

Articuli complanati, lanceolati, elliptici, obovati sea saborbiculati. Aculei nnnqnam vaginatL

Floras inajores sea magni. Petala latiora, obovata sea orbicalata, flava seu larios miniata, larisfiiine porporascentia.

Stigmata plura (5-10) obtusa.

Bacca floris rudimentis dejectis late umbilicata, pulposa sea enccosa, et inermis, rarius sicca et aculeata.

Semina margine latiore seu angustiore cincta.

Embryo plus quam circularis circa albumen parcum spiraliter convolutus. Cotyledones semper contraries incumbentes.

This is the well-known form of *Opuntue,* with compressed and more or less elliptic joints, decumbent or erect, with fibrous or sometimes tuberous roots; mostly with spines only on the upper or in one section *(Xerocarpea)* on all the pulvilli, rarely (principally the *PubescenUs)* spineless. Flowers commonly 2-3 inches and sometimes even 4 or 5 inches in diameter; stigmata, as far as my observation goes, always from 6 to 8 or at most 10 in number, whitish, yellowish, or green, patuious or mostly erect. Fruits often edible, so that some species are cultivated for their fruits, and have been introduced into the warmer parts of the other continents ; in the section *Xerocarpea* the fruits are spiny and dry. Seeds among the largest in the whole genus, or even in the whole family ; in some species over 3 lines in diameter.

2. 0. STRIOIL, sp. nov.: suberecta ; articulis ovatis obovatis sea orbiculatis obtusis sea subinde subacatis tenuibus ; pulvillis confertis, janioribus albido-villosis mox setis difformibus ntramineis stipatis, omnibus aculeiferis; acnleis rufis fuscisque versus apicem flavidis, 5-8 radiantibus deflexi*, versus margines articuli cum 1-2 robustioiibufl longioribus erectis patulis seu deflexis; bacca parva subglobosa late umbilicata areolis 25-30 minutis stipata rubra; seminibus parvis crassis obtuse marginatis. (Tab. LXVII.)

Western Texas, west of the Pecos, in crevices of flat limestone rocks ; Wright, Bigelow. — About 2 feet high, pale green ; joints covered with numerous pulvilli, each with a bunch of bright red-brown spines, paler at the tip, which give this plant a very showy appearance. Joints 4-5 inches long, 3^-4 inches wide ; pulvilli 4-6 lines apart, prominent; their whitish wool soon disappears, leaving them covered with fine pale-yellow bristles, a dozen of which are longer than the rest, radiating upward and laterally, and by joining the lower radiating spines forming with them a complete circle. Spines on most areola 5-8, — on the lower ones (as usual) fewer, shorter, and paler, on the upper and marginal ones more perfect; exterior radiating spines 3-4 lines, lower ones 5-8 lines long ; the one or two stouter somewhat compressed spines on the upper areota are nearly an inch long, deep-brown below, light red-brown in the middle, gradually fading into yellow at the point. Flower unknown. Fruit 6-7 lines long, about 6 lines thick, with a broad aiid flat umbilicus; areol* small, with gray wool and a few bristles. Seed 1} line in diameter, rather irregular, very thick in proportion.

It would be desirable to obtain living specimens of this showy species, which could he easily done by traveller* on the now well-frequented road between San Antonio and El Paso.

a O. ENOILMANKI, Salra : erecta, grandis ; canle demum lignoso tereti cortice cinereo rimoso obdacto; articulis orbicalato-obovatis sea obovatis magnis pallide viridibas; pulvillis remotis grineo-tomentosis; setis [48] flavis rigidis valde inaeqnalibus sparsis; aculeis paacis (in areolis superioribus plerumque 2-3) validis compressis seu angnlatis recti* sen subinde cnrvatis deflexis sea varie divergentibas stnmineis corneisve basi rufit, cum adventitiis inferioribus 1-2 gracilioribos pallidioribus rope deflcientibas; floribas flavis intus rube 11 is; ovario obovato-sabgloboso sea rarius elongato subclavato sepalis e basi lata subulatis et pulvillis 90-25 griseo- sen fnlvo-toniento*is pane setosis instructo ; sepalis tubi sub-13, exterioribus ovato-lanceolatis acaminatis, interioribus orbicnlato-oboratis cospidatis; petal is 8-10 obovatis subupathulatis obtaiiis macronatis; stylo crasso parum tumido; stigmatibns 8-10 erectis; bacca globoso-obovato wn rarins pyriformi late urabilicata; seminibus minoribos snb-imgnlaribus plerumque angnnte tuarxinatis. (Tab. LXXV. fig. 1-4.)

From the Canadian River (Bigelow) to New Brannfeln, in Texas (Lindhetmer), and to the month of the Rio Grande; westward to the Pecos and Presidio (Bigriow), El Pano (Wright), and perhaps to the Pacific (Parry) ; south to Chihuahua (Wi*lizemi»). Flower* in May and June. — A stoat, coarse-looking plant, 4-6 feet high ; lower part of old stems woody with l<*wely reticulated ligneous fibres, and with gray bark often covered with lichens, about 6 inches in diameter. Joints in the larger specimens 1 foot long, 9 inches in diameter; leaven subulate, 3-4 lines long, patulous ; pulvilli 1j-1j inch apart, 3-4 lines in diameter; brittle* coane, sparse, and very unequal, longer ones on the tpper edge of the pulvillu* M>metime* 4-6 lines long; spine* 1-1) inch long, lower smaller ones 6-9 lines-long. Flower 2}-3 inches in diameter, characteriied by the usually quite short ovary and the comparatively narrow and not •nwginaie petals. Ovary commonly 1-1j inch long, alnra»t globm*; in some instances, however, I haw seen II d-ovate and nearly 2 inches long (perhaps then sterile and inclined to become prolifcrooj). Fruit sabglobose,

what contracted at base, nearly 2 inches long; umbilicus about an inch in diameter, flat or a little depressed ; fruit dirty purplish, usually with a bright purplish pulp, of an insipid or even nauseous taste. Seeds usually less than 2 lines, in most specimens only 1.6-1 7 line in diameter, of a regular (from Matamoras) or commonly more irregular twisted shape, with an obtuse or acutish, rather narrow margin. Young plants raised from seed ore characterized by the fascicles of very long (j-1 inch) fine woolly hairs on the pulvilli, which appear in the second season, and remain for several years. Among the numerous varieties of this species, the var. *cyclodcs,* from the upper Pecos, has been described in Captain Whipple's Pacific Railroad Report; another one was collected by Mr. Wright on the Limpia, with 1-6 stout, curved spines on the upper pulvilli, and none at all on the lower ones.

Dr. Bigelow distinguishes from this species another plant, which he has frequently observed near Presidio del Norte and Eagle Pass. From his notes, and from the meagre material on hand, I venture to describe it, without asserting its specific difference from the lost species.

0. DULCIS, sp. nov.: adscendens, patula; articulis obovatis; pulvillis remotis; setis fulvis difformibus, exterioribua confertis tenuioribus brevioribus subcequalibus, interioribus uniseriatis robustioribus multo longioribus; oculeis 2-3 angulatis sapius tortis pollidis deflexis, sepe cum 1-3 gracilioribus; bacca ovate late umbilicata pollida; seminibus minoribus regularibus anguste marginatis. (Tab. LXXV. fig. 6-7.)

A suberect, spreading bush, lower and with smaller joints than the last species, and always with a very sweet and pleasant-tasted fruit Plant about 2 feet high; joints } foot long; spines 1-1} inch in length, almost white. A semicircle of short spines or long bristles distinctly separates the spiniferous from the bristly part of the pulvillus; the bristles themselves are much more numerous, finer, and more crowded than in 0. *Engelmanni.* [49] This arrangement of the bristles I find again only in *0. chlorotica* (Engelmann & Bigelow), from the western Colorado. The spines resemble *0. tortispina* (Engelmann & Bigelow) ; the flower and fruit, *0. Engelmanni;* and the seed seems different from all these Fruit 1 J-1j inch long, 1 inch in diameter; umbilicus } inch wide, shallow. Seeds 1.6-2.0 lines in diameter .

O. OCCIDENTALS, E. & B. in Pac Rail. Rep., found by Dr. Bigelow "in immense patches forty miles east of Loe Angeles,* California, was also observed by Mr. Schott in the high valleys of San Pascual and Santa Isabel, northeast of San Diego, " covering extensive tract* of land." It is probably a good species, and quite distinct from 0. *Engdmanni.* Young plants raised from Dr. Bigelow's seeds do not show the peculiar capillary spines of that species mentioned above.

Another *OpunHa* grows on the hill-aides and plains near San Diego (Parry), and on the sea-beach there (Schott). An erect plant, 4-6 feet high; spines 2-4, stout, compressed, yellowish or brownish, also forming large thickets; joints 6-8 inches long and 4-6 inches wide ; ovary subglobose, with 16-20 bristly pulvilli; 16-18 broadly obovate cuspidate •epalg; about 8 (?) orbiculate petals; 8-10 stigmata; a large yellowish or purple fruit, of pleasant taste, much relished by the inhabitants Whether this is a form of 0. *Engdmanni,* or *0. Fieut Indica,* — which, from having for a long while been cultivated about the settlements, may have become naturalized, — I cannot at present determine.

4. O. MACROCBNTRA, sp. nov.: adscendens; articulis magnis suborbiculatis tenuibus saepe purpurascentibus; foliis gmcilibus lineari-subulatis ; pulvillis subremotis orbiculato-ovatis Betas graciles breves fulvas tomentum griseum vix superantes gerentibus plerisque inermibus, sunimis et marginalibus soluin armotis; aculeis 1-2 rarius pluribus pnelongis rectis seu varie flexuosis fusco-atris sursum pallidioribus rope annulato-notatis, superiore terete inferiore •ubbteviore compresso seu canaliculato; flora flavo; ovario ovato; pulvillis 20-26 villosis et fulvo-setosia versus •uperiorenTovarii partem cougestis; sepalis tubi 13 lanceolatjs seu interioribus obovatis acuminatis cuspidatisve; petalis sub-8 obovatis obtusis mucronatis; stigmatibus 8; seminibus majusculis late obtuseque undulato-marginatis. (Tab. LXXV. fig. 8.)

Sandy ridges in the bottom of the Rio Grande near El Paso, also on the Limpia (Wright). Flowers in May. — A remarkably striking plant, 2-3 feet high, with large, almost rounded, thinly compressed, often purplish joints, and •ery long nearly black spines, of which it would be very desirable to obtain living plants, as none of those sent home by Mr. Wright have survived. Joints 6-8 inches long, 4-7 inches wide ; leaves 2J-3 lines long, remarkably slender; pulvilli |-i inch apart, lower ones smaller and closer together, unarmed ; spines on the upper ones 2-3 inches long, lower half almost black ; ovary lj inch long, 8 lines in diameter ; flower 3 inches in diameter when fully open. The •eeds sent by Mr.- Wright as belonging to this species are 2.0-2.2 lines in diameter, much twisted, their border undulating, very similar to seeds of some form of 0. *pkaacantha.* From this species our plant seems to be distinguished' by its burger, thinner, more orbicular joints, the closer and more woolly pulvilli, the slenderer leaves, and the small number of very long spines; the ovary also is more elongated, the sepals narrower, the flower larger.

6. 0. PHAAOjjnBA, E. in Plant Fendl.: diffuse, adscendens; articulis obovatis sea suborbiculatis cnasia ghnrujflentnjui; foliis e fatsi crass* subnlatis; pulvillis subremotis orbiculato-ovalis setas gracflee stimmineas MU fate** tomato griseo pkramqae longiores gerentibus plerisque armatu; aouUis 2-6 rectis superiors [60] teretiuscalo pometa^ «rtob faminibos inaqoalibos pins minus angulatis sea oompressis deflexis fuscis sea

fasco-atris sursum pallidioribus ; flore flavo; ovario brevi pulvillis sub-20·tomentosis et fulvo-setosis versus superiorem ovarii partem congestis; sepalis tubi sub-13 exterioribus late oblanceolatis ceteris late obovatis cuspidatis; petalis 8-10 late obovatis obtusis submucronatis; stigmatibus 8 erectis ; bacca cuneato-pyrifonui late umbilicata vix pulposa; seminibus plerumque majusculis sub-regularibus crasse marginatis. (Tab. LXXV. fig. 9.-13.)

Var. a. NIGRICANS : obovata, viridior; pulvilli* iuagis approximatis; aculeis brevioribus acute angulatis mgricantibus.

Var. *0.* BRUNNEA : obovata, glaucescens ; pulvillis remotis; aculeis longioribus obtuse angulatis infra brunneis.

Along the Rio Grande near Santa Fe*, var. a (Feiidler) ; var. 0. common about El Paso, on the sandy ridges in the immediate valley of the river (Wright). —The northern plant has been correctly described in "Plant® FendlerianB,[9] with the exception of the flower, which probably refers to 0. *Musouriensis,* or some allied species. The variety from El Paso has remarkably thick and glaucous joints, which in fall and winter often assume a purplish hue; they are commonly 4 or 5 inches long and 2J-3 inches wide, the largest ones were 7 inches long and 4£ inches broad, sometimes they are more orbicular and shorter; leaves 2J-3 lines long, thick in proportion; pulvilli 1-1} inch apart, with dirty yellowish or brownish bristles, only the lowest ones without spines; spines usually 2-4, sometimes 4 or 6, and even more, in one bunch, 1-2 or sometimes 2£ inches long, terete or more or less flattened, but without sharp angles, often striate, light or dark brown below, whitish above, lower spines often entirely' whitish. Flower 2^-2i inches in diameter; ovary 10 lines long, 8 lines in diameter. Fruit lj-lj inch long, with the lower part contracted, solid and seedless ; umbilicus rather shallow. Seeds very variable, usually over 2 lines in diameter, but sometimes smaller.

6. 0. TEN u is PIN A, sp. nov.: diffusa seu adscendens; articulis mediis seu majusculis obovatis basi attenuatiB bete viridibus ; foliis gracilibus subulatis parvia, pulvillis subapproximatis setas breves graciles fulvas rufasve gerentibus, plerisque armatis seu inferioribus inermibus ; aculeis singulis binisve teretiusculis rectis gracilibus flexilibns albidis non raro basi apiceque fuscatis annulatisque, adjectis sepc inferioribus tenuioribus albis, superiore in arcolis superioribus porrecto, ccteris deflexis ; ovario clavato gracili pulvillis 25 versus apicem aggregatis griseo-villosis et fulvo-setosis stipato; sepalis tubi sub-13 obovato-orbiculatis abbreviatis cuspidati* ; petalis 13 obovatis sub-emargtnatis mucronulatis flavis basi aurantiacis ; stigmatibus 7-8 erectis virescentibus ; bacca minore oblonga profunde umbilicata, seminibus minoribus irregulariter angulatis anguste marginatis. (Tab. LXXV. fig. 14.)

Sand-hills on the Rio Grande near El Paso, from Doiia Ana to San Elizario (Wright). Flowers in May. — About a foot high, spreading; joints 3-6 inches long, 2-4 inches wide; leaves 2 lines long or less, | line in diameter; pulvilli | inch or in the largest specimens almost an inch apart, with short gray wool, and bright, reddish-brown, slender bristles, 1-1$ line long. Spines stiff and very straight, but flexible; lowest ones f-l£ inch long ; upper ones 1J-2J or farelj even 3 inches long, whitish or in some species brown toward the base or on the lower half, always darkish at tip. Flower 2}-3 inches in diameter; ovary 1-1J inch long, slender; sepals remarkably short; petals rounded or somewhat emarginate, *1-1 J inch long, 6-0 lines broad, yellow, with orange-red at base, turning all red on the seeond day of flowering. Fruit 1-1$ inch long, with a very deep umbilicus, and without any contraction at base. Seeds [51] 1.5-2.0 lines in diameter, deeply notched at the hilum, very irregular. Distinguished from the nearly allied 0. *pkaaeantka* by its thinner joints, slenderer and longer spines, larger flowers, different fruit, etc .

7. O. FILIPINDULA, sp. nov.: adscendens, glauca; radicibus nodoso-incrassatis tuberiferis; articulis minoribus diveiassimis orbiculatis seu obovatis seu oblanceolatis tenuibus; foliis minntis subulatis; pulvillis approximatis in tomento albo setas numerosas tenuisissimaii peniciilatas demum elongates Virescenti-stramineas gerentibus, plurimis armatis seu omnibus plus minus inermibus ; aculeis 1-2 albidin elongatis setaceis non raro subangulatis tortisque, 1-2 minoribus saepe adjectis ; ovarii subcyiindrici gracilis pulvillis 16-20 villo albo et setis parcis stramineis munitis ; sepalis tubi sub-8 lanceolatis, interioribus obovato-cuspidatis ; petalis 8 late obovatis retusis purpnrascentibus maigine pallidioribus; stylo purpurascente; stigmatibus 5 erectis flavidis; seminibus minoribus tumidis anguste cnwseuuo marginatis. (Tab, LXVIII)

Alluvial bottoms of the Rio Grande, in rather fertile mil, near DoEa Ana, above El Paso, and at 8an Hixario, below it; also on alluvial prairies between El Paso and the Limpu (Wright). Flowers in May and June. — The tubers of the root, J-l inch thick, are long and cylfndric, or oval, or globular swellings of the roots, strung upon thick fibres; these tubers will sprout when planted. The stems are 6-12 inches high and spreading ; joints of a bluish, glaucous hue, more so than any other of our species, wry variable in shape, orbicular, or even transverse to obovate and lanceolate ; often on the same plant, 1J-3 inches long, 1-2 inches wide, very much compressed ; leaves 1|-1| line long; pulvilli 4-6 lines apart, with a perfectly white tomentum, becoming gray when old, and numerous slender, gmnish-yellow bristles, which finally become 2-3 lines long and very conspicuous. Sometimes the joints are entirely spineless, bat usually they are armed with long, deflexed, very slemler white spines, the longer ones 1-2 inches, the lower and shorter ones lea* than 1 inch in length ; ovary slenderer than in any other upecien known to me, an inch loog, si lop hardly more than 3 lines wide. Flowers about 2J inches in diameter, purplish, without any mixture of

brick-red or yellow, as in the allied species ; the only other purple one of our *PlatopuntiK* is *0. batUaris,* which is of a yet purer and deeper purple color. Fruit unknown. Seeds have been sent which have germinated and produced plants which already after the first year showed the characteristic glaucous hue and the tuberous roots. These seeds also differ from all our other *Opuntia* seeds by their great thickness, and their remarkably narrow but thick and obtuse margin. They are only very slightly notched at the hilum, and have a diameter of 1.7-2.0 lines, with a thickness of 1.2 line.

8. 0. MACRORHIZA, E. in Plant. Lindh., from between San Antonio and Austin (Iindheimer), is apparently well distinguished by its large tuberous roots, which even the young seedlings very soon begin to show ; but without these it is hardly distinguishable from 0. *Rafinesquii,* £. of the Mississippi valley. I find the flower bud long-acuminate, and the stigmata always 5. (Tab. LXIX.)

9. 0. RUFIDA, sp. nov. : erecto-patula; articulis late obovatis seu suborbiculatis pubescentibus; foliis e basi lata subulatis longe acuminatis; pulvillis confertis griseo-villosis Betas rufidas graciles numerosissimas penicillatas gerentibus inermibus; floris flavi ovorio obovato pulvillis 40-50 instructo; sepalis tubi 20-30, exterioribus linearilanceolatis acuminati*, interioribus obovatis cuspidatis ; petalis (8 ?) orbiculato-obovatis obtusis eroeis ssepe inucronubtis; stigmatibus snli-7 abbreviatis in capitulum globosuin congestis.

Common about Presidio del Norte, on the Rio Grande, on rocks and mountains (Bigelow) ; in the lower [62] valley of the Nazas, southeastern Chihuahua (Gregg). Flowers in May. — Stems 2-4 feet high ; joints 2-6 inches long, pale green, without any red or colored spots surrounding the pulvillus, as is said to be constantly the case in the allied 0. *puberula* and 0. *decumbent;* leaves very slenderly acuminate, *ty* lines long, about twice the length of the axillary wool; pulvilli thickly tomentose, and with an abundance of very delicate brown-red bristles, almost entirely covering the surface of young or not fully-grown joints, in adult ones about 4 lines apart. The flower described above was obtained south of the Rio Grande, in the Bolson de Mapimi; ovary 10 lines long, flower 2| inches in diameter, stigmata (green ?) about 1 line in length. This species is nearly allied to 0. *mierodasys,* which is common in cultivation, and specimens of which from Saltillo I have been able to compare. Our plant has more rounded and larger joints, more distant pulvilli, which bear reddish-brown (not yellow) bristles and longer leaves. From 0. *puberula,* which seems to be yet nearer allied to it, it differs by the absence of spines, larger leaves, etc. Mr. Schott han noticed a pubescent *Opuntia* on the dividing ridge of the California Cordilleras, near the boundary line, and a suberect species in the Santa Cruz valley, in Sonora, about 3 feet high, both without spines. It is impossible to form any opinion where they belong, as no specimens have been saved.

10. O. BABILABIB, E. & B. in Pacif. R. R.: found by Mr. Schott in the Gila valley, and up the eastern dope of the California mountains. Flowers in May.

11. O. ARBNARIA, sp. nov. : diffusa, adscendens ; radicibus crassis elongatis rope stoloniferis ; articulis minoribus obovatis crassis tumidis seu subcompressis tuberculatis nitide virentibus ; foliis minutis pulvillo vix longioribus; pulvillis subconfertis parce albo-tomentosis Betas plurimas gracillimas pallidas demum in articulis vetustis numerosissimas pulvinatas fulvas gerentibus, omnibus fere annatis; aculeis superiorilms 1-4 sape subangulatis, summo Talidiore porrecto albido seu fusoo-rariegato, cvteris brevioribus divergentibus seu deflexift albidis; aculeis inferioribus 2-6 brevibna setaceis albis radiantibos; floribns sulphureis; ovario obovato pulvillis 20-30 setosis aculeolatisque inatructo; sepalis tubi 12-14, inferioribus late obovatis cuspidatw, superioribus obtusis; petalis sub-8 obcordatis seu emarRinatis snpe mucronatis; stigmatilms 5 mucronatis viridibus in capitulum collectis; bacca oblonga ovata aouleolis inaqualibus armaU; umbilico infundibaliformi; seminibus magnis irregularibus late craseeque marginalia, (Tab. LXXV. fig. 15.)

8andy bottoms of the Rio Grande near El Paso (Wright). Flowers in May. — Roots 3-5 lines thick, at last ligneous, far spreading in the loose sand, and sometimes stoloniferous, which I have also noticed in some forms of 0. *Mmouriensis;* stems spreading 2 or 3 feet, fr-1 foot high ; joints 1f-3 inches long, 1-2 inches wide, often terete or rather oral, or clavate (a specimen before me is 2| inches long and { inch thick), and always strongly tuberculate; leaves about a line long; pulvilli smaller than in *O.fragilu,* very sparingly tomentese, very bristly, the tawny bristles of the old joints covering almost the whole surface. Upper and longer spines 9-15 or even 18 lines long, white, with a yellow tip, or brown, yellow, or reddish at base and tip ; other spines 2-6 lines long, white. Flower 2-2| inches in diameter; ovary 9-12 lines long; filaments greenish-yellow; stigmata nearly 2 lines in length. Fruit dry, 10-14 lines long, contracted at top, with a deeply immersed umbilicus, and with spines of 1-6 lines in length. Seeds H-* Mnes in diameter.

This species is nearly allied to the northern 0. *fragile,* but is distinguished by the larger and more strongly tuberculated joints, smaller pulvilli set with numerous bristles, the longer and slenderer spines, and the spinose fruit

Subgen. 3. CTUNDBOPUNTIA. [53]

Articuli teretes, clavati sen cylindrici. Aculei plerumque vaginati.

Floras parvi sea majores. Petala obovata seu orbiculata, rubra seu purpurea, rarius flava,

Stigmata 5-8, obtusa.

Bacca umbilicata, sicca seu subsicca, rarissime pulposa; inenuis, seu setosa, seu aculeata; floris rudimentis dejectis seu persistentibus.

Seraina sntura commissurali cincta, plerumque iiniuarginata.

Embryo circa albumen copiosius subcircularis. Cotyledones contraria, incumbentes, baud raro obliquee, interduui parallels, accumbentes.

The species forming this subgenus have an appearance so striking, and at the same time so distinct from the common type, of *Opuntue,* that a generic separation has been attempted ; but the flowers are so entirely identical, and in the fruit so little difference is observed, that it had to be abandoned. The only real distinction, and a permanent one as far as my observation goes, I find in the embryo. In *Cylindropuntia* it is less curved, not completing an entire circle, and surrounds a more copious albumen ; in *Platopuntia,* on the contrary, it is somewhat spirally coiled, and the space for the albumen is thereby much smaller. It is worthy of remark that in *Oylindropuntia* the direction of the cotyledons is by far less constant than in other *Cactacea ;* though usually incumbent, as in all other *OpurUia,* they are very often oblique, and not rarely accumbent, like those of *Echinocachu.* In 0. *echinocarpa* I have found them invariably so,

§ 1. *Clavata.*

Steins prostrate; joints short and clavate, tuberculate, proliferous near the base; the ligneous tissue loosely reticulated, much like that of *PkUopuntia;* spines more or less compressed and striate, the epidermis not or but slightly separating from them; flowers yellow and rather large; fruit always dry, crowned by the persistent remains of the flower, beset on the pulvilli with numberless spiny bristles.

18. O. PAERTI, E. in Siilim. Journ. Dr. Parry observed this species on the eastern slope of the California mountains near San Felipe, and sent notes about it, an extract of which I published in Silliman's Journal. Since then Dr. Bigelow has collected it eighty or one hundred miles northeast of that place, near the Mojave River, and in his report a full account of the plant is given. Dr. Parry describes the joints as 4-8 inches long, ascending, with white spines only 6 lines long; flowers greenish-yellow, 1} inch in diameter; stigmata green.

13. O. EMORYI, sp. nov. : prostrata ; articulis cylindricis basi davatis glaucis adscendentibus ; tuberculis elongatis; pulvillis magnis setaa paucas rigidas gerentibus; aculeis plurirois rufis seu fuscis demum cineraacentibiis; interioribns 5-9 validioribus triangulatit compresms porrectis seu defiexis, superioribus solum suberectia; aculcis exterioribns 10-90 s»pe pluriserialibus undique radiantibus, superioribus gradlioribus teretiusculia, inferioribus rigidioribus Ampressis; floribus flavis eztus rubellis; bacca ovaU basi clavaU flava pulvillis 35-50 setosisdmis, ttipaU omnibus sen solum inferioribus aculeatis; seminibua numerosittimia valde inaqualibos plerumque tnnaversis indis. tincte commissurati*. (Tab. LXX.-LXXI.)

Arid soil south and west of El Paso, especially between the Sand-hills and Lake Santa Maria (Wright, Bigelow), in Sonora (Wright), and on the lower Oil* and in the Colorado deaert (Scbott). Flowers in August and September. — This is the largest and stoutest of our clavate *OpurUtm,* with very numerous and long npines, spreading [54] largely, and growing £-12 inches high, — forming a welcome retreat for the smaller Rodentia, snakes, etc^ which, under the protection of its powerful spines, are secure against the attacks of their enemies. Joints curved, 4-6 inches lon& 1-1J inch in diameter. The tubercles are 1-1) inch long, very prominent, and might be termed cylindric if they were not longitudinally attached to the stems. The upper tubercles of each joint and their spines are more fully developed than the others in this, as in all *Opuntue.* In those we distinguish 4 larger central spinet; the upper one more erect, the lower one «touter, longer, broader, and deflezed. We often find a second upper one above, and a second lower one below the other; or the 4 central spines are surrounded by a circle of 6 or 8 somewhat smaller •pines, which may be considered at an interior series of radiating ones; the exterior tenet consists of 10-20 shorter and more slender spines. But the arrangement of spines in this genus is never so regular as it is in other genera, especially in *Erhinoeaehu.* Stontett spinet 1J-2J inches in length, |-1 line wide, striated, flat on the upper, strongly earinate on the lower surface, so at to appear triangular; other interior spine* 1-2 inchea, exterior onet J-1} inch long. Fruit 2-2} inches long, an inch in diameter; larger pulvilli 2-2| linet in diameter; brUtlet whitish or reddish, 3-4 lines long; 10 or 12 spinet, 4-8 linet in length, are mixed with the bristles on all or only on the lower pulvilli. Seeds, very different in size and shape, in the name fruit, 2|-3 linet in diameter or more, often transverse or «''g''l**, blunt or beaked ; cotyledons generally obliqne, sometimes accunibtnt, contrary to the usual arrangement in this genua. The specimens from the lower Oila and the Colorado murt, I have little doubt, alto be referred here. Plant 11-18 inches high, far-spreading, of a dull grayish-green color; jointa similar to those described above ; tpinet only

1-1J inch long; flowers sulphur-yellow, externally tinged with purple, 2 or 2£ inches in diameter; pulvilli of the ovary over a line in diameter, white-tomentose, supported by subulate leaves (2 lines long) bearing short white bristles and reddish spines; exterior sepals oblanceolate, cuspidate, red-brown, interior ones with yellow and red petaloid margins; petals yellow, with red tips ; fruit not as large but even more spiny than in the specimens from £1 Paso.

This species also has been named in honor of Colonel W. H. Emory, who, in his different expeditions to the extreme southwestern parts of our territory, always exerted himself for the advancement of our knowledge of the natural history of these regions.

14. 0. SCHOTTII, sp. nov.: articulis breviter clavatis adscendentibus; tuberculis elongatis; pulvillis pauci-setoeis; aculeis scaberrimis rubellis, iuterioribus 4 cruciatis, superiore triangulate erecto, oeteris ancipitibus supra planis subtus convexis, inferiore latiore; aculeis exterioribus 8-10 radiantibus valde inoqualibus; bacca obovato-clavata, pulvillis 35-40 setas suberectas aculeooque paucos gerentibus ; seminibus angulatis rostratis transversis, commissure lineari indistincta. (Tab. LXXIII. fig. 1-3.)

Abundant on the arid hills near the Rio Grande, between the San Pedro and Pecos rivers (Wright, Schott).— The specimens gathered in July and September were all in fruit Joints 2 inches, tubercles 8-9 lines long; pulvilli, even in the oldest joints, with few bristles. Spines rougher than in any other allied species, red, the broader ones with a white margin, 1J-2 inches long; smaller radiating spines 4-9 lines long, almost surrounding the inner one. Ovary with white-tomentose pulvilli and short bristles ; tboae in the fruit become a little longer, but are confined to the upper half of the pulvillus and are erect, while in all the allied species they are much more numerous and stellately spread in all directions. Seed a little over 2 lines in the transverse diameter; cotyledons in all [55] the seeds examined oblique. Dedicated to one of its discoverers, whose name I have often had occasion to mention.

Dr. Gregg has sent a similar plant from San Luis Potosi, Mexico, which, though growing 7 or 8 degrees farther south, I must consider the same as 0. *Schottii.* Its joints 2 inches long; tubercles 10-12 lines long; 4 central spines ancipital or triangular, 12-20 lines long, much less rough, 8-12 exterior spines of very different sizes. (Tab. LXXIII. fig. 4.)

15. O: GRAHAMI, sp. nov.: radicibus crassia fusiformibus; articulis breviter clavatis adscendentibns bete viridibus; tuberculis oblongis ; foliis e basi ovata abrupt* acuminatis; pulvillis albo-tomentosis setas demum nnraerosas elongata* rigidas gerentibus; aculeis gracilibos scabris rubellis demum cinereo-fuscis, interioribus 4-7 robustioribuB scabrift tcretiusculis sen 4-angulatis sen rarius compressis, exterioribus 4-6 multo niinoribus ; flore flavo ; ovarii pulvillis sub-30 albo-tomentosis setosis; bacca ovata setouissima; seminibus regularibus vix rostratis, com-miseura lineari indistincta. (Tab. LXXII.)

Sandy soil in the bottom of the Rio Grande, near El Paso, and for a distance of about one hundred miles along the river (Wright, Bigelow). Flowers in June. — Boots often 6 inches long and an inch thick, tapering, single or divided ; joints 1f-2 inches long, | or at most 1 inch in diameter ; tubercles 6-7 lines long ; leaves similar to those of *0. vulgarity* short and thick, nearly a line in diameter at base and about twice as long ; larger spines 1J-2 inches long and spreading, scabrous, slenderer than in any allied species. Flowers apparently 2 inches in diameter, and, like the fruit, very similar to those of *0. davata.* Seeds 2.5-2.8 lines long, with a linear and often very indistinct commissure; cotyledons in the seeds examined regularly incumbent

This epeciea, peculiar to an interesting part of our boundary, has been named in honor of the gentleman who was for a time chief of the scientific corps of the Commission, and by whose- orders this, with many other species of *Oacti,* has been sent to me.

16. 0. BULBISPINA, sp. nor.: radicibus furiformibus; articulis panris ovatis vix cUnratis gaping ex apice proliferis fagilibus ; pulvillis parce setotis, junioribus laxe villoeis ; aculeis teretiuscnlis scabrellis basi bulbosift, interioribog 4 cruciatis, inferiore lonrfore, exterioribns 8-12 radiantibus. (Tab. LXXIII. AR. 5-6.)

Near Perns Bravos, north of Saltillo (Greg*). — Spreading masses 2-4 feet in diameter; joints 0-12 lines long, 6 lines in diameter, often proliferous at the upper end ; tubercles 3-4 lines long; interior spines 4-6 lines, exterior ones 1J-3 lines in length. This species ban the subcylindric joints, the reticulated ligneous texture, and the scabrous spines of the davate *Opuntia,* but its mode of ramification is rather different, and the form of the joints is more ovate than davate. Perhaps it belongs rather to Prince Saliu's section *GlomeraUc,* and near *0. putiQa* from South America.

§ 2. *Cylin&rica.*

Stems ascending or usually erect, much branched ; joints cylindric or tumid, tuberculate or sometimes almost smooth. The ligneous tissue is compact, and either (in spec. 17-24) forms a reticulated hollow tube, in which the meshes correspond with the tubercle*, and which by age becomes more and more solid and massive, or it is (in spec. 25-28) reticulated only when quite young, and soon becomes quite den*e. The spines are almost always terete, and are always covered with a loose glistening Aeath. Flowers purple or rarely yellow, large, or usually

middle-sized or (in the two last species) quite small. The fruit is unarmed, somewhat fleshy or leathery, rarely [5G] pulpy, throwing off the dead flower, or very rarely retaining it In a few species it is dry and spiny.

17. 0. ECHINOCARPA, E. & B. in Pacif. Rail. Rep., Var. /3. MAJOR : elatior; articulis elongatis basi attenuatis ; tuberculis oblongo-linearibus ; eetis tenuibus penicillatis; aculeis lungioribus laxius vaginatis paucioribus ; bocca globosa seu basi clavata pulvillos pauciores gerente.

In the deserts on both sides of the Colorado and in Sonora (Schott). —This form looks very different from the plant collected by Dr. Bigelow, and described in the Report of Captain Whipple ; but the very peculiar seeds which fortunately have been obtained by both collectors prove them to k* identical. Dr. Bigelow's plant is a low straggling shrub; but Mr. Schott's is 4 or 5 feet high, with divaricate branches, joints 8-10 inches long, with elongated tubercles (6-9 lines in length), fine long bristles, and longer spines with looser sheaths. The 4 central larger spines are 1-1] inch long; the 4-8 radiating spines, on the contrary, shorter. The fruit is longer, and Deal's only about 25 pulvilli, as spiny as in the original form.

18. O. SERPENTINA, E. in Sillim. Journ. 1852: diffusa; rainis elongatis subverticillatis divaricatis adscendentibus; tuberculin prominentibus ovatis ; pulvillis albido-setosis; aculeis 7-9 vaginatis albidi* seu rufescentibus porrectis, infimis deflexis; floribus minnribus flavis extus rubellis; ovario depresso pulvillis sub-20 sti|>ato; sepalis 10 late obovatis breviter cuspidatis; petalis sub-5 obovatis integriusculis mucronatis; stigmatibus 8 erectis; bacca sicca subhemisphaerica villosa aculeatissima late et profunde unibilicaU flore eiuarcido soepe coronata.

Dry hills near San Diego, California (Parry); generally nearer the sen-coast than 0. *prolifera,* and not gregarious, nor so common as that species (Schott). — Steins 1-1} inch in diameter, suberect, 4-5 feet high, or almost prostrate ; joints (M2 inches long, j - l| inch thick, somewhat verticillate, divaricate; spines 3-9 line* long, sheathed, light-yellowish or rusty, upper ones stellate-divaricate, lower one closely deflexed. A single flower was collected by Mr. Schott in October : it is not quite 1} inch wide, the ovary depressed, about 8 lines high, with 20 arpnlm tearing dirty-yellowish wool, yellow bristle*, and 5-7 reddish-brown sheathed spines, 2-4 lines in length ; sepals externally yellowish-green tinged with purple, even the lower ones unusually obtuse or short cuspidate ; JKUIB rounded, scarcely 9 lines long, yellow above, red at tip, ascending and forming a cup-shaped corolla; stigmata feiwn ?) 2 line* long. Fruit aaacer-shaped, deeply and broadly umbilicate, yellowish-brown, very spiny, and "long woolly."

19. O. PBOLTFERA, E. 1. c.: caule arborescent* ; ram is numerous horixontalihn* divaricatiaaimis; articnlii oratis sen ovato-cylindricis tumidis fragilibut versus ranmrum apicem congestis perviridibus, inferioribus deraum refraetis brunneis; tubercolit obovato-oblongit prominulis; pulvillis ovatis tomentosis, vetustiorihus stramineo-setosis; aculeis 8-10 oliscuris stramineo-neu rufo-vaginatis, singulo subcentraii, casteris patulis stellatis, inferiorihu* brevioribut; flore rubro; sepalis late ovatis; petalii oblongo-obovatis; stigmatibus erectis; bocca ovata umbilicata aculeolata sstpissime sterili proliferaque.

On arH hills about San Diego, California, near dry beds of stream*, forming impassable and extensive thieketo (Parry, Schott). — These thieketo are likened by Mr. Schott to unapproachable coral reels. Stem 8-4 and sometimes even 5-7 inches thick, and 3-10 feet high; the wood forms a reticulated hollow tube, with abort meshes, which in old plant* finally become obliterated. Hie tumid joinU are 3-6 inches long, 1J-2 inches in diameter, clustered at the end of the branches; the younger ones easily break off and stick to the skin of men or animals. The [57] tubercles are obovate, narrowed below, and about 6 lines in length, arranged in 5 or 8 spirals; arenlie oval, somewhat immersed, with bunches of fine straw-colon*! bristles at the upper edge. Spines *ery* variable, always with large loose sheaths : in a specimen before me I find 7-8 radiating spines, ihe upper \>nes and the central one equal, about 12-14 lines long, the lower ones 6-8 lines long, with a few still smaller ones Mow; in other specimens the npper spines are reduced in size or are wanting. Flower* dark-red, salverfonu, alwut If inch in diameter. Fruit said to be spiiiulose, but always abortive, — as Dr. Parry bos often salitfied himself, — and usually proliferous,

This species somewhat resembles *(). arborescttu,* but is easily distingui»hed by the short and tumid joints, short tubercles, spiny fruit, etc. The alliance with the next species and with *0. Bigelovii* is much closer. They represent the same type east of the California mountains that this does on the Pacific coast; just as 0. •*ckimocarpa* ia the Colorado valley represents another type, which has ou the coast its representative in *O. mrpentituu*

20. O. rruuDA, sp. nov.: caule em*to arborvscente flexuoso; nun is divaricatis; articulis ovatis sea orato-cylindricis tumid is ^laitrescentilius ad ramorum apicetu congesti*; tultcrruli* ovalo-oblongi* sub-pmniinults; foliis ovatis cuspidatis ; pulvillis pulvinati* ovatis tomentosis st'tas pallide strmuinvu* et oruli«« 7-0 subuquale* laxe vaginatos undique porrecto* stellatos gerentibus; florin parvi purpurei ovario ovato pulvillis 25-30 all>o-tomentosis pnsdito setis aculi*iw|ue destituto; Sfpalis tubi 8-10 orbiculatis obtusis crvnulatis; |wtolis 8, exterioribos cuneatis ittntis crenulatis, intimis lanceolatis seu tin ca*Ur» su|wraiiittbus; sti^natibus 5 erectis j bacca ovata pulposa vix tahficnlato plane umbilicata svpiwimff sterili et fasrirulatim prolifrra; seminihtis panris irrcgulariter angulalis voalratis anguste commissumti* ; cotyledonibti* i^ulariter innrmbentibus. (Tub. LXXV. fig. *K)*

Throughout all the Sierras in western Sonora, named by the inhabitants "Vela de Cojote," whence the specific name; which, however, would be just as appropriate for most other cylindric *Opuntim,* which are often visible for several miles when the sun strikes the glistening sheaths of their spines. Flowers in July and August. — Stems 5-12 feet high, flezuous with few divaricate branches; joints clustered at their ends, 3-8 inches long and often 2 inches in diameter, "dull-grayish, inclined to olive ;" tubercles ovate-elongate, 6-7 lines long; leaves thick and only about 1 line long ; spines almost equal in length (1-lJ inch), stellate and not much deflexed, completely hiding the surface of the young joints ; ovary about 10 lines long. Flower cup-shaped, mostly less than an inch in diameter. Fruit a plump fleshy berry, oval, rounded, not or only slightly tuberculated, 1-lJ inch long, a little less in diameter, and entirely spineless ; characterized by the large white tomentose pulvilli. Seeds 1-1} line in diameter, or with the beak often 2 lines long, much compressed, and thin and very angular, often oddly shaped. The fruit is not rarely sterile and proliferous, and becomes pendulous from the weight of the young sprouts attached to it.

21. 0. WHIPPLEI, E. & B in Pacif. Rail Rep., var. 0. SPINOBIOR : elatior, erecta; articulis cylindricis; tubercnlis ovatis confertis ; pulvillis parce tomentosis, vix setosis; aculeis 12-14 stramineo-vaginatis stellato-porrectis; flore rubro; ovarii ovati tuberculati pulvillis 20-90 albo-tomentosis Betas stramineas et aculeolos paucos mox deciduos gerentibus ; sepalis 8 orbiculatis cuspidatis; petalis &-10 spathulatis cuspidatis; bacca subglobosa leviter tuberculata inernii; seminum coniiuissura lineari.

From the Qila south to the Santa Cruz River and Tucson, and farther east (Scbott). Flowers in June. — Stems 6-10 feet high ; joint* 4-12 inches long, J-j inch thick, covered with ovate or rather rhombic tubercles; [68] spines much more numerous in this variety than in the original form, found by Dr. Bigelow farther north, 6-9 lines long. Flowers 1j-1} inch wide, cup-shaped. Seeds nearly 2 lines in diameter, larger than in the northern form, with a very sharply marked linear commissure.

22. 0. ARBORESCENS, E. in Wisliz. Rep.: canle arborescent* erecto reticulato-lignoso; ramis verticillatis horilontaliter divergentibus seu pendulis ; articulis verticillatis plerumque ternis quaternisve cylindricis perviridibus; tuberculis elongatis cristatis; foliis teretibus elongate patulis; pulvillis ovatis pulvinatis breviter tomentosis vix setosis; aculeis 8-30 cornets seu fuacis stramineo-vaginatis undique stellato-porrectis, 1-8 interioribus longioribus laxiu* vaginatis, centrali sub-deflexo, exterioribus debilioribus arete vaginatis; flore purpureo inagno; ovarii subglolwsi tuberculati pulvillis 20-25 breviter tomentoeis setas minutas et aculeolos paucos erectos deciduos gerentibus; sepalis tubi 8-13 obovatis obtusia medio virescentibus margine purpureis; petalis 10-12 obovatis obtusis retusisve ; filamentis purpureis; stigmatibus 8; bacca globoaa seu bemispharica tuberculis prominentibus cristata late umbilicata inermi sulmcca flava ; seminibus regularibos auguste commissuratis ; cotyledonibus incumbentibuB sea rare obliquis. (Tab. LXXV. fig. 16-17.)

This species extends from the upper waters of the Arkansas and the Platte rivers deep into Mexico, and from the plains east of the Llano Estacado (200 miles east of the Pecos) to Zufii, 150 miles west of the Rio Grande, about 15 degrees of latitude and 8 of longitude. Flowers in May and June. — North and east this species is only about 5 feet high, but farther south it is said to become 20 or 30 feet high; even the old trunks continue greenish and spiny. The massive ligneous skeleton is always characterized by the elongated-rhombic meshes and the verticillate insertions of the branches ; in very old specimens the cavity of the tube and the meshes become almost obliterated by the filling in of ligneous layers. The roots are often somewhat tuberous by a swelling of-the fibres. Joints 2-6 inches long, less than an inch in diameter; tubercles compressed-cristate, elevated, 7-8 lines long; leaves 6-10 linet long, hardly a line in diameter. Spines very variable in number and size; sometimes we find only 8-12 spine*, not half an inch long, so that the plant from a distance appears spineless, but more frequently 20-25 or even more spinet occur, the longest middle ones deflexed, and 8-10 or rarely lfc-14 lines in length, other spines spreading all around, 4-8 lines long. The beautiful purple flowers are 2J-3 inches in diameter, and often profusely cover the tree; the stigmata have a length of 3 or 3j lines. The fruit is about an inch long in all dimensions ; umbilicus wider or narrower, shallower or deeper, according to the greater or smaller prominence of the upper tubercles of the fruit Seeds lf-2 lines in diameter, usually of a regular shape, with little or no beak; the commissure distinct, and between 0.1 and 0.2 line broad; cotyledons almost always regularly incumbent, rarely somewhat oblique. Sometimes 3 cotyledons are observed in the seeds of this species, as is also the case in many others.

83. O. MAICILLATA, A. Schott in litt. : caule arborescente reticulato-lignoso divaricate-ramomssimo; articulis ovato-cylindricis entasis abbreviate retusis perviridibus ; tuberculis ovatis tumidis prominentibus ; foliis ovatis abbreviate cuspidatis ; pulvillis ovatis albo-tomentosis setas brevissimos seu nullas gerentibus; aculeit 4-6 gracilibus brevibut arete vaginatis stramineis, plerisque deflexis; flore parvo purpureo; ovarii ovati pulvillii 18-24 pulvinatis albo-tomentosis; sepalis tubi sub-8 orbiculatis ; petalis 8 late obovatis abbreviatis; filamentii exterioribus dilatatis (sterOibun T); atigmatibus 7-8 erectis ; bacca ovata plane umbilicaU pulvillis magnis albo-tomen- [50] tods inermibus notata; aeminibus parris angulatis rix rostratis anguste eommisfturatis valde compressis. (Tab. LXXV. fig. 10.)

South range of the Sierra Babuquibari, iii Sonora, and southeastward, in fertile valleys (Schott). Flowers in July and August. — This peculiar specie* is more tree-like than any other Sonorian *Opuntia.* It has a distinct trunk and a dense top, much like any other ordinary tree, though only 5 or 6 feet high ; the joints are 3 or 4 inches long and *H* inch in diameter ; the swelling tubercles much resemble those of a *MamiUaria,* whence the name ; the thick leaves are scarcely a line long; spines few, 3-9 lines long, sometimes almost wanting. The flowers are hardly an inch in diameter, and of a bright pink or purple color; the ovary is 8 or 9 lines long, and the fruit of the same length, slightly tuberculate, in all the specimens before me unarmed (according to Mr. Schott's notes, [a]spiny"). Seeds 1-1 i line in each dimension, often higher than broad, very irregular, remarkably similar to those of *0. fulgida,* but scarcely beaked, and still more compressed ; cotyledons incumbent or often somewhat oblique.

24. O. THURBERI, sp. nov.: fratescens, erecta ; articulis cylindricis gracilioribns tuberculatis; tuberculis oblongo-linearibus minus prominulis; pulvillis sub-orbiculutis breviter fnlvo-tomentosis vix setosis; aculeis 3-6 brevibus obscuris stramineo-seu fulvo-vaginatis lateraliter divergentibus, infiino robustiore deflexo; flore miniato; ovarii clavati tuberculati pulvillis 18-20 tomentosis brevissime setosis et parce aculeolatis; sepalis tubi obovatis cuspidatis; petalis erectiusculi* obovato-spathulatis obtusis retusisve; stigmatibus 7 brevibus crassis erectis.

Near Bacuachi, Sonora (Q. Thurber). Flowers in June. — Similar in some respects to 0. *arborescent;* but the slender joints only about 6 lines in diameter; tubercles 9 lines long; spines 3-8 lines long, the lowest one the stoutest! and deflexed.. The ovary is about 10 lines long, and bears on some of the pulvilli 1 or 2 spines, which are evidently deciduous, as we see them in *0. arborescens* and *0. IVhipplei.* The flower is lj inch in diameter, dull brick-red, salver-form, and opens much less than that of *0. arborescent,* which is pure purple ; stigmata 1-1J line long.

This species I have named for its discoverer, Mr. George Thurber, who, in Mr. Commissioner Bartlett's party, traversed Sonora, and gathered many interesting plants in that then almost unknown country.

25. O. WRIGHTII, sp. nov. : caule frutescente erecto, juniore reticulate, seniore compacto-lignoeo ; ramis adscendentibus ; articulis cylindricis graciiibus sub-tuberculatis ; tuberculis elongatis depressis ; foliis elongatit subulatis patulis ; pulvillis orbiculatis albo-tomentoeia setas gracillimas penicillatas gerentibus ; aculeis singulis (sen rarius 1-2 superioribus minoribus adjectis) porrectis seu paulo deflexis e cinereo rubellis vagina straaninea decidua indusiatis; flore miniato; ovarii obovati pulvillis 15-18 albo-tomentosis setosisque ; sepalis tubi £-12 orbiculatis, exterioribos cuspidatis, interioribus obtusis; petalis sub-8 late obovatis emarginatis; styli crassi stigmatibus 6-7 brevibus odpressis.

Common on steep rocky mountain-sides on the Limpia (Wright), and along the Rio Grande from Presidio del Norte to the Pecos (Parry, Bigelow) ; also southward, in Mexico (Gregg). Flowers in Jane and July. —A shraK, 2-4 feet high, about 1 or IJ inch thick below, intermediate between *0. arborescens* and *O.fmiescens* in six*, structure of •tern, and arrangement of spines. Branches few; joints 4 lines in diameter; tubercles flat, 7-9 linès long; leaves about 6 lines long. Spines 8-10 lines in length, generally single or with 1 or 2 small and divergent ones above; in one specimen before me those upper spines are almost as stout and long as the lower one. Flowers About 1 or 1$ inch in diameter; ovary 7-4 lines long. Fruit unknown.

This pretty species of *Opuntia* bears « nam* which has been often mentioned in these pages, and which is *[60]* forever inseparably connected with the botany of oar Southern boundary.

26. O. ARBUSCULA, sp. nov.: canle erecto arborescent* dense lignoso apice ramosisrirao capiUto; nunis divari-eatis elongatis teretibas etuherculatis; articulis junioribus l»te viridibas leviter tuberculatis; tuberculin oblongo-lineiribus depressis; pulvillis niagnis orbiculatis albo-tomentosis; setis parcis gracillimis penicillatis; aculeis singnlis (*eu subiude binis lateralibus) porrectis demum deflexis stramineo-sea fulvo-vagiiiatis, rarius une alterove breviore inferiore deflexo adjecto; flore flavo-virescente; ovarii clavati pulvillis 16-18 albo-tomentosis vix setosis; eenalis tnbi sub-8 orbiculatis cuspidatis sea macronatis; petalis sub-5 spathulatis, staminibos extos in staminodia latiora tabulate transeuntibus; stigmatibus 5 brevibos rrectia.

On the desert heights, near Moricopt village, on the Oila (Schott). Flowērs in Jane. —A truly arbormceitt species, 7-8 feet high, with a solid ligneous trunk, 4-5 inches thick, smooth green berk, and a top formed by the numerous slender and divaricate branches; ultimate joints 2-3 inches long, about 4 lines in diameter; tubercles flat and indistinct, about 6 lines long; spine 9-12 lines long. Ovary, in my specimen, 10 lines long and only 4 lines in diameter, without any spines; bat the fruit in described by Mr. Schott as [M] bristly, crowned by the persistent fluvrer.* Flower apparently nearly 1| inch in diameter; petal* few, 9 lines long and 4 lines broad, greenish-yellow, tinged with m1. Stamina and staminodia (perhaps what I consider no are bat the broader filaments of the exterior fertile stamens) finally breaking off near their base, leaving a rough surface. The name of this species indicates a small tree.

27. O. r*tmncB!fii, E. in Plant Lindh., was collected abundantly in all western Trxas and southern New Mexico. For a fuller account and a figare, see Engelmann and Bigdow's paper on the *Cadacsm* of Captain Whipple'f Pacific Railroad Exploring Expedition Report

28. 0. TESSELLATA, E. in Pacit Rail Rep. (0. *ramosissima,* E. in Sillim. Journ. 1862).—This curious species was first noticed by Dr. Parry, and described, as above cited, in an account of his California *Cactacecc,* under the name of *0. ramosissima;* which, being deemed an improper name in a section where all could claim it with equal and some with greater justice, it was changed in the account of Dr. Bigelow's plants, who brought specimens of the wood, the branches, and the fruit Mr. Schott, the third botanist who collected it, was fortunate enough to And the flowers. Living plants are jet a desideratum in our gardens.

This species grows in arid sandy soil, from the Sierra Madre south of the Gila to the lower Colorado, Bill Williams'a Fork, and the California mountains. Mr. Schott found it in September with flower and ripe fruit The flower is purple, about 6 lines in diameter; the clavate ovary is of the same length, and bean 40 or 60 very tomentose but scarcely spiny or bristly pulvilli; the 6 petals are almost orbicular; the exterior filaments are broad and persistent (sterile staminodia ?) ; 6 stigmata short and erect The fruit resembles very much those of the clavate *Opuntue;* it is 9 or 10 lines long, dry, ovate, and contracted above; the narrow and deep umbilicus contains the remains of the flower, the above-mentioned broad filaments being most conspicuous ; externally it is covered with a profusion of hair-like flexuous bristles of a red-brown color, 2-3 lines in length, mixed with dense wool. Seeds thick, with a broad spongy commissure, 1.8-2.0 lines in diameter. Mr. Schott collected in May other greenish-yellow flowers from similar bushes, which he considers as of a distinct variety. The ovary in these flowers appears elongated, and is probably sterile, and would have become persistent and proliferous, as we find it in many other *Opuntiw;* so that this green-flowered form probably is not a variety of our species, but a degeneration.

CORRECTIONS TO THE CACTACEJE OP THE BOUNDARY.

A voyage to Europe, since my paper has gone through the press, has afforded me the advantage not only of the per- [78] •anal intercourse with numerous men of science and many cultivators, but also of an actual examination of various large collection* of living *Cactacea.* Some of the results of my investigations, as far as they bear upon the " Cactaces of the Boundary," have been incorporated with the list of corrections of typographical errors.

Page 2, line 22 «= page 177, line 9. *Sepalxs peialisque.* It will scarcely be necessary to inform the reader that the numerous foliacoous integuments of the cactus-flower do not very properly range under the divisions of *aepaU* and *petals.* For convenience' sake, however, the exterior more herbaceous ones are called *sepals,* and the interior ones, with thinner texture and brighter color, are named *petals.* The "sepals" usually are more numerous than the "petals," and in most genera form a complete transition from the organs — which on the stem represent the leaves (usually with their spiny appendages) — to the petals. On the ovary they usually resemble the former, which, among other reasons, seems to give color to the suggestion of Zuccarini mentioned in the note to page 39, line 29 = page 200, line 52.

Page 4, line 12 « page 177, line 22. I follow De Gandolle in giving, as one of the characters of the species, the number of the more distinct spirals of the tubercles in *Mamillari** and cylindric *Opuntict,* just ai we describe the number of ribs of *Eckinocacti* or Caret. It is now well known that no character can be deduced from the direction of the spirals to the right or left. It is also known that the greater or less prominence of one or the other spiral depends on the number and crowded state of the tubertles and the comparative thickness and elongation of the axis. The characters deduced therefrom are not absoUite, nor an they quite scientific It would be more exact to state the phyllotactic law of the arrangement of the tubercles. I would bare to say that *M. mieromeris* has its tubercles arranged after the H or even the |J system. But I suppose the plan followed by me is more intelligible to roost readers, and not much less clear to the scientific phylloUxist

Page ft, line 4 — page 178, line 8. *M. microtheU* is well distinguished from our species by its much larger tubercles and 2 unusually stout and short central spines.

Page 5, line 86 — page 178, line 88. The pale yellow spines look like fibres of raw oik, and form a silk-like tuft, but are not *tipped by a brush,* as the original edition had it

Page 7 — page 179. *M. Orahami* is nearly allied to *M. Sehelhasii,* Pfr., from Beal del Monte, Mexico. The [74] next species, *M. Wrightii,* is closely allied to *M. eephyranthoides,* Scheidw., from Oaxaca, Mexico. Without the flower, however, and es]tecUlly without the fruit and seed, —which latter has never been paid attention to, —these plants can scarcely be sufficiently well characterized nor their relationship ascertained.

Page 9 — page 180. *M. spkariea* is almost too closely allied to the Mexican *M. Longimamma,* DC.

Page 10, line 41 — page 181, line 54. The plant here described as a variety exactly agrees with some original specimens of *M.* A&Wft preserved in the collection of Prince Salm-Dyck. It will not be useless here to urge the importance of preserving the dead etotns plants, or, as these specimens are fancifully called, the " skeletons." I have been materially assisted by being able to examine the skeletons of some authentic original specimens, of which no living ones are now found in the gardens; bat generally the dead plants are thrown aside, and a description, often vague or incomplete, or at beat an indifferent figure, is all that la left for future identification. Unscrupulous gardeners and traders do their best to increase the confusion.

Page 12 = page 183. *M. pectinate* is probably not sufficiently distinct from *M. radians,* DC, and, with it and both the following species *(M. Echinus* and *M. seolymoide** may belong to *M. cornifcra,* DC.; the two former being the forms without, and the three latter those with, central spines.

Page 14 = page 183. *M. scolymoidcs.* A specimen brought by Dr. Bigelow has flowered. The flower greatly resembles that of *M. pcctinaia,* figured on Plate XI., but is more of a reddish than yellow tinge. Dr. Poselger assures me that they also vary with white or whitish flowers. *M. tubcrculosa* is clearly identical with *M. strobilifunnis,* Schcer in Salm, Hort. Dyck (1850), as I have ascertained by a careful examination of the original specimen (now dead) in the collection of Prince Salm. Mr. Scheer's name, having the priority, must be substituted for mine.

Page 17 = page 186*. *M. heteromorpha,* Scheer in Hort. Dyck, 1850, is the same species, to judge from the "skeleton" of the original specimen in Coll. Salm. — *Anhalonium.* As the genera of *Cactacca* are now constituted, *Anhalonium* will probably better be kept distinct from *Mamillaria.* A second section of the genus, with flattened tubercles arranged into rib*, would comprise *Echhwcactus Williartisii,* Lem. The tufts of dense wool on this plant do not represent the (absent) spines, but are axillary productions, surrounding and partly including the flower and fruit. The ovary is perfectly naked, as in other *Anhalonia* or *Afamillaricc,* which has already been noticed by others. The interesting *Ltuchtcnbcrgia Principis,* Fisch., may possibly have to be reduced to a third section of this genus. The flowers being borne just below the tip of the nascent tubercles (which, when full grown, are 3 to 6 or 7 inches long, prismatic or awl-shaped, and bear at the tip several flat flexible scales ill [75] place of spines), the plant can have no affinity with *Ccreus.* If the ovary should prove to be nuked, the large flower and elongated tube would not be sufficient to separate it from *Anhalonium.* Mr. Labouret, in *bin* " Monographie des Cactées," Paris (without date, probably 1853), page 162, notices the position of the flower. I have seen the young buds below the apex of the tubercle at Kew, and the scar left by the fallen fruit at Mr. Haage's in Krfurt, but could not meet with either flower or fruit itself. — *A. fissuratum* is very nearly allied to the Mexican *A. sulcatum,* Salm *{A. Kotchubei,* Lem.), of which it seems no living nor dead specimen is at present extant in Europe. The upper surface of the tubercle of *A. suleatum* is said to be deeply grooved, the groove being tilled with silky tomentum ; otherwise the tubercles are said to be smooth.

Page 21 =» page 188. Fig. 12 exhibits (he enlarged *funieuli,* which consist of a loose juicy tissue. It seems that in most *CicUxctct* the *funiculi* toward maturity become large and juicy. Usually their cells then burst, and form the so-called pulp, in which the seeds are described as nestling, — " semina nidulantia."

Page 23, line 14 = page 190, line 6. It ought to have been mentioned that the lower central spine is is long AS the others, or more commonly greatly exceeds them.

Page 26 = page 192. *E. harizonihalonius.* Numerous original specimens of this plant, living and dead, examined in European collections, leave no doubt of the entire identity of the different forms, which can scarcely be counted as varieties.

Page 38, line 31 = page 200, line 6. *C. pentalophui* is *erect,* " 10-15 inches high," only when to trained. It [76] grows naturally like *C. BerlandUri, C. procumbnu,* and *C Ehrenbrrt/ii,* Pfeif., all of which closely resemble one another in habit. *C. penlalaphus* has a 5-anglnd stem of bright green color, with short npine* ; *C. Ehrtnbtryii* is usually 6-angled, pale green, with numerous long and setaceons spines. Flower and fmit of either seem to be unknown.

Page 39, line 21 => page 200, line 45. The root of young plant* forms a tingle globose tuber ; in older onet it consists of a cluster of several oval or rylindric tubem, sometimes 6 or 8 in number, 1-1} inch in diameter and 2-3 inches long.

Page 39, line 29 = page 200, line 52. After " family," add : "or the specimen observed by Dr. Poarlger offered one of those rare anomalies (one of which, found by Zuccmrini in *Crrrus Merprniinut,* was figured by him in the Annals of the Munich Academy) where the ovary actually form* the continuation and termination of a branch, by which the sagacious observer Just mentioned wma induced to consider the so-called ovary of *Cadaeuz* itarlf a branch, with the real ovary immersed in it. But how would he view it in *Mamillaria f* "

Page 41, line 13 — page 202, line 1. This is *C. Patuïu* Salm, Hort. Dyck, • Ut-%r MIne.

Page 46, line 26 _ p*g« 205, line 28. Cultivated specimen* of *O. grandiM* art erert, because, tied to the stake, they art not permitted to grow otherwise. Their white Hpinm neem t« grow dark vi*ry soon, and the • mailer number and greater distance of the spines may be owing to the influence of cultivation. There i» therefore scarcely a permanent character left to distinguish the new species from this one.

Page 47, line 8 — page 206, line 7. This *margin* is the enlarged and indurated */nnicului* itself, which, by a lateral expansion, envelopes the teed proper and forms iu exterior bony coating. This dilatation of the *fumiculu** takea plaot long before the flowering period ; it coven the *oruJum* to completely that only two small lateral openings remain, which lead to the *or&a.* After Mr. Payen and othen had already noticed thi- expansion of thr */umiemims.* Dr. Caspar?, of Boon, lataly baa mow completely investigated iu nature, It appears that in many if not in all other *Caetnet*, \h*/*niculus* is bent onr UM orifice of the *orulum,* partly covering it (I have seen it in some *JfamiUarim, Kekimocndi,* and Or*0; bat that only In *Ofrnmtim* it expands into an exterior seminal coat, which U distinguished from •*riil*s* proper only by iU being already fully formed [77] at the flowering period.

Page 58 - page 213. *O. arbortmnu* seema to be very closely allied if not identical with 0. *nma,* DC., and 0. *imhritaia,* DC. The former is deacribed from a figure ; the flower and fruit of the Utter remain unknown, —to that it k difficult if lot iapoasible at present to solve these doubta.

Page 59, line 30 - page 214, line21 0. *Wrigktii* may sot be different from 0. JT7fM*r, DC., from Mexico, loaf cultivatad la Europe, the flower of which doe. not atm to be known.

Pag. 60, line 21 - page *)4. line 63. *O.fn*~tn** teems identical with *O. gneilU,* Hort Mooac, and 0. Wffaaa, *UmL* Tla4.,tfenVwtraiidfhritofwhkh$_M$uBlUM»w* It is Hated that UM ftnts of 0. *frtUU* art not vaginaU. This is BO doabt

a mistake; but the sheath is probably not as loose as in others. It corresponds, therefore, with my var. *brevispina*, Synops. Cact. in Proc. Amer. Acad. Arts and Sci., Vol. III. In delicate specimens — and such are usually the cultivated ones — the spines of most of the cylindric *Opuntiæ* do not exhibit the sheath very plainly; it usually adheres closely to the body of the spine. This vagina consists, like the whole spine, of elongated indurated cells; the barbs ‹ ˆ h a ine are cove dceely adpreMed until the vagina detaches iUelf, w\icU commonly take, pbce very J1y! ** * * «d "»

TK ^ PlUIIU Btt>tter* of St* Louii, made the dn were done partly by Mr. W. H. Dougal, of Georgetown, D. C.; a few by ... of St. Louis, ... Mr. Rebuffet, M. ... WSnCe b/ EUrOpeatt ... Web «. of BerUn. Prusaa, J T ». £ 2. [76] engravings, Martin Schmelz, and the brother* Picart, JlofP.ru.Fnu.ee. The high order «f excellence^ especially of those of the Picarto and of Schmelz, cannot fail to strike those who examine the plate*,

In the figUres of *. embry« « W*** XXIV., XXXIV., XLI., and XLVIL, the line indicating the division of the cotyledoi figs. 9 an that of Plate LXXIV.

ST. LOUIS, November, 1868.

EXPLANATION OF PLATES.

. BUIABU. — All the fignres an in natural size unless otherwise stated. The seeds of Mamillaria, EchinoceetL •»! r««i Ce»i are represented in the natural size, and eight times magnified: *a* is a lateral riew, natural size; *6*, same, eight tim- "Wuaed;«, part of the surface of the seed stiU more magnified; *d*, seed after the removal of the outer coat with endopleura and albumen j *t*, «nbryo; /, another form of same seed; *g*, seedling pUnt; A, back view; *i*, front view'; *, basal view; top view of embryo. All eight times magnified.

a* *JiH T^* . rf 0Vmamt ... four times magnified, as •w all the following ones j *e*, posterior view; *d*, anterior view j «, vertical section;/, seed after the removal ofthT tL." *g*, embryo.

. The landscape opposite the titJepaga represents a region near the Colorado Biver. with several *Cadi*, especially (W . JJJ"'" OM of them deeayed, showing the form of the ligneous skeleton. The different plants are accurate eoptaTof

«. ^.r*** L MAMILtAWA MOKOMttw: 1, a young plant not yet blooming, without the toft; J, a plant in bloom, *mtu*, tt«t.ft; Sand 4, different views of a plant of the largest size,- several fruits are seen in the tnft; 6, a tubercle with abZfc Of •pnee, eight times magnified; «, a bunch of spines in natural size, and 7, the same, eight times enlarged.

Plate ... th. ... *lf UUMl* View of * bunoh of ,,pin98> *mi* ita WCol on the floTM-k»ring part of the plant. eight «»•» magnifi«l, exhibiting the upper elongated ckvate spines; 2, flower, four times enlargnl j a, freiV- 4 a*rf — Fig. 5-8. M. ... QBMOM: 6, bunch of ·pine:; «, ..., right time, magnifi.4, ... where the long spines, eight clavate

Plate I... M> tA8U0AMTHA: 1. • Pl"t of the ordinary size in flower; 2, flower, four times magnified • S a tubercle with a bunch of *Sbm* ... «. bn«dk«. of spin^ *vJZaZ rt** ght times magnified.

"rt« IV. M. LABIAOAMTHA, w. DCNUDAZt: 1, ft ftuit-bearing plant; a, a tubsrde, with its bunch of spines, eight times BMguified; 8-4, bunches of spines in natural sise, end the same eight times megnfned?6 esei

Hate V. M. roaILtAt var. TKCAKA: 1, whole plant in flower; 2, etaberde, withabunchof spinesand th.axill.rv wool, twice magnified; 8, a bunch of spines, «m«; 4, flower, same; 8, fruit natural size; «, seed. V ^ M au»«flta T

Pkt. VI., fig. 1-8. M. OBAHAXI: 1, a single plant; 2-4, bunches of .pine., with one, two, and three central g j, *I* • tutarel. and bunch of spinea, nugnifed twice, 6. a bunch of spin-from Dr. *fLry'*. ^ *T t* ^ , [64] Colorado, also magnified twice; 7, a flower from A. Sehotf. specimen from the Gila; 8, seed *-TiToIi** *u* •..taherd. and bunch of spin*, naturalabe; 10, bunch of spine* magnified twice; u. *££.* u tei ... «•««ATA:

Plate VII. M. rHELtOHKEMA: 1, a flowerlesi pUnt; 2, a bunch of spine.; 8, a tubercle with the axillary wool and bristles, ... size; 7-8,

Plate VIII., fig. i^. M. WBIOHTII: 1, a whole plant in fruit, from a sketch of Mr. MoeUhansen's • 2. a vomur ... and, part of *t^r*** Wlth ipl11^ rf tbe ...• §pBclmel1; ... ipinei rf a i»)ecilnel1 from *• Coppto-imW four fromtt. older size; ... magni iiita ... ofl JM: ThelartS^i tural ... are

Plate «.. flg. I-l. M. mucAXTHA: 1, whole plant in flower j 2, fruit; 8, esed. - F%. 4-14. 1C Htroni, nr.

APPLANATA : 4, upper part of plant in flower and fruit; 5-6, different views of flowers; 7, fruit; 8, seed, — all from the same specimen from £1 Paso; 9-14, bunches of spines of different forms of the same variety, from western Texas. — Fig. 15-17 : bunches of spines and seed of the var. HEMISPHAUICA, from Matamoras. — Fig. 18-20. M. GUMMIFEBA : different views of tubercles and spines.

Plate X. M. ECHINUS : 1, whole plant in fruit; 2-3, tubercles showing the groove and the wool on the basal aieola; 4-7, bunches of spines of younger and older plants ; 8-9, same, with the central spine curved ; 10, fruit; 11, seed.

Plate XI. M. PECTINATA : 1, whole plant in flower; 2-3, different views of tubercles from the sides of the plant; 4-7, bunches of spines; 8-9, tubercles from the flower-bearing top of larger plants ; 10, seed.

Plate XII., fig. 1-16. M. TDBERCULOSA : 1, a large specimen in fruit; 2-11, tubercles and bunches of spines of different specimens (2-3, from a young plant; 10, a very young tubercle), — all the tubercles exhibit the large mass of dense wool at base ; 12, flower-bud ; 13, flower ; 14, fruit; 15, seed of the same ; 16, seed of another specimen, smaller, and with smaller marks. — Fig. 17-22. M. DASTACANTHA : 17-20, tubercles and bunches of spines of different specimens ; 21-22, seeds of the same.

Plate XIII. M. RADIO8A, var. NEO MEXICANA : 1, a plant with several branches in flower; 2 and 8, different tubercles with bunches of spines, the woolly grooves extending more or less down along the upper aide of tho tubercle ; 4, a bunch of •pines ; 6, a fruit; 7, seed.

Plate XIV. M. MACROMERIS in flower.

Plate XV. *The same:* 1, one of the largest bunches of spines ; 2, one of the smallest ones ; 8, a young tubercle not fully developed; 4, a young but full-grown tubercle, bearing the flower at the lower end of the woolly groove, far above the axil, a younger tubercle attached to it; 5, a ripe fruit, with ft few scales; 6 and 7, seeds of the largest and the smallest kind.

Plate XVI. M. FISSCKATA : 1, a flowering plant; 2, petals ; 8-9 tubercles of different size and age and in different potations; 3, a large tubercle from above; 4, same from below ; 5, same from the aide ; 6, a smaller one, with fewer divisions from above; 7, side view of same ; 8, a small tubercle from above; 9, a young one, with the silky wool yet [65] straight and smooth; 10, a young tubercle bearing a fruit, which becomes visible alter separating the wool; 11, seed.

Plate XVII. ECHINOCACTUS SCHEERII : 1, a full-grown plant in flower; 2, part of a rib, front view, showing the form of the tubercles and their grooves; 3, part of a rib, side view ; 4-6, bunches of bpines ; 7, seed.

Plate XVIII. E. BREVIIIAMATUS : a fnll-grown plant of ordinary size.

Plate XIX. *The miuu :* 1, part of a rib, side view, to exhibit the tubercles and their grooves ; 8, part of ft rib almost in front, with a flower; 8, a tubercle, with a flower at the base of the long groove; 4, ft young bunch of spines from ft small specimen ; 5-8, bunches of spines from different full-grown specimens.

Plate XX. E. urnsriNus : 1, top of a plant with flower; 2, another flower; 8, flower-bod; 4-6, bunches with IS radial and 1 central spines of different size and shape; 7-9, bunches with more radial and sometimes more central spines; 10, bunch of spines, with two almost straight central spines; 11, feuit; IS, several seeds attached to the funiculi, four times magnified; 13, seed of the usual size and form; 14, larger seed of ft specimen from Eagle Pass, to which spines fig. 8 belong.

Plata XXI. E. LOHOEHAMATUS : part of a rib, with ft flower.

Plate XXII. *The mme*; ft rib, side view, showing the tubercles, and with their short grooves sad their flexuons spines.

Piste XXIII. *Themms:* 1, ft bonch of spines of the longest spined variety; 2, a fruit; 3, sssd; 4 and 5, bunches of spines of the smaller variety.

Piste XXIV. *The earns:* 1, s bunch of spines of the thick spined Mexican fora; S and 8, lower central spines of the same; 4, seed of the *Limat agria** the soar csctas-bsnies of 8ftltillo, to exhibit the peculiar form of the seed sod the grrat fsvosity of the surface.

Plato XXV. E. WISLIXEXI : 1, upper part of a rib with a flower and s flower-bod ; 2, pistil; 3, fruit; 4 and 5, seeds of different form and surface, from El Paso; 6, seed of different shspe, from the upper Gils,

Plato XXVI. *The mme:* 1-8, bunches of spines of different shape and proportion.

Plate XXVII. E. L i C o m i : 1, part of a rib with a fruit; 2, a bunch of spines; 3, ft flower; 4, section of same; ft, seed.

Plato XXVIII. E. EMORTI : 1, bunch of spines of a Urge specimen, from Ouaymss; 1, young bunch of spines with flower, from Sonora; 8, section of flower.

Plato XXIX. E. TiKiDEscEjfs: I and % bunches of spines of s young plant; 8, flower; 4, pistfl; 0, fruit, not fully rips, sod therefore ft little shrivelled ; 6, seed.

PUto XXX. E. CTUNDRACECS : 1, S bunch of sptiies of ft young sf>sciii>en; 9-6, tenches of spines of older but Dot yet fully grown specimens.

PUto XXXI. E. BOiiiojcTHALOHiirs: in flower.

PUto XXXII., fig. 1-5. *The mme:* 1, a young plant; S-4, spines of different forms; 5, sssd. —Fig. $-7. E. PABBTI : bunch— of spines.

PUto XXXIII.. fig. 1-6. E. TEXIXSIS: 1, s lsrger, 2, s smaller bunch of ipines; 8, flower; 4, fruit; S, sstd from Tests; t, sssd from Mstsmorss, smaller and more distinctly marked than fig. 6. — Pig. 7, sssd of L 8AJDILLQ* (OSTL fas* Chili, which hss sUo s woolly fruit

Plate XXXIV. E. INTBRTEXTUS :-1, a plant of rather large size, in flower ; 2-5, young bunches of spines, more [66] or less developed ; 6-8, old bunches of spines ; 9, fruit, with a few scales, with wool at base and the dry flower on top; 10, seed.

Plate XXXV., fig. 1-5. E. INTEETEXTUS, var. DASYACANTHUS : 1,1-2, young bunches of spines; 8-5, old ones. — Fig. 6-8. E. UNGUISPINUS : bunches of spines.

Plate XXXVI. CEEEUS VIRIDIFLORUS : 1, large plant, from the Iimpia, in flower, one flower fully, another one half open; 2, bunch of spines of this plant without, and, 3, with a central spine; 4-7, bunches of spines of a specimen collected by Dr. Bigelow on the upper Pecos, with one or more central spines (4, a very young bunch; 6, a full-grown one; 6, a similar larger one, like the former, with two central spines ; 7, another one, with the largest central spine curved upward); 8-10, bunches of spines with and without a central spine, from plants collected by Dr. Wislizenus in northeastern New Mexico; 11, part of a plant in flower, with very obtuse petals and very small spines, collected by A. Fendler at Santa *F6;* 12-18, bunches of »pines of this variety; 14, fruit from Santa Fé; 15, seed of the same ; 16, fruit from the Limpia.

Plate XXXVII. C. CHLORANTHUS : in full bloom.

Plate XXXVIII. *The earns:* 1, top view, exhibiting the rays formed by the central spines; 2-7, different bunches of spines; 8, a small fruit; 0f one of usual size ; 10, seed of common size; 11, smaller seed.

Plate XXXIX. C. DASYAOANTHUS : a simple, branchless plant, with one flower.

Plate XL. *The same•* bunches of spines, different in size, number, and proportion of the spines; all twice magnified.

Plate XLI., fig. 1-2. *The mms:* 1, fruit; 2. seed.-Fig. 8-5. C. R«TERI : 8-4, bunches of spines, magnified twice; 5, a fruit

Plate XLII. C. OTENOIDES : 1, a large specimen in flower; 2-8, front view and lateral view of a bundle of spines, twice magnified; 4, top part of another specimen, in which the spines are not so closely pectinate ; 5-6, spines of this specimen, twice magnified.

Plato XLIII. C. c»rrrosv. : • specimen of one of the largest form.; petals unusually curled.

Plate XLI V. *The mm*:* 1-4, spiue. of the Uiger form, in different state, of development, minified twice ; 5-7 *tpum* of the .m.lW form, .bo minified twice, -some of the bunch- show rudiment, of <*nt«l spine.; *, a frart with the mdimeats of th. flower shrivelled up; », a fn.it exhibiting yet th. tube of the flower very dutuictly; 10-11. Ned of the larger, and, 12, seed of the smaller form j 11, *g,* young seedling soon after germination.

Plate XLV. C. LONOIUKTUS.

Plato XLVI. C. .TBAMINEU8: One head oat of a plant with numerous heads.

Plato, XLVII. *Thtmme:* 1. another specimen larger than usual, ^ Z x L ^ n / l ^ ^ the same. — Fig. 2–4. C. ENNEACANTHUS : * ^ f a s t e n , showing the rib. and ^ n e . ^ . ^ ' ^ P a t ! T « o w . r o f a ^ ^ n fn»n Eag»e P Ps; 4, bjnch of .pine f from El P-o, which, however. may batons to a form of *C. dramiMtu,* — lower central spine triangular and much flattened.

p.f.i XLI 2. *T l u mZ T;* head of a si-***" from Eagle Pa*s; 2, another one with longer and stouter .pine.; 8-10, tanthi oVspine. o f ^ t o collet at Eagle Pa- and at El P-o; 10, with a curved central spine; 11, fruit belonging to ^ *X 2* TM 8, last *Z : U* 1 ^ ^ * * «o«r; 2. bunch of spine*, and, 8, «ed of -me plant; 4-6, bunch- Iff] of spines of anothor specimen ; «, same, with flower jnst dowd; 7, fruit, and, 8 wed of same.

Plato LI. C. F«ND«EI : a vigorous hesd of a plant, brought from El PMO.

Plato LII *Th* tame* • I top of a plant with flower-bud and flower, from El Paso; 2, fruit with few and stouter spines; «. s-d of same"; 4, fruit with numerous .lender spines; 5, *ed of same; «, another form of-ed.

PlateLIIL *Thetanu:* 1, flower, from Santo W; 2, young bunch of spines; 8-12, bunches of .pine, of different shap* ind size.

Plato LI V. C. FOLTACAWTHOT *:* in flower; nsual form with short spinea.

PlateLV. *Themnu:* 1, part of a rib with a flower and a bud; 2-4, bunches of spines; 6, fruit with a bueh of spiae.; «, seed of tame; 7, fruit of another long-spined form; 8, seed of same.

Plato LVI. C. PATOMPiinis: 1. an wtire plant; 2-6. bunche. of spfa-; *9, m*d.*

Plato LVII. C. EsoittiiAimi: 1. ahead, brought from Sonera by A. Schott; % young, and 8-4, older bunehaa of •pinMofthewne; S, fruit; «, seedof-me; 7, s^ofDrJ^rry*.originalqwdmen.

6, seed

Plato LVHI C. BMLAMDIEBI : 1, part of a plant with flower and flower-tad; 2-4, bunch- of aplnw 5 ftirft; PUte MX., fig. M1. C. PROOUMBENB : 1, a p^nt with flower-bud, flowers, and young fruit; * 0 , different bunches of

* - » * * * ' « - * - * 1 1 ^ X r ^ a ^ n c h of n-n-of this fruit; 8. anothr one *trim* th. -^nral *.;

Plate LX. 1–4. C. EMORYI: 4, seed 6, seed.

t. park of a yonng rib of an adult plant collected in March, spin- very short and .lender yet j 4-«, bunch-of ipiMS of a young plant about 8 inch—high.

PlatoLXII. *Thtmmi:* 1. flower; 2. froit; 8, -ed; *m,* side TWW of embryo, cotyledona a Uttb opn; % frontview same.

Plate LXIII. C. GKIGGII, a. CISMONTANTO : 1, a flower; % a young plant raised from seed in the third year, showing the tuberous root.

Plate LXIV. *The same:* 1, lower part of a stem with the large tuberous root, half the natural size ; 2-4, sections of the stem; 6-11, spines of different states of development and of different ages, all four times the natural size (5, a bunch of very young spines imbedded in the wool of the areola ; 6-10, full-grown spines, —10, shows the lower spines crossed; 11, represents a very old bunch of spines); 12, a fruit; 13, seed.

Plate LXV. C. GREOOII, /3. TRANSMONTANUS : 1, flower; 2-3, spines. Four times magnified.

Plate LXVI. OPUNTIA STENOPETALA : 1, part of a joint; 2, part of another one with two flowers; 3, section of flower.

Plate LXVII. O. STKIOIL : 1, an elongated joint with two fruits, bearing a young joint; 2, an orbicular joint; 3, several seeds.

Plate LXVI 11. O. FILIPEXDULA : 1, a whole plant in flower, half natural size ; 2, a joint with flower and young fruit, natural size ; 3, seed of this plant from below £1 Paso ; 4, seed of same from Doña Ana, above El Paso, a little smaller.

Plate LXIX. 0. MACROKUIZA : 1, a whole plant with flower and buds, half natural size; 2, fruit, natural size ; [68] fc-4, seeds of different size.

Plate LXX. O. EMOBTI : from the region southwest of El Paso, in fruit

Plate LXXI. *The same:* 1, a whole plant, reduced ; 2, lateral view of a tubercle with a bunch of spines; 8, front view of one of the largest bunches of spines; part of the central spine, four times magnified; 4, different seeds.

Plate LXXII. O. GRAHAMI : 1, whole plant, with large tuberous root*, and in fruit; 2, a young joint; 8, a bunch of spines of the usual form; 4, another one with broader central spines; 5, seed. The seed, as well as parts of spines, are four times magnified.

Plate LXXIII., fig. 1-3. 0. SCHOTTII : 1-2, bunches of spines, with parts four times magnified; 8V seed with an oblique embryo.— Fig. 4. 0. SCHOTTII, var. GREGGII : a bunch of spines, with part magnified four times. — Fig. 6-6. O. BULBISPINA : 5, an entire joint; 6, a bunch of spines, part of central spine four times magnified. — Fig. 7-8. 0. IMBBICATA : 7, a joint; 8, a bunch of spines, and fragment of ceutral spine, four times the natural size, showing the sheath.

Plate LXXIV. Seeds of, —1, *Mamillaria calcarttta;* 2, *it. compada;* 3, *M. vivipara* ; 4, *M. radiom,* var. *borealis;* 6, *M. mdiosa,* var. *Texnna;* 6, *M. Nuttailii,* a. *borealis;* 7, *0. cocspitom;* 8, *M. robuslispina;* 9, *Echinocachu uncinatus;* 10, *B. uneimtus,* var. *Wrightii;* 11-14, *E. sinuatiu* (11, from the San Pedro, Wright; 12, from northern Mexico, Gregg; 15, from the same regions, Poselger; 14, the form sent by Poselger under the name of *B. rvbustus);* 16, *Cereui Thurberi; 1% O. SckoUii.*

Plate LXXV. Seeds of OrwnA : 1-4, *0. Engelmanni* (1, from Chihuahua, Wislizenns; 2, from Matamorms ; 8, from Presidio, Bigelow; 4, from SanU Rosa, Bigelow); 5-7, *0. dulds,* Wright and Bigelow; 8, *0. mnenetmtra,* Wright; *M3, *0. pkmeanOa* (9, from Santo Fe\ Fendler; 10-13, southern New Mexico, Wright); 14, *0. tenuupina,* El Paso; 16, *0. artnaria,* El Paso; 16-17, 0. arõorcMw; 18, *O.fulgida;* 19, *0. mamilUUa.*

IX. CACTACRS OF THE IVES EXPLORATION.

FROM REPOET UPON THE COLORADO RIVER or THE WIST, EXPLORED IX 1867 AXD 1858, BT LIEUTE*ANT JOSEPH C. IVES. Washington 1861. Part IV. BOTAKT. P. 12-14.

MAMILLABIA GRAHAMI, Engelm. in Mcx. Bound. Rep., II. p. 7, tab. 6, tig. 1-8; Synops, Orct. in Proc [18] Amer. Acad. Arts and Sci., III. p. 6. Common along the Colorado. In flower April 7 ; fruit of last year just ripe. In the Mex. Bound. Rep. the fruit is erroneounly called a M small oval berry, probably green." The specimen* then at command had shrivelled and discolored fruit; those now before me show that the berry ii elongated, clavate, scarlet, J or even 1 inch long, with or without the remains of the flower. The seeds are absolutely the same as those of the El Paso plant.

MAMILLARIA PFIELLCWPERMA, Engelro. 1. ?« p. 6, Ub. 7 ; Synope. CncL, p. 6. Common with the laet, arid easily confounded with it J>y the casual obnerver; apparently more abundant westward, while the former prevail* more eastward, (feiterully ftitnple, wmietimen many-headed. S*>me of Dr. Newberry's specimens closely nstmUe the figure in Mez. Bound. Kcp. ; others have fewer (3O-3."), nhorter, and utifler spine*, almo*t in 3 seriea, the 8-18 interior ones stout and puq>li*b-brown. One of the specimens before me has in each bunch three divergent, hooked, central spines.

EcHiffoCAcrrs WHIPPLEI, Engtlm. A Billow in Pacif. Rail. Rep. IV., CacUms of Iieut Wbipplet Eipsd, p. 88, tab. 1; Synops. ('act, p. 15. In sandy soil on the Little Colorado, often half buried in sand, in tht tin[illegible] region where Dr. Bigelow discovered this pretty njiecies in 1853. In flower in the middle of *M*y.*

areolaV S S ted fZ *? J IT"?* J'™™?**%• The floriferous b contiguous to the spiniferou. [13]
areoia, not separated from it by the cyli.dric glands present in several allied species. After flowerin* th
floriferous areoia forms a groove two third, down the upper ride of the tubercle (V prominent Zt ofh rib), or
Str -*-*"»*«•'»«• The description of the Wer, wanting ^ fc^ may be

orW-mSf118 VeK? T^ Conge8ti8 vta «««-*'^ PoUicaribus; ovaris sepalis squamiformibu. p.ucb (2-5) orbiculatM seu reniform,bus munito; sepali* tubi 10-16 inferioribus ovatis, superioribus oblongis obtasb. petalis sub-8 oblongis mucronatb; infimo tubi parte intus nudo; fikunentis tenuissimis numerous; stvlo exerto' ursum clavato apice infundibulifomi in stigmata Vbrerissima erecta seu conniventia diviso.

nnV The *oWm *Z! !noh 10ngl S"*"1^-"*, e^ternaUy tinged with brown-red; stigma green. The fruit remains unknown a« yet. The large seed has been figured in the work mentioned.

fc,k m^TT^?* LItERTEr» ^ge1"1- il» Mex. Bound. Rep., II. p. 23, tab. 27; and Pacif. Rail. Rep. 1 .c.. p. 28, tab. 2, fig. 3-o; Synops. Cact., p. 18. In the Colorado valley. In flower in April.-Specimens of 3-6 inches dimeter nave below 8 and above 13 ribs; those of 9-12 inches show 19-21 ribs. The lowest bunches (those develowd probably in the third or fourth year) have 8 radial and 1 central spines, all annulated; the central one is curved not noofced, 1 or even 3 of the lower radial ones are often hooked. The fully developed bunches consist of 4 central spines! we upper and lower one of which is quite flat; 6 or 7 lower radial ones, never hooked; 3 upper ones; and 6-12 slender bristly radial spines. The ovary is covered with about 30 sepaloid scales, in the specimens examined in A or JL arrangement ' " -- t»

EcHntocACTOB? Young specimens, 3-6 inches high, of another evidently large species, were collected with 13 nbs; 4 central and 6 lower, stouter, and 3-6 upper slender radial spines, all annulated and curved. The plants, showing no indication of floriferous areole, must be undeveloped; they may possibly be young ones of *E tvlvamhniJ* or belong to species yet unknown to us. *'P«V«P*alu»,*

E. vnuDEBCENS, Nutt. in Torr. AGray, Fl. I., p. 664; Engelm. in Mex. Bound. Rep. II., p. 24, tab. 29-qjrnope. Cact, p. 19. San Diego, California; with 26-30 scales on yellow fruit Seed as described in Mex. Bound' Bep-, but the pits are much closer together than in fig. 6, c.! The hooked acute cotyledons are bent over a rathar copious albumen, similar to those of *E. Widizeni,* tab. 26, fig. 4, e.

CjtMra FKNOLKRI, Engelm. in Plant Fendl. in Mem. Amer. Acad. 1848, p. 61; Mex. Bound. Rep. II. p. 33. tab. 61-53; Synops. Cact., p. 26. Coveww, New Mexico, and from Laguna to Santa F4. Flowers in April.

C. PHONiCEua, Engelm., Pacif. Rail. Rep. 1. c, p. 34, tab. 4, fig. 1; Synops Cact, p 28 *Echinoctmu* «*»«««, Engelm. in Wislii. Rep. N. Mex, note 9. - This is *ManUUaria aggregata,* Emory's Report, 1848, and X -aggregated Cactus" of the explorers of the western parts of New Mexico and the Oila regions. It grows in lane oense masses, often 100 or 200 beads from a single base, the whole often of the shape and size of a bushel basket generally on apparently naked rocks 5 in the proper season densely covered with beautiful crimson flowers It w« found from Camp 64 to Camp 78 (Yampai Valley to Partridge Creek). In flower in April. The flowers collected « leMUuns Inches long, much more densely covered with bristle-bearing sepals than the next species, and with onlr

ptant, which has now been known to science for twelve years, still remain, unknown, and livin* plant* an a.T«t extremely r mice.

C. co*OIDI08, ^gel*-* ®8<to"> L <^ P. 35, tab. 4, flg. 4-5: Synops. Cact., p. 28. Camn 98 (Oryabe *j^2 M0qUi flOmlljr) FU>Wering " May __ So "^yUiedtothe Urt tlui w, con«d3ita T141 form or ... ofit Dr. Newl«ny has now obtained the flowers. His specimen ha, feweTSTti^ Dr. Bigelow's T^o^_ew9^W0n^^ntlinchl0^mdIw2 <^^. all whitish and somewhat translucent. They resemble the spines of *00 mmvuamth^.* ZT% 1½-2 inches lon f ^ t .t. Wiggen day and night, and light/and U «tho/dfL ^ j ^ TIS S ttd'.

-orl... "I"8" diametro t™««ersaU duplo longioribus coccineis; ovario parvo squamb sepaloideb 8-18 Man. gulati... s m.a«n. bnam albam et ^uleolo, 3-6 gracile. gerentibn. munito; tubo ampl... latis ac uk^ru intructo; palb superioribussub oblongis obturis; petali. io-,3 spatE ob E ; Z ___ ^Z numerosissimis et stigmatibus sub>9 vix exsertb peUla rabnquantibus. ^

a* AX flo ^? are 3 M lnche* bng and 1H inche" " diainetCT i the «len"er spines in the axils of the upper sepals «• «-8 line* in length; the stigmas, as in the whole submenus *Echinoeereut,* velvety green.

Opui ITU^l^IIB, EngeIm> *Kgd°W,l«_P* A tabl 13> *!_"* "d tab_«» % 14; Synops. Cact p. 48
Abundant on the Colorado from Fort Ynma to the Great Canon, and one of the most w t Ti S f t h i 7*
valley and trs ^ Ni in the description *Mon* ^ of th - ^ZTo?Sb^e.Til0
number of ... of ... erent shape
- ooov^e, obconiate, emarginato, or elongate and .W oblancw!T!!!b«w fr^

nearly the flame base, and are covered in spring (March and April) with a profusion of rose-colored or purplish flowers, often 150 on one plant. The ovary is described as somewhat tuberculate, but sometimes almost smooth. The fruit is dry when ripe. Seed large and thick, as in the figure above cited.

0. HYSTRICINA, Engelm. and Bigelow, 1. c, p. 54, tab. 15, fig. 5-7, and tab. 23, p. 15; Synops. Cact., p. 43. Common from the Colorado to the Rio Grande. The form collected by Dr. Kewberry, and named in his notes "hairy-spined Opuntia," has fewer, shorter, and usually straighter spines than the specimens figured and described in Lieutenant Whipple's Report; the larger ones are also angular and erect, and by these characters distinguished from the nearly allied *Opuntia Missourientù.* However, Mr. Fendlert specimens from Santa Fé (the flowers of which were inadvertently distributed with No. 276, *0. phaacantha,* but are easily distinguished by the spinulose ovary) seem to be intermediate l>etween the two, and may make it necessary to unite them.

Dr. Newberry's specimens have 1-5 larger spines, 1-1j inch long, nearly erect, and about 5 smaller deflexed ones below, with a few very small ones above. Flower nearly 2 inches in diameter; ovary with 20-25 tomentose pulvilli, each with a short slender leaf (sepal) less than 1 line long, and 5-12 bristly spines of very different lengths; the interior sepals are obovate cuspidate petals, obcordate, orange-yellow; 5 erect green stigmata, forming a compact head.

O. ECHINOCARPA, Engelm. & Bigelow, 1. c, p. 40, tab. 18, fig. 5-10, and tab. 24, fig. 8; Mex. Bound. Rep. II., p. 56; Synops. Cact., p. 49. In the Mojave valley, and common on the Colorado. Begins to flower the end of March. The specimens obtained are low, with many short branches, much of the habit of the davate *Opuntut,* but distinguished from them by the sheathed spines and the reticulated wood peculiar to the cylindroid *Opuntia.* The ovary is 6-8 lines long, with about 20 pulvilli, bearing thick ovate leaves, abruptly narrowed into a subulate point, 1-2 lines long, and in their axils in a white tomentum 6 or 8 sheathed spines, the large ones 6-8 lines long. The greenish-yellow flower when fully open is 1} inch wide; petals spatulate, rounded or emarginate, denticulate, the exterior ones mucronate; stigmata 5-6, large and thick, and apparently yellow.

0. ARBOHESCBNS, Engelm. in Wisliz. Rep. N. Mex., note 5; Mex. Bound. Rep. IL, p. 58, tab. 75, fig. 16-17; Pacif. Rail. Rep. IV., tab. 17, fig. 5-6, tab. 18, fig. 4, and tab. 24, fig. 12 ; Synope. Cact, p. 51. Common in western New Mexico.

X. ADDITIONS TO THE CACTUS-FLORA OF THE TERRITORY OF THE UNITED STATES.

FBOM THE TRANSACTIONS OF TBI AOADKMT OF 8CTBXCX OF 8T. LOUIS, TOL II.

SINCE my " Synopsis of the Cactacea of the United States[191] was published, Dr. J. S. [197] Ne wherry, attached to Lieutenant Ives's Expedition to thè Colorado River, 1857-58, has elucidated more fully the natural history of several species heretofore only imperfectly known.[1] In the same year (1858) and the following one my brother, Henry Engelmann, geologist to the Expedition sent under Captain James H. Simpson, U. S. Topographical Engineer, to explore the best emigrant routes through the interior of Utah, discovered in that interesting country a number of new forms, which were placed in my hands for examination. My report on them, illustrated by several plates from the hands of our skilful artist, Mr. P. Rcetter, was in due time sent to the Department; but the necessities of the country not permitting the official publication, I have received permission to communicate the substance of my investigations.

1. MAMII.LARIA VIVIPARA. Haw. Engelm.Synop*.Cact, p. 13. In the South Pans, and on Sweetwatar River; no specimens of thin wide-*pn»ad specie* have turned up from the other side of the great mountain-chain.

2. EcHiNocArrrH SuiPflONi, up. nor.: e bast turbinata simplex, subglobnsns sen depressns, mamillifarns; taberculU laxia ovatis oblique trunrati* axilla nuclìn; areoli* ovatin w>u ovato-lanceolatia, natcentibu* albo-villodssimis [redacted] nndatis; aculci* exterioribus tub-20 tenuibus rigidU rtctia albklia, interioribus 8-IOerscto-patulis lobustioribos

* Free. *Amrr.* Ar«t. Art* and Sd., Vol. Ill. pp. S59-814, and S44 S4*. Nor. 1858.

[9] ftst *mj* account in Ltattnaat Im'i Colorado Rivrr Exploring Eip*m**»; Botany, Pp. 19-11 WtakJaftoa, Ml.

paulo longioribufl obscuris; areola florifera sub tuberculi apice acaleis contigaa circulari; floribus in vertice dissitis minoribus; sepalia ovarii paucis et tubi brevis inferioribus orbiculatis crenulatis, superioribus ovatis obtusis, petalis oblongis cuspidatis e virescente roseis, stigmatibus 5-7 brevibus in capitulum globosum compactis ; bacca parva sicca umbilico latissimo truncata flore marceBcente demuni deciduo coionata; seminibus paucis magnis oblique obovatis minute tuberculatis.

Var. 0. MINOR : tota planta, tuberculis, aculeis, seminibusque minoribus.

Butte Valley, iu the Utah desert, and Kobe Valley, further west; var. 0. in Colorado Territory, *e.g.* in coarse gravel or in crevices of rocks, abundant near Mount Vernon, at the base of the mountains (Parry, Hall, & Harbour). Flowers in May; fruit in July and August. — With the New Mexican *E. papyracanthus** the Mexican [198] *E. horripilus,* Lem., and perhaps the South American *E. Odierii,* Lem., and *E. Cummingii,* Salm, this species forms a small section of Echinocacti with the appearance of Mamillaria, named by Prince Salm (Hort. Dyck, 1849, p. 34) *Theloidei.* Through the *Coryphantha* they are nearly allied to Mamillaria; while our species at least (the fructification of the others not being known), by its dry fruit, its black tuherculated seeds, and especially the large and curved embryo and the presence of an albumen, proves itself a true Echinocactus, very closely connected with the regularly ribbed *E. inUrtextui,* Engelm. Cact. Mex. Bound., tab. 34. The similarity in all essential organs of these two species is such that no system ought to separate them ; proving again of how little essential importance among Cactacea the external form must be regarded. Another striking example, among many, is the rat-tail *Cerem tuberonu,* and its globular or oval allies, *C. catpitosus,* etc.

Full-grown specimens are 3-5 inches high and 3-4 inches in diameter ; dark ‹Sreen tubercles, loosely arranged in /r °r 1} order, 8 and 13 spirals being most prominent; tubercles 6-8 lines long, at base 6-7 lines wide in the vertical and 4-5 lines in the transverse diameter, fruit^bearing ones rather shorter and stouter; areolue 3-4 lines long. External spines 4-6 lines long, whitish, with the addition of several bristles at the upper end of the areola; central spines 5-7 lines long, yellow, reddish, deep brown or even black upward. Flowers 8-10 lines long and of nearly the same diameter, with a short and wide tube, externally greenish-purple; petals yellowish-green verging to pale purple ; the short Htamens arise from the whole inner surface of the tube, leaving only a very small nectariferous space in its base; funicuius very short, stout and straight, and not curved over the micropyle, as I have found it in almost all other cactus flowers examined. Fruit &-3J lines long, about the same in width, with 1-3 small calycine scales toward its flat top, each with 1 or 2 small spines in its axil; it usually bursts irregularly on the side, and, falling off, leaves its base adhering to the areola, as is the case in other dry-fruited. Echinocacti, e. g. *E. Korixontiudonvu**. Seeds 1* line long in the longest diameter, covered with minute, closely set tubercles, with a large oval subbasilar hilum, and an embryo strongly curved around a small albumen. The plant germinates with erect pointed cotyledons, and [199] when a few weeks old begins to develop ito then pubescent spines.

Var. £, with smaller tubercles in fl or «, or even ft order, closely set, bearing smaller but often more numerous spines (20-28 external, 6-7 internal), may be confounded with the simple mountain form of *M. vivipara,* from which, when not in flower or fruit, only a close examination can distinguish it

8. ECHINOCACTUS PUBIBPINUS, sp. nov.: parvus, turbinatus 5 costis 13 eubobliquis compressis interrupts; areolis orbiculatis; aculeis breviusculis velutinis demum nudatis aTbidis apice adustis, radialibus inferioribus lateralibusque 5-8 brevioribus, superioribns 1-2 robnstioribus wctis curvatis seu hamatis, centrali deficient* seu singulo robustiore longiore arrecto sursum hamato.

Pleasant Valley, near Salt Lake Desert Found in May without flower or fruit, but exhibiting in the vestiges of the small supraspiral floriferous areola the character of the genus. —Perhaps the smallest species of the genus, 2 inches high, 1-1J in diameter; ribs formed by compressed confluent tubercles; areol» 4-6 lines apart. Radial spinet 1-4 lines long, more densely pubescent or even tomentose than I have seen them in any other Cactus, on the lower areol»5or6,onthe upper ones 9-12; here and there a single central spine makes itoappearance,5-6.lines long, stouter, and always strongly hooked.

4. E. WHIPPLIL Engelm. & Bigelow, Cact Whipp., p. 28, tab. 1; Synops. Cact., p. 15; Ives's Exped. Bot, P. 12. Var. BPINOBIOB: aculeis radialibus 9-11, inferioribus s»pe obscurioribus, reliquis longioribus niveis, summis * s«pe elongatis latioribus curvatis, centwlibus 4, suramo longo piano flexuoso, cateris paulo brevioribus obecuris, solo inflmo sea omnibus hamatis.

Desert Valley, west of Camp Floyd, Utah, with tbe remnants of flowers and fruit, and with seeds bid between the spines exactly like the seeds figured in the plate cited above. Embryo curved about | around a large albumen;

• *Mamaiariapapyracantha.Zug^m.* Plant. Fendl., p. 49; Synopt. Cact, p. 8. A closer examination of the dry specimen obtained by Mr. Fendler near 8enta F4 proves that the floral areoUjoiiistheepinifeTOQSoneoQthetopof the small | ntscent tubercles, making the plant an *Echinooaetus,* according to the views at present prevalent It is singular that Fendler's single specimen hat remained that far the only one ever obtained of this well-marked species.

stigmas 6-7. The locality is about 5 degrees north of the place where Dr. Bigelow, and afterward Dr. Newberry found the plant.

5. CEREUS VIRIDIFLORUS, Engelm. Evidently the most northern Cereus, found as far north as the Laramie region, and not rare in Colorado, where it occurs 1-3 inches high, mostly with 13 ribs, and with the greatest variability in the color of the radial spines and in the presence of the 1-2 central ones.

6. C. ENGELMANNI, Parry. In the Salt Luke Desert, far to the northwest of the country where it was originally discovered. Always characterized by the cruciate central spines,

7. OPUNTIA sPHiEROCARPA, Engelm. & Bigelow. Var. ? UTAHENSIS : diffusa; articulis orbiculato-obovatis crassis, junioribus saepe globoso-obovatis vix tul>erculatis ; areolis subapproximatis ; foliis minutis [200] subulatis divaricutis ; setis brevissimis, aculeis nullis seu parvulis seu ran˙us singulo longiore recto robusto albido ; floribus sulphureis ; sepalis exterioribus transversis obcordatis cuspidatis ; petalis 8 late obovatis emarginatis; stignjatibus 8 brevibus erectis; bacca obovata areolis sub-25 stipata; seniinibus irregulariter compressis angnste niarginatis.

In the Pass, west of Stcptoe Valley, in the Utah basin. In flower and fruit at the end of July. — Joints 2-3 inches long and of nearly the same diameter; areolte 6-8 lines apart; leaves smaller than in any other of our species except *0. basilaris,* scarcely 1 line long; briptles few on young, none on old joints, about $ line long; stouter spines, when present, f-1 inch long. Flowers 3 inches in diameter, pale or sulphur-yellow. Fruit 1 inch long, half as thick, with a very deep umbilicus, and with a few bristles, or here and there a minute spine on the areoln ; in the specimens before me apparently fleshy, but perhaps dry at full maturity. Seeds very irregular, 2 lines or in the longest diameter 2} lines wide.

Loth to increase the number of ill-defined species, I provisionally attach this to the New Mexican 0. *tphctro-carpa,* of which, however, leaves and flowers are as yet unknown, and the fruit is rather different.

8. 0. HTBTRICIVA, Engelm. & Bigelow, is evidently a western representative or may be a western form of 0. *MiuourientU.* (See Bot., Ives's Exped., p. 14.) It was collected in the present Territory of Nevada, between Walker and Canon rivers. Flowers 2J-3 inches wide, larger than in Dr. Newberry's specimen; stigmas 8-10, abort, erect

0. 0. MISBOURIIXBK, DC., itself is not rare in the desert* between Salt Lake Valley and Rush Valley. Var. •LBUPIKA, approaching to var. *triehophora,* was found on Smith Creek, Lookout Mountains. Flower 3-3) inches in diameter; ovary with 20 or 25 scarcely spiny areola; 5 very short erect stigmas.

10. O. nuoiLiB, Haw. Snppl., p. 82. *Cactus fragilu,* Nntt, Gen. I., p. 296. Fort Kearney to the North Platte country. In flower in June and July.—This, I believe, is the first time, since Nuttall's discovery in 1813, that the flowers of this species were collected. Travellers report the plant very common on the sterile prairies at the foot of the Rocky Mountains, hut rarely found in flower, and still move rarely in fruit. It seams to propagate principally by the extremely brittle joints, which even the wind is apt to break off and carry about I have had for many years specimens in cultivation, brought by Dr. Hayden, but have never been able to obtain flowers. Nuttall says the flowers are solitary and small, — in the specimen before me they are nearly 2 inches in diameter, pale [201] yellow ; ovary 8-9 lines long, with 13-15 areoln, densely covered with white wool, the upper ones with a few % white spines; lower sepals broadly oval, with a short cusp ; petals 5 obovate, roundish, creuulate; style longer than stamens; stigmas 5, short, cuspidate, erect

11. 0. PULCHELLA, sp. nov.: parvula, diflfuwi; articulw obovato-davatis leviter tuberculatis; foliis minutis a basi ovata subulatis; areolis confertis, superioribus aculeos alhidos rectos, singnlum longiorem complanatum por-rectum seu deflexum, ccteros brevis*imos radiAntcs gprentibiifl ; florin pnrpnrei ovario areolis 13-16 albo-villosiatimis et aculeoligeris dense stipato ; sepalis inferioribn* lineari-oblongi* breviter cnnpidatia, superioribus cnneato-spatnlatia ; petalis 8 obovatw obtu*i« ; stylo cylindrico exuerto. fltignuitihus 5 linearihti* unherectis.

Sandy demito on Walker River, Nevada. Flower* in June. — This in one of the smallest and prettiest spades of the genus, and belong to the flection *Clatattt* (Svnopn. Cart, p. 46). It is readily distinguished from its allies by the small joints and purple flower*. Joints 1-1} inch long ; leaves scarcely I line long. Flower bright purplish-red or deep rote-red, lj-1} inch in diameter; ovary 4-6 lines long, beset with white bristly spines, 15-25 on each areola; style not veutricose in the lower half, as U usual in this genus ;[4] stigmas slender, pale yellow.

• Aaothir deviation from tht omuil form I observe in tb# ptyle of 0. *cocemtni/ira.* From a very narrow sad short base *kkmddmlj* dilated fivt or six times its diameter, and then gndiially contracts upward.

From other sources I am enabled to give the following further Additions and Corrections to my former publications: —

Many *Eumamillarice* (Syiiops. Cact., p. 4) have an *ovarium exsertum.* Not only do the large-flowered *LongimamnuB,* which approach closely to Coryphantha, deviate in this respect from the assumed chai-acter of the subgenus, but in a great many other species I find the same peculiarity ; so that I am inclined to restrict the *ovaritm immersum* to that natural subdivision, the *Lactescent,* already recognized by Zuccarini. Probably all those with limpid juice have an exsert ovary.**

MAMILLARIA BARBATA, Engelm. This species is easily propagated by seed, and apt to flower in the second year. The first flowers in spring (May) appear in the axils of the last, innermost tubercles of the last year, and are therefore almost central; the later ones seem to be developed from the axils of the first tubercles of the same spring! Flowers 9-10 lines long, of the same diameter; tube constricted above the exsert oval ovary; 12-13 exterior green sepal*, lanceolate, cuspidate, fimbriate, 8 interior ones, reddish, longer, lance-linear, , slightly ciliate ; 18-21 petals, rose-red, with a deeper colored streak, lance-linear, shorter and narrower than [202] the inner sepal*, entire; stamens not half as long as petals, with oval anthers; style much longer than stamens, with 6-6 short, greenish-yellow suberect stigmas.

M. BICOLOR, Lehm., is not a Texan plant, as has been stated inadvertently in Synops., p. 7. Dr. Poselger found it on another Rio Grande, between Tampico and Real del Monte, Mexico.

M. PAPTRACANTHA, Engelm., is an Echinocactus, as stated above.

M. REOURVISPINA, Engelm. in Cact Mex. Bound., p. 12; Synops., p. 10. As there is already a species named thus by Vriese (see Walp. Rep. 2, p. 301), I now name the Arizona species *M. recurvata. M. recurva,* Lehm., is a form of *M. macracantha,* DC., fide Salm.

CEREUSVARiABiLis-thus named in Cact Mex. Bound., p. 40, tab. 60 fig. 5-6, rt fa E * m » » - b i* Pfeiffer>s plant, figured in Abbild. 2, tab. 15, but seems to be, as regards fruit and seeds, identical with a species obtained by Dr. Poselger near Tampico, and decided by him to be C. *pnnceps, Uort.* Wurzb. ex-Pfeiff. Enum, p. 108. Plan* from the Rio Grand; have repeatedly bloomed here at the late Mr. Grieve * and as the flower has never been described, I here supply the omission. Fruit and seed, obtained near Matamoras, have been described and figured in M6x,, S a d ^ J m ' c a u l U ramorumve pauci magni albi Docturni; ovario ovato areolis aculeolatis 25-30 stipato; tube elongate cylindrico sunmm sensim ampljato areolis 16-20 vix squaniigens infenonbus aculeolatis munito; sepali. superioribus 2O-25 lanceoktis patulis reflexisve; peUlis 4(HH> plunsenatis linean-hmceolatis patentissiims ; Htaminibus superior! tubi parti gradatim adnatis; stigmatibus 12-13 in capitulum clavato-obovatum coarctatis pallide vir ntibi t.

^nblllom from July to September. Flower 7-8 inches long, 5*-6 inches wide ; tube 4-5 inches long. Lower •epals near the well-defined upper edge of the tube reddish-green, 3-9 lines, upper ones petaloid, 9-18 lines long; petals 2 inches Ion* and about 4 lines wide. Lower part of the tube, for 2 or 2} inches, with a naked, nectariferous •irface; the upper part, 2W inches, densely beset with stamens of about equal length, so that the mass of the anthem form a deep funnel correnponding to the shape of the upper part of the tube. The outer series of stamens forms a uegular crown, but is not separated from the inner lower ones by a naked belt, such as is found m many species; nor are the filaments declined and, so to say, fasciculated. This is interesting, as it^weakens the value^of this arrangement of stamens as a generic or subgeneric character; nevertheless, it is one of the few general characters left us [203] to be used in the arrangement of the very large number of species of this protean genus, to which several lately established genera have to be reduced. The following disposition is suggested : -

1. Cewlflowregnbriplemmquebreviore; itaminlbns tubo gradatim adnatis.

EchinocertuM, **Engelm.**
AcmUhoeertui.
Lepidocereus, **Engelm.**
Pilocereus, **Lem.**

8. Card flora a»pe obllquo plerumque tenure; corona staminum ezterionim ereetorum a enteria gradatim adnatia pliia minaa deoUnatis diaorata.

EchinoptU, **Zuoc**
Bucereus.
PhyUocadus, **Link.**
Dititocactu.* **Undk.**

Under the name Acanthocenms I comprise the specie* of this division with spiny fruit, but not belonging to ·Echinocereus; It is probable that Pfeiffera, Salm, is only a diminutive form of Acanthocereua. Lepidocereus — to

which many tropical species must be referred, and also a few which lately have been classed with Pilocereus — is distinguished from the latter by the uniformity of the fertile and sterile branches and ureolss ; while in Pilocereus the fertile areolse are closer together, and densely beset with bristly spines or long wool. Eucereus, in a more restricted sense than Miquel has used it in his Genera, or 9 in the Synopsis, would coinpiise the largest number of Cerei of the second division, of very different external shape, and would probably have to be again subdivided when we get to know more of the fructification of the different species. Neither Echinopsis nor Phyllocactus do in their flowers differ from Eucereus; and Disisocactus is but a depauperate Phyllocactus, with scarcely more than the crown of stamens left, a few single ones representing the great mass of inner stamens of the allied sections. I am as yet undecided whether Epiphyllum, as restricted by Prince Salm, has also to be united with Cereus or not. The fasciculated declined stamens spring from the whole tube; the exterior ones form no crown, but the innermost ones are separated from the rest, and form, with their confluent bases, a kind of vault, which is arched over the base of the tube. I have had no opportunity to examine fruit and seed.

I am not sure whether the true *Cereus variabilis* is also found on the lower Rio Grande. A specimen in Mr. (kobel's horticultural establishment, said to come from that region, has repeatedly flowered and borne fruit The flowers opened in May, and the fruit ripened after ten or eleven months. Flower 9 inches long, white, open only at night; ovary angular, with 5 or 6 triangular scales, but no spines; long tube with about 8 scales; [204] crown of exterior stamens distant from the others 8 or 9 lines ; about 10 filiform spreading stigmas. Fruit irregularly oval, about 2 inches long, naked, deep violet-purple, at last bursting and dropping seeds and pulp. Seed quite different from that of the last species, very obliquely obovate, almost curved from a narrow base, with an orbicular fiilura, 0.9 line long, smooth, shining, with a few irregular dots.

Through the kindness of Dr. A. W. Chapman, of Apalachicola, Florida, I have received living specimens and fruit of the little southeastern sea-coast Opuntia, so that I can now complete and correct the description of this very distinct species.

OPUNTIA PEB CORVT, LA Conte in herb ; Engelra. App. to Synop*. Cact. in Proc. Amer. Acad. Arts and Sci., III. p. 346; Chapra. South. Flora, p. 145: late vindis, diffusa; articulis parvis ovatis seu obovatis tumidis nopius teretiusculus fragilibus; pulvillis pulvinatis; foliis ovatis cuspidate incurvis ; areolis junipribus albotomentosis setae pareas brevissiinas pallidas et plerisque aculeos 1-3 rectos rigidos sa?pe basi compressos tortosque obscuros gerentibus, infimis inermibus ; floribus miuoribus flavis ; ovario obovato pulvilli* perpaucis fusco-villosis stipato; sepalis exterioribua ovato-lanceolatis, interioribus obovatis cuspidatis; petal is sub-5 obovatis spatulatis obtusis ; stigmatibus 4-6 ereetis; neminibus panrissimis anguste obtuseque marginatis in pulpa viscosa bacca s»pe floris rudimentis coronats) niduiantibus.

Barren sands along the coast of Georgia and Florida. — Joints 1-3 inches long, obovate, tumid, or narrower and snbcylindrk, usually many of them growing in the same season, one from the top of the last one, till they at last become prostrate and 1 or 2 feet long; pulvilli somewhat prominent, 4, 6, or even 8 lines apart; leaves 2 f i j lines long; spines 1-1* inches long, very straight, when in threes divergent Flowers 1|-1| inches in diameter; sepals and petals lest numerous and narrower than in any allied species; ovary i inch long, with only 2 or 3 areoln on iU surface and 3-5 on its upper edge. Fruit obovate, 6-7 lines long, rose-purple, with a shallow umbilicus; areola almost obliterated. 8eeds 3 lines in diameter, 1-3, rarely as many as A, in one fruit Evidently near 0. *vulgartt,* frolm which the shape and armature of the joints sufficiently distinguish it; far removed from *0. frogilti,* with which at lint glance the tumidity and fragility of the joints would seem to connect it

XL CACTACEiE OF CLARENCE KING'S EXPLORATION OF THE FORTIETH PARALLEL VOL V. BOTANY, BY SERENO WATSON. P. 115-120. 1871.

MAMILLARIA (EUMAMILLAUA) OBAHAMI, Engelm. Globose or oral, usually simple, 1-3 inches high. [116] On the short, oval, dose-set tubercles are numerous thin but rigid whitish spines, 3-6 lines long; the outer 15-30 in a single series and straight, surrounding a stouter and longer hooked brown one. Flowers —~11$_{r}$ nearly 1 inch wide, reddish ; berry oval, green, with black pitted seeds. — Rocky localities in southern New Mexico, Ariaona, and the adjoining parts of Utah.

1L raBLU*rauf A, Engelm. Resembling the U* rather larger, more oblong or cylindrical; tubercles longer and less crowded. Spines more numerous; the outer 40-61) in two series, the eiterior bristle-like, the inner more robust, with 9-4 brown central spiuet, of which one or more are hooked. Flowers similar; berry clubchaped,

scarlet; seed globose, with a larger spongy brown appendage. — Gravelly soil in southern Utah and Arizona; rarer than the last

M. (COBTPHANTHA) VIVIPABA, Haw., var. Simple, oval, the almost terete tubercles bearing fascicles of 5-8 reddish-brown spines surrounded by 15-20 grayish ones in a single series, all straight and very rigid, the latter 5-8 lines, the former even 10 lines long. Flowers purple, often 2 inches or more in diameter, with numerous lance-subulate petals and fringed sepals; berry oval, green ; seed pitted, light brown. — Near St. George, southern Utah (J. E. Johnson). Larger than the often cespitose forms of the eastern slopes and plains. Another simple [116] form, but scarcely half as large, occurs in Colorado, and possibly in eastern Utah.

M. NUTTALLII, Engelm. Smaller, globose, simple or sometimes cespitose, with fewer (10-20), weaker, ash-colored spines. Flowers yellow, 1-2 inches broad; berries scarlet, subglobose; seeds few, black, globose, pitted. — Common on the eastern slopes of the mountains of Colorado, and perhaps to be found in eastern Utah.

ECHINOCACTUS SIMPSONI, Engelin. Simple, globose or depressed, with ovate tubercles like a *MamiUaria,* bearing about 20 outer ash-colored spines and 5-10 stouter darker inner ones, all straight and rigid. Flowers from the top of the just developing tubercles, small, 9-12 lines broad, yellowish-green to purplish; scales on the ovary very few; berry small, dry, with few black tuberculated seeds. — Butte and Kobe valleys, Utah (H. Engelmann); frequent on the eastern slopes of the Rocky Mountains, Colorado. Flowering in April and May. [Found on the HavaUah, Battle, and Toyabe mountains, and above Thousand Spring Valley, Nevada, only on high rocky ridges, 7,000-8,000 feet altitude. July in flower. Heads 2-5 inches in diameter, often clustered, the fleshy interior frequently colored, s. w.] A small variety, resembling forms of Af. *vivipara* in habit, but the tubercles grooveless and fruiting at top, has spines 4-6 lines long, the inner scarcely different A larger form has much larger tubercles and spines, often 12-14 lines long, the inner ones bright reddish-brown. (433.)

& WHIPPLBI, Engelm. & Bigelow. Middle-sized, globose or oval, with 13 interrupted ribs. Outer spines 7-11, mostly ivory-white, the owest darkish, the upper much longer, flat and often curved; central spines 4, the upper broader, longer, white, the others brown, the lowest hooked. Flowers greenish-red, with few (2-5) sepals on the ovary, !M5 lines long, not quite so wide ; seeds few, large, tuberculate. Heads 3-5 inches high; spines 3-20 lines long. - On the lower Colorado (Bigelow, Newberry); in Desert Valley, west of Sevier Lake, Utah (H. Eugelmann) ; the latter with more radial spines, and often with more than one hooked.

E. POLYANCIBTBDB, Engelm. & Bigelow. Medium-sized, oval, with 13-17 interrupted ribs. Outer [117] spines 20 or more, white, the uppermost broader and longer; central spines 5-10, upper one broadest, longest, white, curved, the other* brown, terete, mostly hooked. Flowers yellow, krge, 2-2J inches long and wide, with about 8 (ringed sepals on the ovary; seeds as in the last. - He^waters of the Mohave (Bigelow) to the sage-plains of western Nevada (Gabb). The southern form 4-10 inches high, with longer spines (the longest W> inches); the northern but 3-4 inches high, with spines rarely more than 2 inches, the radial ones but J-1 inch long.

E. POBIBPINUS, Engelm. Small (only 2 inches high), oval, with 13 compressed sinuate ribs. Outer spines 6-10, bristle-like, 1-4 lines long, the uppermost longest, often curved or hooked, with or without a stouter hooked central one, all usually densely pubescent. Flower and fruit unknown. — Found by H. Engelmann in Pleasant Valley, near Salt Lake Desert.

E. JOHNSONI, Parry MSS. Medium-sized (4-6 inches high), oval, with 17-21 low, rounded, interrupted, dose-set, often oblique ribs, densely covered with stoutish reddish-gray spines; the outer 10-14, J-1 J inch long, the upper longest; the central 4 stouter, recurved, 1J inch long. Flowers large, 2-2J inches long and wide, purple or pink, with numerous reniform sepals on the ovary and tube, and ovate obtuse petals; seeds reticulate-pitted. — Discovered about St. George, in southern Utah, by J. E. Johnson, whose zeal for the development of the natural history and resource* of his region is commemorated in the name of the species.

E. POLTCBPHALUS, Engelm. & Bigelow. Usually with several heads, often over a foot high, with few very stout annulated curved spines and very early flowers, the base of which, as well as the fruit, is enveloped in dense cotton. — From the Mohave region, and may be looked for in southern Nevada.

CEREUS ENOELMANNI, Parry. Heads several, 4-12 inches high, cylindric or ovate, with 11-13 rib^ bearing bunches of about 13 pale adcular radiating spines, 3-6 lines lon*?, and about 4 darker (yellow, brown, [118] w black), stout and angular, straight or curved central ones, 1-3 inches long. Flowers very numerous, large («* inches broad or more), purple, diurnal. - From Salt Lake Desert (H. Engelmann) to Silver Peak in the Sierras (Qabb), and southward to southern Utah (Johnson) and the Mohave country (Bigelow).

C. TOUDiFLOBua, Engelm. With very short, pectinate, pale, and reddish-brown spines and small green flowers. — Common in Colorado, and may be found in Utah.

OPUHTIA (PLATOPUHTIA) BABILABIB, Engelm. & Bigelow. Low; joints 5-8 inches long, obovate or triangular, proliferous from their base, pulietcent, unarmed, but beset with numerous dente fascicles of short brownish brittle*, M

is also the ovary. Flowers large, 2J inches in diameter, purple ; fruit dry, with large and thick seeds. — Nevada, in the Silver Peak region south of Walker's Lake (Gabb), and southward.

0. 8PHJSR0CARPA, Engelm. & Bigelow, var. (?) UTAHENSIS, Engelm. Prostrate; joints email, orbicular-ovate, 2-3 inches long and nearly as wide, thick. Spines in the axils of the minute subulate leaves, few and mostly weak or solitary or none, with few and very short bristles. Flowers 3 inches in diameter, pule yellow; fruit oval, almost spineless, at last dry. — In the pass west of Steptoe Valley, Utah (H. Engelmnnn).

O. MISSOURIENSIS, D. C. Prostrate; joints medium-sized, obovate or almost orbicular, tuberculate; leaves minute, subulate, all bearing in their axils 5-10 radiating or deflexed spines, 1-2 inches long, often with a few erect darker ones. Flower large, 3 inches broad, yellow ; ovary and dry fruit spiny. — Quite variable, especially in the stoutness and color of the spines. From the upper Missouri to the Canadian and New Mexico, and throughout the Salt Lake basin. [Found in Salt Lake Valley and the Wahsatch, 4,200-6,500 feet altitude. July in flower. Joints sometimes 6 inches long and 4 inches broad, s. w] (434.)

O. HYSTRICINA, Engelm. & Bigelow. Very similar to the preceding, and proliably only a form of it, with [119] longer and more numerous gray or reddish spines, longer yellow bristles, and usually smaller flowers. — New Mexico ; between Walker and Carson rivers (H. Engelmann), and Owen's Valley (Gabb), Nevada. [Found abundantly in Monitor and Thousand Spring valleys, Nevada, 5,<XXM5,<>00 feet altitude. July in flower; September in fruit. Flowers either purple or sulphur-yellow, scarcely smaller. 8. w.]. (43(S.)

O. RUTILA, Nutt. Similar to *0. Missouriensis ;* joints often larger, 3 indies by 4 inches, covered with closely set bunches of mostly radiating and deflexed spines, the larger ones fluttened and often twisted. Flowers rone-red ; ovary and dry berry spiny. — From Fillmore to SU George, Utah (I>r. Palmer, J. E. Johnson). A rediscovery of Nuttall's long-lost plant, who found it near the Green River in southern Wyoming.

O. ERINACEA, Engelm. & Bigelow. Pacif. R. R. Surv., 4. 47, tab. 13. Diffuse, ascending ; joints thick, ovate, 2-2J inches lon*?, or sometimes elongated and almost cylindric, densely covered with clusters of 3-5 radiating spines, slender, f-1j inch long, very rigid, widish-gray, with 2-4 smaller ones Mow ; l*?rry ovate, \\ inch long, with crowded clusters of 12-20 mostly deflexed spines, 3-fi lines long.— Near Molmve ('reek, southern California (Bigelow). [A specimen in Herb, (fray., collected by Dr. Bloomer near Virginia City, Nevada (not seen by Dr. Engelmann), may belong to this species, B. W.J

O. FRAGIMA, Nutt. Joints small, ovate, compressed or tumid or even tervte, 1-1 \ inch long, fragile; larger spines 4, cruciate, mostly yellowish brown, with -M5 nmaller white radiating ones Mow ; brittle* fow. Flower* smaller, yellow ; fruit smaller, with 20-28 clusters of bristles, only the up|MT ones * itli a few short spine* ; seeds few, regular. — On the upper Missouri and Yellowstone, southward probably to New Mexico. [Found at the went hom*, of the Wahsatch, in Jordan Valley. Specimens not seen by Dr. Engeliiiann, but doubtless of this species. B. w.] (437.)

O. (CTLIXDBOPUKTIA) PULCHELLA, Engelm. Low, 3-10 inches high, spreading. Joint* «mull, slender, 1-3 inches long, 6 lines thick, elevate, tuberculated, with bunches of straight radiating npiues (MB lines long, fruin white to nearly black, one or more of the inner longer ones flatten**!. Flowers purple, If inch or lesb in diameter ; ovary and dry berry bearing numerous flexible, not barbed bristles. — Near Walker's River, Nevada (H. Engeliiuuin, Gabb). [Frequent in the valleys of western Nevada from the Trinity Mountains to Monitor Valley, 4,(XMU5,(KX) feet [120] altitude; May-August A very showy species, with sometimes 60 flowers upon a tingle plant; muiii sU-in " erect, becoming !) lines in thickness, and occasionally showing 25 annual rings, s. w.J (438.)

O. ARBOREHCENH, Engelm. • 3-5 feet high or more, with horizontal branches, rylindrfc, strongly tuberctiUted joints, numerous sheathed spines, large purple flowers, and tuberculated unarmed fruit. — New Mexico and Arixona, and probably farther northward.

O. ACANTHOCARPA, Engelm. & Bigelow. Similar to the last; rather more slender, and with more erect branches, smaller copper-colored flower*, and rather even, wpiny fruit. — Arizona, and pn»bobly southern Utah.

O. KRLTKseENrt, Kn^eliii. 2-1 feet high, with slender terete joint* 3 line* in thickticMi, very small yellow flowers, and «'url«*t lirrrif*. — From TVxa* to w»iithniL-<t«Tii California, and probably farther northward.!

[1] For th»- B'TWV «»K <'\MKOI:\I \, »»y W II. IInwrr .iii<l Hrreoo WAIMMI, I>r. Kii^»*liiiaiiii M»ntri)Hitii| t)t«- nrti«-|i« 'V-*hunt.* Hut IM nil but on** nf the N|Miif» luid «Inj.|y \m-*'U pabliahe\1, only thin "IK* in I».rr iriH»rt^l. Kl»tr«>i;*.

MAMILLARIA \KI/O\I< \, n <»». *(*>n *fi»Afin(hn:* ^luiw**** or ovate; tuberi les long ‹ Uin.Inil. a«-*-n<linif. ili-rplv LT'-*"I. bearing numerous straight, rigid spines, the 15 to 20 exterior ap4iir^ whitish, .1 to fl iu(rn<>r -»t«»iit#r *tnl *k«-f»)irn»n abort ; Hotrri Ur>5*-, r « ^ : o|.,n-l , v|^U »i t» *i*\ lin«*»r. *uUiUt«\ fnnl»ri*tc; |M-U)N 4" to 50, UlHV-linear, curved; MII?IIUIM 8 to |n, mint.-; Urry oval, grvrii, «ith obtuse, »«*ni|»r»TMitt|, pitr<t|(h^lit Kmniii M^IA.

< *hi* MIH<|V. »l».| r«- k\ *>t\ in iM>rtlfrn Aruoiis, fmm tho(\»l«>-r»«l«»«ntwiinl (^••IP<«. Pnlm«*r(F Bi*rh«»(T). ••*•! into VHillirnt rt.ih (.f. *K Jnln**%)* : |m»UMr in «nathf««t«*m Cilifnmla. Ijirijr in nil it« |mri4 t)i.in «!/. *pluU*Mprrm<9*%* S or 4 inih«*t thick : t'ibrr«)r« «n in.*h* Imitf ; «|iinr« 6 to 15 liwa l«»ng; Ilu«.r» 2 *in* 21 iu« hm mnlr, *trry* »howy. — Vol. I. p. 144.

XII. CACTACE.E OF SIMPSON'S EXPEDITION.

FROM REPORT OF EXPLOITATION ACROSS TUB GREAT BASIS OF THE TERUITOBY OF UTAH FOR A DIRECT WAGON-ROUTE FROM CAMP FLOYD TO GENOA, IN CARSON VALLEY, IS 1859, BY CAPTAIN [NOW COLONEL] J. H. SIMPSON, U. 8. ENGINEER. Washington, 1876. Engineer Dupartmeut, U. S. A.

THE geographical limits of the area of this curious American family have been con- [436] siderably enlarged by this Expedition, proving the presence of at least seven species in the Utah Basin between the thirty-eighth and fortieth parallels, — namely, two Echiuocacti, one Cereus, and four Opuntise. Several species known before have been found in new localities, and three new and very distinct species have been discovered, — two Echinocacti and one Opuntia.

MAMILLABIA VIVIPARA, Haworth, Suppl, p. 72 ; Torrey & Gray, Fl. N. Amer. 2, p. 554 ; Engelm. Synops. Cact, p. 13. *Cactu. viviparu,,* Nutull, Gen. 1, P- 295. Was collected in the South Pass and on Sweetwater River. It extends from here to the mountain, of Colorado and New Mexico ; but its most characteristic forms are peculiar to the more elevated plains, where it assumes that eeqntoM, spreading appearance from which it has received its name. The mountain form usually makes larger heads, but remains single or branches out very sparingly, Its large purple flowers, with numerous lunce-Unear, long acuminate, bristle-pointed petals; and its leather-brown pitted seeds, readily distinguish it from allied species.

ECHINOCACTUS SiMPSONi, sp.nov.:» simplex, subglobosus seu depressus, basi turbinatus, mamilliferus; [437] radicibus fasciculatis ; tuberculis laxis ovatis apice oblique truncatis axilla nudis, junionbus leviter compressis basi deonmrn productis, vetustioribus obcompressis basi dilatatis; areohs ovatis seu ovato-lanceoktis, nascentibus albo-villosissimu. mox nudatis; aculeis exterioribus sub-20 radiantrbus ten.ubus ngidis rectis albidis, additui supra aculeis 2-5 setaceis brevil.us, interioribus 8-10 robustioribus obscuris erecto-patubs, areola flonfera sub tuberculi apice areola, acnleigera, contigua circukri; floribus in vertice dissitis minonbus; ovano abbreviate, squanus sepaloideis triaugulatis ,«ucissimis (1-3) instructo; sepalis tubi brevis late infundibubformis orb.culatis seu ovatis obtusis .nembranaceo-marginatis crenulatis fimbriatis, sepalis supenonbus 10-12 ovatw obtusis inteKnuscuhs, petal* 12-13 oblongis apice crenulatis cuspidatis ex virescente roseis; stignuttibus 6-7 brev.bus erectis, bacca parva vind. sicca umbilico lutUsi.no truncate squaniis paucis eubinde aculeiferis ...structo flore marcescente demuni decduo coronat* irregularity basi seu latere dehiscente; seminibus magnis obovatis obbquis minute tuberculatis, hilo magPO ovato subbasilari, erabryone circa albumen parcum fere circu.nvoluto hamato.

Var fl. MINOR • tota planta, tuberculin, aculeis, flonbus nemimbusque minonbus.

Butie Valley, in the Utah desert', and Kobe Valley, farther west. Flowers in April and May ; fruit in June and July V.ir. fl. comes from the mountains of Colorado. - This, and the New Mexican *Edunocaetu, papyratantliu*** the Mexican *E.* W»piJ«, Len.., and perhaps the South American *B. Odieni,* I^m, and *B.* Ctmm^tt, Salm, a,.d probably one or two others, form the small *gnu?* of *Echinocactx,* w.th the appearance of *MamUarxa (ThdouUt, tuberJi, ffiraliUr dupont: dirtinclu,* Salm, Cact. Hort. Dyck, 1849, cult, p. 34). They constitute the closest and most imperceptible transition to *MamiOaria,* subgen. *Coryphanlha,* Synops. Cact, p. 8, which bear the flowers in the axils of the nascent tubercles, the flower-bearing and the spine-bearing areoln being connected by a woolly groove. In *M. fnammeru,* Engeinuinn, they come from the middle of the tubercle (Cact. Mex. Bound • tab. 15, fig. 4), and in the *Theloidei* they advance to the top of the tubercle, close to the spines, thus assuming the position which the flowers regularly occupy in the genus *Eckinocactu,* (see Cact Mex. Bound; tab. 20 fig. 2 ; tab 21; tab. 25 fig. 1; tab. 27, fig 1 ; tab 28 fig 2). • The ovary is also almost naked, like that of *MamMana* generally, or has only a few scales, like' that of *M.nuurtmerů.* On the other hand, the dry fruit,-such as is often found in *EMnocactv,* but never in *MamiUaria,* — the tul>erculated black seeds, and especially the large and curved embryo, and the presence of an albumen, do not permit a separation from *Eckitwcacttu.*

[1] An extract of this description was published in tlw Tranmctioim of the 8t Louis Acudemy of Sciences, Vol. II. p. 197 (1893).

[1] The plant I formerly d«*criM AS *ifamiltaria papyraevtiha.* Plant Fendl., p. 49, Synops. Cact., p. 8, proves to Wong to this section of *Behinoeaettu.* A closer exaniinntion rf Mr. Fendler's original specimen shows that the floral awola joins the spiuiferous one at the apex »f the small nnsoonl tnixrclcs. Thus far Mr. Fmdler's specimen, found near Simtii Ft', has remained the only one ever obtained of tliis pretty species.

* *Eehinceaetut hrtmhnmotwi,* Engritn.', forms an exception. In this species the flowers are situated exactly as in *Coryphnntiut,* at the base ol the tubercle, and connected with the ilintinot spiniferous wools by a woolly groove. (See Cact. Mex. Bound., tab. 19, fig. 2 and 3.)

This species is further interesting because it again strikingly proves that the general appearance, the [438] *habitus,* of a cactus plant not necessarily indicates its real affinities. Not only is it a true *Echinocactus,* notwithstanding every appearance of a *Mamillaria,* but it is moreover closely allied in all its essential characters to the very compact *E. intertextus,* Engelm., Cact. Mex. Bound., p. 27, tab. 34, in which all traces of tubercles are lost in the straight ribs. It has the same small flowers and the same small dry fruit, containing few large seeds, of similar structure, though not entirely the same arrangement of the spines.

Full-grown specimens of our plant are 3-6 inches high and 3-4 inches in diameter, of dark green color, tubercles loosely arranged in ^f or Jf order, 8 and 13 spirals being most prominent; they are 6-8 lines long, at base somewhat quadrangular, 6-7 lines wide in the vertical and 4-5 lines in the transverse diameter, becoming subcylindric upward; areolae 3-4 lines long, a little more than half as wide; the fruit-bearing tubercles are rather stouter and shorter. Exterior spines 4-6 lines long, whitish ; interior ones spreading, stouter, and a little longer (5-7 lines long), yellowish, and upward deep brown or black ; no truly central spine. In the very young plant the spines — 18-20 in number and only 1-lJ lines in length — are all radiating, closely fitting with their compressed bulbous bases on a linear areola, resembling in shape and arrangement those of *Cereus ccespitosus.* Soon afterward the areola becomes wider, and 6 or 8 short, stout, brown interior spines make their appearance, divergent like the original ones; jiext the ordinary arrangement, as described above, takes place.

It seems that quite early in spring the young tubercles on the vertex of the plant begin to form, exhibiting their densely woolly tops ; and SOQU afterward, long before any spines make their appearance, the tips of the smooth brown flower-buds come out. The flowers are 8-10 lines long and of nearly the same diameter, externally greenish-purple ; petals yellowish-green or verging to pale purple. The short stamens arise from the whole surface of the tube, leaving only a very small nectariferous space in its base. The fruit is about 3 or 3£ lines long and almost as wide, borne on a very large circular areola, surrounded by a woolly margin (see tab. 2, fig. 1). It bears toward its top 1-3 scales, sometimes with 1 or 2 small spines in their axils. The fruit usually opens by an irregular lateral slit; falling off, its base remains attached to the areola, as is the case in many (or all ? or only all the dry-fruited ?) *Echinocacti,* thus producing a basal opening (see tab. 2, fig. 5). Seeds H line long in the longest diameter, covered with minute close-set tubercles ; the young seedling shows erect, pointed cotyledons, and when a few weeks old begins to develop its pubescent spines.

Var. /9. has been received this fall from the Colorado gold region.[4] The smallest specimens were 1 inch in diameter, globose; the small tubercles in *-f*$_x$ order; spines l£-2 lines long, often curved, sometimes 1-3 darker stouter ones in the centre. The larger specimens are almost of the size of those of Utah, but often depressed at top ; tubercules arranged in |f or even fj order; spines only 4-5 lines long, 20-28 external and 6 or 7 internal ones. This species has been named in honor of the gallant commander of the expedition. *

E. PDBI8PINU8, sp. nov. :• parvulus, turbinatns, costis 13 subobliqnis compressis interruptis tuberculatis; [439] areolis orbiculatis, aculeis brevibus, rectis sea ssepe curvatis albidis apice adustis velutinis demnm nudatis, radialibus superioribus 1-2 robustioribns, longioribus rectis curvatis sea hamatis, ceteris 6-8 brevioribus;, aculeo centrali deficiente seu singulo robustiore longiore arrecto sursum hamato; flora ?; fructu t.

Pleasant Valley, near the Salt Lake Desert; found May 9 without flower or fruit. Plant 2 inches high, 1 or l£ in diameter; compressed tubercles 4-6 lines distant from one another, confluent in 13 ribs. Radial spines 1-4 lines long, white pubescent or almost tomentose, more so than I have observed in any other cactus. On the lower areolae I find only 5-6 spines, the upper ones a' little longer and stouter than the balance; farther upward the number increases to 10, one or more of the upper ones becoming still stouter and often hooked ; at last here and there a single central spine makes its appearance, 5-6 lines long, the strong hook always turned inward or upward. At first only the dusky point of the spine is naked ; with age the whole coating seems to wear off. In another specimen I find the spines 8-12 in number, a little longer, more slender, all radiating. The small supraspinal areola proves this plant to be an *Echinocactus* ; it probably belongs, together with the next, to the section *Hamati,* Synops. Cact, p. 15.

E. WHIPPLEI, Engelm. & Bigelow, Pacif. Rail. Rep. IV. Cact., p. 28, tab. 1; Synops. Cact, p. 15. Var. BPINOBIOR : globosus; costis 13 coinpressis interruptis, aculeis radialibus 9-11, inferioribus rope obecurioribus, reliquis longioribus niveis, 2 superioribus scope elongatis complanatis curvatis ; centralibus 4, summo elongato [440] complanato pergamentaceo flexuoso albo, 3 reliquis paulo brevioribus obscuris omnibus seu solum infimo hamatis ; floribus minoribus ; ovario squamis se|Miloideis 5 oblongis munito; sepalis tubi linearibus margine membranaceis integris mucronulatis, petalis angustis oblongis; stigmatibus 6-7 brevibus in capitulum globosum congestis; bacca ovata parce squamata floris rudimentis persistentibus coronata.

[4] It here grows and thrives, probably at a higher elevation than any other northern Cactus, occupying, *e.* ?, the gravelly moraines of the glacial period of Clear Creek Valley, between 8,000 and 9,000 feet altitude, and, in the southern part of the Territory, the Sangre de Cristo Pass, 10,000 feet high.

» This description has been published in Trims. St. Lonis *Acml*$_t$ Vol. II. p. 199 (1863). It is rather strange that neither this nor the above-mentioned *E. papyracantkm* has ever been found again (January, 1876).

The species was originally discovered on the Little Colorado by Dr. Bigelow, and was found afterward on the same stream by Dr. Newberry. The variety here described was met with more than five degrees farther north, in Desert Valley, west of Camp Floyd ; remains of fruit, with the withered flowers attached, and some seeds, were found concealed between the spines, from which the description has been drawn.[6] Globose heads 3 inches in diameter; radial spines J-1J inch long, central ones 1J-2 inches in length. Flowers, if I may judge from the withered remains^ about 1 inch long; ovary small, bearing about 5 membranaceous scales, the lower triangular, the upper oblong-linear/almost entire, and never cordate or auriculate at base, as they appear in most of the allied species; sepals of tube also 'narrow linear, or oblong-linear, 2-6 or 6 lines long, £-1 line wide; stigmas about J line long. Fruit apparently an oval berry, £ inch long. Seed just as it is described and figured in Whipple's Cactaceae; the tubercles on the seed-coat are extremely minute and distant from one another, each forming a central protuberance on the otherwise flat surface of an angular cell of two or three times the diameter of the tubercle itself; embryo curved about | around a rather copious albumen.

CEBEUB VIRIDIFLORUS, Engelm. in Wisliz. Mem., note 8, sub Echiuocereo; Cact. Mex. Bound., tab. 36; Synops. Cact., p. 22. This is evidently the northernmost *Cereus,* extending to the upper Platte ; it is abundant in Colorado. These northern specimens are 1-3 inches high, 13-ribbed, and show the greatest variability in the color of the radial spines; in some bunches they are all red, in others white. In others again the colors are distributed without much regularity ; sometimes the upper and lower spines are white and the lateral ones red, or a few or even a single one above and below are red and all the rest white, or the lower ones are red and the upper ones white, and all these variations sometimes occur on the same specimen. I mention this to show how little reliance can be placed on the colors or the distribution of the colors of the spines. Central spines wanting, or one or two projecting horizontally, straight or curved upward, white or tipped with purple or all purple, 6-9 lines in length.

C. ENGBLMANNI, Parry in Sillim. Journ., n. ser. 14, p. 338; Engelm. Cact Bound., p. 36, tab. 57; Synops. Cact., p. 27. Deserts west of the Salt Lake, without flower or fruit. Specimen entirely similar to the one figured in the Cactace© of the Boundary. The species seems to extend from the Salt Lake region southwestwardly to Arizona and the Mohave country.

OPUNTIA SPMROCARPA, Engelm. & Bigelow, Pacif. Rail. Rep. IV. Cact., p. 47, tab. 13, fig. 6-7; [441] Synops. Cact., p. 44. Var. ? UTAHBNSIS : diffusa, laete-virens, articulis orbiculato-obovatis, crassis, junioribus s»pe globoso-obovatis; areolis subapproximatis; foliis minutis subulatis divaricatis; Retis brevissimis paucis straminеis; aculeis nullis seu parvulis nunc singulo longiore recto robusto albido; floribus sulphureis, ovario obovato areolis fusco-tomentosis sub-25 instructo, sepalis exterioribus transversis obcordatis cuspidatis ; petalis 8 late-obovatis emarginatis; stylo vix supra stamina exserto; stigmatibus 8 brevibus erectis; bacca obovata areolis plurimis tomentoais Btipata; seminibu8 numerosis irregulariter compressis anguste marginatis.

Pass west of Steptoe Valley, in the western mountains of the Basin ; found July 19 in flower and fruit. Joints 2-3 inches long and of almost the same diameter, often over £ inch in thickness, sometimes almost terete or rather egg-shaped; areolae 6 or 8 lines apart ; leaves very slender and acute, scarcely 1 line long, smaller than in'any other of our species except *0. basOaris,* also a western form from the lower Colorado ; bristles few, and even in old joints scarcely more than \ line long; spines none, or on the upper areolae a few short ones, with here and there a stouter one j-1 inch in length. Flowers nearly 3 inches in diameter, pale or sulphur-yellow; when fading, reddish. Fruit about 1 inch long and half as wide, with a deep umbilicus, and with 20-25 areola, which sometimes show a few bristles or a minute spine. Seeds very irregular, 2, or, in the largest diameter, sometimes *2*± lines wide.

Unwilling to increase the number of ill-defined species in this most difficult genus, I attach this plant to the ≤mly species known to me to which it possibly can be compared,- *0. yhvrocarpa,* from New Mexico, - though its &uit is not spherical, has not a shallow umbilicus, and is, at least in the specimen before me, not dry. The latter would be an insuperable distinction, if we might not suspect, what in fact is often the case, that the fruit later in the season would become dry and brittle. The leaves—which heretofore have been entirely too much neglected as a diagnostic character in this genus—and the flowers of the original *0. sphcerocarpa* are unknown thus far.

0. TORTISPINA, Engelm. & Bigelow, 1. c, p. 41, tab. 8, fig. 2-3 ; Synops. Cact., p. 37. Forks of the Platte • in nowerm July. The specimens being very incomplete, I am not quite sure that this is the same species as that of Uiptarn Whipping Expedition 5 the joints appear to be somewhat smaller, the areol© closer together, and the spines [illegible] and *ntheT* weaker. It may possibly prove to be an extreme form of *0. Bajmesmiii,* the area of which extends to the Rocky Mountains. Leaves subulate, 2 lines long; flowers 2J-3 inches in diameter, sulphur-yeuow; ovary long (1-1* inch), with 20-30 areol», with light brown wool and short bright brown bristles; exterior [illegible] broadly obovate, obtuse, crenulate5 stigmas 6-8, short, erect, as long as

• The botanist of. Dr. Hayden'a Expedition of 1875, Mr. Bnmdegee, found it abundantly in southwentern Colorado.

0. HYSTRICINA, Eiigelm. & Bigelow, 1. c, p. 44, tab. 15, fig. 5-7 ; Synops. Cact., p. 43. A flowering specimen, collected in June between Walker and Carson rivers, is exactly like one found by Dr. Bigelow on the Colorado Chiquito. It has slenderer and straighter spines than the one figured iu Whipple's Report, and approaches somewhat to *0. erinacea,* Engelm. & Bigelow, of the Mohave region, in which I now recognize the long-lost *0. rutila,* [442] ttutt. in Torr. & Gray, Flor. 1, p. 555. Joints 5 inches long, half as wide, obovate; leaves l£ lines long; areolsB closely set with long straw-colored bristles; lower ones with few and short white spines, upper ones with numerous grayish-red spines l£-2 inches in length. Flowers pale straw-colored, 24-3 inches in diameter; ovary 1 inch long, with 20-30 white woolly aculeolate areolse; exterior sepals oblanceolate, squarrose, or recurved at the elongated tip ; petals obovate, obtuse, crenulate ; style with 8 or 10 short erect stigmas, longer than the stamens. The squarrose tips of the sepals are particularly conspicuous on the bud.

0. MISSOURIENSIS, De Cand. Prod. 3, p. 472 ; Torr. & Gray, Flor. 1, p. 555 (in part). *Cactus ferox,* Nutt. Gen. 1, p. 296. From the deserts of Salt Lake Valley to Rush Valley; specimens without flower or fruit. Joints small (2-3 inches long), broadly obovate or circular; areolso closely set; spines numerous, stiff, stout, angular, white, mostly deflexed.

0. MISSOURIENSIS, var. ALBISPINA, Engelm. & Bigelow, 1. c, p. 46, tab. 14, fig. 8-10; Synops. Cact., p. 44. Smith Creek, Lookout Mountains, in western Utah; flowering in July. By their slender flexuous spines the specimens approach to var. *trichophora.* Flowers 3-3J inches in diameter, bright golden-yellow; ovary 1 inch long, with 20 or 25 areolae, scarcely spiny ; exterior sepals obovate, cuspidate ; petals about 8, obtuse, crenulate ; style shorter than the stamens ; stigmas about 5, very short, erect. Some flowers have elongated and very spiny ovaries, evidently abortive.

0. PRAGILIS, Haworth, Suppl., p. 82; Torr. & Gray, Flor. 1, p. 555; Synops. Cact., p. 45. *Cactus fragilis,* Nutt. Gen. 1, p. 296. Fort Kearny to the North Platte country; in flower in June and July. This is, I believe, the first time that the flowers of this species were collected since Nuttall's discover}' of it in 1813. Travellers report that the plant is very frequently seen in the sterile prairies east of the Rocky mountains, but that it is rare to find them in flower, and rarer still in fruit. Since many years I have the plant in cultivation from specimens brought down by Dr. Hayden, but have not been able to get it to flower. Nuttall only informs us that the flowers are solitary and small. In the specimen before me they are yellow, scarcely 2 inches in diameter; ovary 8-9 lines long; the 13-15 areolse are densely covered with thick white wool, the upper ones bear a few white spines ; lower sepals broadly oval, with a short cusp ; petals 5, obqvate, rounded, crenulate ; style longer than the stamens; stigmas 5, short, erect, cuspidate.*

0. PULCHELLA, sp. nov.:[7] parvula caespitosa diffusa; articulis parvis obovato-clavatis; foliis minutis [443] e basi ovata subulatis ; areolis confertis, superioribus aculeos albidos rectos, singuluni longiorem complauatum porrectum sea deflezum alios brevissimos radiantes gerentibus; floris purpurei ovario areolis 13-15 convexis albo villosissimfe et longe setosis dense stipato ; nepalis inferioribus lineari-oblongis breviter cuspidatis, superioribus spatulatis; petalis sub-8 nbovatis obtusis, stylo cylindrico exserto, stigmatibus 5 linearibus suberectis; bacca sicca setosissima, seminibus crassis rhaphe lata plana notatis.

Sandy deserts on Walker River; * flowers in June. — This is one of the smallest, as it is one of the prettiest, species of this genus. It belongs to the small section of *Clavatw* (Synops. Cact., p. 46) of the cylindric *Opuntue,* but is distinct from all those known to me by its small joints and purple flowers; all the others have, so far as I know, yellow flowers. Joints l-1£ inch long, 4-6 lines thick, very slightly tuberculated; leaves scarcely 1 line long; areol© crowded, white woolly. Larger central spine on the upper areoloo 4-6 lines long, flat, and somewhat rough above, convex below; smaller ones 4-6 or 10, radiating, $-1£ line long. Flowers crowded, of a beautiful bright purplish-red or deep rose-red color, lj-lJ inch in diameter ; ovary 4-5 lines long, beset with white capillary spines, 3-5 lines long, 15-20 on each areola; style not ventricose, as is usual in the genus, but cylindric; stigmas slender, pale yellow; berry clavate, at last dry, about 1 inch long, well marked by the conspicuous white-woolly areoko and their numerous purplish-brown, flexible, hair-like bristles, 4-6 or 7 lines long. These bristles are entirely destitute, of the minute barbs which otherwise invariably characterize spines and bristles of *Opuntia.* The thick round seeds, 2 lines in diameter, are well distinguished by a broad rhaphe, much wider than I have seen it in any other clavate *Opuntia**

* This note, containing the character and description of *Opuniia Pes* Com', having been printed iu the preceding article (p. 226), is here omitted. — EDITORS.

[7] An account of this species was given in the Transactions of the St. Louis Academy, II. p. 201 (1863).

[8] This pretty species was afterward (1867) collected "among the sago brushes" of Nevada, by Mr. William Gabb; and in the following year by Mr. 8. Watson, "frequent in the valleys of western Nevada, from the Trinity Mountains to Monitor Valley, 4,000-5,000 feet alt.[11]

EXPLANATION OF PLATES.

Plate I. *JEchinocactus Simpsoni* as it appears in early spring. On the vertex a young growth of tubercles is visible, their tops covered with wool.

Plate II. Details of the same.

Fig. 1. Four tubercles from near the vertex : one shows the broad scar where the fruit has fallen off; another one is just developing its spines, exhibiting their points above the thick wooL

Fig. 2. A detached tubercle bearing a ripe fruit.

Fig. 3 and 4. Flowers with the upper part of the tubercle and its young spines.

Fig. 5 and 6. The fruit magnified three times; fig. 5 showing the basal opening, fig. 6 the broad umbilicus.

Fig. 7. A scale of this fruit more magnified, with two axillary spines.

Fig. 8-12. Seed : fig. 8 natural size, the others eight times magnified; fig. 9 lateral, fig. 10 dorsal, fig. 11 basal view; fig. 12 part of the surface, highly magnified.

Fig. 13. Embryo, enveloped in the inner seed-coat, including also the albumen, magnified.

Fig. 14. Lateral, fig. 15 frontal view of the embryo, magnified.

Fig. 16. Seedling, a few weeks old, magnified.

Fig. 17. Tubercles of the smaller variety, from Colorado, in every state of development.

Plate **III.** Fig. 1. Part of a plant of *Opuntia pulchella,* showing a flower-bud and two flowers, natural size.

Fig. 2-4. Bunches of spines, four times the natural size.

Fig. 5. Section of a larger spine, more magnified.

Fig. 6. A leaf from an ovary, with the axillary woolly and bristly areola, four times natural size.

Fig. 7. A fruit.

Fig. 8-9. Seed, four times magnified; fig. 9 showing the broad rhaphe.

XIII. CACTACEJE OF WHEELER'S EXPLORATION.

FROM REPORT UPON UNITED STATES GEOGRAPHICAL SURVEYS WEST OP THE ONE HUNDREDTH MERIDIAN, IN CHARGE OF FIRST LIEUTENANT GEORGE M. WHEELER, U. a ENGINEERS. Published by ENGINEER DEPARTMENT. Vol. VI., BOTANY, by J. T. ROTHROCK. 1878.

MAMILLARIA (CORYPHANTHA) VIVIPARA, **Haw., Engelm. in Watson's Bot. King's Expl. 117. A common [127] plant on the western plains from the Missouri to Texas, extending in the mountain regions as far west as Arizona and South Utah. The large, deep rose-colored or purple flowers, with fringed sepals and lance-linear, acuminate petals, green oval berries, with light brown pitted seeds, readily distinguish the species. The form of the plains is lower and often densely cespitose-spreading; the mountain plant is often simple and larger. The largest form, which comes from Arizona, I had at one time distinguished as *M. Arizonica,* but must now consider it as only a gigantic* *Vivipara,* a-5 inches high, 4 inches in diameter, with spines often over 1 inch long on rather broad and spreading tubercles. Rothrock, 1874 (203), is a smaller form, from Camp Apache, Ariz.**

M. (CORYPHANTHA) CHLORANTHA, sp. nov. Similar to the last, but with broader yellow petals; stems oval to cylindrical, 3 inches wide, sometimes 8-0 inches high ; tubercles compressed from above ; 20-25 outer spines gray, almost in 2 series; 6-8 or 9 inner ones stouter, $-1 inch long, reddish or brownish only at the tip. Flowers yellowish or greenish-yellow, crowded on the top of the plant, 1 } inch long 8 and wide, often 1-2 small fringed sepals on the ovary (which also occasionally is seen in *Vivipara)* ; sepals lanceolate, fringed; petals lanceolate or linear-lanceolate, acute, denticulate; 7-9 whitish stigmas, erect-spreading. — Southern Utah, east of Saint George (Dr. Parry, I* £. Johnson).

EOHINOCAOTUS WIBLIZKNI, **Engelm. Very large, often over 3 feet high and half as much in diameter; at first globose, then ovate to cylindrical, with 21-25 rather sharp ribs. The large linear-oblong areola (very [128] woolly when young) bear three kinds of spines: first, 4 very stout, anndated, reddish ones, If-2J inches long, the 3 upper ones straight, the lower one hooked; second, 3-5 lower and usually 3 uppermost spines, slender, but straight, stiff, and annulated, of reddish color; third, 12-20 whitish, bristle-like, flexuous, lateral spines. Flowers »-2$ inches long, lfc wide, yellow, outside greenish with purple-brown; ovary and fruit imbricately covered with numerous (60-60) cordate or reniform crenulate sepals; sepals of tube oblong, ciliate; petals broadly linear, crenate, bristle-pointed; style deeply divided into 12-18 linear stigmas; seeds 1 line long or over, reticulate ox shallow-pitted. — Southern New Mexico.**

Var. LE CONTEI *(E. Le Contei,* Engelm.). At last clavate from a slender base ; lower central spine more flattened, curved or twisted, but not hooked ; flower rather smaller and with fewer parts. — This is the western form, from South Utah and Arizona to and beyond the Colorado River. Dr. Rothrock collected, at Camp Bowie, Arizona, a peculiar form (492), which may represent another variety, *decipierw:* globose, 1 foot in diameter; spines shorter and fewer, no straight spines above the 4 central ones, none longer than 1-1£ inches, 10-15 thin flexuous spines on side and upper end of areolae ; only 20-25 sepals on ovary.

E. POLYCEPHALUS, Engelm. & Bigelow (see Watson in Bot. King's Expl. 117). From the Mojave region to southwestern Utah. The numerous spiny-bristly sepals, and the linear, acute, yellow petals, almost hidden in a dense cottony wool.

£. WHIPPLBI, Engelm. & Bigelow; Watson, L c 116. On the Lower Colorado River, and northward into Utah.

CEBEUS (ECHINOCEREUS) ENOELMANNI, Parry; Watson, L c. 117. Throughout Arizona and into Utah and southern California. Flower purple, open only in mid-day sunshine. —Camp Bowie (1002) ; Mrs. Major Sumner. Flower only. May be this or an allied species.

C. (ECHINOCEREUS) PHCENICEUS, Engelm. Globose or oval heads, 2-3 inches high, about 2 inches in diameter, several to a great many (sometimes over 100) from one base, 8-11-ribbed; 8-15 slender but straight, stiff, and very brittle spines in each bunch, £-1£ inch long, 1-3 of them more central and a little stouter. Deep red [129] flowers, 1J-2J inches long, half as wide, open equally day and night; spatulate, rather stiff petals, rounded at tip. — From, West Texas to southern Colorado and Arizona, as far west as the San Francisco mountains (Bigelow), and from Fort Whipple (Palmer).

C. (ECHINOCEREUS) TRIG LOCH IDIATUS, Engelm. Few (2-5) globose or oval beads, 2-4 inches high, 2-2£ thick, 6-7-ribbed ; areolae more distant than in the lost; spines fewer, only 3-6, flattened or angular, usually curved, about 1 inch long; flowers same as in last. — New Mexico, Santa Fé, 1874 ; Rothrock (39).

C. gonacanthus, Engelm. & Bigelow, — which extends from New Mexico to the Arkansas River and westward to Zuñi, and is characterized by its stouter, longer, and more numerous spines,—may belong to this species; and perhaps both, with numerous other so-called species, which vary only in the number of the ribs, the number or form of the spines, and the closeness of the spine bunches, but have all similar flowers, may have to be considered as forms of one polymorphous type (C. *phceniceus).*

OPUNTIA (PLATOPUNTIA) BASILARIS, Engelm. & Bigelow. A low plant, with broadly obovate, often return or fan-shaped joints, branching mostly from the base, pubescent, as well as the fruit; areolee very close, without spines, but densely covered with short yellowish-brown bristles; flowers large, rose-purple ; fruit dry, subglobose, with rather few large and thick seeds. — Southeastern California to Arizona. Distinct from all other species of this region by its mode of growth, its pubescence, the absence of spines proper, and the very large (3J-5 lines wide) seeds. The large purple flowers, which in the season completely cover the plant, make a beautiful show.

O. (PLATOPUNTIA) MISSOURIENBIS, D.C. Santa Fe\ New Mexico, 1874; Rothrock (6). Common from the plains of the Missouri into the mountains. A low, very spiny (whence NuttolTs name, *0. feroz)* species, with yellow, or sometimes (on the upper Arkansas plains) purple flowers, and dry spiny pods, which contain large, much compressed, and broadly margined seeds.

Several more — probably half a dozen — flat-jointed *OpuntüB* have been noticed in Arizona; some prostrate and with smaller joints, others tall, erect, with large joints (to a foot or more in length), many of them very spiny. Of them not much is known, as the plants are difficult to preserve, and flowers and fruit have not often been [130] found or collected. Full notes, living joints, good fruit and seed, and pressed flowers are desirable to make us sufficiently acquainted with these plants. The best method of preserving the flowers is to split them open before attempting to dry them. Living plants or joints are very valuable, but alone are not sufficient, because in cultivation they very rarely flower and scarcely ever bear fruit.

O. (CYLINDROPUNTIA) OLAVATA, Engelm. A low, cespitose plant, with short (1-3 inches high, 1 inch thick), clavate, ascending, strongly tuberculate joints, the upper areola bearing 4-7 ebony-white, flattened, striate spines, surrounded by a number of smaller bristly ones; yellow flowers, 2 inches wide; dry, yellow, oval pod, covered with numerous large, woolly, and long-bristled areola. —El Rito, New Mexico (Rothrock), in 1874 (92); also about Santa Fe\ etc

O. (CYLINDROPUNTIA) PULOHSLLA, Engelm. (see Watson's Bot King's Expl. 119; Simpson's Rep. Bot., tab. 3) A very small, purple-flowered species of Nevada. A flower brought home by Mr. Bischoff was by a singular error enumerated in the Catalogue of 1874 as *Cereut viridijtorut.*

O. (CTLINDROPUNTIA) ARBORESCENB, Engelm. (see Watson, 1. c. 120). Cuero, New Mexico £101), Rothrock in 1874; Cienega, South Arizona (near Tucson), the same (584); and from Camp Bowie, Ariiona (1002), by

Mrs. Major Sumner. This handsome species extends northward to the plains of Colorado and Pike's Peak, covering extensive tracts. Remarkable for its horizontal, often whorled branches; purple flowers, 2-2J inches in diameter; ovary often with some spiny bristles, which at maturity disappear. The skeleton —as the cactus wood is rather fancifully called after the soft tissues have rotted away—forms a heavy, hollow cylinder, with regular rhombic holes or meshes corresponding to the tubercles and spine-bunches of the plant, and makes excellent canes.

This species is closely allied to the Mexican 0. *imbricate* and *0. decipiens, —arb&rescen** being the northern larger-flowered form, — but the seeds are different.

O. (CYLINDROPUNTIA) BIGBLOVII, Engelm. (Pacif. JRaiL Rep. 4, Bot. 60, tab. 19). An erect, bushy [131] plant, 10-12 feet high, with oval or subcylindric joints, bearing on short oval tubercles 3-6 large (1 inch long) and many smaller spines, the larger ones loosely covered by glistening whitish sheaths ; purple flowers, small, 1 inch wide; fleshy greenish berry; numerous small and very irregular seeds, or often abortive; wood a wide fragile tube, with short meshes,

O. (CYLINDROPUNTIA) TESSELLATA, Engelm. Very bushy, from a stout trunk, with solid wood, sometimes several inches thick; ultimate branches as thick as a swan's quill, covered with angular, flattened, ashy-gray tubercles, the uppermost bearing at their upper end single, long, loosely yellow-sheathed spines; flowers small (about f of an inch wide), yellow; small fruit, oval, covered with long, soft, brown bristles. Pacif. Rail. Rep. 1. c. tab. 21. — On both sides of the Lower Colorado River, 6-7 feet high. The yellow shining spines, crowded on the upper end of each year's growth, together with the scale-like tubercles, give the plant a singular and striking appearance.

There are several other cylindric *Opwntia* in Arizona not collected in these Expeditions, and for the most part only imperfectly known. It is desired to direct attention to this interesting group, which, on account of the bulky forms and forbidding armament, are too much shunned by travellers. — 0. *echinocarpa,* Engelm. & Bigelow, is a low and very spiny bush, with yellowish flowers and dry spiny fruit. — 0. *accmihocarpa,* Engelui. & Bigelow, is taller, with elongated tubercles, or rather ridges, copper-colored flowers, and dry fruit bearing few but stouter spines. — *0. mamillata,* Schott, and 0. *fulqida,* Engelm. & Bigelow, are allied to 0. *Bigelovii,* with thick tubercles or prominent crests, the former with small, the other with numerous long and shining sheathed spines; fruit often abortive. Good specimens, with flower, fruit, and good seed of the same plant (so that mixing species and forms may be avoided), are very desirable, as we know scarcely anything more about them than what the botanists of the Mexican Boundary Commission (often at the most unfavorable season) could find out twenty-five years ago.—0. *leptocautis,* D. C. *(0. frutescens,* Engelm.), the most slender *Opuntia* known, bushy, with branches like pipe-stems, small yellow flowers, and red, somewhat fleshy berries, is common from North Mexico, through Texas, to Arizona. It has been said that [132] its flowers, contrary to the habit of the genus (which has diurnal flowers, t. *e.* open in sunlight), are nocturnal, which, however, is now positively denied.

XIV. THE PULP OF CACTUS FRUIT.

FBOM TRANSACTIONS OP THE ST. LOUIS ACADEMY OP SCIENCE, VOL. II., OCTOBER, 1861.

ZUCCABINI, than whom none better understood the morphology, as well as the systematic [166] characters of the Cactaceae, had already in the year 1845 (Plant nov., fasc. 5, pag. 34) expressed the opinion that in Cactaceae, as well as in Cucurbitaceae, the *funiculi* assisted in forming the pulp of the fruit Schleiden (Grundziige, ed. 3, p. 408) ascribes the pulp of Mamillaria to an *arOlus,* dissolving into single juicy cells. Gasparrini, in his extended but rather odd description of the Opuntise fruit (Osservarioni, 1863, p. 20), also considers the pulp as a peculiar sort of an arillus* I had long since come to the conclusion, especially after examining the somewhat dry fruits of *Cereus caspitosus* and *fichinocadu* setispinus,* that the funiculi alone constitute the pulp, and in Cact Mex. Bound, tab. 20, fig. 12,1 had figured the enlarged funiculi of the latter plant

The Cactus fruit is usually succulent; only some Echinocacti and some Opuntiee are known- to tear dry fruits. The succulent fruit consists of the fleshy walls of the fruit itself, originating from the carpel and the adhering calyx (or part of the stem, as Zuccarini will have it), coalescing and forming a homogeneous mass, and of the juicy pulp, in which latter the seeds are imbedded. In

some species the parenchyma of the walls, in others the mass of the pulp, prevails. *Tlie pulp is always the product of the faniculus or its appendages.* The funiculus, even at the flowering period, bears on its inner side a beard of transparent fibres, 0.01-0.10 line in length; the fruit maturing, these fibres are enlarged, and the whole cellular tissue of the funiculus becomes, as it were, hypertrophic, every cell swelling up, filling with a sweetish, mostly red-colored juice; at last the cells in most species separate from one another, and leave the seeds floating in the pulp attached only to the slender spiral vessels. The mass of the funiculi and their proportion to the mass of the seed is very different in different species; in *Zepismium Myosurus* it constitutes only £ or £ of the seed ; in *Mamillaria Nxdtallii* it bears, perhaps, a still smaller proportion; while in other Mamillariae, e. g. *M. polythele* and *M. pusilla,* it is 2-4 times as large as the seed. In the large edible [167] fruits of *Cerei,* such as *C. trvtngularis, C. graiidiflorus, C. giganteus,* etc., it constitutes by far the largest part of the fruit. The cells are globular, oval, or variously compressed; in some species extremely small, 0.01-0.03 line long, while in others they are 0.1-0.2 and even 0.3 line long.

The genus *Opuntia* apparently differs in having the whole seed covered with juicy cells, which, in size and quantity, vastly predominate over the cells of the rather insignificant funiculus proper. But the whole bony coating of the seed being but an arillary enlargement of the funiculus (Cact. Mex. Bound., p. 76), this peculiar case entirely falls into the analogy of the other *Cactacece.* The real difference is caused by the nature of the arillus, which, getting extremely hard, leaves the cells of the epidermis only to grow out, and finally to form the pulp of the fruit. Soon after fecundation these cells gradually become elongated, cylindrical, and disconnected among one another, rising perpendicularly from the surface of the seed; they are shorter, of nearly equal length, and perfectly straight, on the faces of the young seed, and longer, hair-like, and twisting in different directions on and near the rim. In *O. glaucophylla,* which I take to be a mere variety of *O. Ficus Indiea,* I find them at their first appearance on a seed of less than one line in diameter only about 0.004 line long and wide; on the rim they soou grow to twice the diameter and ten times the length, till at maturity the larger ones are 0.3-0.5 line long. These cells, at first simple and cylindrical, become at last jointed and clavate, the terminal cells being many times larger than the basal ones, thus properly filling the interstices between the seeds. During winter, the fruit and seeds having reached their full growth, these cells contain a colorless, viscous, insipid fluid ; in the following spring, when the fruit has assumed a deep purple color, and attained full maturity, they contain a sweetish, purple liquid, and soon separate, forming what is properly called the pulp. The single cells are mostly oval or oblong, 0.02-0.20 line in length. I find the same structure in *O. Engelmanni,* which, however, ripens its fruit, with us, in autumn, and it undoubtedly obtains in all Opuntise with large and juicy fruit In *0. Rafinesquii,* and probably in all species with less juicy fruit, the cells on the face of the seed are not developed, those on the rim producing the pulp, which in this species as well as in *O. vulgaris* and *0. Pes Corvi,* remains, even at full maturity, insipid, viscous, and of pale red color. In this condition the fruit adheres to the plant, unchanged, until it falls off in the following spring.

In *0. Brasiliensis* and *0. monacantha* these epidermis-cells are greatly elongated, forming, in fact, a matted tough beard, 2-3 lines long, analogous to that of the unripe cotton-seed; each hair consists of several slender joints, 0.01-0.02 line in diameter, the terminal one often thickly clavate or otherwise variously inflated. I have found them thus in the unripe fruit late in autumn; how they may change at maturity I have been unable to ascertain.

No such development of the epidermis-cells seems to take place in the Opuntia with dry fruit, such as 0, *Missouriensis, O. clavata,* etc.; the seed, consequently, has a whiter, polished, ivory-like surface, while that of the juicy Opuntise fruits is dull and almost rough, and not so white.

The cells of the parenchyma of the fruit, as well as those of the bony seed-coat, are full of aggregations of crystals; those of the funiculus proper contain fewer and smaller clusters; but in the pulp itself I have never seen them ; neither could I discover any in the parenchyma, or in the pulp of the fruits of Mamillariae.

V.

PAPERS ON JUNCUS.

I. A REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS JUNCUS, WITH A DESCRIPTION OF NEW OR IMPERFECTLY KNOWN SPECIES.

FROM THE TRANSACTIONS OP THE ST. LOUIS ACADEMY OP SCIENCE, VOL II., p. 424-498. [Issued down to p. 458, May, 1866.] 1866-1868.

THE difficulty I found in arranging the species of *Juncus* of my own herbarium, the [424]. doubts in which the authors left me by incomplete and unsatisfactory descriptions, and by confusion in the names and synonyms, the want of confidence which all my correspondents, even such as had paid a good deal of close attention to it, seemed to place in themselves and their own judgment when this genus was under discussion, — all this induced me to enter upon a critical study Qf our *Jund.* I was greatly aided by the most liberal contribution of specimens and of observations from all sides; among those to whom I am thus indebted I mention Professor Asa Gray, of Cambridge, and Messrs. E. Durand, 0. E. Smith, and Professor Leidy, of Philadelphia, who sent me their own and the herbaria of the institutions under their care; Dr. J. W. Bobbins, of Massachusetts; Rev. 0. Brunet, of Quebec; Dr. H. P. Sartwell, of New York; Professor T. C. Porter, of Pennsylvania; Mr. M. S. Bebb, of Washington; Eev. M. A. Curtis, of North Carolina; Mr. W. H. Ravenel, of South Carolina; Dr. A. W. Chapman, of Florida; Mr. E. Hall, of Illinois; and last, but not least, Professor W. H. Brewer, of the California State Survey, and my indefatigable and ever obliging friend, Mr. H. N. Bolander, of San Francisco. In Europe I was greatly assisted by Professor Cuspary, of Kcenigsberg, who compared E. Meyer's herbarium, and by Professor A. Braun and Dr. Garcke, of Berlin, who examined Willdenow's and Kuuth's herbaria for me. My very particular thanks are due to all of them. Michaux's and Lamarck's plants have, thus far, been inaccessible to me, and thus some questions of synonymy must remain unsettled for the present

A very conscientious examination of over a thousand specimens from all parts of the country, with careful dissections of their flowers and fruits, and drawing of these details, has enabled me, I believe, to place the proper value on the characters derived from the different OTgans of these plants, and to arrive at definite conclusions in regard to their species and varieties and their affinities among themselves.

These investigations, to be sure, were all made " in the closet" since the end of last summer, but I trust that they are not the less reliable, and that those who have the opportunity will follow them up in the field, and will enable me not only to improve upon this paper, but also to publish, with their aid (which some have already promised me) an *Herbarium Juncorum Boreali-Americananim normale,* which will stand in place of expensive plates, and will, it is believed, be [425] far preferable to them.

Arrangement. — The numerous species of the genus *Juncus* have been divided into sections

according to characters taken from their organs of vegetation, their stems and leaves, and also their inflorescence, more than from the differences found in their flowers or fruits.[1] In these most essential parts all the species show a remarkable uniformity, which will only permit us to make use of them to characterize minor (divisions, and for specific diagnosis. Desvaux (Journ. Bot., Vol. I., Paris, 1808) had already separated our *Juncus repens*, on account of a peculiarity in the dehiscence of the capsule, and some alpine species, because of their long-tailed seeds, as two distinct genera, *Cephaloxys* and *Marsippospermum.* But we know now that other species of far different alliance form a transition from the ordinary loculicidal to the septifragal dehiscence, that species of all forms and sections, and otherwise very dissimilar, have tailed seeds, and that others exhibit all the transitions from the tailed and loosely tunicated to the merely pointed and closely coated seed. From the following it will appear that these genera cannot stand even as sections.

Vegetative Organs. — The different forms of the root-stocks, and of the stems and leaves of these plants, are so well known that I need not here dwell upon them; by their differences the principal types of *Junci* are best characterized, i. e. those that produce no leaves or leaves equal to the stem itself, those that have channelled or flattened leaves, and those that bear knotted leaves. But I must say that we have forms that seem to bridge over these apparently well-marked distinctions, and which again prove that Nature knows nothing of our systematic subtleties, and that our systems are only an imperfect aid for our limited comprehension. To give an example — no section of *Juncus* seemed to be better characterized and more natural than that of the true *Junci* with naked stems and so-called lateral inflorescence. To this section we are bound to refer *J. Drummondi* and *J. ffallvi,* while *J. biglumis,* which can scarcely be separated from them, is, in all our systematie works, far removed from them. Again, *J. Vaseyi* comes so close to *J. Hallii* that we should hesitate whether to class it with this or with the flat-leaved *J. tennis,* if *J. Greenii* did not unite it more directly with the latter. The form of leaves is not quite constant. While those of the articulate *Junci* are usually described as terete or compressed-terete, the observations of our southern botanists prove that in some species, at least, soil and moisture have a most important influence on [426] them, as they also have on the development of the inflorescence; the overgrown forms of *J. scirpoides,* as I understand that species, have large, laterally compressed, gladiate leaves, while in the forms grown on drier and poorer soil the leaves become almost or entirely terete. On the other hand, the peculiar tribe of articulate *Junci* of the Pacific slope, which I have called *Ensifolii* from their characteristic sword-shaped leaves, exhibits, in alpine situations, such narrow leaves that they might inadvertently be mistaken for terete ones.

Inflorescence. — The inflorescence offers us important but, to a surprisingly great extent, variable characters. All *Junci* have, as is well known, a terminal inflorescence, even where it is seemingly lateraL In the Californian sub-genus *Juncellus,* and in a few South American and antarctic species which form the subgenus *Rostkovia* (gen. *Bastbovia,* Hook, f., *Rostkovia,* Desv., and *Marsippospermum,* Desv., in part), a single flower terminates the stem or scape; but all the true *Junci* have a more or less compound inflorescence of single flowers or of flowers crowded into larger or smaller heads.

In the inflorescence we observe numerous bracts, usually of a membranaceous texture; the uppermost bracts bear in their axils the flowers, which are always lateral, though in the species with single flowers they appear terminal. In these the lower of the two highest bracts, which are always found at the base of the flower, and which were therefore termed " calyx " by Kostkovius, bears the flower in its axil, the upper one remaining sterile; but the trace of an axillary product, an abortive flower or a leaf-bud, ought occasionally to be found, as is regularly the case in *J. pelocarpus.* In the single-flowered forms of this species the'uppermost bract usually bears an abortive bud, or this bud grows out into a leafy branch, or it becomes a second flower; and then a third bract is formed, often

[1] Steudel, in his " Plant* Glumacett," 1855, enumerates 196 specie*, many of them, howew, undoubtedly nomihal ones.

again with a leaf-bud, but never, so far as I know, with a third flower. Thus we have the complete transition from the single-flowered to the species in which the flowers are grouped into heads. In these each bract bears in its axil a flower, in centripetal succession, the uppermost minute bracts remaining sterile in the centre of the head.

The single-flowered *Junei* bear panicles, or, as E. Meyer and many botanists after him called them, *anthelce,* of different form and development. In some species *(e. g.* in the common forms of *J. tenuis.* and *J. dichotomus)* the panicle has often the shape of an almost regularly dichotomous cyme, or at least the main branches are dichotomously divided; in most other species this regularity is considerably obscured by the development of many elongated branches from a short axis, which often almost seem to constitute an umbel, but which are mostly of very different [427] length, the lower ones being by far the longer. These rays or branches often repeat the development of the main axis several times, or are regularly dichotomously divided, or they assume the appearance of one-sided spikes with lateral inflorescence, somewhat after the fashion of the *BorragineoB.* A remarkable example of thk is furnished by *J. tmuis,* var. *secundus,* which form also proves that this unilateral development of the inflorescence can by no means constitute specific distinction, as a series of intermediate forms are not wanting. We observe a similar condition in *J. Baltics* and the var. *Pacific^;* the Eastern form has the ordinary panicle, while that of the Pacific coast bears on the branches unilateral flowers.

In many others, and especially in all those that have knotted leaves, the flowers are arranged in heads. These heads consist of few, or are (often in */. pdocarpus)* reduced to single flowers, or they bear a great many, and the different forms of the same species often vaiy immensely in this respect Thus we find from 2 or 3 to 50 flowers in each head of the different forms of *J. pallesems,* 6 or 9 to 100 in the forms of *J. nodosus,* and 2 or 3 to 80 or 90 in *J. CdnMenm.* These heads are single, or composed of several heads crowded together, when they appear lobed. I have seen the axis of the heads abnormally elongated, thus changing them into spikes 9-12 lines in length in three different species, ail found in the southern States. In all of them the lower flowers seem to remain sterile, and only the uppermost ones bear fruit; or, after the earliest flowers have performed their functions, the axis, perhaps in a wet season, continues to grow and produces a second crop of flowers. *J. cylindricus,* Curtis, is such a spicate form of *J. marginal;* I have also seen it in *J. pallescens,* var. *fraternus,* and most beautifully developed in *J. Cmademis,* var. *loryicaudatus.* In this last specimen numerous rays form a rather compact almost level-topped umbel, and each ray bears a head of 3 to 5 or 6 sessile, diveiging spikes. The heads are either single, terminating the stem like the head of an *AUium,* or they form a more or less compound inflorescence similar to that of the single flowers.

Flowlrs. — The flowers of these plants consist normally of 5 circles, each of 3 component parts; 3 outer and 3 inner perigonial leaves, which we call, on account of their herbaceous texture, sepals; 3 outer and 3 inner stamens and 3 carpellary leaves; each of the circles alternating with the next one, so that the 6 stamens stand before the 6 sepals, and the 3 carpels before the 3 outer sepals; but the 3 stigmas, as well as the valves of the capsule, before the 3 inner sepals. The third circle, consisting of the 3 inner stamens, is sometimes wanting. Only in one instance, in the only species of the sub-genus *Juncdlus,* I find each circle consisting of two parts only, a curious [428] and rare arrangement in a monocotyledonous plant

In place of flowers we find, in some species with articulate leaves, leafy buds or shoots as the result of retrograde metamorphosis, or as the morbid product of the oviposition of the *Lima Juncorum* or s6me allied insect They are most common in *J. pelocarpus,* which, from this peculiarity, has been named *viviparus* and *dbortivus;* in *J. pcdlescens,* var. *fraternus,* which therefore got the name *J. par&doxus,* and in *J. nodosus genuinus.*

Sepals. — The always persistent sepals furnish important characteristics. The exterior and interior ones are sometimes similar, but more frequently dissimilar; the fonner usually carinate or

naviculate, more herbaceous, more strongly ribbed and sharper pointed; the latter more delicate, with a wider membrauaceous margin, flat or slightly concave, but not naviculate, and more frequently obtuse or only mucronate, but more variable in their outline than the exterior ones. The sets of sepals are either equal in length, or one exceeds the other, but neither their proportion nor the form of the inner sepals offers perfectly reliable characters in all species; in some they are more constant, while in others they vary considerably. In examining dried and even living specimens, the error of mistaking an involute sepal for an acute one must be avoided;— an error into which even careful botanists have sometimes fallen. The nerves of the sepals, which are of such diagnostic importance in *Graminem* and even *Cyperacece,* are of minor value in *Junci,* as they vary considerably in different forms of the same species.

Stamens. — E. Meyer had already paid attention to the number of stamens and their proportion, and in many species valuable characters are derived from them, but they alone cannot constitute specific distinction. They are generally persistent, which permits us to examine them in all stages of development of the flower and fruit; only in *J. Smithii* and in *J. Bcemerianus* the anthers fall away early aud the filaments only persist The number of stamens is normally six, but in many (principally American) species, it is, by suppression of the inner circle, reduced to three.; those three stamens stand, therefore, before the outer sepals and at the angles of the ovary or capsule. We have only two species in which their number regularly varies between three and six, *J. Bvddeyi* and *J. cavdatus ;* in them the inner circle of stamens is incompletely present. In many triandrous species we find occasionally a fourth or fifth stamen, and that often smaller than the rest; but where both circles are regularly developed, I have never seen them unequal in size or shape, which we notice so often in other allied families.

The proportion of stamens and sepals, and of anthers and filaments, is often very con- [429] stant, but in some species they vary very much, as may be seen in *J. scirpoides,* the different forms of which bear stamens of different length and anthers of different size, without exhibiting other characters of sufficient specific value.

In a rare form of *J. Rcemerianus* I find both circles of stamens suppressed or rather undeveloped and in a rudimentary state, so that those plants become w^T^n_»1. Corresponding male plants may perhaps yet be discovered.

Filaments are always present; in some species they are very short, in others elongated, in all dilated at base, and, at least in the hexandrous ones, more or less united. Their base, which in the young flower adheres to the base of the pistil, after fecundation remains attached to the base of the sepals.

The shape of the anthers is of slight importance; they are longer or shorter, linear or oblong, in some species pointed or cuspidate, in most others obtuse or emaiginate, more or less sagittate at base; but these characters show little constancy.

Pistil. —The pistil exhibits great differences in its form, and furnishes good and generally constant characters. The ovary is obtuse or acute, gradually or abruptly elongated into the style. This organ is often very short, but in many species it has the length of the ovary, or even exceeds it; in a few species oply it is variable, *e. g.* in *J. scirpoides,* which in this as in most other organs offers a degree of variability scarcely seen in any other species. The stigmas are longer or shorter than the ovary with the style, always (except in *Juncellus)* three in number, very slender and more or less twisted; in *J. aeutus* they are short and thick, and in *J. stygius,* as already Iinnaus remarks, short and recurved. In just expanding flowers the length of the stamens is often equal to that of the ovary and style together, so that the stigmas only emerge from between the anthers, or they are equal to the ovary alone, when the whole style with the stigmas protrudes over the anthers.

Capsule.—The capsule is diagnostically one of the most important organs in *Junci.* It varies from globose to ovate, obovate, prismatic, pyramidal or subulate, terete or angular, retuse, obtuse or

acute, mucronate or rostrate; it is shorter or longer than the sepals or equal to them; but all these characters vary within certain limits, in some species more than in others, and only the examination of a large number of specimens can decide about their constancy and value in a given species. The capsule is always three-valved (excepting again *Juncdlus),* opening into the cells, the valves bearing on their median line the placentae either immediately (parietal placentae and one- [430] celled capsule) or on a fold which extends to the centre and forms the dissepiments (central placentae and three-celled capsule); shorter dissepiments make semi-trilocular capsules. Very fragile dissepiments, which break off when the capsule opens, leaving the placentae central and detached (septifragal dehiscence), are found in *J. repens* (therefore generically distinguished by Desvaux), and to some extent also in *J. Parryi, J. patens,* and *J. setaceus.* The placentae of *J. Rcemerianus* are enormously developed into a spongy mass, which fills the greater part of the capsular cavity.

The capsule opens almost always from top to the middle or to the base; only in some of our species with subulate capsules *(J. scirpoides, J. nodosus)* the separation of the valves commences in the middle, while at the top they remain united for some time.

Seeds.— The seeds, when perfectly ripe, furnish some of the most interesting and constant characters, but they are so small and their markings so delicate that only a. strong glass, or, better, a microscope with a magnifying power of fifty or sixty diameters, will properly exhibit them. It may not be useless to caution botanists not to be deceived by seeds loosely lying about with the specimens, as they very often will be found mixed.

The seeds are ascending or (the elongated ones) more or less erect, with a lower end at the insertion of the funiculus and an upper one at the chalaza, both ends united by the rhaphe and' often by a distinct fold of the testa. The seeds are usually obovate or oblanceolate, thicker at the upper than at the lower end, mostly terete, or, in rare cases *(J. trifidus),* angular, when a few large seeds are pressed upon one another. The ends are sometimes obtuse *(J. bufonius),* but commonly either abruptly or more gradually pointed, apiculate or even fusiform *(J. palkscens, nodosus, scirpoides).* Very frequently the testa is slightly elongated beyond both ends of the body of the seed and forms a small, niembranaceous appendage *(J. effusus, tennis, marginatus);* in such seeds the longitudinal fold of the testa, mentioned above, also becomes more distinct. In many and apparently more in American and in alpine or arctic species *(J. Drummondii, Greenii, Canadensis;* etc.) these appendages become more conspicuous, and extend beyond the seed itself as empty, shrivelled, tail-like, white, or, rarely, reddish sacs. Such seecifr have been called scobiform; their seed-coat is more loosely adhering and sometimes (/. *stygius)* can be readily removed. This elongation of the testa is of great diagnostic value, but the absolute or proportionate length of the appendages is extremely variable; even in the same capsule I find the lower seeds with shorter tails than the upper ones, and in *J. Canadensis* we see forms with such different length of tail that only the absence of [431] any other diagnostic characters can induce us to consider them as belonging to one and the same species. Much less can generic distinction- be based upon this character, as was done by Desvaux, who comprised in his genus *Marsippospermum* all *Junci* with tailed seeds. Even E. Meyer's (in Synopsis Juncorum, 1822, and in Ledebour's Flora Uossica, 1853) separation of the species with tailless seeds as a second section is unnatural, as not only tail-seeded kinds are found in all the great groups, but also species with intermediate seeds exist, which it would be difficult enough to place properly. R Brown (Prod. Nov. Holl., p. 258) settles the whole question in the following pithy sentenoe: *Nee secernenda* sunt ece qua seminibus gaudent scobiformibus, testa nempe, qw* in pluvibus utrinque lam, in hisce valde elongata.*

The size of the seed varies from 0.1 to 2.0 lines in length, it mostly ranges between 0.2 and 0.3 lines, and rarely Teaches 0.4 lines; the tailed seeds are usually larger than the others, averaging from 0.5 to 2.0 lines in length; even without the appendage, *J. trifidus* has the body of the seeds of 0.5, *J. castaneus* of 0.5-0.6, and /. *stygius* of 0.7-0.8 line in length.

The delicate markings of the seeds are so various, and in the same species so constant, that it will be useful to dwell a little longer on them. Their surface appears never quite, and rarely nearly, smooth, when magnified fifty or sixty times. We can almost always discover longitudinal ribs, more or less close together, from 8 or 12 to 30 or 40 or more around the seed; as it is difficult to count the ribs all around these small bodies, and as an approximate designation is quite sufficient, only the number visible on one side may be counted. These ribs are very marked, sharply elevated, in *J. margittatus (semina, costata),* or they are reduced to more delicate lines in *J. Canadensis* and most tail-seeded species *{semina multicostata* and *striatcxostata).* These ribs or lines are usually united by very delicate transverse -lines *(lineolce),* when such seeds may be termed *costato-lineolata,* or by fewer and more prominent cross-bars : *semina costato-reticulata.*

When the ribs are fewer and wider apart, and united by transverse ridges so as to form somewhat rectangular meshes, I call the seeds *semina reticulata.* The area of these meshes is sometimes quite smooth *(J. militaris),* or crossed with very few transverse or longitudinal lines *(J. scirpoides)*: *semina areis Icevibus reticulata;* or it is distinctly marked by numerous delicate transverse lines, sometimes, also, with one or two perpendicular lines: *semina areis lineolatis reticulata.* In very few instances I find an irregular and indistinct reticulation: *semina irregulariter sub-reticulata.*

A large number of *Junei* exhibit a very delicate but regular transverse reticulation without (in fully ripe seeds) very distinct ribs: *semina lineolata.* In some species the [432] marks are coarser, in others more delicate.

We divide the seeds, then, into *semina reticulata, lineolata;* and *costata* ; to both the former belong the tailless, to the latter the tailed seeds.

I arrange all the species, the seeds of which I have been able to study, according to their surface markings, in the following table. Our species are in italics, the foreign ones in Roman type:—

L SEHJVA RBTICULATA, vix sen distinct© apiculata.

1. 8emina loviaaime irregulariter reticulata sen toviuscula, non costata nee lineolata. ***Omnes e Juncorum genuinorum $ectione.***
/. Pae\ficus, cornpressus, Jil\formis, Smithii.

2. Semina regulariter reticulata, areis levibns tea leviasime longitodinaliter lineolatis. ***Aostrates e Juncorum artiadaiorum seeUone, pauci exotici gramxnifolii.***
J. vulitaris, EUioUii, scirpoides, phoeocephalus ; **J. Tasmanicus,' squarrostui, capitatua.**

8. Seniina regulariter reticulata, areis tenuiter transverse lineolatis. ***Omnes ad J. articulate* pertinent,***
J. pelocarpus, articulates, alpinus, paUeseens, Bolanderi, brachycarpus, nodosus, xiphioides, Mertensianus; **J. sylvatiens, atratns, obtusiflorus, microcephalus, oxycarpus, supinus, LescbenaultiL**

II. SXMINA TRANSVERSE LINEOLATA, leviasime costata; viz sen distincte apiculata seu breviter caudata.

1. Semina areis latioribus fere transverse reticulata, ***E. Juncorum genuinorum et graminifoli&rum sectumibus.***
J. Balticus, sctaceus, dichotomus.

2. Semina areis angnstissimis transverse lineolata. ***E. Juncorum gmninorum et graminifvliarum sedionibus et JunceUi species unica.***
J. efusus, patens, tenuis, Oerardi, bufonius, repens, saginoides ; **J. glaucus, pauciflorna, bulbosus.**

IIf. SEMRTA COSTATA, plus minus caudata.

1. Seroina inter costas plerumque panciores conspicuas liueolata; apiculata seu breviter caudata, ***E. Juncorum genuinorum et gi-amini/oliorum sedionibus.***
J. RamerianuM, acutus, marginatus, longistylis, BuckUyi ; ***X.*** **raaritimus.**

2. Semina inter costaa plum distincte reticulata; apiculata seu plus minus candata. ***Ex omnibus Juncorum sectumibus.***
J. areticus, Drummondii, Hallii, biglumis, Oreenii, Canadensis^ **var.** ***sub-caudatus.***

3. Semina inter costas numerosissimas tenues sen tenuiwimaH transverse lineolata seu lsevia; caudata. ***Ex omnibus Juncorum sedionibus.***
/. Parryi, Vaseyi, triglumis, eastaneus, stygius, trifidus, Canadensis, caiulatus, asper ; **J. Jocqnini.**

It will be observed that in this arrangement some forms which I consider as belonging to one specific type had to be separated ; thus, the Pacific form has been removed from </. *Baliicus,* **and the**

8 The Tasroanian /. *fakatus,* which I consider a distinct species.

sub-caudate variety from *J. Canadensis,* proving that differences in the surface or in the shape of the seed alone are not sufficient to establish specific distinction.

What constitutes a Species. — The specific character lies not in any single organ of the [433] plant, however essential it may be; only sufficient and corresponding differences in a series of organs can authorize us to recognize specific distinction. But as such discrimination is of course left to individual judgment, different investigators will arrive at different conclusions. Sprue species, to be sure, vary very little, and will by every botanist be recognized as distinct from all others, and as indivisible; such are, e. g., *J. filiformis, J. militaris, J. stygius, «/'. repens;* but other species exercise the botanists considerably, some forms being held distinct by some, while they are united by others, such are, among our species, especially *«/'. pallescens, J. scirpoides, J. nodosus,* and *J. Canadensis,* all belonging to the group *Articulati.* I have no doubt that some botanists, especially such as have not the means of comparing the bewildering quantity of transition forms now before me, will find my views in this respect too contracted, but careful investigation in the field will, I trust, bear me out.

After these preliminary remarks I submit a list of our North American *Jund* and their principal varieties, as I understand them, followed by an account of their geographical distribution.

Systematic Arrangement.

GENUS JUNCUS, *Linn.*

SUB-GENUS I. JUNCUS.

I. JUNOI GENUINI, caule aphyllo basi vaginis aphyllis sen rarius folia ipso cauli similia gerentibus stipato.

MARITIMI.

A. Glomemliflori.

1. *J.acutus,* Linn., California, New Jersey (?).
2. /. *Acemerianus,* Scheele (J. maritimus, Auct Am.), New Jersey to Texas.

B. SinguliflorL

a. Pluriflori, panicnla plus minus composita.

«. Robustfores, capsulis ovatis sen obovatis.

COMMUNES.

1. Foliiferi.

8. /. *compressus,* H.B.E., California, Mexico.

2. Aphylli.

• HexandrL

4. *J. Breweri,* n. sp., California.
6. *J. Balticus,* Dethard.
   fi. littoralis, coast of New England to the Mississippi,
   y. *montanus,* western deserts and Rocky Mountains.
   Sub-species /. *Pacificus,* Pacific coast

• • Triandii

6. /. *procerus,* E. Mey. (?), California.
7. /. *effusus,* Linn., over the whole country.'

£. Graciliores, floribus pleromqne paucioribus, rape viridulis, sepalis fmctiferis wepe patentibus, capsula subglobosa. •

1. Aphylli

8. /. *patens,* E. Mey., California.
0. *J.JUtformis,* Linn., northward.

2. Foliiferi.

10. /. *Smithii,* n. sp., Pennsylvania.
11. /. *setaceus,* Rostk., Virginia to Louisiana.

b. Pauciflori, panicula vixusqnam composita.

a. ApiculatL

ARCTICI.

12. /. *arcticus,* Willd., Greenland.
    Sub-sp. /. *Sitchensis,* northwestern coast.

p. Caudati.

1. Aphylli.

13. /. *Drummondii,* E. Mey.f Rocky Mountains and northwestward.

2. Foliifeii

14. /. *BaUii,* n. ap.f Colorado.
15. /. *Parryi,* n. sp., Rocky Mountains, and mountains of California and Oregon.

• The triandrous /. *Pylcri,* La Harpe, which is entirely unknown to me, seems to belong here, or near /. *arcticus.*

II. Juraci GRABONIFOLII, caule nudo seu foliato ; foliis planis sea semiteretibus canaliculatis seu raro subteretibus.

A. Macrospernii, alpini, seminibus paucis magnis caudatis, foliis fistulosis.

a. Pauciflori.

16. *J. trifidus,* Linn., northeastern mountains.
17. *J. biglumis,* Linn., Arctic regions.

b. Capitellati.

18. *J. triglumis,* Linn., Rocky Mountains to Arctic regions.
19. *J. stygiuSy* Linn., -western New York to Maine and New Brunswick.
20. *J. castaneus,* Smith, Rocky Mountains to Arctic regions.

ALPINI.

B. Singuliflori.

a. Sirupliçes, nudicaules, erecti.

a. Caudati.

21. /. *Vaseyi,* n. sp., Lake Michigan to Colorado.
22. *J. Grecnii,* Oakes & Tuck., New England.

0. Apiculati.

23. /. *tenuis,* Willd.
«. *communis,* all over the country.
0. *secundus,* Pennsylvania to New England.
y. *congestus,* California.
24. *J. dichotomus,* Ell., District of Columbia to Louisiana.
25. /. *Gerardi,* Lois., eastern sea and lake coasts, and salines.

b. Ramosi, caulophylli, diffusi.

26. /. *bufoniiis,* Linn., all over the country.

TENUES.

C. Glomeruliflori.

• Hexandri (No. 80, 3-6*ndrtts).

27. /. *repent,* Michx., Maryland to Louisiana.
28. *J.falcatus,E.Mey.,* Pacific coast.
29. *J. longistylisy* Ton*., Rocky Mountains and northwestward.
80. /. *leptocaulis,* Torr. *k* Gray (J. tilipednulus, Buckl.), Texas.

• • Triandri.

31. /. *maryinatus,* Rostk., Atlantic and central States to Texas.

GRAMINEI.

III. JuifCl ARTICULATI, caule folioeo; foliw septis transversis interceptis inde nodoso-articulatis.

A. Articulati veri, foliis teretibus seu leviter (in No. 40 var.-forte) tereticompressis.

a. Apiculati.

1. Sub-singuliflori.

82. *J.pdocarpus,* E. Mey. (J. Conradi, Tuck), Newfoundland to South Carolina, and along the great Lakes.
0. *axutieaudex* (J. abortivos, Cbapm.), Florida.
7• (/> *mtUUis,* Cauada,

2. Pauciflori (No. 37, r*r. *, ad inulUfloro. aooedeu).

» Hexandri.

S3. *J. articulates,* Linn., northern New York and New England.
34. *J. alpinus,* Vill. (J. pelocarpan, Gray), north western New York to the Rocky Mountains and the Arctic regions.
85. /. *militarU,* Bigelow, New England and southward.

• • Triandri.

36. /. *Etliottii,* Chapm., North Carolina to Florida and Alabama.
87. *J- pallescens,* Lam.
a. difusissimus, Texas.
fi. debiiis (J. acuminate, Mx), middle ami southern States east of the Mississippi.
y. *robustus,* Mississippi valley from Illinois to Louisiana.
«. *frattrnm* (J. paradoxua, Mey), Michigan and Massachusetts to the Rio Grande.

3. Multiflori.

• TrwndH.

:;>. /. *hr>t<'Jnrr<tr»»i,* n. ^p.. MisM^sippi valley and to the Rio Grande.
:vj ./. *lltlni'lsui n.* «*]., Califoniia.
in. *J ^arj/'H'?'*,* Lim.
a. [illegible]
A. ri *'rwtylm,* Sonth Carolina to Texas. B. *brachyrtjis,* Xew Jersey to Arkuusas aiul Ti-xas.
fi. brach f^tfnvn.
A. *echinattts,* Maryland to Florida Ami Texas. a *gladiattts,* North Carolina to Arkansas and Texas.

• • Hexandri.

41. *J, nodosus,* Linn.
«. *ffenuinus,* Pennsylvania to Canada and to the northwest coast.
$. Texan us, Texas.
y. *megacephalus,* western New York, sonthwestward to Texas and California.

ARTICULATI rf.

b. Candati.

• Hexandri (No. 43, 3-6-andrus).

42. *Jfasper,* n. sp., New Jersey.
43. */. caudatus,* Chapm., South Carolina to Florida and Louisiana.

JS r • • Triandri.

44. *J. Canadensis,* Gay.
a. *brevicaudatus* (J. acuminatus, Gray).
A. *coarctatus,*. Pennsylvania, northward and northwestward.
B. *patulus,* Pennsylvania to western New York and Ohio.
0. *subcaiulatus,* Connecticut to Georgia.
y. *longicavdatus* (J. paradoxus, Gray), Massachusetts southward to Louisiana, and northwestward to Minnesota.

CAUDATI.

B. Ensifolii, foliis iridaceis compressis equitantibns.

45. *J. Mertensianus,* Bong., Rocky Mountains northwestward to the coast.
46. */. xiphioides,* E. Mey.
a. *auratus,* California.
0. *littoralis,* California.
y. *mtmtanus,* Rocky Mountains and eastward into the plains.
9. *macranthus,* Oregon and to the northwest coast.
c *triandrus* (J. ensifolius, Wick.), California to Unalaschka.
47. *J. oxymeris,* n. sp., California.
48. */. phceocephalus,* n. sp., California.
49. */. cMorocephalus,* n. sp., California.

ENSIFOLII.

SUB-GENUS II. JUNCELLUS.

50. */. saginoides,* n. sp., California.

JUNCELLUS.

• GEOGRAPHICAL DISTRIBUTION.

Of the fifty species above enumerated, thirty-three, or two-thirds, are peculiar to our [437] country, and seventeen, or one-third, occur also in other parts of the world. Two of these seventeen *{J. effusus* and *bufonius)* are cosmopolitan species, which are found in almost all countries of our globe; six *(J'. arcticus, trifidm, biglumis, triglumis, stygius,* and *castaneus)* are alpine or arctic forms, which also inhabit appropriate localities in the old world; three *(J. acutus, Balticus,* and *Gerardi)* grow principally near salt water, and also occur in Europe, and the former, also, in Africa and South America; three others *(J. JUiformis, articulatus,* and *alpinus)* make their home in the northern parts of the northern hemisphere; one *(J. tenuis)* is also found in middle America and western Europe; and two extend southward over our limits, *J. compressus* into Mexico, and *J. procertis,* if our plant is correctly referred, to Chili.

The different forms of *J. Balticus, nodosus,* and *Canadensis,* grow in different regions. The eastern and northern */. Balticus* is distinct from the form of the interior plains, and veiy much so from that of the Pacific coast; the Texan form of *J. nodosus* is very different from the northern one, and that of the western States and Territories is quite unlike the others; *J. Canadensis* has a northern, an eastern, and a third form, which is more generally distributed.

None of the eight southern species are found anywhere else, and of the nine Pacific species only the two above mentioned extend beyond our territory to other parts of America, adding another proof of the well-known fact, that of all our Floras that of the southern and that of the Pacific States are the most peculiar and exclusive ones.

From their geographical distribution our species may be arranged thus: —

1. Over .the whole country grow */. effusus, tenuis, bufonius,* and *nodosus.* Of these only the last one does not extend into other Floras.

2. Over the whole country, with the exception of the western plains and mountains, and the Pacific slope: *J. marginal* and *pallescens,* botH peculiarly North American.

3. Over the whole country, with the exception of the great interior valley and the Pacific region: *J. pelocarpus* and *Canadensis,* both only found in North America.

4. In the great interior valley from Michigan to the Rio Grande: *J. Irrachycarpus,* and, with more extensive limits, one of the forms of *J. nodosus* (the var. *megacephalns).*

5. Northward: *J.filiformis* and the northern varieties of *J. nodosus* and *Canadensis;* northeastward : *J. articulates, Greenii,* and, very locally, *J. Smithii;* northwestward, extending [438] to the Rocky Mountains : *J. alpinus* and *Vaseyi*

6. Southward, mostly southeastward and to the Gulf, some of the species extending south- westwardly to Arkansas and Texas: *J. sctacens, dichotomus, repens, fflliottii, scirpoides, caudatus,* **and *aspcr,* the latter only in the most northeastern limits of the region; *J. scirpoides* as far north and southwest as any of these species; south westward : *J. leptocaulis* and a form of *J. nodosus* (the var.** *Texanus).*

7. On the Pacific slope, in the low country: *J. compressus, Breweri, patens, arcticus* (var.), *Bolanderi,* and *oxymeris.* The following extend from the coast to the mountains: *J. Meriensianm, xiphioides,* and *phceocephalus,* the two former spreading eastward to and beyond the Rocky Mountains.

8. Maritime species, — northeast: *J. Balticus, Gerardi,* and *militaris,* the two former extending inland along the lakes, the two latter also southward; southeast: *J. Bamerianus;* Pacific coast: *J. acutus, procenis, Balticus,* subspecies, *andfalcatits.*

9. Alpine and arctic species, — eastern: *J. arcticus, trifidus,* and *stygius;* western: *J. Drum-* *mondii, Hallii, Parryi, triglumis, castaneus, longistylis, chlorocephalits, saginoides,* — the **two last only on the Californian Alps. *J. biglumis* has been found thus far solely in the highest arctic regions of our continent.**

The following table exhibits at a glance the geographical distribution of our species: —

	Pteullarto our country.	Common with other countries.	TotaL
1. Whole country.	1	3	4
2. Whole country except Pacific region.	2	..	2
3. Whole country except Pacific region and Mississippi valley	2	..	2
4. Interior valley.	1	..	1
5. Northward.	3	3	6
6. Southward.	8	..	8
7. Pacific slope.	7	1	8
8. Maritime species.	3	4	7
9. Alpine and arctic specie*.	6	6	12
Total.	88	17	60

NOTES ON THE NORTH AMERICAN SPECIES OF JUNCUS.

1. J. ACUTUS, Linn., has been found by Prof. Brewer near San Luis Obispo, California, " where it is abundant in a stream in the hilU between the town and the landing of the name name, a few miles from the sea, growing in dense tuft*." His sjiecimens were collected in April in full bloom ; the stem is nearly four feet high, the pan- [430] icle six inches long; the flower*, al*olutely identical with European specimens, are easily recognized by their broadly margined 8e|wils, the inner ones being deeply emarginate, and by their thick and short subulate stigmas. I have also seen specimens said to have come from the coast of New Jersey ; Baldwin collected it on the La Plata in South America, and Churni) and Gaudicbaud brought it from the same regions. /. *macroeaqnu,* Nees, from the Cape of Good Hope, i* the same s]>ecie8.**

2. J. ROCMERIANUB, Scheele, Linnaa, 22, 348 ; Walp. Ann. 3, 655:.rhizomate longe repent*; foliit caules (2-3 pedales) robnstoa rigidos terete* oquantibu* ; spatba paniculam supra-dAcompositam patulo-efTuaam longe snperante ; glomerulis 3-6-floris; sepalis ovato-lanceolatis ft-nervii* eiterioribtis acutatis, interioribus brevioribus obtusis sep*

mucronatis ; antheris sex late linearibus filamento ter quaterve longioribus demum deci<luis ; stylo ovario ovato multo breviore; capsula ovata obtusa mucronulata sepala exteriora sequante placentis tumidis triloculari; seminibus late obovatis obtusis vix apiculatis tenuiasime (sub lente) costato lineolatis *(J. maritimus,* auct. Amer.).

Atlantic coast of the United States from New *Jtmey* to Florida and Texas. — Closely allied to the European /. *maritimus,* for which it has always been taken, uutil Scheele, without discovering its distinctive characters, gave it a new name. It is well marked by an open spreading panicle with slender flexible branches; deciduous anthers; a very short style, which is not half as long AS the obtuse ovary ; an obtuse, short, deep brown capsule; remarkably forge, 6pongy placentae, which till the greater space of the capsular cavity, and the like of which I have not seen in any other species ; and obtuse, tailless seeds, marked with *very* blight wavy ribs and slighter cross lines. — *J. maritimus* bears a rigid, fastigiate panicle, persistent anthers, an ovary attenuated into a style of nearly its own length, a greenish, acute eapsule which usually exceeds the sepals, placentae of ordinary size, and seeds with distinct tails and stronger ribs. The light brownish flowers are 1.5 lines, and the seeds 0.3 line long, and nearly 0.2 line thick.

This is the only *Juncus* in which occasionally unisexual specimens occur (Georgia, Le Conte, in Hb. A cad. Philad., and Florida, Chapman, in lib. A. Gray); these plants, pistillate by abortion of the stamens, have a stricter but fewer flowered panicle, and thus present a very unusual aspect; our southern botanists ought to find out under which conditions this form occurs, and whether any corresponding staminate plants grow with them.

3. J. COMPRESBCS, H. B. K. nov. gen. 1, 235 ; Kunth, Enum. 3, 317: rhizomate repente, caulibus (pal- [440] maribua sesquipedalibus) compressis furctis siccis tenuiter striatis ; vaginis aphyllis muticis seu scepius folia culmo simillima breviora gerentibus; spatha paniculam compositam seu decompositam ad ultimos ramos secundiflnram equante seu superante ; sepalis lanceolatis, exterioribus acutis seu subulato-acutatis, interioribus paulo brevioribus obtusinsculis stamina sex dimida seu tertia parte superantibus ; antheris late linearibus filamento brevi multo (quadruplo quintuple) longioribus; stigmatibus ovarium cum stylo fere tequilongo subeequantibus; capsula ovata acuta (inclusa?) triloculuri ; seminibus ovatis obtusis vix apiculatis laviusculis.

Salinas valley, in sandy river bottoms, May 1, in flower; Calif. State Survey No. 529, the only locality in our flora known to me. Dr. J. Gregg collected the same species in northern Mexico ; smaller forms, eight inches high, with very short spathe, and a stouter one, 12-18 inches high, with longer spathe and larger panicle. The Californian specimens are 10-15 inches high, with a spathe 2-4 inches long; panicle small, rather simple, only the extreme branchiets with one-sided flowers ; the reddish streaks on the sepals very pale; the only capsule seen (not ripe) was shorter than the sepals and contained a few large seeds, 0.37 line long and apparently very slightly lineolate. — This plant is evidently closely allied to /. *Balticus;* it bears very similar but paler flowers, with the same stout anthers on very short filaments ; but the flattened stem and the frequent occurrence of leaves distinguish it. Among Fendler's Sante Fe plants, however, I find under No. 860, with the legitimate /. *Balticnu,* var. *montanus,* small specimens 6-7 inches high, with the darker flowers of the former, but with a slightly compressed stem, and occasionally with a leaf from the vaginae. Is that a form intermediate between and connecting both species ?

4. J. BBEWERI, n. sp. : rhizomate perpendicular!; caulibus cospitosis (pedalibus) compressis laevibus farctis ; vaginis nervosia muticis ; spatha paniculam paucifloram in ultimis ramis secundam longe superante ; sepalis subaequalibus ovatis late niarginatis abrupte acuminatis ; antheris late linearibus filamento brevi multo (quadruplo quintuple*) longioribus; stigmatibus ovarium cum stylo oquilongo eequantibus exsertis ; capsula . . . .

Wet^ sandy soil, near Monterey, California, the same unfortunate locality that has so often been confounded by botanical writers with Monterey in Nuevo Leon, Real del Monte in Mexico, and even Montreal in Canada; Calif. State Survey No. 651, in flower in the latter part of May. — The perpendicular rhizoma (if a constant character) and the strongly compressed stem, together with the broad and abruptly acuminate sepals, distinguish it from [441] the smaller forms of /. *Balticus,* the absence of leaves and the form of the sepals from *J. compressiu,* with both of which it in closely allied by the form of the stamens, so different from those of any other American or European *Juncus* of this section. — Stems a foot high, four or five inches of which belong to the spathe ; inflorescence small, naher compact; flowers 2} lines long ; sepals dark brown, greenish in the middle, membranaceous on margin. — I have named this plant for Prof. Win. H. Brewer, in acknowledgment of his services in the cause of science in California.

5. J. BALTICUS, Dethard. ap. Willd., is well characterized by its long and large anthers, which it has in common only with the two last-mentioned species, and its terete stem and leafless vaginae. Originally found on the shores of the Baltic, it has been traced to those of northwestern Europe and to our northeastern coasts from Newfoundland to Massachusetts ; but here it leaves its seaside home and appears in several swamps in Lancaster county in the interior of Pennsylvania ; all along the great lakes it is a common plant, not unexpected, to be sure, as on their shores we meet with many qjher marine plants, such as *Cakile, I/ithyrui maritimui, Euphorbia polygoni/olia,* and others, while they are quite free from saline matter. Is it the ocean-like spray of the waves of these immense bodies of fresh water, is it the ever-varying sand-formation of the downs, which invites sea-strand plants, or are they the remnant* of an ocean-

coast vegetation left from a period when the beds of these lakes were, filled by an immense arm of the sea ? Be that as it may, our species is not confined by the line of the lakes, but appears again on the upper Mississippi and St. Peters rivers, hence northwestward into the British possessions, and westward to the Mauvaises Terres and to the head waters of the Missouri, and then southward along the Rocky Mountains to Colorado and New Mexico, and farther west to the Cascade Mountains in Oregon. We find it again as a true maritime plant on the Pacific coast from the northern Russian islands to California and in Chili. This Pacific form is so different from the others that some will regard it as a distinct type. The different forms may be thus characterized : —

J. Balticus genuinus: caulibus tenuioribus riyidis farctis ; paniculs laxioris ram is dichotomis ; floribus minoribus; capsula obtusa mucronata; seminibus grosse lineolatis.

Var. a. *Europftu*:* sepalis exterioribus acutioribus longioribus capsulam late ovatam obtusam mucronulatam subaequantibus ; antheris minoribus filainento duplo longioribus; seminibus ovatis obtusis brevissime apiculatis. —- Noithem Europe.

Var. 0. *littoralis:* sepalis ut in Europaeo capsulam angustiorem acutius angulatam longius mucronatam eequantibus; antheris majoribus filamento brevissimo quadruplo longioribus ; seminibus ut in Europaeo. — Atlantic coast to the upper Mississippi.

Var. y. *montanus:* sepalis fere aequilongis aequalibus seu interioribus obtusioribus; antheris ut in littorali; capsula ovato-pyramidata angulata rostrata ; seminibus minoribus angustioribus longius apiculatis. — Western plains and mountains.

Sub-sp. /. *Pacificus:* caulibus crassioribus mollioribus saepe fiatulosis ; paniculse densiflone ramis secundis ; floribus majoribus ; sepalis exterioribus acutissimis interiora obtusa paulo superantibus capsulam ovatam acutam mucronatam subaequantibus; antheris majoribus filamento brevissiino quadniplo quintuplo longioribus; seminibus magnis ovatis obtusis breviter seu vix apiculatis tenuissime irregulariter reticulatis seu laevisculis. — *J. Lesueurii,* Bolander in Proc. Ac. Calif. 2, 179. /. *Balticus,* Benth PL Hartw. p. 341. *J. compievus,* E. Mey. PI. Chamisso in Linn. 3, 368, planta Chilensis.— /. *Hviikei,* E. Mey. Syn. June. p. 10, forma borealis puuciflora.

6. J. PROCERCS, E. Mey.? Linn. 3, 367 ; Kunth, En. 3, 322 : culmo erecto elato (tripedali) tereti stiiato farcto basi vaginis atrofuscis obtusis breviter aristatis stipato; spatha paniculam decompositam densifloram multiradiatam corymbiforniem longe superonte ; sepalis squilongis lanceolatis, exterioribus acutato-subulatis, interioribus obtusis mucronatis capsulam ovatam subacutam trilocularem squantibus ; staminibus 3 sepalis quarto parte brevioribus antheris 1 mean bus filamento paulo longioribus; seminibus majusculis ovatis.

In brackish marshes, San Francisco, Cal., *H. BoUmcbr.* — In its technical character, especially in the form of the sepals and the capsule, this plant corresponds well with Meyer's Chilian species, but a specimen in the royal herbarium at Berlin, brought from Chili by D'Urville, has much smaller flowers, a more compound, loose-flowered panicle; smaller flowers, and smaller, narrow, long-apiculate, finely lineolate seeds, and is in all respects similar to /. *ejfutu*^ with the exception of the inner sepals and the capsule. But unwilling to give a new name to a plant so incompletely known, I provisionally refer this Califomian to the Chilian species; I suggest, however, the possibility of the Californian plant being a hybrid between *J. effusu** and /. *Pacifiau,* which both occur in its neighborhood ; it seems that only very few and imperfect seeds can be found in the otherwise well developed specimens now before me, [443] and that in size and form these seeds, as well as the flowers, anthers, and capsules, are intermediate between those of the supposed parents, while the number of stamens is that of /. *effusus.* The panicle is remarkably compact and consists of 10-15 secondary branches of nearly equal length.

7. J. EPFD8U8, Linn., is found from Maine to the Rio Grande and to the Pacific, but is wanting in some districts. It has *always* three stamens, the small anthers of which are of nearly equal length with the filaments. The most prominent and very constant character consists in the number of stameus and in the obovate or even clavate, upwards almost tricoccous, *rttuu* capsule; seeds apiculate and finely lineolate.

8. J. PATENS, E. Mey. Syn. Luzul. p. 28; Rel. Hsnk. 1.141; Kunth, En. 3, 318. J. *compressw,* E. Mey. Syn. June, p. 16, non H. B. K. This very distinct species teems not to have fallen under the observation of botanists since, about seventy years ago, Haenke discovered it near Monterey, Cal., until Mr. Bolander and Prof. Brewer again obtained it near San Francisco and in the Santa Lucia Mountains of that State. Meyer's description in KeL Hcnk. 1. c. is so complete that very little can be added. I find, however, the densely cespitoae, slender, but wiry stems not compressed but terete, and distinctly striate; they are 15 inches to 2} and 3 feet high including the spatbe, which bat a length of 3 or 4 to 8 or 10 inches; their base is enclosed by elongated sheaths, brownish-red below and greenish straw-colored upwards, tipped with a conspicuous awn; the panicle, 1-2 inches long, consists of 3-5 larger branches, with the ultimate branchlets one-sided, spreading, or recurved/ whence the specific name. The flowers are not quite as large as those of /. *Baltiau,* and much lighter colored; sepals lanceolate, acute, exterior ones subulate at tip, •quailing, or slightly exceeding, the inner ones, spreading in fruit; stamens about half the length of the sepal*, and anthers nearly equal to the filaments; ovary with the short style about the length of the stigmas. The subglobose,

mucronate capsule, a little shorter than the sepals, opens with septifragal dehiscence, the three placenta with their membranaceous wings, remnants of the dissepiments, remaining in the centre. The very numerous seeds are ovate, obtuse, usually oblique, obliquely apiculate, delicately lineolate, 0.22-0.30 lines long.

9. J. FILIFORMIS, Linn., which was formerly often taken for /. *setaceus* by American botanists, extends from Oneida Lake in western New York to the White Mountains in New Hampshire, and to Maine, is common in Lower Canada and in the Hudson Bay region, and has also been found from the northern Rocky Mountains to the Cascade Mountains. The American specimens are in nowise different from the European ones; the seeds are [444] obovate, strongly apiculate, with a very distinct rhaphe, and are irregularly and rather indistinctly reticulated.

10. J. SMITHII, n. sp.: rhizomate? vaginis? foliis? caulibus bipedalibus teretibus farctis siccis striulatis; panicultt laxae subsimplicis pauciflonc spatha longissima; sepalis aquilongis, exterioribus acutatis, interioribus obtusis; staminibus 6; capsuis exserta subgloboss acute mucronate (fuscatie) trilocularis dissepimentis tenuusimis fragilibus; seminibus magnis obovato-oblongis obtusis vix apiculatis irregulariter reticulatis.

Pennsylvania, in a sphagnous swamp on Broad Mountain near Pottsville, Schuylkill county, where *Mr. Charles E. Smith,* of Philadelphia, for whom this species is named *(J. Smithii,* Kunth, is the English /. *tennis),* discovered it in June, 1865, with nearly ripe fruit, and where he expects to obtain more complete specimens in the coming season, as it grows in a very accessible, but thus far little explored part of Pennsylvania. We will then learn whether I am correct in my surmise that it is a leaf-bearing species, closely allied to /. *setaceus.* The question may even arise, whether our plant is not the true /. *setaceus* of Rostkoviua, as he credits it to Pennsylvania, and, so far as I know, the plant we take to be *setaceus* has not lately been found so far north. The figure of Rostkovius is too poor to decide the question, but his description is full enough to point to our *utaceus;* the "three-leaved calyx" — t. e., the three bracts under the flower by which he distinguishes his species from *J. Jiliformis*— are found in most flowers of both *J. Smithii* and /. *setaceus,* and also in some other species, e. g., /. *tennis,* but not in *J. JIUformis;* the lowest of those three bracts generally bears an abortive bud in its axil, and has, therefore, another morphological value than the two upper ones. —The thin and wiry stems before me are two feet high, eight or nine inches of which belong to the spathe ; the flowers are scarcely more than one line long, not much more than half as long as those of /. *setaceus;* the anthers had fallen off and only the six filaments remained; the thick but sharply angled and pointed capsule is light-brown and shining ; its valves seem to tear away from the dissepiments when it opens. The seeds are few and of large size, 0.4 line long, and irregularly ribbed and reticulated. — Tjje small flower, the form of the sepals, the exsert angular capsule, and the more elongated and differently marked seeds distinguish it abundantly from the next

11. J. SETACEUS, Rostk. Mon. June. 13, t. I, f. 2, is a regularly leaf-hearing species, though neither its author nor most of the later writers make mention of the leaves, while E. Meyer (Syn. June. 1822, p. 18) [445] already describes them, and Gray and Chapman are fully acquainted with them. Though its author credits the species to Pennsylvania, it is not now known to grow there; in all the herbaria examined by me I have seen no. specimens found north of North Carolina, whence it extends as a common species to Florida and Louisiana. It is well characterized by its terete leaves; a very long spathe; a compact or sometimes spreading, few-flowered panicle; smooth and shining sepals; a globose scarcely angled but conspicuously rostrate capsule, the dissepiments of which separate from the valves; and by the subglobose, obtuse, coarsely lineolate, OP almost transversely reticulate seeds, with short appendages and distinct rhaphe, and seldom over 0.3 line long.

12. J. AEOTICUS, Willd. The only American specimens I have seen were brought from Greenland by Dr. Kane; they differ in no respect from the European plant. The seeds are 0.4 line long, obovate, oblique, obtuse, with very short appendages and distinct raphe; 12-16 ribs are visible on one side, with very faint cross-lines.

Of the plant which is found on the Russian islands Kodiak and Sitcha, on the northwest coast of America, I have seen too few and too incomplete specimens to form a definite opinion. It seems to me to constitute a subspeoies of/, *arcticus,* which might be designated as *Sitchensis,* and which can be distinguished by the much elongated spathe, the larger flowers, nearly equal sepals, turbinate pyriform capsules, with very few and apparently smaller seeds.

13. J. DRUMMONDII, E. Mey. in Ledeb. Flor. Ross. 4, 235 : caspitosus; caulibus (pedalibus sesquipedalibus) teretibus filiformibus; vaginis setaceo-aristatis; spatha paniculam simplicem (snbtrifloram) plus minus superante; sepalis lanceolatis acutis vel exterioribus interiora vix superantibus acutatis stamina 6 plus quam duplo excedentibus; antberislinearibus filamento paulo longiorihuB ; stigmatibus ovario graoili prisnMtico stylo perbrevi coronato hrevioribus inciusis; capeula ovato-oblonga triangulari retusa triloculari sepala nquante seu eis breviore ; seminibus ovatis striato-reticulatis longe candatis.—/. *eomprtssus, y. subtrijbrus,* E. Mey. Linn. 3, 368, and Rel. Hcnk. 1, 141; *J. arcticus,* Hook. FL fyr. Am. 2,189; Gray, PL Hall *k* Harb. in Proa Ac. Phil. 1863, p. 77.

Var. *fi. humihs:* caulibus digitalibus; spatha brevissima 1-2-flora; sepalis obtusiusculis.

On the alpine heights of the Rocky Mountains of Colorado, *Hall* 6 *Hath.,* 563; to California, *HiUebrand;* the

Cascade Mountains, *LyaU;* and to Unolaschka; the variety on Mount Shasta, Calif., at an altitude of 8,400 feet, *Brewer.* — The soft, compressible stems are 8-17 inches high, and always, as far as I have seen, leafless; [446] and when Meyer (Fl. Ross. 1. c.) says that they occasionally bear leaves, he had probably one of the allied leaf-bearing species before him, which are at first glance so much like our plant that they have been almost constantly confounded with it. The spathe is £-1} inches long and usually exceeds the flowers; in the variety it measures only 2 or 3 lines and is shorter than the flowers, of which the primary one is sessile and the accessory one peduncled, just as we see it in /. *biglumis.* Flowers 3 lines or more long; sepals green on the back, brown on the sides, pale and membranaceous on the margins; outer ones with 5-7 nerves ; stamens less than one-half, often only one-third as long as the sepals; capsule deep chestnut-brown and shining; seeds 0.3 line, or including the tails, about 1 line long; appendages as long as, or longer than, the body of the seed, which is delicately striate, with 10 or 12 ribs visible (on one side), and distinctly cross-lined; it is one of the very few species in which we find the appendages as long as or longer than the seed itself.

14. J. HALLII, n. sp.: cespitosus; caulibus (spithameis pedalibus) teretibus filiformibus folia teretia setacea longe superantibus; spatha paniculaoi subsiinpliceni paucifloram coarctataiu vix seu parum superante; sepalis lanceolatis acutis, exterioribus paulo longioribus stamina 6 bis superantibus; antheris linearibus filamento paulo brevioribus; stigniatibus subsessilibus ovarium ovatum sequantibus inclusis; capsula ovata angulata retusa triloculari vix exserta; seminibus oblongo-linearibus striato-reticulatis longe caudatis.—/. *arcticus,* var. *gracili*?* Gray in PI. Hall & Harb. 1. c. p. 77, ex parte.

Near Lake Ranch, Colorado, *Hall <& Harbour,* Rocky Mountain Flora, No. 562; for the former of whom, Mr. £. Hall, of Athens, Menard county, 111., who discovered this and many other plants in that region, it is named. It seems to be a rare plant, as neither Dr. Parry nor any one else, so far as I know, has obtained it — Stems very slender, 6-12 inches high; leaves from 2-5 inches long, grooved just above the vaginal part, terete upwards ; spathe as long as, or a little longer than, the compact inflorescence, which consists of 2-5 flowers about 2 lines long; capsule deep brown, as long as, or longer than, the acute but not subulate-pointed, chestnut-brown, white-margined sepals; seeds 0.5-0.6 line long, the body of the seed being about 0.3 line long, and the appendages half as long as the body, or often shorter; I notice on one side of the seed about 10 delicate ribs.

15. J. PARRTI, n. sp.: caespitosus; caulibus setaceis humilibus (digitalibus spithameis) folia sulcata aursum teretia superantibus; spatha poniculam simplicissimam (1-3-floram) superante; sepalis lanceolato- [447] subulati*, exterioribus longioribus oristotis stamina[1] 6 ter superantibus; antheris linearibus filamento bis terve longioribus; stigmatibu* ovarium lineori-prismaticum in stylum attenuatura vix aquantibus inclusis; capaula prismatica aentala exserte triloculari; seminibus oblongis tenuiter striato-costatis longe caudatis.— /. *arcticus,* var.. *gracilUt* Gray in PL Parry, p. 34, and in PI. HalL & Harb. 1. &, ex parte.

On the western and northwestern mountains; *Dr. C. C. Parry,* the indefatigable explorer of those mountain regions, who has been so often mentioned in the pages of these Transactions, and for whom I have named this interesting little plant, discovered it in Colorado in 1861 (coll. No. 360); Mean*. *Hail 6 Harbour* found it in the same region (No. 561), *Dr. HilUbrand* in the Sierra Nevada, and *Dr. LyaU* in the Cascade Mountains: it is generally, as it seems, associated with /. *Drummondii.* — Stems *very* thin and wiry, 4-8 inches high, leaves one-half to two-thirds as long, deeply grooved for over half their length, terete upwards; spathe usually overtopping the flowers, often 1 inch or more long; flowers mostly two, very rarely three in number, 2^-3| lines long, larger than those of the lost two species, and distinguished by their bristle-pointed exterior sepals, which are greenish, with brown sides and white margin, and strongly nerved. After maturity the placenta) of the slender and very acute brown capsule become detached from the valves and persist in the centre. The whole seed is about 1 line, and the body alone about 0.4 line long; longitudinal ribs 10-12 on one side, cross-lines very faint. A Caiifornian specimen before me has somewhat shorter capsules and smaller and thicker seeds, but shows no other difference.

16. J. TRiFiDCS, Linn., apparently a rare plant in North America ; thus far found only on the highest moontains in New York, New Hampshire, and Maine, and in Newfoundland and Greenland. —American specimens do not differ from those of Europe. The seeds are few and large, irregularly compressed, very faintly striate, with very short appendages; 0.7-0.8., or even as much as 1.1 lines long, and 0.3 line or more in diameter.

17. J. BIGLUMIS, Linn.: the only American localities known to me are those given by Hooker (Fl. Bor. Am. 2, 192) — " Arctic sea coast and islands, Rocky Mountains north of Smoking River, and Bearing's Straits." A specimen from the Arctic sea coast, which I bad the opportunity of examining, does not differ in any respect from the Norway and Lapland plant The body of the seed is ovate-oblong, 0.34-0.42 line, and with the appendages 0.66-0.72 line, long; these are equal to, or shorter than, the diameter of the seed. In a Scotch specimen I [448] have seen a regularly tetramerous flower, with 8 sepals, 8 stamens, and a 4-valved capsule. The leaves, which botanists do not seem to agree upon, appear to me fatulous, on the lower half so deeply grooved as almost to praaent two cavities, and upwards nearly terete or slightly flattened. IU alliance with *J. Panyi* it indeed *rwy* dose.

18. J. TBIGLUMIB, Linn., on the Arctic coast and in the Rocky Mountains; in Colorado, *Parry* 395, and *Hall <& Harbour,* 557. —The seeds are of the same size as in the last species, hut the appendages are much longer, though only in a specimen from Zermatt, Switzerland, I have Been them longer than the body of the seed. The roundish leaves are channelled below and flattened upwards, and really enclose two, or even three, tubular passages.

19. J. STYGIUS, Linn. From northwestern New York to Maine, New Brunswick, and Newfoundland. The seeds of this are the largest of any of our species; the body is 0.7-0.8, and the whole seed 1.5 lines long; the seed-coat, extremely loose and easily removed, is scarcely striated Mention has already been made of the short and recurved stigmas which are peculiar to this species; the filaments are 8 or 10 times as long as the oval anther, and much longer than the pistil; the flowers, in the American specimens examined by me, are 3 lines long, while in one from Norway I find them only 2 lines long. A careful examination of the leaves proves them to be somewhat laterally compressed, with a very shallow groove on their lower part (generally a little on one side), and the interior cavity filled with very loose tissue which divides it into several (3-5) tubes.

20. J. CASTANEUS, Smith : the lower part of the terete fistulous leaves is so deeply channelled that their base appears eqnitant, and thai in the herbarium the pressed leaves look like the averse and ensiform leaves of /. *xiphioides;* but their back is rounded and not in the least carinate, and the upper part of the leaf is only very superficially grooved. The flowers are usually over 3 lines long, and the stamens, as well as the elongated ovary with the short style, attain the length of the sepals; linear, pointed anthers half as long as the filaments; stigmas exsert; oblong seeds, 0.4-0.5 line, or with the appendages, which considerably exceed the seed in length, 1.6 lines or more, long, the longest of any of our species.—From the Rocky Mountains of Colorado to the northwest coast, and eastward to the Hudson Bay regions and to Newfoundland.

21. J. VASEYI, n. sp.: cwspitosus; caulibus (1-2-pedalibus) tenuibus rigidis striatis basi fusco-vaginatis; foliis elongatis setaceis teretiusculis striatis versus basin sulcatis farctis; spatha paniculara parvam contractam [449] aquante seu raro superante; sepalis aequilongis lanceolatis, exterioribus apice subulatis, interioribus latioribus niucronatis stamina 6 plus quam duplo superantibus; antheris filamenta squantibus; stigmatibus ovarium ovatum cum stylo brevi vix oquantibus inclusis; capsnla straminea ovata sursum tricocca retusa triloculari sepala aquante seu paulo superante; appendicibus semini ipso lineari costato-lineolato paulo brevioribus.

On the banks of Fox river, near Ringwood, in Northern Illinois, "a few years ago, in an open wood, now plowed over," *Dr. George Vasey,* who paid a good deal of attention to this gemis and to the botany of his neighborhood fcroerally, and for whom this species is named? on the Saskatchawan, *Bourgeau;* in the Rocky Mountains, *Drwmmond}* and, mixed with /. *tennis,* in Colorado, *E. ffaU.* — The wiry stems, 1 or 1J to 2 or 2J feet high, are covered at base with brown sheath*, the innermost of which bear very slender terete leaves, shorter than the stem, and channelled only near the base, so that our plant is thus most closely allied to those of the first section; its inflorescence, however, »decidedly terminal, and connect* it with *J. tennis* and its relatives. The compact panicle is i-1 inch long, green, or, when fully ripe, of a light brownish straw color; flowers 2 lines long; seeds very slender, body about 0.3, and With the appendages, 0.5-0.7 line long. This species is the western representative of /. *Greenii,* from which it is distinguished by the longer stems, the terete, scarcely channelled leaves, the lighter colored flowers, the shorter capsule, and by the slender seeds with longer appendages.

22. J. GBBBNII, Oakes & Tuekerm. Sillim. Journ. 45 (1843), p, 37; Steud. Glum. 2, 305; Gray Man. ed. 2, 483: csspitosus; caulibus (pedalibus sesquipedalibu*) rigidis strictis striatis basi parce stramineo-vaginatis; foliis eaule brevioribus teretiusculis totis profunde sulcatis; apatha paniculam contractam ad ramos ultimo* secundifloram plerumque longe superante; sepalis (stramineo-fascui) lanceolatis subulatis subnqualibus seu interioribofl paulo brevioribus cuspidatis stamina 6 duplo superantibus; antheris filamenta ©quantibus; capsula ovato-oblonga retuia ttpala excedente (pallide fusca) triloculari; seminibns obovatis costato-lineolatis breviter caudatis.

On the coast of Massachusetts and Rhode Island (to Long Island ?) and on the Saco River at the foot of the White Mountains. — Few and pale sheaths at the base of the stem ; leaves deeply channelled all their length; panicle contracted, with erect one-sided branches 1-lJ inches long; flowers 1.7-1.8 lines in length; seeds 0.25-0.30 line, and with the appendages, 0.37-0.40 line long, appendages about half as long as the diameter of the seed.

S3. J. TBKun, Willd., is one of the most common and best knbwn, but also one of the most variable [450] species, and can always be readily distinguished from all the allied ones by its flat leaves, which only in the narrow-leaved fonniiare on the margin slightly involute; by the lanceolate, subulate sepals of equal length, which flomewhat exceed the ovate, rotase capsule, and principally by the small, mostly oblique, delicately lineolate seeds, With distinct but.jhort whitish appendages; they are very similar to those of J. *effutu,* and are mostly 0.25-0.28, Wejy only o,20 line long.

Notwithstanding the great variability in the size of the plant (from a few inches to two feet), in the size and development of the one, two, or even three spathes, and in the size and fulness of the inflorescence (1-5 or 6 inches in length), I can tlMnguish only the following well-marked varieties: —

Var. *fi secwndus,* ramis panicul® spatham excedentibus erectb incurvis; 0oribu8 minoribus secundis.—*J. aecnndus,* Poir.

Var. y_i *congestus,* ramis.paniculsB spatba brevioribus abbreviatis; floribus fere in capitulum congestis; sepalia fusco-striatis ; capsula e stramineo fusca.

The legitimate *J. tenuis* is found over tbe whole country, from the Atlantic to the Pacific, and south into the tropical parts of America, in the West Indies, and in western Europe. — The interesting and quite distinct-looking variety with unilateral flowers has usually 4 or 5, but sometimes even 6 or 7, flowers on a single[4] branch, which is curved inward and not backward, as is the case in *Borraginea,* the one-sided inflorescence of which bears a great analogy to that of our plant. Most of tbe specimens of this variety which fell under my observation were obtained in Pennsylvania, and a few in New England ; forms approaching it are found in other regions also.—The variety y_f which occurs in California (San Francisco, *Bolander;* Monterey, *Brewer)* and in Colorado, *Hall,* is very striking; its apparent heads, 4-9 lines in diameter and nearly as high, bear flowers a little larger than ordinary, with darker colored sepals. The seeds of both varieties are undistinguishable from those of the common plant.

24. J. DICHOTOMUS, Elliott, Sketch, 1, 406 ; Chap. Flor. 493; though closely allied to the preceding, is a well-marked species, and would not have so often been confounded with it if the characters, as given by Elliott, had not been overlooked. The terete leaves, which ore marked by a shallow groove on their upper side, distinguish it at once, even when the subglobose, mucronate, but never retuse, capsule is not yet formed. The seeds are very [451] similar to the smaller ones of /. *tenuis* (0.22-0.23 line long), and have the same oblique white appendages, but they are coarsely lineolate, the meshes being about twice as wide as in the other species ; the bulbous base of the stem, indicated by Chapman, is perhaps not always so well marked. Mr. Bebb remarks that about Washington, where it is abundant, the contrast in the color of the mature plants of this and the last species is quite striking; the latter becomes pale throughout, while *J. dichotomus* remains dark green, and the ripe pods assume a mahogany color. — The northern limit of this species seems to be on the "Chesapeake Bay, whence it extends to Florida.

25. J. GKRARDI, Lois. Notic (1810) p. 60, ex Kunth, En. 3, 352 ; Koch, Syn. Germ. 731, is well distinguished from /. *bulbonu,* Linn., which has never, I believe, been found in America, by the subterete stem, the much larger flowers, which are as long as the capsule; by the large linear anthers and very short filaments, the long style, which is equal to the ovary, and by the larger seeds. These are 0.31-0 33 line long, while those of/, *bulbonu* ore only 0.23 line long; both are delicately lineolate. — It is a salt water plant, and is found in brackish marshes from the British possessions to North Carolina, *Curtis,* and Florida, *Ware (J. Floridanus,* Raf. in Hb. Durand) ; inland it has been found by *Judge Clinton* about Salina, western New York ; and near Chicago by *Dr. Vasty.* On tbe coast of New England it is well known under the name of "black grass/' and is cut in large quantities and makes pretty good hay *((Jakes).*

26. J. BuroNius, Linn.: this well-known weed, found all over tbe globe, and, perhaps with the exception of /. *saginoidesy* the only annual *Juneus* of our flora, is most variable in its size, the size and disposition of tbe flowers, tbe proportion of inner and outer sepals, and the size of tbe seeds. Tbe seeds are ovate, very obtuse, and commonly very slightly apiculate, and delicately lineolate; 0.15-0.20 line is their usual length; I have rarely seen them 0.22 line long, and in a Galveston specimen have found them only 0.13 line long.

Only one marked variety has been distinguished under the name of *fasciculatus,* Koch, or *fascicvliflorvs,* Boiss, apparently a southern form, common in our southeastern States and in tbe south of Europe ; it is also found in the interesting colony of southern plants near the Philadelphia navy-yard; the last three or four internodes of the branches of the inflorescence are so much shortened that the flowen become crowded into false heads, which gives the plant a very peculiar aspect

27. J. REPENS, Michz. Fl. 1,191. *Gephaloxys JlabeUata,* Desv.; Chapm. Flor. 496. A well-marked south- [462] eastern species, found from Maryland, *Canhy,* to Florida, Alahama, and Louisiana; it is a true *Juneus,* as I have shown above, and evidently, notwithstanding its great difference, nearly allied with tbe Lust species. Seeds obovate, somewhat pointed, about 0.2 line long, and delicately lineolate.

28. J. FALCATUS, E. Mey. Synop. Luzul. p. 34 ; in Rrl. Haenk. 1,144, et in Led. Fl. Horn. 4, 22ft, excl. syn.; Kunth, En. 3, 360: rhizomate ascendente, stoionifero; caulibus (digitalibus pedaiihus) erectis bevibus compremis unifoliatis sen nnrii* ; fnliis grnmineis plains ariveraifl plemmque oblique ad latu* deflexis inde falcatis; capitulis sub-singuli* spatha strpius brevioribiiR ; floribu* (majorihus castaneis) i»xtus scabri* pediccliati*; sepal is ovatis, exterioribus acuiuidatis interiora obtusa su hi ride mncromtlata sjquantibon sen eis brevioribus; statninihus 6 dimiria sepala super-antibus ovarium obtusura cum stylo ei Kquilnngn squantibus, antheris late linearibus filainento multo longioribus; stigmatibus elongati* exsertis; capsula obovata obtuaa niticronata triloculon ; seminibus (ex Hooker) testa producta Unesuri-oblongis. — /. *Menzierii,* R. Brown in Hook. Fl. Bor. Am. 2, 192.

[4] These branches are only apparently single axes, for in reality they srs formed of many short, sacortsi?t branches.

From the Russian island of Unalaschka, *Chamisso,* to California, *Hanke, Eschscholtz, Douglas, Coulter* 808, *Bolander, and* on the Cascade Mountains, 49 deg., *Lyall.—A* very striking and much controverted plant, as distinct from /. *castaneus* as it is from /. *ensifolius* and *J. Mertensianus,* with all of which different authors have thrown it together; the perfectly flat and adverse (i. *e.* the flat surface facing the stem) leaves, the very broad and scabrous sepals, and the long anthers on short filaments, distinguish it fully from all these. — Eschscholtz's specimens in Hb. Gray are only lf-3 inches, while those of Lyall are 15 inches high; 6 or 8 inches is their usual size. The leaves are of different lengths, shorter than or sometimes exceeding the stem, and are usually laterally bent so that even the stipular appendages of the sheath are unequal. Heads mostly single, sometimes two or three, } inch in diameter, composed of from 8 to 18 large (3 lines long) flowers; sepals remarkably broad and rough on the outside, chestnut-brown or (in Coulter's and Lyall's specimens) green with two lateral brown stripes; this roughness seems to be constant in this species, and in no other have I seen it Meyer (Rel. Haenk. 1. c.) says of the fruit in Chamisso's specimen: *trigono-pyriformis, perianthio paulo longior trUocularis; semimm testa laxior albkans sed rum scobiformis.* None of the specimens before me have ripe fruit, only one, from the Cascade Mountains, shows a half-developed capsule with young seeds, and these are undoubtedly tail-pointed and already 0.6 line long; Dr. [453] Hooker (Bot. Antarct Voy. FL Tasra. 2, 64) speaks of the seed of this species as "linear-oblong, striate, with the testa produced beyond either end," and as the Tasmanian plant* has very different seeds, his remark must refer to the Californian species.

Hooker & Arnott, Bot. Beechey, p. 402, distinguish from the original *J. Memiesii,* with obtuse sepals, the variety *Californicus,* with acuminate ones. I have found, in all the specimens examined by me, the outer sepals acuminate and the inner ones obtuse, with or without a mucro; but in some, as stated before, the outer ones are much shorter than, in others as long as, the inner ones.

29. J. LONGISTYLIS, ToiTey in Bot. Mex. Bound, p. 223 : caulibus (pedalibus bipedalibus) csspitosis stoloniferis teretiusculis sursum ssspius (sub lente) scabriusculis foliatis; foliis planis gramineis ; capitulis paucis in paniculam contractam aggregatis seu raro singulis; floribus (majoribus viridulis fusco-striatis) luevibus pedicellatis; sepalis oqualibus ovato-lanceolatis acutatis seu cuspidate stamina 6 duplo superantibus ; antheris filamento subduplo longioribus ; ovario stamina et stylum aquante, stigmatibus exsertis; capsula ovata obt-usa mucronata seu rostrata castauea nitida triloculari calycem awuante seu paulo superante ; seminibus oblanceolatis sen obovatis apiculatis costato-reticulatis. - *J. Menziesii,* Gray in PL Parry, p. 34, and PI. Hall & Harb. p. 77, "the var. *California*,* Hook & Am., probably an unpublished species.*

Rocky Mountains from New Mexico, *Wright* 1924, *Fendler* 857, to Fort Wbipple, Arizona, *Couu* <* *Pahner* M8, and northward to Colorado, *Parry* 631, *HaU & Harb.* 566, to the Saskatchawan, *Bourgeau,* and towards Oregon, *LyaU.* - Stems cespitose, or, probably in richer soil, stoloniferous, 1-2 feet high ; panicle usually l| -2* or 3 inches long, consisting of 5-9 heads ; heads 3-8 or 12-flowered, sometimes fewer or single, and then 12-15-flowered; flowers 2f-3 lines long; stamens as long as the ovary, so that the style, which is of the same length, protrudes beyond [454] them; seeds 0.25-0.27 line long, oblanceolate and acute, or, in the Fort Whipple specimens, obovate and upwards obtuse; these specimens are also distinguished by the absence of all traces of stolons, and by the slightly roughened surface of the upper part of the stem. — From the closely allied *J.falcatui* our plant is distinguished by the greater size, the paniculate heads, the shape, proportion, and surface of the sepals, and the shape of the seeds.

30. J. LEPTOCAULIS, Torrey & Gray in Herb. Durand: caulibus ciespitosis erectis (spithameis pedalibus) gndlibua compressiusculis fistulosis paucifoliis; foliis planis caule brevioribus; capitulis singulis seu paucis (1-3) spatham fere aquantibus 3-6-floris; bracteis ovatis aristatis flore subpedicellato plerumque brevioribus; sepalis ovato-lanceolatis acuminato-aristatis »qualibus seu exterioribus paulo brevioribus stamina 3-6 et capsulam obovatam tricoc cam retusam mucronatam triloculararera quarta parte superantibus; antheris oblongo-linearibus filamento bjs terve brevioribusi; stigmatibus ovarium obovatam cum stylo perbrevi «quantibus inciusis; seminibus obovatis apiculatis costato-lineolatis. — *J. JUipendulu*,* Buckley in Proc. Acad. Phil. 1862, p. 8.

Arkansas, *Herb. Durand,* Western Texas, *Lindheimer, Wright, Buckley.* - Whole plant light green ; gracile stems 6 or 8 to 12 and 14 inches high, growing in dense tufts from very small but apparently perennial rhizomas; heads single or rarely two or three, the secondary ones pedunculate and overtopping the primary one, in fruit 4-5 lines in

• The Tasmanian /. *falcatus,* Hook. f. 1. c, of which I find a good specimen with ripe fruit, collected by Gunn, in Hb. Gray, is certainly very similar, but seems to be distinguished by smaller tort also scabrous flowers, ovate retuse capsule* of the length of the equal acutish sepals, and oborate, obtuse, abruptly apiculate reticulate seeds, the areoln of which are *perpendicularly* lineoiate; it might be distinguished by the name of /. *Tasmania**

• While this sheet was in the hands of the printer I received a most interesting collection of Arizona Plants, made last year by Drs. Elliott Cones and Edward Palmer, in which I found good specimens of this species, and also some of *J. compressus,* unfortunately again without fruit; the leaves of this last, however, are finely developed, thus adding another proof for the opinion that it is really a regularly leaf-bearing species. (Compare p. 440.)

diameter, consisting of 3-6 or 7 light green flowers: these Dot quite 2J lines long, remarkable for the elongated sharp points of the inner as well as the outer sepals, and for the irregular number of stamens; stamens sometimes &» often 4 or 5, rarely 6, some of the inner ones commonly depauperate, with very slender filaments and extremely small anthers ; seeds very similar to those of the next species, 0.22 line long, with about 6 strong and dark ribs visible on one side.

I had to change the only published name of this species, /. *filipendulus,* because it is absolutely wrong, the fibrous rootlets bearing no tubers at all; intending to substitute the name of the author and call it *J. Buckleyi,* I discovered, from a label in Mr. Durand's herbarium, that Torrey and Gray had already named the species; I therefore adopt their very appropriate designation.

31. J. MARGINATUS, Rostk. Mon. June. 38, t. 2, f. 2 : a well-known species which grows aft over the eastern and interior States, and down to Texas as far as woodlands extend, but has not been found in the western plains or-mountains. It is distinguished from all our other species by the purple, or when dry red-brown color (already [455] noticed by La Harpe) of its three anthers, which usually exceed the outer sepals in length; it is further characterized by the acute outer sepals being much shorter than the obtuse or sometimes mucronate inner ones; by the ovate, obtuse ovary, with the almost sessile enclosed stigmas of the same length ; and the suijglobose, obtuse, mucronulate capsule. The weds are quite variable in size and form, but always strongly pointed or almost caudate and conspicuously ribbed, with few (4 or 5, or at most 6) ribs visible, lineolate or rarely reticulate ; they ore commonly slender; oMiquely lanceolate or fusiform, but in Lindheiiuer's Fl. Tex. exsicc. 193, which has been named /. *heteranthoM,* they are quite 'short, ovate-obtuse and abruptly apiculate. The length of the seeds varies from 0.22 to 0.33 line, and their thickness from J to } of. their length. —/. *aristulatus,* Michx. 1, 191, and /. *arUtatu$$_y$* Pen. Syn. 1, 385, are exactly the same ; /. *biflorw,* Ell. Sketch, 1, 407,[7] and /. *heteranthos,* Nutt. PL Arkans. in Trans. Am. Phil. Soc. V. 153, are forms of the same with fewer flowers in the head. *J. cylindriciu,* Curtis, Sillim. Journ. 44, 83 ; Steud. Glum. 2, 304, is a form with heads elongated into spikes 6 lines long and 3 lines in diameter, sterile below, only the uppermost flowers bearing fruit; outer sepals almost as long as inner ones. We may dfrtiuguiAh the following forms : —

Var. a. *vulgaris,* 1J-3 feet high, with 5-8-flowered heads in a compound or decompound panicle; the common form*

Var. *fi. tnjforui,* as toll as the former, with 2-3-flowered heads in a decompound and often very large panicle; a southern form, from Delaware, *A. Commons,* to Texas.

Var. *y. paueicapitahu,* 1-1$ feet high, with few (2-6 or 8) larger 8-12-flowered heads; Long Branch, New Jersey, 0. *W. Short,* and elsewhere,

32. J. PELOOARPUS, E. Mey. Synops. Lnzni. p. 30; La Harpe Monog. 124; Knnth, En. 3,333, non Auct Amer.: lfeizomate horizontali tenni pall Mo ; caulibus (spithameis pedalibus et ultra) gracilibus teretiusculis exectis pancifoliU; foliis teretiosenlis indistincte nodulosis; panicula decomposite laxc ramw plenunque eloogatis seenndifloris demum recurvw; flnribns (parvis) singulis birmve ssspe. in gemmam vel mraulam fotiosum abortientibus; sepalis oblongis obtusis, exterioribns plenunqne brevioribut rarius moeronatis stamina 6 et ovarium acuminatum in stylum breviorem abiens vix wperantibua ; antheris late lineaiilras filamento mnlto (duplo quadruplo) longiori- [456] bos; stigmatibas exsertis; capsnla triquetra aeuminato-rostrata 1-loculari exserta ; seniinibns obovatis breviter apiculatis reticulatis, areU lineolaftia,—*J. MvKknbergX,* Spreng. Syst 2,106 (1825). *J. vivipanu,* Conrad in Jonrn. Ac. Phil. 6, old ser. part 1, p. 105. /. *Conradi,* Tuckerm. in Torr. FL N. Y. 2, 328 (1843) ; Gray Man. ed. 2, 482; Chapm. FL 495. *J. dichotomut* in herb. plur.

Var. 0. *crasticaudex,* e rhizomate craeso canlibus foliisque robustforibus. —/. *aborting* Chapm. Fl. L c.

Var. y? *gubtilu,* caule reptante vel fluitonte radicante foiioso : foliis brevibos setaceis ex axiilis proliferis ; floribus subbinis 3-andria. —/. *fluitans,* Michx. Fl. 1,191. J. *$ubtili$$_y$* E. Mey. ^yn. Lnz, 31; La Harpe Mon. 135.

From Newfoundland (ex La Harpe) and Canada, *Macrae,* westward to Lake Superior, *Robbim,* and southward, chiefly along the coast, to South Carolina, *Curtis* ; var. 0. in Florida, *Chapman ;* var. *y.* in Canada, *Herb. Michaux.* — A very peculiar and morphologically very important plant, the synonymy of which has been quite obscure. Meyer's original diagnosis is too short, so that it permits strong doubts about the identity of the plant he had in view, and his unfortunate comparison of his species with /. *Utmpocarpui* and /. *paradoxus, "eujus habitum nfirt** neeeswily throws botanists on the wrong track. But La Harpe,[1] who wrote only two years after Meyer's publication, and who seems to have been well acquainted with Meyer and with bis species, gives a fnll description, which can leave no doubt, even if Meyer's herbarium did not settle the difficulty. Though originally the species was described from specimens in GL

[1] The inner sepal*, however, are not the shortest, ss the •wall/ ao careful and reliable Elliott, probably by a lapse of the pan, aaya, but, as in all the forms of thia sprcies, the

Jaaa <fe La Harpe's " MoDogmphie dfa m i * Jonrfcs" to be little acoaiaibla to botaniaU; it was published, 1825, in the third volume of Mé'tnoires da la 8octtta d'HIstoire Naturelle de Paris, pp. Sft-181, and is a work of careful research, in which I believe I cab trace the cooadmtioat inventigatinn and the critical spirit of my old and highfy esteemed, now departed, friend, Jacqnts Gay, of ParUTLa Harpe waa the lint to give fall and careful descriptions of

Sprengels collection, which seem also to have been the originals of his /. *Muhlmbeiyii* (most probably received from Muhlenberg himself), several specimens, obtained later from different sources *(e. g.* E. Tuckerman and A. Gray) are preserved in Meyer's herbarium with the name of "/. *pelocarpus*" in his own handwriting; and others so named by him are found in the royal herbarium at Berlin. Now, this plant is so peculiar that no one who has ever examined it can confound it with any other ; is it, then, at all probable that Meyer himself should have done so in his [457] own herbarium ? His original specimens may not have exhibited the foliaceous excrescences, so that he could not mention them in his description of this species, while he did allude to similar ones in his account of his *J. paradozm;* his diagnosis is so short that he does not even mention the unusually small number of flowers.

The rhizoma is whitish and slender, often almost filiform, and sends out few and distant, or sometimes more crowded, sjender and almost terete, not flattened, stems, 4 or 6 to 18 or 20 inches high ; leaves sleuder, almost setaceous, scarcely compressed, and incompletely knotted. The panicle shows very different forms in different specimens ; sometimes, probably in the earlier part of the season, it is only 2 or 3- inches long, and moderately spreading, with flowers more crowded; but usually, at least in the numerous herbarium specimens examined by me, and perhaps later in the season, it attains a length, of 4 or 6 inches, with about the same diameter, the few slender spreading or recurved branches bearing the distant flowers on one side. The flowers are green, with a reddish tinge, especially on the inner sepals, usually 1.0-1.3 lines long, and generally single ; sepals obtuse, sometimes mucronate, or rarely the outer ones acutiah ; these are generally shorter than the inner ones; but in a Lake Superior specimen the flowers are only 0.8 line long, and all the sepals equal, broadly oval and obtuse. Stamens about the length of the outer sepals ; anthers always longer than filaments, sometimes scarcely twice as long, in others fully four times their length. Style shorter than the acuminate ovary. The capsule ought not to have been described as Meyer and (copying him) La Harpe did, as *triquetro-ovata mucronata ;* it is rather, as Gray has it, taper beaked, and is completely one-celled, the lateral placent® occupying only the lowest third or fourth part of the commissure of the valves. Seeds 0.26 line long, delicately but distinctly reticulate, areas transversely lineolate.

I cannot distinguish Dr. Chapman's /. *abortivu** from the northern plant except by the not essential characters given above; the flowers are absolutely identical, and fruit I have not seen.

With some hesitation I add /. *subtilii* as a procumbent or floating variety with short internodes, and short leaves which bear leaf-buds in their axils. In American collections this form does not seem to exist, but La Harpe, who saw it in Michaux's herbarium in Paris, gives a full description of it, from which I have extracted above; the flowers are described exactly like those of /. *pelocarpus,* and there is, notwithstanding the different habit, nothing in it that would specifically distinguish it, except the smaller number of stamens, and the single, two-flowered heads ; [458] frnit and seed are unknown. I take it for a depauperate water form of our species, while Hooker, Fl. Bor. Am. 2, 191, unites it with *J. uligino$vs,* which with him is what I have taken for /. *alpinus ;* but that is also a 6-androus species. The botanists of Canada and of our northern border ought to find it again and clear up these doubts.

t have already (p. 426) spoken of the great morphological importance of this plant, which connects the single-flowered with the head-flowered species, and proves, as certainly might have been expected beforehand, that no absolute difference exists between them: that the flowers in all of them are really lateral; that in the former only one flower is formed, while in the others a series of them, from two to an indefinite number, are developed in centripetal order. In our species a second flower is more commonly not present, and its place is occupied by a bud, which 8ften, and especially later in the season, grows to a leafy excrescence (whence the name *vitipanu)*; sometimes even the first flower is replaced by a leaf-bud, and in rare instances a leaf-bud makes its appearance between two flowers as a third alillary organ. I have never seen more than two flowers, nor more than one leaf-bud in a head. Botanists who have the opportunity ought to investigate the variations in the inflorescence of this plant according to locality, season, or other circumstances.

83. J. ABTICULATUS, Linn. That form of the Linnean species which was distinguished by Ehrhart as *J. lampowrpui,* and which is common in northern Europe, has a very Umited range in North America. All the specimens 1 have seen came from the New England States (Boston, *Pickering;* Amheret, *Tuckerman* ; and Providence and Nantucket, *Olney)* and from western New York (Penn Yan, *SartweU)*; to these La Harpe adds Newfoundland.—Stems densely cetpitose from a creeping rootstocll,with us usually erect and about one foot high ; panicle short, dense-flowered, spreading, brown; sepals mostly equal, lanceolate, acute and mucronate, or inner ones slightly longer and sometimes obtusish ; stamens about two-thirds the length of the sepals, and anthers as long as filaments; ovary acuminate, terminating in a style about half its length ; capsule longer than the sepals, acute, or even rostrate, at least in all the American specimens seen by me, and imperfectly threj-celied, the placentae not meeting in the centre. Seeds obovate,

these pints, and of all their organs, and only after the date of his publication do we find in Meyer's papers similar extended acconnte In place of the former abort diagnoses, *e. g.* in the *Junei* of the *Bsliquim Hm*l*anm,* published 1827. Not having been able to compare M i c W s original plants, I have with confidence relied on the critical references of La Harpe especially in regard to species about which doubts had existed! such as /. *fluitmu, aeuminatu*, %n& polycephalv**

obtuse at the upper, acute at the lower end, and at both strongly apiculate ; 0.3 line or a little less long, and about half as much in diameter ; reticulate, with ares finely cross-lineolate ; 7 or 8 ribs visible.

34. J. ALPINUS, Villars, Delph. 2, 233 ex Koch, Syn. Germ. 730. *J. fusco-ater,* Schreb. ex Kunth, En. 3, 326. */. affinity* R. Brown. */. Richardsonius,* Rcem. & Schult. */. pehcarpus,* Gray, Man. ed. 1, 507, in part, non [469] Mey. */. articulatus,* var. *pelocarpus,* Gray, Man. ed. 2, 482, in part. */. elongatus,* Vasey, in herb.— This form ought, perhaps, not to be separated from the last species ; but with us it is easily distinguished, and occupies a distinct geographical range. I, therefore, keep them apart for the present, and leave the final decision to the botanists of Europe, where both forms are much more abundant. — With us this species is confined to the northern and western parts of the continent, where it is usually found on the sandy or gravelly banks of lakes or streams; from Lake Champlain, *Robbing, Macrae,* and Seneca and Ontario lakes, *Sartwell,* where it meets the eastern *J. articulatus,* northward to the Hudson Bay regions, *Drummond* and others, and the Arctic shores, and westward along the Great Lakes to Detroit, *Bigelow, Herb. norm.* 51, Northern Illinois, *Casey,* and the upper Platte, *Hayden,* Colorado, *Hall & Hark.* 558, and beyond the Rocky Mountains toward Fort Colville, *Lyall.*

Stems erect from a creeping rootstock, 10-18 inches high ; branches of the meagre panicle, at least in the larger specimens, strictly erect and much elongated, greenish and light brown; sepals oblong, obtuse, outer ones mucronate or cuspidate, equal to, or exceeding, the rounded inner ones ; stamens same as in last; ovary ovate, with a very short style; oapsule as long as or a little longer than the sepals, obtuse, niucronate, incompletely three-celled ; seeds very similar to last, but usually more slender, oblanceoiate and acute at lwth ertds, rarely obtuse at the upper one, 0.30-*0.ZS* line long. —The alpine form of this plant, the original type of Villars, is found in our Arctic regions, and is only a few inches high, bearing very few almost black heads, and has the slenderest and longest seeds. The ordinary American plant is distinguished from the usual European form by its lower stems, still stricter panicle, and paler flowers and fruit Fries has sent absolutely the same from Sweden, formerly as */. sylvaticus,* and as */. acutiflorus,* and later as */. alpinus,* var. *insignis,* which name may be retained for it.

35. J. DUBIUS, n. sp.: rhizomate crasso horizontal! ; caulibus (lf-3-pedalibus) erectis cum foliis tereti-compressis; panicula supradecomposita patula; capitulis pauci-(6-10)floris stramineis; floribus subsessilibus; sepalis lanceolato-subulatis acutissimis aqualibus stamina 6 fere duplo superantihus ; antheris linearibus filamento suhlongioribus; capsula lineari-prisinatica acutata uniloculari exserta ; seniinibus obovatis utrumque apiculatis areis lineolotii reticulatis.

Forming large tufts in wet granitic sand in Clark's meadow, near the Big Tree Grove, Mariposa, California, at an altitude of 6,500 feet, *H. Bolandcr,* flower and fruit in July; Cal. State Surv., 6032, Hb. nonn. 52. With a [460] good deal of hesitation, expressed in the specific name given to this plant, I venture to separate it from the closely allied */. oxynuris* of the same region. Ita rounded and only slightly compressed leaves certuinly seem to be very distinct from the flattened equitont leaves of the latter species ; but otherwise the whole appearance, the rhizoma, the panicle, the flower, the stamens even, and the fruit, show scarcely any diffettnee ; only the teed proves distinct, and as, I believe, we can safely rely on character* derived from the sculpture of this organ, we niuut consider both at really distinct specie*. The seeds of *J. oxymsris* show on one aide 7-9 ribs and a distinct reticulation, the area being smooth, and Q»ly the ribs slightly crenulate; */. dubius* has seeds of the tame six© (0.22-0.25 line long), but with fewer (6-7) ribs, and larger, strongly lineolate axes. The panicle of this plant it 3-6 inches long, the flowers slender, and with the capsule nearly 2 lines long.

36. J. MILITARU, Bigelow, Flor. Bost. ed. 2 (1824), p. 139; Gray, Man. ed. 2. p. 482, was "discovered by *B. D. Greens* at Tewksbury," and has since been traced from Maine, *Blake,* to Massachusetts, and southward to the Pocono Mountains in Pennsylvania, *T. Green,* New Jersey, *Asa Gray, C. F. Parker,* Maryland, *A. Commons,* and, if there is no error in the label, as far as Alabama, *Drummond.* — The stout stems, 2 to 4 feet high, spring from a creeping rootstock, and bear on their lower half a single leaf, f-3} feet long, which usually overtops the inflorescence, and is mostly fullowed by a second very short one., rarely developed beyond the vaginal part The decompound, rather crowded and often somewhat contracted light brown panicle is 2 to 5, nsnally about 3, inches long; the heads are 5-12-flowered, only in a Maryland specimen I find them 15-25-flowered. Flowers (in the North in August) 1} lines long ; sepals lanceolate, outer ones subulate-pointed or even aristate, mostly very little shorter than the acute inner ones; stamens 6, two-thirds the length of the sepals ; linear anthers a little longer than the filaments; stigmas exsert, as long as the ovate acuminate ovary and the distinct style together; capsule sharply triangular, ovate, acuminate, rostrate, equalling or slightly exceeding the sepals, one-celled; seeds obovaie, olfcuae. unusually thick, and abruptly apiculate, 0.25-0.30 line long, ami three-fifths of their length in diameter, neatly reticulate, the area marked with few longitudinal lines ; 8 to 10 rite visible.

Dr. Bobbins has discovered a very curious peculiarity of this plant, which abounds in the Blackrtone River, naif Uxbridge, ManMchnsetta, and iu tributaries, and in the flumes of the manufactories, but only in rapid part* of these streams, and is there not found in sluggish streams or in stagnant water. It seems that about the period [461]

of maturing the seeds, at the end of August, the long horizontal rhizome, which at its end is to bear the flowering stem of next season, begins to shoot forth, and from the axils of its scales produces a number of extremely short or rudimentary branchlets which are again branching and form short knobs on the rootstock. These branchlets bear a number of capillary leaves of the thickness of horsehair, but knotted like the ordinary leaves of this species, at this time, end of August, few in number, and only a few inches long. Towards the close of the season they increase in number and length, and seem to live through the winter wherever they are immersed deep enough to escape the frost They attain their full development about May and June, when they are 2 or 3 feet long, and carpet the bottom of those streams, at the depth of 2 to 4 feet below the surface, with their dark green undulating masses, most beautiful to look at, but quite obnoxious to the proprietors of the mill-streams, the sluices of which they are apt to obstruct These leaves decay about the period the plant begins to bloom. The beautiful specimens collected by Dr. Bobbins for the Herbarium Normale (No. 63) exhibit them to perfection. The twist and bend of the stem of many of Dr Bobbins' flowering specimens is caused by the strong current in which they grew. The only thing approaching such submerged leaves, Mr. Parker has found in the Delaware above Philadelphia, where this plant grows "in shallow water, extending to the border of deep running water, the finest specimens growing at a depth of 3 or 4 feet" How does this species grow in stagnant ponds or swamps? It would be very desirable that collectors of *Junci* should pay more atteution to the circumstances under which these plants occur, the process of their vegetation, the time of flowering and of maturity, and, of course, to the base of the stem and to the rootstock, which is too often a vain desideratum in herbarium specimens.

37. J. supiNiFORMis, n. sp.: foliis vernalibus e basi latiore snbulatis capillaceis longissimis teretibus pallide virentibus natantibus evanescentibus; caule florifero erecto humili (digitali vel ultra) folia erecta teretia longiora gerente; panicula simplici; capitulis sub-5-floris; sepalis ovato-lanceolatis cuspidatis nervosis equalibus seu externis paulo brevioribus inter se inaqualibus stamina 3 stigmataque paulo excedentibus ; antheris oblongis filamento multo brevioribus; stylo perbrevi; capsula prismatica obtusa mucronata uniloculari calycem fere excedente; seminibus obovatis utrumque apiculatis.

Common in and around ponds, near Mendocino City, California; May and June, *H. Bolander,* Cal. State Surv. 4767. — Mr. Bolander informs me that in spring these ponds are completely covered with the pale green [462] capillary leaves of this species, 1 or 2 feet long. As the water recedes with the advancing dry season, the erect flowering stems begin to form, and a little later the vestiges of the decayed vernal leaves cover the remaining mud with grayish spiderweb-like filaments. The flowers are nearly 2 lines long, the (immature) capsule is prismatic with concave sides; the seeds* too imperfect to make out their sculpture, were 0.27-0.30 line long, large for the size of the plant.

This species is closely allied to *J. tupinus* of Europe, whence the name, and appears to stand next to its var. *fluitan*;* but that species has smaller flowers, with obtuse sepals, an obtuse capsule, and smaller seeds. These characters, however, do not seem to be quite constant, so that further examination of more complete specimens will be necessary.

38. J. ELUOTTTI, Chapman, Flor. South. St. 494: caulibus (1-2-pedalibus) cospitosis erectis folia tenuia longe excedentibus; panicula composite vel decomposite subpatente; capitulis 3-G-floris globulosis; sepalis ovato-laneeolutis acutiseimis nqualibus stamina 3 tertia parte superantibus capsulam late ovateni obtunam brevissime niucrouulateni 1-locularem atrofuscam lucidam fere aquantibus; antheris linearibus filamento vix longioribus; ovario ovato obtuso stigmatibus subsessilibus subinclusis fere aquilongo ; semiuibus oblanceolatis fusiformibus utrinque attenuate rufofuscis areis Iamibus reticulatis.

From North Carolina, *Canty,* to South Carolina, *Ravend, Beyrich* (distributed under the name *J. acuminatu*),* Florida, *Chapman,* Hk norm. 54, Alabama, *Sullivant,* and southern Mississippi, *E. Hilgard.* — Many slender stems spring from a short rhizoma, which bean numerous long fibrous rootlets (under water ?); panicle usually 3-4 inches long, with a few principal branches; fruit-heads (from the broad, blunt capsules) obtuse, 2 or 2} lines in diameter; flowers 1.0-1.2 lines long, greenish, turning brown ; capsule usually very dark-colored and shining, rarely paler; seeds easily distinguished by their dark color and slender form, mostly 0.23-0.27 line long and one-third as much in diameter ; 5 or 6 ribs quite conspicuous. This is one of our earliest species, flowering in April and May. The slender growth, the small, obtuse, dark-colored heads and dark seeds distinguish this plant at once, but whether Elliott's *J. ocuminatui* is the same as this, as Chapman suggests, or whether it belongs to one of the forms of the next specie*, does not appear from his insufficient description. #

39. J. AOC7XINATUS, Michx. 1, 192, non Gray, Man., nee Anct Amer. plur.: caulibus caspitosis pleramque ereotis ; panicula effusa pins minus composite; capitulis pauci- vel multifloris pallidis sape demum stramineofusoatig; sepalif lanceolato-snbulatis acutiseimis subaqualibus stamina 3 dimida seu tertia parte superantibus ; [463] antheris filamento pleramque brevioribus; stigmatibus subsessilibus ovario ovato obtuso seu rarius acutato tub-

brevioribus inclusis ; capsula prismatica mucronata seu acutata unilocalari eepala squante sea exeedente ; seminibos minutis obovati9 seu oblanceolatis utnimque acutis areis lineolatifl reticulatis.

Var. a. *legitimus:* caulibus (1-2-pedulibnp) erectis gracilioribus; panicula simplici composite vel decomposite patula; capitulis pluri- seu multi-(5-l 2-30-50) floris demum e fusco stramineis; floribus majoribus ; sępalis cequalibus seu raro exterioribus paulo longioribus capsulam prismaticam obtusiusculam mucronatem fere squantibus; antheris filamento multo brevioribus; ovario ovato acuto. —/. *acuminatus,* Michx. 1, 192; La Harpe, 136; Elliott, I, 409? Kunth, 3, 335, non Auct Am. plur. *J. pallescens,* E. Mey. *June.* 31, non Lamarck. /. *paradoxus,* E. Mey. 1/c. 30 ; La Harpe, 141; Kunth, 3, 341; non Auct. Am. *J. fraternus,* Kunth, 3, 340. /. *debilis,* Gray 1. c. ex parte. /. *Pondii,* Wood Bot. (1861) 724.

Var. *p. debilis:* caulibus (spithameis sesquipedalibus) debilibus erectis seu decumiientibus radicantibusve ; capitulis pauci-(3-6)floris ; floribus minoribus pallidis ; capsula acute breviter mucronate exaerta. — J. *debilii,* Gray, Man. ed. 2, 481.

Var. y. *diffusissimus:* caulibus (bipedalibns ultra) erectis panicula; ultradecompositn ramis numerosissimis filiformibus elongatis ; capitulis pauci- (3-7) floris pallidis ; sepal is angustioribus stamina fere duplo superantibus; ovario acuteto ; capsula lineari-lanceolate acute calyci fere duplo longiore. — *J. diffusissimus,* Buckley, PI. Tex. L c. p. 9.

Var. *d. robustus:* caulibus elatis (2-4-pedalibus) erectis foliisque elongatis robuatis ; panicula ultradecompoeita patula; capitulis pauci-(5-8)floris stramineo-fuscis; floribus minoribus; antheris filaiueiite aquantibus; capsula ovate obtusa mucronate fusca sepala acutissima paulo exeedente.

. All over the States, from Massachusetts southward to the Rio Grande, and westward to Missouri. Var. a. is the most common form found in the whole territory indicated ; var. 0. I have only seen from New Jersey, *C. E. Smith ;* Pennsylvania, *Schweinitz, Moscr, Porter;* Ohio, *Lea;* Kentucky, *Short* (the original of Gray's *J. debilis)* ; Mississippi, *E. Hilgard,* and South Carolina, *Ravenel,* but it is probably more extensively distributed ; var. y., northwestern Texo/% *Lvuecum, Buckley;* var. £., in the Mississippi Valley from Illinois, *Gcyer, Mead, Vasey,* to Missouri! and to Louisiana, /. *Hale.* — All the forms of this species flower early in the season, according to latitude, from April to June, and shed their numerous seeds from May to July.

. Through the kind liberality of Profs. Boeper of Rostock and Decaisne of Paris I have now had the oppor- [464] tunity of examining and comparing fragments of Lamarck's original /. *pallescens* and Michaux's /. *acuminatus.* The former9* name refers, as Prof. Boeper informs me, to two poor *(more suo)* specimens collected by Comraernon Bear Baenos-Ayies; the heads are apparently 5-flowered ; the flowers, not yet open, are similar to those of our plant, bat are 6**ndious and pedicelled. Lamarck gives North as well as South America as the habitat of bis plant, but adds that his specimens are those above noticed; his reference to North America is evidently based on quotations from Pluk. AlflL t. W, £ 0, and Mods. Hist 3, sect. 8, t. 9, f. 5, which both represent rather something like *J. tenuu.* Meyer was undoubtedly misled by these reference* to North American localities to substitute Lamarck's for Michaux's name„„ I* Harpe, p. 136; suggests, probably with more justice, that Commerson's plant is an immature *J. Dombeyanu*. Michaux's specimen, collected in South Carolina, is a rather small-flowered fonn of var. *legitimu*, inch as often occur southeastward (comp. Hb. norm. 58), with only 6 flowers in a head (Micbaux says 3 flower*), the (unripe) capsule being about as long as the sepals. The other synonyms of the older authors have not given any less trouble, principally beeause both Meyer and Kunth have described their /. *poradoxus* and *J. fntemm* with outer sepals exceeding the inner ones (a very rare case in any form of /. *aeuminatus)*; and in the former the capsule was said to be longer, in the Utter shorter, than the sepals; neither mentions the seeds. Having been able to examine a fragment of. Kunth's plant, which had been sent from Boston by Boott, and is preserved in the Royal Herbarium at Berlin, I can most positively assert that it is a scanty-flowered form of what I have called var. *legitimiu,* with the outer sepals very slightly exceeding the inner ones, and with a not fully ripe capsule about the length of the inner sepals. Meyer's *J. paradoxxis* is more difficult to identify, because the original specimen does not exist in his herbarium; he had examined it, as a memorandum indicates, in Hb. Lehmann, to whom it was given by Willdenow under the name of /. *polyetphalas,* and preserved only a drawing of it and a rough sketch of some details. There are, however, in the sheet superscribed by Meyer /. *paradox*** ten dried specimens from different parts of the United States and Mexico, perhaps rather uncritically thrown together; flowers of only one of them have been sent to me, and they belong to the ordinary form of var. *legitimut.* The figure of the original type represents a plant with a decompound panicle about 4 inches high and as wide, with numerous few-flowered beads, and leafy excrescences from some of them; the other sketch shows an acute capsule exceeding the lanceolate-subulate sepals of *mpud* length, and the inside of a valve [465] with a parietal placenta on the lower half. Meyer, therefore* had seen the ripe fruit, and could not have failed to see some seeds, unless all bad fallen out; but as they did not differ from the common form of *Juncus* seed% he did not mention their shape, which he would certainly have done, and would have placed the plant in his ssoond section, *Manifpotptrmum,* had they been at all appendiculate, as they are in the plant with us heretofore taken for /• *pmnh donu.* Besides this, the latter, which is enumerated here as /. Goaatam, Tar. *longfcaudatut,* never has the Inner sepals shorter, but almost always longer, than the outer oues, and has rarely, if ever, as Car as I am informed, these

leafy degenerations of the flower-heads so common in var. *Ugitimus.* La Harpe, who describes /. *paradoxiu* from Pennsylvanian specimens, speaks of the sepals as being nearly equal to the capsule, and of the seeds as *ovoid.* Why both, Meyer as well as La Harpe, should have separated their /. *pallescen^* or *acuminatus* from this /. *paradoxus* is hot very clear; they have evidently seen very few or single specimens only, and seem to have laid too much stress on the slight difference in the length of the sepals.

The extreme forms of this variable plant might readily be taken for distinct species were the intermediate ones wanting. All the forms produce from a short rootstock few or many erect or somewhat ascending, rather weak (except in var. «.), terete or slightly compressed steins, rarely (except in var. *y.* and fl.) over two feet, and sometimes less than one foot high. The bracts are broad, meinbranaceous, and (the outer ones at least) awned ; heads and flowers are of different sizes, but the sepals always regularly lance-subulate and very acute or almost awned, but not rigid, and, wltti rare exceptions, equal in length ; only in some few specimens of var. *letfitimm* I have seen the outer a little longer than the inner ones. Capsules as long as or longer than the sepals, pale green to straw-colored or light brownish, with parietal placentae on the lower half of the valves. Seeds obovate or oblanceolate, acute or apiculate at both ends, O.2O-0.25 line long, the length being equal to about ^ diameters, of a yellowish or light brown color and apparently semi-transparent, neatly reticulated, and 6 or 7 ribs visible on one side.

Var. a. *legitimus* is the most variable of all the forms of this species, but is always readily recognized by the larger flowers, 1:5-2.0 lines long, and the ovate-prismatic obtusish mucronate capsule of the length of the sepals. Stems scarcely ever over 2 feet high ; panicle as well as heads extremely variable, the former apparently more compound and the latter fewer-flowered north and eastwa*!, while some Illinois *(E. Hall,* Hb. norm. 55) and Texas specimens (" Hog-bed prairies " on the Guadalonpe, *Wright,* Guadaloupe to Matamoras, *Berkmdier* 1671 and 2556 [466] iu part) have few (3-8) large globose 20-50-flowered heads. Capsule Tarely exceeding the calyx, and-then approaching var. *fi.* Seeds variable within the limits of the species, slender, or sometimes thick. Hb. norm. 56 is a taller and 57 a slenderer form with fewer flowered heads, from Michigan, *Bigdow;* 58 and 59 are what Meyer named /• *paradoxks,* the former a smaller-flowered form, from S. Carolina, *Jtovaul,* the latter a larger-flowered one from Delaware, *Commons.*

Var. *p. dcbilis* is distinguished by the mostly very weak stem, Hi ** Kgfc sometimes reclining, and even decnmtent and rooting ; panicle loose-flowered, 3-6 inches long; flowers 1.2-1.5 lines long; capsule very pale, more or less protruding beyond the calyx; seeds the smallest in the species. A rather small but rigid form comes from South Carolina, Hb. norm. 60, *Bawnd,* and a similar autumnal one, in whicl* the heads by renewed vegetation of their *tis degenerate into spikes, has been sent by the same botanist, ib. 61.

Var. *y. diffutissimtu* is stouter, 2-2} feet high, with a panicle 8 or 9 inches long and fully as wide ; fruit-heads 5 lines in diameter; flowers 1} lines, or, with the straw-colored radiating capsules, fully 2£ lines long ; seeds as in last.

Var. ft. *robwtus* is a very different looking plant, which in the hot Nelumbium swamps of the Mississippi bottoms grows even 4 feet high, with a stem 3 lines in diameter and leaves in proportion, which, however, do not reach beyond the baaa of the ipflorescence; panicle 6-10 inches long and a little less across, with fruit-heads only 2 lines in diameter ; flowers smaller than in the other forms, 1.1-1.2 lines long; and capsules more obtuse than in the others, with a short mucro ; seeds among the larger ones. —The specimens distributed in Hb. norm. 62 are, owing to the very dry season, not so well developed as the plant is often seen, nor did the fruit mature at all in that or the following year. It is an interesting fact observed by me for many years, that, if not in the whole Mississippi Valley, at least in this neighborhood, our ponds and lakes become lower every year, their rich vegetation is becoming extinct, and many have dried up altogether. Our beautiful Nelnmbium, which twenty and ten years ago was an ornament to many sheets of water on hill as well as lowland in this vicinity, biding them under their broad velvety leaves, and from the end of June to the middle of August dotting them with their splendid cream-white flowers, is fast disappearing in consequence of the retrocession qf those waters, and with it its companions the Sagittariee, the Spargania, the Junci, the Scirpi, the Zizania, and many of their minor attendants. But what botany and beauty loses cultivation gains, and, above all, the health of the neighborhood.

40. J. BHAOHYCAEPUS, n. ep.: caulibus 0 rhizomate cianso horizontal* paucis erectis (1-21-pedal^bus) [467] rigidit teretibu*; panicula e capitnlis globosis multi-(3O-«0-100)-flori8 paucis seu pluribus simplici sen composita eonferts; sepalis laflceoUto-subulatii, interioribus quara exteriora multo brevioribus stamina 3 capeulamque triangnlfttto-ovatatn aouminato-wtfrataffi unitocularem nquantibus seu panlo superantibus; antheris lineari-oblongis filamento mnlto brevioribus; stigmatibos subsemilibus ovarium ovatum acuminatum fere nquantibus inclusis; «eminibus parvb ofafeneeoifitin obovatisve utrumque acutatis areis toviusculte reticulatis. —/. *cryptocarpus,* Bebb iu litt.

In the Mississippi Valley from central Ohio, *8uHwant,* Michigan, *FolweU, Bigdow,* Hb. norm. 74, and Illinois, *BM, Hall,* Hh. norm, 63, to Mimiouri! Kentucky, *Short,* Missiieippi, *UOgwrd,* Louisiana, *ffaU,* and Texas, *Berkmdier* 309,313. 1573, and 8509 in part, *Limdheimer;* also, if the locality is correctly reported, near Charleston, S. C, *Beyrich* (distric t_d «s /..MfcMMhif). —Flowen in May and June, in Texas in April—On one aide this species is allied to the large-headed forms /. *mwmmrtutt,* and on the other much more closely to /. *Kurpoidu,* with both of which it has

been confounded. It has the rhizoma and the inflorescence of the latter, but its very short inner sepals and short capsule at once distinguish it from either. — Stems from 8 or 10 inches (seen mostly in Texas specimens) to 2-2$ feet Ugh, rather rigid; heads 4-5 lines in diameter, single or 2-3 together, or more commonly 5-8, or even 10, in a short (1-2 inches long) contracted panicle; flowers 1.8-2.0, and capsule 1.2, lines long, so that, as Mr. Bebb remarks, at maturity the arid sepals, protruding over the almost hidden capsule, give the plant an* appearance of sterility. Filaments twice or three times as long as the anthers. Seeds 0.20-0.22 line long, in shape like those of the last species ; but the areas are scarcely lineolate, the ribs however are crenulate, and sometimes short, transverse lines extend from them into the area. Among Linheiiner's Texan specimens are some, the heads of which are degenerated into leafy excrescences.

41. J. SCIRPOIDES, Lamarck, Enc. 3, 267 (E. Meyer in Linn. 3, 370) : caulibus (1-4-pedulibus) e rhizomate horizontal! crasso albido rigidis strictis (seu rnro decunibentibun) foliosis; capitulis globosis multifloris paucis *eu pluribus; sepalis subulatis saepius aristatoacutissimis demum rigiilis spinescentibus; staminibus 3; capsula trian^u-lato-pyrainitlata subulate uniloculari; seminibus oblanceolatis obovatisve utrumque acute apiculatis areis sublamibus roticulatis—/. *polycephalus,* Michx. FL 1, 192 ; Pursh, Fl. 1, 237 ; Mey. June. 33.

Var. a. *macrostemon:* caulibus (l-2-pedalibii8) foliisque teretibus rigidia strictis; capitulis paucioribus [468] minoribus in paniculam strictam dispoeitis; staminibus sepala fere aequnntibus, antheris lineari-oblongis filamento pluriea (quater seu ultra) brevioribus ; capsula calyci aquilonga seu rarius exserta; semiuibus minoribus. — *J. scirpoides.* Chap. 494, in part.

A. *macrostylus:* sepalis aqualibus seu sspius exterioribus brevioribus; stylo elongato, capsula plerumque lageni-formi. — /. *maeroitemon,* Oay, in La Harpe, 140.

a *brachystylus:* sepalis squalibus seu plerumque exterioribus longioribus; s tylo perbrevi.—/. *echinatus,* Muhl. Gram. 207 ? /. *scirpoides,* Lamarck in Herb. ! Gray, Man. ed. 2, 481.

Var. *0. echinatus:* caulibus (1^-3-pedalibun) foliisque teretibus rigidis strictis; capitulis paucioribus majoribus in paniculam simplicera d is posit is ; sepalis exterioribus plernmque longioribus stauiina dimidia seu tertia parte super-antibus; autheris filaraento (duplo triplove) brevioribus; stylis abbreviatis; capsula sepalis nquilonga seu rarius exserta; seminibus minoribus. —/. *echinatus,* Ell. Sk. 1, 410. J. *megacephalus,* Curtis, in Boat Jour. N. H. 1, 132. *J. polycephalus, a.* La Hnrpe, 140. /. *scirpoides,* Chapm. 1. c. in part.

Var. y. *polycephalus:* caulibus (2-4-pedalibun) compresHifH erectis wu flaccidis hinc decumbentibus; foliis a latere compressis gladiatis; pauicula effusa decomposita et ultra; capitulis nutjoribus; styliii abbreviatis; capsula exserta.—/. *polycephalus,* Ell. 1, 409; Chapm. 494. /. *polycephahu,* o. Michx. 1. c; Pursh, L c. ; Mey. June 33. /. *polycephalus, y.* La Harpe, 140

A. *minor:* caulibus capitulisque paulo minoribus; sepalis aqnalibus trinerviis; antheris filamentum fere aquantibus; seminibus majoribus fusiformibua.

& *major:* caulibus capitulisque majoribus sepalis uninervii* exterioribus interior* tenaia suparantttras; anthem filamento brevioribus; seminibus ohovatis abrupte apiculatis.

A southern species, which extends northeastward as far Pennsylvania and New Jersey. Var. a. A. I hare only seen from South Carolina, Hb. norm. 67 (the form with lobed heads), to Florida, Alabama, and Texas: o. B. is distributed over the whole range of the species, from New Jersey and Pennsylvania, Hb. norm. 66, to South Carolina, Hb. norm. 60, Arkansas, and Texas. Var. 0. has been found from Maryland to Florida, Hb. norm. 68, and Texas ; var. *y.* A. from North Carolina to Florida, Hb. norm. 69, and var. y; a. from the same States westward to Louisiana, Arkansas, and Texas. There must be some error in La Harpers statement that La Pylaie found *J. macrostemon* in Newfoundland; perhaps ha took the large-headed form of /. *nodosus* for it. — It flower*, according to latitude, from June to August

I comprise under the name of/, *scirpoides* a number of forms, several of which have often been taken for distinct species. Micbaux, who no doubt had seen a great deal of it in the southeastern States, had united all [469] under his /. *polycephalus,* in which he was followed by Pursh as well as by Meyer; but the earlier name of Lamarck must take precedence, though it seems to refer only to a single form, a specimen of which, brought by Fraser from South Carolina, is still preserved in his herbarium, now in the hands of Prof. J. Roeper of Rostock. Thin proves to be var. *mucrostemoii* (the form with longer exterior sepalit), as has already been stated by Meyer (Linn. 3, 370). The oKler author* appear to have confounded it with /. *nodosus,* which latter Michaux does not seem to have known or distinguished, and which, on the other hand, is taken by Hooker in Flor. Bor. Am. for /. *polycephalus.*

All the forms of this species have compact, glolwue, mcwtlv greeninh head*, turning *traw-color or light brown at maturity, on rigid or stout stems, rifling, at least in var. a. and 0., from thick white horizontal rhimmat; those of var. *f.* I have never seen in herbarium Rpecitnens ; sheaths of the leaven, especially in a. and 0., loose and open ; nUtnens 3, very rarely, in var. a, 4 or 5 in number; seeds though differing much in form and siie (from 0.8 to over OJ line lon& and from an elongate fusiform to a thick ovate shape), with ft or 6, very rarely 7 ribs on one side, and smooth or delicately marked arest; these marks consist of one or a few perpendicular line*, sometime* crossed by a couple of ho*-

izontal ones. —Our southern botanists will Lave to find out whether one or the other of these forms may not justly claim to be considered as a distinct species.

Var. a. is readily recognized by its wiry stem 1-2 feet high, its strictly erect panicle of a few (5-9, rarely single) small heads, 3J-4 lines in diameter, and composed of 16-30-40 flowers,* the stamens of which are as long as the sepals, the small anthers often protruding from between their tips; flowers 1£-1* lines long; seeds 0.22-0.28 line long, their length being equal to 2-2J diameters. The form with long protruding styles has in flower a very curious aspect; in fruit it is often of a deeper brown than any other variety, and its capsules are not regularly subulate, as we find them in all other forms of this species, but oblong and rostrate, almost bottle-shaped. Another peculiarity of it is, that its heads are often lobed, as already remarked by Dr. Chapman, i. e. composed of a number (3-5-7) of smaller heads, the axillary productions of the lowest bracts of the primary bead. Sometimes the panicles become larger, 6 inches or more in length, and composed of numerous heads; in some southern, especially Texan, specimens I find the inflorescence more spreading, and with somewhat larger heads, so that thus the transition [470] to the following varieties seems to be given.

Var. £. is 1-3 feet high, and stouter, and bears its larger heads in an almost umbel-shaped more compact panicle; heads 5-6 lines in diameter, consisting of 50-90 flowers, each of which is If—2 lines long; seeds 0.22-0.25 line long, slender, their lengths being equal to 3 diameters. The inflorescence is sometimes looser and more compound, making a transition to the next

Var. *y.* is a very different looking plant, with a compressed, tall, often inclined and even decumbent stem, which is said to become 4 feet long ; leaves laterally compressed, already described by Elliott as *gladiate,* 3-6 lines wide; panicle spreading, &-12 or 15 inches long and about as wide, with distant, sometimes one-sided (usually called *sessile)* heads* i. e. heads from the base of which a long axillary peduncle springs, which bears a second head that often behaves in the same manner. So far both forms of this variety agree, but in the flowers and in the seeds they appear very different, and may eventually have to be separated, though our best southern botanists do not distinguish them, and seem to agree in the view that it is the rich marshy soil of their ricefields, and similar localities, which produces these "overgrown" forms.—The fruit-heads of the smaller form have a diameter of 5-6 lines, and are composed of 30 or 40 to 70 or 80 flowers; flowers, i. e. calyx, 2-2§ lines long, sepals about equal in length, and exterior and interior ones not more different in structure than is usually the case; anthers longer than in any other variety of our species, and equal to the filament; seeds the longest and most slender of all the forms, 0.30-0.33 line long, the length equal to 3 or 3$ diameters. — The subvariety *major* has fruit-heads of 5-7 lines in diameter, the long pointed capsules radiating conspicuously in all directions; 20-50 or 60 flowers, 2J-2J lines long, in each head ; sepals very unequal in length, as well as in texture, the exterior ones triangular dagger-shaped, and at maturity indurated ; the interior ones much shorter, and more or less membranaceous; seeds ovate or almost globose-ovate, obtuse, very abruptly or sometimes scarcely apiculate, 0.20-0.23 line long, the length being equal to 1J or less than 2 diameters.

42. J. BOLANDERI, n. sp.: caulibus (bipedalibus ultra) gracilibus rectis compressis ; foliorum teretiusculorum striatorum vaginis longe biauriculatis; capitulis multi-(30-50) floris singulis sen paucis in glomerulum congestis seu breviter pedunculatis; florum (fuscorom) sessilium sepalift lineari-lanceolatis subulatis nquilongis stamina 3 quarta parte superantibus capsulam clavato-turbinatam obtusam mucronatam unilocularem nquantibus; [471] filamentis anthera oblongo-lineari apiculata bis terve longioribus; seminibus obovatis apiculato-acutatis areis lineolatis reticulatis.

Swamps near Mendocino City, California, discovered in October, 1865, by *H. N. Bolander,* and named for him, one of the acutest and most zealous explorers of Californian Botany. Rhizoma not seen; flattened stems very slender, terete leaves strongly knotted; mature heads 4-5 lines in diameter, brown, shining, single, or 2, or usually &-5 together, either sessile and crowded together into a large cluster, or some of them peduncled ; flowers 2 lines long, with very narrow and sharp pointed sepals, and very slender stamens; shape of capsule quite peculiar; seeds 0.25 line long, with about 8 ribs visible. The flattened stems and the brown heads assimilate this species to the Californian *EnsifdiU,* but the rounded and strongly knotted leaves and the sessile flowers seem to separate it from them and place it with /. *sdrpoides* and its allies.

43. J. aroDosus, Lin. Sp% PL, ed. 2,1, 466, excl. syn.; Rostk. Mon. 38, t. 2, f. 2, excl. syn. Torr. FL N. T. 2, 326, excL var. 2; Gray, Man. ed. 2, 482 : caulibus teretibus erectis e basi stolones tuberiferos emittentibus; panicolce pierumque subsimplicis capitulis pluri- vel multifloris; sepalis lanceolato-linearibus subulatis stamina 6 fere duplo superantibus capsulam pyramidato-rostratam unilocularem equantibus seu pierumque ea brevioribus; seminibua ovatia abrupte apiculatis lineolato-reticulatis. — *J. Rostkorii,* Mey. June. 26; La Harpe, Mon. 133; Kunth, 1. c. 332. * *polycephaltu,* Hook. FL Bor. Am. 2,190.

[9] Muhlenberg describes his /. *echinatus* with 9-flowered heads, and Umtrck his /. *scirpoides* with heads bearing 12-18 flowers.

Var. a. *genuinus:* caule humiliore (spithameo ultrapedali, rarissime elation) foliiaque tenuibus; spatha erecta paniculani subsimplicem coarctatam (raro capitulum singulum) superante; capitàlis minoribus pluii-(8-20)floris ; floribus minoribus fti9catis; sepalis lanceolatis aequalibus seu exterioribus paulo brevioribus; antheris oblongis seu oblongo-linearibus plerumque apiculatis filamento brevioribus; ovario ovato stylo brevissinio coronato ; capsula ovato-lanceolata rostnita plus minus exserta.

Var. /3. *Texanus:* caule elatiore (pedali bipedali) foliisque tenuibus ; spatha patente paniculam plerumque corapositani tlecompositamve fere aequante; capitulis niajoribus iuulti-(l&-40)floris; floribus majoribus demum stra-miueia ; sepalis lanceolato-subulatis exterioribus brevioribus; antheiis linearibus obtusis filamento (hinc duplo) longi-oribus; ovario lanceolate in stylum long ioreni sensim abeunte ; capsula pyramidato-lunceolata subuLata exserta.

Var. *y. megacephalus,* Torr. 1. c. : caule elatiore (pedali tripedali) foliisque robustis ; spatha erecta sea paulo deflexa foliove summo paniculam subsimplicem courctntam siepius superante; capituli* mugnis densissime [472] multi-(30-80)floris; floribus majoribus virescentibus demum stramineis; sepalis lanceolato-subulatis exterior-ibus longioribus; antheris lineuribus filnmento paulo brevioribus; ovario lanceolato in stylum brevem sensim abeunte ; capsula pyramidato-subulata vix exserta.—/. *megacephalus,* Wood, Bot. 724, non Curtis.

Tbis species takes a much wider geographical range than the last, including the whole of North America north of Mexico, with the exclusion of the southeastern States ; but the different forms occupy different geographical regions. Var. a is found throughout Britinh North America from Canada and the Hudson Bay regions to the Rocky Mountains and the northwest coast, and extends southward to Pennsylvania, *Porter,* Hb. norm. 70, Ohio, *Lapham,* Michigan, *Bigelow,* Hb. norm. 71, and Wisconsin, *Lapham, Halt.* I have seeu no specimens from further south, though the older authors credit it to Virginia and Carolina, quoting, among others, Bosc as their authority. Var. 0. has been solely found in Western Texas, *Lindheimer,* 545, *Wright, Buckley.* Var. *y.* meets a. on Lake Ontario, where also /. *aljinus* and *artieulatus* join, and extends from thence westward to Michigan, *Bigelow,* Hb. norm. 74, and soutliwestward to Illinois, Missouri, the northern Red River, *Hubbard,* the Saskatchawan, *Bourgeau,* the Yellowstone, *Haydcn,* Colorado, *Parry,* Hb. norm. 75 (a dwarfed form), New Mexico, *FtixdUr,* 849 *Wright,* 696 and 1926, Texas, *Lindheimer,* 546, and others; and to Arizona, *Coues & Palmer,* and California, *Coulter,* 809. It flowers from July to August.

Our plant is very closely allied to the last, and is often confounded with it; but the number of stamens and the marking* of the seeds will readily digtinguieh any of the forms which may be mistaken for one another, e, g. /. tcfr-jpouto, 0. *echinatu$,* and «/. *nodosus, y. megacephalus.* Besides, the slender stolons which terminate in a chain of small bulbs, probably the only)iart that sustains the life of the plant during winter, are quite characteristic of all the forms of this species. Another peculiarity of var. *ft.* and y. is the direction of the leaves, especially the upper ones, which are patulou*, making a very distinct angle with their sheathing base, while in var. a. the leaves are erect, forming an alnuwt straight continuation of the sheath. Var. a. and more rarely var. *y.* exhibit sometimes that degeneration of the heads into tranches of sheaths or Waves which han been *j>oken of in another place. The seeds are 0.22-0.27 line long, the length being nearly equal to 2, rarely to 2} d mine ten*; commonly 8 ribs are vinible on one side.

The northern form, var. •., is the genuine /. *nodosus* of Linncun, who described it from specimens sent bj Kalm (most proUbly from Canada), as Prof. Gray ascertained in the Unnaan herbarium itselt He informs me that * Linnau*[9] reference to Oronov. Virg. 15 [leg. 152] is. a miMake, in copying from Gronovius of *Oramen junceum* [473] *dakut ptruarpiu* otufu *'Amencmtum,* Pluk. aim. That thin is not the type of /. *nodotut* is dear, because it does not, like all other Gronovian plants, appear in the first edition of Spec. Plant. Linnams' annotations prove that he was considering some plant in his berUrium, and not a mere qnotatiou." The figure of Rostkorius is a very good reprwmtatkm of the ordinary appearance of tbis variety. — It in by far the slenderest form, usually from 8-19 or 15 inches high, with *-5 or 8 brown beads in a rather compact and simple or slightly compound panicle; in tbe Rocky Mountains a dwarf form oeenn, with a filiform stem 3-5 inches high, bearing a single few-flowered bead (S. *poltfc^hd^,%* Hook. L e.); a similar variety was collected on the mountains of Vermont by *H.* Jfinm, Hb. norm. 72; *Judgi* d*'**m* and Dr.B^sW, Hb. norm. 7a, send fmiutbesboratof UM northern lakes a Ullerfofm,*-* feet higfa, with a more compound lighter colored panicle ; and tbis makes a transition to one which Dr. Vatejr hat tent from tbe north*™ bonier of III 'mott*, a stoat, fax* (nearly 8 feet high) gram-beaded plant, with a decompound panicle of at least 30 greenish heads, each eotnponed of K-3A flowers. This latter U an Interesting form, aa it connect* all three •*rietie*. — Tbe heads of tbe genuine /. **odo*u$* are 31-4 lines in diameter, and show a deeper brown color than an/ of tbe other varieties; tbe flowers are 1|-S lit,* long, and the cap«u1e, which is musty rostrate from an oMong body and not ivgnlarl r subulate, in most in«ane« considerably etceeds tbe sepals. The seeds are, as in all other forms of this specie*, orate or oborate, abruptly apiculata, and prrttil? reticulated with very distinct cross-lfaieolation, *0M-*0.27 Una long, their diameter being equal to about one-balf their leugth, or, in some forms with slender seeds, much less.

Var *fi* is usually a taller plant, 12-90 inches high, but quite slender ; the compound or deenmponnd rather lit pride if S-4 inches long, and tbe echinate frait-headu have a diameter of 6 or 6 lines. Flow** ty line* long; obta* •nthm often twios as long as the Uaments; seeds usually a little smaller than in the last, OSK0.S4 line long.

Var. y. is a stouter plant, 1-2} Feet high, with the largest heads of any *Juncus* known to me, in fruit 6-8 lines in diameter, in a rather compact panicle; seeds like those of the last. The Texan variety and Dr. Vasey's specimens mentioned above, unite this with the genuine /. *nodosus,* from which I cannot separate it, though looking so very distinct.

44 J. CANADENSIS, J. Qay in LaHarpe, Mon. 134; Kunth, 1. c 333: cauiibus casspitosis teretibus lievibus ; paniculsD capitulis pauci-multifloris ; sepalis lineari-lanceolatis plerumque acutis, exterioribus brevioribus [474] stamina 3 vix seu paulo superantibus; antheris oblongo-linearibus filamento brevioribus ; ovario in styium brevera attenuate, stigmatibus vix seu breviter exsertia ; capsula triangulato-prismatica uniloculari plerumque exserta ; seminibus oblongis seu oblongo-linearibus multicostatis plus minus caudatis.

• FormiBB capitulis minoribus paucifloris.

Var. a. *coarctatou:* caulibus humilioribns (J-lJ-pedalibus) erectis; paniculflB minoris coarctato ramis erectis; floruin minorum sepalis acutis seu raro obtusiusculis; antheris oblongis iikmento duplo brevioribus; capsula castanea acutata longius exserta ; seminibus oblongis lineolato-multicostatis, appendicibus diametrum fere teqnantibus. — /. *Oanadtnsů, fi.* Gay, 1. c. /. *acuminatus,* Torr. N. Y. 2, 327; Gray, L c. 481; Chapm. FL 464, et Auct Am. plur. non Michx.

Var. 0. *brachycephalus:* caulibus elatioribus (li-SH****[111,,18]) gracilibus erectis seu descendentibus; panicul® majoris effuse ramis patulia; florum minonim sepalis plernmque obtusis; antheris linearibus filamento brevioribus ; capsula e stramineo fuscata obtusiuscula mucronata breviter exserta seminibus. ut in var. *a,*

* * Form© capitulis majoribus plurifloris.

Var. *y. subcaudatus:* caulibus (l-2j-pedalibus) gracilibus erectis Beu decumbentibus; panicuta efflusa ramis patulis rope horizontalibus; capitulis pIuri-(8-20)floris ; florum majornm sepalis acutissimis ; antheris oblongo-linearibus filamento multo brevioribus; capeulis demum straiuineis plerumque acutatia exsertis rarius mucronatis sabexsertis; seminibus oblongis reticulato-multicostatis in appendices perbreves attenuatis.

Var. ». *longecaudatus:* caulibus (Ifr-3-pedalibus) erectis robustis rigidis ; pAnicula abbreviate seu patula capitulis pluri-multi-(5-8-20-50-90)flori8 ; florum majorum sepalis acutis sen rarissime obtusiusculis ; antheris oblongis B»pe mucronatis filamento plerumque duplo brevioribos; capsulis prismaticis obtusis mucronatis seu-rarius acutatis snpe fuscatis sepala excedehtibus seu rarissime aquantibus ; seminibus oblongis seu oblongo-linearibus lineolato-mnlticostatifl, appendicibus diametro longioribos. —/. *Ganadermt, a.* Gay, 1. c /. *polycephalw, 0. paradoxus,* Torr. N. Y. % 327. /. *paradox**,* Gray, 1. c.; Chapm. 1. c. et Auct Am. plur., non Meyer.»

This species inhabits the eastern parts of North America and extends westward in the region of the Great Lakes to the Upper Mississippi and down to central Illinois, and again in the Gulf States to Louisiana, leaving <rat the central States of the Mississippi Valley, to which it seems to be a stranger. It flowers in July and August, [475] when /. *acuminatus,* with which it might be confounded, has already shed its seeds. — Var. a. is decidedly the most northern form of this species, which extends from the northeastern States to Canada and the Lake Superior region, Hb. norm. 76 and 77, and southward to Pennsylvania, where Prof. Porter finds it in the neighborhood of Lancaster; Dr. Chapman gives Georgia as the southern limit of *"J. actminattu,"* but I have seen no specimens from those southern parts. —Var. 0. has been observed from Pennsylvania, *Porter,* to western New York, *Gray, Sartwell, Vtuey, Clinton,* central Ohio, *Sullivant,* central Illinois, *Hall, Brendel,* Michijjan, *Bigetow,* Hb. norm. 76, and Wisconsin, *Lapham.* — Var. *Y** is a form of the Atlantic States, found from Connecticut, *Eaton,* to New Jersey and Pennsylvania, *Durand, Smith,* Hb. norm. 81, **Leidy, Porter,* Hb. norm. 80, Delaware, *Cownumi,* Hb. norm. 82, District of Columbia, *Bebb,* South Carolina, *NuUall,* and Georgia, *Beyrieh* (distributed by him under the name of /. *aeuminatut).* — Var. a. is the most common of all the forms, extending over the whole region, with the exception, perhaps, of its northeastern extremity. I have not seen any specimens from Canada, or from the States north of Massachusetts. The Herb. norm, contains different forms of this variety; from Michigan &4, Pennsylvania 83, Maryland 88, and South Carolina 85, 86, and 87.

The different forms of this intricate species are as wide apart in habit, as well as in artificial characters, as they possibly can be, but are connected by insensible transitions, so that even the different varieties cannot always be kept clearly distinct Its synonymy is in some confusion. It is quite impossible that specimens of so wide-spread and so easily accessible a species should not have been obtained by collectors long since, and we do indeed find such among Michaux'B (La Harpe, 1. c.) and among Schweinitz's plants, and no doubt in many other old herbaria; but, somehow or other, Its striking diagnostic characters were overlooked, and it was thrown together with other species, such as th4 similar looking /. *acuminatus,* especially its var. *legitvmui,* under the name of /. *polycephalus* or /. *verticittatu** (lege *nbv*rtic%Uatus)*> -~ *Thin* and the following two species are well distinguished from all the other articulate ones by their tailed seeds and by the proportions of their usually strongly nerved sepals, the inner of which always exceed the

[10] This arrangement of the varieties differs somewhat from that previously adopted by roe on p. 486, sod in some herbaria labelled byme. No confWon will sriss from this if the reader will only substitute *"brachycephalus" torbrtvicaudatuspatulu*.*

outer ones. From its two allies it is distinguished principally by the shape and proportion of its capsule, and the smaller and differently shaped seeds.

Varr. a. and 0. are distinguished from the others by their small, usually 3-4-flowered heads, smaller flowers, which are 1£-1£ and, only in Lake Superior specimens of *a.* 1J lines long, and the form of the smaller seeds. [476] These seeds are 0.25-0.33 line long, 2£ diameters being equal to the length ; appendages about equal to the diameter, so that the whole seed has a length of 0.40-0.60 line ; 7-9 ribs visible, connected by delicate cross-lines.

Var. *a.* is readily known by its low stature, rarely over a foot high, erect, dark colored panicle (1-4 inches long and j-1 J inches wide) and elongated capsules, and therefore longer fruit-heads ; the sepals are usually acute, but in some forms from Pennsylvania and from New Hampshire I have found them obtuse. American botanists have usually taken this form for *J. acnminatus,* Michx.; but Michaux's plant is very different and, moreover, comes from South Carolina, while the present variety is, I believe, not found south of Pennsylvania. Prof. Porter gets in the mountains of that State a low form with more patulous lighter colored panicles, and more obtuse sepals, Hb. norm. 78, which seems to form a transition to the next variety.

Var. 0. stands in habit and stature nearest to var. y., but its small, short heads, obtuse sepals, and short capsules distinguish it at once from that and from var. a. ; our botanists have sometimes confounded it with *J. debilis* or with */. articulatus,* from both of which however the characters enumerated readily distinguish it. Stem l)-2£ feet high ; panicle 4-9 inches long and proportionately wide. Mr. C. £. Smith gets a form at Tinnicum, near Philadelphia, which unites this with var. y, having the seeds of this, but the greater number of flowers (10-12), the larger heads, and the pointed sepals, of the other.

Var. *y* is a rather rare plant, and does not seem to have attracted the attention of botanists, although it had been collected, especially about Philadelphia ami in New Jersey, until Mr. Bebb of Washington and Mr. Smith of Philadelphia studied it with a great deal of attention. The shortness of the appendages had induced some to place it away from its close alliances and with or near */. acuminatus,* but I cannot entertain any doubt but that it is so closely allied to var. ft. that it can barely be kept apart from it, the length of the appendages being quite variable even in seeds from the same capsule. The whole plant, however, is more delicate, lighter green; the stem weak, and more usually decumbent ; the panicle very loose, commonly with long and often horizontally-spreading slender branches ; heads pale, 8-15-20-flowered ; flowers as large as in the next, 1 J—2 lines long ; sepals always subulate and very acute, and often only 1-nerved ; capsule more commonly acute or acutate, as long or mostly longer than the* sepals; seeds 0.25-0.36 line long, thicker than in the next variety, the length being equal to 2-2} diameters; seed with appendages 0.33-0.50 or very rarely 0.60 line long ; appendages less than the diameter of the Reed, often only half as long; 7-8 [477] ribs visible, usually very distinct, with cross-striation and an approach to reticulation.— A slender form is distributed in Hb. norm. 80 and 81, a more rigid one is Hb. norm. 82, but both run together.

Vár. ft. is the most polymorphous of all the forms of this species; it is stouter, taller, and more rigid than the other varieties, and thus approaches more nearly to the following species. The panicle 3-6 or sometimes as much as 9 or 10 inches long, and 2-5-7 inches wide, with somewhat spreading but rarely horizontal rays, is either much branched and bears smaller (5-6-20-flowered) but more numerous heads, or it is nitre simple, with larger (90-40 and in some Delaware specimens even 80 or 90-flowered) and fewer heads ; it is usually loose, but sometimes quite compact ; specimens from South Carolina, Hb. norm. 85, have large green heads in a decompound panicle. Flowers l}-2 lines long, greenish, at last with the capsules light brown ; sepals generally 1-3 or sometimes 5-nerved, very acute, or rarely somewhat obtusish, usually quite unequal, or as an exception, nearly equal in length ; capsule prismatic, and usually obtusish and mucronate, as long as or mostly longer than the sepals, sometimes acutate and elongate. Seeds slender, and either large with shorter appendages, or smaller and thinner and with longer tails; the former are 0.30-0.46 line long, length equal to *2* diameters, with the appendages 0.60-1.00 line long; the more slender seeds are of the same total length, but the body of the seed is a little shorter (0.25-0.35 line long) and its length is equal to nearly 3 diameters; 8-10 or 15 ribs or striae are visible on one side of the seed. — A. curious form with branched heads, the single branches being elongated into spikes, was found by A. Commons near Salisbury, Maryland (see p. 427). Mr. Ravenel has collected this species in South Carolina with often more than three stamens: Hb. norm. 87. —This variety is the plant which by most American botanists has been taken for Meyer's *J.parodoxu$;* but I have shown above (p. 462) that Meyer's plant, *tepalis " exUrioribus bngioribu$"* must be what I have designated as *J. acuminatus,* var. *Ugitimus,* and cannot have been meant for our plant, the exterior sepals of which are *thorter,* Meyer's name was not given in reference to the curious seed*, but to the frequent foliaceous excrescences of hit plant, which seem to be quite rare, if not unknown, in the present species.

45. J. CAUDATUS, Chapm. Fl. S. St. 495: canlihn* (2-3-pedalibos) cvupitmii teretibns foliisqne rigidis levibni; panicula composite *eu decomposite ramis suberectin; capitulis pauci-(2*-5)flori*; sepal is lanceolatit 3-5 nerviift, exterioribus brevibus acutis stamina 3-6 cqnantibu*, interioribus subulatis longioribus; ovario linear- [478] lwolalo in stylum perbrevem sentim abeunte, stignutibui exsextii; captula obtuse triangulaU pyramldAU

acutata atro-rubente lucida semitriloculari longe exserta; seminibus lineari-oblongis multo-lineatis longe caudatis.—/. *erythrocarpus,* Chapm. olim in sched.

Southeastern and southern States, from South Carolina, *Curtis, Ravenel,* Hb. norm. 89, to Florida, *Chapman,* Hb. norm. 90, Alabama, *Bigekw,* and Louisiana, *Hale;* fl. Sept. & fr. Oct. —"Similar to the next but with much smaller flowers, long protruding pyramidal capsule, slender stamens inconstant in number, and larger seeds. Rigid cespitose stems " from a thick and creeping rhizoma" (Chapman) ; panicles in most of the specimens before me 2-6 inches in length and quite contracted, the principal branch of the panicle being often strictly erect and quite elongated, — in others more open; fruit-heads 2-4 lines in diameter, with 2-4 or 5 flowers ; flowers 1} lines long, with very unequal strongly nerved sepals; capsule much longer, sometimes twice as long as flowers, regularly pyramidal from an oval base, deep, red brown or almost black. The number of stamens is quite variable, but more frequently 3 than 6 ; in 40 flowers of eight different specimens, from all the localities mentioned above, I have found only 4 with 6, 9 with 5, 11 with 4, and 16 with 3 stamens, and in no instance did all the flowers of one plant exhibit the same number of stamens. Seeds, without the appendages, 0.45-0.50 line long, their length being equal to 2& or 2} diameters ; appendages straw-colored or white, upper one mostly as long or longer than the seed, lower one stouter and shorter, as is usually the case in the appendages of *Juncus* seeds ; whole seeds with the tails 1-1J lines long; striae of seed very numerous and close. — This may possibly be the same as /. *trigonocarpus,* Steud. Glum. 2, p. 308, of which I have not been able to obtain a specimen or a satisfactory description.

46. J. ASPER, n. sp. : caulibus (bipedalibus et ultra) cespitosis teretibus cum foliis papilioso-asperatis; paniculee composites seu decomposite ramis erecto-patulis ; capitulis pauci-(2-6)floris; sepalis late lanceolato-subulatis rigidis multinerviis laevibus, interioribus longioribus stamina 6 duplo superantibus ; antheris late linearibus filamentum late 8ubulatum fere sequantibus; ovario lanceolato in stylum eo breviorem abeunte, stigmatibus exsertis; capsula ovato-oblonga sursum triangulari rostrata rufo-vel virescenti-fusca lucida semitriloculari sepala vix excedente; seminibus majusculis ovato-oblougis costato-lineolatis longe caudatis.

Thus far only in New Jersey, where it was found many yeaTs ago, at Quakerbridge, *Pickering* in Hb. Ac Philad., *Durand;* rediscovered within the last few years " in a sphagnous swamp at Griffith's 6J miles south-east of Philadelphia, where it grows with several forms of *J. Canadensis," C. E. Smith,* Hb. norm. 91; also at [479] Quakerbridge, *C. F. Parker;* flowering in August and in fruit in September. —An interesting and well-characterized species, closely allied to the last ones, with which it has in common the longer inner sepals and the tailed seeds; distinguished from them by its rough stem and leaves, its large flowers with 6 large stamens, and its large dark seeds with (usually) purplish tails. —Roughness is a rare character in the genus *Juncus,* which I find noticed only in the South American /. *rudis,* Kunth, and the Portuguese /. *rugosus,* Steud.; in these the flowers are smooth just aa in our species, while in /. *falcatus* the stem and leaves are smooth and only the flowers rough (see p. 452). All parts of this plant are very rigid, the stems lf-2j feet high, the panicle 2 or 3-6 or 7 inches long, less in expansion; fruit-heads 4-6 lines in diameter, usually with 3-5, sometimes only with 2 flowers; flowers 2J lines long or more ; capsule equalling or scarcely exceeding the rigid and sharp-pointed green or darkish tipped sepals ; outer sepals indistinctly 5-nerved, inner ones (at least in the dry state) strongly 7-nerved ; capsule tough and hard, reddish or greenish brown, at base completely, upwards partially 3-celled ; seeds 0.5-0.6 line long, their diameter being nearly equal to half their length, the lower appendage thick and usually short, the upper one not quite as long as the seed itself; whole seed, with the tail, about l£ lines long; side of seed with 12 or 14 ribs, and usually distinctly cross-lineolate.

47/ J. MERTENSIANUB, Bong. Veg. Sitch. in Mem. Ac. St. Petersb., ser. 6, vol. 2 (1833), 167, ex Kunth, 1. c. 361: caulibus e rhizomate crasso repente caespitosis humiliorilras (spithameis pedalibus) compressis debilibus; vaginis foliorum averse compressomm auriculatis; floribus pluribus (15-25) fusco-atris pedicellatis in capitulum laxius singulum seu rariu8 bina ternave aggregatis spatha brevioribus.; sepalis ovato-lanceolatis, exterioribus acuminato-subulatis, interioribus plerumque paulo brevioribus obtusis mucronatis seu rarius exteriora aequantibus acutis, stamina (3-6) Buperantibuscapsulam lute obovatam obtusam mucronatam aequantibus seu superantibus; antheris oblongis seu oblongo-linearibus sapissime mucronatis filamentum eequantibus seu eo brevioribus; stylo quam ovariuni obtusum plerumque breviore; seminibus oblanceolato-obovatis fiuiformibus utrmnque breviter caudatis reticulato-costatis, areis lineolatis. —/. *ensifoliHt,* Hook. Fl. Bor. Am. 2, 191; Gray in PI. Hall & Harb. 1. c.

Var. *0. paniculatu$:* caule elatiore (ultra-bipedali) ; vaginis vix auriculatis; capitulis (6-9) minoribns (10-15-floris) in paniculam compositam dispositis.

From the islands of the Northwest coast, Sitcha, *Mertens,* Unalaschka, *Chamisso,* to the Cascade Moun- [480] tains, *Lyall,* and Rocky Mountains, *Drummond,* Big Horn Mountains, *Hayden,* Medicine Bow Mountains, *H. Engelmann,* and southward to Colorado, *HaU & Harbour,* 565, Huerfano Valley, *C. C. Parry,* and to the California* Sierras, JEL *Bolander,* at the Mono Pass, Hb. norm. 92; var. *fi.* in the northern Rocky Mountains, *Bourgeau.*

With some hesitation I refer the Rocky Mountain plant, of which I have numerous and well-preserved specimens before me, to /. *MerUntianv** of the Northwest coast, the authentic specimens of which, at my disposal, are

rather incomplete ; but they are distinct enough to prove Meyer wrong in referring the Sitcha plant to his *J. falcatu** (Ledeb. Fl. Ross. 4, 228). Bongard, to be sure, describes the leaves as flat, but they are not adverse like those of J. */ideatus,* but averse like those of «/. *xiphioides,* and besides, are slightly but distinctly knotted.

Stems 7-14 inches high, compressed, but not ancipitous except in var. £., "weak and flaccid" (Hall), grooved below, smooth upwards ; leaves, as in all its allies, of very different width, usually £-1 or rarely 1J, but in 0., 1^-2J lines wide ; heads 4£-6 lines in diameter; flowers very distinctly pedicelled, 1 j to (commonly) 2 lines long; inner sepals, as in this whole section, quite variable, obtuse to acute and eveu acuminate, usually shorter, but in some flowers of the Sitcha specimens even longer than the outer ones. Stamens f or j the length of the sepals, usually 6, but sometimes 3 (3 Bongard ; 4-5, Kunth) in Sitcha and Cascade Mountain specimens, 6 in all those from the Rocky Mountains or California, which I have examined; anthers as long as or usually shorter than the filament, often apiculate. Ovary as well as capsule broadly obovate and obtuse. The seeds make a near approach to those of the last section, their appendages being sometimes quite conspicuous; in Hall's Colorado specimens I find them usually very short, while in a specimen of Dr. Hay den's they ure almost equal to the diameter of the seed; the seed itself is 0.23-0.30 line long, the length being equal to 2-2 J diameters; with the appendages they are 0.30-0.35, and in the above-mentioned specimen of Dr. Hayden even 0.50 line long ; 7*9 and in some Rocky Mountain specimens *(Drummond, Hall)* 9-12 ribs are visible on the side; the surface is regularly reticulated with more or less distinct cross-lineolation.

Var. 0 , with its tall stem, long and broad leaves, and a panicle of 3 inches in length, looks quite distinct from the ordinary form, but I cannot tind any more essential differences.

This species with the four following ones, the Mexican *J. brevifolius,* Liebm., and the Asiatic /. *LcscJun-aultii,* Qay, form a very natural group, united by characters as well as geographical range. Their compressed [481] or ancipitous stems usually come from a creeping rhizoma, and bear laterally compressed or averse equitant leaves, which in the larger forms resemble greatly those of *Sisyrinchium* and other iridaceous plants, and which are very imperfectly septate or articulate; their sheath sometimes terminates with two auriculae or rtipular appendages, or frequently, and in the same species, imperceptibly runs out into the edge of the leaf. The flowers, always pedicelled, are brown, mostly deep chestnut, rarely greenish or paler, and are arranged in few or many-flowered heads; in many species we find forms with single or few large heads in clusters, and others with numerous small heads din posed iu compound panicles. The sepals are mostly broad, the outer ones acute or acuminate, the inner ones often shorter and obtuse, rarely longer, often variable even in flowers of the same head. The number of stamens also varies in the same specie*, The style id distinct, either short, or sometime* very long. The mucronate capsule is about as long or rarely longer than the calyx, nearly one-celled. Seeds reticulate, with smoothiah or lineolate area. They inhabit the western slope of North America and extend to the Asiatic nide of the Pacific.

48. J. XIPHIOIDES, E. Meyer, Syn. June 60 et Rei. Haenk. 1, 143 ; Kunth, 1. c 331 : caulibus (1-4-pedalibus) erhixomate craaso repente erectis ancipitibua; capitulis pauci- vel miiltifloris paucia plurimiave; floribiu pedicellulis ; sepalis lanceolate subulato-acuniiiiatis tequalibus *eu interioribus obtusioribus brevioribus stamina 6 ecu raro (in var. #.) 3 fere duplo superantibus capflulam piisnmticnm acutam mucronatam hinc ratratam plerumque aquontilius; antheris oblongo-linearibus filamentum fere ©quaiitUm*; ovario ovato in sty him breviorem attenuate, stigmatibus •nbexsevtis; seininibus ovato-oblancwlatia utrumque apiculatis lineoUto-reticulatis.

Var. a. *littoraU*:* caulibus rubuttin elatin (2-4-pedalibuii) ; foliis latis iridaceis, vaginis sspius inappendiculatis; panicula scpe supradecompoftiUe capitulis pauci- vel phiri-(3-20)florise straniioeo fuacw; sepali* suboquilongis captula acuta sea rostrata vix brevioribus ; antheri* ssjie apiculatis filamento paulo longioribus ; eeminibus oblanceolati*. — /. *xiphioidf4,* Mey. 1. c

Var. 0. *auratus:* caulibus gracilibus elatif* (3-pedalibus ultra); Tasinis in folia latiora sensim exenrrentibus ; panicula supradecompotita capitulis pauci-(5-10) Doris straminei* nitentibus; sepalis sqnilongis capsula rostraU brevioribua; seininibus ut supra.

Vary, tmmtonia: canlibasbutniliorihns (npithamein nenqnipedalibtm) ; foliis angnstioribosbad pleruraqne anricuktis ; capitulis paud-(3-10)floris pall id iorn bui pinribus paniculatis sen panels (raro aingnlis) pluri-(12- [482] 20) vel iuulti-(2O-60) floris fuscis ; floribus paulo minoribus; nepalis interioribas brevtoribas plerumque acutis, exterionbus capsulam longe mncronatam aqoantibuii; seminibus ut supra. — /. *xiphioiUs,* Torr. Bot Mex. Bound. 222; Gray, PI. Hall ft Hurb. 1. c.

Var. d. *macranthut:* caulibus mediis (nesqui-bipedalibu^; vaginis in folia anguatiora nensim excurrvntibun; eapitulis paucU uiulti-(18-40)flori»; floribus majoribus funcift ; ftepali* fere 0Dquilon^i% iutorioribiw ncpe oUuMUaculis eapsnlam acutam nquantibus ; seminibus majoribus obovatis abrapte apiculatk — /. *polycrphalut, a.* ex porte, Hook. FL Bor. Am. 1. c

Var #. *triandru*:* caulibus humilibus s<:u niediin (ppithamelu bipedalibus) ; vaginis in folia angustiora sensim excnrrpntibuA ; capitulis singulu pauewve muUi-(15-30)tlurisseu plaribus |iauci-(5-8)fluris poiiiculatu ; fluribos msjor-ibns atrofunciR 3-andri^; ftojmliH srt|uilr>n^in M-ti iuterioribim o))tu*ioribui fuibbrrviorjhu* mp»ulam nuicronsUm ssqtuintibos seu ea breviorilmn ; semiuibu^ fere ut iu var. o. — / *tmijolim^* Wickslr. iu Act. llulm. 1823, II. 1; Kunth, 1. c. 337.

On the Pacific slope of the continent from southern California to Unalaschka, extending eastward into the plains east of the Rocky Mountains. Var. a. seems peculiar to the fertile lands of the California coast region: Monterey, *Haenke*> San Francisco, *Bolander, Kellogg,* Hb. norm. 93, Fort Tejon, *Xantvs.* Var. 0. has been found on Monte Diablo, near San Francisco, *Brewer,* Calif. St. Surv. 338. Var. y., the large-headed form in the Rocky Mountains, from Oregon, *Spotting, Lyall,* to Colorado, *HaU dt Harb.* 564, and N. Mexico, *Fendler,* 868, *Wright,* 1925, and into the plains, Saskatchawan, *Drummond,* and Ft Riley, *H. Engelmann;* the small-headed form is of more southern origin — Arizona, *Coues <& Palmer,* 70, N. Mexico, *Wright,* 1923 in part, and west Texas, *Lincecum.* Var. d. only in Unalaschka, *Eschscholtz,* on the " Northwest coast," *Douglas,* and in. the Cascade Mountains, *Lyall.* Var. c. from Unalaschka, *Eschscholtz, Chamisso, Mertens,* to the Cascade Mountains, *Lyall,* and the Californian Mountains, *Bolander,* Hb. norm. 94 : the panicled form, San Francisco, *Bolander.*

This species, the type of the group of *Ennfolii,* is as variable as any of its eastern congeners, and its extreme forms are as widely apart in size of stems and leaves and of flower-heads, in their inflorescence, and even in the number of stamens, and transitions between the different varieties are not wanting; but in flower and fruit they are remarkably uniform. — The flowers are \\ lines long, rarely a little smaller, and only in var. d. and c. larger; the sepals are narrow, the outer ones always long-pointed, but the inner ones quite variable and often shorter; stamens scarcely more than half as long as sepals; seeds 0.23-0.26 line long and attenuate at least at the lower end, except in var. 6\ ; their length is usually equal to *fy* diameters; about 8 ribs are visible on the aide; the network of the surface [483] and the cross-Hues of the are© are very delicate but quite distinct

Var. o. is often 4 feet high, with a stem 3 lines wide, and leaves 3 or 4 or sometimes even G lines broad ; panicle 4-8 inches long; heads in some forms, and also in the original Haenkean specimen, few-flowered, in others many-flowered ; seeds usually slender and almost fusiform. Var. 0., similar to the last, with leaves 2-3 lines wide, is distinguished by its showy, glistening, golden straw-colored panicles, about 4 inches in length ; sepals almost nerv«-less ; capsules larger than in the other forms and longer than the sepals, thus approaching the following species. Var. y., the mountain and eastern form of the species, is smaller, with fewer heads either few-flowered and in a small panicle (about 1J or 2 inches long), or many-flowered, 3-4 lines in diameter and 1-5 or 8 in number ; leaves usually \ to 1J lines wide. Var. & may be considered a Urge-flowered northwestern form of the latter ; flowers If Hues or more in length; seeds 0.25-0.26 line long, thicker than in the other forms and with short and abrupt points. Var. c, with its very flat and somewhat curved sword-shaped leaves, and usually few large dark-colored heads of triandrous flowers, looks quite peculiar, but flower, fruit, and seed are the same as in the other forms. I find plants of the same habit and with the same kind of leaves and heads among the different forms of /. *Mertensianvs* and of *J. phaocephalut,* but the fruit and flowers will always distinguish them. The seeds in this variety are intermediate between those of the last and those of the other forms. — Meyer (Linn. 3, 373) describes *J. ensifolius* with an obovate obtuse capsule; I do not find it so, but suppose he had a specimen of S. *Mertennanua* in view, for which this shape of the capsule is quite characteristic

49. J. OXYMBRIS, **n. sp.:** caulibus (2-3-pedalibus)* e rhizomate repente erectis sen ascendentibus compreseis; feliis a latere coinpressis plus minus distincte nodosis; panicula supradecomposita patula seu stricta; capitulis pauci-(5-10)floris pallidis; floribus pedicellatis; sepalis lineari-llnceolatis acuminato-aristatis, interioribus snpe paulo longioribus stamiua 6 quarta parte superantibus capsula lanceolata rostrata uniloculari plerumque brevioribus; antheris longo-linearibus filamento duplo longioribus; stigmatibus ovarium lanceolatum apice attenuatum cum stylo ei »quilongo aquantibus exoertis; seminibus ovato-oblanceolatis apiculatis areis Iambus reticulatis. — *J. acutiftorus, ftoribu$ *too lonqlonbut,* Benth. PI. Hartw. 341.

Sacramento Valley, Cal., *Hartweg,* 2017, San Francisco and Mariposa, OaK, *Bolander,* Hb. norm. 95.

This species is intermediate between *J. xipkioides,* var. *awratus,* the paniculate form of *J. phaocephalui,* and [484] /. *duiriut;* from the first two it is distinguished by the sharp-pointed sepals and their proportion, and the almost subulate capsule, which is similar to that of /. *wdomu,* from the first also by the long anthers, from the lost by the flat leaves, and from both these by the sculpture of the seed. Sheaths of the leaves with or without auricular appendages, leaves 1-2$ lines wide; panicle 4-6 inches long; flowers lf-2 lines long, greenish straw-colored or sometimes redrtUfc, toward*, the tip ; seeds 0.22-0.24 line long, with the ribs (7-9 visible on the side) slightly cumulate but the area* smooth.

50. J. PHIBOCEPHALUS, **n. sp.** i canlibus erectis ceraprtssis apice capitnlum singulum paucave multiflora sett rarissime plura minora paniculate gerentibus ; foliis coinpressis basi auriculatis seu inappendiculatis ; floribus majoribus fusco-atris pedicellatis; sepalis lanceolato-ovatis aeqtlttongifl omnibus acurainatis ocutis vel cuspidatis seu interioribus obtunatis stamina 6 paulo superantibus capsuiam obtusam seu acutara mucronatam subunilocularem ©quantibus seu ea pauW brevioribas; antheris late linearibus filamento bis terve longioribus ; ovario lanceolate in rtylum asquilongum attenuate •tigmatibnsslongatii exsertis; seminibos ovatis utrumque apiculatis areis sublsvibus retionlatis____/. &*. *w« f .Mqrer in Bel. Haenk. 1,142.

Yar. a. *glomeratus*: rhizomate longe repente, caule spithameo sesquipedali; vaginis sine auriculis in folia latiora sensim excurrentibus ; capitulis multi-(15-25)floris paucis glomeratis.

Var. 0. *paniculatus :* caule bi-tripedali ; vagiuis foliisque ut in a. ; capitulis minoribus pauci-(8-l2)floris composite paniculatis.

Var. y. *gracilis:* csspitosus caule digitali spithameo ; vaginis auriculatis; foliis angustis sea angustissimis; capitulis multi-(15-20)floris ssepius singulis.

California, from the sea-coast into the Sierras; var. a. near the coast, from Monterey, *Haenke, Brewer,* to San Francisco, *Bolander, Kellogg,* Hb. norm. 96, and to Mendocino, *Bolander ;* var. 0. also in the lowlands, Napa Valley, *Bigelow,* San Francisco,- *Bolander, Kellogg,* lib. norm. 97, and in the mountains, *Bolander* ; var. y. in the higher mountains, about the " Big Tree Grove," *Hillehrand, Bolander,* and especially in the upper Tuolumne Valley, *Brewer,* Cal. St Surv. 2:339, 1709 and 1760, *Bolander,* 5062, Hb. norm. 98, and Mono Pass, *the same,* 6013. —All the forms of this variable species are readily recognized by their deep brown heads, large flowers, broad sepals, large conspicuous anthers, long style, and by the markings of their seeds, whatever the height of the stem, width of the leaves, or [486] nature of the inflorescence may be. — Flowers 2-2£ lines long ; sepals broad and either obtuse, or, usually, acute or acuminate and even with subulate tips, the inner ones as long as the outer ones, but often more obtusisb; anthers about 1 line (in a large-flowered specimen of var. *y.* even \\ linen) long, always much longer than the filament; capsule long mucronate, scarcely exceeding the sepals, incompletely 3-celled, by the projection of the placentae; seeds 0.31-0.33 line long, their length being equal to 2 diameters ; 8 or 9 ribs visible ; reticulation close but distinct; arete smooth or marked with one or two delicate perpendicular lines, and thus similar to the seeds of/. *scirpoides,* which, however, have fewer rilw. — £. Meyer (1. c.) descrilws the plant very correctly, but suspecting that the flattened appearance of stem and leaves might be owing to undue pressure in drying, places it with doubt with *J. Rottkovii,* from which it is widely different.

Var. o. has leaves 1-2 lines wide, as long or longer than the stem ; heads large, about 5 lines in diameter, usually 2 or 3 in a cluster, or sometimes as many as 6 or 8 in a nhort panicle. —Leaves of var. *fi.* 2 lines wide, shorter than the tall stem ; panicle loose-flowered, somewhat erect, sometimes 6 inches in length. Some of the mountain forms collected by Mr. Bolander (Vosemite Valley, Cal. St Surv. 6036, and especially "alpine meadows,[1]' 6006, which is only a foot high) have smaller flowers 1 J-l J lines long, and seem to approach closely to *J. oxymcris.* — Under Hb. norm. 97 two forms have been inadvertently mixed, one the real var. *paniculatus,* and the other a tall (2-3 feet high) several-headed form of var. *glomeratus,* — Var. *y.* is a small mountain form, which with its dark heads, large flowers, and long protruding stigmas, resembles so nearly the smaller forms of *J. falcatus,* that a close examination only will distinguish them ; leaves \-\ line wide; heads 4-5 lines in diameter, single or two together.

51. J. CHLOROCEPHALUS, n. up. : caulibus (pedalibus sctHiuipedalibu*) e rhizoraate brevi repente ce*pito»is erectis et foliis compres^is ; capitulis multi-(15-2r>)floriR singulis seu paucis glomeratis upathain niembranaceam subaquantibus; floribus magni* conspicue pedicellatis pallidis; sepalis oblongis obtusis seu exterioribus et rarisBime interioribas mucronatis wjualibus seu interioribus patilo longioribtis stamina vix excedentibus; antheri* longe-liuearibus filamento multo longioribu* ; stylo ovario ovato pluric* longiorc exserto; stigmata vqtiante vel iis longiore; captula ovata obtusa mucronata uniloculuri sepal is breviore ; Heminilma o vat is utruimjue apiculatis reticulatk

In the higher mountain* of California, *Ifiliebraml,* Cal. St. Surv. 2338 ; dry places on peaks near Mount Dana, 10,000 ft high, *Brewer,* Cal. St. Surv. 1804 ; along the rapid current of streamlet* in Ycmenita Valb-y, [486] 4,000 feet high, *Bolander,* Cal. St. Surv. 6033, Hb. norm. 99; mountain* near Canton City, Nevada, *C. L. Anderson.* — Allied to the last, but readily distinguished by it* (Nile flower head*, which look more like thone of some cyperaceous plant, ito broad and obtuse sepals, small ovary, very long style, shorter Btiffinata, and very short obtuse capsule. — The specimens before roe are from 10 to 17 inches high, pale green, with the auriculate sheath* often rose purple ; leaves f-1 line wide, like the stem compressed, but not anoipitous, shorter than the stem ; 1-3 heads, 6-7 linen in diameter; flowers 2} lines long, pale or whitish-given, nhining; nepal* very obtuse, often nittcronate or cuspidate, with broad membranaceous margins; stamens scarcely shorter, and sometime* even a little longer, than nrpals; anthers twice to four times as long as filament, murh exceeding the ovary ; style often twice an long an the ovary ; capsule, in the only fruiting specimen which I could examine, much shorter than the Berlin ; need* (immature) very similar to thone of the last Rpecien, 0.32 line long and more than half as wide, 7-8 riU visible ou the side, reticulation distinct, but, as yet at least, uo transverse lineolation vuuble.

During the two years which have passed since the first part of this paper, pp. 424-458, was published, the attention or many botanical friends has been directed to our *Junci,&nd* their exertions have enabled me to add several new species to the foregoing list, complete the history of others, and

make several additions and corrections. In the foregoing pages I have already acknowledged the liberality of Professors Roeper and Decaisne, who have enabled me to study the *Junci* of Lamarck and of Michaux; I have now also seen fragments of those collected by Haenke on our western coast from the Herbarium of Prague sent by Professors Kosteletzky and Von Leonhardi, and those obtained on the northwest coast by the Russian explorers, communicated by Director Regel of St. Petersburg. Thus, I believe, I have had an opportunity of examining all the original specimens of the older authors; the single *J. Pylori,* La Harpe, from the "little island of Saint-Pierre-de-Miquelon, near Newfoundland," remains unknown to me.

The request for assistance in forming an *Herbarium Juncorum Boreali-Americanorum Narmale* (p. 424) has been generously responded to by twenty-three botanists, who have sent sets of 99 plants, to be distributed by me among the great standard herbaria of this country and of Europe, and among the contributing botanists themselves. They are quoted in these pages as *Herb. norm,* or *Hb. norm.* The largest number of species were sent by Messrs. Bolander and Kellogg of [487] California, Ravenel of South Carolina, and Bigelow of Michigan, and after them by Messrs. Porter and Smith of Pennsylvania and Chapman of Florida. My own and the whole botanical fraternity's acknowledgments are due to all of them.

The 99 numbers comprise 38 different species,—among them ten described here for the first time and twelve very rare or critical ones, and twenty important varieties; the remainder consists of minor varieties, different forms of the same species or variety, and in a few instances the same plant from different localities. The specimens are not all of equal value or beauty, in some few instances they are inferior, or the different specimens of the same number are sometimes not sufficiently homogeneous for a collection that claims to be a standard one; but on the whole they will be found satisfactory, and many of them very perfect and better and more complete than they can be found in most herbaria. If my friends or the friends of botany in this country will undertake the labor of collecting and sending me specimens of the *Junci* not at all or only incompletely represented in the Herbarium Normale, I will cheerfully promise to do my best to arrange and distribute them in the same manner as in the present collection. I would, in this case, urge the importance of getting not only those species that are wanting in the Herb. Norm., but especially the intermediate and doubtful forms, that connect the different forms of such polymorphous species as *J. scirpoides* or *J. Canadensis,* **and** similar ones.

ADDITIONS AND CORRECTIONS.

Page 425. Among the vegetative organs, the *rooUtock* has been barely mentioned, while it is a most important organ and exhibits many differences in the different species of perennial *Junci.* Very few of our species are annuals, and these all belong to the section *graminifolii: J. bufmius, triformii, KtOoggii,* and I believe, *rcperu.* The others bring forth buds from the axils of the lowest scaly leaves *(Niedtrblaetter)* at or soon after the period of flowering, and especially at the time the fruit ripens, in the form of short leaf-buds or stolons or horizontal rhizomas, which preserve the existence of the plant through winter while the old stock is decaying, and in the following season produce the new flowering stalks, and die themselves in the succeeding summer or fall when their successors are forming, so that the living part of the plant never gets more than a year old ; but in most species the rhizoma, often bearing the vestiges of the decayed flowering stems, continues to exist much longer, attached to the living plant, but desti- [488] tute of vitality. The buds are very short and ascending in the cespitoee species, /. *acvminahu,* etc.; in the creeping ones they form shorter or longer stolons, fibrous (/. *falcatus, J. phaocephalus)* or fleshy (/. *scirpoiUs),* and often bearing a bunch of leaves at their end ; in /. *nodonu* the stolons form thin fibres, which bear little bulbs, and often a series of them, the source of the stems of next season (see Herb. norm. 74, where in many specimens the old withered stolons with the vestiges of the decayed stems of last season and the new ones can be seen). The species of the first section *(Junci genuinx)* have stout horizontal rhizomas, and none stouter than the maritime species (/. *acutm* and *Rammàntu),* which bear upright stems at almost every node, and not at the end like most *articulaU.* Where the

internodes are short, they become cespito.se, where they are long, the plants are called creeping; differences in soil and moisture, however, seem considerably to influence the length of the internodes in the same species.

Page 427. For "*J. pallescens*" wherever that name is used for one of our species, read /. *acuminatus;* for "var. ***fraternu8,*" var. *legitimus;* for "***J. Buckleyi,*" *J. leptocaulis ;*** and for "***J. saginoides,*" *J. triformis,* var. *wiiflorus.***

Page 423. The " subgenus *Juncellus* " here and p. 436 must be cancelled.

In *J. pelocarpus* and /. *acuminatus* the viviparous buds are the result of retrograde metamorphosis; in other cases they may be produced by insects, and are then much larger degenerations.

Page 430. It is evident that the sculpture of the seeds is the result of the structure of both the epidermis and the next inferior layer of cells, which both together probably constitute the *testa;* in some species it is more one, in others more the other stratum, which gives character to the appearance of the seed. My investigation of these points is not sufficiently advanced to furnish definite results; but I may state that what I have, in common with other authors, designated as the *testa,* properly seems to be the epidermis only, consisting of a single layer of cells, always larger than those of the layer under it, and never transverse. In most species the epidermis is thin, transparent, and closely adhering to the body of the seed; in others (/. *Ramerianus, Balticus, arcticus,* etc.) it is thicker, swells up when moistened, and may then be detached ; in others again, those with tailed seeds, it is quite thick and loosely adhering to the body of the seeds, so as almost entirely to obscure their proper sculpture. In the first two classed the cells of the epidermis are about as wide as they are long, and only in part correspond with the sculpture of the seed ; they seem, however, to cause the markings designated by me as " levi&riine irregulariter reticulata " (p. 432, I.I). In the third class these cell* are narrow and much elongated, sometimes as long as the seed itself, and [489] their thick walls form the ribs of these seeds.

Dr. F. Buchenau, the acute observer of the *Junci,* has published the results of his observations on the seeds of the German species in Botanische Zeitung 25, p. 201 (June 25, 1867). He generally coincides with my views; but a new term for the crowbars of the reticulated seeds, *transtilla,* seems to him necessary, and for my *semina liiuolata* be sutatitutes the words *transverse reticulata,* which is correct in itself and was used by me p. 431 and p. 432, II. 1., but does not seem to me to express the predominant character of these seeds as well as the former term. He also minutely describes the color of the seeds, a character which I have occasionally mentioned, but which seems to be in most species too slight, and even varying, to give it much importance.

Page 432. *J. brachycarpus, oxymeris,* and *falcatus* ought to be classed under I. 2. For "/. *rudis*" read /. *mierocephalus. J. dubius* comes under I. 3. /. *acutus* belongs rather between I. 1 and I. 2, and /. *Kelloggii* near /. *marginatns,* III. 1. /. *Umgistylis* together with *J. obhwatus* may be properly classed under I. 2. The apparent necessity of these numerous changes is a proof of the difficulty of properly classing the seeds; only completely ripe •nd well developed seeds ought to be used for these investigations.

Page 433. It ought to have been stated that in the systematic arrangement all the species not expresslj marked as belonging to 3-androus sections, are 6-androus.

Add : 5. b. /. *Lesueurii* for sul»p. *Pacificus.*

Page 434. 10. /. *Smithii* comet* under 1. *Aphylli.*

Page 435. 27. /. *repens* was inadvertently classed with the 6-androus species. The *Ohmendiflm* **would be** better arranged thus : —

• Triandri. (No. 26 b. It c. sapim unlflori; No. 80, M-andnui.)

J. Kelloggii, n. up. California.
J. trijonnu, n. tp. California.
/. *repens,* Michx.
***/. marginatus,* Roctk.**
***/. leptocaulis,* Torr. *k* Or.**

• • Hexandri.

***J. falcatus,* Mey.**
J. oUuMtuM, n. ip. California.
***J. lonyistyliM,* Torr.**

The other changes, necessary on this and the following page, the reader will please make for himself, following the text from p. 45!) onward.

Page 438. /. *acutus.* The specimen* mid to come from New Jeroey are from Z. Collins' herbarium, and are, an Mr. I)uraml inform* me, undoubtedly of European origin ; the only certain locality in North America [490] is the Califomisn one,

Psjp 439. /. *Jiamerianus.* The New Jersey locality rent* on the doubtful authority of Punh ; I baft * "° specimen* collected farther north than Wilmington, N. Carolina, whence Mr. Canby has ssnl it, Hb. norm. 1* ***

Pa Se ^J; '• ^ ^ w has been distributed in Hb. norm., viz.: 4, from Pennsylvania, *Porter;* 3, Michigan, *Bigelow*; 2, Wisconsin, ZopAam ; and 5, Califomian Mountains, *Bolander.* It also occurs on the Pacific coast at feast as far south as the Dalles of the Columbia, *LyaU; J. Haenkei,* Mey. June, p. 10, is a depauperate northern form.

Page 442. In place of " subsp. /. *Pacificus,*[19] put:

5. b. J. LERUEURII, Bolander, in Proc. Acad. Cal. 2, 179 (1863) : rhizomate repente; caulibus (2-3-pedalibus) crassioribus mollibus saepe fistulosis ; panicul© ramis secundis ; floribus (brunneo-striatis) majoribus ; sepalis lanceolatis exterioribus acutissimis interiora obtusa paulo superantibus, omnibus supra capsulam ovatam vix obtuse angulatam acutam breviorem vel fflquilongam conniventibus; antheris 6 late linearibus filamento brevissimo quadruplo quintuplo longioribus ; seminibus magnis ovatis obtusis breviter vel vix apiculatis tenuissime irregulariter reticulatis vel teviusculis—/. *Balticus,* Benth. PI. Hartw. 341. /. *Balticus,* subsp. *Pacificus,* p. 442. *J. comprestus,* E. Mey. PI. Cham, in Linn. 3, 368, and /. *pictus,* Philippi, ib. 33 (1864), p. 268 (planta Chileneis).

In suit-marshes and in saline sandy soil near the coast of San Francisco Bay, *Bolander, Kellogg,* Hb. norm. 6. — Flowers July and August — The plant certainly stands close to /. *Balticus,* but may always be recognized by the characters given above, and .the habit is quite different The stems of the larger specimens are much thicker, often 2J-3 lines in diameter, and softer; inflorescence as in all its allies very changeable, sometimes loose but more commonly compact aud with strikingly 1-sided branches ; flowers larger than in /. *Balticus,* 2J-3 lines long, and capsule from an oval base pointed; seeds 0.30-0.37 and in Chamisso's Chilian specimen even 0.40 line long, smoothish or usually somewhat reticulate, the network corresponding with the cells of the epidermis, which when removed leaves the seed, very similar to that of /. *Balticus,* marked with a distinct but delicate transverse reticulation ; something of this is also seen on the inside of the detached epidermis, perhaps from adhering parts of the second layer of cells. /. *Balticus* has usually smaller flowers, 1|-2 lines long, only in North Pacific specimens have I seen them nearly as large as in *J. Lesueurii;* its capsule is more prismatic and abruptly mucronate, the seeds of the same size, but (evidently owing to the greater transparency of the epidermis, which otherwise exhibits the same structure) always marked [491] with regular transverse reticulation.

Page 443. /. *effusus.* Several forms are distributed in Herb. norm.; the common one from Michigan, 7, and South Carolina, 8, and an unusually slender one, 9, from the Califomian Mountains, where the common one also grows. The western botanists find in the salt-marshes near San Francisco a brown-flowered variety, which may be distinguished as var. *brunneus;* inflorescence somewhat looser and fastigiate, Herb. norm. 10, or more compact, ib. 11: other differences, if they exist, have escaped me.

/. *patens* was distributed by Dr. Kellogg in Herb. norm, in two forms ; 12 is a tall plant with loose panicles of green flowers, 13 a low (8-15 inches high) rigid form with a more compact darker colored inflorescence.

Page444. J. SMITHII: rhizomate longe repente; caulibus (lJ-2-pedalibus) gracilibus teretibus ferctis WCCIR Btriulatis basi vaginis fusco-rufia breviter aristatis instructis; panicul* laxas vix composite panciflone spatha longiBsima; sepalis ©quilongis, exterioribus lanceolatis acutatis, interioribus obtuais stamina 6 fere duplo superantibus ; antheris oblongis fiiamentura ©quantibus ; ovario ovato in stylum brevem attenuate cum stigmatibus eo tequilongis fere incluso; cetera vide p. 444.

Found abundantly by Messrs. Smith, Porter and Leidy on Broadmountain, Pennsylvania (Herb. norm. 15), where it had been discovered by Mr. Smith a year before; also in Rausch's Gap, Lebanon county___The very complete specimens sent by these gentlemen enable me to complete the history of this, thus far, very rare plant, which proves to fe intermediate between /. *Batticm* and *J.JUiformis,* with the rootstock of the former and the inflorescence of the latter, and with almost the seeds of J. *arctkus.* Seeds 0.32-0.38 line long, with short and broad appendages and a distinct rhaphe, distinctly but somewhat irregularly reticulate and partly also lineolate ; epidermis easily removed after soaking.

J. Htaceus: a larger and a smaller form from South Carolina have been distributed in Herb. norm. 14 by Mr. Bavenel; internodes of the creeping rhizome short, stems cespitose.

Page 445. /. *arcticus* is more closely allied with /. *Balticus* and *Smithii* than with *J. Drumnwndii.* More specimens obtained from the coasts of the North Pacific show that the var. *Sitchensis* is not rare there, and extends to Kamechatka; its characters hold their own well.

J. Drummondii, Californian Alps, *Bolander,* Hb. norm. 16.

Page 448. /. *Parryi:* a form with the interior sepals obtuse and much shorter than the exterior ones, which are «B long as the capsule, was found by Mr. Bolander on alpine meadows, California.

Page 448. /. *stygius,* also on the north shore of Lake Superior, *0. B. Wheeler;* it seems rare everywhere, [492] so that 1 have not yet been able to obtain it in sufficient quantity for the Herb. norm.

J. Vaseyi. While I was deploring the destruction of Dr. Vasey's original locality, Rev. Mr. Holzer and Dr. Bigelow discovered this species in abundance in damp open woods on both sides of the river near Detroit, growing together with /. *Oreenii.* Dr. BigeWs fine specimens are distributed in Herb. norm. 17. Many of them are 2| feet high.

Page 449. *J. Grecnii.* Dr. BigelowV Detroit specimens, Hb. norm. 19, are 2-2£ feet high, taller and stouter than those found ou the coast, Massachusetts, //. *Mann,* Hb. norm. 18, Maine, *E. Tuckerman.* — Both species hold their own perfectly well, and can always be readily distinguished by the characters given above ; *J. Vaseyi* is also a much more slender plant and flowers earlier, maturing its fruit, near Detroit, in the beginning of July, when the other is just in flower.

Page 450. /. *tenui**. A form with long Rpathes, most specimens tall, is Hb. norm. 20, from Pennsylvania, *Porter.* Another, even taller, with the flowers often onesided, is 21, from Illinois, *Hall;* 22 is the var. *congestus,* from California, *Kellogg,* unfortunately in too few specimens ; 23 is var. *seeundus,* from Pennsylvania, *Porter.*

J. dichotomy has been found as far north as Delaware and New Jersey, *Leidy, Commons, Parker,* Hb. norm. 24, and others. Mr. Ruvenel sends from South Carolina a taller- form, Hb. norm. 25, and a smaller, few-flowered one, 2a

Page 451. /. *Gerardii,* Massachusetts, *Mann,* Hb. norm. 27.

J. bufonius, Hb. norm. 28, is an erect form from the coast region of California, *Bolander.* — Prof. E. Hilgard found on the sandy beach of Ship Island in the Mississippi Sound the var. *fasciculiflorus* with perfectly smooth seeds ; specimens of the same sent by Lindheimer from Galveston show extremely slight marks.

26. b. J. TRIFORM is, n. sp. : caule annuo brevissirao folioso ramuloso ; pedunculis capillaribus scapiformibus numerous (£-4 pollicaribus) folia brevia filiformia supra canaliculate apicem versus plana longe excedentibus ; floribus paucis capitellatis vel singulis; sepalis lanceolato-subulatis aequilongis capsulam ovatam obtusam mucronatam 2-3 locularem fere sequantibus ; seminibus o vat in obtusis breviter apiculatis tenuiter pauci-costatis et transverse lineolatis.

Var. a. *stylosus:* planta major (2-4-pollicaris) ; capitulis 3-5-floris ; sepalis stamina et capsulam longius mucronatam paulo excedentibus; antheris longe-linearibus filamento plusquaiu duplo longioribus ; stylo ovario ovato pluries longiore exaerto, stigmatibus elongatis.

Var. &. *brachy$tylu$:* planta minor (1-2-pollicaris) ; floribus binis ternis ran us singulis ; sepalis stamina [403] fere duplo superantihus ; antheris oblongis filamento bis brevioribus ; stylo brevissimo cum stigmatibus brevibus incluso ; cajwuia caiycem flequante vel vix excedente obtusa brevissime mucronulata.

Var. y. *uniflorut:* planta minima (J-1-pollicaris); floribus bracteis 2 suffultis singulis plerumque dimeribus (sepalis 4, staminibus rtigmatibus carpellisque binis). — /. *saginoides,* p. 436.

California, from the coast to the mountains ; var. a. Yosemite Valley, alt. 4,000 feet, *Bolander,* Hb. norm. 30; flowers July ; var.0. Ukiah, Mendocino county, *the name,* Hb. norm. 31, flowers May, also "Fort Bragg, near the coast" (1-3-flowered); var. y. Sierra Nevada, among mosses, *HiUebrand;* upper Tuolumne River, *Bolander,* and in the lowlands, Anderson Valley, *the $ame,* Hb. norm. 32 ; flowers April and May.

A curious and suggestive little plant, which must considerably undermine our confidence in certain characters, considered of specific value, already shaken by the variations of other species from the same wonderful country ; it proves that the singleness or plurality of flowers on the peduncle, the number of their parts, and, if my view is correct, even the proportion of stamens and styles, are not sufficient to establish specific distinction. The first points are established beyond a doubt by some of Mr. Bolander'* specimens from the mountain region, intermediate between 0. and y. with one or two flowers, and often with a dimerous and trimerous one in the same inflorescence. Var. a. may *he* considered a distinct species by those that hold its differential characters to be of paramount importance; but the similarity of the whole appearance of the plants and of most of their parts, and, above all, the absolute identity of the well-marked seeds, convince me that it must be united with the others, and thai eventually intermediate form* will dispel all doubts.

Only the small dimerous form was known to me when the first part of this paper went to press, and wat then considered as the type of a distinct submenus, *JunceUm,* allied through its single-flowered stems to *Rottkovx̌a,* and distinguished by its dimerism from any other known *Junau* (nee pp. 426, 428 and 436). Mr. Bolander, however, bat since discovered other forms of this plant which bear tritneruus flowers, thus assimilating it to the ordinary form of *Junci* and more particularly to the European /. *capitatus,* and destroying the suhgenus *Juneellus.* I am now convinced that it must be placed with its European ally near /. *marginahu,* in the section *Graminei,* the dimerous variety constituting an anomaly not otherwise observed in this genus, but again found among the allied *Eettiacem* and *Eriocaulonea,* where dimerism and trimerism occur in the same genus,—whether in the same species, is unknown [49*1 tome.

In all the forms of this little plant the leaven are 2-12 lines long and \ line wide, filiform, but fleshy, on their lower part strongly carinate below and grooved above, flattened towards the tip; axillary stems, or properly peduncle* with one or two leaves at their base, naked upwards and much longer than the leaves, bearing at the apex 1-6 or • flowers in the axils of membranaceou* bract*, half as long as the sepals or smaller ; flowers 1-1J lines long; sepals* green with red, outer ones sharp-pointed, inner ones rather broader; seeds 0 23-0.28 line long, their length being equal to 1| or 1| diameters ; 4 or 5 faint ribs visible and between them a well-marked cras-lineolatum. The central

peduncle is really terminal and bears the earliest flowers, the lowest axillary one is the next in the progress of development, and then follow the others in ascending order, so that the one next to the terminal one bears the latest flowers- in the smaller specimens the leaves of the main stem, and consequently the peduncles, are alternating, or in J order.

Var. a. is the largest one with a remarkably long style, about 3 times as long as the ovary, and much exceeding the sepals and the very long anthers ; its seeds, however, are among the smallest of the species. Var. 0. is intermediate in size between both others; when the heads bear 2 flowers, these are arranged exactly like those of /. *pelocarpus,* with 2 lower bracts, bearing the flowers in their axik, and a third sterile one at the inner base of the upper flower ; sometimes this upper flower is dimerous. Var. y. is the smallest one, only f-1 inch high ; its single flowers have 2 bracts at their base, just as those of any other single-flowered *Junciu,* and alternating with the exterior sepals, the stamens, carpels, and stigmas ; the inner sepals and the valves of the capsule are opposed to them.

26. c. /. *Kelloggii,* n. sp.: caule annuo folioso brevissimo ramosissimo ; foliis e basi vaginali latiore filiformibus supra canaliculatis ; ramulis abbreviate infra foliosis capitula laxa pauci-(3-5)flora terminalia et subinde ex axillis inferioribus pedunculos longiores bifloros gerentibus ; sepalis lanceolato-subulatis aequalibus medio herbaceis stamina 3 tertia parte superantibus capsulam ovatam obtusam mucronatam tenui-membranaceam 3-locularem fere ©quantibus ; antheris oblongo-linearibus filamento brevioribus; seminibus ovatis vix apiculatis pauci-costatis lineolatis.

Sandy soil in San Francisco, in flower and fruit in April, Dr. *Albert Kellogg,* for whom as the pioneer of modern Californian botany, which he investigated and elucidated, at first unaided and struggling with numerous impediments, this plant has been named. — Nearly allied to the last but differing in many striking points, this little [496] species represents a glomerule of a few lines in diameter, pushing out in all directions a number of thread-like leaves ; these are 6-10 lines long, and £-£ line wide ; the short terminal heads are quite loose, the flowers on such distinct peduncles that one would be inclined to consider them as single, if the pair of bracts were not wanting which always surrouud'the base of single flowers in this genus; the lowest axils of a branch often produce longer peduncles, elevated above the glomerate mass, but shorter than the leaves, and bearing small heads, usually of two flowers only! Flowers pale green and whitish, and, especially the capsule, of very delicate structure, 1f-2 lines long ; seeds 0.25 line long, \\ diameters equal to the length, similar to the seeds of the last species, but with much more prominent dark ribs, 4 of which are visible on the side.

Page 452. /. *repent,* Hb. norm. 29, South Carolina, *Raverul.*

J. falcatui. Add : capsula sepala subaequante; seminibus lanceolato-ovatis epidermide plus minus product* subcaudatis irregulariter costato-reticuiatis, areis elongatis laevibus. — Sandy soil near San Francisco, *Kellogg, Bolander,* Hb. norm. 40. — Ripe seeds 0.35-0.40 line long, length equal to 2 or 2} diameters; tips slightly or rarely considerably elongated, or the upper one wanting; surface palish and shining, with a thick rather loose epidermis, the cells of which correspond with the reticulation of the seed. — A form from the mouth of the Columbia, *Douglas,* communicated by Dr. Hooker, has an obtuse capsule and thick ovoid seeds. — The differences between this and what 1 have named /. *Tasmanicus* (p. 453, note) seem to be almost too slight to be of specific value.

Mr. Bolander sends from sphagnous swamps near Mendocino, California, a form which may be distinguished as •ar. *paniculatus;* analogous to the paniculate forms of *J. phaocephalu** and others ; the heads of the simple or somewhat compound panicle are about 5-flowered ; Hb. norm. 41, not yet in bloom in May; no stipular appendages at the base of the leaves. Maturer specimens would be desirable.

Page 453, no. 28. b. J. OBTUSATUS, n. sp.: rbizomate repente rtolonifonni; caulibus (spithameis) erectis tavibns plerumque^-foliatis folia linearia plana tenuia fere oquantibus; capitulis pauci- seu pluri-floris paucis in paniculam simplicem dispositis; floribus minoribus virescentibus extus leviter scabrellis pedicellatis; sepalis ovatis nqualiluis, exterioribus sape cuspidatis, interioribus obtusissimis capsula ovata obtusa brevissime mucronulata 3-loculari multo brevioribus; staminibus 6 dimidia sepala superantibus ovarium obtusum cum stylo breviore oquantibus; stigmatibus elongatis ezsertis ; seminibus ovatis obtusis seu vix apiculatis reticulatis.

Near the Big Tree Grove, Maripoea, California, growing in large tufts, 2-3 feet in diameter, on the sandy [406] banks of streamlets, alt. 6,500 feet, *S. Bolander,* flowers in July. — In many respects intermediate between the foregoing and the following species, this plant is distinguished from both by its small obtuse flowers, green with light brown margins (If or in fruit nearly 2 lines long), the elongated obtuse capsule, and above all by the distinctly reticulated almost obtuse seeds, which in both others are more or less pointed or even tailed and differently marked; the seeds I could examine, not quite mature, are 0.25 line long and half as much in diameter, and exhibit 8 ribs on one side; their area are apparently smooth.

/. *Umgutylu,* also on the Red River of the North, *Evbbard* in Hb. Lapham; Huerfano Valley of the Rocky Mountains, Parry; on the banks of Mono lake in the Californian mountains, *Bolander,* Hb. norm. 43. — Stem with several short leaves, always considerably exceeding the linear foliage; seeds apiculate or short tail-pointed, with a distinct white rhaphe, strongly ribbed, when not perfectly mature like those of *J. marginal*;* fully ripe seeds with •ery slight crow-bars and a faint transverse lineolation.

Yar. ? *latifolius:* caule erecto (pedali) nudo seu basi unifoliato, folia brevia lineari-lanceolata longe excedente; panicula simplici spatha meinbranacea rare fuliacea longiori; capitulis pauci-(3-5)floris; antheris longe Hnearibus fi la men to triple quadruplo longioribus ; seniinibus obovatis costato-subreticulatis.

Californian Sierras on alpine meadows or along rivulets in the Yoseinite Valley, alt. *4,000 feet, Hb. norm. 46 ; on the upper Tuolumne, alt. 10,000 feet, and frequent on the eastern slope of the mountains,. 2£ *Bolander.* — Easily recognized by its broad (2-3 lines wide) and short (2-4 rarely 5 inches long) light- green leaves, few-flowered heads and long anthers, but probably not specifically distinct; seeds 0.25-0.30 line long, reticulate with faint cross-bars, areas slightly lineolate or almost smooth ; 7 or 8 ribs visible.

Page 454. /. *leptocaidis.* The Arkansas specimens have been collected by Dr. Leavenworth; for the Texan localities credit is also due to that ardent old gentleman, Dr. Gideon Lincecum, who, in his seventy-ninth year, still continues an active botanist, and is now seeking a new field in Mexico. — Mr. Buckley protests against the change of his and the restoration of an older manuscript name, and threatens to lay the matter before the public for arbitration, in which I wish to assist him, referring only to the remarks on page 454.

J. marginatus. Var. *paucicapitatus* ought to fullow var. *vulgaris;* both are distinguished from the other variety by a more slender growth, meagre panicle, and mostly smooth edges of the leaves : in Herb. norm, only gracile forms are represented, 33 Pennsylvania, *Porter;* 34 West Canada, *Bigelow;* 35 South Carolina, *Ravenel;* var. [497] *biflorus* is a stouter plant with broader leaves, rough on the edges and a larger panicle; Hb. norm. 38 Delaware, *Commons;* 39 S. Carolina, *Ravenel.* Intermediate forms do not seem to be rare and are found in Hb. norm. 36 and 37. Characters taken from the relative length of the inner and outer sepals, or from the differences in the shape of the capsule, seem to be entirely inconstant. No species bears more abundant seed than this, but in the collections it is rarely found fully mature.

Page 455. /. *pelocarpus,* as far west as the banks of the St. Peters River, in Minnesota, *C. C. Parry.* — It seems that the plant attains its normal development and bears fruit only in a northern climate, and grows then only 4-7 or 8 inches high, Massachusetts, *Tuckerman* in Hb. norm. 45, while the proliferous forms usually become 1 or 2 feet high, New Jersey, *Smith it Leidy* in Hb. norm. 46 ; the interesting southern var. *crassicaudex,* Florida, *Chapman,* Hb. norm. 47, is often 2 feet or more in height and bears a very large decompound panicle, 5-9 and even 11 inches long.

A specimen of Michaux's /. *fluitans,* from his own herbarium in Paris, bears me fully out in my supposition that it is a depauperate water or mud form of this species; its short, rooting stems, about 4 inches long, bear single terminal 2-flowered heads. The flower I could examine was not fully open yet, and leaves me in doubt whether it is 3- or 6-androus. The description of La Harpe is not quite correct in so far as he attributes to the head 2 external bracts; while they have 3, as the 2-flowered heads of the regular form have, one under each flower, and a third one above the upper flower. Michaux found bis plant, as Prof. O. Brunet of Quebec informs me, on the Chicoutimi, about 100 miles north of Quebec.

Page 458. /. *articulatus,* as far west as the shores of Lake Erie, *Q. W. Clinton;* in Herb. norm. 48 from Western New York, *Sartwell,* and 49 from Massachusetts, *Tuckerman.* — *A* form with obtuse 5-flowered green heads in a spreading and often almost level-topped panicle, obtuse, mucronate sepals and obtuse short mucronate capsule, which I designate as var. *obtusatiw,* has been found by Messrs. *Diffenbaugh* and *Burke* on the river banks near Philadelphia; Hb. norm. 50.

FURTHER ADDITIONS TO THE REVISION OF THE GENUS JUNCUS (1. c. p. 590).

1. 0. JUNCUS COOPERI, n. sp.: rhizomate . . . foliis . . . . caule (fere bipedali) robusto rigido; spatha rigid* paniculani compositam strictam vix atquante; glomerulis 2-5-flnris ; sepal is demum induntis nervosis, exterioribus convexis lanceolatU subulato.acutatis, interiorihus ovato-lanceolatis mucronatis paulo brevioribus stamina 6 vix super-antibua ; antheris lute linearibun, filamentis brevifwinii*; capsula e bnsi ovata acutata vix angulata indurmta (viret-cente) paulo exserta ; Reminibus mnjoribus appendiculatis costato-reticulatis.

Camp Cady, in the southern part of the State of California, *Dr. J. G. Cooper,* 1861. — A single incomplete speci-men, preserved in the botanical collection of the Geological Survey of California, discovered by the lealou* naturalist whose name it bears, proves this plant to be closely allied to and intermediate between /. *acutw* and *J. maritimu*,* and therefore mo*t probably leaf-bearing. The panicle is 3 inches long and 1 inch wide, green even at full maturity 5 flowers with the fruit 3 lines long, anthem lj lines in length ; seeds with white rhaphe and broad white appendages f line long; marked with irregular longitudinal reticulation. /. *acutu** (also found at San Diego by Dr. Cooper) bai •mailer flowers of different shape, and a deep brown almost globose capsule, and smaller differently marked seeds ; /•

maritimus, not yet found in North America, has all the parts much smaller, an ovate mucronate capsule, smaller seeds with short appendages.

J. acuminatus, var. *diffusissimus,* exactly corresponding with the Texan plant, found by the late Dr. Clapp near New Albany, Indiana, is preserved in Hb. Torrey.

The account of *Juncus* in Gray's Manual, 5 ed., 1868, 537-544 and the *Junci* of Watson's Botany of Wheeler's Expedition, 1878, 272-274, are omitted from the reprint, as they add nothing to this paper.—EDS.

II. ISOLATED DESCRIPTIONS.

FROM BULLETIN OF THE TORREY BOTANICAL CLUB.

JUNCUS MARITIMUS, Lam. In your [illegible] York Flora, No. 6, p. 24, you mention *J. Rœmerianus* [illegible] sent me the [illegible] *J. maritimus,* Lam., [illegible] not before seen from any American locality, as collected on that same island, Sept., [illegible] really [illegible] and do both species [illegible]. Have you compared your specimens from Coney [illegible] the minute characters of flowers and [illegible] a green, contracted, and *J. [illegible]* a spreading brown panicle, and blooms, I believe, much earlier [1873. IV. 40].

FROM THE BOTANICAL GAZETTE.

JUNCUS RUGULOSUS, n. sp. Pale green, [illegible] rugose and rough, stems 2-4 feet high from a stout running rhizoma, very weak, leafy; leaves septate; panicle lax, decompound, 6–8 inches long and wide; heads with hyaline bracts, 3–5–8-flowered; sepals linear-lanceolate very acute, nearly equal, the outer carinate-one-nerved, the inner 3-nerved; stamens 6, much shorter than sepals, linear anthers shorter than filaments; capsule exceeding the calyx, lanceolate, acute, 3-angled, 1-c[illegible] there [illegible] of our flora with rough epidermis. It may be compared [illegible] s of *J. acuminatus* var. *debilis,* but is readily distinguished by its roughness and its 6 stamens, and then, no forms of J. *acuminatus* occur west of the great plains [1881, VI. 224-6].

JUNCUS CANALICULATUS, n. sp. A coarse [illegible] of the section *Graminei,* 3 feet or more high, from a cespitose rootstock [illegible] annelled leaves, 2 or 3 of them [illegible] auricled sheath, on the stem, with stout terete stem. [illegible] rather contracted panicle; flowers light greenish-red, over [illegible] long; sepals [illegible] inner acute, outer ones acuminate; stamens 6, two-thirds the length of the sepals, long linear red-brown [illegible] attenuated into a slender style bearing [illegible] 3. [illegible] distinguished from the allied *J.* [illegible] brown-red anthers, otherwise rare in the genus, by the stouter habit, th[illegible] flowers, acute sepals, acuminate ovary, long style and stigmas [1882, VII. 6].

VI.

PAPEES ON YUCCA, AGAVE, ETC.

I. YUCCA AND HESPERALOE

FROM WATSON'S BOTANY OF THE FORTIETH PARALLEL. — REPORT OF THE UNITED STATES GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL. CLARENCE KINO, GEOLOGIST IN CHARGE. V. SUPPLEMENT, 496-497. WASHINGTON, 1871.

The following addition to the Catalogue of the plants of Nevada and Utah is from DR. GEORGE ENGELMANN as a result of his recent study of our hitherto ill-defined and little understood species of these genera. — S. W.

YUCCA, L

Perianth cup-shaped, of six (whitish) petal-like lance-oval acutish leaves, withering-persistent, longer than the six club-shaped filaments. Stigmas 3, more or less united. Pod oblong or cylindrical, somewhat 6-sided, 3-celled, the cells incompletely 2-eelled by a partition from the bock. Seeds very numerous flat, horizontal, in 6 rows, black, with the linear straight or curved embryo diagonal, as long as the albumen. — Stems woody, fibrous, very short or rising into thick columnar palm-like simple or branching trunks, bearing persistent rigid linear or lance-linear mostly sharp-pointed leaves, with smooth, rough, or filamentose edges, and terminated by an ample compound panicle (or rarely ft spike) of showy pendulous flowers, opening wide in the evening and half-closed in the morning.

| 1. EU-YUCCA. Filaments club-shaped, obtuse, papillose-pubescent, mostly shorter than the pistil, often spreading or recurved ; anthers oblong or sagittate ; ovary prismatic or subcylindric, obtuse or narrowed into a sort of style ; stigmas elongated, bi-lobed, papillose.

• *Sarcocarpa.* Pendulous fruit fleshy and indehiscent; thick seeds somewhat rugose, with deeply lobed (ruminated) albumen.

1. Y. BAOCATA, Torr. *Boi. Mex. Bound.* 221. Stems none, or short, or several feet high ; leaves very thick and rigid, lance-linear, narrowed above the broad base, concave, terminating in a stout spine, with very coarse marginal fibres; flower* panided; petals rhombic-ovate (Ij-l} inches long) or linear-lanceolate (sometimes over 3 inches long) ; ovary attenuate into a style; stigmas short; fruit ovate or cylindric, long-rostrate. —From New Mexioo sad 8. Colorado, through S. Uuh, to Arizona, California, and Mexico. Northward a low plant, it becomes a tree farther south ; leaves 1|-2 feet long, 1J-2 inches wide. The edible sweet fruit are often called "Dates;" seeds vftriftblft in •be, usually the Urpst in the genus, 5-6 linen wide, 1 J-l | lines thick. #

• e *ClutoearjxL* Fruit iudebiseent, at last dry ; soeds thickish, smooth, with the albumen entire.

2. Y. BRiviroLiA, Eng. *(Y. Droamu,* var. orftoraetiu, Torr. *Bot. ITkipp* Pat. R. R. Sure. 4.* 147). Tree-like, at last much branched ; the short narrow leaves crowded at the end of the branches, thick, very rigid, stout, and sharp-pointed, not narrowed above the broad base, serrulate on the min; ptnicle textile at the end of the branches ; fruit Urge, 4 inches long, ovate, pointed. — DenerU of 8. Utah tbrongh Arizona to 3. E. California where it torns entire forests on the desert plateaus at 2-4,000 feet altitude. Often 2n-0O feet high and 1-1 feet in diameter, witb ft *» rough bark ; leaves 4-41 inches or in young* specimens 10-12 inches long. H-*[nch] *nd'i **** ™d stouter pointed tM» tny other in the genus. The flower when known may make it necessary to remove It from § *En-yucca.***

e e e *Outnoearpa.* Erect fruit dry, septiddally 3-valved from the apex, the valves si last again divided ^ <p I seed very thin, smooth, with an entire albumen.

***• [T]- AJroueniOLiA, Pnrsh. 8tetns none or short; leaves narrowly linear, scarcely narrowed above tbt broad osss, rigid, spiny.poiiited, nearly flat above, convex below, with very slender marginal fibra, l}-2i feet long; flowers**

spiked ; petals broad-ovate, 1 J-1f inches long ; stigmas half as long as the ovary, sessile, erect; capsule cylindric-ovate thick, obtuse, short-pointed ; seed large (5-7 lines in diameter), with a wide margin.

Var. |9. RADIOSA, Eng. Stems several feet high, with large panicles ; petals narrow lanceolate, 1j-1f inches long.

Western plains to Texas, Colorado, New Mexico, and into Utah; the variety in Central Arizona, and northward to the borders of Utah. A very variable plant, which eastward toward the Mississippi and the Gulf has broader, shorter and more flaccid leaves (F. *ttricta,* Sims ?), but is always recognized by the thick never constricted obtuse capsule, and the large broad-margined seed, 6-7 lines wide. Both forms here noticed have very narrow leaves [497] the former 6 lines, the latter 4-5 lines wide. About St. George, Utah, a form occurs with leaves only 2 lines wide.

f 2. HESPERO-YUCCA. Filaments thickened upward, acute, smooth, mostly longer than the pistil, erect; anthers didymous, broader than long ; ovary oval, the slender style tipped with a broad short 3-lobed stigma, bearing numerous filiform papillae; erect capsule loculicidally 3-valved from the apex, valves entire, undivided ; seeds thin, smooth, with entire albumen.

4. Y. WHIPPLEI, Torr. *Bot. Mcx. Bound.* 222. Stems none or short, prostrate; leaves few, often falcate, rigid but not thick, gradually widening toward the broad base, rough on the margin, sharp-pointed, striated, glaucous, 12-18 inches long,} inch wide or less; flowers panicled; petals lance-oval, l£-3 inches long; capsule small, ovate or obovate, obtuse; •eed narrowly margined. —Prom N. W. Arizona to the mountains and coast ranges of S. California; it may be expected in S. Utah. Flowers very different in size, some specimens with the largest in the genus; style sometimes as long as the ovary or much shorter.

The following genus is founded on a plant from W. Texas, originally described as a doubtful *Yucca,* then as an <4foe, but evidently distinct from both.

HESPERALOE, ENO. N. GEN.

Perianth cylindric, of 6 (reddish) petal-like linear obtuse leaves, united at base, withering-persistent, the outer ones cucullate at apex ; filaments from a broad adnate base, subulate-filiform, of the length of the perianth, in the bud geniculate-inflexed below the tip ; anthers oblong, bifid below; ovary ovate, 3-celled, several tiroes shorter than the filiform style; small capitate stigma exsert; capsule 3-celled, 6-valved, with 6 rows of thin black horizontal Yucca-like seeds, and a linear diagonal embryo of the length of the albumen.—Conn bearing the Yucca-like filamentose-margined leaves and a scape, with the fascicled flowers in a spike or few-branched panicle. The leaves, pollen,[1] and teeds are those of a *Yucca,* the perigone and pistil that of an *Aloe ;* the filaments, being adnate at base and geniculate upwards, resemble those of an *Agave.*

HESPERALOB YUCCJsroLiA, Eng. *(Yucca* (?) *parvijtora,* Torr. *Bot. Mex. Bound.* 221. *Aloe yucca/olio,* Gray. Proc. *Amer. Acad.* 7.390.)

IL NOTES ON THE GENUS YUCCA.

FROM TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, III. 1878, pp. 17-64.

The stately Yucc^of liliaceous alliance and of American origin, had attracted the attention of European horticulturiSs long before Linnaeus classed the then known species, four in number; and, indeed, three of these were based on specimens cultivated in European gardens, two of them, *Yucca doifolia* and *Yucca Draconis,* on the elegant and very accurate figures of cultivated plants by Billenius, published some one hundred and forty years ago. Ever since the Yuccas have remained favorite plants in the gardens on account of their palm-like (hence *Palmilla* of the Mexicans), either frigid and pungent or gracefully curved foliage, shooting up from the ground in pleasingly regular masses, or raised into the air on simple or branching trunks, all overtopped by immense white panicles of hundreds of glorious flower-bells.

[1] The potlen-cells of *Yucca* an globose, 0.055-0.065 mm. diam. 5 those of *ffesperalo** are similar but only 0.050-0.055 mm. diaro, and those of *Aim* 0.080-0.050 mm. diam., globose when fresh, bat when dry lanceolate, folded or groored (much like those of *Hyadnlhu** and many other *Liliacem).* Jowly becoming globose when soaked.

It thus happened that these plants fell into the hands of professed horticulturists, and — perhaps because the herbaria could afford only few and very incomplete specimens — scientific botanists rather shunned them, as they did many other such plants, and notably among them the Cacti. With these they share the precious property of being easily propagated from some, perhaps a single, imported specimen; hence, the individual peculiarities of such specimens, propagated a thousand and a thousand fold in the course of a century (for most of our cultivated [18] Yuccas have been thus long in the hands of nurserymen), at last impress the observer with the dignity of specific characters. But the botanist finds it necessary to fall back on the organs of inflorescence and fructification as the only safe guide in such difficulties; here, however, the cultivated Yuccas leave us in the dark. They yield us flowers, to be sure, but we find the flowers so very similar in many species, and again so dissimilar in different forms of the same species, that evidently but little light can be obtained from their study. And the fruits ? Unfortunately the Yuccas scarcely ever have borne fruit in European gardens. The difficulties are increased by the fact, that, as will be shown below, in their native homes these plants vary remarkably in the structure and the form of even their more important organs; and until fuller examination of native forms can be had we must remain in considerable doubt as to the limits of species.

My attention was drawn to this genus, when, since 1842, Mr. F. Lindheimer sent several then undescribed species from Texas, and Dr. A. Wislizenus, and after him Dr. J. Gregg and Mr. A. Fendler, others from New Mexico and Northern Mexico. A few years later the botanists of the Mexican Boundary Commission and of the Pacific Railroad exploring expeditions added to the stock of our knowledge, and within the last decade the explorers of the botany of California and of Arizona filled up some further gaps. Within the last two years au unpretending physician of South Carolina, Dr. J. II. Mellichamp, who does not even claim to lie a botanist, but is imbued with arduous zeal and keen sagacity, and who lives right among the Yuccas, has wonderfully improved his opportunities, and has very greatly aided mo in my investigations by specimens as well as by his observations. I may add here that also on other families of plants of his rich State, already so long and well known through the labors of a Walter and an Elliott, have his researches shed new light, as will appear in future pages of these Transactions.

Having thus been interested in the Yuccas for many years, I ever had an eye on these plants, aud in my travels in Europe I neglected no opportunity to study them in the herbaria as well as in the gardens. There I was first struck with the "fact" that "Yuccas do not bear fruit" To be sure, I had seen the fruits in the Texan and New Mexican collections, and bad observed the capsules in our St. Louis gardens; but I found none in Euro]*, or almost none, I should say, [19] for in the botanic garden of Venice I gathered the pulpy penis from a large *Vurca aloi/olia,* about 15 feet high. This was the only Yucca fruit seen by me in Europe, though I have since learned that in other instances also, yet exceptionally, fruit and good seed have been produced there, principally by this same species, and very rarely by others. *0*

The question why the flowers should almost invariably fail, had been frequently discussed and various reasons suggested, such as sexual incompleteness of the flowers or impossibility of self-fertilization of plants originating from the same stock.

I had observed that all the Yuccas which came under my notice, opened their more or less pendulous flowers in the evening, and half closed them during the following day, after which they withered.* The anthers were observed to open a little before the flowers did, and to expel a laigd-grained glutinous pollen, which did not seem to readily find its way to the stigma. And how is the stigma constituted ? The conspicuously papillose termination of the pistil had always been considered the stigma, but closer examination showed its papillae to be epidermidal appendages, c&rres-

• See notes by the author, in Bulletin *Tonty* Bot. Hub, 1872, III. 8ft, 87; and Gardeners' Chronicle, July 18,187*. — Ed.

ponding to similar ones on the filaments, and entirely destitute of stigmatic functions; never did they contribute to the development of a pollen-grain occasionally adhering to them. Dr. Mellichamp's notice of a minute drop of glutinous liquid in the tube formed by the coalescence of the so-called stigmas led me on to further experiments. That tube proved to be the real stigma, exuding stigmatio liquor, and insects (in these *night-blooming* flowers, of course, *nocturnal* insects) must be the agents which introduced the pollen into the tube. Last June, several forms of Yucca which were blooming under my windows, were carefully watched, and soon different species of beetles were found in the flowers, but not as regularly and frequently as white moths, which, usually in pairs, disported themselves in the open flowers at dusk, and were found quietly ensconced in them when closed in day-time.[1] The suspected insects were handed over to my friend, Mr. C. V. Riley, who thereupon took up the zoölogical part of the investigation, the surprisingly [20] interesting results of which are detailed by him in the succeeding paper.

GERMINATION.

The seeds of Yucca germinate easily, the cotyledon remaining partly in the ground[2] within the seed, extracting its liquefied contents, and never grows into a leaf organ; the first leaf issues from a slit in the cotyledon opposite the remnants of the seed; the succeeding six or eight leaves of the first season following in \ order, which, in the further growth of the plant, gradually changes to the higher orders of $ and further. From the nodes of the very short axis, stout white rootlets break through the back of the leaves, the first «ne through the back of the cotyledon, opposite the first leaf, while the original radicle withers away. The Californian *Y Whipplei* is the only one in which the axis, together with the base of the leaves, swells up into a sort of bulb.

In the second season, a stout, cylindrical secondary axis originates from the axil of one of the earliest of last year's leaves, covered with scale-like leaf-rudiments, and eventually producing from its nodes the rootlets which are to nourish the plant. This secondary axis takes a horizontal direction in all the species I could examine, especially in the different forms of *Y filamentosa ;* only in *Y angwtifolia* I have always found it to grow straight downwards, continuing this direction through at least the third and fourth year, and perhaps longer. Some observations seem to indicate that *Y. gloriosa* develops in a similar manner. The terminal bud of this secondary axis does not seem to form leaves as long as the primary leaf-bud continues to grow, and probably not until it has produced a flowering stem, and perhaps not even then for years. At last, however, the secondary axis branches out, if horizontal, near the surface of the soil, if perpendicular, as in *Y angustifolia,* at a certain depth, even two or three feet, below it, forming horizontal branches, and eventually sending out leafy shoots above the surface. Some species are surrounded by such offshoots, thus forming clumps or thickets; *Y baccata, Y gloriosa, Y filamentosa,* behave in this way, while *Y angustifolia* is said to do this much morq sparingly, and *Y aloi/olia* quite rarely.

ROOTSTOCK.

While the rootlets of Yucca annually spring from the youngest part of the rootstock, and [21] decay again after a season, the rootstock itself increases often to a large size and irregularly branched shape. We have very few data about the form of this organ; in fact, the only definite information accessible to me has been imparted by Mr. Iindheimer, who, with persistent zeal, has

[1] "These snow-white 'millers,' which I have found in almoat every flower examined, when closed in daytime, doubtless enter their •ivory palaces' at night, and would be quite •ufficient for the purpose." — DR. MELLICHAMP. Later, the same correspondent adds: " Where I have found many moths last year, I noticed none or few this season. A few weeks later the plants were found without fruit, or with fruit bearing empty seedH."

[2] The very similar seeds of A^ve have a very different development; in their germination the cotyledon grows into a leaf, bearing the remnants of the seed on its tip.

dug up from the often hard and stony soil of West Texas the different species accessible to him. He informed me that *Y. angustifolia* usually exhibits a perpendicular rootstock of a finger's thickness, and two or three feet long, " rising from " (it is evident from what is stated above, that it is rather " descending to ") a long horizontal simple or branching part, one or one and a half inches thick, exhibiting many knobs and buds of future shoots. *Y. rupicola* has a Tootstock consisting of a few thick, cylindric, horizontal branches, one to two feet long. The tree-like *Y. Treculiana* has few short, thick, club-shaped, horizontal branches to its rootstock, sometimes only a single, short, and very stout knob, which does not seem to readily sprout out. It will be interesting to study these conditions in other species in their native localities.

The rootstock of all the Yuccas is, under the name of " Amole," an important article in a Mexican household, being everywhere used as a substitute for soap, as it is replete with mucilaginous and saponaceous matter, probably a substance analogous to the saponine of the *Saponaria* root It is curious to learn that the negroes of the coast of South Carolina repeatedly destroyed Dr. Mellichamp's carefully observed clumps of Yuccas, in order to obtain the saponaceous rootstock. How may the knowledge of its quality have reached them ? Perhaps from the West Indies.

TRUNK.

The trunk of the Yuccas either remains entirely below the surface, or it takes different degrees of development above ground. Heretofore, specific characters were partly based on such differences, but we know now that only few species are regularly aifB always acaulescent *(Y rupicola),* while others, when in a perfect or flower-bearing state, always have trunks *{Y. aloifolia* and *Y. Treculiana,* though this species was first described as stemless); a certain number, usually counted as acaulescent, under favorable circumstances make short trunks, sometimes of only a few years[9] [22] duration *(Y filamcntosa,* and still more *Y. angustifolia),* and others, again, among them roost notably *Y baccata,* are absolutely stemless near their northern limits, while the farther south we meet them the higher and more tree-like their trunk grows.

The primary axis of the Yuccas is terminated by the inflorescence, and its apex dies with it The plant is then rejuvenated by lateral buds, either from the same axis or from the subterranean rootstock. In the first instance the buds appear about the time of the maturity of the fruit, in the trunk-bearing forms from the axils of the uppermost in the stemless ones from those of the lowest leaves. A single subterminal bud will soou simulate the direct continuation of the main axis; several buds will produce branches in the trunk-bearing species, while in the stemless ones they will give the plant a cespitose appearance. From I)r. Mellichamp's observations, it seems that the caulescent Yuccas show certain differences in the place where the bud appears; he noticed the young bud of *Y. aloifolia,* from exactly the uppermost axil, at the base of the inflorescence, while in *Y. gloriosa* it sprung from between the uppermost and the next lower series of leaves. In a *Y.fU&m mentosa* in my garden, I observed several buds in the axils of the highest leaves developed two years in succession, so that a short branching trunk was formed, while after the third year the vitality of this trunk seems to have died out and the plant was rejuvenated by shoots from the subterranean rootstock. In other forms, which probably belong to the same species, I find only rarely, in veiy vigorous garden specimens, a bud from the uppermost axils, while almost always they branch from below the crown of leaves. But observations of this kind, relating to the biology of these plan* have been made too seldom to permit yet the deduction of general laws.

The Yucca trunk has a light fibrous wood, which exhibit* distinct marks of ooncentrio arrangement, so that in an old trunk of *Y Treculiana,* of two and a half feet in diameter, I can oount twenty *Uym* in a space of two and a half inches, or one and a half Unas to the layer; the trunks certainly grow in thickness as they get older. Another peculiarity of old Yucca trunks is their thick, corky

bark; the above-mentioned *Y. Treculiana,* sent by Mr. Lindheimer, has an irregular, rather scaly, dark gray bark of a quarter or a third of an inch thickness, resembling that of some [23] elm or willow; a trunk of *Y. aloifolia,* received from Dr. Mellichamp, is covered with a bark of the same thickness, of a deep brown color, broken up into numerous small square or angular fragments, much like that of the dogwood *{Cornus Jlorida).* The bark of a section of *Y. brevifolia,* sent by Dr. Parry, is similar, but over half an inch thick, and still more deeply cleft The investigations of these organizations would form a worthy subject for an experienced phytotomist.

LEAVES.

The leaves of the Yuccas are evergreen, i.e. they last at least a whole year in the low species, or several years in the arborescent ones. They are lance-linear, abruptly narrowed above a very broad, mostly membranaceous base, and usually widening again near or above the middle (some narrowed-leaved species are not contracted below the middle), and gradually, or rarely abruptly, terminate in a horny, often sharply pointed, rarely obtuse, sometimes soft and herbaceous spine, below which the tip of the leaf is more or less concave and involute. The leaves are usually more or less thick, and more or less rigid, but we find all the transitions from the stiff and sharp-pointed ("Spanish bayonet") to the soft and . flaccid leaf. Their size in the different species varies from half a foot to four feet in length, and from one quarter to two and three inches in width.

The upper side of the leaf is flat (the tip excepted), or almost always more or less concave, sometimes deeply channelled, and occasionally folded or plicate. The lower side is convex, and its lower part bluntly keeled. The surfaces are smoothish or more or less rough, and this roughness is the result of the peculiar structure of the cells surrounding the stomata. The lateral walls of these cells are thickened, hard, and transparent, and somewhat elevated above the general surface; especially in the true *Y. filamentosa* the edges of the upper and lower marginal cells protrude over the stoma like minute, beautifully chiselled, conchoidal shields, sometimes almost completely covering it. In *Y. brevifolia* the edges of other cells are also apt to protrude, and, besides, numberless little knobs, similar to the marginal asperities, to be described below, increase the roughness of both surfaces. I notice the same appearance on the lower surface of the leaves of the *Y Treculiana* and *Y. eanaliculata,* and less distinctly on *Y. gloriosa.*

The color of the leaves varies from deep or fresh green through dull green to light glau- [24] cous. Of great interest and diagnostic importance is the edge of the leaf. In some species (such as *Y aloifolia, Y. brevifolia, Y. rvpieola)* it is rough, or, as it is usually termed, serrulate, and remains unaltered through life. The teeth consist of small, irregular, isolated cartilagiuous knobs, each consisting of quite *a large number of colorless prismatic or clavate cells, arranged in fan-shaped or straight bundles. These are the "serrulate" or rough-edged Yuccas.

Others have "smooth-edged" leaves, *(Y. gloriosa, Y Treculiarui);* the edge, at first green, and often roughened with very delicate and deciduous asperities, soon becomes discolored and brittle, and in old leaves is apt to crumble off, or sometimes to detach itself in a few short fibres, thus approaching the next form.

The "filamentose," or fibrous-edged Yuccas *(Y. filainentosa, Y. angustifolia, Y. baccata)* constitute the third class. In these the fibrous system of the leaves is much stronger and tougher than in the last, and, the parenchymatous tissue soon withering on the edge, the mai-cescent marginal fibres detach themselves as more or less numerous, delicate or coarse, straight or often curled threads, of a whitish or ashy or reddish color. In the young leaf they are most conspicuous, especially near the involute point of the leaf, but in old ones they sometimes become obsolete.[8]

[8] n the books as hiring marginal spines, and >. Janata, HBK. Nov. Gun. I. 28§, from Mexico, in quotini as the representative of this type. But the inspection of the Berlin Herbarium proves this to be a factitious species, made up of Yucca flowers (similar to those of *Y. Treculiana)* and the spiny leaves of *Dasylirum acrotriche.*

Some importance has been attached to the number of leaves, which in healthy plants precede the development of the inflorescence, and there really is a relative difference in this respect in different species; but specific characters could hardly be based on a condition which depends so much on external influences of soil, climate, etc. From Dr. Mellicharap's notes it is evident that wild plants, in good health, exhibit a great many more leaves than cultivated ones, and that the number not rarely rises above one hundred on one axis.

The diagnostic characters derived from the leaves must be adopted only with great circumspection. The characters of the edges of the leaves are the most constant and reliable ones, though the abundance, thickness, and, still more, the length of the fibres, vary considerably, [25] even in forms of the same species. The shape of the leaf is quite variable, and more so still its color, its thickness, its stiffness (hence its direction), and the nature of its terminal spine; broader leaves with abundant parenchyma are apt to become plicate, while in the same species leaves of stronger fibrous structure are even. The characters derived from the roughness and the peculiar structure of the stoniatic surroundings, as above detailed, are also inconstant, and therefore unreliable.

INFLORESCENCE.

The inflorescence, which terminates the axis in Yucca, usually consists of a compound raceme or panicle of different dimensions, from two to three or four feet high, with differently developed lateral branches, and therefore of different shape, oval, lanceolate, or pyramidal, and in one species at least (the northern form of *Y. angu&tifolia)* reduced to a simple raceme or spike. This inflorescence is nearly sessile between the uppermost leaves, especially in the arborescent species; or it is raised on a longer or shorter scape, sometimes longer than the inflorescence itself, principally in the acaulescent forms. The scape bears reduced, bract-like leaves, those of the inflorescence itself usually becoming quite small and raembranaceous, or, in some southern species, increasing in sue, broad, concave and spathe-like, fleshy and discolored. The inflorescence is smooth or rough or pubescent, but no important value can be assigned to these differences. The pedicels are single or (on reduced branchlets) clustered, always distinct, but shorter than the flowers, curved, patulous, declined or pendulous, never, during the flowering period, erect

FLOWERS.

The Yucca flower consists of a PERIGONE of six oval or lance-oval segments, united at base with one another, with the stamens and with the pistil, and not articulated, so that they wither after flowering without falling off. The perigone, expanding only for one evening and night, forms a shallow cup of whitish, creaiu-white,[4] or greenish-white color, sometimes externally tinged with purple, of two to five inches in diameter; on the following morning, the fading segmeuts conniving, the flower assumes a globose or deep bell-shape, of one and one-fourth to three iuches in [26] depth.* The three outer segments are usually narrower and often a little shorter, and more frequently tinged with green or red along the midrib and tip; the three inner ones are broader (except apparently in *Y. Guatemalans;* where they are narrower), more jieUoid, of more delicate texture and color, and tipped with a small bunch of short white wooL They possess a certain, usually not pleasant fragrance.

The size of the flower and even the shape of the segments is extremely variable in some of the species (K *baeeata, Y. Treeuliana, Y. rupicola),* and can scarcely be used for diagnostic purposes.

• Th. flowvn of T *«*nalicul*ta* tr» datcri bed tad *figured* b U» BoUnUml Mapita tt "straw-yellow." gives an erroneous impression as to ...veloped flower.

The six STAMENS, in two series, but of nearly equal length, are adnate to the base of the perigone, and always shorter than this, and mostly shorter than the pistil; only in *Hesperoyucca* they are longer than the latter. Straight in the bud, they are frequently more or less recurved and even uncinate *after* maturity, in some forms more, in others less; but I am not able to discover a specific character in this change of form.

The filaments are fleshy and club-shaped, and in the true Yuccas covered, especially upwards, with transparent one-celled papillae or papillose hair; a minute point on the obtuse, sometimes slightly trilobed ape* bears the introrse anther. In *Hesperoyucca* the filament is smooth, thicker upwards, but with an acute tip.

The anthers are comparatively small, 2J or usually 3-4 mm. long; in exceptional cases, only in cultivated plants of *Y. angustifolia,* I have seen them 5-6 mm. long; they are sagittate or cordate at the base, rounded and entire or notched at tip, adnate on the back and two-celled; they open longitudinally just before the perigone expands, and contracting to one-third or less of their size and curling backwards, expel the large, comparatively scarce, globose, glutinous pollen-grains of 0.055-0.070 mm. diameter. The size and shape of the anthers seem to me to vary in the same species.

Eesperoyucca has smaller, deeply cordate, emarginate, somewhat didymous anthers* 1J—2 mm. long, and broader than long, bearing pollen similar to that of the other Yuccas.

The PISTIL in the true Yuccas is a cylindric or rather prismatic, obscurely six-sided ovary, [27] sometimes irregularly impressed and angled by the close application of the stamens in the bud, rarely attenuated at base; terminated by three more or less united stigmas, which are usually «essile,,or are elevated on a style formed by the gradually attenuated upper part of the ovary. Only in F. *Ouatemalensi** the ovary is more oblong than prismatic.

The ovary consists of three carpels, opposed to the exterior perigonial lobes, forming by their connection three primary dissepiments, each one bearing on two central placentae two series of numerous flat, horizontal anatropous ovules on very short (not long, as is sometimes stated) funiculi, separated from one another by a secondary dissepiment springing from the back of the carpel; the single ovules, however, are not separated by transverse dissepiments, as Gaertner has it.

The Yucoas with thick seeds and fleshy fruit bear thicker ovules (0.3-0.4 and even 0.5 mm thick), those with thin seeds and capsular fruit thinner ones (0.2-0.25 mm. thick), so that to some extent* we may, from the thickness of the ovules in well-developed flowers, guess at the section to which the plant may belong. *Y. gloriosa* and *Y. Treculiana,* however, have somewhat thinner ovules than the others of their section, and in some forms, which I class with *Y.JUamentosa,* I have found them occasionally as thick as these.

The three carpels are firmly united from the centre of the ovary to beyond the middle; here a thin tube, open at the base and top of the ovary, and from this to the external surface a more or less closely compressed slit, separate them. These slits open as the fertilized ovary grows, and in the flofihy-fruited species eventually form the three inner impressed sides of the six-sided pod-

The always glabrous ovary is either obtuse and abruptly terminated by the stigma (F. *aJaifolia),* or it is gradually attenuated into a conical or prismatic glabrous style, sometimes as long as the ovary, itself (F. *rupicoh),* which towards the tip ends in the stigmas. This style is an organ of great variability in length and thickness, and may or may not be present in forms of the same species.

Stigmas we conventionally call the terminations of the three carpels, which are distinguished from the ovary and style by their coating of transparent oval or globose epidermidal cells, which, however, as already stated, have no stigmatic function, not even that of gathering the [28] pollen. The three stigmas, emarginate or bilobed at the summit, are more or less united, and form a tube; they are generally erect, but in some species, especially in the true F. *Jilamentasa,* they are at. last patukus and even recurved The inside of the stigmatio tube, somewhat triangular in

the transverse section, with three pairs of tiny prominent ridges, corresponding to the commissures of the carpels, is coated with much smaller and less elevated, truly stigmatic cells, which exude the stigmatic liquor, under the influence of which alone the pollen can develop. The tube terminates near the upper ends of the three ovarian cells, and does communicate directly with them.

Hesperoyucca has an obovate ovary of a similar structure, crowned by a shorter or longer, sometimes filiform style, bearing a very peculiar, laige, hood-shaped, trilobed stigma, beset with long filiform papillae.

The color of the stigma is usually of a pearly white, while the ovary is dull or greenish-white; only in *Y. anguslifolia* I find the stigma bright green.

FECUNDATION.

The fecundation of the Yucca flower, as has been stated in the introduction, is very uncertain, and evidently depends on contingencies not always attainable; so that very often in its native condition, and almost always in cultivation in Europe, these plants remain sterile. The flower can only be fertilized by the introduction of the pollen into the stigmatic tube. This, at least in the capsule-bearing Yuccas, which alone I have been able to examine in the growing state, is accomplished almost always by a nocturnal insect, the *Pronuba yuceasella* (thus named by Mr. Riley and described in the next paper). Even where we are unable to observe the moth itself, ito traces are manifest in the presence of its offspring, the larvae, feeding on the maturing seeds, tunnelling their rows and finally emerging through a perforation of the capsule. Wherever, therefore, we find such perforated capsules, or merely the remaining annular rim of seeds, we know that *Pronuba* has been at work. The capsules and seeds of the Californian *Hesperoyucca* also show the unmistakable traces of this or a similar insect. On an average in our gardens, as well as in the fields of the coast of South Carolina, about two-thirds of the capsules and their seeds hear the marks of these larvre.

Of the baccate Yuccas, *Y. gloriata* and its allies seem to bear fruit very rarely, as neither [29] my correspondents nor I myself have thus far ever been able to obtain one; *Y. Trecu liana* is abundantly fertile in its native localities, but will not fructify, as Mr. Limlhcimer informs me, in the gardens of the same region; *Y. almfolia,* however, matures its pods more readily than any other species in Europe, where our moth cannot have an agency in it. We, therefore, are forced to assume that some other mode of fecundation, or even self-fertilization, can take place with them. Occasionally, no doubt, the moth performs its functions in the flowers of this species as well as in the capsular Yuccas. Dr. Mellichamp has found its larvic tunnelling the seed rows of *Y. abifolia,* destroying 10 to 14 seeds during its growth, and eventually emerging through the characteristic perforations of the surface. He discovered also another larva in the green pods of this species, the egg of which is evidently deposited into the rind of the ovary or young fruit, and which principally feeds on th0 immature pulp and only rarely attacks the Browing seed. This, Mr. Riley thinks, must be the larva of a hymenopterous insect, which has, perhaps, nothing to do with the fecundation of the flower. But how may these Yuccas be fertilized without the action of the IVomila ? Probably, occasionally! and, so to speak, accidentally by other insects, or possibly sometimes by the withering and conniving segments of the flower bringing adhering clumps of .pollen in contact with the sti^matic juices in the open tube. Such chances, however, seem to Ъе slim, not to say improbable, and in this case impregnation would have to take place on the day following the opening of the flower.

It has l>een stated above that the quantity of pollen is small, and that the grains are lai^e and somewhat viscid; thus, when expelled from the contracting anthers, they remain in little clump* here and there within the flowers, on the papillose filaments, or, more frequently, attached to the inner surface of the perigon. When introduced into the etigmatic tube and in contact with its seel*tion, its tubes are developed, and, when we carefully dissect a fertilized ovary, large bundles *d*

straight parallel tubes are found to fill the cells and to find their way, one to almost each ovule. I have followed them through both openings of the ovule, and found them attached with their enlarged end to the outside of the nucleus," separated from the germinal vesicle by two layers [30] of cells. It is probable that the minute, almost filiform, egg of the moth is carried with and between these bundles of pollen tubes as they elongate and push on into the ovarian cells and among the ovules.

As soon as fertilized the nascent fruit of the capsular Yuccas (and apparently also of *Clisto-yucca)* becomes erect and its pedicel thickens and hardens, while the young fruit of *Sarcoyucca* remains pendulous, as the flower was, and as afterwards the mature fruit is, and its pedicel more flexible.

The Yuccas bloom from the early summer months to the end of the autumnal season. The first one in the latitude of St. Louis (all cultivated plants) is *Y. angusiifolia,* which opens its flowers when the roses are in full bloom, from the middle to the end of May ; the true *YJUamentosa* makes its appearance next, about 10 or 14 days later; then come, one after another, different forms allied to the latter. Later than these, in July and August, *Y. aloifolia* unfolds its flowers, and *Y. gfa-iosa* very often, in our gardens as well as on the coast of South Carolina, blooms in September and even in October.

FRUIT.

The fruit of the Yucca is an oval or prismatic, more or less distinctly six-angled, more or less completely six-celled pod, usually with a short beak, bearing six rows of horizontal seeds. This pod is either pulpy and never opens, or it is dry and dehiscent, or it is 'intermediate between these extremes. Some of these conditions of the fruit were known to the older botanists; Linnaeus (Syst. Nat. ed. X., 1759, n. 388) has a *eapsula trivalvis;* Gaertner (Fruct II. p. 34, t. 85; 1791) figures and describes the fruit of " *Y. Vraconis",* as *bacca carnosa . . . . non secedens;* Nuttall (Gen. L, p. 218; 1818), says: *capsule opening at the summit;* but he mentions that of *Ygloriosa* as *pulpy;* Endlicher (Gen. n. 1117; 1836) tries to reconcile the apparent discrepancies by describing the capsule as *wbbaecata, demum dehiscent;* Kunth, Enurn., and later botanists have followed Endlicher. In the Botanical Notes to Wislizenus' Memoir of a Tour to New Mexico, etc., 1848, p. 101,1 first distinguished the Yuccas with "juiceless capsules and thin seeds" from those with " succulent fruit and thick seeds." Subsequent American botanists (Torrey in Bot Mex. Bound, p. 221, and especially Chapman in Southern Flora, p. 485), confirm and adopt these differences. In [31] S. Watson's Botany of the 40th Parallel (Utah and Nevada), 1871,1 have briefly characterized the four sections of Yucca, as I now understand them.

The fruit in some Yuccas is pendulous, pulpy, and indehiscent, with a sort of crown or disc at base, consisting of the enlarged remnants of the perigonial segments and the stamens *{Sarcoyucca)*; in another, thus far only imperfectly known species, the originally fleshy fruit eventually dries up, and constitutes a spongy pericarp, which never opens, and is apparently erect, with a disc at base like the former *(Clistoyucca)*; in a third group, the erect fruit is dry and capsular, the base is contracted into a short obconical stipe; it opens with three valves corresponding with the carpels and dividing the primary dissepiments, the valves finally divide again at tip *(Chamoyucca);* in the fourth group, represented like the second by a single species, the pod is similar to that of the last section, but opens at tip through the middle of the carpels loculicidally, the three valves remaining entire *(JTesperoyucca).*

The secondary dissepiments are usually incomplete at base and top, and, at least in one form (K *JUamerdosa).* they are often rudimentary throughout; in *ffesperoyucca* they seem to tear irregularly at the dehiscence of the capsules.

All the Yucca fruits, but more especially the capsular ones, and those of some species more

than of others, are extremely variable in shape, and this seems to be caused principally by the irregular development of the seeds. When these fail near the middle, the capsule becomes constricted (very often in the true *Y. JUamentosa);* when near the top, it usually is beaked (forms of *Y. rupicola)*; so that definite diagnostic characters cannot be derived from these apparently so well-marked differences in the shape of the capsule. In the species just named, and in the *Y. baccata,* the beak of the fruit may also be the result of the development of an elongated style.

The substance and the surface of the capsules would also seem to afford good distinctions, for we find the capsule in some, thin, membranaceous, aud smooth; in others, thick, ligneous, cross-wrinkled, with thick carinal and also lateral ridges, aud sometimes warty; but I have observed such differences in forms of the same species, and especially in *Y Jilamento&a,* which seems to be one of the most variable species, perhaps, only because we know more of it than of the [32] others.

SEEDS.

The seeds of the Yuccas are compressed, of a triangular-obovate or obliquely ovate, or sometimes even orbicular form, the straighter inner margin with the indistinct rhaphe corresponding with the secondary dissepiment, aud the angle at its base containing the hilum. They vary in size from 6-12 or 13 mm. in diameter, and 0.6-3.5 mm. in thickness. The thin, black, more or less opaque testa exhibits under a strong power elevated cells or tubercles, each with or without one or several pits or impressions; in some forms these cells appear larger aud irregularly rugose, but I have, thus far, not been able to discover constant specific characters even in the seed surface.

The seeds are of three different forms, corresponding with the three kinds of fruit The baccate Yuccas have the thickest seeds (2.0-3.5 mm.), of an uneven rugose or undulating surface, with a very narrow two-edged rim, and a deeply lobed or ruminated albumen, as already indicated by Torrey, in Bot Mex. Bound., in the instance of *Y. baccata;* I have been able to examine only the seeds of this species, *Y. uloifolia* and *Y. Trcculiana. Clistoyucca* has a thinner seed (2 mm.), with a little more distinet rim, and with an even albumen. All the capsular Yuccas have the thinnest seeds (0.&-1.2 mm.), with a very distinct, narrower or wider, thin and brittle maigin, and with an even albumen.

The serai-transparent, hard, almost corneous, farinaceous and oily albumen (ruminated in *Sarcoyucca,* plain in all the others), contains the straight or mostly more or less curved axile embryo, which extends diagonally from the hilum, to which the short caulicle points, almost to the opposite margin, thus attaining the full length of the albumen. Only very rarely and in imperfect seeds I have seen a shorter embryo, such as Gaertner figured and Kunth described, as being less than one-half or ouly one-fourth as long aa the diameter of the albumen. The slit in the base of the cotyledon, under which the plumule is concealed, shows the cotyledon to be about four or five times as long as the caulicle

MONSTROSITIES.

I have seen very few abnormal development* of Yuccas, and these only in the flowem. Tetramerous flowers with an eight-parted perigon, eight stamens and a fouissarpellaiy ovary [33] and fruit, more or less regularly developed, am not quite rare in cultivated as well an wild plants. In oveigrown garden specimens of *Y. angHtti/oUa,* I have seen floweis irregularly doubled, the number of perigonial lobes increased, some of them yet bearing the traces of anthers, or filaments bearing perfeot anthers, with petaloid excrescences or wings, also filament* adnate to the ovary, and •ome of them even tipped with the green stigma of the species. In a cultivated form of *Y. JUa-r*eiUo*a*$_t$ the floral axis was elongated, the perigonial segments separated and increased in number, the exterior somewhat ibliaoeous and bearing regular or inegukr axillary flowers.

GEOGRAPHICAL DISTRIBUTION.

Yucca is a peculiarly American genus, the limits of which were said by the old botanists, Linnaeus among them, to extend from Canada to Peru. It is certain, however, that no Yucca grows in Canada, and I find no evidence of any being indigenous in countries south of the Equator. The greatest development of the genus is found in Northern Mexico, and the Southern United States, to the Pacific, principally between the 25th and 38th deg. N. lat. On the eastern coast, one species, *Y. JUamentosa,* extends as far north as 38°, while on the western so much milder slope, they are not found farther than 35°, or perhaps 36°. On the western plains, the hardiest species, *Y angustifolia,* reaches as high up as 44° or 45°. Southward, a form allied to *Y ahifolia* has certainly been met with in Yucatan ; and another species, *Y. Guatemalensis,* is said to be a native of Central America. I have seen no specimens from the West Indies, though many authorities credit these islands with *Y. aloifolia,* nor have I seen any from South America.

The capsular Yuccas represent the low or herbaceous northern type of the genus; all the known species belong to the United States, and only two of them *(Y angustifolia* and *Y rupicola)* extend beyond the Rio Grande into Northern Mexico. The baccate Yuccas are the more southern, caulescent forms, and some of the species do not come up into our territory. The eastern and western species are entirely limited by the Mississippi, which none of them seem to cross. *Y angustifolia* is a native of the great plains from north to south, and also extends southwestwardly into the mountain region; *Y. rupicola* inhabits the southern portion of the [34] plains. *Clistoyucca* and *Hesperoyucca* are southwestern types, peculiar to Arizona and California.

SYSTEMATIC ARRANGEMENT.

In the foregoing pages it has been shown that in the fruit and seed we have excellent characters for the arrangement of the species of Yucca into several very natural groups; the nature of **the edge** of the leaves furnishes proper subdivisions; the specific characters are based upon the differences of trunk, leaves, flowers, and also of fruit and seed.

YUCCA, LIMN.

Perigonium patulum demam globoso-campanalatum 6-partitum subpersistens; segmente lanceolato-ovata acattucula; filamente clavate multo breviora; anthers biloculares introreum dehiscent* para; pollen globosum; ovarium tricarpetlara triloculure, loculi incomplete bilocellati: stigmata 3 enuuginate plus minus connate tutum stig-"toticum effomiontia; ovula pluriina compressa horiiontalia anatropa brevissime funiculata 6-seriata; fructus Inccatua •ea capeukris inconutlete 6-IOCUIAHS; semina obovato-triangularia compreasa borizontalia 6-Heriate nigi-a, embryo diagonals albumini corneo cquilongus.

Plant* in America tropica cis nquatorom et procipue in boreali calidiore indigene; caudice arborescente elatiore •el huiniliore, anpe hypogeo ; foliig in apice caudicis confertis lineari-lanceolatis crasvis rigidis ran us flaccidis apice plerumque spinescentibus; panicula terminali raultiflora subsessili vel in scapo bracteato elata; floribua majoribus •IWdia pendolis noctumia.

I. EUTUCOA : filamente davaU obtusa papillos apUtillo plerumque breviora demum patula Tel recnira; anthene coidato-aagitteta ; ovarium prismaticum ; stigmata papillosa.

A. SABCOTOOCA : fructus indehiscens baccatus pendulus; semina crasw undulate immaiginate albumine lobato-ruminato. PlanUe pleruraque arborescentes panicula saepius sessili.

• Folia maiy™ semilato-asperate.

1. YOCCA ALOiroui, *Linn.:* **caule elatiore ; foliis lineari-lanceolatis supra leviter concavii none rigidis pungen-**»• leribus margine aiperrimis; bwcteis paniculas subsessilis ovata vel oblongae glaberrimw minoribus triangolaHbos marcesotntibus; perigonii segmentis ovatis ; staminibus ovarium prismaticum rtigmatibos sessilibut [36] brevibus onssis rtctis eofooatom nono »quantibus demum patulis; bacca prismatica (Wangnlari acatiuscula.**

Forma genuina: simplex vel parce ramosa ; foliis crassis rigidissimis niucrone valido brunneo pungentibus. — *Y aloifolia,* Linn, et auct. plur. *Y. Draconis* ?.Elliott, Bot. I. 401.

Var. j3. *Dracmis:* elatior, subsiinplex ; foliis laxioribus ssepius demum reflexis mucroue debiliore pungentibus. — *Y. Draconis,* Linn.

Var. y. *conspicua:* e basi ramosa ; foliis laxioribus supra lucidis in mucroneni debiliorem virescentem excurrentibus. — *Y. conspicua,* Haw. Suppl. pi. succ. 32.

I have seen native flowering and fruiting specimens of the genuine plant only from South Carolina, whence Dr. Mellichamp has abundantly supplied fresh and dried material, and from Florida ; it there grows always near the coast, often and apparently most luxuriantly under the direct influence of salt water ; it extends to North Carolina and to the eastern Gulf States ; it is also credited to the Wast Indies and to the eastern coast of Mexico; but on the shores of Louisiana and Texas it seems to be unknown. Var. /3. is said to be a native of South Carolina ; var. y. was described from plants cultivated in English gardens; its native country is unknown ; my description is taken from several magnificent specimens *in* the lx>tanic garden of Naples probably correctly named.

On the coast of South Carolina *Y. aloifolia* grows 6-8 or very rarely 1(>—12 feet high, mostly simple, sometimes in favorable localities with a few, often three', branches ; trunk seldom more than 4 or 5, at most 0 inches in diameter, only the lowest part of the oldest ones covered with a rough dark brown bark ; higher up the marks of .the leaf-bases are seen, while the upper part is coated with the withered and dependent leaves themselves, persistent for years ; the rigid foliage forms dense heads, the leaves, in £ J or even higher orders, are narrowest above the very broad base, and widest about the middle. I find them in the native specimens usually 18-24 inches long, and lj—2 inches wide ; grown in the shade, they reach a length of 24-32 inches by 1-} inches in width ; under the direct influence of salt-water on the sandy teaches of the islands near Charleston they have been found shorter and broader than [30] usual (18-21 by l$-2& inches), and it was here that the three-branched plants were observed. In cultivation the leaves are 12-21 inches long, and 1-,1£ wide. Dr. Mellicbainp has sometimes, in plants growing clone to the beach, seen the upper surface of leaves incrusted with a white deposit, which might be taken for saline efflorescence, but proves to be carbonate of lime, with a very delicate film of organic matter representing a cast of the epidermis cells; probably an exudation from these cells of oxalate of lime altered by oxidation.

The flowers open in July and August, and in the evening expand 3-4 inches, while in daytime they are l|-1j inches deep. I find the stamens, in native aft well as in cultivated plants, as long as the ovary, often as long as the whole pistil and occasionally even overtopping it. The unusually stout ovary with the short stigma is 9-11 lines long, the ovules I found 0.35-0.38 mm. thick. The pod is 2J-3 times as long as it is thick (3-4 by lf-1 j inche*X six-sided, the sides corresponding to the cur]>eL) more elevated, tlie alternate ones shnqily di>prefi84*1 and turning purple before the rest of the fruit, which at last assumes a deep purple^ color innide and ouUide, has a sweet not unpleasant taste, and is much eaten under the name of Banana. It in always acutish but never rostrate, distinctly tipped with the 3-lobed stigma preserving iu tube, whence the fruit is described as " perforated at the apex." The seeds, 6-7 mm. in diameter by 2^-3 in thickness, are.very similar to those of all other Sarcuyuccas examined by me.

Var. *Draconii* I cannot distinguish from the last except by the leaves being said to be less crowded, longer, softer, less pungent, and somewhat flaccid and curved. It in said to come fn»ui the same region where my specimen*, above described, were obtained, and may p<*ma|M lie the form with very long leaves grown in the shade, described above. The plants, cultivated here and there under that name, may in part be *Y. GuaUmaUniis,* described below. #

Var. *corupicua,* or at least the plant cultivated under that name in the botanic garden at Naples, differs from the type by its softer, though not pendulous, leaven, with a green scarcely pungent point It there makes large bushes, over 20 feet high, branching abundantly from or near the bane, the thickest trunks 6-9 inches in diameter. I notice that the panicles sometimes three feet long, are almost sessile on the older trunks as they usually are in [37] this section ; but in vigorous young shoots they are borne on a scape of nearly their own length. When I examined the plant* they had not borne fruit for many yean, though flowering abundantly ; I learn that they have been fertile since, but have not obtained the pods.

There are other forms of serrulate Yuccas, most probably of this section, described in the book* or enumerated in the catalogues of nurserymen, which are entirely unknown to roe. *Y.* •frrWo/a, *crenulala, arcuata, tm*tfoK*> &* named but scarcely descrilied by Haworth (Suppl. PI. succ), about fifty-four years ago, from cultivated, partly WT young plant*, and not known now. *Y.* mprro, *Pormentari,* and *albo^pica* of the catalogues, undescribul, as I believe, will probably prove in part to be forms of *Y. abi/olui,* and the name* which cannot be identified now, the origin*! types having perhaps disappeared from the pnnien. and their native country being unknown, ought to be dropped. The two following, however, of which at least their flowering state and native country are known, are believed to tore a claim to specific distinction.

*. YCOCA YUCATAKA, *nor. gpu.:* elaU, e basi ramosissima ; foliis UneeoUto-linearibna versos basin vix angusta-Us caraoau brtviaribus nurgine tenuisaime asperatis demum patulia recurvisve; panicnla ovata mbtwaiUi

pubescentis bracteis ultimis lanceolatis albis ; florum minorum segmentis ovato-lanceolatis, staminibus demum uncinato-recurvia ovario prismatico stigmatibus parvis erectis eiuarginatis coronato jnulto breviorihus.

Ruins of Nohpat, Yucatan, collected in flower, Nov. 24,1865, by Dr. A. Schott, who, not only by his specimens, but also by notes and sketches, aided me in drawing up this description. — Habit of the plant very similar to that of the above described var. *conspicua ;* about 20 feet high, branching abundantly from and near the base ; leaves in the specimens before me 14-16 inches long and about 1 inch wide, thick, fleshy, smooth, but apparently not rigid, with extremely slight marginal asperities; points of leaves in my specimens broken off. Panicle densely villous, bracts fleshy, whitish; flowers spreading about 2 inches, segments 14 lines long, less than half as wide ; pistil similar to that of *Y. aloifolia,* but stamens much shorter and anthers smaller. It is quite possible that this plant is already in cultivation and may have received a name not known to me, but no accessible description agrees with it. [38]

3. Y. GUATEMALENSIS, *Baker in Saunderi Refug. bot. V. L* 313, *Jul.,* 1872 : elata; foliis majoribus lanceolatis leviter concavis planiusculisve lacvibus tenuioribus margine levissime asperatis mucrone concolore vix pungentibus demum patulis ; perigonii majoris segmentis lanceolatis sun»um angustatis, interioribus angurtioribus longioribus ; fllamentis apice patentibus ovario prismatico-oblongo stylo brevissimo stigmatibusque profunde bilobis patulis coronato brevioribus.

Prom " Guatemala and Mexico " ; flowered in the Kew Gardens in September, 1871, whence through Mr. Baker I obtained dried specimens. That plant was 8 feet high, with leaves 2^-3 feet long, and 2^-3 inches wide ; panicle sessile between the upper leaves, ovoid, 2-3 feet long; flowers spreading apparently 5 inches, with narrow segments (3 inches long and }-1 inch wide) and, an unusual case, the inner ones narrower than the outer. The most characteristic part of the flower is the ovary, which ẅ only twice as long (J inch) as it is thick, and bears on a short style 3 deeply and acutely bilobed spreading stigmas ; the walls of the carpels are unusually thick, the ovules themselves have the diameter of others, but are very thick (0.5 mm.), indicating very thick seeds and a pulpy fruit, which will probably be also found short and thick.

This species is said not to be rare in collections, but seldom to flower; it seems that it is often taken for *Y. Drawnii,* and it nuilly resembles the typical figure of that plant by Dillenius. In the botanic garden of Rome are several fine specimens named thus, which I scarcely hesitate to refer here ; they are 15-18 feet high, 1 foot in diameter at the enlarged base, not branched • ; leaves 3J-2} feet long, 2-2J inches wide, much contracted al>ove their very broad base, thin and somewhat flaccid or even pendulous, glossy on the upper surface, delicately serrulate and with a very weak point. The plants have not flowered. ^ „. . .

• • Folia margine Integra.

4. YUCCA GLORIOBA, *Linn.:* caule humiliore nunc ramoso; foliis lineari-lanceolatis versus basin latam *ngU8tatẅ supra plano-concavis irepius plicatis opocis fere glaucescentibus doreo asperuliR pungentibu*; panicula angustiore nunc pul>csccnte pedunculata folia excedente, bracteis e basi lata lanceolatis, summis marceacentibus ; staminibuA ovarium prisinaticum apice attenuatum stigmatibus gracilioribus coronatum subaquantibus, effcetU tincinatift. [39]

Forma gmuina: folii* latioribus rigidis rectis ; panicula angusUi pulxwccnte SPU gliibrata.

Var. *p. plicata :* foliis Litioribus tenuioribus valde plicatis exterioribun patuliM; ñhimentis parce papilloRía ovario sequilongis Jemum ciirinato-unciimti* ; stigniotibua distinctis subdivergentibus basi in stylum brevem contractis.

Var. *y. recurvifolia:* foliis debilioribu* patulẅ recurvia, junioribus glaucis; panicula subpuberula; filamentis parce papilUi* piritilluin wiuantibus. — *Y. recurvifolta, SnYwh.*

Var. ft. *planifolia:* caule hrevissimo ; panicula ovata gubsessili folia angustiora plana viz excedente staminibus pistillum »|imntil»us demum uncinatin; stiKmate brevi craiwo seiwili.

North Can.lina to Florida on sandy sea-beache*. — All the specimens I have seen came from South Carolina, And belong to the principal form. Their stem i« from a few inches to 4 or 6 feet high and 4-6 inches in diameter, simple or with a fi?w brunches ami even the oldest ones entirely covered with a shaggy coat of old withered pendant k-aves. Leaves 2-2| fwt long and U-2J inches wide, stiff, sharply pungent, very frequently longitudinally folded, the narrower ones sometime* even. *Tẅ* edge of the young leaf is pale and usually delicately serrulate toward the base ; later it turns brown and brittle, the asperities diAnp|K»r, and it ĺN apt to crumble off or occasionally to detach itself in a few fibres. The Hurticc of the leaf is of a dull, often pale or glaucous green, and on the under side, ««]*;-ciftllj towani* the tip, rough with umall asperities. The panicles (2-4 feet long, 1-1 £ feet in diameter, contracted topwaid and downward, where the flowers often spring directly from the main axin) arc mined al>ove the leaven on * stalk of their own length or shorter, beset with herliareoun bracU, lanceolate from a broad base ; ultimate bract* of •ame shape, small and membranac«ous; panicle, or at least the pedicels, often pubescent, or nearly or quite glabrous,

* Shoots hart been cut off from the base f The** mitimfc-d plants are often altered In appearance by trimming and by the 'ttuoval of the *dmi* laaraa, which Ufl to nature would continue to cover the trunk for several feet below the living leaves.

Flowers, as in the genus, wide open in the evening, 3£-4 inches wide, whitish, tinged externally with green or brownish or reddish green; segments ovate, acute, or nearly lance-ovate, the inner longer and wider than the [40] outer ones, minutely pubescent at tip (which, perhaps, is meant by Elliott's "sparingly ciliate"). Stamens often as long as the whole pistil, or at least as long as the ovary, straight at first or only patulous, but at last mostly recurved and even variously twisted ; filaments in some forms scarcely papillose, in others strongly hispid; anthers deeply emarginate at tip; stigmas narrower than the prismatic ovary and much longer than wide, divided upwards and at last somewhat divergent; the ovules thinner than usually in this section,—iu the wild flowers examined by me 0.25-0.30 mm., in cultivated ones 0.25-0.33 mm. thick. I have not been able to obtain the fruit, which is said to be 6-niigled, pulpy, and of a deep purple color, by Elliott and by Nuttnll, both of whom singularly enough omit to describe the much more common fruit of *Y. al&ifolia.* The seed which was sent to me is smaller and thinner than that of that species (5.2-6.0 mm. in the longest diameter and 1.8-2.0 mm. thick), but otherwise very similar to it—The flowering time seems to be July to October, very often in South Carolina in autumn.

The cultivated plants which I have seen scarcely differ from this form ; their flowers are sometimes larger, and either whitish or cream-white, or very often externally greenish-purple; they seem to open usually in July and August, or sometimes later in the fall.

Y. acuminata, Sweet, and *Y. obliqua,* Haw., garden species, the native country of which is unknown, seem to belong to the typical form.

The variety which I have distinguished as var. *plicata* I have found under the name of *Y. plicaia* in Mr. G. Thuret's gardens at Antibes near Nice, flowering in February and March ; it has a trunk over 2 feet high, with thin but stiff much folded leaves, 11-2£ feet long and 2-2} inches wide, glaucous above, rough beneath, serrulate near the hose; panicle large, flowers over 4 inches wide, externally tinged with brown-red; stamens as long as the ovary, which is contracted into a narrow neck, a sort of a style, bearing the thicker, divaricate stigmas.

Var. *recurmfolia* is the well known and commonly cultivated, elegant garden form, said to come from Georgia, where Elliott also seems to have seen it, but nobody apparently has found it since. I cannot distinguish it from the type but by the flaccid, gracefully recurved leaves. *Y. recurva,* Haw., and *Y. pendula,* Sieb. and [41] Carrière, nre synonymous, and *Y. superba,* Haw., *Y. rufocincta,* Haw., seem not to differ. *Y. ensifolia,* Baker, R?f. hot. V. t. 317, and the smooth-leaved *Y. Ellacombii,* Baker, Gard. Chron. 1. c, *Ref.* hot. ib. t. 318, are intermediate forms connecting this variety with the typical plant

Var. *plani/nlia* is also based on a single 8|>eamen, which I found in September, 1868, in flower in the botanic girden of Genoa, under the name of *Y. gliuca.* Its short trunk, long and narrow *(2* feet long, lj inches wide), even, not at all plicate leaves, and especially the short stigma, which is almost as thick as the ovary and resembles that of *Y. aloifolia,* distinguish this form. Flowers whitish, smaller, 2 or 2} inches wide; ft 1 amenU as long as the pistil; anthem small, entire alxive ; ovules only 0.26 mm. thick; fruit unknown. Could it be the *Y. glauca* of gardens ?

Yucca flexilis, Can\, Rev. Hort. viii. t. 89, to which Mr. Baker refers his *Y. pruinosa,* Gard. Chron. L c, and *Y. tortulata,* Baker, ib., may be smooth-leaved forma of *Y. gloriosa;* they are thus far only known as acaulencent, and in foliage only. Leaves of both 2-2} feet long, \\ inches wide, stiff and pungent; the edges serrulate toward the narrowed base.

Yucca Bocrhaapii, Baker, Gard. Ch. 1870, p. 1217: caulescent, e basi latissima laQceolato-linearibus elongatU infra vix angustatis plan is hevitwimig, in mucronem herbaceum moll em excurrentibus.

This plant makes a short trunk ; leaves 27 inches long, about 9 lines wide, with traces of marginal denticulation; flowers are unknown. — It may be an extreme form of *Y. gloriota.*

YUCCA DESMETIANA, *Baker.* 1. c : caulescent, foliis plurimifl lanceolato-linearibus brevibus versus basin angustiorem obsolete denticulati* crawia laevksimis in mucronem vix pungentem exciinvntibiis.

This little plant is cultivated in many garden*, but has I believe, never flowered. The very fleshy purplinh-green leaves are only 10-15 inches long, 6-9 line* wide, and scarcely pun^nt. It* native country is unknown.

5. VUCCA TRBCOLUNA, *Carrvert lUv /fort.* vii. *p* 280, 1858, *Baker, Gurd. Ch.* L c. *p.* 828: caule elato ntnioso; foliis longissimis rigidiasimi* profunde concavo-canaliculutis marline bmnneo aernilati* tune integris denium parce filamentous pungentibus aubtus a»perrimi*; panicula densiflora ovnta subsraili lcviuscula, bractcis infe- [42] rioribufl amplis o vat is *eu ovato-lanceolatw pungenti-cunpidatin perganienteceis albidifl, sumniis ovntis seu Unceo-latis albis; staiuinibus pistil lo vix brevioribus uncinatis; ovario prinmatico in stylum stigniatibut gracililnis coronal urn attenuato; bacca fere cylindrica elongate rostrate. — *Y. Umgifolia,* Eugelia. iu scbed. 1846; Buckley in Pwc. Acad. Phil. xiv. 8, 1862.

Texas from the MaUgnrda Bay and the Braxos and Guadalotipe, south and south went ward into Mexico, at least as fa *• Saltillo, Parras, and Chihuahua, on the tea-beach and in the interior, on the gravelly overflowed banks of •&Mms and on the stony declivities of their slopes ; flowering in April and May. — Specimens from Texas and fall »oUs were supplied by F. Lindheimer, Mexican ones by Dr. Wisluenos and Dr. Gregg.

This is perhaps the most magnificent Yucca known; trunks 6-15 and, even in Texas, sometimes 20-25 feet high, and 1-2 feet thick, terminating in several (sometimes 5-7) branches, each one bearing a crown of long rigid leaves, and often a panicle 2-4 feet long of something like 500 flowers. The bark of very old trunks has been noticed above ; younger stems are covered with the reflexed withered foliage. — Leaves longer than in any other species, 2J-3 and very often 4, or even 4£ feet long and 2-3J inches wide when flattened out, deeply channelled and quite semi-circular in the cross-section, thick, rigid and straight, "bright sea-green," very rough on the back, less so on the upper surface, terminated by a stout brown spine. The edge of the leaf at different stages of development partakes of the character of all the three forms, as to a less extent also do the leaves of *Y. yloriosa;* the margin of the young leaf is deep brown with a pale, cartilaginous, strongly serrulate edge; then it becomes smooth and at last is often detached in brown rough fibres.

The short peduncle or scape of the inflorescence is 1-2 inches in diameter, the panicle 2-4 feet long, much branched and dense-flowered, glabrous or sometimes upwards pubescent, bearing large conspicuous bracts 4 or 6 inches long, 1-3 wide, concave, fleshy or leathery, greenish outside, whitish inside, with a sharp herbaceous or brown point; the ultimate small bracts arc similar, mostly ovate-lanceolate; in Mexican specimens from Parras they are thinner, oblong, obtuse, and pure white.

The flowers vary from 2 to over 4 inches in expansion, and, if I may judge from the dried specimens, are [43] remarkable for the unusually narrow, ovate-lanceolate, acuminate segments of the perigone, 1J-2J or even 2 inches long, and about J as wide, and conspicuously pubescent at tip ; in the Mexican forms I find the segments more ovate and of the ordinary shape of most Yucca flowers, and only 1 J-ty inches long. The very slightly papillose filaments, as long as the ovary mid ervct in the bud, soon become recurve<l-hooked. The prismatic ovary terminates in a slender, short or longer style, crowned by deeply divided strongly bilobed stigmas. I find the ovules invariably thicker (0.4-0.5 mm.) than in any of the foregoing species.

The fruit is a pulpy cylindric, or rather indistinctly 6-sided, somewhat sulcate and 3-lobed, strongly rostrate berry, 3-4 inches long, about 1 inch thick, of a bitter-sweetish pleasant taste, much eaten by the Indians, who roast them and peel off the acrid rind. Seeds 6-7 mm. in the longest diameter, and 3 mm. thick, very similar to those of *Y. aloifolia,* but with the back less rounded.

Yucca eanalkidata, Hooker, BoL Mag. 86, t. 5201, 1860, described from a plant cultivated at Kew, with a stem 1-2 feet high, leaves 2 feet long, concave, semi-cylindric, rough on back, very prolwbly is not different from our plant; the flowers, in a peduncled pyramidal panicle, 4 or 5 feet high, are described as sulphur-yellow, but are stated by Baker in Gard. Ch. 1. c. to be cream-white. —A specimen in Mr. Henry Shaw's Missouri Botanical Garden, thus labelled, flowered in April, 1872 ; its trunk is 4 feet high, the leaves 2*-3 feet long, panicle 2 feet long, lj feet wide, very densely flowered ; flowers 3-3| inches wide, segments ovate acute, outer 8-9, inner ones 9-11 lines wide ; filaments strongly ^curved even when the flower has barely oi>eiicd ; anthers very slightly notched above, with a bunch of white articulated hair, corresponding with the hair at the tip of the perigone.

Yucca glaum, Sims, as understood by Baker and figured in Refug. I>ot. v. t. 315, and *Y. exigiia,* Baker, ib. t. 314, Which can scarcely be distinguished from it, are classed with the acaulescent entire-leaved Yuccas, though the former bear* a few fibres; their fruit, in Europe unknown, may possibly be capsular, of which more at the proper place. Both are characterized by the conical attenuated stigma.

Y. orchurides, Carriere, R*»v. Hort. 1861, p. 369, t. 89, as quoted by Baker, is descrilxsd as the smallest of [44] •11 YUCCA* P'ternlcs* like the last, with few short, soft-pointed leaves (9-10 inches lonp, 1 inch wide, almost fl**); scape with a simple pubescent raceme only \\ feet high, perianth 1 inch deep; native country unknown.— Could it be a dwarfed variety of some other form, possibly of the last-mentioned *Y. glauca ?*

• • • Folia margine filifera.

6* YUCCA BACCATA, *Torrty in Bot. Hex. Bound.* 221, 1858 ; *Ivafs Rep. Bot.* 29: Acaulis seu pierumque caulescent; foliis anguste lanceolatia venms banin dilataUm angustatis crassis rigidissiinis scabris mucrone brunneo robusto pungentibua concavU ; nmryine filis crassioribus ornatis ; panicula hrevius seu longius pedunculate plerumque levi, bracteis inferioribtu amplis ovato-inuccoLitis cuspulati* pungcntilms perpamentoceis supra ftlbidis, ultimis lanceolatis ; stnminihiis dt»mum patuli« vix reeurvis ovarium prismaticum fere aequantibus ; stylo vario mine elongato ; bacca tcpius ovate strata. - *Y. crnsn/Ua,* Enpelm. in sched. 1848.

Forma genuina: boreolis, stolonifera ; caule nullo seu brcviore ; foliis lonflioribus latioribus asperrirais rigidiuimia, filis margim&Jihtii) craasis cineivis ; segmentis floram mRxnonim angustin, stylo elongate.

Var. 0. *auMtralis:* caule elato ramono, foliis tenuioribus Iscvioribus, filis marginal ibiis ten u ion bus scpe brunneis; segmentis florum minorum ovatis, ntylo breviore.

A •onthwentern specie*, extruding from Southern Colorado, *C Thnnat,* to New Mexico, *Dr. Widiunu*, A. Fendler No. 849, Ch. Wright, Dr. Bigdov,* and West Texas, *A. Srhott,* and into Southern Uteh, */. E. Johnson,* Arizona, *Dr. *• Palm*,* GalifornU (Lou An«elct, *Capt. RUSMII,* Prr,vi«lrnce Mountein, *Dr. J. 0. Cooper,* Monterey, *Ih. Parry),*

and far into Mexico (Chihuahua, *Dr. Wislizenus,* Parras, *G. Thurber,* and Saltillo, *Dr. Gregg*). — Flowering season according to latitude from March to June, or in Northern Mexico, where with the rainy season a second spring opens, often again *in* August and September.

The very full series of specimens before me satisfies me as to the great variability of this species, the extremes of which are so very dissimilar. The typical plant toward its northern limits is stemless, more southwardly it makes trunks of 1 or 2 to 8 or 10 feet high, covered with the refracted dead leaves. Leaves 1J-3 feet long, 1-2 inches [45] wide, narrowed downward, gradually attenuated into a very stout, sharp or blunt brown point, channelled or quite concave, thicker than in most other species, very stiff and rough, especially on the back ; on old branching plants Dr. Palmer found the leaves scarcely over a foot long and an inch wide, but very thick. The fibres are as thick as ordinary twine, and often regularly curved backward. The panicle of the stemless form is raised on a scape of almost its own length; in caulescent ones the peduncle is shorter. The exterior bracts are 4 or 5 inches long and 2 wide, similar to those of the last species, but narrower. The flowers are large, spreading 4-5 inches, segments 2J-3J inches l°ng> §-1 inch wide, stamens papillose-hispid, as long as ovary, rarely at last reflexed ; pistil 1-2 inches in length, style slender, unusually long for the genus, in the largest flowers equalling the ovary, in others £ or only J its length ; ovules about 0.4 mm. thick. The fruit is a dark purple berry, oval, "about the size and shape of a hen's egg," with a very distinct and often elongated beak, which is marked with six grooves, while the fruit itself is not angled or grooved. Some fruits I have seen were 3 inches long and 2 in thickness, with a beak of about half their length; one fruit from Arizona was 5 inches long, cylindric and curved. The base is protracted below the remnants of the perigon, which is not the case in the fruits of *Y. aloifolia* or *Y. Treculiana ;* the]KR1S of these three species are remarkably distinct, and always easily recognized, while the seeds themselves are very similar. The fruits are said to be "savory like dates," and are eaten fresh by whites and Indians, and cured by the latter for winter provisions. Dr. Palmer informs me that the Arizona Indians find the stewed flower-buds and flowers quite pleasant and nourishing. The seeds are often distinguished from those of the other Sarcoyuccas by their large size, 10-17 mm. in the longer diameter and 2-3 mm. in thickness ; but other fruits from the same regions have seeds only 7-8 mm. long and 1.8-2 mm. thick.

Var. £., the southern or Mexican form of this species, is principally distinguished by it* smaller flowers, 2-3 inches wide, with ovate or lance-ovate segments 1 J-1 j inches long ami usually more than half as wide ; by their short style and the somewhat thinner, less rough, leaves with thinner, often red-brown fibres; the jmnicle is sometimes pubescent. Dr. Gregg notes that it is very abundant in the plains and valleys aUnit Saltillo; his statement is [46] almost incredible, and is not supi>orted otherwise, thut sometimes it reaches the height of fifty feet, with leaves 1-3 feet long, '* seed said to be actively purgative." Prof. Thurber brought from Farms leaves and fruit of this species, an account of which, together with a cut, is found in Bartlett's Personal Narrative, II. 401: "a plain covered with Yuccas presents a beautiful appearance when in flower in pyramidal spikes several feet in length .... the trees 25-30 feet high and 2-3 feet in diameter, with ten or a dozen branches." He mentions that the fibres of the leaves are used for cordage, the trunks for palings or they are split into slabs for the covering of huts; thn tender top of the stem is roasted and eaten under the name of *quioU ;* the edible fruits arc called *latin**. A specimen of the latter I find oval, 2 incites long, with a beak of | inch ; needs small for the sjweies. We learn in the uliove account that the inflorescence is pyramidal ; the cut represents it a* sessile or |>eduiuled, and alxmt 3 times as long as wide.

The Califoroian forms are in foliage intermediate* between the northern and southern extremes; a leaf collected at Monterey and distinguished by iU narrowness (lews than j inch wide) prolNibly indicates the northern limit of the species.

The caulescent fibrous-leaved Yuccaa, recently introduced from Mexico in Eurojx\in estnUihlnnents, of none of which either flower or fruit is known, sevm distinguished by narrower and smoother leaves, some with red, others wilh gray marginal fibre*, but they may potwibly be only forms of our 8|>eeies ; they are *Yucca periculota, Y. polypliyllflt Y. cxrcinata,* and *Y. mubrifolia,* Baker in Oard. Ch. 1870, p. 1088, and *Y.JUifera* of the gardens.

7. YUCCA SCHOTTIF, *nov. tpec:* cattle humiliore svpiu* e l*»i ratnoso; foliin minorihus lnnceolato-linearibus rectis rigid is crassis sub-pungtntibiis supra concavin subtus con vex is uTvimiiiiin versus basin paulo angustati*, margins fllis temiisnimis rectis albidis omato ; panicuhc mine puhcmlv sivtniflorc supra folia data* pedunculo et ramis flexuosis, bracteis exterioribus magnis lanceolati* ; floram minorurn staminibu* demuin uncinatis, ovnrio in stylum hrvvern stigmate brevi coronatum abeunte ; baccn ovata breviter nwtraU, wmiuibus niagnw crassis. — *Y. brcvifolia,* Schott ill Herb. *Y. jmberula,* Torrey in Bot Mex. Bound 221, non Haw.

Upper Santa Cruz River in Southern Arizona, *A. Schott,* in Juno and July, 1855.— Trunk 2-5 feet high, crooked, covered with a shaggy coat of dead leaven. Leaves "yellowish-green," g-io inche* long. «-* [47] lines wide ; marginal fibres singularly fine and straight ; panicle pubescent or glabrous, its axis m* stmight, •Ms usual in these plants, Mr. Schatt exprwly remarks, but variously twi*ted; lower bract* 4-σinrlii* long, 1 inch +*H*\; the pendulous, ovate, short-rostrate berry not at all angled, aUnt 2 inches long. — Some doubt may exist wbet er all the parts of specimens in 8chott's, Torrry's and my own herbarium, all collected bj Dr. Schott, belong

together; from these specimens the leaves and flowers have been described above, while in the account of the stem and fruit I had to rely on Mr. Schott's notes, who possibly may have mixed the fruit of *Y. baccata* with the foliage of the new plant ; but the leaves appear so peculiar that there can scarcely be a doubt about the distinctness of the species to which they belong.

B. CLISTOTUCCA : fructus indehiscens, erectus ? demum siccatus, spongiosus; semina crassiuscula plana vix marginata, albumine integro. — Arbor elatior ramosa, panicula sessili.

* Folia serrulato-asperata.

a YUCCA BREVIFOLIA, *Engelm. in S. Watson, Bot. King Expl.* 1871, *p.* 496 : caule elato ramoso ; folife brevibus e basi lata sensim angustatis late linearibus supra planiuseulis versus apicem concavis subtus convexis corinatis pungentibus rigidissimis utrumque asperrimis margine durissimo serrulatis; panicula sessili ramosa; fructu ovato obsolete 6-angulato acutato. — *Y. Draconis ?* var. *arborescent,* Torr. Bot Whipp. Pac. R. Exp. iv. 147.

On the arid plateaus between the Colorado River and the South California Mountains, in latitude 34$°-36°, at an altitude of 2000-4000 feet, in patches from Southwestern Utah, Northwestern Arizona to Southern Nevada and to Southeastern California, where it is abundantly distributed on the " Palm-plains," also called " Tehachipi desert," between the Mohava River and Walker's Paw, often forming straggling forests. It was first noticed by Fremont, 1844, ten years later by Bigelow, and since then by Brewer, Parry, Palmer, and Johnson, and has lately even formed the object of photographic pictures. Leaves and fruit with seeds have been obtained, and young plants raised, but the flower remains unknown.

This remarkable Yucca makes considerable trees, 15-20-30 feet high; the stout rough-barked trunks, [48] often 1-2 feet in diameter, 3-10 feet high, before they send off the long and numerous branches, of which, in a vary characteristic photograph, I have counted 23 large and small ones. Leaves stiffer, harder and rougher, and perhaps shorter than in any other species, sometimes only 3-4, usually 6-8, and rarely, in young and vigorous specimens, even 10-12 inches long, 3-6 lines wide, not at all narrowed above the base, glaucous, very rough on both sides, with •mall but stout whitinh or brown teeth on the edge, and a stout and sharp brown point. The flower is said to be •mall and white. A fruit before me is evidently erect, as the fragment of the branch to which it is attached indicates, oval, slightly 6-sided, pointed but not roMtrate, and tipped with the well-preserved short, sessile stigmas. The fruit i» light and perfectly dry, the brown somewhat spongy fragile pericarp 2-3 lines in thickness. Seeds large,] 1-12 mm. in diameter, 2--2J mm. thick, with a narrow margin and an even, not ruminated, albumen. In both the fruits I have been able to examine, the traces of the moth *Pronttba* are apparent by the perforated rind and gnawed seeds or their empty ring-like rims.

C. CfiKNOYUccA : fractttft capsularis, erectus, septicide dehiscens, demum apice 6-valvis; semina tenuia plaua, latius marginato, albumine integro. — Acaules vel vix caulescentes, panicula in scapo elata.

• Folia margine serrulato-asperata.

9. YUCCA RUPICOLA, *Rekeeh in Linnma,* 23, *p.* 143, 1850 : acaulis, folii* lineari-lanceolatis supra basin Hatiorem •ngustatia canulinilAti* 8U|ira planiusculin mibtiM convexis rigidia ercctis pungentibus ; sca|>o elato infra bracteis majoribus foliaceis ornato, panicula pyramidali laxiflora bracteis parvis marcescentibus stipata ; florum majorum segmentis ovatis acuminatis nunc aristatis apice sub-nudis, staminibus rectis demum patulis ovario ipso aequilongis, stylo elongato ; ca|mula acuta seu rostrata nunc medio constricta; seminibus angustius marginatis. — *Y. tortifolia,* Lindheimer in *hed. IK4H, *Y. lutrscrns,* Cftrrîcre, 1. c. vii. 579, ex Baker.

Vur. a *tortifolia:* foliia sat unite viridibus varie tortis unduktisve sèpius obliquitt dorso hcvibus et capsulis cum seminibus majoribus.

Var. 0. *rigüli:* foliia pallidin giauci* planis dorao carinatw asperati* et capsulin cum seminibus minoribus. [49]

Western Texan, in fertile noil mixed with broken-up cretaceous limestone rocks, discovered by F. Lindheimer, 1845, on the plateau* went of New Braunfels, and described from his specimens by Scheele; found afterwards by the botanists of the Mexican Boundary Survey; the second or southwestern form was sent by Dr. Gregg from *»P«mi in the Mexican State of Coahuila, and by Dr. Bigelow from the mountains of the volcanic dirt riet of Bufatello *** Pretiflio del Norte on the Rio Grande. — Flowers in Texas in May and June, "after *Y. Treculiana* and before r. *angustifotia*."

As far as my information goen thin gperiea i« always ntemiess ; a misapprehension of Lindheimer'a notes must be toe eaune of Scheele's, mid after him B*ker\ ranging it among the canlencent Yuccan, with a "stem 4-7 feet high ;" **frtock of few Rtout branches 1-2 feet long; leaven dark or bright green, opaque, narrowed above a not very broad j**[6] 1-8 feet long, | - 1 | inches wide, with bniwii-n*l, Mrong nerratun»s mostly undulate, oblique, one side longer than *• other, therefore twisted, stout, thick, nharp-point^l. but not to !w compared with *Y. aUnfolia.* Scap« 4-7 feet high, with long \m*fy* n a m > w lanceolate bract* ; pnnirlf with few lar«e " greemish-white" flower*, which apparently spread 3-4|9 perhaps 6 inches, and are well characleriicd by the very acute, sometimes even oruUte when dried,

strongly nerved segments, 1J-3J inches long, 10-14 lines wide, the inner wider than the outer; also by the erect or slightly spreading, never recurved stamens, which nre of the length of the prismatic ovary; and by the slender style, which in all the specimens seen by me is as lon# as the ovary; ovules 0.2 mm. thick. Capsule 2-2$ inches long, about an inch thick, acute or cuspidate or rostrate, prismatic, or very often variously constricted or distorted, often showing traces of the Yucca moth; secondary dissepiments sometimes, like those of most species, incomplete at top and bottom, but not rarely, especially in very acute capsules, entire above or nearly so. Seeds 7-8 mm. long, with a distinct but narrow margin. — This form is reported to be in cultivation in France from Mr. TrecuPs seeds, under the name of *Y. tortilis* or *contorta.*

Var. *rigida* looks very different indeed, with its smaller, pale, yellowish or glaucous, often rough, straight leaves, only 8-12 inches long, and 3-6 lines wide, and its small wrinkled, less pointed capsule, 1} inches in [50] length, and seeds only 5-6 mm. in diameter ; the scape is said by Dr. Gregg to be 6-10 feet high; flowers not seen; the short beak of the fruit indicates a short style. Wright's No. 1909 from Eastern New Mexico connects both forms.

* * Folia margine filifera.

10. YUCCA ANGUSTIFOLIA, *Pursh. Fl.* ii. 227; subcaulescens; foliis (plurimis) e basi latiore linearibus lavibua plemmque pungentibus; stigmatibus ovario brevioribus viridibus; capsula prismatico-ovata obtusa brevi-cuspidata, seminibus magnis late marginatis.

Forma genuina: acauli* seu breviter caulescens ; foliis rigidis radiatim porrectis pungentibus ; racemis pleruraque simplicilms inter folia fere sessilibus; flu rum segrnentis late ovatis e cupreo virescentibus nuncalbidis; capsulis majoribus vix unquam constrictis.

Var. /9. *data:* caule altiore; foliis numerosissimis rigidis pungentibus nnnc glaucescentibus filamentosissimis rare denudatis, demum refractis ; panicula oblonga seu lanceolata supra folia elata; florum segmentis albidis angustioribus; capsulis ut supra. — *Y. angustifulia var. radiosa,* Eng. in King Bot. 40th par. 496.

Var. *y. mollis:* acaulis ; foliis supra basin angustutU medio latioribus mollibus vix pungentibus ; racemis rariua ramosis scnpo ipso bracteis brevibu* lanceolato-subulatis ornato brevioribus ; capsula breviori nunc cum seminibus angustius nnrginatia minore.— *Yucca $tricta*$_y$ Sims Bot. Majj. 2222 fide Baker, Gard. Chron. 1. c

All the forms of this species are characterized by the secondary axis descending horizontally, narrow leaves, bright green stigma*, and forge capsules and seeds; but var. y. in many respects approaches to and forms a connecting link with the next species. They are peculiar to the West and Southwest.

The typical *Y. angustifolia* is the more northern form of the plains from Northwestern Missouri and Western Iowa west and northwestward to Colorado and New Mexico; flowers May and June, earlier than the allied species. Trunk none, or, farther south, short; leaven very stiff and sharp-pointed, 1-2 or in cultivation 3 feet long, 3-6 lines wide; raceme simple or with few short branches 1 or 2 to 3 or 4 feet long almost smile, the base hidden between the inner leaves; flowers 1f-2j, in cultivation even 4 or 6 inches wide, usually greenish white or [51] tinged with green-brown ; lobes bromlly ovate ; stigma half the length of ovary ; capsule usually 3 inches long, half as thick; seeds 10-12 mm. wide. In dwarf forms the leaves are sometimes only half a foot long and 1-2 lines wide.

Var 0 is the south western form extending from Went Texas to Uub, Arizona, and Northern Mexico ; trunk 3-5 feet high ; leaves {-1} feet long, 3-6 lines wide, rigid, often gluucouft, with an abundance of long fibres or, rarely, almost destitute of them (Wright, Gregg) ; naked jwrt of ncape about as long as the panicle, together 6-8 feet, whole plant therefore often over 12 feet high; flowers montly white, 2-2J inches wide ; capsules and seeds as large as in th# type. It is not improUble that the narrow-leaved Mexican forms, doubtfully referred to p. 46, *Y. baccaia,* may belong here; flower and fruit would decide.

Var. *y.* is found southeastward in Arkansas, Louisiana, and throughout Texas, distinguished by its wider, softer, lens pungent leaves, distinctly narrowed above the bane, 1-1 |$_f$ rarely 2 feet long, 5-8 lines wide in the middle, half as wide below; scape 8-3 feet high, flowem usually in a raceme, 4-1 feet in length, sometimes paniculate, If-*} inches wide, greenish-white ; green stignuui sometime* as long an ovary, often shorter; capsule shorter than in the other forma, i-2| inches long, sometime* coiwtricted ; needs 9-10 rarely NM2 mm. wide. *Y. dricta,* which is referred here, is said to come from South Carolina, entirely outaide of the limiu of this form, which makes a transition to the next.

11. YUCCA PILAMENTOHA, *Linn.:* nuhucau1i*; folii* linenri-lrtiiceolatia supra basin 1st iorem contract is spice indulato seu m»1li; panicula pyrainidaU in ncapo foliaceo-bracteato alto supra folia elata; Btigmalibus elongatis nuuc di«tinctia albidiA ; cArwula cmpidata, fleminibun angnntius marginalia.

Forma genuina: **pius breviter caulencenn ; foliin rigitlioribu* rertin mucrone nunc obtosato lirevi spiestisdono scabriili*, filis marginalibuR crebri* plerumque circinati«; panimla rumi* few hnriionUlibuii pyrsmidsU dentiflorm •capo bracteb minorihiif spatulatin inntnicto »iui!onpi «eu longiore ls?vi; nUminibus Mrpe pintillo a«iuilongis ; iliig- "Mtibus gracilibus demum diveivpntiliun M»U recunrati* ; ca|»ula minore plerunK|ue mnlio constricU, dissepimflBtii •scundanis fere semper rodinwnurii*; Mminilnm minoribus.

^.a. *angusttfolxa :* foliis (plurimis) lineari-lanceolatis e medio sensim angustatis. — *Y. filamenton,* Linn, ex Gronov. irg. 162.

b. latifolia: foliis (paucioribus) rigidioribus sureum latioribus nunc spathuktis versus apicem sspius obtu- r62l satum abrupte inucronatum cocbleato-concavifl. — *Y. concava,* Haw. suppl. 34.

Var.0. *ftaceida:* acaulis ; foliis (pluribus) lineari-lanceolatis mollibus flaccidis demum irregulariter decurvatis refractisve glaucescentibus vix scabrellis subinermibus margine filis tenuissimis abunde oniatis; scapo bracteis brevibus spatulatis instruct*) panicul® nuuc puberulae ©quilongo; ovario versus basin irregulariter angulatam angustato, stigmatibus brevioribus conniventibus sursum attenuatis; cupsula majore socpius constricta angulata sursum profunde triloba, seminibus majoribus. — *Y. flaccida,* Haw. suppl. 34 ? Refug. bot. 5, t. 323 ?

Var. *I y. bracteata:* subacaulis ; ibliis (pluriuiia) lineari-laiiceolatis rigidiusculis scabrellis mucrone debili aristatis abunde filiieris, exterioribus demum nudatis laxis; scapo bracteis foliaceis majoribua infra medium latioribus sensim agustatis fere imbricate flexuoso quam panicula raniis ascendentibus pyramidata asperula seu puberula multo longiore ; staminibus ovarium fere ©quantibus ; stigmatibus profunde divisis elongatis; capsula prismatica ovatave.

Var. ? a. *Icevlgata:* subacnulis; foliis (paucioribus) lanceolato-linearibus elongatis fere planis lrevibus rigide pungentibus margine mox denudatis laxis deflexis demum decumbentibus; scapo bracteis lancifonnibus e medio aensim angustatis iiwtructo quam panicula ramis a»cendentibus laxifloris pyramidata lavissinia multo longiore; ovario •tainininbus breviore Rtigmatibus ad basin divisis rectis aBquilongo ; capaula prismatica,

Thw most variable plant id a native of the coast region of the southeastern States from Maryland, *W. M. Canby,* to Florida, Alabama, and, according to Riddell's Cat., to Louisiana. — Numerous varieties, often difficult to class, have been described in European gardens.

Linnaeus' diagnosis: *foliii lanceolate acuminate,* together with the Hab. Virginia, points to the narrow-leaved form of what I have described as the genuine plant, as the one he and Gronovius had in view. Of this and other forms numerous specimens und full notes have been obtained from Dr. Mellichamp, of South Carolina, on which the following descriptions are based.

The genuine plant has a short trunk of 2-6 inches or a foot (Chapm. FL 475), stiffer, rougher, " reed-like," dull green leaves and smaller capsules than any other variety, and blooms earlier, in S. Carolina in May, in gardens of St Louis in the first weeks of June. — The narrow-leaved form makes tufts of 60-80 or 100 leaves, 16 or 18-20 and 2* inches long, 1-1$ rarely l^ inches wide, widest about the middle, tapering to a hard obtusish point, with numerous **ther thin curly fibres. The broad-leaved variety has only 30-60 leaves, 20-24 inches long, 2-3 inches wide about the upper third, and broad to the almost obtuse blunt tip; outer shorter leaves often broad-Rpntulate and quite obtuse; "Wfxin with fewer, coarser, more curly threads. The scape of both forms is 4-8 or 9 feet high, stout, very soft and •mooth, pale green, below with oblique, spatulate bracts, 2, rarely 3 inches long; panicle with numerous nearly horizontal dense-flowered branches as long or longer than the naked part of the scape. Flowers 2 J-3 inches [53] "We* white, tinged with green ; stamens as long as the pistil, at last spreading, the elongated eventually '•curved stigmas rather shorter than the ovary. Capsule \\ inches long, more or less constricted, thin, smooth, and *V*P*ry* in some localities, hard, wrinkled, and longer beaked in others; secondary dissepiments mostly very incomplete, not reaching to the centre, but in a Maryland specimen, and in some cultivated ones, of the ordinary form, so that no •pecifio character can Ibe based on them ; seeds 6 mm. diam. — Forms intermediate between a. and 6. are found wild f^d in cultivation; leaves sometimes more flaccid, with fewer fibres, shorter stamens or stigmas, longer capsules, ^***jw seeds*

The variety *flaccida* is descril>ed from plants in common cultivation about St, Louis; wild specimens I have not J*60* It is doubtful whether it is Haworth's plant, which has *fila validurima,* or of the *Rtfugium,* with brood, involute 6*J8i> bat tne 8h»rt attenuated stigtnofl fully agree; the characters indicated in Oard. Chron. 1. c, "an irregular, ^ntidj appearance," "leaves conspicuously filiferous," •'point not at all pungent," "panicle pubescent," point m our pant. — 1t jt mostly stemless with 40-60 leaves, 20-26 inches long, 1-1 { inches wide, thin, at first glaucous, flat, sometimes plaited, with a weak not pungent point, and numerous very thin threads, outer ones abruptly recurved or deflexed. ^ P 8 4-6 feet high, bracts as in the last; panicle pubescent, almut as long as the naked part of the scape. Flowe.? 2-3micne" *i<le, white with greenish ; ovary attenuated and angular-improved toward the base and attenuated upwi inthT" •tOWaitI th,, iholI> pomewnast «necllllll» ^ether conical ntigmas. Capsule *2*\ inches long, always constricted u *« middle, angular and toward* the short beak deeply trilohefl; seeds 8-10 mm. long. — *Y. puberula,* Haw. Phil. 7 * J.| M * P. 186, Refill 1. c. t 322 is sciimily distinct, as Mr. Baker 1. c. already suggests for this as well as for *Y. \VVJta* •— K *glaura,* Sims Bot. Mag. t. 2662, Refug. t 315, with exactly the pistil of our plant, but leaves almost ^ * o u t fibres, aU, belongs here.

Mentif The o followin R formil, wnicn *mnfT eventually prove distinct from *Y. filamenttma,* I have not been able to tK . -- *I* wilh **>? described species. All often grow together on the coast of South Carolina and there ever retain * * « W t « » unaltered.

var. f *bracUata* has 60-100, usually about 70 leaves 20-24 inches long, 1-1} or even 1} inches wide, with a sharp

but slender and weak point, and numerous thin deciduous threads. Scape 4-6 feet high, stout, greenish bronze, almost coveiled, with large foliaceous bracts, the lower 9-12, upper 4-6 inches long, tapering upwards; panicle contracted, scarcely half as lung as the flowerless part of the scape, rough, uneven, or somewhat pubescent. Flowers white with greenish, about 3 inches wide; pistil 16 lines, stamens half as long, elongated stigmas at last divaricate at tip. Capsule 1J-2 inches long with a short cusp, rarely constricted. Seeds 8 mm. wide. The rarest of the South Carolina forms, and not seen from anywhere else ; flowers later than the others, in the second half of June.

Var. ? *kevigata* is well characterized by its very long (30-40 inches, 10-15 lines wide), deep green, smooth, [54] thickish, very sharp pointed leaves, only 25-50 in number ; lower third attenuated into a narrow stalk, leaf therefore soon decumbent; epidermis cells 3 times as long as wide. Scape 8-10 feet high, smooth, purple below with lance-shaped bracts 6-9 inches long ; panicle half as long as peduncular portion, contracted, with comparatively few, sometimes slightly pubescent branches. Flowers often in pairs, smaller than in last, 2£-3 inches wide, white with purple tinge, of a strong almost disagreeable odor, which was not noticed in other varieties ; stigmas divided to the base, deeply bilubed. Capsules l$-2 inches long; short pointed ; seeds 8|-9 mm. wide. This is the most common species between Charleston and Hilton Head, on the sandy coast, but is also found on the clayey soil up the rivers ; it probably extends down the coast to Florida, as I have seen a specimen from Tampa Bay, — flowers about 2 weeks after the first and as long before the last form. A transition form between this and the regular *Y. filanicntota* is cultivated in the Missouri Botanical Garden, with shorter, weaker-pointed leaves, lanciform bracts, and constricted capsules.

II. HESPEROTUCCA : filamenta clavata, acute, loevia, erecta, pistillo «ublongiora ; anthers didymse transversse; stylus tenuis ; stigma calystraeforme papilloso-pilosuin ; capsula erecta loculicide trivalvis, valvis indivisis; semina ut in *Chanoyucca.* — Planta acaulescens, folia niargine serrulato-asperuta, panicula in 8capo elata.

12. YUCCA WHIPPLET, *Torrey, Bot.* Afex. *Bound.* 222 ; *BoU Exp. Ives,* 29: subacaulis; foliis paucioribus e basi lata attenuatis lineari-subulatis rope falcatis carinatis rigid is pungentibus Icevibus glaucis ; scapo bracteis late vaginantibus sursum foliaceis pungentibus munito paniculam grandi-bracteatain tavern gerente ; capsula globoso-obovata obtusa.

California, on dry rocky hills, rare north of San Francisco, abundant from Monterey to San Diego, eastward to the Cajon Pass and into Northwestern Arizona ; flowers in April. — Trunk none or short, sometimes prostrate between rocks, stoloniferou.s ; leaves 10-20 inches long, 4-6 lines wide, concave only near the stout point; scape 4-12 feet high, together with the lower j>art of the panicle iUclf, beset with bracts 6-9 inches long, consisting of a broad whitish base terminating in a short rigid leaf. Flowers greenish white, spreading 2 to 4 inches ; segments 1J-2} inches long, 6-12 lines wide, outer much narrower than inner ones ; anthers 1-1J lines across ; pistil 4-8 lines long; style proper slender, as long as or much shorter than the ovary ; trilobcd hood-like stigma 3 times as thick as style and longer than thick. Capsule less than 1 to nearly 2 inches long, frequently rough; secondary dissepiments incomplete at both ends, divided and often rent by the opening of the cnpaulc ; seeds 6J-8 or 9 mm. in diameter, with a very narrow margin. — Most of the specimens and numerous notes have been communicated by Prof. W. H. Brewer of the California State Survey.

CORRECTIONS AND ADDITIONS. [55]

Page 24, line 33. Mr. Baker gives 150-180 as the number of leaves of *Y. reeumfolia.*
" 26, « 5. They are *ahoayt* thus tipped, much more sparingly in some species than in others; hair usually 1-celied, sometimes articulated.
" 27, « 20. The ovules of *Y. Treculiana* are among the thickest of any.
" 29, " 8. I have found the pods of *Y. aloi/olia, Trtculiana, baccata,* and *brmfolia* perforated and the seeds eaten by the larva.
" 33, « 23. They reach nearly to the same northern latitude.
" 42, " 22. Leaves of young pUnU nearly flat, whence discrepancies in descriptions.
" 4d, " 2. Dr. Wialixenus ascribes them the same height.
* « 26. They rather belong to or near *Y. angusii/olia ;* only the fruit will decide.

Yucca jptnoia, HBK. N. Oen. I. 289, b made np of the flower of A Yucca and the leaves of *DatulwUm acotrid**. (See p. *4, note.)

Yucca acaulu, HBK. ib., is a *Foumvya.*

*T**a t parrtfora, Ton.* Bot Mex. Bound. 221, constitutes UM genus *HajxroU,* Engdm. in King Bot 40* Par. 487*

ADDITION TO ARTICLE ON YUCCA.

[1. c. 1876, III. pp. 371, 372.]

Page 47. *Y. b*evifolia* has sessile, densely-flowered panicles; flowers greenish-white, inconspicuous, and fetid. Flowers in April and May. — It is remarkable that at least in Southeastern Nevada [372], north of the great bend of the Colorado River, where Messrs. Johnson and Parry have repeatedly examined numerous plants, no fruit has ever been found.

Page 54. *Y. IFliipplei* has now become quite familiar through living specimens and beautiful photographs. From the latter we learn that the scape is imbricately covered with conspicuous, broad, at last patulous or drooping bracts, and that the panicle is densely flowered, narrow, spike-like, almost lanceolate.

III. NOTES ON THE GENUS YUCCA. NO. 2.

[1. c. pp. 210-214.]

Since my paper on Yucca was published (pp. 17-54 of this volume) I have been ena- [210] bled to make the following corrections and additions: —

Page 20. The examination of more seedling Yuccas has proved that the growth of the secondary axis and the young rootHtock exhibits the following forms : In *Y. aUnfolia* as well as in *Y. JUamentoM,* var. *Ucvigata,* I have found a single horizontal branch ; in *Y. avgustifoUa genuine,* and var. *elata,* a single perpendicular branch directed downward, and in *Y. filamento$a genuina latifolia* all the young plants examined at the end of the second year exhibited 2 to 5 •econdary axes directed downward* i to 2 inches and then abruptly bent upwards. More observations are needed about these interesting peculiarities and their constancy in each species or variety ; it is possible that the nature of the soil and the mode of cultivation may have some influence on them.

Page 26. The bunch of white wool is always present at the tip of the perigonial lobes, but is very slight and •bort in some, and longer and more copious in other species ; the hairs constituting it consist of single or sometimes of •everal cells.

Page 27. *Yucca Treculiana* has, as is also stated on p. 43, very thick ovules, and thus *all* Sarcoyuccas have such ovules and can by them Ъe readily recognized even in the flower and where the fruit remains unknown. *Y. gloriota* with its thin ovules does not belong to this section at all, as will be shown below.

Page 28. The stigmatic tube does communicate directly with the three ovarian cells, but the passage closes immediately after the night of flowering.

Pa«e 29. I have seen the voatiges of the moth, or rather its larva, in all the Sarcoyuccas as well a* in all [211] those with dry pods ; but fruit* which show no trace of the larvA may be seen more frequently in the former than among the latter. This does not indicate that all may not have been fertilized by the action of the moth, but in •uch ca*» either no ej«8 were laid or they nuiy have Aborted.

Observations mode lost year by Mr. Riley and myself have proved that the filiform flexible egg of the moth is *ot deposited with the pollen' into the utignmtic tube, but that the mother introduces it through a puncture in the •Me of the ovary directly into one of the cells just between two ovules, both of which at once begin to swell up to three or four times the thicknes* of the healthy ovules, and are thus preparing the sustenance of the young larva, *hich feeds on one or usually on both of them until able to attack the meanwhile more or less developed young seeds joining the former. In a few canes I have seen the very young larva at a place where four ovules, two from each side, * * *, and here all four were prematurely enlarged.

P*g« 31. See below an account of the frnit of the *Clutoyucca.*

P«K« 34. At the end of the *c*lmracter of *Yucca* add: flaribus majoribus pendalis noctarnis albidis nunc virescenti seu Pttipunmcenti colons tincti* olentibus.

Page 38. Southerners object to the remark, that the frnit of *Y. almfotia* is " much eaten ;" I should say that it is edible. I am informed that on the coo*t of Florida this *p<*ic* makes almost impenetrable thickets, in which bears h■ve their pasftAjp* and no doubt their lair*, and in the fruit of which they delight.

Page 37. *Y. atpen* and *Y. Motpica* are erroneously introduced here ; for their proper place see below.

Page 38. K. *gloriom* does not belong to *Sarcoyucca,* where, relying too much on the statements of others, I had placed h. Dr. A. 8chott, who has repeatedly been mentioned by me as a dose observer of Yuccas in the Southwest,

was fortunate enough last autumn to discover a specimen loaded with fruit, growing in the open ground in the Congressional garden at Washington. A photographic view was taken and specimens of the fruit and ripe seed [212] were gathered, which latter have already germinated. The fruit is a pendulous, dry, leathery, not-opening capsule or berry, of deep brown color, with (as the ovules, described p. 40, indicated) thin seeds ; the species therefore belongs to *Clistoyucca,* the character of which section will have to be slightly modified. Those botanists who described the fruit as pulpy must have confounded it with that of *Y. aloifolia,* as indeed seedsmen in Europe also have done, whose wrongly-named seeds, raised in Italy or Sicily, I have on page 40 erroneously described as those of *Y. gloriosa.*

The best formed fruits seen by me were, before full maturity, 3 inches long, 1 inch in diameter, prismatic, cuspidate, the 3 wider sides forming the back of the carpels and opposite the outer segments of the flower, and 3 alternate sides, corresponding to the commissures, only half as wide as the others, depressed and separated from the others by 6 prominent ridges. The fruit at this stage is altogether like a small fruit of the *Y. aloifolia,* only more pointed. At maturity its parenchyma dries up, the texture becomes leathery, and the markings less distinct. Fruits infested by larvae are often smaller, constricted about the middle or variously twisted. In such fruits the rains of a wet autumn are apt to penetrate through openings made by the larvae, and cause the germination of the seeds in the closed pod. — Seeds 7-8 mm. in the longest diameter, 1-1| mm. thick, with an entire albumen; differing from the seeds of the capsular Yuccas only by the entire absence of a wing-margin.

Page 41. *Y. Treculiana* and *Y. canaliculata* are synonymous. If, as it is said, no sufficient character accompanies the name given by Carrière in 1858, and if the first description of *Y. Treculiana* was published by Herincq, 1863, in the *Horticulteur Français,* then Hooker's name of *Y. canaliculata,* published with description and figure in 1860, would have precedence. — Fruits lately obtained from Southwestern Texan are 3-4\ inches long and \-\\ in diameter, pointed but scarcely rostrate, somewhat less distinctly six-angled than those of *Y. aloifolia.* Seeds 7-8 mm. wide, 2-3 mm. thick, the smallest ones the thickest*— *Yucca aspera,* Rege], Gartenfl., is the same, to judge from a specimen cultivated here ; *Y. gigantea,* Lem. Rev. Hort. 9 (I860), p. 222, fide Baker Gard. Chron. 1. c, [213] would, from the size of the leaves (4} feet long), have to be referred here, if the leaves were not said to be glabrous and shining.

Page 47. The character of *Clistoyucca* is to be modified as follows: —

Fractu* indehiacens, pendulus (in altera specie erect us ?), demum aiccatus; semina tenuiora, pinna, viz marginata, albuiuine integro. — Plants caulescentes, altera arborescens, panicula sessili vel pedunculata.

• Folia serrulato-aApcrata.

YUCCA BREVIFOLIA, *Engelm.:* pericarp spongy (erect ?), seeds thicker. — Dr. Parry has just sent a specimen, which shows the panicle to be ovate, dense-flowered ; bract* wide and membranaceouA, much like those of *Y. Trcculiana* (as are al*o the flowers), the lower ones 2 inches wide, 3-4 inches long, tapering into a herbaceous serrulate point; the upper ones 1 inch long, oblong obtuse, of thinner texture, white; segment* of perigone 2J-2} inches long, narrow; ovary attenuated into a short style, ovules 0.4 mm. thick. — In Southern Utah in flower about the end of April.

• • Folia margine integra, etc

YUCCA GLORIOSA, *Linn.:* pericarp leathery, pendulous ; seeds thinner.

Page 60. *Y. constricta,* Buckley, Proc. Phil. Ac, 1862, page 8, seems to belong to *Y. angustifolia,* var. *data,* and *Y. albotpica* of European gardens to var. *mollis* of the same.

Page 51. *Y. filanuntosa.* Numerous specimens from South Carolina, Georgia, and Alabama, prove that the varieties are difficult to keep apart. Even the inont marked forms of *grnuina litifolia* have sometime* large, not contracted, capsules, with nearly complete secondary dissepiments and largo weds. AS thus the characters by which I have tried to distinguish the *forma genuina* prove to be uncertain, thin arrangement of the different forms will have to be abandoned ; we may simply diatinguinh them a* var. *angusta* (preferable to *angustifolia* on account of the species of that name), var. *lata*$_y$ etc. *Y. filamentota* seems confined to the low country of the Southeastern State* and not to penetrate into the interior more than perhaps 100 miles while *Y. gloriosa* and K. *aloifolia* appear to be strictly seaside planU. The westernmost specimens of *Y. filamentomi* I have seen came from the western border of [214] Alabama ; but it is said to grow also in Mississippi and Louisiana.

Vv.flaccida: the contracted panicle is usually shorter than the peduncular part of the scape.

Var. *lavigata* I have now also seen in cultivation, remarkable for the narrow, smooth, ħVcťd or even prostrate leave*; the tall (6-9 feet high) scape purplish-brown ; the narrow panicle three times as long as wide, about as long •• the peduncular part of the scape; flowers and young fruit with purplish tinge; secondary dissepiments of large capsule very incomplete, or almost wanting; in the wild plant they are nearly perfect

Page 64. *Y. fFkippUi* does not occur north of Monterey; it abounds near San Luis ObUpo, whence Dr. W. W. Haji hat sent seeds and living plant*.

The following synopsis exhibits at a glance the arrangement of the species and their geographical distribution: —

YUCCA, LINN.

SARCOYUCCA.

1. *Y. aloifolia,* Linn., southeast and south.
2. *Y. Yucatana,* Eng., south.
3. *Y. GuatemaUnsu,* Baker, south.
4. *Y. Treculiana,* Carr., southwest.
5. *Y. baccata,* Ton., southwest.
6. *Y. Schottii,* Eng., southwest.

CLISTOYDCCA.

7. *Y. brevifolia,* Eng., southwest
8. *Y. gloriosa,* Linn., southeast

CH^NOYCCCA.

9. *Y. rupicola,* Schcele, southwest
10. *Y. amjustifolia,* Pursh, west and southwest.
11. *Y. filamentoM,* Linn., southeast

HESPEROYUCCA.

12. *Y. Whippki,* Torr., southwest

IV. SCATTERED DESCRIPTIONS OF YUCCA.

FROM BOTANICAL GAZETTE, 1881, VI. 224.

YUCCA MACROCARPA n. sp. Trunk several (1-4) feet high ; leaves spreading, sharp-pointed, concave with entire margin ; panicle subeessile with lanceolate white fleshy bracts ; flowers not seen ; fruits cylindrical not marked by any ridges, obtuse, pale yellowish, pulpy (4-6 inches long, 6-7 in circumference) ; seeds thick and large (6-6 lines wide, 1-1$ lines thick), rugose-ruminated.

In ravines of the Santo Rito Mountains south of Tucson, Arizona. — Evidently closely allied to *Y. baccata,* Torr., which is found from Southern Colorado all along through Arizona to Southern California ; distinguished from it by the absence of fibres on the leaf-edges (I have rarely wen on one or the other thin fibre detached from the edge, just a« we find it sometimes in *Yucca gkriota,* and F. *canalitulata,* which ordinarily have entire edges), by the smaller, Nfrrow brae*, and the obtuse, not rostrate fruit The fruit is of the color of a yellow apple, rather pulpy, of a Peasant sweetish acidulous taste.

FKOM BOTANICAL GAZETTE, 1882, VII. 17.

YUCCA ELATA. Trunk 3 to 5 feet or more high, leaves linear rigid sharp-pointed, filamentose on the white marfna; with white oval acute or acuminate bracts as long as the pedicels; flowers white; segments ovate acute ; ovary attenuated into a whitish style; capsule cylindrical-ovate obtuse short-cuspidate; seeds large, J inch wide, narrowly wing-marginei — *Y ,angmtifolia,* var. *elata**, Engelra., Notes on Yucca, p. 50. *Y. constricta,* Baker, Yuccoideae, p. 229; not Buckley.

D«erU of Arizona, probably extending into Southern New Mexico and Mexico. Altogether on* of the most •Utely Yuccas, distinguished from'the closely allied *Y. angitstifolia,* with which I had formerly united it, by it* distinct tonk, which is usually 3 to 5 feet, but which I have seen even 10 or 11 feet high, and 3 to 7 inches thick, and especially by its long flowering scape, 3 to 7 feet, naked below, and bearing a much branched panicle often 5 feet long; •owers spreading, 31 to 4 inches wide, while those of the allied specie* are more globose, mostly of a greenish color, With broadly oval concave segments, with a gnvn stigma ;%P«1«» *»nilar to that of *angustifolia.* seeds of same size as that species but with a narrower margin. Young ..perimon* flower before they make a trunk, and they look much like *Y. OHgurifolia,* but can always be distinguish^ by the naked scape and by Uie characters of the flower.

Yucca eonitricta, Buekley, appear* to lie a form of 1'. *angiutifolia* with a short trunk ; the constricted capsules ascribed to it are not normal, but occasionally occur in all species of Yucca.

YUCCA MACROCABPA, Engelm., VI. 224, of this Journal, has now been found by C. G. Pringle in flower; the panicle is densely pubescent ; flowers about 2£ to 3J- inches wide with broadly oval acutish segments. *Y. baccata* has a glabrous panicle and larger flowers with narrow tapering segments. F. *Schottii,* Engelm., Yucc. 46, from Arizona, is known only from Schott's notes and very poor specimens, and has never been identified since. Its panicle is likewise pubescent; its leaves short, narrow and very thick, with few thin fibres. It may possibly be a small-leaved form of *Y. macrocarpa,* which also shows a few thin fibres on the leaves. Both are recommended to the study of observers.

V. NOTES ON AGAVE.

FROM THE TRANSACTIONS OF THE ACADEMY OF SCIENCE OF *ST.* LOUIS, VOL. III. pp. 291-322; pp. 3-35 OF REPRINT ISSUED DECEMBER, 1875.

JUST as the Yuccas among the Liliaceous plants, of which I have treated in a former [291 (3)] paper (vol. Ill, pp. 17 and 210), the Agaves present among the Amaryllidacese a peculiar, gigautic, and sometimes tree-like development, not otherwise found in these families. Like the Yuccas, they are confined to the New World ; but, unlike them, which are represented by only about a dozen species, of a more or less uniform and unmistakable character, the Agave type branches out in perhaps a hundred (or 180 or 200, if we dare trust the catalogues of nurserymen) species, of greatly diversified appearance.

The botanical investigation of the Agaves meets with the same difficulties as that of the genus above mentioned in connection with them, the Yuccas, and as the Cacti, or, to use a term more of horticultural than botanical significance, but sanctioned by the authority of no less a name than that of the elder DeCandolle, the *plantes grasses.* They have, for the most part, l>een long in cultivation, the individuals being propagated with their individual peculiarities by suckers, and very rarely by seeds. Many of them have never bloomed in Europe, and many that did bloom have not been studied by competent botanists ; of a large number, their native country is unknown, and the travelling horticultural collectors have paid more or chief attention to marketable plants than to botanically-instructive specimens. Moreover, most of these plants are so clumsy aud so difficult to prc>|>erly preserve for the herbarium that travellers have shunned them; so that even the standard herbaria mostly contain only very scanty and incomplete material.

In the old United States only a single representative of the genus was known, the *Agave Virginica,* a rather small and inconspicuous plant, if compared with the extensive development the genus attains in Mexico and further south, in the number of species as well as in the bulk of individuals. But on our southwestern border lands, the same region where the Cacti become a leading feature of the Flora, the botanists of the U. S. and Mexican Boundary Commission, twenty to twenty-five years ago, discovered a greater development of the genus, and Prof. Torrey in his [292 (4)] Botany of that Boundary (published in 1839) wits able to indicate five other species; his account, however, owing to an insufficiency of material, is meagre and to some extent erroneous. As far as I am informed, nothing has been added to our knowledge of these plants in the sixteen years elapsed since his publication ; but in the last few years a quantity of new mati-rial has been gathered, and, being placed at my disposal, has enabled me to make a more thorough study of the genus.

The Agaves are American plants, some of which liecamo known to Europeans since the discovery of America, and especially since the continent of Mexico : the great *Agave Americana* is said to hav$_6$ been already in cultivation in Europe as early as the year l.r»Gl; from the similarity of the spinous leaves they were considered forms of the Aloes of the Old World, and the name - Aloe " haa m popular lansua*e stuck to them to this day. LJnmens waa the firet to distinguish them ; and in his Hortua Ui*alenai8 (1748), p. 87, he established the j^nus *Agave,* and enumerated the characters by which "these American plants* are readily known from the true -Asiatic and African Aloes."

He adds that he has " named them *Agave,* because that word indicates something grand and admirable." It is interesting to observe how even at that early date, when botanical geography was not yet born, the geographical domains of these different groups of plants struck the discriminating mind of Linnaeus as something remarkable and characteristic.

The AGAVES were first recognized as a distinct tribe by R A. Salisbury,[1] who united in his 12th order of *Sarmentaccce* Yucca (with a " pericarpium superum") and Agave, Polyanthes, and others (with a "pericarpium inferum "), thus recognizing the great resemblance of these plants, which we now place in different but parallel families, just on account of the relation of the ovary to the other parts of the flower.

Other botanists[8] have appended them to the *Amaryllidacece,* but it must be confessed that they have only the inferior[8] ovary in common with the true bulbiferous Amaryllidaceae, [293 (5)] distinguished by a naked scape and an involucral spathe. The numerous horizontally-flattened black seeds, mentioned already by Salisbury as being common to Yucca and Agave, are not found in the true Amaryllis family; nor do these possess the filiform embryo which diagonally traverses the whole length of the albumen. Other interesting differences are found in the valvate aestivation of the Agave® and in their coramissural[4] stigmas, while the true Amaryllidaceae have an imbricate aestivation and carinal stigmas, and so have Yucca and perhaps all Liliaceae.

TRUNK.

The majority of the Agaves are aocmlescent and monocarpic; the short subterranean trunk continues to grow for years[6] until vigorous enough to evolve the flowering stem, — a continuation of its axis,— and dies after bearing fruit. During its growth a wreath of numerous thick, fleshy, white root-fibres is developed every spring from its lower part, while the lowest, oldest part of the trunk dies and rots away. This is the case at least in *Agave Virginha.* A few Agaves have persistent trunks, sometimes of considerable dimensions; these produce flowers repeatedly, just as the caulescent Yuccas do, from axillary branches, after the terminal bud of the main axis has fulfilled its destiny and died. These secondary branches ure initiated by a pair of short and clumsy, strongly carinate leaves, *hich may be considered as representing bud-scales *(Nicdcrblacttcr),* as I noticed in vigorous specimens of *A. Bouchrajw,* Jsicobi, and *A. chlorocantha,* Salrn, in the Berlin botanic garden, 18G9.

In the acaulescent Agaves the subterranean trunk dies entirely, or for the greater part; but in -4. *Americana,* and probably in the majority of the species, it first emits from the axils of decaying leaves numerous offshoots, which grow into separate young plants and thus propagate the individual. In *A. Virginia** it produces sessile lateral buds, which grow up, still adhering to the per-•istent part of the old trunk, a sort of conn, giving to the plant eventually a cespitose ap- [294 (6)] pearance. Polyanthes behaves just in this manner.

The subterranean trunk of moat (or all?) Agaves contains, like that of Yuccas and many other plants of these families, a great deal of mucilage,[6] which, mixed with water, has detergent qualities to a considerable degree : these " roots" and the whole plants thus used are known to the Mexicans ty the name of *A mole.* Another use is made of the trunk, when before flowering it has developed a large quantity of saccharine matter, — for nourishment; and not only the trunk of Mexican Agaves,

[1] Oenetm of Plants «1. 18M, p. 77.

[2] Endlirher, gen., p. 181 ; Kunth, Enum. 5. p. 818.

[3] In *A§m** the ovary in truly ami entirely inferior, but the w My allied *Folyantka* ahowt a partly (about J) aupcrior ovary. °*iry.

[4] fttigmaa formed by the *trmmimrt** of the carpela, there-•• •itertuting with the*, — a oomparat irely rare can*, TV form *i** UM cariuaJ •tigma, funned by the tip of the *CRTV^* it4ielf or iu ««*••» therefore oppoted or rather super-import to the carpi.

* In *A. Americana,* in its home, eight to fifteen or more years; under more unfavorable circtunttunces, in cult i rat ion in colder countries, much longer, even, it is said, fifty or a bundml yeara, whence the name *ctnUry-pIant*

* • The miR^tion made (p. 21) that the rooUtoc* may contain aaponinr, haa not been verified by cheruirjil aualyain.

but also that of the larger Arizona species, is thus eaten, after baking, under the name of *Mezcal,* and is said to be a very savory dish. The name *Maguey* is more commonly used for the plant itself.

LEAVES.

The leaves of the Agaves are sessile with a broad sheathing base, from linear to lanceolate or even ovate, the broader ones contracted above the base, and widened again upwards. They are thick and fleshy, sometimes soft, but usually of a firmer texture, rarely quite tough and hard; in some species (only in the first group) they decay at the end of the season, but in most Agaves they are persistent for years.

The margin of the leaf usually bears hard and dark-colored straight or hooked or variously flexed spiny teeth; sometimes it is denticulate with minute, pale teeth; rarely it dissolves, Yucca-like, into threads; in our *A. parvi/lora* it combines the teeth on the lower half with the fibres on the upper half of the leaf; very seldom the edge of the leaves is entire; iu some species the whole margin of the leaf bearing the spines becomes dry, hard, and horny, and is eventually, together with the spines, detached from the leaf *(A. hcteracantha).* It is not well k)iown whether the spines, so much relied on to characterize the different forms, are sufficiently constant; it seems, at least,- that an extensively cultivated form of *A. rigida,* of Yucatan, has lost its spines, and produces them only occasionally and very sparsely; in the allied genus *Fourcroya,* leaves with and without marginal spiny teeth are of common occurrence.

The point of the leaf forms a soft herbaceous bristle, or usually a hard and pungent [295 (7)] spine, of different shapes, round, or compressed sideways, or flattened on the upper surface, or concave, or channelled ; and these characters seem to be constant and of specific value.

The tissue of the leaf of most Agaves contains innumerable extremely tough fibres, which, in some of the species with sufficiently long leaves, afford, when freed from the surrounding parenchyma, valuable textile material, usually called *Pita,* in general use in their native countries, and even exported. *A. Americana* furnishes a coarser Pita; *A. rigida,* and its cultivated varieties are the source of the finer Sisal hemp; other species, e. g. *A. heteraeanl?ia,* are locally used for the same purposes.

INFLORESCENCE.

The flowering stem or scape shoots up from the centre of a rosette of leaves, continuing the main axis ; it bears numerous bractlike leaves *(Hochblaetter),* generally triangular from a broad base, often attenuated into a slender tip, smaller as they reach up into the inflorescence. All the vigor of the plant, all the nourishment accumulated in the massive leaves and in the succulent trunk, are used and exhausted in the production of the inflorescence. It is well-known that *A. Americana* is extensively cultivated in Mexico, principally for the immense quantity of saccharine juice prepared in its leaves for this ptiqioae. When the flowering scape shows the first signs of development, the terminal bud and the innermost leaves nrc removed, when in the basin thus formed the liquid collects and is dipped out; on an avornjje al>out a gallon a clay, for two or three months in succession ; from a single plant 150 to 300 gallons in all. From this juice the fermented *(pulque)* and distilled *(mezcal)* liquors are prepared which are so generally used all over Mexico. The juice which is extracted before the plant prepares to bloom is acrid and not copious.

The flowering stems are in the different aperies from 3 to 20_t and, it is said, even 30 feet high, and from a few lines to 3-6 inches in diameter, together with those of the allied Fourcroyas, the tallest flowering stems known.

The flowers are articulated on (usually extremely) short, persistent pedicels, bearing [296 (8)] one or two small bracts. The inflorescence itself shows three different forma, and, accord-

ing to these, the numerous species of this genus naturally are distributed in three different sections.

The first section, *Singulijlorce,* to which our *A. Virginica* belongs, bears single flowers in a simple; generally slender spike, never crowded as the spikes of the next section are; each flower is borne in the axil of a bract on a short pedicel, which is distinguished by a single lateral bractlet. This bractlet is normally sterile, but in monstrous inflorescences may produce secondary and tertiary flowers, which, however, can always be distinguished from those of the next section by never appearing in pairs.[7]

The second, section, *Geminijlorce* (gen. *Littcca,* Tagliub., *Bonapartea,* Willd., nou. Ruiz & Pav.), comprises the species which produce flowers in pairs, crowded into a more or less dense spike. From the axil of each primary bract a short or rarely longer (e. g. *A. Utahensis)* peduncle originates, bearing two opposite lateral bracts (sometimes pushed somewhat toward the main axis), and in their axils the flowers on two short (rarely, e. g. in *A. attenuata,* Hort. Cels. Paris, 1869, longer) secondary pedicels with bractlets of the third order directed toward the primary bract. These bractlets occasionally bear a second pair of flowers with lateral bractlets of the fourth order, directed inward, and in the axils of these occasionally *{A. attenuata)* rudimentary flower-buds are seen. An internal perigonial lobe of the flowers of the primary pair is directed backwards and outwards toward the margin of the primary bract, and an external lobe toward the bractlet. * In rare iustances the primary peduncle does not terminate abruptly, as usual, but is continued [297 (9)] into a bristle between the flowers *(A. mitU* in H. Bot. Berlin), and may even bear a third, median, flower, if the description of the inflorescence of *A. lophantha* by Jaçobi (Ag. p. 202) is to be relied on; the flowers are there said to be termite, the pedicel of the middle one being one line longer than those of the lateral ones.[8]

The species of the third section, *Paniculate,* are distinguished by a branching inflorescence, a panicle, in which more or less crowded bunches of flowers are borne on the end of secondary or tertiary branches. I have not been able to examine fresh inflorescences or their development, but, judging from dried fragments, the flowers seem originally to appear in pairs, usually with secondary and tertiary flowers unsymmetrically developed from their pedicels, and at last clustered, sometimes 20 or 30 or more together, so that their relative position cannot be unravelled,

FLOWERS.

The flowers of the Agaves are thick and fleshy, often of lurid, greenish, yellowish, or brownish colors ; rojely brighter, yellow *{A. dcsertx),* or orange *{A. Antillarum).* They consist of an inferior ovary, bearing the style, and a not articulated, subpersistent perigone, with the stamens.

The perigonial tube, straight, or often somewhat curved, is either short, campanulate, sometimes quite shallow, or longer, funnel-shaped, or even cylindric, or rather triangular-prismatic. The lobes

[7] I have a plant of this species growing, brought from the Woc*k in this vicinity, which produces iU irregularly 2**d«l flowering spikes every year in the same manner. ** lateral bractlet usually bears a second flower on a sim-l y bracted pedicel ; this second bractlet stands either on dorsal (toward the principal bract) or on the ventral (towrd the main axis) side of the little iiiliorvAoenee; a third Bower, if present, is not coeval nor op|*we«l to the *°ond one, but later and higher up, snd usually on the 2Wwor inner side of the second flower; if the antholytic ... n t , which then is often combined with faviation, P ? * |*rts of the primary flower may become more or •••detached and again bear incomplete axillary flower*.— **y.W be remarked that the flower of the Singuliflone ¥***& in regard to bract and axU, that an external lobe of the perigone and one carpel are turned toward the bract, and an internal lobe and the commissure of the other two carpels toward the axis. That abnormal stock, however, produces sometimes toward the tip of the spike flowers without a JKHUWI and without a lateral bractlet; in these one external lolw and one cartel are turned toward the axis.

[8] Some forms are described so as to leave us in doubt in regard to their inflorescence, e.g. *A. horizontal^* Jacolii, with a spike consisting of cluitters of 3-8 flowers in the axil of earh bract; others are said to hsve 1 - 3 or 4-5 flow ITS together. All these probably belot.g to the Geminiflorae, with a greater normal or, perhaps, monstrous development of flowers. It is to be hoped that in future botanists or smsteurs will be more precise in their appreciation of these characters.

form two trimerous verticils, each of valvate aestivation, the thicker exterior ones covering the broader thinner margins of the interior ones, leaving ouly a prominent tapering middle part free. The lobes are generally oblong or linear-oblong, shorter or longer than the tube, flat or often channelled and including the filament, concave at the obtuse tip, which is sometimes thickened, and usually bears a short, whitish beard; they are erect or patulous, or sometimes at last reflexed.

The six stamens are more or less aduate to the tube, iu some species free from near [298 (10)] its base, in others adnate up to the base of the lubes (an important character which has often been neglected); the outer stamens are usually placed a little higher than the inner ones. In the bud the filaments are always doubled up,[9] geniculate, and straighten out when the flower opens, and almost always become much longer than the perigone; in a few species they do not exceed the length of the lobes. The filaments are generally attenuated from a broader base and terminate in a thin point, on which they bear the large and conspicuous linear,[10] nearly'quadrangular, somewhat introrse, 4-celled, versatile anther, attached near or a little below the middle; in *A. Virginica* the filaments are thickened upwards, almost clavate. The globose, or elliptic, delicately reticulated pollen-cells have, on an average, a diameter of 0.06 to mostly 0.08 or even **0.11** mm.

The ovary consists of three carpels, opposite the outer perigonial lobes, forming three cells, in each of which two vertical rows of flat, horizontal, anatropous ovules spring from the central placentae. The stout, somewhat triangular, tubular style rises to the height of the anthers and sometimes above them, but its length is variable and does not seem to be always characteristic. The stigmatic part is thickened, clavate, or somewhat capitate, and is divided into three carinal[n] lobes, which at last open somewhat or, especially in the first section, expand horizontally, and are often emarginate or even obcordate ; after expansion they (at least in *A. Virginica)* exude a viscid liquid — whether stigmatic or only intended to allure insects, has not been ascertained.

The flowers of Agave (I speak particularly of *A. Virginica,* the only one I have been able to observe iu its development, but I suspect that the same holds good in **all** the species) are vespertine or nocturnal and proterandrous. They o]>en late in the afternoon or in the evening, and, while **the** filaments straighten out and elongate, the anther-cells burst and emit the large pollen grains, and on the following morning are found withering and empty. The style at this period usually does not yet exceed the perigone (in *A. macutosa* it is much shorter), and its lobes are [299 **(11)]** firmly closed; but now it begins to elongate and attains its functional maturity 48 hours after the anthers have opened, which by this time have mostly fallen off.*

The Agave flowers are odorous, some of them, like *A. Virginia*,* of the sweetest fragrance, resembling tuberose, though not so overpowering; others are more or less fetid. These odors **are** most fully developed, as is also the case in the tut>erose, in the evening and at night, indicating undoubtedly the design of attracting vespertine insects to assist in pollenization. But whether insects aid in this process, or the higher-placed flowers drop their pollen from the just bursting **anthers** on the opening stigmas of the lower and older ones, has not been ascertained.

The fruit is always an erect, dry, 3-celled capsule, globose or even depressed, OP ovate, oblong **and** sometimes prismatic, obtuse at base or contracted into a sort of a stipe, obtusish qt tip or acute or rostrate, opening above, generally about the upper third or **half only. The numerous horizontal** seeds are flat, black, semi-orbicular or obliquely **orbicular** with **a shining or opaque surface, which,** magnified 100 or 150 diameters, shows the epidermal **cells flat and scarcely distinct from one another, or** with distinct somewhat elevated **cell-walls**; **or they are slightly depressed, giving the**

[f] **ETCH the ihort filaments of *A. macukm* are tbua gen-**
lato. (Seep. 801, note.)

*** The cunred anthcra n|>okeii of in some descriptions cnn only i*fer to effete and withering ouea.**

" -8e page *.. ., note.

• In (Ignres of Agare flowers we not rarely meet with bursting anthers snd a fully elongated style in the same flower; which I snppo*e is fictitious, and not founded on correct observation. — 8re a *hrirt* note on this subject, by Kngelmann, in Bull. Torrej Dot. Club, 1872, 111. S7. — to*

seed a pitted appearance, or rarely elevated and tubercular. The area of these cells are very minutely dotted or pitted.

The filiform, cylindric, or slightly compressed embryo is as long as the hard, whitwh, semi-transparent, farinaceous and oily albumen. In germination the seed-shell is elevated above the ground on top of the largely developed foliaceous cotyledon, contrary to the behavior of Yucca, where the husk enclosing the small and soon decaying cotyledon remains buried in the ground. (See Notes on Yucca, 3, p. 20.)

Some species bear uo fruit, but, in place of the withered flower, or probably in the axil of its bractlet, a bud or bulblet appears, which grows to a considerable size and will eventually sprout and propagate the plant Alt the so-called viviparous Agaves belong here. Some [300 (12)] species, *A.* L i , Karw., in the garden of the late Mr. Thuret of Antibes, bears both capsules and bulblet,; and so appears to do *A. scboli/era (A. vivipara,* Urn.) None of our species possess this peculiarity.

The native country of the Agaves is p — l y Mexico; in the southwestorn^rtsof the United States. mostly in Arizona, 13 species are found; but only one of these extends to the 39° and even 40' N. Lat. while in California the northern limit of the Agaves is about 34°. A few species seem to be natives of the West Indies, and a few more may be peculiar to Soutl.America. The Agaves said to come from the East Indies, St Helena, and other parta of the Old World, are probably all forms of *A. Americana* originally brought there from America.

I now proceed to the enumeration of the species of the territory of ^ ^ J " . * and of ft few undescribed or imperfectly known foreign Agaves of which I possess sufficient material.

AGAVE, *Lin**.

Perianthium superum tubulosum vel campanulatum subreffulare, aubpereUtens, limbo 6-fido, laciniis valvatis. Stamina 6; filamenta tubo plus minus adnata, in alabastro inflexa, demum plerumque longe exserta; antheræ lineares versatiles. Ovarium inferum, triloculare, ovulis ..., biseriatis; stylus apice incrassato trilobus. Capsula coriacea, loculicide ... embry ... cornei. Mexicanæ, acaules vel caulescentes, sæpius giganteæ; foliis crassis sæpissime aculeato-dentatfu spinoso-mucronatis.

I. SINGULIFLOR2E.

Flora e bmcteanim axillia Binguli, laxe spicati.

The species of this section have a more herbaceous character than tboae of the two others; they are stemless with softer ... annual leaves. not t S L - -V»e the b^e, with n^.peHU.^U-n.eth. indttda M m e ,1H!ciM of the next action. Only .bout« dozen specie, are known, tb«e of them w.thm our [301 (13)] domain. The .pike, an slender, the flower, fragrant, the rtigmatic lobes w.de-.preading.

1. A«AV« MACULOSA, *HooL Bot. Mag.* 1859, t 5122 : fcUfa e caudice subterraneo cr«o ^ W r i « f J T ^ S ^ linearibus coneavi. undulatU demum «eurvati. KU«ci. ' « « ^ 1 f ... 7-denticul...s; spi... bracteis Un«olato*ubuUti. ; ov.rio ov.to-l««c«.lato b^vi. kM. lin«ri.oblonRI. en...-patulis tubo gracili subcylindrico sursum parum an ... ito plerumq multo brev ... B f«uc. . p ... insertis lobos vix ... £fl%£um plerumque s...rantibu ^ipn.tib,«, demum patnli. * « * & ; cap.ul. oWon lon. c»..P.kU U, , >n rt,p,Um con tracta. - *A. Zculata,* Engclm. in Bot. Met. Bound. 1859, p. 214, non Regd; *A. Vxr»n«a,* Torr. ,Wd, non aL

•«r. * BMvrrcBA : lobU perigonii tnbo maj. ampiiato fere ^nilongJ., artheri, lontronbuk.

Along the Rio Grande from below El Paso to Matamoros, ... Wislizenus, 1847; Bigelow, Schott, 1850-52; the variety below El Paso, Wright, No. 1905. — Flowers May and June. — The caudex, somewhat different from the allied species, is a black cylindric stock ½-¾ inches thick and 4-6 inches long, bearing thick white radical fibres at the base. Leaves ½-1 foot long, as many inches wide, concave, flexuous, at length recurved; scape 2-4 feet high, spike 6-12 inches long; fragrant purplish-green flowers, about 2-2½ inches long; ovary 3-4 lines, tube 1 inch and lobes 7-9

lines long, filaments[12] and anthers as long as lobes. The stigma is remarkable on account of the deep emargination, almost bilobatiou, which form is only indicated in other Agaves, but is distinct in Polyantbes. The firmer texture of the capsule (1j inches long, J inch thick), and its stipe and beak, further characterize this species. Seed 2-2J lines wide, thicker than usual in this genus, marked by a flat reticulation.

2. AGAVE VIRGINICA, *Linn.:* acaulis; foliis late seu oblongo-lanceolatis concavis undulatis flexuosis demum recurvis late vifidibus herbaceo mucronatis margine asperatis; perigonii ovario ovato multo longio- [302 (14)] ris tubo angusto sensim ampliato lobis lineari-oblongis erectis bis terve longiore, filamentis inferiori tubi parti adnatis sursum clavatis perigoniuni vix duplo superantibus, stiginatibus suborbiculatis demum patent]bus; capsula tricocca subglobosa retusa breviter stipitata.

Var. £. TIGRINA : robustior ; foliis inajoribus pulchre purpureo-macula tis; staminibus imo tubo adnatis; capsulis depresso-globosis.

Lusus POLYANTHCS : spica densiflora in glomerulos paucifloros congestis saepius antholyticis.

On dry hills and in open woods from Maryland and Virginia southward and westward to Missouri and Texas, but not on the western plains or iu West Texas, nor on the Rio Grande ; the variety near salt-marshes on the coast of South Carolina, Dr. Mellichamp. — Flowers June to August, according to latitude. — Thin species was first known through Clayton's collection, who described it as "Aloe from Virginia," and makes mentiou'of its fragrant flowers and deciduous leaves; from his specimens and notes it was published by Gronovius in his Flora Virginica, 1739, and through him became known to Linmeus, who in 1751 (Amoen. A cad. 3, p. 22) referred it to bis new genus Agave.

Leaves mostly J-l foot long, l£ or 2 incbes wide ; in a form from Houston, Texas, the leaves are lance-linear and not more than half as wide ; marginal teeth extremely small, consisting of single projecting epidermis cells, or larger, ^ to (rarely) £ line long, and then consisting of innumerable short cells, not sharp-pointed, but rough, like the small serratures of nome Yuccas, only less rigid. Scape altogether 3-5 feet high, of which the spike measures 1 or *H* feet Flower, including ovary but excluding stamens, — as I always measure Agave flower*, — 1-1 j inches long, with the stamens £ or rarely 1 inch longer*;* anthers 6-6J lines long. Capsules 7-9 lines long, a little less wide; seeds 2-3 lines wide, lightly reticulated, with depressed, minutely dotted areas.

Var. *tigrina* is larger and more robust; leaves tapering to a point or abruptly cuspidate, 1-1} feet long 2J-3 inches wide, lwautifully mottled ; the purple color is produced by a clear purple liquid contained in a single layer of small flattened cells between the transparent epidermis cells and the large parenchymatous cells filled with chlorophyll and often with rhaphides ; capsule 8-9 lines wide, left high ; seeds over 4 lines wide. This [303 (15)] variety has retained its peculiarities in cultivation with inc.

Of the sport with crowded, often antholytic flowers, and with a tendency to fasciation, I have before spoken (p. 296, note).

3. AGAVE VARIEGATA, *Jacobi, Hamb. Gart. Zcitg.* 21, p. 459; *Agav.* p. ISO; *Saunden Refug. Bol.* v. t. 326: acaulis; foliis late lanceolatis uudulutis margine oajwruto denticulatis; perigonii tulio late infundibulifonni ovario oblongo paulo longiore lobos ovato-oblongos jwitulos demum ruflexos longitudine K<]uante seu cis paulo breviore, filamentis superiori tubi jNUti adnatis longe exsertis, stylo demum Htaininu, stipe rente ; capsula oblonga cuspidata.

On the lower Rio Grande near Mierand MaUimonw, Dr. J. Gregg. ^ay» 1847.— Leaves (before me) 9-10 inches long, lf-2 inches wide ; edge similar to that of the Li*t, but teeth often *bar]>cr and curved upwards ; scape "3-5 feet high"; flowers in Dr. Gregg'* specimen about j inch apart, in the axil of a broad triungulur bract, 4 lines long, upwards smaller. Flowers 1} inches long; ovary, tul*, and lobes, of nearly equal length, 6 lines, or tube a little shorter and lobes a little longer; stamens inserted about § or } up the tube, not at the INK* of the lobes, and al>out 2 inches in length; anthers \ inch long; style slender, at last often longer than the stamens; only capsule seen 10 lines long and 6 wide ; seeds unusually oblique (always f), 2J lines in longest diameter.

I refer this plant from the Rio Grande with some hesitation to Jacobi'a and Sutinders' *A. variegata,* the stamens of which are said to be inserted "in the throat/' whatever that may mean ; the leaves of thin plant, which is said to be " probably " from Mexico, and which has repeatedly flowered in Europe, are mottled with lurid blotches, of which in *my* dried specimen no trace is visible. I have not the means to ascertain whether any of the older names, such as *A. brachyitachy**,* Oav., or *A. polyantiuridu,* Hort, refer U> this same plant; the former, however, seems to be a larger plant, with larger « entire" leaves ; *A. mponaria,* Lindl, is certainly aluo similar, but, if the figure in Bot. Reg, 25 t. M is to he relied on, is well distinguished by having a prinmalic flower-tube. The insertion of stamen* in the tube is not mentioned by Lindley, nor is it scarcely ever spoken of in any descriptions, nor indicated in [304 (16)] the figures.

* This is one of ths few Agave* with *tamens so short thst they may be called *included;* they occur in all three flection*. Itisiiot imposaible that superficial investigation ha* rla«ed •^•tal of these American plants with the Asiatic genus Polyanthus, but they have - at l«ut this one ha» - an entirely inferior ovary snd filament* doubled np in the had, both of which character* are wanting in Polranthea. Knnth (Kn. 6, p. 48) alrtadj suggests this in regard to *Polyanthes Mexicans* Zocc.

II. GEMINIFLORJE.

Flores e bractearum axiliis bini oppositi, dense spicati.

The species appertaining to this section, 40 or 50 in the books, 4 of which belong to our Flora, are usually stouter, sometimes with a short trunk, leaves rarely soft and almost herbaceous, but perhaps always perennial, often tough and sometimes the toughest in the whole genus; their margin is most variable, entire, or with small pale cartilaginous teeth, or filaraentose, or with stout, horny brown spines. — Together with the first section they constitute the *Agava spicatce* of some authors ; others, who have principally regarded the growth and foliage of cultivated plants, have scattered them in various groups, mixed with the species of the next section.

* Folia margine serrulato-aspera.

4. AGAVE FALCATA, n. *$p.:* acaulis; foliis e basi lata linearibus rectis seu plerumque falcatis rigidissimis supra plania concavisve (siccatis) dorso carinatis margine serrulato-asperatis apice in spinam fere triangularem supra planlusculam excurrentibus ; scapo et spica bracteis e basi latiore subulato-filiformibus marcidis deciduis stipato ; ovario lobisque perigonii ovatis erecto-patulis eo aoquilongis tubo raulto (ter) brevioribus ; stamiuibus medio tubo vel ultra insertis perigonium fere duplo superantibus; stylo gracili apice trilobo.

Saltillo, Buena Vista, and apparently all over that northern part of Mexico, abundantly collected by Drs. Wisliaenus and Gregg in 1846-48 ; flowering in the latter part of May, and again in July and August, probably at different seasons, as many Mexican plants do, stimulated to development by a few rains or even a single heavy one.— As the plant is common in a region often traversed by collectors, it seems strange that it should not have become known and been brought into cultivation long since; but I can find no description which I might refer here, unless it be the *A. Californica,* Hort. Kcw, of which I find a notice in Jacobi's Agave, App. p. 47 ; but I strongly suspect that this refers to no Agave at all, but to *Yucca IVhijrplei.*

Leaves hard and rigid, finely serrulate, 6-15 inches long, sheathing base 1-1$ inches wide, soon [305 (17)] contracted to the width of 3-5 or 6 lines, tapering to the point, the sharp brown spine of 6 lines in length, triangular, nearly flat above, with two sharp lateral and one obtuse carinal edge; leaves usually fulcate, rarely straight. Scape "3-8 feet high," bearing arid filiform bracts of 2 inches or more in length, smaller in the inflorescence. Flowers crowded on very short knobby pedicels, 12-15 lines long, ovary and lobes each 2^-3, tube 6-7 lines long, and at the throat nearly 3 lines wide ; filaments inserted just above the middle of the tube, reaching about 1 inch above the Perigone; anthers 7 lines long. Fruit not collected.

• • Folia margine filamentosa.

5. AOAVB SCHOTTI : acaulis; foliis e bosi lata linearibus rectis seu subfalcatis rigidis supra planis concavisve dorso convexis seu (rticaitin) carinatis marline abunde filiferis apice in apinam robustam teretem fuscam excurrentibus; pedir,ellj$ brevibus, ovario et lobis pcrigonii patulo-ercctis lineari-oblongis oequalibus tubo anguste infundibiliformi multo brevioribus, staminibus HU peri on tubi parti adnatis paulo exsertis; stylo robusto staminibus demum aequilongo. — 4 . *geminiflora?* var. *Sonortw,* Torrey, Dot. Mex. Bound. 214.

Sierra del Pajorito in Southern Arizona^ flowers August; collected only by the late Dr. Arthur Schott, 1855, to whose memory I have dedicated thin specie* in consideration of long years of friendship and of the valuable services to science rendered by him in many arduous exploring expeditions in the arid southwestern wilds, as well as in the primeval Uopical forest* of the isthmus and on the plains of Yucatan.

According to the discoverer, this as well as the next is one of the *AmoU* or soap-plnnts. Leaves 6-12 inches long, 3~4 lines wide, terminating in a perfectly terete spine 3 lines long; margin splitting into numerous extremely pne whitish fibres. 8c*pe 5-fl feet high; spike rather looser-flowered than in the last; primary and secondary pedj*** about I line long : flower 1$ inches long, ovary as well as narrow lobes about 6 lines, the gradually widening tube 8 <>r 9 lines long, and bearing the filaments (8 lines long and reaching scarcely more than 1 line beyond the lobea) 1} lines below the throat; anther* 5-6 lines long, large for the flower ; no fruit seen.[11] [306(18)]

6. AGAVE PARVIFLORA, *Torrey, Hot. Mex. Bound.* 214: parvula, acaulis; foliis rosulatis tenteadpremis e basi l*ta vaginante dentata lincari-lanceolati* margine infra brunneo-dentuto mirmirn in filament* brevia crassa alba soluto,>"|>ina terminali rigida supra pinna; scajw elatiorc, pcdicellis hrevirtftimi*; floribus geminis sea suiiquaternis P^1** ovario oblongo perigonio duplo breviore, tubo profunde campanulas lobis oblongis erectis bisloDgiore, filabasi tubi insertis subinclusis ; capsula pisiformi subglobosa breviter cuspidaU.

[11] Dr. Gregg collected near Ortillo, direction of To|»ie, in Western Mexico, leaves of a plant which h« MVI brar* s scape 5-6 feet high, snd which, like many narrow-lcavcd Agaves ^d Yuccaa, waa called *Palmilla* by the natives; unfortunately flowers came along, but, as it seems to he an undescribed Agave.. it may he deaignated ss A. AKorsTISKIIIA : leaves "2-3 feet long," 2J-3 lines wide, convex on the hack, filnmcntosc on the msifcin, narrowed into a short (2} linos), it out, triangular, brown ipine. It seem* allied to *A. mfilnmenjUma,* Salm. which, however, has much shorter snd wider h-aves. The form of the terminal spine precludes its bring taken for s Yucca.

On various sierras in the Pimeria Alta in Southern Arizona, in flowers and fruit in July, A. Schott. — The leaves of this prettiest and smallest of all Agaves are, together with the broad, sheathing base, not quite 3 inches long ; base 1 inch wide and a little longer ; blade 1| inches long, 4 lines wide, somewhat contracted above the base ; spines 2 lines long, at last gray. On its lower third or half the leaf-margin bears very small, but rigid, sharp teeth, and higher up separates into a few short, stout, white filaments, — the only instance of this combination, I believe, in the whole genus. Scape 4-5 feet high. Flowers 6, ovary over 2, tube 2£, and lobes lj lines long, with stamens and style about 4 lines in length and scarcely reaching beyond the lobes of the perigone ; anthers 3, capsule 4-5, and seeds 1 j lines long.

• • • Folia margine aculeato-dentata.

7. AGAVE HETERACANTHA, *ZUCC. in Act. Leop. Car.* 16, 2, 675; *Kunth, En.* 5, 836: subcaulescens; foliis crassis rigidis lineari-lanceolatis in margine corneo demum soluto aculeos complanatos uncinatos gerentibus, spina tenninali valida subterete versus basin leviter exaruta; scupo et spica bracteis e basi triangulari subulatis marcidis demum deciduis ornato ; floribus in pedicellis brevissimis binis, perigonio ovario oblongo longiore, lobis [307 (19)] lineari-oblongia erecto-patulis tubum campanulatum brevisaimura multoties superuntibus, ulamentfs basi loborum insertis perigonio fere duplo longiorihus; capsula ovatu s. oblonga plus minus cuspidata. — *A. Posclgcri,* Salm, in Bonplandia 7, 92 ; Jacobi, Aguv. p. 40; *A. Lech uyu ilia,* Torr. But. Mex. Bound. 213.

On the Rio Grande from £1 Paso down the river, Wright, 682, 1432, 1907 ; southward to Parras, Saltillo, and further, Gregg, Wislizenus; Karwinski, Poselger. Flowers in *May.* — I have ventured to unite the different forms under the oldest (Zuccurini'.s) name, the more so as I was able to compare the original specimen in the Munich botanical garden, where I found it in flower in August, 1869. Whether several other garden-forms, described under different names, all characterized by soluble corneous leaf-edges, belong here, or constitute distinct species, can be decided only when their flowers become known. Zuccorini's typical specimen has leaves 18 inches long and 2} inches wide, with a spine lj inches long, the spiny teeth straight or curved up or down, whence the specific name; sea)**: 6 feet high ; flowers only 1 inch long (ovary 5, perigone 7, tube over 1£, filaments 15 lines long from base of tube) ; no fruit was matured, but many bulbilli were sprouting from the top of the scape. Gen. Jarubi (Ag. app. p. 14) describes a specimen which flowered at Brussels with perigone divided to the base, most probably inaccurate, as no Aguve is known with such a flower.

Our plunt grows in mountainous and rocky localities, is called *Lechuguilla* (* Lecheguilla" in the Mex. Bound. Bot. is a misprint), and its rooUtock *Amole ;* the leaves furnish excellent but ruther coarse fibre, and tbe rootstock is used as soap and is a " savory food " when roasted ; trunk 4-6 inches high ; leaves (before me) 10-20 inches long and 1-1J inches wide, margin and its teeth d.irk red-brown, at last fading to ash-color and becoming detached from the leaf, but adhering long to the terminal spine; teeth 9-12 or 15 line* uport, Mow smaller and straight, upward larger (1^-2 or even 3 lines long) and strongly uncinate, not irregular, as iu the original specimen ; terminal spine 7-9 lines long, slightly grooved on lower third or fourth. Scape 6-10 feet high, its bracts from 2 inches down to \ inch long, deciduous, so that in the flowering spike little of them is seen. The flowers before me indicate two forms, one with a slender ovury, 7-9 lines long, larger flower (perigone 9-10, tul« 1-1 J, anthers 6 lines long), and [308 (20)] oblong, strongly cuspidate capsule, about 1 inch long and half as wide ; *%Q* other form has a shorter ovary, 5-7 lines long, smaller flower (])trigone 7-8, tube J-l line long), and rather shorter anthers, ca]«ule shorter, 8 lines long and 6 wide, with a short ubrupt point. Both forms seem to occur in all the localities mentioned, and certainly belong together. I have been particular in describing them, because we rarely have occasion to study numerous and varying specimens of these plants, but must be generally satisfied with poor fragments, so that it is difficult to ascertain the amount of variation within the species.

8. AOAYB UTAHENSTB, *Engdm. in S. Watson's Dot. 40th Parall.* p. 407 : acaulis ; foliis crassis glands e barf lata attemiatis in spinain validara infra carinatam supra usque ad apice.ni late exaratam excurrentibtis, margine aculeis rectis validis albidis dentato; bracU>is senpi elnti e basi lata suhuiati* marceflcentibiis; floribus (minoribus flavis) pedunculate binis rel tapius quaternis, ovnrio oblongo perinnthio subhreviore, tubo late campaiiulato abbreviate lnliia oblongis erectis tor quaterve brevinre medio stamina limhutn paulo excedentia gerente; capsula oblonga taeviter cospidata.

Southern Utah, about St. George, etc., extending into Arisnna, Dr. R. Palmer, J. E. Johnson, F. Bischoff. — Leaves 6-12 inches long, 1—If wide, not contracted above the wider base, very thick and rather bard, strongly marked with the impresaions of the margins of the adjoining leaves ; terminal spine about 1 inch long, pale or mhite in tbe specimens before me, with a darker base ami tip, almost triangular in tbe cross section ; lateral apiny toeth IJ-2 line* long and as wide, white with a darker base. Scape, together with the dense spike of 1-2 feet in length, 5-7 fwt high; peduncles and pedicels distinct, in fruit often 3 lines lonjj, ultimate ones shorter. Flower* scarcely 1, perigone abont } inch long, lobes three times or more tbe length of the shallow and wide tulie, which l»ears the stamens in the middle, not at tbe Use of the lubes as many short-tubed Agaves do ; AlamenU less than | inch long, about 2 or 3 lines longer

than the lobes; anthers 6-6 lines long ; capsule 10-14 lines long, 4-5 wide ; seeds 1J-2 lines wide, marked with flat punctate area.

JII. PANICULATE. [309(21)]

Flora ad apices ramorum iiiflorescenti© congesti paniculati.

These are the typical Agaves, of which 20 or more forms are enumerated, with stout, often very large, fleshy leaves, almost always with spiny marginal teeth and strong spiny tips, a stout and high scape bearing a paniculate inflorescence, the branches of which are usually J-2 feet long or even more, stout, vertically compressed, and naked up to the base of the branchlets or peduncles. Most of them are stemless, some have trunks several feet high, but none grow as large as some Yuccas do. Among them we find the economically and commercially most important Agaves, especially *A. Americana* and *A. rigida.*

* Tubus perianthii lobis multoties brevior.

f *Stamina tubi bari inurta.*

9. AGAVE NEWBERRTI, n. *tp.*- acaulis ; foliis e basi latiore sensim angustatis lanceolato-linearibus rigidis urtegris apice aculeo fusco semitereti supra cunaliculato armatis ; scapo gracili, paniculae angustee racemiformis ramulis remotis bracteis lanceolatis breviusculis fultis abbreviatis paucifloris; perigonii tubo campanulato brevissimo, lobis oblongis, staminibus infinio tubo adnatis. — *Agave, n. tp. ?* Torrey in Bot Ives Exp. p. 29.

Peacock Spring, Northwestern Arizona, west of the San Francisco Mountains, between them and the Colorado River, over 4,000 feet alt., discovered, when just lieginning to bloom, March 31,1858, by Dr. J. S. Newbeny on Lieut Ivea' Expedition, and named for him in commemoration of his services to Botany in this and other western explorations. —This very peculiar plant, of which we unfortunately know so little, is so different from the other paniculate •Agaves known to me, that their connection seems to be altogether artificial; but for the present I cannot do better than to place it between them and the List section, to which the small stature and the form of the leaves seem to approx- Ua ot, though the infloivHcence is clearly a contracted, short-branched panicle.

Leaves 7-10 inches long, at bane } inch wide, with entire, cartilaginous margins," terminating in a sharp, semi-terete or almost triangular, dark colored spine, grooved on the upper side, and about £ inch long. [310 (22)] Scape 8 feet hfch, flower* in a long, loose racem« or contracted panicle; bracts lanceolate, about £ inch long ; brancbleto 1-3 inches apart, 1-2 inches long, bearing 2-5 (not opposed) flowers. The whole flowerbud, just about opening, nearly 1 inch long; prismatic ovary equal to perigone; tube very short, only \ or J of the lobes; short stamens, *nich, when fully developed, probably will not be much longer than the perigone, from near the base of the tube; others *4* J-5 lines long.

11 *Stamina tubifauci inurta.*

10. AGAVE DESERTF, n. *tp.:* acaulis; foliis crossis glaucis supra basin lntissimam aculeato-dentatam leviter con- fcctis ovato-lunceolatin Rurnum sensini attvnuatis in spinam gracilem elongatam coinpressam ad medium anguste can- fiiiculatam excurrentibiiA, murgine sursum corneo obscuro infra herWeo aculeis uncinatis flexuosis fuscis armato ; •^P0 graciliore bracteis <li*tuntil>us folioceis lanceolato attemmtw dentatis stipato, ramulis paniculre superioribus erectis, Pedicellia fanciculati* longiiiHculi* ; florin flavi ovario subprisinatico person nun fere awpiante, tulw infundibuliformi b^evissinio hfcu oblongin crccto-patuli* quatcr s. quinquies breviore, staiuinibus loborum bosi insertis ipsis lobia duplo l°ngioribu» ; capsula olilonKo-primiiatioa bwviter cuspidate.

Eastern base of the Southern California mountains and in the adjoining deserts. Flowers in June, but occosion- ally, ** most of thew planta do, at other seasons. —The then Lieut. Emory,[11] in the adventurous expe<lition to Coli- fornia ta the fall of 1840, was tin? fin*t to discover this species in Valcitron, southeast of San Felipe. A few years later Dr. p«ry found it [a] on the arid hills and valleys " in the same region, and drew up a full description, but did not ool- lect «V specimens. Since then it was lost sight of until within this year, when horticultural collectors again brought it mt0no ti<*. My specimens were obtained from Mr. O. N. Hitchcock of San Diego and Dr. E. Palmer.

The pUnt in one of the smaller of this section ; leaves densely clustered around the base of the stalk, [311 (23)] a-cend;ng and erect, thick, flenlyvv deeply concave, very glaucous, 6-12 inches long, J-2 wide, contracted a*o*• the very bnjud ▷a»o, which is nlged with sharp, stmlight, J?ale U*bh, vidder above the middle and terminated by an unusually long (1-j inches) and riemk-r, latenlly compresijed spine marked with a deep narrow groove half-way

[11] Possibly • homy toothlimringrdpf, mirh as wo find in A. Asterocanth ffl» may have broken off, but no tracca of such roma' i in jf in b ^e only extant upecimen.

1S4S 104, ,iNoUioll»MmUnRr.x)nnotaannce Washington, ttilat & fcf my% un<inr <lttr of NoT_ w : ,, Wo wl<% for ***** thlcketo of the centennial plant and found one in full bloom. The sharp thorn* terminating every leaf were a fcreat annoyance to our demounted ind wearied mon. . . . [A] numlwr of planU were cut by the aoldiera and the body of them uw.1 as foal." A few flowera were saved, and are noW ln the late Dr. Torrey's herbarium.

up ; the hard and horny, dark colored edge of this spine extends down to about the middle of the leaf, bearing the crowded strong hooked teeth (2-3 lines long) ; below the middle the teeth-bearing margin is herbaceous. The stalk is, according to Dr. Parry, 4-10 feet high, 1-2 inches thick below. The flattened branches of the panicle, almost horizontal below, longest (2-3 inches) in the middle and nearly erect upwards, divide into not very compact clusters of forked pedicels, 2-3 lines in length, the ultimate ones shorter, bearing a profusion of bright yellow flowers. Prismatic ovary a little shorter than the perigone and scarcely contracted at top ; perigone 10-11 lines long, tube only 1J-2 lines long and wide, lobes about 9 lines long and 2i wide ; filaments inserted at base of lobes, about twice their length; anthers as long as lobes ; capsule 1| inches long, (5-7 lines wide, pointed ; seeds 2J lines in diameter.

11. AGAVE PARRYI, *n. sp.:* acaulis; foliis ascendentibus rectis supra basin dilatntam vix angustatis ovato-lanceolatis versus apicem attenuatis spina valida supra planiuscula medio leviter carinata decurrente terminatis, margine aculeis distantibus minoribus rectis seu paulo deflexis armato; scapo valido bmcteis magnisfoliuceis triangularibus integris imbricato ; paniculae ramis robustis horizontalibus seu vix ascendentibus apice flores numerosissimos breviter pedicellatos ochroleucos gerentibus, ovario prismatico perigonium fere sequante, tubo brevi infundibuliformi lobis lineari-oblongis erecto-patulis duplo hreviore, staminibus summo tubo adnatis longe exsertis, stylo saepe demum stamina excedente; capsula ovata hrevissime cuspidatn, seniinibus ninjusculis.— *A. Americana,* /9 ? *latifolia,* Ton*. Bot. Alex. Bound, p. 213, pro Emoryi planta; *A. Mescal,* C. Koch, Wochenschr. 1865, p. 94 (ex Jacobi), and *A. crenata,* Jacobi, Agav. p. 229, quoad plantain nco-mexicanam.

Western Xew Mexico to Northern Arizona, and perhaps eastward to the mountains below El Paso, apparently not south of the Gila River ; flowers June and July. — The botanical history of this species is [312 (21)] similar to that of most of the larger Agaves, the material for whose definition must be gathered piecemeal and from many different sources. Oct. 19, 1846, a fruiting specimen was collected near the "Copper Mines" by Lieut Emory, in the California expedition (see p. 310), 1. c, p. 69, now preserved in the Torrey herbarium and mentioned in the Mex. Bound. Botany as a short and broad-leaved form of *A. Americana.* In 1865 Dr. E. Coues sent flowerbud8 from Fort Whipple, which seem to belong to this species. In January, 1868, Dr. C. C. Parry, then on a railroad surveying expedition, again found it and collected seeds, which I distributed in Europe as *A. Parryi;* the young plant*, raised from them, are now advertised in nursery catalogues, but no description has yet been published. Then Mr. F. Bischoff, of Lieut. Wheeler's expedition of 1871, brought capsules and seeds home. The first who, collecting foliage, flowers, and fruit, enabled me to connect all these scattered fragments, was Dr. J. T. Rothrock, Surgeon and Naturalist of Lieut. Wheeler'* Southwestern Expedition of 1874. He met with the plant in " Rocky Cañon " and as far north as Camp Apache in Northeastern Arizona. Why Koch and Jacobi should have referred the short notes of Torrey to a plant which they found in cultivation in Europe, is unknown to me ; Jacobi's description does in nowise agree with our plant, as the margin of the leaves is nearly straight and not " deeply crrnate," etc.

Leaves erectish or the outer ones patulou\ 10-12 inches long, 3-3} inches wide, somewhat concave as all Agave leaves are, rather abruptly acuminate and terminating in a very robust spine, 1 inch long, flattened aliove, with two sharp lateral angles and a slight ridge in the middle ; from this spine a horny, brown margin runs down the leaf-edges for 1 inch or more and to the uppermost teeth. Teeth 6-12 lines apart, comparatively small, only aliout 1J lines long, straight, or slightly curved up on upper, and smaller and curved back on lower part of leaf. Scape 8-12 feet high, 1-2 inches thick, bearing numerous large (2 inches wide at base, and twice as long, smaller upwards), triangular, closely udpressed bract**, herluceous, with scarious brown margins and sharp points. Panicle itself, in well-devel»|>ed plants, al>out 3 feet long, and 1 foot in diameter, the stouter branches considerably flattened, [313 (85)] } inch wide, 6 inches long ; ultimate pedicels usually 2-3 lines long. Flowers over 2 inches, the perigone 12-14 lines long, tube 4-4} lines long and wide, lobe! 9-0} lines long and 2 wide ; stamens inserted at the Use of the lobes, the inferior a little lower than the exterior ones; filaments 1} inches, anthers 10 lines loug ; style often at kft longer than stamens. Capsule wider in proportion to its length than in any other of our species belonging to this section, about 1} inches long and half as wide ; seeds 4 lines wide, with flat, punctulate, strongly marked reticulation, visible under a strong glass.

12. AOAVE ANTILLARCM, *Dacourt. Fhr. med. AntiU.* 4 *tab.* 284 (1827) : sabcaulescens ; foliis late lanceolate-linearibus elongatis, margine aculeis parvis distantibus rectis rocurvisve fuscis armato, spina terminal! valida fuses terete ba*i m>lum anguste canalicuiata ; scapo «u MO-pedal i; panicuta ovata ramis horizontalibus, pedicellis longiu* culis dense fosciculatis; floruni (aurantiacoruin) ovario perignnio longiore, tnbo late infundibiliformi lobis lineari-oblongis erecto-patuli* ter quatervc brvviore, staiiiiinibu* ba*i lolionim inscrtis longe exsertis; capsula ovato-prismatic* enspidata hasi in stipitem 1>n*wm contrncta.

San Doniingo, Purry 6 Wright, U. S. Expl. Exp . Feb. 1871. in flower. —The unusual color of the flower *tad* the native country of the plant make it almost certain that this U Duscourlir* plant, and 1 adopt hi*, the oldest nam*, evtn if Orisebftch'* (Flor. W«st. I ml. p. 582) sanrenfion should prove true, that it might be identical with *A.* IOW* /fro, Salm, hort 1834 (*A.* rtnpara, Lam , non Linn.) This plant is also report**! to come from San Domingo and

Jamaica, but to have greenish or yellowish-green flowers (Jacobi, Ag. 122) and to bear capsules as well as bulblets, whence the names ; but none of our botanists seem to have observed such proliferation, which in other allied Agaves and in a Fourcroya were duly noticed. The measurements taken by them in San Domingo of a " medium specimen " are : height of leaf-bearing trunk 2 feet, length of leaf 30-36, greatest width 4£ inches ;• scape 8-10 feet high, at base 2$ inches thick, length of lower branches of the panicle 9, of middle 12, and upper 3 inches; nearly 100°flowers on the strongest branches.

A single leaf before me is 3 feet long and 3J inches wide, the terminal spine 9 lines long, a narrow groove occupying only *i* of its length; marginal teeth 6-12 lines apart, only 1 or at most 1± lines long, [314(26)] hard and sharp, deep brown. The flowers are reported as having a yellowish-green tube ; limb and filaments and the anthers, before opening, are orange. The flowers before me belong to two forms, one with longer (1 inch) pedicels and larger flowers, the other with smaller flowers on shorter (3-5 lines) pedicels. The ovary of the former is 16-18, the tube 4, and the lobes 10-11 lines long; filaments not twice as long as lobes; anthers 11 lines tong. The ovary of the smaller flower is 15, tube 2, lobes 7-8 lines long, and the exsert part of the filament longer than the whole perigone; in the former the stamens are inserted a little below the base of the lobes, in the latter at the •ery base itself. The capsule of the latter is 1 J-l^ inches long and 7-8 lines wide; seeds 3 lines wide.

• • Tubus periauthii loins brevior vel acqualis ; stamina medio tubo inserta.

f *Tubus lobis brevior**

13. AGAVE SHAWII, n. «p.: subacaulis ; foliis perviridihus erecto-patulis supra basin dilatatam vix denticuiatam paulo contioctis ovatis ocutis spina valida late exenvata acuniinutis, margine corneo fusco vix soluhili aculeis subcont]gui8 maxi mis sursum cur vat is vel varie flexis omuto ; scupo vulido bracteis foliuceis trianguluribus toto inibricato • J[11]^* panicul© horizontalibus seu superioribus adncendentibus apice glomerulum floruni subsessilium com pact um ;o laceo-invohicratuin gerentibus ; ovario prismatico perigonio vix breviore, lobis lineari-oblongis suberectis tubo late Uuundibulifornii medio stamina paulo exserta gereute duplo longioribus, stylo stamina superante scepius arcnato* <*peula prismatica acutu.

^ On the arid hills which overlook the sandy strand of the Pacific in the southwest corner of California, where the j*nndary is marked by the initial monument, this fine species, growing together with *Cereus Emoryi,* was discovered *T* Dr. Parry in 1850, and a full description made; from his memoranda Messrs. Parker and Hitchcock of San Diego red ^covered it a few months ago and supplied me with most instructive photographs and excellent specimens ; last su nmer Dr. Palmer collected it with immature fruit, and in November the above-named gentlemen found it in full bloom and sent fresh bunches to St. Louis. This is the short history of a remarkable species, [315 (27)] w nich will flourish, highly esteemed by amateurs as one of the most striking and beautiful Agaves, and f°mmemorate, among all who love horticulture in other climes, the name of HENRY SHAW, already so highly esteemed in S*. Louis as the rounder and donor of the " Missouri Botanical Gardens," grand at present, and promising a future as [TM] M it will be magnificent.

The trunk of this species is short and globose or more elongated, 8-12 inches long, but all covered with its very regul w l- v (in ft) arranged, broad, doep green leaves, forming masses nearly 2 feet in diameter, set off by the large bright J*d-l>ruwn spines. Leaves 8-10 inches long, 3J-+i wide, with a distinct brown horny margin, which bears the unm w i y larfle, very close-srt, flat spiny t«!th, straight, or mostly curved up or rarely downwards, or flexuous, the largest (near (Jie middle) 6 lines long and half as brood ; in old leaves the margin with a few of the spines adhering in often I^artially <letacbet] *>ut not as regularly as e. ff. in *A. htteracantha.* The stalk, 2-2J inches thick, 8-12 feet •Wfih ^6 *9* W almost entirely covered with lar^e (1-fl inches long by 2 wide) triangular bracts, foliaceous with brown scari- la marg n thfct\T ***t!pped W;th ft Bpine, Th ○ branche9 of tbe browi 0Val *I*[TM]^ are verv 8tout *(*-& °r 9 inches long, 1- *«ihv Knl/*^06* alwve» am*l>ear ftt tne cn<l A ra08t *compact* clugter of 3°-S° flowers surroundeil by lar^e foliaceous °ttly thfct*1 1,,8 lncne« wide, 2-3 lonp, which form a sort of involucre ; the whole, after the flowers have fallen and lates th* n truncate cl<Melvpacke«l pcilic̈eh are seen, internperwl with subulate bracts, 1-2 inches in length, siinune receptacle of some lar^e Comlkwitn, 2-3 inches in diameter.

Flowe inside 6-7 '' 3~3^ inche,, lon>fl B[1]^011'',^-^111^ 5 P^ri(imatic oval 7 * H i Frij?one l|-2 inches long, tube outside 8-9, serted in the lln«* long, lolws 12-14 lines long, outer a little longer and 3f inner shorter, 4 lines wide. Stamens in- 0.09-0 w m*cl,ll○ of the tul*. only alxmt \ inch longer than perigone; anthers 14 lines long ; pollen grains oval, €ar?^' mm -jn longest diameter, lwiutifully marked Style," in the numemiw upecitnens before me, begj[n] ^ W >nch longer than the filament*, apparently already con»i(l«rablylengthentHl when the stamens [316 (28)] *fonnlna ?* ld[a]P*«le* cunpiMate but not utipitate, 2J-2J inches long, not quite 1 inch in diameter, ""g a densely packed radiating cluster, 6 inches in diameter ; seeds 4 lines wide.

dlrlded i ^*tl*ultr c*[M]«>nd prnftrmt^* the style to n«*r its bnw. wliw, bv Mlient §n[fl]l«i meeting in the centre, the cavity is "Briar tissu/** ^^ WUch *lmd* to ^ 0?trUn c*[U-]» K>m«what obstructed, bowerer, about the neck of the oTuy by looee

f f *Tubus lobis vie brevior vel aqualii.*

14. AOAYB RIGIDA, *Mill. Diet. ed.* 8, 1768 : caulescens; foliis lanceolato-linearibus glaucescentibus, margine aculeis distantibus rectis parvis fuscis dentato, spina terniinali vulida terete saepe torta basi ipsa solum paulo excavate in marginem corneum decurrente ; scapo elato foliaceo-bructeato, paniculae ovatie capsuligers viviparaeque raniis horizontalibus ramulosis fasciculos floruin laxiures bracteib triangularihus brevibus stipatos gerentibus; ovario perigonio paulo breviore, staminibus medio tubo iufuiidibulifoiuii lobis paulo breviori vel supra medium insertis longe exsertis stylo demum aequilongis.— *Fourcroya rigida,* Haw. Syn. 74, Kunth en. 6, 843 ; *A. angustifolia,* Haw. Saxif. 36 ; *A. Ixtli,* Karw. ap. Salm, Hort. Dyck. 304; Jacobi Ag. 95.

Var. LONOIFOLIA : foliis niulto longioribus glaucis, aculeato-deutatis, spina tenninali non decurrente.

Var. ? SISALANA : foliis multo longioribus viridioribus margine integris seu puuei-dentatis, spina terminali non decurrente. — *Agave Sisalana,* Perrine, vide infra.

The original plant was, according to Miller, brought from Vera Cruz; my specimens, on which the above diagnosis is based, were collected in Yucatan by Dr. Schott. Dr. Perrine forty, and Dr. Schott ten years ago, studied in Yucatan this interesting plant, its different forms and economical uses, and left us accounts of it, the former in Senate Doc. 300, Washington, Mar. 12, 1838; the latter in the Report of the Agricultural Department at Washington for 1869. Both agree that there is a common native species in Yucatan, called *Clulem* by the aboriginal inhabitants ; but from time immemorial a number of varieties, all characterized by much longer leaves, and one also by the absence of marginal spines, and differing among themselves in the quantity and quality of their fibre, have been cultivated by the natives of Yucatan, and are a staple product of that country to this day, furnishing the well-known Sisal hemp. The people know them as *Jenequen* (Schott) or *Jlaiequen* (Perrine), and distinguish, as [317 (29)] Dr. Schott reports, the *Yaxci* (Yoshki) as furnishing the best quality and the *Sacci* (Sacqui) with the largest quantity of fibre ; *Chucumci,* larger than the lost, produces coarser fibre ; *Babci* ha» fine fibre but in smaller quantity; *Citamci,* with small narrow leaves and poor fibre, stands probably nearest to the wild plant. Dr. Perrine mentions another variety, *Istle,* evidently the *Ixtli* of Karwinski, as furnishing a fine fibre called *Pita.* These plant* yield a return of leaves when four or five yean old, and may last 50 or 60 years under proper management; the flowering scape is cut off as soon as 4 feet high, when, evidently, axillary branches continue the growth of the plant, which is tbuf kept so long alive by being prevented from flowering.

The trunk of the wild plant of Yucatan — which I refer with little doubt to Miller's old *A. rigxda* — is 1-2 feet high, leaves 1J-2 feeC long and as many inches wide, contractal above the broader base and widest about the middle ; lateral teeth] or even 1 inch apart, mostly straight, from a brood haw 1-2 lines long, rather unequal, with smaller ones interspersed, dark brown; terminal spine 1 inch long, Ij line* in diameter, straight, or often somewhat twisted, terete, scooped out at base but not channelled, <lnrk red-brown, a dark corneous margin extending down the leaf-edge for several inches and bearing the uppermost teeth. Scape 12-15 feet high ; flowers pale yellowish-green. 2j-2i inches long, perigone 18, tul>c 0-7, lol** 9-10 lines long ; utamens inserted about the middle of the tube, '* blood-red upwards," 1 inch longtT than the perigonc; authors 1O-1O| lines long ; styles at last as long as stamens.

A. Ixtli, which in 1872 flowered in the gardens of the late Mr. Thuret at Antihes, is entirely similar, flowers of the same dimensions, anthers a little larger (11} lines long) ; capnule*, which grow with the bull* on the same panicle, oval, over 8 inches long, 1J wide, very short, utipitatc ; seeds uncommonly larg*, 4\ lines high, with a ventral hilnm (in many other Agaves I find the hilum more Wai, a character which may be of some value). I believe this is the first time that the flowers of the Ixtli havt* Wn described ; they identify the plant with the old *A. rigida,* or at least the above-described Chelem. *A. KarwinsLii,* Zucc. in probably the same thing.

With the name of *longifolia* I denignate the variety known as *Sacci* and extensively cultivated In [318(30)] Yucatan. It is principally distinguished by its much longer npiny leave*, 4-5| feet long, 3J-4 inchen wide; flower* very similar to those of the wild plant, but filament* pTwnwh. *A. fourcroidrs,* Jacobi, Ag. 107, probably belongs here, and *A. elongate,* Jacobi, 108,1 would also refer to this form if the description did not expressly mentfc* a channelled terminal spine.

*Ayave Sudan** is the name that Dr. Perrine gave to the plant known to the natives of YucaUn as *Yaai,*** most valuable of the fibre-producing Agaves, and which was introduced by htm into South Florida, some thirty-** or forty years ago, during his efforts to acclimatise commercially valuable tropical plants in that almost tropical portktt of our territory, - efforts which were aided by Congress by alar** grant of land, but which wm destroyed, U^sthst with his own life, during the subsequent Indian wars. With this Agave, however, he has bten successful, as it is ** fully naturalized, and in quite abundant at Key Wwt and the adjacent coast. Dr Parry found it there in full bloom in February, 1R71, and gives the following description of it: trunk short, leaves pale fr**u but not glaucous, 4-6 «* long and 44 inches wid, e l l t hld d h ng description of it: trunk short, leaves pale fr**u but not glaucous, 4-6 «* long and 4-4 inches wide, generally smooth-edged, but here ^ *ti^ \^ug * tew nn^xi^ mmrim*. rtTj *U*t ** •OMP tasth; terminal spine stout, often twisted. purplUh. black ; scape 80 or t5 fctt high, panicle ft f~t long and batf Mwkk: one of the bigs* plant* eianiiiied hsd 35 bmnebe* in the panicle, the largsst (near the middle) 8 fstt long. «T P« and lowtrones shorter. The flowers are slightly larpr than those describsd, with s shorter, thicker ovary,1

inserted a little higher up in the tube. The plants bore no fruit, but produced on abundance of buds, by which they propagate themselves and from which this interesting form has been multiplied in this country and in Europe.

IT this plant is, as is most probable, only a cultivated variety of *A. rigida,* it is of the greatest importance for the study and the understanding of the Agaves, indicating, as it does, the extent of variation which they may undergo. It shows that the size of leaf and scape and color of leaf, are of no great specific value; and also that the presence or absence of spiny teeth on the margin is not an unalterable character, not any more than the [319 (31)] cartilaginous margin decurrent from the terminal spine. The presence of a trunk, the proportions of the leaf (in *A. rigida* and nil its varieties the length equals 12-14 times the width), probably the form of the terminal spine, the character of the inflorescence, and, above all, the form and proportions of the flower and its parts, remain constant, and perhaps also the proliferous character of the inflorescence of some species.

16. AOAVB PALMERI, n. *ip.:* acaulis; foliis lanceolatis sursum attenuatis in spinam gracilem teretem ultra medium canaliculatam cxcurrcntibus, margine aculeis inajqnalj'.us wepius recurvw flexuosisve atro fuscis dentato; florum albidorum pedicellis bracteis abbreviatis carnosis fultis; ovario perigonio asquali seu paulo longiore, tubo lobis vix longiore stamina longe-exserta raedio vel paulo supra gerente; capsula gracili prismaUca brevi-cuspidata in stipitem contracta, seminibus niinoribus minute verruculosi..

In the mountains of Southern Arizona Dr. Schott collected the flowers in 1855 ; in 1869, Dr. E. Palmer, who during ten yean, has male Arizona and the adjacent regions the field of his explorations, and for whose services to botany in that district this species is named, gathered more complete specimens and seeds ; and last year, 1874, Dr. Rothrock, of Lieut. Wheeler's expedition, brought very fine specimens found there at an altitude of 6,300 feet. — Rowers July and August.

This species seems to take in the southern part of Arizona the place of *A. Parryi* of the northern part of that territory, and is used there for the same purpose ; it is easily distinguished from it by its longer and narrower leaves, the much less deeply divided perigone, and the slender capsule and small seeds. - Leaves 10-20 inches long, 2-21 wide, •Wghtly contracted above the base, long pointed; terminal spine 8-14 lines long, deeply channelled to above the »Mdle, decurrent with brown, horny margins about 2 inches; lateral teeth J-| ™h •!**. j ^ 2 lines long, often ktonpened with small,r one., straight, or usually hooked, or often, especially the lower ones, flexuous Scape 8-12 feet high (bract, not noticed by the collector.) ; branches of the panicle repeatedly and loosely ramified' ultimate pedicels crowded, al»ut 1 line long. Flowers ^2 inches long; perigone 10-12 bnes long, whitish ; filaments, •Whers, and Hyfe, purple ; lubes usually a little shorter than the tube, exterior one. strongly cucul ate and much thickened at the a,.ex, interior shorter, broader and thinner j nectariferous part of tube, below the [320(32)] W i o n of the stan,™ 21-3 lines long, a little longer than upper part of tube; exsert part of filament. •l»»t the length of p.rig,..,,. anther, 8 line, long; capsule, slender, 18-24 line, long, 7-8 w.de; seed, among the •mallest of this section 2^ lines in the longest diameter, easily distinguished by the minute tubercles, 0.01 line wide, *hich, different from other Agave weds, cover the surface.

16. AOAVE W U M K M • acaulis ; foliis ovatis supra basin paulo angiutatis medio latissimis acutis, spine sub-WKNMB supra late exaraUc marine acutiusculo decurrente, dentibus jigidi. atrofuscis mperioribui majonbu. distantibus rectu, inferiorihua t«rvis confetti* subdeflexi.; panicula laxiflora; ovario perigonium et tubo lobos fere wjuanle, lt«"«Ubu. ultra medium tubo adnatis longe exsertis ; rapsula graciH prisiuatica utrumque acuU nee .tipiUta, areoli. •••i«m pimi, pUnctuhitis. - *A. tcabra,* Salm, BonpL 7, 89 ; Jacobi, Ag. 88.

This interesting species wa. discovered by Dr. A. Wislizenu. on the celebrated inarch of Domphan'. corp. through Northern MMICO on the Xazas River near San Sebastiano, in the southeast corner of the State of Chihuahua, »* far east of Parraa, May 10 1847, in flower and fruit Uving shoot, were sent by me to Prince Salm and seed, to *«»«nt European cormpondent., among othen. to Prof. A. Braunof Freiburg. Two yew. later Gen. v. Jacobi °«*«io«d some of the young planU rauwl from theae «seds in the boUnic garden of that university and afterward, wmmumcated them to Princo S«lm, who d«cril*d them (1W»«) «n«ler the inappropriate name *A. tcabn,* though, a. *• General ejpn^ly ,,«u*. they ar. i-riWtly smooth on both sides." A. thus the published name is inadmissible, J*«em U pn,p«r k> substitute for it that of the discoverer of this and so many, other interesting plant.of Northern Mexico.

Jaoobi deacribes hi. pinion, (then 16 y«irs old. and, a. he thinkN full grown) a. 8 inches high and 16 in ?"mrtWi rosuUte and somewhat Mtiarme. wilh bro»l, nearly rhombic and almost flat h-aves, 6 inches £»* 3* "Me, pal. g r a y T g ^ S T Z L l a»d curved downward. The leaf of the wild plant, now [321 (33)] !" " • • * *• 8 inches long and 4 wide, terminal spine very stout, 10-11 line, long, decurrent about the " • ' *«••«• ; arrangement of marginal teeth «,uite peculiar, the uppermost ones the large*, l H l 1«« W from •

If 4f^ •*«***, JaeoW, b on. of th, fr- n»o«h « «. and tb. only hsiry on. kmrwa. I beli^, is *A puU^u* lately described ^ «ngl. *"•» 1»*K obuto«l fro. M«k.aod «ow««l at 8t Petmbu* UOM pf tb. -nailer one. and setm. to belong to the first sectio

broader base, straight, almost black and very rigid, 6-8 lines apart; teeth below the upper third smaller and closer set, and below the middle only 2-3 lines apart, less than 1 or only \ line long and strongly curved downwards. Scape 12 feet high, branches of the panicle loosely ramified, branchleta 3-6 inches long, pedicels 1-2 lines long; flowers in small clusters, 3-6 or 8 together, 2,J inches long, perigone half as long, divided to the middle ; stamens inserted about § from the base of tube, exsert about } inch above lobes; anthers 10-10$ lines long. Capsule 18-22 lines long, 7-8 wide, similar to that of last species but not stipitate; seeds 2| lines in diameter, cells of the surface under the microscope, flat, punctulate.

I have a flower and a capsule of Agaves differing from any above described, and thus perhaps indicating two other species; but as the material is too incomplete to characterize them, I only indicate them here for further investigation,

· AGAVE SP. "Common on mountain sides in the Wild Rose Pass on the Limpio," West Texas, Chas. Wright, No. 1906 ; flowers only, collected June II, 185], referred by Torrey in Bot. Bound. 213, to *A. Americana.* Flower not quite 3 inches long, perigone equal to ovary, divided to the middle; stamens inserted about § up the funnel-shaped tube, reaching 14 lines above the lobes ; anthers 10 lines long. — Could it belong to the last described species, which was found 300 miles further south ? *U*

AGAVE SP. Dragoon Mountains, Southeastern Arizona, Capt Chas. Bendire, U. S. A. A capsule and seeds only, with the verbal information that the leaves are about 3 feet long and 4 inches wide, and the scape Dearly 20 feet high. The capsule is ovate-prismatic, 2 inches long, 10 lines wide, strongly cuspidate, at base obtuse; seeds 3J lines in longest diameter, apparently minutely pitted. —It is not probable that this could be a form of *A. Americana,* as that species has, I beliflge, always a stipitate capsule and larger seeds with flat, punctulate are®.

ADDITIONAL REMARKS.

The highest trunks of cultivated Agaves which I find noticed are 3-4 feet high, and [322 (34)] 3-4 inches iu diameter; the thickest one was 14 inches through, but less high. I have met with no account of the size they may attain in their native country.

The scape of *A. Americana* is said to measure sometimes 36-feet in height

The flowers of Agave are always more or less erect and of a coarser, calycine texture, while those of Yucca are pendulous and corolline.

NOTICE TO BOTANISTS.

I wish to direct the attention of botanists, who have the opportunity to observe the development of these plants, to the following questions: —

At what hour of the day do the anthers of the different species burst and begin to shed their pollen, when do they become entirely effete, and in what state is then the style? How long afterwards and when does the style of the same flower attain its full development, and when aud how much do the stigmatic lobes open or spread, and when does the stigmatic liquid fill the cavity of the style and cover the inside of the lobes? — I have above given an account of these physiological processes in *A. Virginica ;* the only reference to them in literature which I can find is made by Jacobi, Ag. 310, where he says of an Agave of the second section, that the full development of the style and the separation and partial spreading of its lobes take place only after the stamens have faded, which, as far as it goes, fully coincides with my observations. His further remark, that the stameus are not indexed in the buds of that species *(A. Garjfprrtiana),* is unquestionably erroneous. Of the floral development of the Agaves of the third section nothing at all seems to be known.

I wish also to direct, tlw atteuticm of observers to the time and nature of the secretion of honor b ihojuuer **pert** uJ"ttie llower-tuto.

Tho inflorasceiUM of thoso Agaves of the second swtmu which uro said to bear 1 or 3 or 6 to 8 flownrs in a fascicle r«iutres further invcsUyatiuu.

Acaroful uxuiuin- [323(^"0] nti«tii of the **young** (forming) **iotorcscsooei** *vt* **tho** third sectio>t will diBylosetlie true nature of their arrangomeiiL

Another jxiLut winch clniins OMS niU'iiii'*n of observers, *h* Lite |! Kse and time of tJm fprm;;tion of bulbluta in ttio proliferous Agaves

PLATE 2.

AIJWT1ON 10 ARTICLE ON AG.WE.

l.c. 1876, pp. 270–1; **pp.** i.-ii. of ADVERT.

Additions and **oon«t>** [ij tions have accumuliOcd in the interval between priatinj and publ**kati**on.

Page 294. It requires further and tensive observations

111 *• **gunks** to ascerta*iti* **tho limiu of** variability of the edges of the leaf and its aculeate-toothed margins. **Culti*** vators have already discovered **wit-** sideralde latitude **in (hi. mpwt tl** plants raised from seeds from the same parent.

Page 302. **V«r. iujrMw d«- not** grow in salt-marshes, **hrt wu JMI,** l by Dr. Mellichamp, "in one spot only, on a tongue of partly brackish land, extending out into the salt-mud and marsh, under dwarfed live-oaks, Cassine, and saw-palmetto, on the decayed shells, mixed with sand and earth, of what seems to be an old Indian oyster-heap"!

Page 304. *A. falcata.* The lately introduced *A. Hystrix* (' the Belgian nurseries may have to be this species; **twtiw etiunlry wJ ttuwm,o> u«uul, u d n** own.

Page 305. (SdfattK (Wttoi than *Schott*, as printed). **ll U |n** oper to add **1 that ,t** *geminiflora*, Gawl., the *Bonapartea juncea* of the gardens, is a very different plant, and has nothing ... *ettii*, except that both b**long** to the same section of the genus.

Page 310, *A. dtttrtL* In characterizing UHJ foJiaKu, I was l«l into the too enmiuon mlttako of adopting the imliviilaal character! f f A tingle individual an tbuw of tin- ojH-tic*. Full gmwu luivtsi are at U-ut 1.V2O iachr* 1 long, utd 2 3 fiMrfcii ml* shew UM taw. TJrt tanuhttl *fptat* it eampnaiiJ aal aajmw-jpjovwl wily in ilip youn#, not fully <• v. Liprtl *lad,* a tW *dall ft it tmtr-tnaiigitLar w«l» * wikand ihaTlii • aansi .n uWe. — Tlie localltj u Vallecito, not "Valcitron."

Page 314. *A, Amrii. To* the Ubnltty of Mr. Heirr shmr we *m* iiirhtl fur UM Gna pbntognphi of tM* >pn-M« vbkk pwca UIM anmher ^ nur Tmti—cttnrn.* *They* »o» Ukn by Mr- J. C Park«r of San Uin^o, lart Jm««7. PUu S ttpmeut* a yiwp «f tb«at pknti <w Ifc* «MM HU t>w cuaot of ike Poi-ific, wliidi U «een in tbt *da&*nc**; M n w h w U m full ldata, OOMTI I m n d tit S^.ml*r and are tn>w liearing fruit djtnriri^lv. Hi i-ayiiii! uU jiliiHln «re ma iirmiud. nii'l youu^ one* uprouinig. Tin; pliyllntiiLtic UTQH|^cin£Ut <f tint •Jmrt brood leavm it iMaulirulljf <|i»|-livi'-l ; tl«j brigbl ?i|itny U^JILJ app«r dlw>»t wliile from ill- tfJHt •>(reflected lt^lit Tho acapo i* pjQiiHpiftioiHly cnvi<i«.1 by thei Lnuil, iri;iii^itl.ir, jtubrictU«d bract*. TW Jl^iirt* an about one-twenlj-fourth of the uatuittl *iie, ur half an iucb to tlit foul.

Fig. 1

Flu- 3,

PLATE 3.

Dutc 3 «liuw», iu t ig, 1, a y-mnit plant: it» K«n« an more dsoply concave than LW an Ulet, and thmftpj. Mnn to he rurrowifT ; the twlb «od tlnir inijirrwU^ni (in tin: mljoiTimg torn* at* nnnaritaUtT well dtmiopcd. fourth *ut* natural «IJW. — Fi^. S ii a rlmlcr of Itrnri: irig *x* duiwlr cotn]Mctr<l nuun, unfi>rlnnatcljr ttol cnuiigh in iti dctJiiti; imC :Jie ourJiuo* of thir cfiutcr, the nnfrjilpldf; hf*TC*, *the* Twy l«fig, nioncfy T<rrti<af, and t|;r (i^ricil *Lylet, art »• 11 randefvd. It u two anil a h^lf timtw lea than Uic batural lit?.

Pujtr 322, line 1. In tlio Idrlin UiUtiic i^mleit an *A guv* alinmaUt i** CUILJTKLCJ »liich ha* a trunk 0 f«t high; it is told to Wo ^ i r a 4 fvet x iiliiu ilw lart 18 yean.

* These photographs are reproduced, M wrll as possible, by the Ives process, on this and the preceding page. — Ens.

VI. THE FLOWERING OF AGAVE SHAWII.

FROM THE TRANSACTIONS OF THE ACADEMY OF SCIENCE, OF ST. LOUIS, 1877, Vol. III. pp. 579-582; pp. 1-4 OF REPRINT.

In May, 1876, Mr. Shaw received from San Diego, Cal, through the kind offices of Messrs. Hitchcock and Parker, a full-grown specimen of the fine species named for him. In June the new, innermost, leaves became more slender and their marginal teeth smaller. Early in July the flowering stalk began to rise. Eegular measurements of its growth were made by Mr. Gurney, the superintending gardener, at 7 o'clock A. M. and at 7 P. M., from July 8th to September 5th. I have divided this period of 60 days into 6 decades, and have added the mean temperature and the fall of rain (at my station, 3 miles northeast of the garden) of each decade. The following table exhibits these data: —

Amount of Growth in Ten Days.

1876.	7P.M.-7A.M.	7AM-7P.M.	Total.	Mean Temp.	Rainfall.
July 8-17.	.22 in.	2 in.	4j in.	82°.8	1.26 in.
" 18-27	3 "	2J"	*H* "	77°.4	1.03"
" 28-Aug. 6	.4J«	3j«	8J "	69°. 1	0.72"
Aug. 7-16.	.7 "	4*"	11*"	78°.3	1.51-
u 17_26	6 "	4 "	9 "	79°.1	2.21"
« 27-Sept. 6! . . . ' . ' . ' . .	- 4j "	3 "	7} "	72°.6	1.71"
July 8-Sept. 5.	.27* in.	19* in.	46} in.		

The table shows that the night-growth (including the morning hours) was in every decade larger than the day-growth, and in the whole period surpassed it by 16 per cent., the former amounting to 58, the latter to 42 per cent

It is further seen that the largest advance was made about the middle period, or from the 3rd to the 5th, and m<$tly in the 4th decade. After Sept 5th the growth diminished rapidly, about the end of the month the head began to swell, and 3 months later the first blossoms opened.

The table also proves that the temperature of each decade did not have any material effect on the growth of the stalk ; in the warm weather of the first two decades it grew much less than in the cooler 3rd period.

The latest growth in 24 houre, 1J inches, took place in the 4th decade, Aug. [580(2)] lOth-lUb, mean temp. 78°; while on Aug. 18th, with mean temp. 84°, the growth is marked only J inch, and Aug. 23rd and 25th, mean temp. 85°, it amounted to 1 inch and $ inch respectively.

The quantity of rain had apparently little or no immediate effect, as it was pretty evenly distributed through the whole period.

The full-grown scape measured 54 inches to the base of the panicle, which, when fully developed, was itself 21 inches long and a little wider, and consisted of 19 branches, the lowest ones the longest, somewhat S-shaped, and horizontal, with the end turned up.

About Newyears the lower branches of the panicle, which thus far had formed a pointed club covered by the large bracts, began to straighten out, while the upper ones with their bracts yet formed a large cone. The first flowers opened on the lowest branch on Feb. 5th; the innermost ones of each cluster developed first, the others flowering in quick succession, so that all the flowers of a bunch were in bloom within about three days. Two or three weeks later the plant may be said to have been in fullest bloom, though the lower clusters were passed and the uppermost not yet °Pen. These last flowered about March 18-20th, so that the flowering period (at this season and in [a] greenhouse) occupied from six to seven weeks.

Abundant opportunity was afforded to study the gradual development of the flowers (see also p. 298). I have, on Plate IV., represented these various phases by a series of figures carefully drawn from nature.

The bud bursts in the morning or in the middle of the day (Fig. 4); the bent filaments begin to straighten out, the still closed anthers commence to protrude, the top of the style has not yet reached the tip of the perigonial lobes. Only thus far the perigone and its lobes are fresh, exhibiting their fullest development.

In the evening of the same day the filaments are straightened out above the perigone, the anthers begin to open at the upper and lower ends, as Fig. 6 shows, and then all along their commissures; the style has not yet reached the length of the filaments, but the perigonial lobes are already withering at tip.

On the 2nd day the anthers are shrivelled, though quantities of pollen remain adher- [581 (3)]
ing to them; the perigone withers more; the style in the morning is still shorter than the filaments, but in the evening has exceeded their length somewhat; the stigmatic lobes remain entirely closed.

On the 3rd day these changes *go* on gradually and slowly. (Fig. 7.)

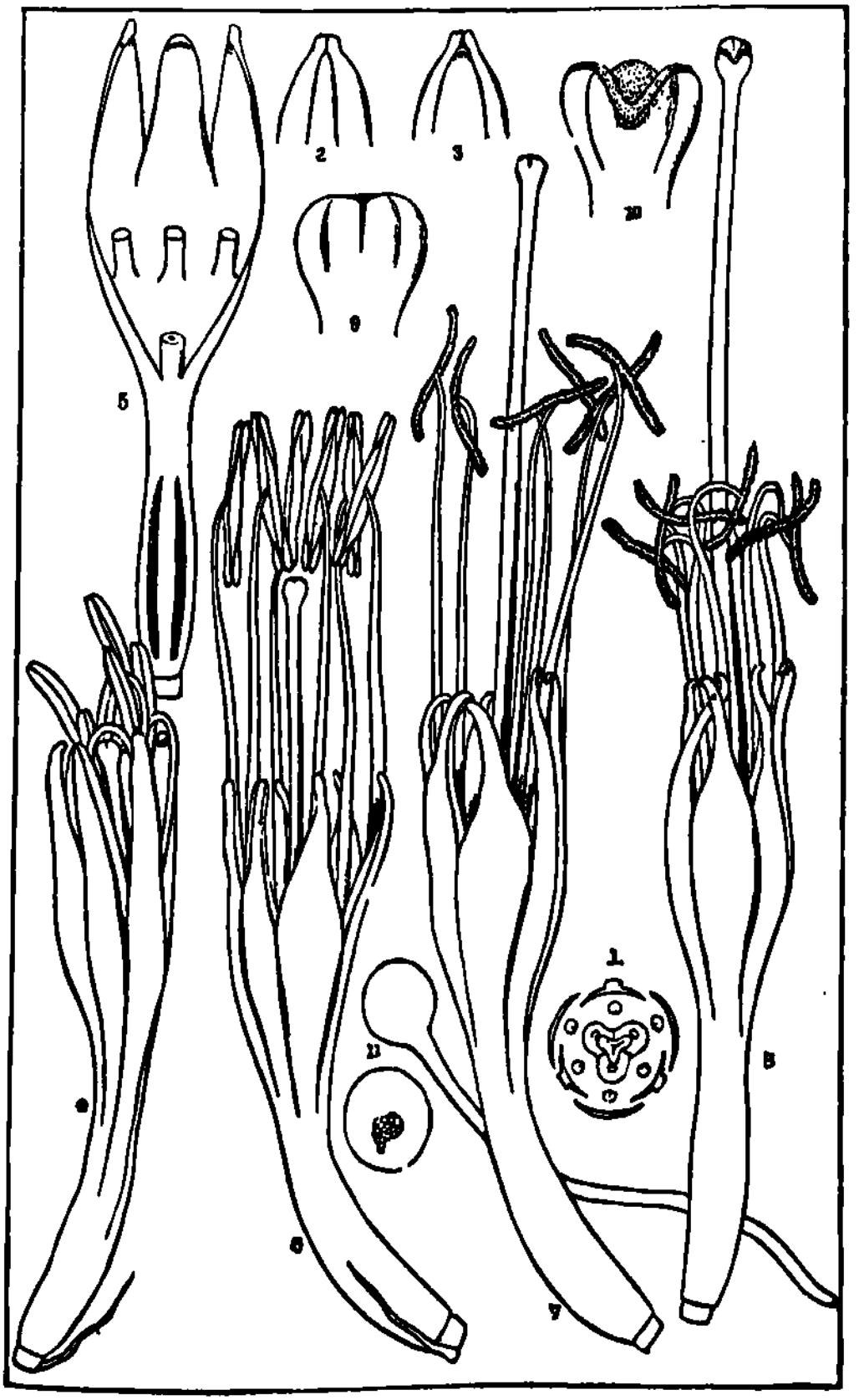
On the 4th the style is 2 inches longer than the perigone, the lobes of which are wilted and twisted, while the filaments also wither; in the evening the stigmatic lobes begin to separate and exude some moisture. The color of the flower, which at first was greenish and sulphur-yellow, now is of a deeper dirty yellow.

On the 5th day the style has reached its full development, 2J-2} inches longer than the wilted perigone; the filaments are drooping, the anthers shrivelled, much pollen yet adhering to them; the stigmatic lobes have separated and are covered with a large drop of sweet, glutinous stigmatic liquid, which causes the pollen grains that drop into it to develop their long.tubes (Fig. 8).

The drop of stigmatic fluid remaius fresh and full for another and often even a third day, and then gradually dries up; the functions of the flower are ended with the fertilization of the ovules.[1]

I have not yet made mention of the abundant secretion from the nectariferous lower part (all the part below the insertion of the stamens) of the perigonial tube. During the several days in which the flowers were open the whole tube was filled to the brim with a sweetish watery liquid, of a slightly nauseous odor. I am not aware that such a secretion has before been observed in Agave flowers, and would now consider it as an abuormal phenomenon, originating under artificial circumstances, had not others, whose attention I had directed to such secretion, noticed the same in other species. Prof. C. S. Sargent, of Cambridge, Mass., saw it in an *A. yucccrfolia* which bloomed there last winter under glass, but could not find it in two specimens of the same species which in September flowered in the open air. Of greater importance, because made ou a wild plant on its native mountains, is the observation of the Rev. K. L Greene, who found last summer [582 (4)]
in Southwestern New Mexico the large paniculate *Agave Parryi* so loaded with this liquid that it actually rained on him when be knocked on the stalk, or when the wind shook the panicle. South European botanists, who have numerous cultivated species and especially the naturalized *A. Americana* at their disposal, are in a position to investigate and experiment upon this curious physiological fact Our *A. Virginica* exudes only a small quantity of honey in the base of the tube, but nothing like such a watery abundance,

[1] Bad* or flower* that are kept for a while Rrparntad from the plant, Mich e.g. aa are suit fresh by mail, become distorted, the orary swell*, the style lengthen*, but the perigoue and stamen* wither eren if Dot yet fully developed



PLATR IV. AOAVI SRAWII.

EXPLANATION OF PLATE IV.

Fig. 1. Diagram of the flower. Three exterior lobes of the perigone cover the thin margins of the 3 interior ones; 6 stamens opposed to the lobes; 3 carpels opposed to the three exterior lobes, each with two series of ovules ; iu the centre the stigma, its 3 lobes alternating with the carpels.

Fig. 2. Top of the flower-bud, showing one interior between two exterior lobes.

Fig. 3. The same, inside, exhibiting the broader hood of the inner lobe between the longer and narrower outer ones, all of them downy below the tip.

Fig. 4. An opening bud in the forenoon of the first day; the filaments begin to straighten, raising the anthers, apparently in irregular order, above the perigone ; style quite short.

Fig. 6. Section of the same, with style and filaments cut olf; the perigone is seen in full development before it begins to wither; insertion of the filaments in the middle of the tube, the inner one slightly lower than the outer ones.

Fig. 6. Flower fully open on the first evening; filaments straight; anthers opening at the upper and lower end ; style not yet of the length of the filaments.

Fig. 7. Flower on the third day : anthers and perigone shrivelling; filaments yet erect; style of nearly full length ; stigma yet closed.

Fig. 8. Flower on the fifth day: perigone and filaments wilted ; style fully developed ; stigmatic lobes separated and bearing a large drop of glutinous liquor. — All these figures in natural size.

Fig. 9. Stigma closed.

Fig. 10. Same with expanded lobes, both magnified 4 times.

tig. 11. Pollen grains magnified 100 times: one intact, slightly elliptic; the other, developing its tube and somewhat contracted.

VII. AMARYLLIDE.E OF WHEELER'S EXPEDITION.

FROM REPORT, ETC. VOL. VI. BOTANY. BY J. T. ROTHROCK. 1878.

AGAVE UTAHENSIS, *Engclm.,* Bot. King's Report, 497; Engelin. Agav. in Trans. Acnd. St. Louis, 3,308.— [267] Stemless; leaves suberect, or outer ones spreading, lanceolate, tapering from a broad base, concave, 6-12 inches long, 1-2 inches wide, not constricted above the base, very thick, hanl, glaucous and rough, terminating in a long (1 inch) pale spine, with broad whitish teeth on the margin; flowering stalk 5-7 feet high, with a spike-like raceme of yellow flowers each 1 inch long, in pain, or often in clusters of 4, on distinct pedicels ; lobes 3 times longer than the funnel-shaped tube, which bean the stamens in the middle ; filaments and-style not much longer than the perigone ; capsule oval subcylindric, about 1 inch long. — Northern Arizona, Bischoff, to Southern Utah.

AGATE PARRYT, *Engdnu,* Agave, 1. c. 311. (.4. *Americana,* var. *? latifolia,* Torn Bot Mex. Bound. 213.)— Stemless ; numerous short and broad (9-12 inches long and 3-3} inches wide) leaves crowded around the base of the stalk pale, glaucous, with small, almost black, spiny straightish teeth, and with a dark horny margin toward the cuspidate tip, which terminates in a robust, somewhat triangular, black spine 1 inch in length ; stout scape 8-12 feet high, bearing a large branched panicle of cream-colored flowers over 2 inches in length ; perigone deeply 6-parUxl; lobes twice as long as tube, which bean the luig-exsert stamens in its throat; capsule broadly oval, sessile; seeds larger than in either of the other species. Western New Mexico and Northern Arizona; Rocky Cafion, Rothrock [268] (274) in 1674. Parry, Bischoff, only fruit Dr. Rothrock's observations and very complete specimens enabled me to give a connected account of this species, of which fragments only had been known* for many yean. Rev. Mr. Greene noticed the abundant secretion of a sweetish liquid filling the tube, which has also been observed iu other species. The rootstock is used as a substitute for soap by the natives, under the name of Amole, much like that of Yucca, and when roasted, is considered a great delicacy, named Mezcal.

AOA VE PALMERI, *Engelm*, Agave, 1. c. 319. — Stemless; leaves lanceolate, 10-20 inches long by 2-2) inches wide, attenuate into a slender, terete, narrowly channelled, brown spine ; marginal teeth flexuous or recurved, dark brown ; scape as in the last; panicle loosely branched ; flowers 2 inches long; perigone whitish, lobes a little shorter than tube, stamens from its middle, and, together with anthers and style, long exsert, purplish ; capsule cylindric, stipitate; seeds small, roughiab. Camp Bowie, Arizona, Rothrock (496), 1874 ; Palmer, in Southern Ariiona. Similar to the last, but readily distinguished by its longer, narrower leaves and the other characters enumerated. Used for the same purposes as the last

VIII. COLLECTED DESCRIPTIONS OF AGAVE.

FROM TORRBT'S BOTANY OF THE BOUNDARY (IN REPORT ON THE UNITED STATES AND MEXICAN BOUNDARY SURVEY, ETC., WASHINGTON, 1859).

AGAVE KACULATA, *Engdm.:* radice crassa cylindrica nigra; foliis raclicalibus lanceolato-linearibus longe acu- [214]
minatis subtus convexis supra profunde concavis recurvatis glaucis maculis atro-virentibus notatis, margine albido cartilagineo-dentatis apiee acutis nee spiuescentibus ; scapo basi foliis paucis instructo; floribus in spicam Bimplicem dispositis brevissirae pedicellatis; tubo corollae superne vix ampliato, laciniis lineari-oblongis rotato-patentibus. — Eagle Pass on the Rio Grande. Root 6-8 lines in diameter, 4-6 inches long ; black, with long thick white [215]
fibres. Leaves 4-6 inches long, i an inch wide, deeply channelled, but not carinate, very glaucous, the dark greenish-brown blotches more distinct on the upper than the lower surface. Scape lf-2 feet high. Spike about 6 inches long, with 12-15 flowers. Bracts subulate, longer than the pedicel, which is about one line long and articulated in the middle. The flowers, which are of musky not disagreeable odor, are about 20''' long 5 ovary 6''', tube 9''', the limb about 6'''. Laciuin of the perianth at first green, afterwards on both sides (with the filaments) of a dirty purplish color. Evidently near *A. rcvoluta,* Klotzsch ; but that species has smooth-margined leaves; limb of the perianth equal to the tube ; stamens free in the tube, and longer than the limb. To *Polyantlies Mexican*,* Zucc (which Kunth in Enum. 5, p. 847, says is probably a species of Agave) it is still more nearly related, but that has leaves entire on the margin, with reddish dots ; flowers white, in pairs and sessile, the tube 18 lines long, segments only 3-4 lines long. Capsule (immature) ovate-oblong obtusely triangular. Nothing is said of the fragrance of the flowers.

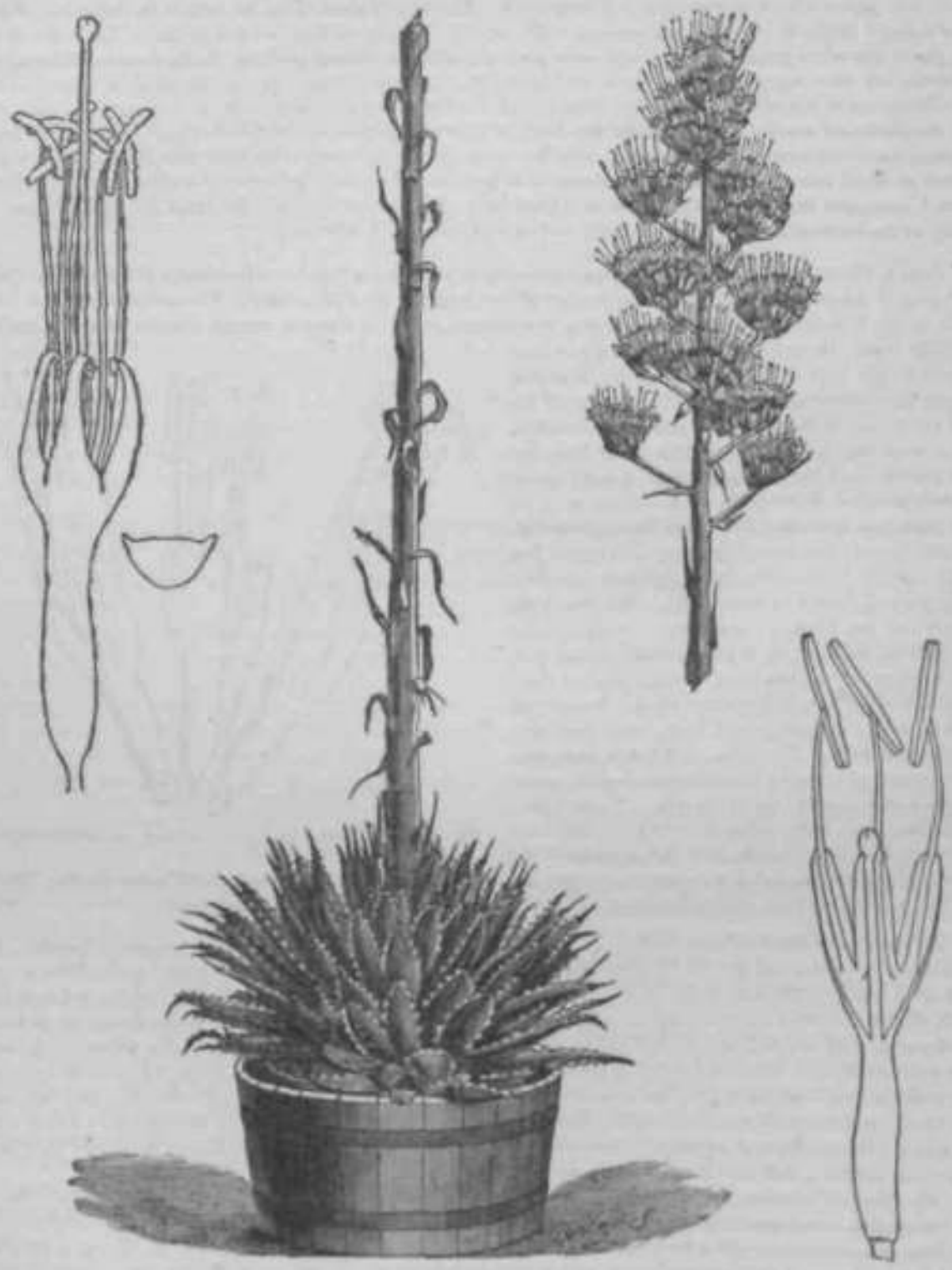
FROM REPORT ON CLARENCE KINO'S EXPLORATION OF TIIE FORTIETH PARALLEL. VOL. V. BOTANY. BY SERENO WATSON. 1871.

AGAVE UTAHKNRIS, *Engdm.,* n. *tp.* Leaves basal, stout, very fleshy, tapering from a broad base and ter- [497]
minating in a long channelled spine, herbaceous on the sinuate margins between the horny flat teeth ; scape bearing a dense spike of small yellowish flowers in fours or pairs ; the oblong obtuse erect lobes of the perigone as long a* the ovary, 3-4 times the length of the short campanulate tube; stamens from the middle of the tube, together with the style slightly exsert; anthers of the length of the lobes; capsule cylindric-ovnte, acute. — About St. George, Utah (Dr. E. Palmer, J. E. Johnson). Leaves at base 1J-2 inches wide, 6 inches long, with stout broad white straight or rarely recurved spines on the margin ; terminal spine whitish, nearly 1 inch long; each leaf marked with the impressions of the teeth of those next to it; scape 5-0 feet high; flowers, ovary included, about 1 inch long, tube very shallow, scarcely more than 1 line long ; capsule and seeds among the smallest in the genus, the former £-10 lines long, the latter 1J-2 lines in longest diameter. Allied with *A. hcUracantha,* Zucc *(A. Posdgeri,* Salni., *A. Lechcguilla,* Ton.), which extends from Mexico into New Mexico and Arizona.

FROM TUB GARDENERS' CHRONICLE.

AOAVI PARRYI (Fig. 39). — We have had here [St. Loui*] in May, Agave Parryi in bloom. The aped- [237]
»en was sent to Mr. Shaw's ganlen from Arizona a year ago, and developed it* flowering-stalk during winter. I enclose to you a photograph, and if you think it worth while to reproduce it in the *Gardeners' Chronide,* I would direct your attention to the very bng exsert styles, which in the photograph ore very indistinct. It was interesting to find most of the flower-bunches open at the same time, presenting with their (at a distance) deep yellow flowers quite a gorgwma appearance. The stalk is about 8 feet high, 7 inches in circumference at base, the panicle is 2J feot high, and 1 foot in diameter, and consist* of alnmt sixteen branches. The leaves are well characterized by the Bemitercte or somewhat triangular terminal spine, nearly flat, or slightly keeled above. They are about 10 inches long, and 3 inches *Me. — [Aug. 23, 1879, n. s^ vol. xii.]

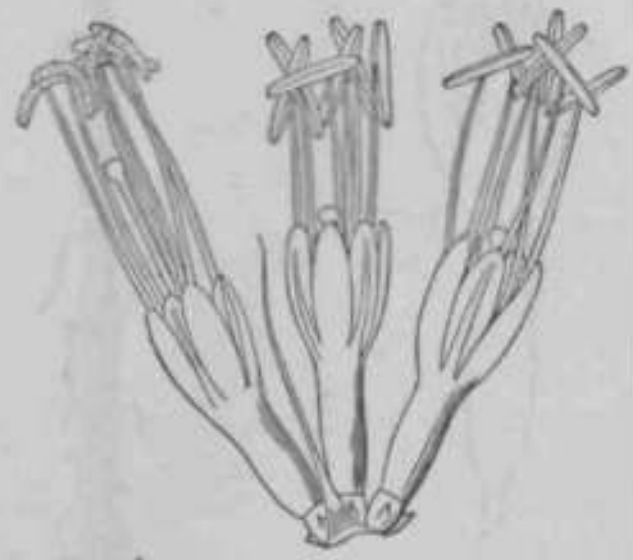
AQAVI (LITTJBA) VicroRiA-RiaTNA, *T. Mom.* Acaulescent; leaves 100 to 250 in a compact rosette, [788]
ovate-lanceolate, concave, 6-8 inches long, 2-2J inches wide above the slightly dilated baw, \ to (towards the ***) I inch thick, rigid, dull green, with white marking*, and a horny, entire, at List detached border, which termin- **** in • rigid, often twisted, blackish spine, usually bearing a few teeth at its base, often with a similar horny bonier °n the dorsal keel, similarly terminating in one or two teeth at the base of the terminal spine (which thus appears two- • thite-erated); scape, 8-10 feet high, 1 inch thick; flowering-spike about one-third of its length, very dense, bearing in the axil of each bract three short-pedicelled flowers ; flowers [with the Btamens] alxmt 2 inches long ; ovary over \ k^ ; tube broadly funnel*haped, only \ line long, perigonial lobes oblong-linear, 8 lines long; filaments inserted at the base of the lobe*, more than twice as long an these, and rather exceeding the style, which IKMIW three orbicular, at last spreading, stigmas; capRulo about 9 lines long, oblong, cu«piclatc ; SWIM, 2 linos long. — flan/. *Chmn.* n.s., iv. p. ^ with woodcut (fig. 137); *Flore de* Sem$,* xxi. p. KHH, with woodcut, Baker, in *Card. Chron.,* vii. p. 628. — *A. Con-* ******, Carrttre, in *Rev. Uort.* 1875, p. 429, fig. «8.



Fin 33, - Aain P*E»TI.

In codTw: pmvlty mil nn rtwp hill* near Monterey, XiirtlnBtn Mexico, flowrrriitg in autumn, w:cat\iiii}; to Dr. E. Palmer, who KwLbureJ fruiting ^trJnmiH in Huhnwry U*t. The lat^t pluil which hu aunt *Ut* SL Lewi* IM* • diameter of 2 feet, a bright ut' 14 UK&M, UK! IMMII about JOO IMTM, 7 t> £ iu- hua long and 2 to 3j wide. The Iwtvws of the older plant* bcu u-hit« nitwit*, wltidi awn Ui OOIMJXMMI wub aul An prvLably jpnxliwvd by Uic jmaiunof UMJ MIJUJU- itijj l«va, liut olher wavy, luwnmt mwka uo tir km of Jottbgcr jilaftta ean ecansrly thtw U nocunnted for. Tim iiiflnhMcuuci! in tluii of * ray iliw limh^. Utum, A* I m n with iui *uBa* 11 i^riyimlnl tulw. Tlia great morphological inl«-Twt o o w b in UH I^IIMIJ (at hwl m im ipeamuj iri-Jlowtavd bunctiat. Uie tfainl Sower occupg Ilbt) oeotre Iwiwocb tb* iwo oomul l«tt Boveb rf lit* *m&a ;* tliis is jirobubly ILL- jiriautry *tUwt>r*$_t$ which in matt or in all otherLiUM It enlirtdj- tUeat, <* if In * ffw «Jitti<M only imheated anil raprawntul W» brintlu. Where 1 Liv,i *.-«ii moru tbun twn flu wen in n Litlun («,jr. uft«n ill *A. Uinhtnn*), Hits tUinl ui.J Amrih tlawtm am axillary 10 Uio brachi of l;lui finrt iuiii 8ucoii.J one. — [Juiw ID, IWH), n. s-i TOL. xiii.]

AGAVE VitTURLK EJKINA.—Thi* *pi^it* dowsnvl in tlie BoLtmic Gsuxlcn of Oanibri<!l^ (IT. H.) in Uio [841] latter I»wt «f Au^bt (Kid lityiiiuiri^ of September of tliin y«ar (fee %. 14SJ, j*, 8JC)[1], TLo ipucitiitin tru W(K tained by Uf. K. Pklmer, nuar Munturvy, JUirxioa, b Fubmary, 1W», it fcniut a regular COMPOUND «MI# of over *$BO* conniving leav*i* the ntulk, aUmt 3 intbtM think nt bow, WM over in fail hfeli, ami ibo«l 0 f.-i of i: nm»l*tul of It* v try . i « * fawifaK ^ikt, wJuk tb. Uw f-rt rf tfia« scape was covered with t»itasmiMh



TOD .1 brawl U H, tb k w * am 4-5 inches long, and spiny-pointed, each one bearing in 3 small knobs, evidently abortive flower-buds. Tb. *towm, with* all their parts pale greenish-yellow, were densely crowded, and very regularly and constantly arranged in threes, [...] as the capsules were in the native specimen described in this journal, J *am* IU, IMt>(jk Pf^)! Tbe fluwen iwv [1]1 baA U I M ! p u b k«jt *• tr« niatatnl in tba formed ' Btid«. UK. «*M7 «b.*ji ^ iReh. Uir 1-TV.TH- J inch, its tnW being only 1| lib* hirm ; rttmrtw iawilli I nl»-ut the middle of the tube, and exerted beyond the perigone about 1½ inch; anthers ½ inch long, t(k nectary JJ into fllUil with to Ow brim. TV *migmatk tAm* in MHMt CM J*** uiwned, uul ihm w f. rtitiiatiim took pbee, *vxeepl* "i- »oott Uuwtn n«ir th<? top of the *pi fee. You iij; planu raised from •«dj in Ilia «j <^ >«gin only *now,* after nwra tluu iwq yw», tn tligw tlia cbwMter *at* the species CnlU now tlia UISYWI w«rc uti«p(jttai, Uirlr *1|{<I »Tij,-Jillv iK-iitkuJate, ftml tlia Uinuiuiil »IHJM virupU. Tlie cut (fig. 1*0, p. «U!i),» u from a photograph iwtit by I>r. A- G»y. — [Di*. Ml, !<*», n.i., vol. iviii.J

FIG. i*a. _ funrm OF AGAVE ttttoiK« s ouwnmn.viit.ww.

A04VB BRACTEOSA Acaulescent, with KM $ Unoeolttte or bnwlly [773] linear, fleshy, grayish-green, irregularly spreading leaves recurved at Uw tip. 16-22 inches width of 1½ inch near the base gradually to an herbaceous [1] - • tb ntUdk; H i i d t l k k below, slightly concave; margin serrulate wife minute rather obtuse cartilaginous t««h BIMHH ^ - ^ line in kngth. The flowering stalk was 37 ,,,-iy, tiffc, 17 inebw of <flk» of lowm ; thu whol« stock cl.wly beset with spreading or recurved bracts 5-6 inches long, subulate-filiform from an ovid base. Flowers in pairs, their short pedicels with conspicuous membranaceous bracts, about half •* law; M tW otwy. Fknran (%. 136) wily KUMII perigone only ½ inch long each; the lobes •irf d k n M *ttemrh h>* tin- IHWQ, tube twiufj only | 1 inch long; ovary as well as perigone oblong-ovoid, i •tonwiw in tit- i.Jimol, fi«it tinn.» d« k m g u UH ttiU*, ttjrk m hu-i line deep; lobes oblong-ovate, spreading; stamens inserted longer than staminate; anthers 4 l whom fresh.

The minutely serrulate, narrow, but yet fleshy leaves, the numerous flexuous or recurved bracts of the stalks, the very conspicuous membranaceous bracts on the pedicels, and the small size of the flowers witlt tltr very long filaments, contribute one of the most curious species of the genus. It was found in the amp lor ality, near Monterey, where Ot A|pn:j> Vibrio, U *»* .,.ll.v,.-l. 1>r. Palmer discovered [rH| this Aga VP, aUdl to»tfri tut ymr in On- Cambridge .S.) Botanical Garden, where <flaker, Monog, in Gard. *dknm.,* Dw 1ft, 1K77>, «t It* iiicy KM<1 lin- nt«n{ioMwo of Uw leaves, while in other respects it m oeara to j|. j»rt^i*« —[l»«, H

full-page wood-cut, u)O.b«¡t ««ITLJ the dense Zitten habit, i. tuHtod him _ RJM.

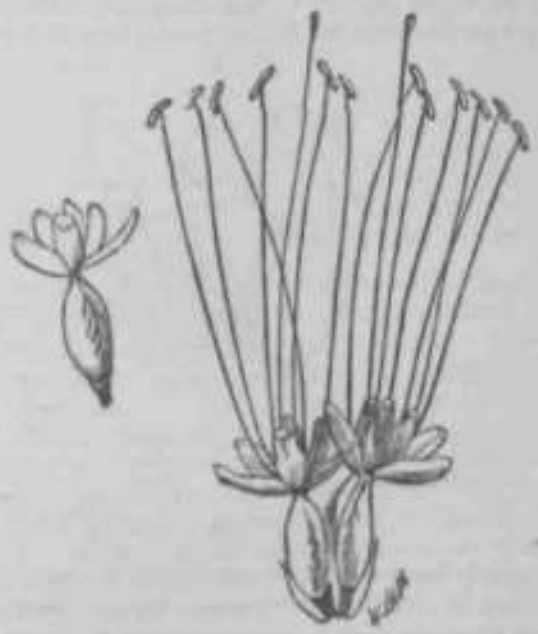


Fig. 135. — Agave reactiona.

Fig. 136. — Aga»rt reactiona.

AUATI nKTuaACJUmt* (Ziw.), FORMA oui*i£ftciJTUOiu. — The mvcrtigntkm* or Dr. V. Haronl oft]* [46] fturiec t.r DM *V.* S. Army *hwt>* tiron$_{K}$hl <nt tome iut- -luting nnir|i I u ^ k a ! foci* in regnnl Ui Uii» which tn*y twitrh HA n liiwun «lxMit the v.i- takt-n fiutn the biltFresceficc n(Apm». Tito (ot thv form whidi is known iw a. flmpurQ. (l abundant iu tin; lm.iuiUiiii iDgimw of W«rt Tcuts uul along

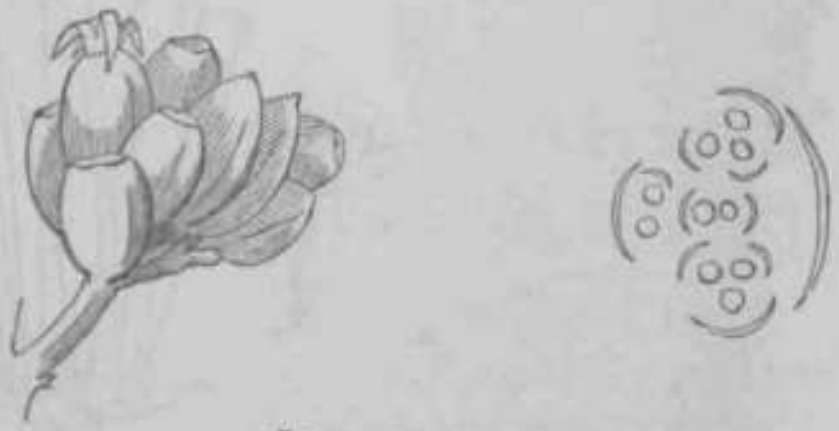


FIG. A, — CAMI'LW OF AOAT*.

Oimde l*tw««i El *Two* $_{Hn}$l IV«Ji<v nod fcw « « • uwillj n«now k v a | to H iwli wide, nnJ n fwl OT k iriifiui *ntr* fuiinil wilii mm m o t c r 1 IIKHW. wkl.. | otlHft l««r tW t v w t n i» CIU-WUIP iiutewl 14 nix, And a m i Kti, tn nuni- •*»•- *n* xtoul, J! limoW 1 to 1 itich lonft wUi«li NUB to f^n« «n ty ib« [v,. *ksnctvr.* Bgm i i durtcTJ to.'e»[^ »«*k«J f'U-i o'n !'a'iw^{111}* "f *= ^{IHJ*ure}-$_{nJltl\ t\ b\ e(}$ K ™ " ' tli.:ir »mu»g«U — [Jim. is, jfwa. ii- *., iul rifc]

VII.

PAPERS ON CONIFERS.

I. ON PINUS ARISTATA,

A NEW SPKCIES OF PINE, DISCOVERED BY DR. C. C. PARRY IN THE ALPINE REGIONS OF COLORADO TERRITORY, AND ON SOME OTHER PINES OF THE ROCKY MOUNTAINS,*

FROM TIIE TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, VOL. II. 1868.

DURING his first botanical expedition to the Pike's Peak region, Dr. Parry, in searching [205] for James* *Firms flerilis,* found, instead of one, two five-leaved pines, which evidently had been confounded by Dr. James; thus the discrepancies of his description are fully explained. His general description of the tree and the edible seeds belong to what we now name *P.JIcjcilis,* while the "erect cones" (smaller than those of *P.rigu'la)* "with unarmed scales" must be either very imperfect young ones of this, or old ones of the new species, which bad lost their awns.

PINUS ARISTATA, jpec. *nov.:* arbor mediocris sea humilis; foliis dense congestis quinis uncialibus integrif acutiusculis ex axillis perularum per plures anno* persistentium, squamis vaginantibus obtusis mox potulis squarrosia demum totis deciduis; amentis masculis ovatis involucre 4-phyllo munitis in axilla bractea ovatss acuminata penistentis stipitatia, antheraram arista ad umbonem parvulum singulum vel binos rednctа; amentia femineis erectis herbaceo-echinatis atro purpureis ; strobilis ovatis horizontalibus violaceo-fascis, squamanun elongato-cnneaUnun apophysi rhombea parum toraescente transverse carinata medio in umbone parvo breviter aristata; seminibus ala ipat oblique obovata dnplo minoribus.

On alpine heights, between 9,200 and 11,800 or 12,000 feet high, on Pike's Peak and the high mountains of the Snowy Range, *Dr.J>arry,* 1861 and 1862 ; *Mean Hail & Harbour* (Coll. No. 530), 1862. Also on the heights of the Coochetopa Pass, nearly S. W. of Pike's Peak (altitude over 10,000 feet), where Capt Gunnison discovered in 1853 what seems to be this species without fruit (see Pac. R. R. Rep. II., p. 190) ; the leaves which I could compare are those of our plant Flowers end of June and beginning of July. Flourishing best in the higher elevations and never descending below 9,000 feet, in its lower ranges not ripening ito fraits as well as on the bleak heights, this truly alpine species — in that respect our representative of the European P. *Pumilio* — characterizes the highest belt of timber on the peaks of Colorado. On sheltered slopes a tree 40 or 60 feet high and 1-2 feet in diameter, it becomes a strolling buah, prostrate, and almost creeping, on the bleak summits of the high ridges. The bark is thin and scaly, even in older trees not more than 3 or 4 line* thick, of a light grnyiHh-brown color ; that of younger bronchon smooth, with many large vesicle* containing a clear fluid buLtain, which remains between the layers of the old bark. Woud [806J white, tough, not very ivminoun; of extremely HIOW growth, HO that a small smooth-barked stem of 13 lines diameter exhibited about fifty annual ringn, all between *I* anil *fa* line wide, the smaller ones consisting of 3-G, the widest ones of 15-25 layers of cells, each cell 0.007 line in diameter. A tree of 2 feet thickuess would at that rate indicate an age of over 1,000 yean ; but the annual rings of larger trees growing in favored situations ore wider, and, if a specimen sent by Dr. Parry is not mislabelled, sometimes as wide as } line, giving the largest trees a probable age uf 50D-800 years. Branches spreading, very often many of them twisted, stunted, or dead ; the larger bunches and the stem

• For a German trmntbtion by Hchkchtondal, M Florm, XXXlli. (XVII.) W-W4. - EDS,

Itself frequently covered with young branches or shoots, which seem to keep life in the old trunk. Leaves crowded from the axils of ovate, acuminate, brittle, at first light brown scales, which, persisting longer than the leaves themselves, cover the branches with their rough blackish remains ; leaves light green on both sides without white dots, mostly with numerous exsudations of white resin, usually curved upwards, entire on edges and keel, abruptly acutish, stouter in fruit-bearing, more slender in such trees as produce principally male flowers, in very robust specimens 1J •nd rarely even 1|, usually about 1 inch long ; on sterile branches straight and horizontal, "giving the branches the appearance of eo many bottle brushes." The vagina; consist of 7-8 oblong scales with fringed margins, adpressed and forming a sheath 3-4 lines long on the young leaf, soon spreading and squarrose, falling off in the second or third year. Many lanceolate acuminate scales, perulte, sheathe the lower part of the young shoots j shorter and broader bracts, bearing in their axils the male amenta, follow next. The aiuents together form a very short spike, or rather head, 6 or 8 lines long; often these heads persist on the axis for 2 or even 3 years with a few bunches of leaves above each one, giving the appearance of a leafy spike 1 or 1} inches long! Our figure does not represent this condition distinctly, but it shows the numerous naked spaces, about 10 in number, which in former years had been occupied by male flower*. I have seen branches with 16 such naked spaces, proving that leaves were persistent for 16 years, - a fact unheard of among pines, where leaves are said to endure generally only 3 year*. The stipitate oval ament 3-4 lines long, has a proper involucrum of 4 oblong scales or bracte of equal length. It seems that the involucrum of the male ament and the form of the ament and of the anthers, together with the fruit and seed, offer characters of importance for the distinction and arrangement of species, hitherto neglected probably because living nature has not been studied as diligently aa the dried mummies of the herbaria, and these contain so few good flowering specimens of Pines ; the number of leave*, eo much relied on, is of secondary consideration, and is often calculated to mislead, separating [207] the most natural affinities, such as our Cembroid Nut-pines with 1-6 leaves, or the Pineoid Pines (P. *Pitua, P. SMrmna, P. Torrcyana)* with 2-6 leaves. P. **«*•** has an oval ament 3 lines long, with an involucrum of 3 spatulate Males in the axil of a lanceolate recurved bract, which is deciduous before the ament; anther with a short, nearly entire crista. *P. Jrutriaca* has a cylindric curved ament 1* inches long, with an involucrum of about 10 very unequal and almost distichous oval scales, in the axil of a linear-lanceolate recurved persistent bract; anther, with a semicucular entire crista, large enough to entirely hide the body of the anther in the yet closed ament, and give the latter the appearance of a young cone -Crista of the wither scarcely indicated by a knob, smaller than in any pine examined by me. Female ament. single or 2 together, near the end of the young shoot, bristling with the lanceolate, anstate, erect scales, of purple-black color. Cones oval, obtuse, 2¼–2½ inches long, about half as much in diameter, often covered with resin as if varnished ; their purplish-brown or blackish color is found also in a little group of alpine pines of the Popocatepetl with 3–5 leaves, discovered by Roezl. Bracts, as in all pines, not obliterated ("evanidæ"), as is usually rtated/but much altered/and rather indistinct; more or less thickened, and partly connate with the base of the scale ; in our species only the upper obtuse mucronate part membranaceous and free; scales 10-16 bnes long and 4-« line, wide at theTexpowd part; Einsvewe ridge of the rhombic rather flat, protuberance of the scale yery conspicuow; the dewier mucro oVawn>»m the small rhombic central knob, 2-3 lines kng, curved upwanl«s at kst tortuous •ad earily broken off, has suggested the name for the species. Seed nearly 3 lines long, with the obovate wing 6-7 Ines long; embryo in all the seeds examined by me with 7 short cotyledons.

Systematically, tbi. specie, belongs to Eudlicbert section *PHudo.tr***, which compru*. many Mexica^ some Oantial American, and a single West Indian specie. ; it is its only reFesentative in the territory of the United Stotea.

EXPLANATION OF THE PLATES [RIPHODUCKD OH pp. 328-9].

PL6. B»»cl«gath^.boutJ«lyl.t;the n wo«^ stouter leaves and half grown cones, about a year old, the JWogahoot of the pnHnt year jut pushing out, .bowing the scabs variouaiy broken, sod in their axils the tips of the young MTU,

The low* branch, with more slender leave* bears mafcnowen.

L 9, Fig. 1, 1 Ripe oonas -a «naller one closed and a larger one with open scales;«,»,«. single scttlos from the •* •»» appsr surt.ee, and mds; these an incomplete, the only ones then seen by me ; better ones an figured PL 11, Fig. 7 --, external or opper ; internal or lower side. Fig. 8, embryo 10 times magn.

*%• K *• Ffcaddi of leaves, 8 magn. Fig. «. young ones with their bract; Fig. 4, full grown ones with the [208] shea g scale, recurred.

*h Fig. * Upper part of kaf of the fruit-bearing branch, 10 magn.; upper or toner side (section at base not correctly drawn)

*>g.«,7,8. 8«*ta»ofh.v«sdryaDdthe«nies««ked,10msgn.;f.«,secUonofrig.2 f. 7, of another leaf; f. 8, of a haforti Mokkbniieh.

«g- ». Bunch oT male amenta with thrfr pernte and bnrtji : the obtnw involnml bract* vMhl> bntwwn the other.; 1 "ago. a. An anther (ram above, 10 taiga, j dopaupemto crisU visible at the end of the commissure *b.* Pollen, 100 magn.

Another 5-leaved species or the Rocky Mountains, first noticed more than 40 jean ago, but hitherto ray imperfectly known, is

I*isru FLKXIUS, *Jama, in hmtf* Kxped.* **£,** *pp.* **S7, JJ. TWrvy,** *in Ann. Lye. N. Y.* **S.** *p. SAQ:* **arbor** mediocris **sett cLtfiar; Liiii detus eoufertii qaiitu auVMuncUUbm rigidfa itUi^ris*;uUuKuiis»LX uilliK jwnikrntii** lanceolatarum deciduarum, squamis vaginantibus obtusis **luii moi crani> d» ; sniirtitia ntfwtcniir*** ovatis **fuvulucro euli-H-iiljTll** *tin* i» miltii> brnch« **tneao-**lattr jntuln; deciduae sessilibus, antherarum crista minore irregulariter inciso-dentata ; nncth-*ti»* femiitcfjs ftnVivi.TtiiriHrttMin **pediiri-ni' benl iM-njJt* Ule UnccoUti* acntU i)en*e tiipnto** ovato-cylindraceis squarrosis horizontalibus K declinatis 0 ni>i'll.i frtwri-. 'qiiMiiia c *hati* ***hnviU't*** **etuirat& Ltlitaiti.i Irfcn lnlo - rliomheln,** apophysi **ttmi-eia wtiiidrvuLui** incrassata **msrpino iiri-n p t m** sub- t ...sa laterali notata ; semi- **Bfhw tnogni* olmnti* tnLdia** carinatis.

OH UI* R^kr VomttfiM, frm SVwHrti.4 to the 49th parallel, sub- **•Jjiihr l*lt, h n r** forming entire forests, **iniln' to«-tr«le-**vation associated with *. 1',* contorta, approaching the alpine districts, scattering ... *P.* aristata **i" {Party'* >?•*•) : oa liw Rmih HwuUiM, Nt-w Uriioc, ||,(W frit kC"!** , to **tfcr t-tv** *th. Bigelow ;* mountain, **of Suite Ftf, <*.** *Fendler* (No. 832) ; Colorado, *James,* Parry **r. J/ciii ^ ZTnrfcrw |** No. **MO) i Uremi«** Mountains, ***H. i'.ny*** *James ;* mountains from **i tin-** Platte to the Bear River **r.** *Kuttolt;* Wind River Mountains, *Fremont ;* Big Horn MuiiMtauu **UM!** mountains at the headwaters of Snake River, *Dr. Hayden,* to *• British bounda•*•, ft- *Lf-* •" . Nuttall's figure ... ki» S»l'»i pi IIS, H very **pwr,** **Md ri>»i I)UIU itMi«TKt i M (M I 1«VB Uiatut; i,**

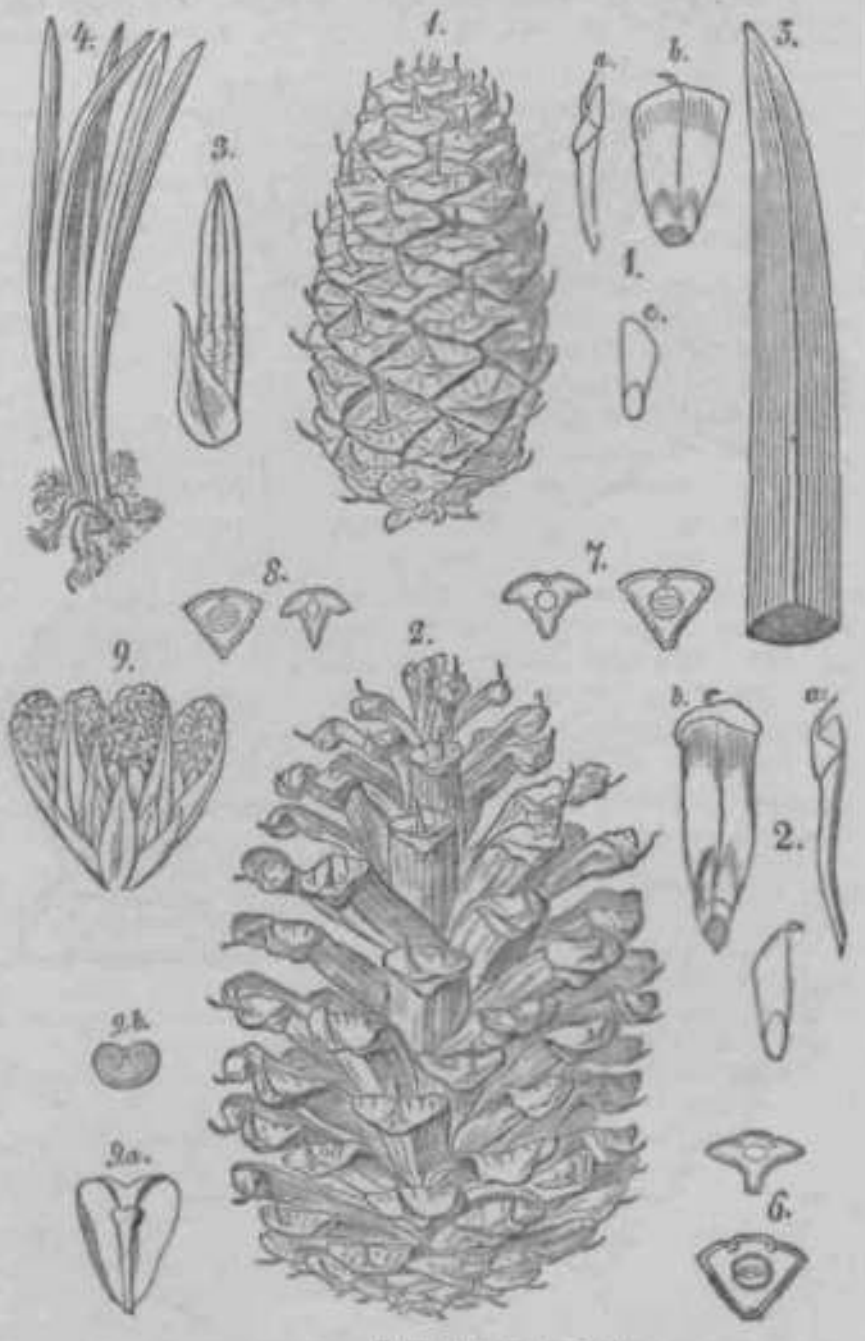
PUT* V. — PIXTJI AnirriTi (p. 327).

of his is preserved 'I' f"L IJCfOUII **f M r. I hinwH or rf tb* A«** cademy of Natural Sci* **«M*. in VIitl*lrlj.hi», Uri"** suppose that he had on[1] **ipacka in tuv. —** *P. flexilis,* the **Vu»t tkui ii []rx.«uuiiv« of /*. tV«fcru of tb» OM Wad*l, k * i** middle-sized

t m , mnuilJy 30-5(1 feet hlflb, though Feiwllmr, a *gnoA* BUtbnrily, «iw it *ptat* Santa Fé 60–80 fwl hijrh j Dr. Bigelow's to*% of tlie height of tO 100–130 feet, ^n U» Swi Fruici*?« MuuuUui (But VUffitb P- 20), must bdaifl to *umut* trffaer Mtavo,J swedes. In Caiundu it it a line Um, witL u^ring trunk uid i^al (outline, Wwicliiiig almost [2/6] bom tlxi boM>, luwrr ImmrhM hoiz ins.ii, upper, *asm* HO ii'linu : wood wliiti.-. hntit, anJIUrtl rili,JJN from j Li J IrW) on an itverugi! J line wi•!t?; trvm IxMome in 250–300 years about 1 feet thick. Leaves crowdnl towards thp ni'l of iLe very Jlexflite tmnclini, |« r-tbtott ft or G yearn, anal If I i-^J. »«y itrdy 1 w3 iud long; ibtulli»tiuiiiar to tlir*e of P. Stn-hu or ft C«»tbntt 8 lint» long, deciduous. Male aments 4-5 lines I«HC. fpmiiiiff n iiiisfe ipflka UMi Uo«» loiiXi eotMi «tih yllmWc, t*-po*itl({ tn tltt CBil, 4-A irutti-> liitlgt S iiu:lii-» iu UH lup^i-it tlMiiiwttft, on Aatiptdtmclei] *a\t» 12-1-I lines \g; LO-U luut wid ei, si narrose; lowest sterilf (Hte* rw nntod ; ft*, tilt mu» with dcfp tiium—faun for fit* twipiimi (tf ttM nt^li bntb m the wpjwt in ttW »«le ami w» Vl» Wk, Uio Uttw oivitlffl jiartly Wttta! by the larjp (-1-0 line* I°"H) lipioouii <ir millet curtjr knct. SmLi 4-^ mrely 0 Hue* long t irnijiiiilurljr uvula tir nttovale ; wing iniiltllt, not [toctcluou* imr *Hicrini(to ilio «uk-, JU in /'. Cembra, *p. nlulu, vit.,* liiitrwlttood to a persistent Vwil mi tint upper end and ouu-r edge uf the soil; embryo with 8 or rarely 9 cotyledons.

PINUS ALBICAULIS, *P. occidentalis*, *H***, AVrftny, Pine. Jf. A: Rep. 6, Bot., &c., non Zucc., an al- nclus ftiiiii the Cascade Mtwnuiiu, in Oregon, may be a western form of this species, though consider it •• lliftfcnt, U)|| itHfnn..lir1li-between *P.*

<ii«Uii|;ili-hr.l),v I!..• pflbMMl W n i fe (nth on the edges of the leaves, tun! M-pecially by the short OT«1 cones with thick squarrose scales pointed with » knob. Tba name is "as white as milk."



Punt V), _ PINUS ARISTATA (p. 327).

•uggtcted bjr the *eaAta uf the* lurk of the Ire*. * *hkh* b

While atud/ing the C^nironn *of Xho* EocVy MdOBU&M* 1 TO W io invettieate the d^iacicn of the diflerent typos which Unnwua biui comprise*! in Itio genus /VMU*. T?]<s p w t niMtvr liinwelf ii*d at «MJ tiuw tlioiij-lit i>rv>por to divide Lliat rnttiiT incongruous *uuua.* cousitivHii^ A j n iw distinct

from *Pinus,* reuniting them, however, afterwards. Since then many botanists have investigated this interesting subject, and while some of the highest standing — I mention only the names of Endlicher and Hooker— have adhered to the Linnaean circumscription of the genus, others of no less authority have thought it more natural to recognize the distinctions already made by popular language, and some of them adopted by the older botanists. The first who more thoroughly examined the question was Link, who (Linnsea, Vol. 15, 1841) characterized 5 genera, *Abies, Picea, Larix, Cedrus,* and *Pinus.* Endlicher, in Synops. Conif., 1847, further separated Link's *Picece descisecntcs* under the name of *Tsuga,* considering all these as subdivisions of the genus *Pinus.* Carri&re [210] (Traits des Conif&res) adopted Link's genera, with Endlicher/s addition, without further developing their distinctive characters. My investigations lead me to adopt Carriire's views, more firmly establishing those six genera, — not without some misgivings, however, as it will appear from the following, that, besides the characters derived from the organs of fructification, in one instance at least the characters of vegetation have also to be brought in to distinguish two apparently not very nearly allied genera, Larix and Tsuga; while others, thought to be closely connected, such as Picea and Tsuga, or Larix and Cedrus, recede far from each other in their essential organs. Otherwise the characters of fructification and vegetation go so well together as materially to confirm one another and to establish the generic differences. An interesting fact is, that the pollen grains of Abies, Tsuga, and Picea are largest (in four species 0.053-0.060 lines in the longest diameter), those of Cedrus smaller (in two species 0.042-0.043 lines), and those of Pinus the smallest (in four species 0.034-0.038 lines). Will the characters of vegetation, after all, outweigh those of fructification, and will we have to fall back to old Tournefort's views and recognize his three genera, — *Abies,* with single leaves and large pollen; *Larix,* with crowded leaves and middle-sized pollen; and *Pinus,* with fasciculated, sheathed leaves and small pollen ?

I have, with Du Roi, Link, and Endlicher, and against Linnaeus', Lambert's and Loudon's authority, adopted the ancient Plinian name of *Picea,* the *pitch* tree, for those with quadrangular leaves and pendulous cones, the original representative of which is the well-known pitch tree of Europe, here usually called " Norway Spruce," and the name of *Abies* also in the Plinian sense for those with **flat leaves and** erect cones, the Fir trees.

ABIETINEJE VERA

I. ***Fruetifieatio annua*; squama ttrobili tenuiores bracteis pleramqne tenuibus pergamenteceis hinc excretcftntibufl rarissime lignescentibus suffulto. Semina facie superior© basi al» fere peraistentis obtecta eaque plus minus inclusa. Amenta mascula femineaque perulis indefinite suffulta, in ramulU anni priori* axillaria, rarius terminalia; anthers varic Folia singula sen, aii abbreviate, fasciculate integerrima.**[1]

§. Anthene connectivo apice apiculato recurvato, loculis rima tnnsvenali dehiscentibus eonfluentibus. [211] Folia subtus conate, supra canaliculate planave.

1. ABIES, *Link:* **squama strobili erecti maturitate ab axi decidua; semina bad al» inclosa libera, testa vesiculU balsamiferis replete ; amenta mascula in axillis folioram versus apicem raraorum annotinoram sesailia; folia petiolata, pseudo-disticha, cicatricem circuiarem relinquentia, sicca pemistentia.— *Fir.***

2. TSUGA, *EndL $ub Pino ; Carrihre:* **squama strobili cum raraulo declinati persistentes; semina banala* adnate ; amenta mascula in axillis foliorum versus apicem ramorura annotinoram sessilia vel terminalia ; folia petiolata pseudo-disticha, cicatricem semicircularem relinquentia. — *Ilemlock-tpruce.***

***Müropeuce,* Spach : bracte® strobili inclusa; teate vesiculis balsamiferis replete; folia sicca deddua.**

***Peueoidei,* Spach : bractea strobili exserta ; testa vesiculis balsamiferis destitute ; folia sicca penistentia.**

3. LARIX, *Link:* **squamae strobili in raraulo brevissimo terminalis nutantis sen adscendentis persistentes; semina basi alfB adnute, teste vesiculis balsamiferis destitute; amenta mascula ex apice ramulorum abhreviatoram annotinoram; folia angustissima, fasciculate, sola inter cstera annua, cicatricem triangularem relinquentia,*sicca decidua.___*Lartk.***

[1] **Though the leaves art nsuaiiy entire, I hare seen a wedling of *Picea exeelm* from the woods of Trient, in 8wittcrland, with spimUoae l«aves; whether that is the ordinary occurrence 1 do not know. The young of *P. nigra,* from the White Mountain*, have entire leaves.**

§§• Anther© connectivo apice in criatam transversam circularem seu seniicircularem recurvatam excrescente, loculis longitudinaliter dehiscentibus distinctis. Folia infra supraque carinata tetragona cicatricem subrhonibeam relinquentia, sicca decidua.

4. CEDBDS, *Link:* squamre strobili in ramo breviter minalis crecti versus apicem incrassatae, demum ab axi solutw cum bracteis lignescentibus decidu© ; semina alae basi lacerae adnata, testa vesiculis balsamiferis repleta ; embryo solus inter coeteros curvatus; amenta mascula ex apice ramulorum annotinorum fere biennia (rotate preecedente evoluta); folia fasciculata. — *Cedar.*

• 5. PICEA, *Link:* squamae strobili nutantis vel cum ramulo declinati persistentes; semina demum e basi alae libene decidua, vesiculis balsamiferis deetituta; amenta mascula in axillis foliorum versus apicem ramorum homotinoruin sessilia; folia circum axin undique porrecta. — *Spruce.*

II. *Fructificatio biennis;* squama) strobili sublignosae, apice apophysi saepius pyramidata incrassatae, cum bracteis plus minus lignescetotibus persistentes. Semina basi alae demum decidua velut annulo cincta vesiculis balsamiferis destitute (ala in paucis angustissima squamae adhaerens, in singula P. flexili cariniformis pereistens). Amenta maacula ex axillis bractearum scariosarum orta, squamis scariosis sub-definitis involucrata, in infiraa ramulorum [212] hornotinorum parte in spicam compositnm congesta ; anthera connectivo apice in urnbonem saepius emarginatum seu in criHtam transversam variam excurrente, loculis longitudinaliter dehiscentibus distinctis. Amenta feminea in ramulis hornotinis subterminalia singula seu subverticillata. Folia ex axillis penilarum siugula-quina, basi vaginis membranaceis polyphyllis inclusa, integra seu margine et carina superiore serrulata; eingula teretia, bina supra plana seu demum concava, dorso convexa, plura supra carinata, dorso plana seu convexa.

& Pi*us, *Linn. Gen. ed.* 1, *Link.* — *Pine.*

PICEA ENGELMANNI ; *Parry, sub Jbiete, St. Louis Trans.* 2, *p.* 122. *Abies nigra, Engel. in Sill. Journ.* 33, p. 330, *non Pair.:* arbor elatior, pyrainidata ; cortice tenui squamato rubello ; ramulis pubescentibus ; perulis oyatis obtusis squar-*»is ; foliis confertis robustis corapresao-tetragonis abrupte acutiusculis plerumque curvatis ; amentis ovato-cylindricis perulis late ovatis involucrutis, femiuearum bracteis squamas ovatas obtusas crenulatas squarrosas longitudine sub»-quantibus ; strobilis ovato-cylindricis obtusis terminalibus lateralibusve cum ramulis suis horizontalibus seu declinatis, squamis tenuibus obovato-rhombeis apice plus minus truncatis emarginatis crenulato-erosis ; seminum ala oblique olx>vata.

Higher parts of the Rocky Mountains, from New Mexico to the headwaters of the Columbia and Missouri Rivera, and probably further ; from the subalpine to the alpine districts, and with *Pinus aristata* reaching the highest limits of timber; occupying in Colorado a belt between the limits of 8,000 and 12,000 feet, it reaches its fullest development between 9,000 and 10,000 feet, near the headwaters of the streams on both slopes of the Snowy Range, constituting "magnificent forests about the head of Middle Park, at Tarryall, etc., often mixed with *Abies grandis;* not found lower down, e.g. at Fontaine-qui-bouit, where *Picea Menziesii,* with *Tsuga Douglasii,* reign as monarchs of the forest. Flowers end of June.

In its most favorable localities this species makes a stately tree, 60-100 feet high, forming a narrow, diarply-topering^pire, of a rather darkish hue; trunk perfectly straight, columnar, tapering very gradually, 1J-2* feet >n diuin-«ter; branches mostly small, lower ones horizontal, upper ones ascending : on higher altitudes it is a smaller, nearly round-topped tree, very much branched,'bearing more perfect fruit than in either lower or higher elevations: on the highest summits a prostrate and almost creeping, sterile shrub, just as *Picea nigra* is found on Mt. Washington, N. H. Barkonly 1-1J lines thick, scaly, reddish, grayish-purple or light purplish-brown, containing much tannin; [213] wood soft, white, not knotty nor resinous, therefore much esteemed for inside and cabinet work ; annual rings Hi li ' y ' tt th they usually are in *P alha* or *ni* bt l t i lines, on an average f-l line wide. Leaves stouter than they usually are in *P. alha* or *nigra,* but less so than in -P. *Menzuni;* in the higher localities 6-9 lines long and not quite 1 line wide ; strongly carinate below, less so above, with a few lines of white stomaU above and Inflow, abruptly but not sharply acute ; in lower localities the leaves are more slender and 8-12 lines long, and if I am correct in referring here some doubtful forma, it occurs al*o with whiter, more slender, and longer leaves (10-15 lines, *Fendler,* No. 833, from a young tree without cones, mountain valley above Santa Fe*), and with almost glabrous branches, ami still more slender and very acute leaves (5-10 lines ; *Dr. Hay-*den, from the Big Horn Mountains; deUched cone* from that locality certainly belonp here). 1 find the leaves in this genus extremely variable ; *P. nigra* at least, of which I have been able to compare a large number of specimens, varies »o much, that any attempt to hose specific characters on the form of the leaves seems nugatoiy ; the leaves in that spe-*• are straight or curved, slender or stout, quadrangular or compressed, — acute, subacute, or very obtuse, —whitish,

\k sprint of the acconnt of thin «f*ci«i, credited by mwUke to the "Transactions of Academy of Sciences of Phil*dcl-phia," oecon in the *Gardener* Chronicle* for Oct. 31, 1863, *y.* 1035. - EDS.

pale, or dark green, — usually only 4-6, but also 10-15 lines long ; the fruit, however, differs in its position from that of all other Picete known to me, being borne on short, recurved, scaly peduncles ; it is 10-20 lines long, oval, acutish ; scales thick at base, very thin at the crenulate edges. *P. alba* is also best characterized by the slender cylindric cones, 1-3 inches long, with thin scales, entire but not thickened, as 1 inadvertently stated in Sill. Jour. 1. c. The true characters and the limits of variation of these species are now being investigated by Prof. 0. Brunet of Quebec, who, living in the inid«*t of them, will be able to solve many doubts heretofore existing, and to give us their correct history. — Male amenta of *P. Engelmanni* 6-9 lines long, on short stipes ; anthers l£ lines long; female aments 9-10 lines long, with ovate lanceolate scales almost equalling in length the dark purple, fleshy scales. Cones scattered on the tree, never very abundant, lJ-2£ (usually less than 2) inches long, { inch or less in diameter when closed; light yellowish brown with the lower part of the scales dark when fresh, all reddish-brown when old ; scales 6 lines wide, and 6-8 lines long in well grown specimens, rhombic with truncated end ; in poorer ones, such as grow in lower elevations, shorter, more rounded, with the truncation indistinct. I observe the same difference in cones of *P. cxcclta,* grown on bushy trees near their *upper* limit in Switzerland ; there also cones, scales, and seeds are smaller, and the truncation of the scales is almost imperceptible. Seeds about 1 line long without, and 4J lines long with the wing, which here, as in all Piceas, overlaps the inner edge of the seed, dropping it at maturity ; cotyledons, as in most species, 6, rarely [214] 5; in P. *excelsa* I find 8, or rarely 9 (not 2-3, as Endlicher inadvertently stated), and in the alpine specimens, mentioned above, only 6 cotyledons.

Picea Afvnziesii, the only other species of Colorado, is entirely subalpine, occurring between the limits of 7,000 and 9,000 feet in low, moist, or marshy soil, especially on the bordera of streams; it is, as Dr. Parry informs me, a tree of a more oval outline, pointed upwards, with a more rapidly tapering trunk ; thicker (i inch), grayish, moderately rough bark ; rapidly-growing (annual ring* 1J-2 lines on an average), harsh-grained, brittle, knotty, resinous wood ; stout, light colored, smooth, glossy brancblets; stout, broad, sharply-pointed leaves; longer (9-12 lines) male and female amenta, the latter composed of pale, glistening, orbicular scales, which are many times longer than the minute bract; cylindric cones (3-4$ inches long, drooping perpendicularly with the branch or usually at an angle with it, abundant even on young (12-15 feet high) trees, crowded especially towards the top of the tree and very conspicuous, whitish at maturity, but turning light brown and persisting on the tree for another year until the new crop matures; scales elongated rhombic, 9-11 lines long, truncate, more than twice as long as the seed with it* triangular obovate wing. The alpine *P. Jrilliamsonii,* Newb., from the Cascade Mountains, Oregon, which I have not been able to compare, seems to be well distinguished by its peculiarly reflexed scales.

II. CONIFERS OF DR. PARRY'S COLLECTION IN THE ROCKY MOUNTAINS.

(BY DBS. PARRY AND EXOELMANN.)

FROM AMER. JOURN. SCI. AND ARTS, SECOND SERIES, VOL. XXXIV, Nor. 1863.

DR. PARRY collected too few specimens of the following Conifer® for distribution, but as [330] his notes are replete with interest they are given here (under marks of quotation) together with a few remarks of my own.

ABIES GRANDIS, *IAndl.* Not common in this region, resembling much the Eastern *A. baUamea.* Fender's N. Mex. No. 828 is the same.

ABIES DOCGLASII, *Lindi.* "Abundant through the eastern mountain district, except on the higher elevations. A very nightly tree, of the average height of 80 feet, with a graceful oval outline ; the spreading branches curving upward* at the eitreraities. W<MM1 of alow growth, but very indifferent, inclined to warp and crack, turning reddtuh-brown in drying." This specie*, as well as the nearly allied *A. Onnatietmis,* is well distinguished from all our other Pines by the distinctly petioled leaves. FendlerV N. Mex. No. 829.

A Bin MENZIESII, *Li mil* "A finely ahaped tree, though of rather stiff outline, of rapid growth; wood rery compact, but rather coarse-grained and piuhy ; the logs taper too rapidly to saw up to advantage." Cones pendulous from the end of the branches. Leaven stouter than in any other allied specie*, stiff and very acute, almost spinescent

A B I B VIQRA, *Pair.* Probably the same as the northeastern tree (characterized by the slender and very acute leaves, orate cones with thin and crenate mniyin of the N'AII*), a pale-leaved form of which is usually named *A. alba,* but which PruL Gray has denumntruUxl to Uloug to *A. niu/ra.* The true *A. alba* (leuvea somewhat stouter and obtuiish,

cylindric cones with thickened entire margin of the scales) Reems to extend from Canada to the northern Rocky Mountains, where it has been gathered by Bourgeau; but it has not fallen under Dr. Parry's or Dr. Hayden's observation, on the headwaters of the Kettle, Colorado, Missouri and Columbia Rivers, where *Abies nigra* seems to be abundant, extending down to Santa Fe (Fendler, N. Mex. No. 833). Dr. Parry found it "composing almost the entire [331] forest growth of the mountain slopes of Middle Park about the head of Grand River ; a magnificent tree, 80 to 100 feet hi-'h, with an even, columnar trunk, below 2-2J feet in diameter, tapering upwards ; of rapid growth; bark scaly, smooth, and quite thin, of a purplish-brown color, full of tannin, and quite different from the rough brown bark of *A. nigra* of Wisconsin; wood remarkably white and soft, free of knots and scarcely resinous, preferred for inside work." Could this be *Abies rvbra* Loud., and specifically distinct from *A. nigra ?*

PIN08 ABISTATA, *Engelm., in St. Louis Transact, vol.* 2, *tab.* 5 *and* 6. Dr. Parry had the good luck to discover this very peculiar and exclusively alpine species « which does not descend lower than 9,000 or 10,000 feeV on the higher mountains of Clear Creek. As a full description and a figure has been given in the Transactions of the St. Louis Academy, I confine myself here to the statement that it is our only representative of Endhcher-s section, *Pseudostrobns,* which comprises numerous Mexican, a few Central American, and a single West Indian species; it is characterized by quinate entire leaves and horizontal ovate cones, with thin apophyses on Ae long-mucronate or anstete scales, and small winged seeds. In sheltered situations it forms a tree 40 or 50 feet high and 1 or 2 feet in diameter' but on the higher bleak mountain, it is a stunted bush, often thickly covered with fruit. ^ growth, at least m the latter localities, is exceedingly slow, as a stick of scarcely more than one inch in diameter, brought back by Dr. Parry, show, nearly fifty annual rings, some of them ^ of a line, and none more than J of a line wide.

PINUS FLKxai8,/a««. This .^.discovered in thesamereg^ Dr. James, has to some extent remained doubtful, as hi. description in the account'of Long's Expedition, and Torrey's diagnosis m the Annals of the New York Lyceum (vol. ii. p. 24J>) are based on notes only, no specimens having been collected. By later writers it has been ignored, until Mr. Fendler in 1847 collected it on the mountains above Santa Fe' (Coll. N. Me* No. 832), when a short notice was published by the writer in the appendix to Wislizenus' Memoir of a Tour to New Mexico, etc., 18-18. Endlicher.inhi. Synopsis Coniferaram, 1847, doe. not enumerate it, and Carnfere m his Trait^ des Coniferes, 1855, credit, it to WislizeL, translating only my short remarks. Nuttall, however, had already (in 1849) given a somewhat' extended account of it, with a pooV figure, in the continuation of Michaux'. Sylva (vol' u, 'p. 10', pi' 112), without clearing up the doubto, which Dr. Parry in his present expedition, 1862, is expected finally to settle' My brother, H. Engelmann, collected it on the headwaters of the Platte, and Dr. Hayden on the mountains about the headwater, of the Yellowstone, Missouri, and Columbia river* Dr. Parry note, that the cones grow several together, sem.pendulous,' t the extremity of the horizontal branchlets; while Jam*, gave hi. plant "erect" cones. Near Santa F^ it grows a^ the elevation of 8,000 or 10,000 feet, and in favorable situation, becomes 60 or 80 feet high and bears « pendulous" "nes, according to Fendler*, note. *Pinus JUxilis* is certainly intermediate between the sections *Cmbra* and « « * « of Endlicher, and unite, the two, as doe. *P. cmbroides,* Newberry, Pac.f. R. Rep., vol' v,' Bot, p' 44, [332] »ot Zucc.,1 if indeed this is not a mere form of *P.* /^approaching by its short conesdo*, to *P. Ctn&ra.* The !«8e «ed« of *P.fiexM,* are, as Dr. Jam* already stated and as Dr. Hayden confirmed, eaten by the Indians. They are dirtingubhed from those of any other of our Pine* by a persistent, .harp, keeled margin, representing the wing.

Pnrus PONDERI08A, *Dougl,* is " common through all the lower valleys and less elevated district, of the mountains, ••ociateiwitb *A. DouglasiiuA A.Jfenziesii;* a most valuable timber tree." Fendler[1]. N. Mex. No. 831. Male "wnts cylindrical, several inches long.

Pnoi oosroiiTA, *Dongl.,* «is quite abundant on the crest and slopes of dry subalpine ridges, forming the principal part of the forest there! and extending to near the .now line; . symmetrical tree of rapid growth' 30 or 40 feet high, with dim and tapering trunk a foot in diameter, a .moothisb, grayish-brown bark, detached in thin Kales, and tough but coarse wood, which i. liable to warp, and rarely cut into boards."

» Znccarim". plant of that name i. one of the cnrlona Uttle 8"*P «f American Nnt-irfnet, including the following fonr •l*cle. : *Pinus uuwpKyUos,* Torwy and Kmnont, with ringle tuot connate, as Endlicher would hare it) Wren ; *P. tduli*, *»gdra., with S leaves; *P. ctmbroidtM,* Zticc. (including *P. *«•«««, Schiede, not Ton., and *P. <*teMi*rma,* Engrlm). X* ••«">• 5 and *P. Parryana,* Engelm. C- W»*«"'' Twr- «•> Hex. Bound., p. 208, t. 63). with 8-5. mostly 4 leaves. "»w characters, Wken princi|»lly fn.m thi> bnwU of the 'T'BAooU.rtiwigthenthetpwiBcdUtinctions. Tbii vrry ••*"" UtU. group is chancterutd by the small, almost globose cones, the seal** bearing large pyramidal apophysen and largo edible seeds, the wingx of which ivmain attached to the scale, which, I suspect, is the case iu all " winglvtw " sewls of pines ; in *P. Pine*,* however, the wing is very distinct, and detaches iUelf clearly from the scale and at the same time also from the seed itself, which is likewise the case in the closely allied, though 5-leaved, Califnrnian *P. Torrtyana,* Parry, where the wing, besides, it very thick, and of a corky sutwtHnce. The great variability in the number of leaves in the nut-pines proves that sectional characters taken from them, are without value.

III. UNTERSUCHUNGEN ÜBER DIE ABIETINEEN.

FROM SITZUNOS-BERICHT DER GESELLBCHAFT NATURFORSCHKNDER FREUNDE ZU BERLIN, MAT 19, 1868.*

Die Genera, welche diese Abtheilung der Coniferen bilden, sind durch ihre Wuchsverhältnisse, die Bildung ihrer Blätter, die Art der Oeffnung ihrer Antheren, die Gestalt Hires Pollens, die Verhältnisse der Friichte (Zapfen), die Form der Sainenfliigel und das Dasein oder die Abwesenheit von Harzbehältern auf den Samen aufs Beste charakterisirt. [13]

Einzelnstehende Blätter und innerhalb eines Jahres reifende Friichte haben 1, *Abies* (Link) 2, *Tsuga* 3, *Petccoides* 4, *Hcsperopeuce* 5, *Zarix* 6, *Cednis* 7, *Picea* (Link); davon tragen 1-4 flache, 5-7 kantige Blätter, alle, init den seltensten Ausnahraen, ganzrandig; bei 5 und 6 bleiben die Aclisen der Seitenzweige unentwickelt, daher deren Blätter in Bliscbel zusammengedrängt sind. Alle bisher genannten tragen bekanntlich ibre kätzchentbnnigen männlichen Bliithen und ihre weiblichen Bliithenstände in den Achseln vorjiihriger Blatter oder an den Enden kiirzerer (am kiirzesten bei *Larix,* etwas linger bei *Cedrus)* oder Lingerer Zweige des vergangenen Jahres. Biindel von 1-5 (oder ausnahinsweise bis zu 8 oder 9) fast immer gesägten Blättern, welche Biindel in den Achseln von Schuppen stehen, und erst im zweiten Jahre reifende Friichte charakterisiren bekanntlich 8, *Finns;* die männliche Bliithen sowohl als die weiblichen Bliithenstände werden von den Trieben desselben Jahres getragen. Andere Gattungen der Abietineen, zuinal *Pseudolariz,* habe ich zu untersuchen keine Gelegenheit gehabt

Die beiden parallelen Antherenfiicher öffnen sich der Länge nach bei den drei letzten Gattungen; bei den fiinf ersten reissen sie der Quere nach auf. Die Pollenkörner sind bei den moisten Gattungen länglich mitzwei seitlichen etwas nach einer Seite gekriiniinten Anschwclltingen, bei *Tsuga* aber sind sie flach schiisselfönnig und bei *Peucoiden* und *Larix* oval; bei *Abies* uud *Picca* sind sie ausgezeichnet gross, viel kleiner, aber doch sehr verschieden gross, bei den *Pinus-Arten.*

Die Bracteen innerhalb der Zapfenfriichte der ersten sieben Gattungen bleiben blattartig, sio mögen sich wiihrend der Zeit vergrüssern oder nicht, bei *Pinus* aber schwellen sie korkartig an und tragen mit ihrer Riickenfläche weseutlich zur Bildung der Scheinfiicher bei, in welchen die Samen liegen.

Bei *Abies* und *Cedrus* lösen sich die Schuppen der reifen Zapfen von der Achse ab, während sie bei alien andern Gattungen persistiren. Meist fallen die Zapfen bald nach völliger Reife ab, bei einigen *Picta-Arten* aber *(Picea nigra* unterscheidet sich untcr andern dadurch von *P. alba)* und bei vielen *Pintt+Arten* hafleu sie mehrere, ja viele Jahre.

Die Samenfliigel, von den äusseren Zelllagen der innern Schuppenfliiche gebildet, bedecken die obere Fläche der Samen bei den meisten Gattungen volktiindig; *Wx Abies* schlägt sich diese Decke auch noch theilweise iiber die untere Fläche dersclben ; bei *Cednis* ist sie zerzasert, und bei *Pinus* bleiben bei dera reifen Samen ausser einem mehr oder weniger vollstiindigen Ringe nur noch Spuren zurück. Die Samen selbet sind bei *Abim, Tsuga* und *Cedrus* mit groesen Harzbehältern besetzt. tiei den iibrigen Gattungen aber fehlen diese — Die Zahl der Cotyledonen ist geringer (meist nur 3-5) bei den ersten Gattungen, bei *Pinus* und *Cedrus* aber kommen deren bis zu 12 und mehr vor; letzte Gattung hat noch die Eigenthümlichkeit, doss die Embryonen gekriiinmt sind, wübrend sie bei alien andern Gattungen fast gerade erscheinen.

Die Begninzung der meisten dieser Gattungen ist liingst bekannt; daher sei nur bemerkt, dass *Tsuga* die bekannten ost-amerikanischen, west-amerikaiii»chen und ast-asiatischen Arten umscbliesst, welche sich kaum specifweh trennen lassen. *Peucoüles,* von Sj*ich nur als Section geachieden, besteht aus der einzigen Art *Douglasii; Hetperopeuce* ist ebenfalb ein monotypes Genus, [14]

• Beprintod, with slight *MlUntUm**,* in Dot Zeitung, 1868, p. 484-7. — KM,

auf *Abies Pattoni* (syn. *A. Hookeriana* und *A. WUliamsonii)* gegriindet, deren Bliithen ich untersucht, deren Samen mir aber unbekannt sincL Diese drei Gattungen haben ini Allgemeinen die Blätter von *Abies* und die Zapfen von *Picea,* unterscheiden sich aber in den andern Organen von diesen beiden und unter einander, wie oben angegeben, auf das bestiminteste.

Ueber *Pinus* wäre nun noch zuzufiigen, dass eine natiirliche Gmppirung der zahlreichen Arten nicht leicht zu finden ist, dass sich aber die Section *Slrobus,* die sich an *Picea* anschliesst, gut charakterisirt durch die gracilen hiingenden Zapfen mit wenig verdickten Schuppen und die 5-zähligen Blätter, welche nicht, wie bei alien andern Kiefern, in eine abrupte, ungesägte Spitze auslaufen, sondern auch auf dem stumpflichen Ende fein und unregelmässig gezähnelt sind. An diese schliesst sich *Cembra* an mit grossem Samen und auf ein Minimum reducirten Samenfliigeln; die echten Cemira-Arten haben noch, wie *Strobus,* wenig verdickte Zapfenschuppen und 5 Blätter, diese sind aber an der Spitze immer und zuweilen selbst am Rande ungesägt; die Unterabtheilung *Cembroides,* unterschiedeu durch die ungewöhnlich dickhöckerigen Schuppen der kleinen Zapfen, verdient besondere Beachtung, weil die vier Arten, welche sie bilden *{P. monophyllos* mit 1, *edidis* mit 2, *cembroides* = *Haveana* mit 3 und *Parryi* mit 4-5 Bliittern) ungeachtet der Verechiedenheit in der Zahl der Blätter so nahe zusammengehören, dass man sich geneigt fiihlt sie als Formen einer einzigen Art zu betrachten, welche vom mittleren Mexico sich nordwestlich bis Californieu und Utah erstreckt. Die von einer Scheide umschlosseuen stielrunden Blätter von P. *monophyllos* haben übrigens nur einen einzigen centralen Gefassbiindel und sind wirklich einfach nicht aus zweien verwachsen, wie die Blätter von *SciadopUys;* es kommen indessen am selben Baum oder Zweig zuweilen auch zweibliittrige Biindel vor.

Die grosse Menge der librigen Arten wäre unter der den beiden vorigen coordinirten Gruppe *Pinaster* zu begreifen; man hat sie nach der Zahl der Blätter in 5, 3 und 2 blättrige eingetheilt; da aber viele Arten 2 oder 3, und einige andere 3, 4 oder 5 Blätter in einem Büschel zeigen, so wäre ein geniigenderer Eintheilungsgrund za suchen; ein solcher scheint in der Stellung der weiblichen Bliitheustande, daher der Zapfen, gefunden. Diese stehen entweder am Ende des Jahrestriebes, dicht unter der Terminalknospe, oder sie entwickeln sich, zumal bei vielen amerikanischen Arten, eeitlich am Jahrestriebe, gewöhnlich in Quirlen, und zwar so, dass iiber den Bliithenständen ein teschuppter aber blattloser Achsentheil, und diesem erst ein beblsitterter folgt; zuweilen wiederholt Bich dies noch einmaL Die erste konnte *mai^yhestres,* die letzteren *Taeda* nennen, nach allgemein bekannten Repriisentanten dieser Gruppen. Dann könnte man vielleicht noch, als Unterabtheiluug von *Pinaster* nach der Funfzahl der Blatter *Pseudostrobus,* und nach der Grösse der Samen und verhältnissmassigen Kleinheit der Fliigel *Pitua* trennen, welche letztere Gruppe ausser der etjropiiischen *weibttttrigen *P. Pinea* die west-amerikanischen dreibliittrigen *P. Sabiniarui und P. Coulteri* und die 4-6 blattrige *P. Torreyana* umfassen wiirde. Die kätzchenartigen miinnlichen Blüthen der .ft nsind von einer ziemlich bestimmten Anzahl von Knospenschuppen umgeben, die z. B. bei *P. sylvettris* aus 3, bei *P. cembroides* und *P. Catutriensis* aus 4, bei P. *Austriaca* aus 8-12 bestehen «• a w. Bei P. *resinosa* und P. *Canuriauu* sind diese Schuppen in der Mitte gegliedert.

Nas Arten sind von einer ziem 4, bi P. Ai 812 b.h

IV. THE AMERICAN JUNIPERS OF THE SECTION SABINA.

FROM THE TRANSACTIONS OF THE ACADEMY OP SCIENCE OF ST. LOUIS, VOL. III., pp. 1-10 OF REPRINT ISSUED IN DEC. 1877.

THE species of our Junipers, are, on the whole, well enough recognized, but their scien- [583 (1)] tific definition is very insufficient — the characters given in the books, vague and indefinite.

I have had a good opportunity to study the different species and forms from all parts of our country, fresh and living as well as preserved in numerous collections; among them those contained in the great Herbaria of New York and Cambridge (Torrey and Gray) and those of Kew (Hooker), and especially those of Berlin, whence the types of the different Mexican species were sent to me by my late excellent friend, Alexander Braun.

With the exception of *Juniperus Sabina,* which with us is always a prostrate plant, all our species occur both in the form of low shrubs and of trees, a few of them of magnificent dimensions. In the arid mountain regions, the trunks of the different species which occur there frequently assume peculiar conical forms, very thick at base and rapidly tapering to a slender point.

The BARK is in most species thin, fibrous, and at last detached in shreds; only in *J. pachyplilaa* it is 1-3 inches thick, cracked like that of some oak or chestnut, the surface at last peeling off in thin layers.

The WOOD is fine-grained and compact, but not always hard; its growth is very slow, so that trees of 200 years have a diameter of 4-6, or, in the species growing in more generous soil and a more favorable climate, of 12-18 inches. Therefore, when we hear of mountain forms (necessarily of slow growth) having near their base a diameter of 3 feet, we cannot help estimating their age[1] at a thousand years and upwards. In *J. occidentalis* the annual rings are often quite eccentric. The rain is confined to the cambium layer and the inner bark; the wood is quite free from it but extremely durable, and, at least in *J. Virginiana,* almost indestructible. In this species the heartwood is red (hence the name *Red Cedar)* and very aromatic, soft, and splitting [584(2)] easily; in *J. Bermudiana* it is said to be similar but harder; in all the others, the wood of which I could examine, it is paler red or yellowish, harder and less fragrant; they split less readily, but are, in the regions where they abound, not rarely the most available and highly esteemed firewood

The LEAVES of young plants or of vigorous shoo^are, it is well known, acicular and arranged in alternating whorls of threes (rarely in twos), quite similar to the permanent leaves of the *Junipers* of the section of *Oxyecdrus,* but the older and especially the fertile plants have very short, mostly closely imbricate, almost scale-like leaves, the lower part more or less adnate to and forming part of the branchlet itself. These leaves occur in some species in pairs, in others usually in threes, so as to form 4-sided or 6-sided branchlets, but this arrangement is not constant and ought not to be much relied on for specific characters. The leaves bear their stomnta on the concave, upper, appressed side; the lower, convex side or back has no stomata, but is marked by a more or less distinct, either prominent or sunken "gland," as it is called,—the dorsal and only resin-vesicle or duct of the leaf. This is globose or oblong according to the shape of the leaf, or rarely (in *J. Bermudiana)* elongated, and lies in some close to the epidermis, or is in others separated from it by a layer of parenchyroa-toas cells. The contents of this resin-vesicle are in some species or in some localities excreted through the epidermis, and are apt to appear on the back of the leaves as an aromatic balsam, and, later, as condensed resin.

The edges of the leaf arc rarely entire, mostly delicately denticulate, or irregularly fringed with minute, corneous, often curved processes. This character permits us to distinguish species where others may fail.

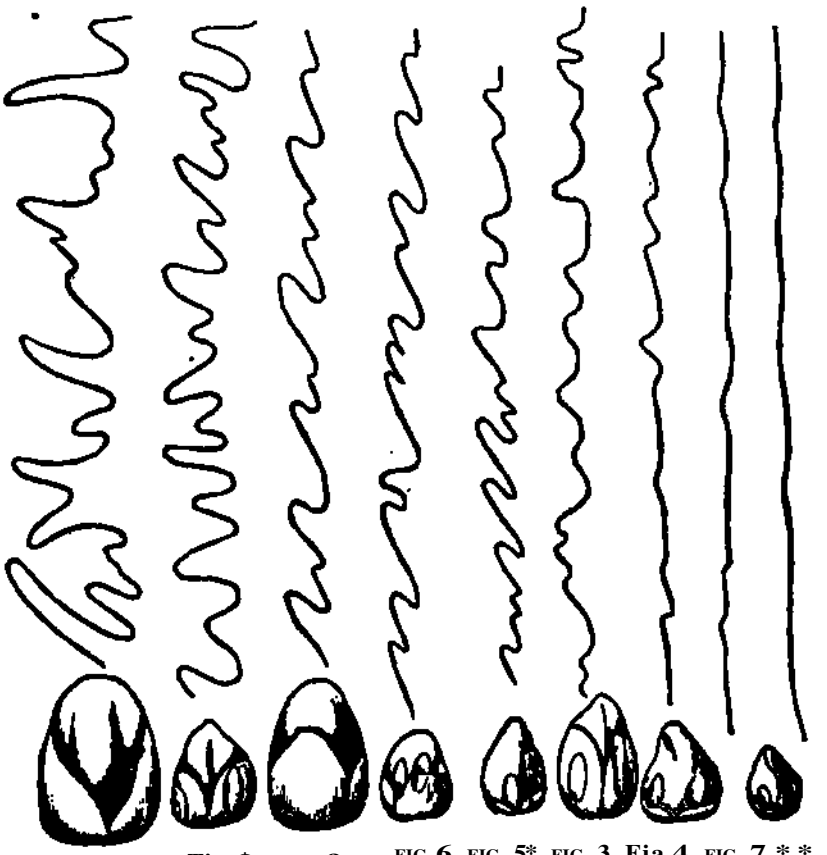
[1] ThU it also alluded to ID • letter received, after the afore wu in tjp*, from Sir J. D. Hooker, who had jott returned from an exploration of oar weatern mountain region*, in which he speaks of the " stupendous age " of their Jauiprra, meaning *Y*Mj J. oceideiUalii.*

In the figure the form and proportions of the leaf-maigin of the different species is represented as it Appears when magnified 280 times; but a much lower power, even a good glass, in a favorable li"ht, will enable the student to recognize its character. The figures show that only *J. Virginiana* and *Btrmudiana* have entire leaves, while /. *Californica* has the most marked fringe; the other species are intermediate between these extremes.

Of the Old World *Sabince* which I have examined, only *J. Chnunsis* (cultivated speci- [585 (3)] inens) is in this respect similar to /. *Virginiana; J. fvtidissima* (coll. Hohenacker) has the strongest dentation, somewhat Uke Fig. 2, but with more erect teeth; *J.pfuemcea* (from Italy) and *J. thurifera* (from Spain) are less marked, more like Fig. 3, and *J. exceUa* (colL Kotschy) still less so, somewhat like Fig. 4, and only a little more than *J. Sabina* (from Switzerland), Fig. 7.

The species of *Sabina* are subdioecious, or more commonly dioecious; no specific characters can be founded on these peculiarities.

The male FLOWERS *(vulgo* amenta) and fe- [586 (4)] male aments have, like the peduncles, and in continuation of them, binate or ternate scales; the edge of the anther-scales coi> responds in its character to the margin of the leaves of the same species; the number of anther-cells varies from 4 to 8 on each scale, more in the robuster, less in the slenderer forms.



Fiat. Tic. $• FIG. & FIG 6. FIG. 5*. FIG. 3. Fia 4. FIG. 7 * *

Margins of the letves magnified 280 times, and seeds twice the natural size : Fig. 1. *J. Californica;* 2. *J. Mexicana;* 3. *J. pachyphlaa;* 4. *J. flaccida;* 5. *J. occidentalis* · 5*. *var. f conjunpens;* 6. *J. tetragona;* 7. *J. Sabina;* 8. *J. Virginiana* and *Bermudiana.* Ontbe^ithBiimpreMy made by the resin-vesicles

The **juicy strobil,** GALBULUS, which we may for shortness' sake desiguate by the popular name of *berry,* matures like the fruit Ü» the second year, but, Unlike them, it attains almost its full size fifS^• in the first autumn, when even the MIM to both. the stony coating of the seed is pretty well formed; but it matures fully a year later. We often c berries o| years, young and maturi-- ones, on the same stock; but where it bears only other yea conifers often do. fruit of 7ne wason and of one state of matumtion only .s found at one time. The erry is gener- •My dowd, but in some species (I have seen it in *J. Mavana, J. occuUntalt** and *J. tetragona*) it occasionally - on certain *XL* almost always remains open at top. with protruding

The be Is .TwZfuJ of resin receptacles, mostly close to the seeds, often leaving long.tudi- •d impwssi^s on thX surface, giving them a grooved appearance. In some species the bernes are > • • » . « • , of a mldish-brown fwhen fresh. reddUb glaucous) color, fibrous texture, and sweetish taste, the resinous matter-present in the immature berry-having apparently mostly been

changed into sugar;[2] in other species they are black with a blue bloom, smaller, more pulpy, and retain to a great extent their resinous contents unchanged. These differences in the berries may be used to divide the species into two groups, while form and arrangement of leaves are unavailable for this purpose.

The SEEDS vary in number; in some species they are single or sometimes in twos, rarely in threes, while in others the number rises from 5 to 10 or even 12, of which some usually remain imperfect The seeds have a hard, stony coating, often of great thickness, ovate in general outline, smooth, or grooved or angled and variously compressed, and sometimes rough or tubercled; they are brown and shining upwards, and are marked below with a larger or smaller, mostly [587 (5)] bilobed, pale hilum. I cannot discover that the shape of the seeds, the presence or absence of the grooves or impressions, or the roughness of the surface, has much specific value.

The embryo of most species has two cotyledons; only in *J. Californica* I find regularly more (4-6, mostly 5) cotyledons, — a curious repetition of a constant character of *Abietinece,* and perhaps the only instance of it in *Cupressinece.* Marked as this peculiarity is, it is not accompanied by any other character which would justify us in separating this species generically from its allies.

The GEOGRAPHICAL DISTRIBUTION of our Junipers is an interesting and, at least in regard to one of the species, an abnormal one. Most of the Junipers are rather local. Three species *(J. Afexicana, flaecida, tetragona)* are confined to the highlands of Mexico, and one *(J. Bermudiana)* to several West Indian Islands. Among those within our boundaries, one (/. *Californica)* is peculiar to the coast ranges and islands of California, and another one (*«/. pachyphlcea)* to the interior of Arizona and New Mexico, into which and into Utah a variety of the former also extends. Another species, properly named *J. occidental^,* is characteristic of the whole western mountain region from West Texas, New Mexico, and Colorado, as far as California and Oregon.

Then there is the northern *J. Sabina,* which, as well as *J. communis,* of which we do not treat here, follows the laws of high northern, or, as it is called, circumpolar distribution, extending from Maine and Nova Scotia along the Great Lakes and to British Columbia as well as through Northern Asia and Europe, *J. Communis* reaching down to lower latitudes than the other, especially in the mountain ranges.

Thus far all our species have not deviated in their distribution from the well-known laws of geographical botany. But one species, our common Red Cedar (</. *Virginiana),* makes a remarkable exception. It is the only conifer and oue of the very few trees[8] which are found east as veil as west, and certainly the only one which at the same time extends through so many [588 (6)] degrees of latitude. It is well known from the St Lawrence to the Cedar Keys of Florida, from the Atlantic to the Rocky Mountains; and farther, even to the Pacific coast of British Columbia.

I arrange the nine American species in the following order: —

I. SABINA, with Uigw, f^dkh^lMaoitt, SVrwM, dry, sweetish berriea.
A. Seeds tingle or few ; lea?es fringed or denticulate*
a. Cotyledon* 4-6.
1. /. *Calyfonica.*
h. Cotyledons 9.
% /. *Uexieana.*
n. Se«U numerous, 4-12; letTts slightly denticulate.
8. *J.paehyphlaa.*
4 *J.Jtacada.*

• I We teen able to examine the feah fait of only /. *California* tad *paeMypUwa,* bat bare little doubt that tint of the other two species, referred here, it of the aame character. 1 similar procees seems to take place in the anp of the •naw-pta* «•«• *UmbmiUma.*

• The others belong to the tmWersal poplars, tad may ptrhape at well be ckewd among the circumpolar vegetation [illegible] tUnxmataiat.

II. SABOTA, with smaller, bluish-black (rarely brown) pulpy berries, of resinous taste.

A. Leaves ciliate or denticulate*

5. *J. occidenlalis.*
5*. /• *cory'ungetu.*
6. /. *Utragona,*

B. Leaves entire or nearly so.

7. *J. Sabina.*
& *J, Virginiana.*
9. /. *Bermudiana,*

1. J. CALIFORNIA, *Carribe:* A stout shrub, or small tree (rarely 20 to even 35 feet high) with stout branches, the branchlets perhaps the thickest of any *Sabina;* leaves almost always in 3's, in young shoots acerose, white above, in adult plants, even on the thicker branches, closely appressed, short and thick, rounded at tip, distinctly cartilaginous-fringed on the margins ; anther-scales (18-24) mostly in 3's, rhomboid, scarcely acute; scales of female ament usually 6, spreading ; berry globose or mostly oval, 6-6 lines long, with scale-tips scarcely prominent; seeds 1 or sometimes 2, 4-6 lines long, with a very thick and hard shell, smooth, shining brown above, with large bilobed whitish hilum. — Bev. Hort 3, 352 (1854); Conif. 58. *J. tetrayona,* var. *osteoiperma,* Torr. Bot. Whipp. in Pac. R. Rep. 4, 141 ; Bot Mex. Bound. 210. /. *Cerrosianus,* Kellogg, Proc. Calif. Acad. 2, 37, fide spec, auctoris in Herb. Torrey. (See Fig. 1.)

Var. UTAHBNSIB : In all the parts smaller, leaves and tips of fruit-scales often in pairs, fringe of leaf-margin ahorter; berries more commonly globose ; seeds mostly single, smaller.

California, from San Francisco (Monte Diablo) southward, principally on the Coast range and on the Islands ; the variety all over the southern parts of Utah and into Arizona and Nevada. — Bark shreddy, wood pale ; •bout St. George, Utah, where the variety furnishes the common fire-wood, it is a small tree 20 feet high; [589 (7)] berries smaller, 3-5 lines long; cotyledons same as in the species, never less than 4. Dr. Palmer has sent from the Colorado River a form with whitish, scaly bark, which I cannot otherwise distinguish, but have seen no "nature fruit of it — The plant is often confounded with the stouter forms of /. *occidentals,* but in fruit can always be wadily distinguished.

* J. MEXICAKA, *SchUchtend.:* A bush or (fide Parlatore) a pyramidal tree ; spray much more slender than the last, older branchlets with semi-acerose, squarrose leaves; leaves of ultimate branchlets mostly in pairs, slender, acute, irregularly denticulate ; anther-scales in pairs (about 12) strongly cuspidate or almost acuminate ; scales of female ament about 2 pairs, spreading, rarely in 3's ; berry globose or oval, as large as and similar to that of the foregoing •Pecies ; seeds single or often 2 or 3, similar to the last. - Linnw 5, 77 (1830) ; ib. 12, 494. Parlat. in DeProd. 16, 2, 4*1- (See Fig. 2.)

Mexico. — The 1-seeded form is Schlechtendal's original, sent by *SchietU* from Llanos de Perote ; Real del Monte, *R*rtweg,* 433. A 2-3-aeeded form has been collected at the last locality by *Ehrenberg* (often with protruding seeds) and *Gregg,* 636 ; in the Sierra Madre, *Seemann,* 2001 ; Cosiquiriachi, *Wislizenus,* 230. — Most collectors describe this •Pecies as a bush or small tree, but Parlatore assigns to it, without giving his authority, a height, sometimes, of 70-90 feet; he gives the bark as *$ecedtn$,* shreddy. The slender branchlets, the acute, denticulate, not deeply fringed leaves •Pwading ou the older branchleta, 'and the regularly 2-cotyledonous embryo, distinguish it readily from the last.

3.~J. PACHTPHUKA, *Torr.:* A middle-sized tree with a spreading, rounded top, thick and much cracked bark •** Pale reddish wood, closely allied to the last, with the same squarrose leaves on the stouter branchleta, but distkguMied by the slenderer, acuter, less prominently denticulate or ciliate leaves, usually in pairs, and by the obtnsish anther-seal* ; berry globose or irregularly tubereled, 5-6 lines thick; seeds mostly 4, angular. - Bot. Whipp. in Pacif. J* B«p. 4, 142 (1857); Bot Mex. Bound. 210; Parl. 1. c 490. *J. phchydtrna,* Sitgr. Rep. (1853), tab. 16, spalm.; PW-Lc.492. (See Fig. 3.)

New Mexico and Ariiona, *Woodkou*, Parry, Wright, Gnus, Palmer, Green*.* - Farther examination must show Aether it stands not too dose to the last; but the character of the bark seems to dirttinpiwh it completely from that •J* any other species. In the report of 8it«reave's Exped[ition]» p. 12, this singular species is mentioned, and on page V[3] Tc**y gives a short account of this and two other forms, without naming them. The plate with the name of * *Ptohyderma,* prohably a mistake of the lithographer for *pachyderma,* gives a rough figure of our tree.

4- J. FLAOCIDA, *SrJiUchUnd.:* A bush, or small or middle-sized tree with shreddy bark, with spreading branches and slendet, nodding bnnchleto ; leaves always in pairs, acute with spreading tips and slightly denticulate J J[1] **^; male flowers quadrangular, narrow, consisting of 16-20 keeled cuspidate anther-scales ; large (&-7 [590 (8)] TM? thick)'globose or often irmrularlr tubereled berry, mostly with recurved acute scales, containing 8-12 •J«am several tiers ; seeds -TM, much distorted, many of them abortive. - Linns* 12,495 (1838) ; ParUU L c. 498. (Bee Fig. 4.)

Mexico, *Ehrenberg* and others ; *Coulter,* 1419; Saltillo, *Gregg,* 432, a shrub, 10 feet high. —Well distinguished by its slender branchlets and acute, mostly somewhat spreading leaves.

5. J. OCCIDENTALS, *Hook.:* A shrub, or mostly a small tree (in Oregon of the largest dimensions) with shreddy bark and pale reddish-yellow wood ; closely appressed leaves in 3's or often in pairs, obtuse or acutish, delicately fringed on the edges; anther-scales obtusish or short-cuspidate; berries 4-5 lines in diameter, with 1 or more seeds. — Hook. FL Bor. Am. 2, 166 (1840) ; Parl. 1. c. 489. (See Fig. 5.)

Var. a. PLEIOSPEBMA with straighter, stouter branchlets, leaves almost always in 3's; berries larger (4-5 lines diam.), very resinous, deep black-blue, with 2-3 much grooved seeds. —/. *cxceUa,* Pursh. Fl. 2, 647, not M. Bieb. /. *Andina,* Nutt Sylv. 3, 95, t. 110.

Oregon to the higher mountains of California, in the north sometimes a large tree *(Lewis, Douglass, NAcberry),* generally smaller or bushy; if without fruit, it is not always easily distinguished from /. *Cali/ornica,* which Parlatore unites with it; the margin of the leaf is much like that of var. *Utahensis* of that species, but the fruit is very different.

Var. *p.* MONOBPERMA, a shrub or small tree, often with eccentric layers of wood (Cañon City, Colorado), of scraggy growth, with short branchlets at right angles ; leaves as often in 2's as in 3's ; berries smaller, with 2 or more, commonly only 1, less grooved need.

From the Pike's Peak region of Colorado through West Texas and New Mexico to Arizona and California, where var. a. takes its place. — In Colorado the berries are often copper colored, as Parlatore describes those of the species, and in some trees the seeds protrude.

Var. *1 y.* CONJUNGEXS, a bush or tree 20-40 feet high, often with eccentric layers of wood; branchlets slender, with 4-ranked, obtuse, closely appressed, slightly denticulate leaves ; anther-scales obtuse or slightly cuspidate ; berries globose, 3-4 lines thick, with 1-2 smooth or more or less tul*rculate seeds. (See Fig. 5*.)

West Texas, where it forms forests and is an important timber tree, " although not as large nor as easily worked and useful as the red cedar of the plains of Eastern Texas" (F. Lindhcimer). *Berlandier,* 671, 2081 ; *Lindheimtr, Wright, Bigelow, Hall.* — Mr. Chas. Wright found in the damp rocky woods of the mountains of Extern Cuba a few individuals of a middle-sized tree, apparently very rare, of which only male specimens were obtained (PI. Cub. 3187, /. *Virginiana,* Griseb. PI. Cub. 217), which without fruit I cannot distinguish from this Texan form ; what I take to be the same thing, has been sent from Mexico by Sartorius in Hb. Torrpy,and by Archenbom from Ziiuapan, 381, in the Berlin Herb.; the latter with small I-seeded berries. — This form connects the northwestern [591 (9)] /. *occidental** with the southern /. *tetragon*,* so that it is sometime* difficult to clearly separate them.

& J. TKTRAGONA, *SchUchtend.:* A low bush with spreading branches and thick sharply quadrangular branchlets; leaves closely appremed, obtuse, strongly keeled, distinctly denticulate ; auther-scales obtusish, short-cuspidate ; berries globose, dark blue-block (4-5 lines thick), 3-5 seeded, needs angular and more or less grooved or pitted.— Linns* *1%* 4*5 (1838) ; Parlat. 1. c. 491. (See Fig. 6.)

Var. OLioosPERM•, a buah or low tree ; berries smaller, with 1 or 2 more regularly formed seeds.

Mexico, Real del Monte, *Ehrenberg, Harlweg,* 43ft, *Uhds ;* Orizaba, *Linden.* — A low throb 3-6 feet high. The variety from Saltillo, *Gregg,* 106 6 398, 10-30 feet high, with needs somewhat similar to Tar. T *conjungens* of the last species, and occasionally protruding, but with stouter branchlets.

7. J. SABINA, *L. ;* var. PROCUMBENS, *Purth.:* A pnwtrate nhrub with appiwed or slightly sqtiamwe acute leaves in pairs, margin slightly or indistinctly denticulate; anther-scale* ohtnuish, nearly entire.; tarry on short recurred peduncles, a-4 line* in diameter, with 1 or 2, rarely 3, often rough see.!*. — Fl 2, 647 (IHlfi) ; /. *Sabina,* Micbx. PI. % 846; Parlat. 1. c. 484 ; *J. proetrnta,* Per*. Syn. 2, 632 ; S. *repent,* NutU (ton. 2, 245 ; *J. Sabina,* 0. *humilu,* Hook. Fl. Bor.-Am. 2, 166. (See Fig. 7.)

From Maine ami New Brunswick to the shores of the Great Lake* and northward to the Hudson Bay regions; westward to the Yellowstone River and to British Columbia and the Pacific coaat. — Michaux as well as Hooker seem to indicate that northward the on!inary form of *J. Salrina* is aU> found, but I have seen no specimens; the plants from the localities given abort are all prostrate, spreading over sml closely carpeting sandy shores and rocks with •terns up to 1 inch or more in thickness, with ml heartwooil and brown scaly, scarcely shreddy bark ; the branches extend 6-10 feet or more; branchlets often covered with siihacerose leaves, and sometimes even bearing fruit in thai •tote ; but generally the fertile plants hare the short, appressed leaves common to the whole section. Mr. H. Gill man -tato of Detroit, now in Waldo, Florida— who has very attentively studied the Flora of the Upper Lake country, m a d U» branches usually flattened, and with eccentric annual rin^'. He observed that where they recline on rocky •oil, the lower part, touching the rock, is rubbed off, or the formation of wood there prevented ; but where they spread OT*r ins sand, the lower side'u protected and the upprr surface underlie* a similar pruceae through the friction of wind-driven sand. He occasionally (bund berries even 6 lines thick, cunuinintf as many as 4 seeds.

%. J. VnoniAVA, *L.* * The krgwt, the widest spread, and the most useful of our American Junipers, comnwmry « pyramidal form, with shreddy bark and red and aromatic heartwood ; slender 4-anglod branchleU, with opposite

obtuse or mostly acutish leaves with entire margins ; anther-scales 10-12, rounded, entire, each bearing [592 (10)] usually 4 or sometimes 6 anther-cells ; berries on straight peduncles, 1-2-seeded; seeds angled, mostly groove 1, and often rough toward the upper end. — Spec. PL 1471 (1753) ; Parlat. 1. c. 488. (See Fig. 8.)

From the St. Lawreuce to Florida and from the Atlantic to the Northern Pacific; it is not found in Southern Texas, in the greater part of Utah and Arizona, and in the whole of California and perhaps Oregon; in Washington Territory and British Columbia it associates with *Sabina* and perhaps with *occidentals,* and in the Rocky Mountains south of Pike's Peak with the latter species; on the Upper Missouri (Cedar Island) it attains large dimensions. — Usually the berries are small, about 3 lines thick, but in the Rocky Mountains forms occur with berries of 4 or 5 lines in diameter, and with larger seeds ; among the foot-hills of Pike's Peak the trees of this species have the size and shape of an apple tree, with a rounded, spreading top.

9. J. BERMUDIANA, L.: A tree said to have been common on the Bermudas, and also in other West Indian Islands, of which I have seen only a few specimens. Branchlete stout; leaves in pairs, oblong or linear-oblong, obtuse, closely approssed, with entire margins and a well-marked linear gland or resin-duct on the back; anther-scales about 16, large, rounded, smooth-edged, with about 6 cells ; berry with 2-4 seeds, much like those of the last species. — Spec. PL L c; ParLit. L c. 490. (See Fig. 8.)

/. *BarbaderuU,* L. : is said to be the same species, and *Biota Meldmrii,* Gord. its aceroee young state. Michaux, ai well as Parlatore, quotes Florida as its home, but all the specimens from that country which I have seen, even those from Cedar Key a, and those of Michaux's Herbarium iu Paris under the name of /. *Barbadcnns,* are nothing but forms of /. *Virgituana,* with very small, rounded, and strongly convex leaves. The forms from the different West Indian Islands, all referred to /. *Bermudiana,* require further examination, as we know that one at least, from Cuba (see p. 590), b certainly quite differeut from it.

V. A SYNOPSIS OF THE AMERICAN FIBS *(Abies,* LINK).[1]

FROM THE TRANSACTIONS OF TUB ACADEMY OF SCIENCE OF Sr. Louis, VOL. III., pp. 1-10 OF REPRINT ISSUED IN 1878.

GRRAT confusion prevails in regard to the distinction of species of our Firs and in their [593 (1)] •ynonymy. This is owing partly to the innate difficulty of the subject and to the very imperfect descriptions in the books, and partly to the inordinate zeal of seed collectors and horticulturwts. But in the last decade the western mountain regions, the homes of most of our 6rs, have been wore fully explored, and the geographical limits of the species ascertained; and in about the same period the anatomical structure of their leaves has been investigated, and has furnished welcome aid in the distinction and the classification of the species.

It is a most interesting as well as significant fact that while the anatomical structure of the leaves *It* higher organized plants shows considerable uniformity, so that it rarely can be made available for diagnostic purposes, tlie conifers exhibit such a wonderful variety of leaf-structure (approaching thereby the lowest orders of vascular plants), that often a single leaf is sufficient to recognize the gwiug, and often the species, even when the ordinary characters may leave us in doubt

The anatomy of coniferous leaves has been often examined into, but the first to appreciate their <*a»oters as a means of classification was F. Thomas, who in 1865 published an extensive treatise °n the subject in IVinpiheim's *Mr*. 4,* pp. 23-63. He was followed in 1871 by C. E. Bertrand, • * * *Sot. Bot.* iVance, 18, pp. 370-381. The same author gave a more elaborate paper on this sub-

[1] I follow Link (£<wkm, 15i 6«, 1841) In hi. name, :Wlnitkm, and circumscription of the twin, which «*m. to *-• «*jr natural one, comprising the silrer or b»»ara fit*. ?? 2*[11]''''[1] « " • Don, In *Lovdo* A*.* 4. S8». 1838. U «• older Bam* and enjoy, the Unimn prwtl*., but i. eon- ■* ^ to •h1.oal (Pltoiu., etc.) and phllologloal authority. 2* "•••_**** Is generally adopted on the continent ol •''''*•» while *H-** was heretofore principally used to Bngland, but i« now being abandoned. *Pieea* Link (the sum as *AUn* Don) U the proper name for the .prow.. Tournefort, the elder DeCandolle, Gray, and otbera comprise under the name of *Abie$* both fini and sprooes. The generic distinctions between them are based both on the floral and fruit characters as well « «n the leaf anatomy.

A reprint or this psper will be found in the *Oatdeneri CkromieU,* n. a., VoL IX. pp. 205-2M, S0O, 334. — Ens.

ject in 1874, in *Ann. Set. Nat. Bot,* 20, pp. 5-153, with 12 plates. He was followed in the succeeding year by W. R McNab in *Proc. Irish Acad.,* 2, pp. 209-213, with 1 plate; and in [594 (2)] 1877 the same published an exhaustive paper in the same Journal, pp. 673-704, with 4 plates. £. Purkinje, of the Foresters' Academy of Weisswasser in Austria, made, four or five years ago, extensive investigations on the same subject, but has, I believe, not yet given his results to the public. My own studies in this line, commenced some fifteen years ago, when the conifers of the Rocky Mountains first got into the hands of botanists, have been carried on more assiduously within the last three years.

Highly important as the microscopic investigations of the leaf anatomy are, they have sometimes been relied on too exclusively, disregarding the characters furnished by the reproductive organs.[1]

It may not be useless to repeat that the leaves of all firs are sessile with a circular base (leaving a circular scar in falling *off),* and without the prominent persistent ligneous cushion which is peculiar to the spruces. They are usually more or less flattened, grooved above and keeled below, and those of the branches are mostly twisted above the base so as to give them a more or less distichous direction; the leaves of the erect shoots are thicker and convex above, and not twisted. The tip of the leaves of young trees, and of the lower branches of older ones, is notched in almost all species; the leaves of robust shoots and of fertile branches are mostly entire, obtuse in some, acute in others.[8] All the leaves have stomata on the under side, arranged in a smaller or larger number of series, forming bands on each side of the keeL On the upper side of the leaf stomata are present in some, especially in those with thicker leaves, and absent in other species, mostly in those with flatter leaves; in several species the leaves of the lower or sterile branches are without stomata above, and the thicker ones of the upper or fertile branches have a few (in the upper part of the groove) or many. The thick epidermis of the upper surface is mostly underlaid and strengthened by very robust longitudinal cells, with thick walls and a very slender cavity, which have been named [595 (3)] pseudo-bast cells, but are now generally known as hypoderm cells. They are almost always preseut on the edges and the keel of the leaf, there sometimes crowded in 3-5 layers, and they often form a more or less interrupted stratum on the upper side. Where stomata pierce the epidermis, the hypodermic stratum is incomplete, or entirely absent Only in a few species *(A. bradeata* and *relir giosa* and the Asiatic *firma)* we find such cells also in the interior of the leaf, a case which is common in true pines. In some species the diameter of these cells is equal to that of the epidermis cells; in some it is smaller, and in a very few larger. Their presence, distribution, and relative size is tolerably constant, and furnishes good specific characters.

I do not describe the parenchymatous cells containing chlorophyll, nor their variety the so-called palisade cells (elongated cells perpendicular to the upper side of the leaf), as no essential characters are derived from them* But of great diagnostic importance are the resin-ducts, of which there are always two in the Abies leaf, readily seen in a horizontal section. In some species they are placed on the lower side of the leaf, close to the epidermis and mostly near the edges; in others we find them in the parenchyma, about equidistant from the upper and lower surface.

The fibro-vascular bundle occupies the centre of the leaf, either single (in the more square leaves of the 4th section), or mostly divided in two distinct bundles (in the flat leaves). Both coses occur sometimes in the same species. The bundles show the laiger (ligneous) cells above and the smaller (bast-) cells IHJIOW ; they are surrounded by small pith-like cells, and the whole separated from the parenchyma by a sheath of larger cells.

• The separation by Rertrand, followed by McNab, of *Atom nobtiu* from Hie other firm, and the connecting it with *f*^{dmi}*^{dmt}*9*^{a} Amf/ojn, notwithstanding their striking dif- *•»«« In pollen, fruit, and seed, must be considered M the * • « of *mch* onesided inrestigstion.

Hence the necessity of collecting, if possible, branch* «• jo«ng tree, met shoots, lower branches of older, fertile trees (the only iperimcn* which we asuslly find in Herbaria, becaoae eamly attainable) and branrhrt with male and mch with female flowers, or with Uieir vmtigrs ; bmides these, th« cones and seeds and young seedling plants sre important A alica of the bark of old and of young trees ought to enplet* the material

On the differences of the leaf-structure we can base the subdivisions of the genus with much greater certainty than on the length of the bracts, as was formerly done.

Sec. I. BALSAMEJE : Resin-ducts within the parenchyma, in the interior of the leaf ; leaves on lower branches notched, and mostly without stomata on the upper side, on fertile branches entire, obtuse, or often acute, mostly with a few or more stomata above, towards the tip. — Two eastern and one northwestern species.

*** *Kxserta:* bracts protruding, recurved.**

1. *A. Fraseri.*

*** * *Incluxe:* bracts shorter than the scales. [596 (4)]**

2. *A. balsamca.*

Sec. II. ORANDES : Resin-ducts close to the epidermis of the lower side, toward the edges ; leaves on lower branches notched or obtuse ; on upper, obtuse, rarely ever acute; bracts enclosed. - Two western species.

4. *A. grand**

Sec. III. BRACTEAT* : Resin-ducts as in last; upper side of the rigid, mostly acute leaves without stomata, with a continuous layer of hypoderm cells, usually similar cells within the sheath of the fibro-vascular bundle ; pallisade-parenchyma very strongly developed ; bracts exsert. -A Mexican and a southwestern species.

6. *A. religion.*

Sec. IV. NOBILES : Leaves of the adult tree and especially of the fertile branches quadrangular, short, curved, but scarcely twisted ; resin-ducts close to the epidermis of the lower side, and equidistant from the edge and keel; fibro-vascular bundles single; stomata on both sides ; leaves of young trees much like those of Sec II. - Two species of the higher mountains of the Pacific slope.

*** *Exserta:* bracts protruding.**

8. *A. nobUii.*

• • *Induta:* bracts shorter than scales.

0. *A. magnified.*

1. A. FRASKRI (««,«, Pun*. Fl. 2,639,1816; Parlatore in DC. Prod. 16• 2, 419)^ Lindl• Pen^ Cyc• 1, No. 5 (1833), Forbes, Link, etc. This is probably the most 1-wal species in the United States, being confined to the tops of the highest mountains of North Carolina, which have an altitude of 6,000 feet or more, and the tops of which it covers together with some *Pxcea nigra,* but it never occurs mixed with the following species. - A small tree rarely as much as 30 or 40 feet high, and 12 or 18 inches in diameter, probably never more than 60 to 75 year* old, with cinnamon-brown •moothùh bark ; readily distinguished from *baUamea* by the shorter, more oval cones with largely exsert and reflexed bracts, and always, even when sterile, by the almost uninterrupted stratum of hypodermic cells on the upper side of the W, more crowded on the edges. The white bands on the under side of the leaf consist usually of 8 or 10, or even 12 •erie. of stomata; height of scales (without the stipe) equal to one-half or two-thirds their width; length of seeds «qual to length and width of wing - Forms of the next species with exsert tips of bracts, in the mountains of Pennsyl- *«nia, Vermont, and other northern regions, seem to have been mistaken for this species. In eastern as well as in European gardens forms of *baltamea* are often cultivated under the name of *Fraten.*

*** A. BAUAIIEA *(Pinu,* L. Sp. PI. 1421, 1763 ; Parl. 1. c 423), Marshall Arb. Am. 102, Link, etc [597 (5)] *• *baUmifcra,* Michx. Fl. 2,207, in part.- The northeastern •' Balsam - extends from Canada and the north- •"tern Bute, along the mountain, to Virginia, and along the Great Lakes to and beyond the Mississippi. It is a Uiget tree than the last, often 70 feet high, 1* feet in diameter, and up to 150 years old ; bark smooth, and reddish- *V** when young, brown and much cracked in old trees. Its slenderer cones with enclosed bracts (only their point, "••time, protruding), and especially the leaves with scarcely any hypoderm cell* above and very few on edges and *••* (fewer than in any other ofoaTspecies and aometimes none) and with narrower bands of stomata below (of 4-8, '"••Ujr about 6 •erie.) readily distinguishes it. *A. Hudtmia* of the gardens, often considered as a form of *Frateri,* is • tetile dwarf form of *baUamta,* found also on the White Mountain, of New Hampshire above the timber line.**

__ * ». A. .UBAtPiNA, Engclm. in Am. Naturalist, 1876,p. 555. *A.* tafaaq* Hook.Fl. B. A. 2,163. I*A.bi/olia,* *mr. Pro* R. Hort. 8oc 3, 318 *A atnabiku,* Parl 1. c 426, in part - Closely allied to the last species, the western fPWWtttatiye of which it roust be considered to be; it extends from the higher mountains of Colorado and the adjoin- »« P«to of Utah northward to Wyoming and Montana, where it is the only species, and westward to the mountain. •f Oregon aad into British Columbia (Fraser's River) and southward probably to Mount Shasta, always scattered in

*** Thb fceoripUon it r«print«d in th. *Oardentr/* C5HwW« for Feb.. 1», 1681, p. 2M, when figures from photographs "•t by Dr. Knjtlmum an published. - EM.**

the subalpine forests, and, at least in Colorado, coming up almost to the timber line, bat never alone constituting forests. It is a larger tree than *balsamea,* often over 2 feet in diameter and 60-100 feet high, with thin, pole whitish, smooth bark, which only in very old trees becomes cracked and ashy-gray ; timber so poor and soft that in some parts of the Rocky Mountains it is called pumpkin pine. Leaves like to those of *balsamea,* notched on sterile and pointed on fertile branches ; hypodenn considerable, though interrupted on upper surface, crowded on edges and keel. Cones retuse, brown-purple, 2-3£ inches long, 1-1 £ inches in diameter, the smaller ones near the timber line. Scales rounded or almost square, often almost as high as broad, similar in their proportions to those of *baUamea,* but larger ; bracts short, emarginate, inucronate; seeds, including the wing, over 1 inch long, the latter nearly twice as long as it is wide.

Var. FALLAX has the resin-ducts of this species, but the foliage almost of *eoneolar ;* leaves sometimes 1 j or even 1 j inches long, mostly obtuse, and covered with stomata above, glaucous when young. —Dr. Newberry's specimen in the Herb. Agricult. Pep. Washington, collected on the higher tops of the Cascades, south of the Columbia River, and described[4] by him as *A. amabilis* in Pac. R. Rep. 6, bot 51, belongs here ; the loose scales (12 [598 (6)] lines wide, 11 high, with pointed bracts, seed with narrow wings, as in the species, but larger) brought home indicate a large cone, such as he describes as 6 inches long and *2* thick. S. Watson and lately A. L. Siler collected a similar form on the Wahsatch Mountains; but the loose broad scales sent by the former may possibly belong to *eoneohr9* which grows in the same region. The mere fragments of this interesting form, seen by me, do not permit me to give more than the above indications.

This species has troubled botanists considerably. It is probable that Hooker's *lasioearpa* belongs here, as a branchlet together with a few scales, preserved under that name in the Kew Herbarium, seems to point out; but the description in the Flor. B. A., which mentions the leaves as the longest of any N. A. *Abies,* refers perhaps to something else, and has certainly given cause for the application of the name to the long-leaved forms of *concolor* in the English nurseries. Then, in 1863, A. Murray distinguished a form of this species, collected by Lyall in British Columbia and on the Upper Columbia River, as *A. bifolia,* recognizing the different forms of foliage, but misapplying the scientific name. About the name time specimens and sejeds from Colorado were distributed by Dr. Parry and by E. Hall as *A. grandis,* and may nuw be cultivated as such in Europe. That Parlatore and others have taken it for *amabUit* has already been stated.

4. A. ORANDIB *(Pinus,* Douglas ms*, 1830, and in Bot. Mag. Comp. 2,147, 1836; Parl. 1. c. 427), Lindl. Pen. Cyc n. 3 (1833), Link, etc. —This is one of the tallest firs known and therefore properly named *grandii* by Douglas, a tree up to 200 and frequently 240 (Xuttall) or even 300 feet high (E. Hall), but in diameter leas than some others, perhaps not more than 4 feet; bark smooth and brownish (Nuttall); wood white, soft and coarse; a native of the littoral regions of the northwest coast, from Cape Mendocino in California, *BoLinder, Vasty,* which seems to be the southern limit of several northern trees, to the British Possessions (in Vancouver Island as *A. Gordoniana* Carr.) at least as far north as Fraser's River, *Jeffrey, Lyall.* But, common and valuable as this timber tree is in Oregon, very little information about it has reached us, and its cones seem to be almost unknown in collections. — The foliage is glossy green, without stomata above, and with 2 well-marked white bands, each of 7-10 rows below ; leaves mostly 1-2 inches long, more markedly distichous, at least in the sterile branchlets, than in most other of our species, strongly grooved and notched; leaves on the fertile branchlet* similar but rather shorter, and occasionally rounded at tip. The hypodenn cells are scattered all over the upper surface of the leaf, forming an interrupted stratum under the epidermis; on the sides and keel they are, mostly, only moderately developed. Cones cylindric, 2-4 inches long, with broad scales (nearly twice as broad as they are high), and short, bilobed or 2-auriculate bracta, with or without a short macro. Seeds with a broad, very oblique wing, almost as broad as it is long.

This species is cultivated in European gardens from Douglas's seeds, sent home forty-five yean ago; in the Edinburgh Bot. Garden under its proper name, in Dropmore Park as *A. amabdu* ; but, though now over [599 (7)] forty years old, seems not to have coned yet In the same establishments another fir is cultivated, in Edinburgh as *amabilu,* in Dropmore as *grandii,* thus continuing the confusion which has existed from the first in regard to these names. I suspect this to be the real *amabilis* of Douglas, but take it for a variety of *grandis,* which — Douglas's name being doubtful — may be designated as —

Var. DENSIFOLIA : Foliage denser than in the specie*, clustered on the upper side of the branches like that of *Ncrdmanniana ;* leaves dark glossy green above, with 2 very conspicuous white bands below; hypoderm cells more crowded under the upper surface of the leaf; cones and seeds the same. — Apparently a mountain form of *grandis,* from the base of Mount Hood, *E. Hall,* mixed with nitaJjrina, to British Columbia, *Lyall.* Douglas found his *amabilis* in September, 1825, "on the mountains immediately south of the Grand Rapids of the Columbia,* together with *A.*

« His description of the foliage, however, seenis to refer to what I call below *A. grandis* var. *densi/olia.* Dr. N. may hare •tad both forms, an unfortunate mùhip which is by no means rare in such collections, mostly mads in haste and cton under urftTorable circumstances.

fuibilit; but the cone sent home by him (at that time or later ?) was a much larger one, 6-« inches long, 2$-3 thick, with lanceolate bracts; from its seeds the above-mentioned trees are said to have sprung. Unfortunately the large cone, figured by Lambert as *grandit,* and by Loudon and in Pinet. Woburn. as *amabilit,* and formerly preserved in the collection of the London Horticultural Society, seems to have been lost since the sale of that collection; it may have been similar to Newberry's cone *ot/allax,* described above.

The following species have been claimed for *amabilu: A. tvbalpina* is called so by Parlatore 1. c, who seemed to rely on its native locality and on its leaves (or many of them) being entire, but overlooks other characters.— Var./oJ-*lax* of that species, taken for *amabilit* by Newberry, has a large cone and similar bracts, but is not in cultivation, as Douglas's tree is supposed to I>e. — *A. magnified,* the *amabilu* of the Californian botanists, has the large cones, the lanceolate bracts, and the entire leaves, claimed for *amabilit;* but the foliage is quite different, and so is its locality. — *A.nobilit:* Prof. McNab finds the leaves of the type specimen of *amabilit* in Herb. Kew identical with *tubilit* leaves; I have examined the same leaves and take them with scarcely a doubt for those of a form of *grandit.* — *A. concolor* has been named *amabilu* in some gardens. — Locally the "yellow fir" of Oregon, as *Pteudottuga DougUuii* is often called, •eems to have been also taken for *amabilu,* perhaps on account of its entire leaves.—There remains only the tree which I have designated as *A. grandit* var. *dentiflara,* which, together with *grandu* itself, is the only western *Abut (tuMi,* excepted) which has sprung from Douglas's Oregon seeds. No **ubaljnna, mngnific** or *concohr* has been in cultivation longer than the modern knowledge of California extends back and the influx of English seed-collectors, beginning with Jeffrey in 1851. None of these species, then, can be Douglas's *amabilu,* but-every consideration points to the tree cultivated under that name in Edinburgh. Prof. McNab has come to the same conclusion, but differs from me in considering it a distinct species. Further exploration of the Cascade Mountains between the [600 (8)] Columbia River and Shasta, probably the least known mountain region of the Pacific coast, will, it is hoped, clear up these doubts.

«. A. CONCOLOR *(Pinut,* Engelm. in Herb. 1848; Parlat 1. c. 420) Lindl. in Gordon Pin. 155,1858. Long known only from Fendler-s New Mexican specimens No. 828, coll. 1847, this elegant species now proves to 1* widespread over the .outhera Rocky Mountains, from Pike's Peak in C6lorado, where it occurs only in the valleys of the foothills, to the higher mountains of New Mexico, the southern parts of Utah, and the northern of Amona, and throughout the Californian sierras, at an elevation of 3-7,000 feet, to Mount Shasta; whether in the southern Cascades, 1« not known. It is *A. Lowiana,* Gold. Suppl. 53; *A. grandu* of the Cahfonnan botanists; *A. la^carpa* of the nur-•erie. (so called from its long leaves, which constitute a character of the original *Umocarpa) ; A. amabdu* of some -taMishnients (because of the large cones and obtuse leaves) ; *A. Partonnna* of the gardens. It is a stately tree, in California up to 150 feet high, 3-5 feet in diameter, and 200-300 years old (Lemmon) ; in the Rocky Mountains not quite .o large. - The bark is pale in young trees, but darker than in *tubafrna,* and soon becomes rough and of an ash-g«y color, in old tree, often several inches thick and deeply fissured. The wood is more valuable than that of « * * *fi-a,* perhaps equal to that of *grandit,* but much less so than the wood of *magmfica.* The tree is always readily «i«Ungui.hed b/its pale glaucousToliage, which at last get. dull green, and by the length of the leaves of the young *«*., 8-21 and .ometfme. even 3 inches long - longer than in any other of our nfrs. Only such leaves or those of the lower branc.be. of old tree, are notched at the end; on the older trees they are shorter, very br,md, convex above, ««»all, falcate, and always obtuse; on the flowering branches they become often quite thick, keeled above, and almost quadrangular. On older tree, stomata cover the upper surface; in young ones they are usually confined to the middle line of the leaf, but are never absent, Hypoderm cell, are interruptedly distributed over the upper surface. Cones oblong, 2–4 or even 5 inches long, retuse, or in some trees short-pointed; usually apple-green before full maturity, but, at least in Colorado, varying to different shades of brown or purple.* The scales are very broad in proportion; the bracts short, rounded, or truncate, or sometimes emarginate, with, or rarely without a short mucro; wing of seed broad, as wide aa it b long; cotyledons 6-7, usually 6.

«. A. MLioioeA *(Pinut,* HBK. N. Gen. Sp. 2, 5,1817 ; Parl. 1. c. 420), Schlecht. Linnea 6,77,1830.-On *• higher land, in Mexico, extending to Guatemala. A tall tree with linear, acute, or rarely obtuse, dark, &my leave. ; cone, oval-oblong, 3-5 inches long, l*-2 thick; bracts more or less protruding, acute or cus- [601 (9)] Pidate ; wales one-third wider than they are high; seed-wings longer than wide; cotyledons 5— *A. hirteUa (PtnuM,* HBK. ib.) is scarcely a variety.

7- A. BBACTEATA *(Pinut,* Don in Trans. Linn. Soc. 17. 443, 1837 ; Parl. 1. c. 419), Nutt. Sylv. 3, 137,1849. P. venusto, Dougl. Hot. Mag. Comp. 2,152, 1836. — A well-marked, but little known tree, of very limited geographical distribution, being confined, as far as known, to the Santa Lucia Mountaius in Southern California, though other localities in different part, of California are attributed to it by seed dealers, and having been gathered only by very

* Tb. color of the eon«s is often consider*! •• of specific mlue, but in th. Black Forest of Germany all the sliades between *Vt* grwn and deep purple mny b* se«n on the cones of *A. ptetinaUt,* just ss in our *coneolor* in Colorado.

few collectors. — Leaves linear-lanceolate, always acute, of very firm texture. The bract is scarcely longer than the somewhat rounded, glabrous (all the other firs have pubescent on«s) scale, but its awn or midrib protrudes 1-lJ inches; wing of seed rounded.

8. A. NOBILIS *(Pinus,* Dougl. Comp. Bot. Mag. 2, 147,1836 ; Parl. 1. c. 419), Lindl. Penn. Cyc. 1, No. 5. *Pseudotsttga nobilis,* Bertraiid, McNab, under *Pinus:* the red fir of the Cascades in Oregon, extending southward to the Shasta region of California; stately trees, 200 feet high, with rigid, glaucous foliage ; thick, rough, cinnamon-brown bark, and useful timber. A section in the Oregon collection of the Centennial Exhibition was taken from a tree 2£ feet in diameter, bark 1 inch thick, 119 annual rings of nearly even thickness throughout. The leaves of young trees and of the lower sterile branches of old trees are longer, flat ami grooved, the resin-ducts lateral, and the fibro-vascular bundles more or less divided in two ; those of the fully developed and especially the fertile branches are shorter, flat-quadrangular, their thickness not more than £ or rarely jj of the width ; ° bundles single, cylindrical. Bracts more or less protruding and reflexed ; scale high in proportion to its width (7 : 10) ; the oblique, angular wing of the seed about as wide as long, and as long as the slender seed ; the only good seed I could examine had 7 cotyledons.

9. A. MAGNIFICA, Murray Proc. Hort. Soc. 3, 318, 1863. *A. nobilis* var. *robiista* in Hort. Dickson & TurnbulL *A. campylocarpa,* Murr. Trans. Bot. Soc. 6,370. *A. amabilis* of the Californian botanists. *Pseudotsuga magnified,* McNab : the red fir of the higher California sierras, at an altitude of 7-10,000 feet ; large trees often 10 leet in diameter, over 200 feet high, with thick cinnamon-brown bark, and valuable wood.[7] Leaves of young specimens flat but scarcely grooved, never, I believe, notched, the fibrous bundles often in twos. On full-grown trees, and especially on fertile branches, the leaves are mostly \ wider than thick, or even perfectly wjuare ; the resin-ducts in these leaves are placed equidistant from the edges and the keel, separated from the epidermis by a layer of hypodenn cells, [602 (10)] which is externally indicated by a green stripe dividing the bands of stomata, so that these leaves show 4 lower white bands. Cones 6-8 inches long, 2£-3| thick, purple ; bracts lanceolate, shorter than the broad scale (height to width as 6 :10) ; wing of slender seed very oblique, wider than long ; the only seed examined had 10 cotyledons.

Many years ago it was suggested by Mr. McNab of the Edinburgh garden, that *nobilis* and *magnifica* might be forms of the same secies ; some seedsmen of California seem, also, to have come to this conclusion ; and now Messrs. Hooker and Gray, who a few months ago enjoyed the opportunity of examining both on their native mountains, incline to the same opinion ; *magnified* would thus be the southern, short-bracted, and *nobilis* the northern, long-bracted form. It is quite probable that the length of the bract* may vary ; we know it of *nobilis,* but it is doubtful whether this could be the case to such an extent as to permit us to unite both species. In *magnifica* no lengthening of the bracU has been observed thus fur, and in *nobilis* they never, I believe, become shorter than the scale. But besides this, I confess, rather doubtful difference in the length of an nrgim of minor im]K)rUince, the flatter and grooved leaves of the young *nobilis,* and the higher and proi>ortionately narrower .scales of this SJMH'U*, together with the smaller number of cotyleddha (if constant), seem to indicate Hjwcific distinction. Further explorations must show whether *magnified,* or anything like it, grows in the regions which we know as the home of *nobilis.*

VI. CONIFEIUE OF WHEELER'S EXPEDITION.

FBOM REPORT, GEOLOGICAL SURVEYS, ETC., VOL. VI., BOTANY, BY J. T. ROTIIROCK, 1878, pp. 255-264.

ABIES[1] SCBALPINA, *Engelm. Am. Xat.* 1876, p. 554 ; *Trans. Ac. St. Louis,* 3, 597. *Abies grandis* in part, [2M] of the Rocky Mountain botanists. — A large tree, 0 0 ^ 0 feet high, with very pale and thin, smooth, or only in very old trees, cracked, and ashy-gray bark ; leaves j-1 inch long, dark green almve, paler or whitish underneath, on the lower branches flat, grooved above, notched at tip and distichous, those of feitile or of erect shoots all around the axis, sharp-

• The leaf section*, figured by McNsb, all seem to refer to young trees ; noue are as thick a» I fiud them in native specimens.

1 A section in the Agricultural Dep. of Cent. Exh., aent by J. O. Lemmon, indicates a tree 6} feet in diameter, with brown, almost fibrous, bark, 3 inchea thick, about 400 yean old, with a pretty uniform growth, 10 rings measuring 1-2 inches in thickness, about the same as in a specimen of *nobilis* in the Oregon collection.

[1] ABIES, *Link,* not *Don; Abies* sect. (Fin), Gray's Han.; «M« *met Ahi4»%* Endl. Parlat ; *Pieea,* Don. - Coniferous trm with mon or less flattened, ami on the sterile bnachleU by a twist near their base*, two-ranked, aeaaile, penistent leaves, which eventually leave on the branches circular, flat aran ; flowering from the axils of the leaves of the previous year ; sUtninate flowers (usually railed staminate amenta) in the form of an oval or cylindrical ament ; an then without cresta, bunting tnnsvenely with large (0.11-0.14— i_n the larger diameter) 2-lohed pollen-grain* ; rones erect on the more or less boriiontal branrhleU, maturing in one season ; their scales with their enclosed or exsert membranareous bracts falling from the penistent axis ; seeds covered with balsam.receptacK and pattially bnt permanently enclosed in the pcrgamentaceous base of the wing, which oovtn OM

pointed and convex and often with stomata above; cones cylindrical-oblong, retuse, 2£-3 inches or ^ inches long, 1-1 £ inches thick, of purplish-brown color; bracts broadly oval, denticulate, mucronate, much shorter than the nearly orbicular or sometimes somewhat quadrangular scale; purplish wings of seeds nearly twice longer than wide ; cotyledons 4-5.

Colorado to Utah on the higher mountains and near to the timber-line ; extending north and northwestwardly. A poor, soft, almost spongy timber, with paler bark than any other American species. The resin-ducts of the leaves are imbedded in the parenchyma, about equidistant from the upper and the lower surface.

ABIEH CONCOLOR, *Lindley; Engclm. Trans. I c.* 600. -* A large tree, 80-150 feet high, with ash-colored, at last thick and much cracked bark, with longer and broader leaves than the last (in young trees often 2-3 inches long, shorter in old ones), 2-ranked, and when young glaucous, later pale dull green, with stomata on both sides ; leaves on the upper branches obtuse, convex above, often falcate ; cones cylindrical-oblong, obtuse, 3-4 inches or even 5 inches long, 1^-1} inches thick, mostly apple-green, sometimes purplish-gray ; bracts orbicular-ovate, mostly mucronate, much shorter than the very broad, transversely dilated scale ; wings of seeds pole, very oblique, as long as wide ; [256] cotyledons 5-7, usually 6.

Common on the mountains of New Mexico and Arizona. Thence extending through Southern Colorado and Utah and throughout the California sierras. A tree of beautiful foliage, highly prized in cultivation ; furnishing better timber than the last, from which (besides the characters already enumerated) it can always readily be distinguished by the two resin-ducts of its leaves lying close to the epidermis of the under surface. In Colorado as well as in California it has often been named *A. grandis,* a species which properly belongs to the coast regions of Oregon the Lower Columbia River, Vancouver Island, etc.

PICEA[1] ENOELIIANNI, *Engdm. Abies Engelmtnni,* Parry. *Pinus commutata,* Parlat. — Large trees, 60-100 feet bigb, with thin, cinnamon-brown, scaly bark ; branchlets mostly pubescent; leaves 4-sided, slender and acute or acuminate in younger, and shorter, stouter, short-pointed, and curved in older trees (especially in higher altitudes), with stomata on both sides ; cones oval or oblong, about 2 lines long, paler or purplish, falling off at maturity ; scales thin, erose-denticulate, broad, with a rounded edge or usually somewhat prolonged upward and truncate; seeds half as long as the very oblique wing, usually with 6 cotyledons.

San Francisco Mountains, Bischotf; Sierra Blanco, Gilbert ; Mount Graham, Rothrock (784). The most southern localities known of this northern and sub-alpine species, which extends through the Rocky Mountains to British Columbia and to Oregon, forming extensive forests. A beautiful tree, often 2 feet and even 3 feet in diameter ; timber •imilar to that of *P. nigra* of the Northeast and *P. excelsa* of Europe : above timber-line, it dwarfs down to mere shrubs often prostrate, but loaded with cones.

PBBUDOTSUOA^ DOUULASII, *Carri*re. Abies Dovghisii,* Lindl.— Often one of the tallest trees known (in [257] favorable localities, in Orvgnn, even 300-3.V) feet high), with very thick, much cracked, brown bark, spreading benches, conspicuous, somewhat persistent bud-scales, slender, flat, linear, obtuse or acutish leaves, j-1 J, rarely \\ inches long; COIICR ovate-oblong, usually 2-3 inches long, brown, well marked by the protruding, long-cuspidate bracts ; scales orbicular, concave ; oval winy* about as long as the somewhat triangular, pale seeds; cotyledons 6-8.

Common through Arizona, as it U through all the western mountain regions, down into Mexico. — Leaves stomatose and whitish only on the lower surface, with 2 resin-duct* close to the epidermis of the under side.

PINUS « FLBXILM, *Jamrs; Parlat. in DC. Prod.* 10,2,403. — A middle-si/^1 tree, with a smoothish, or, in old trees, lightly furrowed, pale or ash-gray bark ; leaves in fives, mostly entire and smooth-edged, 1J-2 inches long, in a loose,

Wer and laps over the inner surface. — Stately trees of rapid growth, but with brittle alulro f>i<n y decaying wood.

o»\ n not Am ; *Abit** Don ; *Abies,* sect. (Spru- «•* Gray's Man. ; *Pimu Bed. Picm₉* Endl., Parlat. - Con if- •routine, which With rillgle CVl*l*rwn more or lei* 4*Med* liave8f ... on at fat aepnrnu* from a prominent, persistent, ligneous ... flowe''»g from the axils of the leaves of the previous year ; staminate flo**ni *• in *Mis**, but stamen* tipped with a large, nftl>Iy ^ ' " k ; denticulate rivalst ; cells opening longitudinally ; pollen as in *Akin,* 0.01MU3— in longer diameter ; cones pendulous from the end* of short or elongated branchlets, mntiirinK in one Reason ; scales and smnll enclosed membranous bra'ta pcmiitrnt on the axis ; »wl without I-ani-**icl«*. imbwldeil in the excavation of the membranous base of the win* whirh]t*xr'* their under side ne...' free *n<i I*''1''1* tllrl» *Ui* drop out. — Tm'K of slow growth ... thtn *ihv* *** wiUl whit*» ^ but tou h cl<wc, and SeHhT* «Wm«i timber.

[3] PSEUDOTSUGA, *Oarr. Conif. ed.* 2, 256, *Abir** sect. *Tsuga* (in part), Endl. — Coniferous trees, with flattened, entire, somewhat 2-ranked, distinctly petiolod leaves, leaving on the branchlets scarcely prominent, transversely oval scars; flowering from the axils of the leaves of the previous year; staminate flowers resembling an oval or subcylindrical ament; anthers with a recurved, spurlike point; cells opening longitudinally ; pollen ovai-suhglobuse ; sessile rones suhpenduloiift, maturing in one season ; scales and their much elongated bracts persistent on their axis ; seeds without balsam-vesicles, not separating from the wing. — Very large trees, with very thick hark and reddish or yellowish wood, of secondary value, which is characterized and well distinguished from the wood of all the allied genera, and of most coniferous woods, by the abundance of spiml vessels, otherwise so rare in this family. The difference in the pollen, the ^ ceils, and the leaf structure make a wjw ration of this gun us from *Abies* as well as from *Tsugi* necessary.

[4] To the character of the genus *Pinus* may be added : Suininafc' flowers surrounded by an involucnim, of a some-

deciduous sheath, about \ inch in length ; involucre of the oval staminate flowers composed of 8-9 oval, obtuse scales ; anthers with a short lacerate or toothed crest; cones sub-terminal,* spreading, or slightly reflexed ovate-cylindrical, 3-4^ inches long, squarrose by the more or less protruding thin-edged scales, the free part of which is [258] rounded or more or less triangular, rarely reflexed; seeds 5 or 6 lines long, somewhat angled, with a narrow deciduous wing-rim ; cotyledons 6-7.

Var. a. SERRULATA. — Leaves slender, slightly and distantly serrulate, and as in the two following varieties, with few or scarcely any stomata on the back ; cones of the onlinary form.

Var. /3. MACROCARPA. — Leaves slender, entire; cones cylindric, 6-8 inches long, 2£ iuches in diameter, the apophysis of the scales short, rounded.

Var. y. REFLEXA. — Leaves as in last; cones ovate-cylindrical, about 4 inches long ; apophysis elongated, reflexed.

A middle-sized tree, rarely more than 50 feet high, on the higher mountains of Colorado, New Mexico, and Arizona, extending to Southern California. Var. a. was found by Dr. Rothrock on Mount Graham (783) ; var. *y.* by the same, on Santa Rita Mountain (east of Tucson), and in the Sunoitu Valley (654 and 1001). The cone of 1(K)1 resembles that of the Asiatic *P. Koraiensis,* or of a small *P. Ayacahuite* from Mexico. Var. 0. was collected on the San Francisco Mountains by Mr. Ferdinand Bischoff in 1871. — The species is intermediate between the true *Strobi* and *Cembra;* of the former it has the peripheral resin-ducts, usually 2, on the dorsil side; with the latter it has the large, almost wingless seeds in common ; from both it is distinguished by the back of the leaf being marked by a single, or a few series of stomata. It thus becomes the type of a third section of the *Strobtit-lika* Pines, which may be arranged as follows: —

1. *Ctmbm,* with large, almost wingless seeds ; dorsal face of leaves without stomata ; resin-ducts of the serrulate leaves imbedded in the f>arenchyma ; *P. Cembra* of Europe and Asia with appressed, and *P. Koraiensis* of Northern*torn Asia with squarrose cone-scales. 2. *FUxilts,* with similar seeds, but entire or nearly entire leaves, with a few series of stoinata on back, with }>eripheral ducts; *P.flexilis, P. albicaxdu,* and the Asiatic *P. pygnura.* This last is thus entirely distinct from *P. Cembra,* as a variety of which it has long Iwvn considered by Parlatore and other botanists, while *P. Mandschurica,* at least what I have seen under that name, is a true *Cembra,* not to 1H» thrown together [259] with *P. pygvuta,* as has Iven done, and distinguished from *Cembra* itself by the denticulate *Stntftus-Mke* leaf-tips. 3. *Eustrobi,* with distinctly winded seeds, leaves sharply serrulate on the edges, and generally denticulate all over the tip, mostly without stomata on the lock, and with peripheral ducts like the List. Of thin Milnoctiun we have P. *Strobus, monticola,* and *Lambcrtiana ;* Mexico has *P. Ayacahuite;* Jajuin, *P. parriflora ;* the Eaat Indies and Turkey, *P. exceUa* with *P. Peuce.*

PINUS M0NOPHYLLO8, *Ton.* fr *Frem. Rejwrt EqA. Erprd.* 1*42-1*44, p. 319, *t.* 4 ; *Parlat. /.* c. 378. — A small tree, of scraggy growth, with grny Wk and stout, mostly single,[9] terete leaven (rarely in pair*, and then semi-cylindrical and entire on the margins), 1J-2 inches long, J-1 line thick or wide, with a deciduous nheath; involucre of the staminate flowers of about 6 scale*; anthers with a nhort, entire, or denticulate knob ; cones subtenuinAl$_y$ ovate-sub-

what definite number of scales (3-15 or 20), the lowest, lateral, pair of which are strongly keeled ; pollen-grains lobed, similar to that of *Abies* ami *Pica,* t.ut only half an large, 0.04-0.06— wide. The bracts of the con-*, which, in the allied genera, remain metubranaceous, Uvmne here much thickened and corky, and, together with the scale below them, form a §ort of ceil for the reception of the w^l*. The bade of the wing only partially covert the upper Hide of the aeed$_f$ and usually forms a mere *rim* around the teed, which eanily separates from it; in a few s|*cieii, the wing is firmly attached to the need, and in a few others it in reduced to a narrow margin ; the ami never shows balsam-vesicle*.

* The fertile amenta of AHIM, and consequently the cones, are usually called *terminal,* but they never are that, but always *tatrm/,* and either appear betwet-n the nppennont leaves and the tennin.d l>iul, when they may be callr-d *uh-terminal (P.* ramam, *Strnbus, tylttdru),* or the axis continues to elongate after the formation of the amenta, when these and com«e«|iiently the cones become *Litenil,* the axis bearing leaves and winM-times other amenta above them (*P. Titdm,* and especially i**yis, an.l in Kurope, /». *H>ilf$_9$****i»).* In seme specie both forms occur, or only s frw leaf, bundle interval* between the amenta and the terminal bud. Whro$_9$ in the following season, the axis elongates, while the ament matures to a cone, this Utter naturally become* <juite lateral, but we continue to designate it as Mil>-teniiiiial, in relation to its own, co-etaneous, pnrt of the axis.

• The fresh leaves of pines, «hen single, are terete, and when dry, become grooved ami ridged ; the leaves which grow in (win are semiterete, flat on the upper or inner, and convex on the lower or outer nide, and only when (on the tree a» well as still more in the herbarium) they become dry, they assume that channelled form which we find so often described as characteristic of a specie* ; those leaves that grow in bundles of S or 5 an* convex on the dornal and ridged on the upper side ; those with 3 are flattUh, about half aa thick as wide ; those with 5 are triangular and nearly as thick as wide. It is therefore superfluous to minutely dcftcrihe the form of the leaves, as that is already given when the nnmlwr within the sheath is stated, nor is it pro|*r to describe the dried and shrivelled condition. The serraturea, their closeness, the stir of the minute teeth or their ilwnrr (only in a few Western American species the edges of the leaves are without terIh) are of much greater ini|«>rtance, and to some extent the Datuie of the tip is also of value.

globose, 2 or 2} inches long and nearly as thick, consisting of few large scales with thick pyramidal apophyses, but without prickles ; oval seeds about \ inch long, with a wing nearly 1 line wide ; cotyledons 7-10.

The oft-described Nut-pine of Fremont's first expeditions, 35 years ago, common from Arizona to Utah and California. This and the following species furnish an important article of food to the Indians and other natives. That single leaf, before its nature was properly understood, troubled botanists a good deal, so that Endlicher, supposing that the single leaf consisted of two agglutinated ones, went so far as to change the name into *P. Fremontii.* They are really single leaves, and the only instance of such leaves in the genus (I do not speak of the primary leaves of seedlings or young shoots, but only of the secondary leaves, which grow in bundles on what we must take for reduced branchlets).

PINUS EDULIS, *Engelm. in JFisl'vs. Mem. note* 2. — Similar to the last, but with more slender, entire leaves, [260] mostly in pairs, rarely in threes ; staminate flowers surrounded by a 4-leaved involucre ; anthers with a knob or short spur ; cones and seeds similar to those of the last species, only a little smaller; cones usually but 1) inches long; cotyledons as in previous species.

Camp Bowie, Arizona, Rothrock (493). Common from Southern Colorado through New Mexico to Arizona. The two species here described, together with the slender and 3-leaved *P. eembroidet,* with harder shells to the larger •eeds, and 8-12 cotyledons, and the little-known 4-6 leaved *P. Parryana* of the northern part of Lower California, constitute a small group of very peculiar Pines, which we may designate as the Cembroid Pines, characterized by the leaves of the *flexili** group (with entire margins, peripheral ducts, and deciduous sheaths), by the seeds of *Cembra,* and by the cones and scales of *Pinatter.* Perhaps it would be proper not to lay too much stress on the number of leaves and minor characters, nor on their geographical difference, and to unite them under the oldest and most appropriate name of P. *cmbroide**,* Zucc., though •ystematista, counting the leaves, have separated them widely in their books.

There is no pine entirely analogous to them in the Old World, unless we should refer here the little-known *P. Bungeana,* Zucc. ; Murr. Conif. J.in. 18, of Northern China. It has similar, small, subglobose cones, though with less prominent knobs, but armed with recurved prickles; the seeds are smaller, with a very distinct wing, the leaves in threes lose their sheaths as our Nut-pines do, but are serrulate, and have several peripheral ducts, but, singularly •nough, also usually a single interior or porenchymatous one, forming thus a link between several groups.

PIHCS AKIZONICA, n. i p . - A middlenrized tree, 40 feet high, 2-3 feet in diameter; branches squarrose, with Persistent bracts; leaves in fives, 5-7 inches long, 1 line wide, closely serrulate, in a sheath over 1 inch long (when old 1«» than half as long); oval cone 2j inches long, 1* inches thick ; scales with a prominent knob, which in the lower ones is recurved, armed with a recurved prickle.

On the Santa Rita Mountains, in Southern Arizona, Rothrock (662), in 1874. •< The l>est lumber of that region, the» called yellow pine." This seems to be a meagre account to found a new species upm in a genus so [261] difficult as *Pinu*,* but I find it impossible to unite it with any other of the allied species. It has the cone of *P. ponderosa,* especially of that form figured by Torr*y as *P. deJUxa,* and, like all forms of that spec.es ,t has the peculiarity that the fallen cone*, found ,,,, the ground, are always imperfect, their lowest part remaining attached to the branch for ·Mother season ; I do not know of any other pine with this singular character. But we could not well class tins 6-leaved Pine with the 3-leaved *pandtrou.* On the other hand, the form of the cone and its scales will not permit us to refer it to the Mexican *P. MonZu,*r,* though the structure of the leaf is very similar to that of this polymorphous species, whic* anpear. to include even V. *Uartvxgii.* The three parenchymatous ducts of the leaf and the strengthening cells within the sheath of the vessels, are exactly as we find them in *Montezuma,* and different from *pondtroia.*

PINCS POSDEROBA. Z W . *Parlat. I e.* 305. - A large troe, with large and spreading head, thick, deeply cracked, Wl-brown bark, and heavy, resinous yellowish wood ; thick branchlets, rough from leaf-scars and the persistent remi t s of bracts; leaves in two, or mostly in threes, 4-8 inches, in some rare forms 10-12 inches long, j line wide, With sheath, at first 1 inch long, when old withering to 2 or 3 lines long ; sUminate flowers cyl.ndnc, with an involucre °f 10 or 18 acale*. the lowest pair of which is about two-thirds as long as the innermost; anthers with a large suborbicular crest; fertile wne nU sub-terminal; patulous cones oval or rarely elongated, very variable in size, 2-6 inches 'on*; knob of the scale* more or less prominent, and in some forms even recurved, bearing a rather stout pnckle; "* b»«k, ridged on the low* side, wing broadest in the middle; cotyledons 6-8, or in the largest seeds as many as 10.

Colorado, New Mexico, and Arizona, extending through the Northern Rocky Mountain, and adjacent regions io OwRon and California, mostly in the middle altitudes; the most common and most useful timber of many

J This n·m, hM Wn ^ · ,one i tll)|in)ll ,,,,. wi«h very thick wall,, destitute of chlorophyll, which arc charac teristic of [illegible] aid in dis scall- arrtinguuhjng th«m from one another. Tiny are pn- •arii rf i?** doie ^ tk% 'H'nnim and i*|«rial •arii rf i?** doie ^ tk% 'H'nnim and i*|«rially in the M «• tpkbrmis coU Uu-nuclvm. We find them *1*o | orcAsionsllysum.un.Hng the darts, e* *in P.* ("'"f™-'1'0 in the Cembroul Pines and in *P. Balfourtana* and *P. arutata;* while in *P. ,ffcxUis* they always k»ave the ducts free, a char-a<tT by nhii-h we can readily distinguish the leaves of these HMv»H' otherwiw; so similar. Not rarely are they, found within the sheath, strengthening, as it seems, the centre of the lea/.

parts of that district and generally known there as " yellow pine." A most variable tree, several forms of which [262] have received distinct specific appellations, but the specimens collected in these expeditions all appear to belong to the ordinary smaller-leaved and smaller-fruited form. Whenever the macroscopic characters leave any doubt, the microscopic structure of the leaf appears to offer a sure guide. The leaves contain two or three or often more parenchym itous resin-«lucts, usually of uncommonly small diameter, always with some, and often surrounded by many, of those strengthening cells of which I have spoken before ; the same cells occur within the sheath, above and below the bundles of vessels. I have examined the leaves of 20-30 specimens from the whole range of the species, and have never failed to discover this same structure, which I must therefore consider as characteristic of the species.

PINDS CHIHUAHUANA, *Engelm. in Wislizen. Mem. note* 26; *Parlat. I. c.* 397. — A middle-sized tree, with teroato, closely serrulate leaves 2£-4 inches long ; the loose glistening sheaths £ inch long, deciduous after the first season; stainiinate flowers slender, cylindric, about \ inch long, sometimes interspersed among the foliage ; involucre as long as the nearly entire-margined bract, of 8-10 scales, the outer about half as long as the inner ones ; anthers with an almost orbicular crest; oval cones sub-terminal, small, 1} inches long; knobs of the scales bearing recurved, deciduous prickles.

Southern Arizona, in Sanoita Valley, at 6,500 feet altitude, Rothrock (649), in 1874 ; also Wright, and in Western Chihuahua, Wislizenus. — A tree 30-50 feet high, "with bark resembling yellow pine ;" easily distinguished by the characters given, and especially by its deciduous sheaths. All the Strobi and Cembroids have such deciduous sheaths, but among the Pinasters the sheatln are persistent, except in one or two Mexican species, in *P. Bungeana,* above mentioned, and in this species. Leaves strongly and closely serrulate, and with three or often four parenchyma to us ducts.

PINUS CONTORTA, *DougL, var.* LATIFOLIA, *Engdrru P. Murrayana,* Balf. Oreg. Com. Rep.—A middle-sized tree, sometimes 60-80 feet high, and 2-4 feet in diameter, with thin, scaly bark of grayish to red-brown color, and close, white, rather soft wood-; leaves in pairs, 1J-2 inches or rarely 3 inches long and 1 line wide ; Btaminate flowers oblong, 6 lines in length, their involucre commonly of 6 scales; crest of the anthers rounded ; pistillate [263] amenta subterminal, their scales with erect or spreading points ; cones oval, usually very oblique, and often curved, reflexed, 1J-2 inches long; scales especially the lower ones, with largely developed pyramidal knobs in the centre, much smaller on the inner side, armed with strong or sometimes slender, awnlike prickles ; seeds black, rough, ridged on the lower side; wing widest below the middle ; cotyledons usually 5.

Southern Colorado to California, apparently not noticed in Arizona. A valuable timber tree of the northern mountain regions, forming large forests in the higher altitudes of the Rooky and California mountains, reaching into the British Possessions. The original form, discovered by Douglas near the mouth of the Columbia River *(P. Bolanderi,* Parlat), is a seaside tree, extending up and down the coast, resisting the ocean storms as docs *P. Halrpensis* those of the Mediterranean, and protecting the inside vegetation ; it is distinguished by its low, scrubby, and often shrubby growth (whence probably the name), and its hk'iider leaves, not more than J-J lines wide ; northward, in British Columbia and Aliska, both forms completely run together. The pack's was formerly confounded with the eastern *P. inops,* which differs by its lateral, more or le** i>educu1ated cones ; it is more elowly allied with the Northern *P. Banksiana,* which, however, bears iU scarcely prickly or entirely unarmed, montly lateral, rarely sub-terminal, conw erect or patulou*, never recurved : a very unusual occurrence among pine*. The cones of the Rocky Mountaiu form, and also those of the seaside scrub, are usually persistent for many years, and often remain closed after maturity (serotinous), while in the variety of the Sierras, they appear to open on maturity, and to drop before the following season, as Prof. C. S. Sargent observed.

JUNIPERUS VIIOINIASA, *Linn. ; Engelm. American Junip. in Trans. Ac. St. Louis,* 3, 591. — Santa Fe\ N. Mez. Rothrock, in 1874 (43). Readily distinguished by ita slender branch let* and leaves with entire margins.

JCSIPKRUS OCCIDENTAL^ *Hook.,* var. MONOHPERMA, *Engelm. Junip.* 590. —A small tree or a bush, with fibrous bark, squamwe brunches; and obtuse, minutely denticulate leaves in twos and threes ; berries globose, blue-black, or sometimes copper-cdiored, 3-5 lines thick, resinous pulpy ; seeds 1 or 2.

Chiricahua Agency, Arizona, Rothrock. A form common from Southern Colorado to New Mexico and [264] westward ; distinguished from the original /. *occidental** of Oregon un<l California by its more squarrose growth, thinner branches, and smaller fruit.

JUXIPEBUS PACHYPHUEA, *Torr. Bot. UJiipp. in Pacific. R. R Hep.* 4, 142 ; *Engelm. L c.* 5*9. — A middle-niied tree, with spreading head und thick, fiisttivd lurk ; branch let* nlcnder ; luave* elongated, often rvniniferou* on the bock, with slightly denticulate margins ; turrit* large, glaucous, niany-scwlwl.

An important tree in Western N\w Mexico (Fort Wingate, Rothrock, number 140, in 1874) and Northern Arizona ; readily distinguished from all the other species by its bark, which Dr. Rothrock compart* with that of the white oak, and others with the bark of pine.

JUNIPERCB CAMFORNICA, *Uarr.,* var. (JTAHEVSIS, *Engtlm. Junip.* 588. —More slender than the western type, /. *Cqlifornica,* with thinner brunches and smaller, not so strongly fringed loaves, often in twos ; smaller, mow globose bemes ; embryo with 5 cotyledon*, as in the species.

Camp Apache, Arizona, Gilbert, Rotbrock.

VII. THE AMERICAN SPEUCES.

FROM THE GARDENERS' CHRONICLE, N. S., VOL. XI. MAR. 15, 1879.

PICEA, LINK NOT DOJ*. [334]

A. Leaves more or less square ; stomata on all sides.

A. Northeastern and Northern species.

1. PICEA ALBA, with slenderer leaves on the glabrous branchlets ; cylinder cones with smooth-edged flexible scales, deciduous after maturity.

2. PICEA XIGRA, with stouter leave* on tbe pubescent branchleU; ovate cones with rigid denticulate scales, more or less persistent.

Var. nuBHA, with larger, darker leaves; larger bright red brown cones, more read.ly dec.duous after maturity.

B. Rocky Mountain species.

3. PICEA ENaELliAN»I (/>»»«. *commulata,* Parlat.), with stouter leaves on the pubescent branchlets; sub-cylindric cone* with flexible, erose, or emarginate scales; deciduous.

4. PJCEA PCNOENB (*Abiu U**Mi* of the Rocky Mountain flora), with glabrous branchleU ; very rigid, strongly pointed and pungent leave*, in young tree, compel, in old ones often flattened , la^e cyhndncal. cones, with ™7 He. elongated, emarg/nate, very flexible, souarrose scale. ; weds larger, with a broad obovate wing, and M cotyledons.[1]

B. Leaves flattened; stomata only on the upper side. Pacific Coast species.

• 6. Pn.4ltacfflMi.04W. *Menziciiot* tbe Pacific coasts).-leaves thin 'blunt or short-pointed; cones much •koiter than in *last,* scale, similar; seed, small, with a very narrow wing, and only four cotyledons. Seems to mclude •avenl East Asiatic nominal species.*

VIII. ABIETINELE OF CALIFORNIA.

F^M BOTAHT or CAurowiA. 1880, Vou II. [AnvA*c« FAOM .SSO.D IH OCTOBER 1879.J

7. ABIES, LINK. FIB.*

Flowers from the axils of last year's leaves : ir cylindrical stamineal [117]
column, its short stipe surrounded by numerous b terminating in a knob ;
cells bursting transversely ; pollen-grains lar— (.0 Female aments erect, the bract
much larger than the scale. an«mturing7n the first year, end, their scale, and enclosed or exsert membranaceous
bracts falling at maturity from o T p n M axis. Seed. covcWl with K.in-ve,s,cles and parUolly but pennanen ly
enclosed in the pei T™ • f,the wing, which overs the outer and Ups over upon the ,nner surface. Coty-
1*0*. *rxnvn-£* ^ ^ *m* ™, of U-Ud fa-«d rapid growth but w.th bntde > * - * * « £
*oodj leave. i.ile, with a circular never prominent base, mostly more or less flattened and often emarpnate, on the
hofconul branohleu ^ n g g.k«l J. twist near the base, bearing stoma* on y .,r ,na,nly on th,.lower s^ace,
"Mi two longitudind rTnnlucU. mostly do. to the epidermis of the lower .,,!• or, » ^ . • P ^ J ^ ? " ^
•W~EngBlm.inT»n..St.LouUAc«d.ui.51». *Abie,,* Toumefort, u, part. P,»u,, L«nn., u. part.
•*w«iEndliclier;P»rktore. *Picea,* Don.

'A very Mne forB of ^ ta Uuly ^ cUivted in as under the name of *Abies Parryana. chensis* is the oldest specific name, and must be the more —rally adopted *Menziesii. A.* (in part), *A. mie^rma.* and perhaps others, seem to belong here ; and the lately discovered * *Omorika* apparently stands very near it.

* The synopsis of this genus, with wood-cuts, is reprinted in the *Gardeners' Chronicle,* n. s., Vol. xii., Nov. 29, 1879, pp. 684-685. — EDS.

The 16 or 18 species of this genus are confined to the mountainous regions of the northern hemisphere, one half to the Old, the other half to the New World. Of these two are found northward and eastward, one in Mexico, and the rest in the mountains of the Pacific slope.

* Leaves flat or flattish. [118]

-i- Upper side of the leaves-dark green, glossy, and without stomata.

*+ Leaves acute : linear tip of the bracts long-exserted.

1. A. BRACTEATA, *Nutt.* A tall slender strictly pyramidal tree, 100 to 150 feet high and 1 or 2 feet in diameter, with brown bark : leaves mostly somewhat 2-ranked, linear or linear-lanceolate, an inch or two long by 1 to 1J lines wide, with two pale (or in young leaves white) bands beneath : cones oval to subcylindric, 3 or 4 inches long and 1J to 2 inches thick; bracts cuneate-obcordate, scarcely exceeding the transversely oval glabrous scales, terminating in elongated linear foliaceous midribs or awns (1 to l£ inches long) : seeds as long as the obovate rounded wing. — Sylva, iiL 137, t. 118 ; Hook. Bot. Mag. t. 4740; Murr. in Edinb. New Phil. Journ. x. 1, t. 2 ; Engelm. 1. c. 601. *Pinus venusta,* Dougl. in Comp. Bot. Mag. ii. 152. *P. bracteata,* Don, Trans. Linn. Soc. xvii. 442.

Thus far only known from the Santa Lucia Mountains, at an elevation of 3,000 to 6,000 feet. The pointed buds are unusually large for the genus (about half an inch long), covered with imbricated scales.

+4 +4 Leaves obtuse or emurginate: bracts enclosed.

2. A. GRANDIS, *Lindl.* Very tall (200 to 300 feet high and 3 or 4 feet in diameter), with smooth brownish bark : leaves channelled above and glossy, with two pale or white bands beneath, an inch or two long and somewhat 2-ranked on the younger or lower branches, on the higher branch lets shorter, somewhat cuneate, and crowded on their upper side : cones cylindric, retuse, 2 to 4 inches long, with scales (13 or 14 lines wide) nearly twice broader than high, the quite short obcordate or 2-lobed bracts with or without a short point: wing of the seeds very oblique, about as broad as long. —Penny Cyc. i. 30 ; Engelm. 1. c. 598. *Pinus grandis,* Dougl. ; Parlat. *P. amabilis,* Dougl. ?; not of later authors. *Picea grandis,* Loud. Arbor, iv. 2341, fig. ; Newberry, Pacif. R. Rep. vi. 46, fig. 16 and t. 6.

Confined principally to the northern Pacific Coast, where it extends from British Columbia to Northern California, as far south as Mendocino. Probably the largest fir known ; in Oregon one of tbe important timber-trees, though the wood is inferior to that of the Douglas and Sitcha spruces. Readily distinguished from the mountain firs by the glossy green upper surface of the leaves, and by the other characters enumerated above.

+- +- Leaves pale and with stomata on both sides.

3. A. CONCOLOR, *Lindl.* A large tree, 80 to 150 feet high with a diameter of 2 to 4 feet, with rough grayish bark: leaves mostly obtuse, pale green, those of younger trees and lower branches elongated, 2 to 2} and even 3 inches long, 2-ranked, often slightly channelled and notched, those of old trees and of upper cone-bearing branches shorter (an inch long), broader, thicker, convex above and often falcate, covering the upper side of the branchleta : cones oblong-cylindrical, 3, 4, or even 5 inches long and If to 1} inches in diameter, pale green or sometimes dull purplish ; scales (12 to 15 lines wide) nearly twice wider than high ; bracts short, enclosed, truncate or emarginate, with or without a short mucro : wing of the seeds oblique, as long as broad : cotyledons 5 to 7. —Journ. Hort Soc v. 210 ; Engelm. I. c. 600, and Wheeler's Rep. vi. 255. *Picea concolor,* Gordon, Pin. 155. *Pinus concolor,* Engelm.; Parlat. in DC. Prodr. xvi[f], 426. *Abies Lounana,* Murr. *A. grandis* of the Californian botanists. *A. amabilis* (?), Watson, Bot. King Exp. 333.

A common fir throughout the Californian sierras, from 3,000 or 4,000 to 8,000 feet elevation, extending into Southern Oregon and through the mountains of Arizona to Utah and S. Colorado. Always readily recognized by the gray bark of the trunk (whence often called in California "White Fir"), and by the pale color of the foliage, which at last becomes dull green. A very ornamental tree, especially the paler variety, but ttie timber is not much esteemed. *P. Lowiana,* known also in nurseries as *P. Parsoniana, lasiocarpa,* and *amabilis,* distinguished by its longer flatter straighter leaves with fewer stomata on the upper side, is a young and vigorous state of this species, which has not yet fruited in cultivation.

• * Leaves more or less quadrangular, short and curved upward. [119]

4- Bracts exsert.

4. A. NOBILIS, *Lindl.* — A magnificent tree, 200 feet high, with thick cinnamon-brown bark (red inside) : leaves rigid, curved upward, covering the upper side of the branchlets, glaucous and stomatose and keeled both on the upper and under side, acute or obtuse, about an inch long, only on the youngest trees or lowest branches longer (14 inches), flatter, slightly grooved and somewhat 2-ranked ; cones cylindrical-oblong, thick, 6 to 9 inches long by 2} or 3 inches broad, obtuse, almost covered by the exsert reflexed cuneate cuspidate bracts; scales comparatively narrow (Ij inches wide, by an inch long or more): seeds slender, with a cuneate-triangiilar somewhat retuse wing: embryo with 7 or 8 cotyledons. — Penny Cyc i. 30; Nutt 1. c, 1117; Engelm. L c 601. *Pinus nobilis,* Dougl.; Parlat. *Picm nobilis,* Loud. 1. c 2342, fig.; Newbeny, L c. 49, fig. 17.

The " Red Fir" of Northern California, forming large forests about the base of Mount Shasta, at 6,000 to 8,000 fc feet altitude, and extending through the Cascade Mountains to the Columbia River. The timber is said to be better than that of other firs. Forms are found with almost enclosed bracts, often accompanying the others, which may connect with the following species.

-1- -H- Bracts enclosed.

5. A. MAGNIPICA, *Murray.* — Similar to the last, even more than 200 feet high and 8 to 10 feet in diameter, with the same kind of thick red-brown bark, and with similar very rigid foliage, but the leaves never grooved nor notched even on the young trees, on older branches shorter and thicker, so that they are mostly only a fourth wider than thick or even perfectly square, and often only 6 to 9 lines long: cones 6 to 8 inches long, 2£ to 3£ inches thick, purplish brown; bracts lanceolate, acuminate, shorter than the very wide scales, which are l£ to If inches broad by scarcely an inch high : seeds slender, the wing broader, very obliquely obovate-cuneate : cotyledons. 8 to lO. — Proc. Hort. Soc. iii. 318 ; Engelm. 1. c. 601. *Abies amdbilis* of Califomian botanists.

The " Red Fir>f of the higher Sierras is not rare at an altitude of 7,000 to 10,000 feet, but forms no forests by itself. Easily distinguished from the last by the enclosed bracts. Forms, however, are said to occur (Mount Silliman, *Brewer)* with exsert bracts, and it remains to be peen whether the slight differences in the leaves, scales, and seeds will suffice to keep the species separate.

8. PSEUDOTSUGA, CARRI£RE. DOUGLAS SPRUCE.

Flowers from the axils of lost year's leaves. Male flowers an oblong or subcylindrical stamineal column, snrrounded and partly enclosed by numerous conspicuous orbicular bud-scales; commissure of the anthers terminating in a short spur, the cells opening obliquely by one continuous slit; pollen-grains ovate-subglobose. Female flowers with the scales much shorter than the broadly linear acutely 2-lobed and long-pointed or aristate bracts. Cones maturing in the first year, with persistent scales and exsert bracts. Seeds without resin-vesicles, the wing at last breaking off. Cotyledons 6 to 12. — A very large tree, at first pyramidal and spruce-like, often at last more spreading, with yellow or reddish rather coarse but very valuable wood, which is distinguished from that of all the allied conifers by the abundance of spirally marked wood-cells. Leaves flat, distinctly petioled, somewhat 2-ranked by a twist at the base, stomatose only on the lower surface, with two lateral resin-ducts close to the epidermis of the under side, leaving on the branchlets scarcely prominent transversely oval scars. — Conif. 2 ed. 256. *Pinus,* sect. *Tsuga,* Endl., in part; Parlat. *Abies,* Lindl., in part.

A single species, which extends through the Rocky Mountains and mountains of California, from Oregon for into Mexico, and in in Oregon the largest and most important timber-tree.

1. P. DOUGLASII, *Carr. I. c.* A gigantic tree (200 to over 300 feet high and 8 to 15 feet in diameter), with [120] very thick brown deeply fissured bark : leaves linear, distinctly petioled, mostly obtuse or obtuaish, 8 to 12 lines ^ng, or on robust shoots even 16 lines long, by j line wide : male flowers oblong-cylindrical, 5 to 10 lines long, half enclosed in large loose orbicular involucral scales: cones 2 to 3 or rarely 4 inches long, subcylindrical; bracts more or less exsert and spreading or reflexed : seeds triangular, on the upper side convex and reddish brown, on the lower flat and white,3 lines long; win^s 3 to4J lines long, broadest at base, acutish : cotyledons 6 to 8.—Engelm. in Wheeler's ^ep. vi. 257. *Pinus DowjlZii,* Sabine; Hook. Fl. Bor.-Am. ii. 162, t. 183; Parlat. in DC. Prodr. xvi*. 430. *Abies Douglasli,* Lindl.; Nutt. Sylva, iii. 129, t. 115; Newberry, Pacif. R Rep. vi. 54, t. 8. *Tsuga Douglasii,* Carr.

Var. MACROCARPA. A smaller tree, 40 to 50 or rarely 80 feet high, \\ to 2 or 3 feet thick, with long spreading branches, and narrower, often acutish leaves : male flowers nearly an inch long : cones 5 to 7 inches long, 2 inches thick ; scales large in proportion ; bracts not as long as in the typical form : seeds and wing both 5 lines long : cotyledons 9 to 12. — *Abies Douglasii,* var. *macrocarpa,* Torr. in Ives's Rep. 28. *A. macrocarpa,* Vasey in Gard. Monthly, Jan. 1876.

Throughout the Coast Ranges and in the Sierra Nevada up to 6,000 or 8,000 feet, and also northward near the coast, attaining its largest proportions in Oregon, and extending in a smaller form to the Rocky Mountains. A beautiful tree, readily distinguished by iU fringed cones, or else by the flat always petioled leaves. The variety occurs in the ^ o n s of the foothills of the San Bernardino Mountains, and in the San Felipe Cañon, at an elevation of 3,000 to 5,000 feet, with oaks and below moat of the coniferous trees. It looks very distinct, but with the exception of the proportions of the cones and seeds no reliable specific characters can be discovered. Transition forms between the two have not yet been found.

9. TSUGA, CARRiiRE. HEMLOCK SPRUCE.*

Male flowers a subxlobose duster of stamens, from the axils of last year's leaves, the long stipe surrounded by numerous budi-tcales ; commissure of the anthers terminating in a short spur or knob ; cells opening transversely by a

• For reprint see *Qanlcnerd Chronicle,* D. s.f Vol. XII. Dec. 13, 1879, p. 756. - EDS.

continuous slit. Female amenta terminal on last year's branchlets; bracts somewhat shorter than the scale. Cones maturing in the first year, pendulous ; scales and short enclosed bracts persistent on the axis. Seeds with resin-vesicles on the surface; wing at last breaking off. Cotyledons 3 to 5 or 6. — Large trees, with slender often drooping terminal branch lets; leaves flat or angled, appearing 2-ranked, with a single dorsal resin-duct, conspicuously petioled, articulated on a prominent and at length ligneous and persistent base. — Conif. 185. *Finns,* Linn., in part *Finns,* sect. *Tsuga,* Endl.; Parlat. *Abies,* Mich*., in part.

Of the 5 species of this genus, two belong to eastern Asia, one to eastern and two to western North America. Four of these species are so closely allied that they can be distinguished only with difficulty. The single species of our second section has somewhat aberrant characters.

* Leaves flat, obtuse, stomatose only beneath : pollen-grains discoidal : cones small, an inch long or less. — ECTSUOA.

1. T. MERTENSIANA, *Carr.* A very large tree (1(X) to 200 feet high), with rather thick red-brown bark ; ultimate branchlets very slender, roughish, and when young long-hairy : leaves linear, 4 to 9 lines long, and about j line wide, abruptly petioled, entire or usually minutely apinulose-serrate toward the rounded tip, shining above, when young with two white bands beneath : male flowers 2 or *2*\ lines in diameter, shorter than the stipe : cones oblong-cylindrical, pointed, slightly pubescent; bracts truncate ; scales longer thuu wide : seeds 1 to \\ Hues long, the wing twice as long or more, scarcely widened toward the base : cotyledons 3, sometimes 4. — Conif. 2 ed. 250. *Finus Mertensiana,* Bong. Veg. Sitch. 45 ; Parlat. *Abies Mertensiana,* Lindl. & Gord. *A. Albertiana,* Murr. *A. Bridgei,* Kell. Proc. Calif. Acad. ii. 8. [121]

Peculiar to the Pacific Coast region, from Marin County *(G. R. Vasey)* and especially Mendocino *(Bolander, Kellogg)* to Alaska. Closely allied to the northeastern *T. Canadensis,* but a larger tree, with finer and straighter grained wood and redder bark, principally distinguished by the more elongated scales of the cone and the proportionately much longer and straighter wings of the seeds ; in the eastern species the scales are almost as wide as they are long and the seeds larger, but the wings, very broad at base and almost triangular, are only J or } longer than the seed. Another character taken from the leaf-structure, the presence of hypoderm cells on the edges, midrib, and keel of the leaf, is not reliable, as these cells are occasionally found in leave* of *T. Canadensis,* though usually absent.

• • Leaves mostly convex or keeled above, acutish, atomatose both sides: pollen-grains bilobed : cones larger. — IIESPEROPEUCE.

2. T. PATTONIANA. A tall strictly pyramidal tree (100 to 150 feet high and 2 to rarely 4 feet through, in high altitudes only a shrub), of graceful habit, with slender pubescent branchlets and light green foliage : bark thick, much cracked and apt to scale off, reddish gray: leaves 6 to 12 lines long, angular, acutish, attenuate at base, often curved : male flowers about 2 lines wide, on a very Blender Bti|>e : cones cylindrical-oblong, 2 or 3 inches long : seeds 2} lines in length, the wing not twice as long (ubout 4 lines), obliquely obovate, widest above. — *Abies Fattonii* or *Pattoniana,* Jeffrey. *A. Hookeriana,* Murray. *A. WUliamsonii,* New berry, Pacif. R. Rep. vi. 53, t 7. *Finus Pattoniana,* Parlat.

In the highest timber regions of the Sierra Nevada, at 8,000 to 10,000 feet altitude, from Ebbett's Pass at the head of the San Joaquin River northward, and through the Cascade Mountains, near Crescent City descending to near the coast *{Brewer).* At the timber-line its proportions are much stinted. Though differing in the shape of the leaves, the disposition of the stomata, and especially in the form of the pollen-grains, which resemble those of the true pines, yet I cannot separate this species from *Tsuga,* with which the single resin-duct of the leaves, the form of the male flowers, and the glands of the seed unite it

10. PICEA, LINK. SPRUCE.

Male flowers axillary or sometimes terminal on last year's branchlets, with an oblong or cylindrical stamineal column, its short stipe surrounded by numerous bud-scales; the coinraisnure of the anthers expanding into a broad nearly circular erect crest; cells opening longitudinally : pollen-grains as in *Abies* (.045 to .065 line long). Female aments at the end of short or longer branchlets, the scales much larger than the bracts Cones maturing in the first year, pendulous : scales and enclosed bracts persistent on the axis. Seeds without resin-vesicle*, imliedded in the mem bra imc eons base of the wing, which leaves their under side nearly free and permits them to drop out. Cotyledons 4 to 8. — Suitely trees of pyrainid.il form and slower growth, with white soft clone tough highly valued timber ; leaves keeled above and beneath, more or less quadrangular or (in our P|>ecie-*) flattened, articulated on a prominent at lost ligneous and persistent rhombic base, spirally arranged all around the branchlets or (by a twist of the *Uve)* somewhat 2-ranked, the utnmata usually more on the upper than on the lower surface, or, on the flat leaves, often only on the upper tide (which U then apt to be turned downward); resin-ducts irregular, 1 or 2 lateral ones close to the epidermis of the lower sifle or none. — *Abies,* Tourn., in part; DC, in part; *Pinus,* Linn., in part. *Finus,* sect *Ficea,* Endl.; Parlai. *Abus,* Don.

An important genus of about a dozen npeciea, peculiar to mountainous and northern regions, of which 2 belong to Europe, 5 to Asia, and 5 to America ; of the hitter 2 are northeastern, and 3 are western species.

1. P. SITCHENSIS, *Carl.* A tall strictly pyramidal tree (150 to 200 feet high and 6 to 9 feet in diameter), [123] with thin scaly red-brown bark ; branchlete thick and rigid, rough with the very prominent persistent leaf-bases, glabrous : leaves 5 to 8 lines long and a line wide or less, flattened, short-pointed (rarely obtuse or very acute), sternatose (and the young leaves white) only on the upper surface or very slightly so on the lower: cones cylindrical-oval, *H* to 2} or rarely 3 inches long, an inch thick or less, pale yellowish, the conspicuous lanceolate rigid bracts i or £ the length of the oblong rounded denticulate scales : seeds slender 1| to 1} lines long, the wing 2J to 3 times longer (4 to " 4J lines long by 1J wide), narrowly oblong, only slightly oblique: cotyledons 4 to 6. — Conif. 260. *Pinus Sitchensis,* Bong. Veg. Sitch. 46. *Abies,* Lindl. & Oord. *Pinus Menziesii,* DougL; Lamb. Pin. 2 ed. t. 89. *Abies Memiesii,* LindL in Penny Cyc i. 32; Loud. Arbor, iv. 2321, fig.; Nutt. Sylva, t. 116; Newberry, Pacif. R. Rep. vL 56, t. 9.

Peculiar to the northern Pacific coast, mostly in wet sandy soil and near the mouths of streams, from Mendocino and Crescent City northward to Alaska; how far inland or how high above the ocean it may be found is at present unknown. This is probably the tallest spruce known, an excellent timber-tree, probably the best in Oregon, but too rare in California to be of much importance there. The older specific name, *Sitchensis,* must be substituted for the more generally used *Mensiesii,* which represents absolutely the same species. The Rocky Mountain Spruce, which has heretofore been known under the same name of *Menzicsii,* is *P. pungens,* Engelm., with more pungent and less flattened leaves, longer cylindrical cones, undulate retuse scales, and minute bracts, and with larger broadly winged seeds. — In Strawberry Valley and other valleys and slopes about Mount Shasta, at an elevation of 3.500 to 4,000 feet, a peculiar spruce occurs of which at present we know nothing but that its lower branches are very long, slender, and pendulous, and the leaves much narrower than those of *P. SxtchentU,* 7 to 9 lines long and two thirds of a line wide, quite obtuse, strongly keeled and stomatose on the upper side and without stomata beneath ; cones unknown. The name of *Picea pendula* suggests itself for this form, if indeed it should not prove to be a mountain variety of *P. Sitchensis.*

11. PINUS, TOURN. ; LINK. PINE.

Staminate flower an oblong or cylindrical often much elongated stamineal column, surrounded by a somewhat definite number (3 to 18) of calyx-like bud-scales, the outer ones lateral and strongly keeled, from the axils of scales and crowded into a capitate or spicate inflorescence around the base of the same spring shoots : anther-cells opening longitudinally, the connective terminating in a mere knob or short dentate or usually larger semicircular erect crest: pollen-grains bilobed with 2 air-sacs, smaller than in *Abies* and *Picea* (.02 to .03 line long). Female amenta also in the axil, of bud-scales, higher up on the growing axis, either next to the terminal bud (.ubtermiual) or on the side with leaves and sometimes other amenta above them (lateral), solitary or several together; scales much larger than the bracts. Cone, maturing in the second year, spreading or reflexed (very rarely erect), and subterm.nal (so called even in case of the elongation of the axis in the second year) or lateral; bracts thickened and corky aud assisting in the formation of cells for the seeds under them; scales more or less thickened and corky, upon the free exposed surface *(apophysis)* bearing a terminal or dorsal unarmed or prickly protuberance *(umbo).* Seeds without resin-vesicles, usually surrounded by the rim-like base of the (sometimes very short) wing, which often spreads partly over the outer side of the seed. Cotyledon, normally 6 to 15. - Trees of very various size and aspect, usually not as large as in the preceding genera, nor often of the same pyramidal growth ; wood soft or hard, often very resinous, of surpassing importance for man's uses : Primary leaves (oily on seedling, ami young shoo.,) flat, subulate and serrulate, the secondary in bundles of 1 to 5, from the axils of bud-scales and surrounded at base by a more or less persistent sheath of membranous [123] scales, needle-shaped, terete or semiterete or triangular according as the fascicles are of 1,2^ or more, mostly delicately serrulate, with stomata on all sides or rarely only on the upper inner sides ; resin-ducts peripheral (close to the epidermis) or parenchymatous (within the cellular tissue) or internal (close K, the cellular sheath surrounding the pith and vascular bundles), varying in number in the same species; strengthening cells (thick-walled longitudinal *hypo-*"• cells) distributed under the epidermis, especially at the angles and keel, and often around the ducts, very rarely becoming detached from the wing at maturity, or rarely remaining adherent and at last breaking off. -

The genus, of 60 or 70 recent species of which belong to the Old World and nearly Ui Ja* many to the New. About 15 species are Mexican and West Indian, 11 belong to the Atlantic 8Utes, and 15 to the Rocky Mountains and the Pacific slope.

I I- Apophysw generally thinner, with a terminal unarmed umbo: anthers terminating in a knob or a few teeth or in short incomplete L s t : leaves in fives, with peripheral ducto (in our species), their sheaths loose and deciduous.: cones subterminal. — STROBI-S.

• Wing, longer than the seeds: leaves serrulate and (at least when young) denticulate at the blunt tip : female amenta long-pedicelled, erect: cones maturing in the second year>

, I- P. HoancotA, *Daual* A tree 60 to 80 feet high and sometime. 3 feet in diameter, with smoothish pale bark •Putting into square plat,-, leaves mostly 2 (.*ca*ionully 4) inches long, with 2 to 6 line, of stomata on the side*, rarely

any on the back ; teeth very small and distant: male flowers oval, surrounded by 8 involucral scales ; anthers knobbed or short-created : cones cylindrical, slender, 5 to 8 inches long, yellowish brown : seeds pale, 3 to 3i inches long ; wings twice as long, widest in the middle, pointed : cotyledons 6 to 9. — Lamb. Pin. 2 ed. iii. t. 67; Loud. Arbor, iv. 2291, fig. ; Pailat. in DC. Prodr. xvi[a]. 405.

On the higher Sierra Nevada, from 7,000 or 8,000 to 10,000 feet altitude, from the Calaveras and Mount Raymond northward ; common in the Shasta region and on the Trinity Mountains, and extending to Oregon and Washington Territory. It is the western representative of the northeastern White Pine, from which it may be readily distinguished by the Larger cones and stiffer and much less serrulate leaves, in which strengthening cells underlie almost the whole epidermis (but do not surround the ducts), while they are absent in the softer leaves of *P. Strobut.* The wood is said to be white and soft, as in the White Pine.

2. P. LAMBERTIANA, *Dough* A tree of gigantic dimensions, 150 to 300 feet high and 10 to 20 feet in diameter, with light-brown smoothish bark splitting in small sections : leaves 3£ to 4 inches long, rigid, with 5 or 6 lines of stomata on each of the 3 sides: male flowers oval, half an inch long, with 10 to 15 involucral scales; anthers denticulate-crested : cones cylindrical, bright brown, 12 to 18 inches long and 3 or 4 inches wide, on peduncles 3 inches in length: seeds smooth, black, 6 lines long; wing not quite twice as long, widest below the middle,obtuse : cotyledons 13 to 15. —Linn. Trans, xv. 500 ; Lamb. 1. c, t. 68, 69 ; Loud. Arbor, iv. 2288, fig.; Nutt Sylva, iii. 122, t. 114 ; Newberry, Pacif. R. Rep. vi. 42, fig. 14 ; Pailat. 1. c. 406.

Throughout the State and northward to the Columbia River, on both slopes of the Sierra Nevada, in a forest belt with *P. ponderosa* and *Abies concolor* at an elevation of 3,000 to 5,000 or sometimes 7,000 or 8,000 feet; in the Coast Ranges only on the highest points, from the Santa Lucia Mountains to Humboldt County. Leaves stouter than in its allies, with a layer of strengthening cells under the whole epidermis and around the ducts. The wood is like that of the White Pine and similarly used. The exudation from the partially burned tree loses its resinous qualities and acquires a sweetness similar to that of sugar or manna, for which it is sometimes used, whence the name of " Sugar Pine."

• • Wings of the large seeds narrow : leaves entire or nearly so : cones subsessile, spreading, or declined. [124]

3. P. FLEXILIS, *James.* A tree about 60 feet high and 3 to 5 feet thick, with furrowed gray bark : leaves \\ to 2 inches long, rarely more, with few rows of stomata on the sides and usually very few on the back : male flowers in a short spike, oval, 6 or 7 lines long, with 8 or 9 involucral scales ; anthers tipped by a spur or sometimes nn incomplete crest: cones oval to subcylindric, 3 to 5 inches long, light brown, with somewhat wiuarroae scales : seeds oval, compressed, 4 to 6 lines long, the inconspicuous wing less than a line wide, usually remaining attached to the scale : cotyledons 6 to 9. —Long's Exp. ii. 27 and 35; Nutt. 1. c, t. 112 (very poor) ; Engelm. Trans. Acad. St. Louie, ii. 208, and Wheeler's Rep. vi. 257 ; Parlat. 1. c. 403.

Var. ALBICAULIS. A tree of 40 or 50 feet in height, on the highest elevations low and shrubby, with very pale bark : cones oval, or snbglobose, 1} to 3 inches long and 1 \ to *2*\ thick, purple-brown; scales much thicker and somewhat pointed. — *P. albicaulis,* Eiigelm. 1. c. 209. *P. cembroides,* Newberry, 1. c 44, fig. 15. *P. Shasta, Can.* Conif. 2 ed. 390.

The species has been found in California only on Mount Sillinmn *(Brcicer)* with the variety, and on the Inyo Mountains *{Hoffman),* and thence eastward on the mountains of Nevada and Arizona to the Rocky Mountains, where it is common from New Mexico to Montana. The variety occurs on all the alpine peaks of the Sierra Nevada from Mono Pass to Mount Shasta and Scott Mountains, and northward to British Columbia, and also in Montana. More closely resembling P. *Ccmbra* of the Old World than our White Pines, but distinguished by the leaf-structure, which in *P. Cembra* shows parenchymatous ducts in the aemilate leaves. The peripheral ducts in our species are destitute of strengthening cells. *P. albicaulis* in probably only an alpine form, occupying a higher belt on the mountains, and marked by its short thick and thick-scaled cones. The large seeds are used for food by the Indians.

§ 2. Apophysis with a mucronate or (very rarely) blunt protuberance on the back : anthers terminating in a seini-orbicular or almost orbicular crest, except in the first three species. — PINASTER.

• Rwin-ducts peripheral : leaves with entire mm-ina and loose deciduous sheaths.

••- Leaves 1 to 5 : cones ovate-sul^lobose, with few very protuberant scales: seeds large, almost winglesi.

4. P. MONOPHYLLA, *Torr. dt Frtm.* A small tree, 20 or 25 feet high, with irregularly spreading branches and pale fissured or flaky bark : leaves rigid, npiny-tipped, solitary and terete or rarely in pairs and semiterete, 1| to 2J (mostly 1J) inches long, the sheaths 4 or 5 lines long : male flowers oval, with 6 involurral bracts ; anthers terminating in a knob or a few teeth: cones 1} to *2*\ inches long and nearly as thick : seeds oval, 6 to 10 lines Ion*:, tliick-thelled, yellowish brown and mottled : cotyledon* 7 to 10. — Fremont's Rep. 319, t 4 5 Parlat 1. c. 378; Engrlm. Wheeler's Rep. vi. 859. *P. Frcnumtiana,* Endl. Conif. 183, in part.

In the Coast Ranges only about Fort Tejon, and from the eastern slope of the Sierra Nevada through Nevada and Arizona to S. Utah, frequent in the mountains and often in the most arid localities; well known as the "Nut Pine," and the seeds invaluable to the Indians as an article of food. It was long considered probable that the terete le if was in reality a connate pair, but the structure shows a single bundle of vessels and therefore a single leaf. The ducts, always peripheral, vary greatly in number, from 2 or 3 to 12 or 14.

5. P. PARRYANA, *Engelm.* A small tree, 20 or 30 feet high and 10 to 18 inches in diameter, with a round top : leaves 3 to 5 (mostly 4) in the sheath, l£ to 1J inches long : male flowers oval, with 4 involucral bracts in the axil of broadly oval acute bracts : cones subglobose, l£ to 2 inches thick, with strongly elevated knobs : seeds oval, 5 to 8 lines long, with a thin light-brown mottled shell : cotyledons 8. — Amer. Journ. Sci. 2 ser. xxxiv. 332, note; Parlat. 1. c. 402. *P. Llaveana,* Torr. Bot. Mex. Bound. 208, t. 53.

Thus far found but once, by Dr. C. C. Parry, 40 miles southeast of San Diego, just across the boundary [125] line, at an altitude of 2,000 or 3,000 feet. One of the four nut pines, and distinguished from the last principally by the number of leaves in a sheath.

•• i- Leaves in fives : cones ovate to subcylindrical, with numerous scales : seeds small, winged.

6. P. BALFOURIANA, *Jeffrey.* A medium-sized tree, seldom over 50 feet high and sometimes 5 feet in diameter, of regular pyramidal growth: bark red-brown, deeply fissured : leaves 1 to lj inches long, rigid, curved, crowded, and appressed to the stem and persistent for 10 or 15 years: male flowers oval, a half-inch long, with 4 involucral bracts ; anthers with a short irregularly denticulate crest: cones pendulous from the slender branchlets, subcylindrical, 3J to 4 or rarely 5 inches lon-, dark purple ; apophyses thick, with short deciduous prickles : seeds pale, mottled, 3J to 4 lines long ; wing 6 to 10 lines long, widest about the middle : cotyledons 5. — Gordon, Pin. 217.

Var. ARISTATA. Tree 50 to sometimes 100 feet high : anthers with scarcely a knob : cones ovate, with thinner acales, and with shorter recurved or slender awn-like prickles : seeds smaller, 3£ lines long, the wings 3* to 5 lines long : cotyledons 6 or 7. — *P. aristata,* Engelm. 1. c. 331, and Trans. Acad. St. Louis, n. 205, t. 5, 6 ; Parlat. 1. c. 400.

Alpine, on mountains near Mount Shasta *(Jeffrey)* ; on the flanks of Scott Mountains, forming a dark green belt from 6,000 to 8,000 feet altitude between the lighter colored *P. monticola* below and *RJlexilis* ; var. *albicaulis,* above it *(Lemmon)* ; on the headwater* of King and Kern Rivers *(Brewer, Stegman),* and on Mount Whitney ; *liothrock.* The variety, with recurved prickles, on the Inyo Mountains *(Stegman)* and thence sparsely Rcattered on the higher mountains through Nevada, Northern Arizona, and Southern Utah ; the form with awned scales in Colorado· Mr. Lemmon descries the bark as radish brown ; the Colorado form has reddish gray bark. The reddish wood ia of extremely slow growth, hanl and tough. Hypoderra cells surround the leaf and also the ducts, distinguishing the leaves from those of *P-ftexilu.*

• • Resin-ducts parencbymatous : leaves serrulate, with stomata upon all sides ; sheaths persistent.

+- Cones subterminal.

++ Leaves in fives.

7. P. TORREYANA, *Parry.* A Rmall tree, 20 or 30 feet high and 12 to 15 inches in diameter: leaves crowded at the emU of the thick branchh-U in the axils of lanceolate strongly fringed bracts, very stout, 8 to 11 inches long; young "heaths 15 to 18 lines long, old ones 6 lines long, cones ovate, 4 to 4j inches long by 3* thick, patulous or deflexed on Munci&aninch Ion- ; uml>o short and stout or sometimes elongated and inflexed: seeds oval, 8 to 10 lines long, twice as L«,g *, the W ? R- which encloses the seed with a thick rim: cotyledons 13 or 14. - Bot. Mex. Bound. 210, t **> W. *P. lophoipcrma,* Lindl. in Card. Chron. 1860, 46 ; Parlat. 1. c. 391.

On the coast of Southern California, from San Diego to San Pedro, buffeted by the sea winds and generally crooked and much defaced. The leaves are perhaps the stoutest of any known pine ; seeds large and edible.

M f+ Leaves in threes.

8. P. FONDEROBA, *Dougl.* One of the l a * * pines known (200 to 300 feet high and 12 to 15 feet in diameter), • ' * very thick red-brown bark, deeply furrowed and split in large plates : leaves on stout branchlets in the axils of strong fringe.! somewhat pmim-nt bract,, 5 to 9 or even 11 inches long; the thin sheaths at first 9 or 10 (later 3) lines long : nude flowers cvlind, L-, flrxnous, 1 * to 2 inches long, erowded into a short head ; involucre of 10 or 12 bracts ; anthers with a l a w semicircular scarcely dentate crest: cones oval, 3 or 4 (rnnly 5) inches long, 1* to 2 inches thick, <*• rich brown color, sessile or snWnsile, spread!..* or -lightly recurved, often 3 to 5 together ; umbo high, with a *« •taught or incurved pri.kle : seels .lark brown, 4 lines long ; wing 10 to 12 lines long^w.dest above the [126] middle : "tyledon. 6 to 9. - Loud. Arbor, iv. 2243; Newberry, 1. c 36,14 ; Parlat 1. c•395 ; Engelm. Wheeler's Rep. ** «8L *P. Benthamiana,* Hartw. Journ. Hort Soc. iL 189. *P. Beard** and *Cravgana,* Murr. Edinb. New Phil. Jonrn. i. 886.

V». Jamcn. A tms 100 to 200 feet high, with a more rounded top, more finely cleft.and darker bark, and P^«leam 4 to 9 inches long; male flowers 1* inches long : cones larger, 5 to 12 inches long, lighter brown, on short

peduncles, fewer in a cluster, with thinner apophyses, and slender prickles hooked backward : seeds 4 to 7 lines long ; wings 12 or 13 lines long: cotyledons 7 to 11. — *P. Jeffreyi,* Murr. 1. c. xi. 224, t. 8, 9 ; Parlat. 1. c. 393.

Var. SCOPULORCM. A smaller tree (80 to 100 feet high) ; leaves 3 to 6 inches long, often in pairs : male flowers an inch L ng: cones smaller, 2 or 3 (rarely 4) inches long, grayish brown, with stout prickles : seeds 2J to 3£ lines long, the wings 9 to 12 lines : cotyledons 6 to 9. — *P. ponderosa* of the Rocky Mountain floras.

The widest spread western pine ; the original form in California and Oregon, at low and high altitudes and even in the plains, often associated with *P. Lambertiana* and *Abies concolor:* the var. *Jeffreyi* usually on mountains above 5,000 feet altitude, especially on the eastern slope of the Sierra Nevada, where it is apt to grow in the most arid localities, ranging into Oregon. The third form is found throughout the Rocky Mountains. A magnificent tree, known throughout the west as the "Yellow Pine," and vying with the Sugar Pine and Sequoias, with very thick bark (in large trees 3 or four inches thick) and unusually thick sap-wood, which shows 100 to 200 annual rings before it becomes heart-wood. The latter is yellow, heavy, and very resinous. The var. *Jeffreyi* has often been considered distinct, but connecting forms are not rare; one of these is *P. deflexa,* Ton*. Bot. Mex. Bound. 209, t. 66. The rows of stomata are often, but by no means always, more distant in var. *Jeffreyi* than in the typical form. The leaves persist about three years and are therefore always found brush-like at the end of the branchlete, except in young shoots. The pareuchymatous ducts (2 or 3 or more) of all the forms are generally very small, and are always surrounded with some (often many) strengthening cells, which are also found within the sheath. *P. Jeffreyi* is one of several species (P. *Balfouriana, P. Murrayana, Abies Pattoniana,* etc.) which were collected by Mr. Jeffreys, and described by Prof. Balfour anonymously (with figures by Greville) in what is sometimes cited as the " Report of the Oregon Committee." The authority for the specific names is given variously by different authors ; fortunately most of them may be referred to other species.

•4 ** *+ Leaves in pairs.

9. P. CONTORTA, *Dougl.* A low tree, 5 to 15 or rarely 20 to 25 feet high and 6 inches in diameter, with a rounded or depressed top and thin smoothish bark : leaves 1 to 1$ inches long by half a line wide, strongly and closely serrulate ; bracts scarcely fringed : male flowers cylindrical, £ inch long, in a spike 1 or 2 inches in length ; the outer pair of the 6 involucral bracts nearly as long as the inner ones ; anthers with semicircular crests: cones clustered, oval or subcylindric, very oblique, with strong knobs and delicate bristles, or rarely almost without knobs, very often serotinous (remaining closed for several or many years) : seeds black, grooved, 2 lines long ; wings 6 lines long, widest above the base, tapering upward : cotyledons 5, rarely 4. — Loud. Arbor, ii. 2292, and Encyc 975, fig. 915. P. *inops,* Bong. Veg. Sitch. 45 ; Hook. FL Bur.-Am. ii. 161. *P. Bolanderi,* Parlat. 1. c. 379.

Var. MURRAYANA. Much taller and straighter, 80 to 120 feet high and 4 to 6 feet in diameter, with a conical .head and thin scaly light grayish-brown bark : leaves 1 to 3 (mostly about 2) inches long, j to 1 line wide, light green, delicately serrulate ; sheaths 4 to 6 lines long, or old ones 1 to 1$: male flowers with 6 to 8 involucral bracts: cones very rarely lateral, less oblique, often opening at maturity and deciduous : wings of seeds longer. — *P. contorta,* Newberry, 1. c. 34, t. 5, and of the Californian botanists ; Parlat. 1. c. 381, in jwirt. *P. inops,* Bentb. PI. Hartw. 337. *P. Murrayana,* Murr. 1. c. 226. *P. cvntorta,* var. *latifolia,* Engelm. in Bot. King Exp. 331; Porters, Fl. Colorado, 129; and Wheeler's Rep. vi. 262.

The original Douglasian *P. contorta,* which came from the mouth of the Columbia River, is a small narrow-leaved tree of the wet sandy coast of the Pacific from Mendocino to Alaska, a distance of perhaps 1,500 miles. Its narrow leaves, persistent and long-closed very oblique cones, which cover the tree so that sometimes scarcely any foliage remains visible, well characterize it. The variety is a common tree on the higher Sierra Nevada to an altitude [127] of 8,000 or 9,000 feet, extending into Oregon and in the Rocky Mountains southward to Colorado and Utah. In the Sierra Nevada the cones are more deciduous, but in Colorado they are as persistent as on the coast Jeffrey's specimens on which *P. Murrayana* was based came from the high Sierras and are undoubtedly P. *contorta,* while *P. muricata,* with which they have been confounded, never occurs far from the sea and is otherwise very distiuct.

P. MUHICATA may be looked for here, as a form of it i* found that seems to have sometimes terminal cones.

+- -i- Cones lateral.

+4 Leaves in three*.

10. P. SAniNiANA, *Dougl.* An open-branched round -topped tree, with rough ash-gray bark, slender glaucous branchlt'tA and Hpine foliage : leaves drooping, slender, light-green or glaucous, 8 to 12 inches long and half a line wide, their nheatlin an inch long, or later but half that length ; bracts deciduous : male flowers oblong, about 10 lines long, in an elongated spike; involiicral bracts 10 to 15, the exterior pair minute; crest of anthers semi-orbicular: female ament on a peduncle 1} inches long : cone short-oval, acutish, massive, 6 to 10 inches long by 4 to 6 in diamet«r, deep mahogany-brown, persistent, with stout projecting apophysea and robust somewhat inclined points : seeda •obcylindric, 9 to 12 lines long, dark ; wing scarcely half as l»ng. with broad rim : cotyledons 15 or 16. —Lamb. Pin. 1 •! 146 ; Nutt. Sylra, iii. t. 113; Newberry, 1. c 30, fig. 13; Torr. Bot. Mex. Bound, t. 57.

Abundant, but scattered or in small groves, over the dry and hot hills of the Coast Ranges, in the Sacramento Valley, and *on* the foothills of the Sierra Nevada through the whole length of the State, not over 4,000 feet above the sea, and occasionally on their eastern slope (Owen's Valley, *Rothrock).* One of the "Nut Pines," and most important to the Indians, in appearance very different from all other pines.

11. P. COULTEBI, *Don.* A tree 1 or 2 feet in diameter, with very thick rough and almost black bark : leaves crowded at the ends of the thick branchlets, stiff, erect, 6 or 8 to 10 or 11 inches long and f line wide; young sheaths 1* inches long, a half-inch when old ; bracts much fringed : male aments cylindric, 18 to 20 lines long, surrounded by 8 or 10 bracts, the outer half as long as the inner; anthers crested : cones shortly peduncled, long-oval, pointed, 10 to 14 inches long and 4 or 6 thick, yellowish-brown, persistent many years; scales with a broad elongated apophysis and a very stout long incurved point (sometimes 2 inches long) : seeds oval, slightly ridged, black, 6 to 8 lines long ; wing 10 to 15 lines long: cotyledons 11 to 14. — Linn. Trans, xvii. 440; Parlat. 1. c. 392. P. *macrocarpa,* Lindl. Bot. Beg. xxvi. misc. 61.

In the Coast Ranges, at moderate elevations, from Monte Diablo to the southern border of the State. Wood brittle. Similar to the last species, but readily recognized by the thicker and stiffer branchlets and leaves. The cones are sometimes shorter and thicker than usual, with very short spurs, and may then be mistaken for those of P. *Sabiniana,* but the seeds and wings (or their impressions on the scales) will always distinguish them.

12. P. IN8MNI8, *Dougl.* A tree 80 to 100 feet high and 2 or 3 feet in diameter, with thick much-figured bark : leaves 4 to 5 or rarely 6 inches long, slender (only half a line wide), very closely serrate, bright green, their bracts not fringed: male flowers oblong, half an inch long, in a spike 1 to 1| inches in length, and surrounded by 10 involncral bracts ; anthers small, crested : cones shortly pedanded, in clusters, deflexed, very obliquely short-oval, pointed, 3 to H inches long and 2 or 3 thick, deep chestnut-brown, very persistent and often remaining closed for many years; scales on the outer side and especially toward the base enlarged, very thick and hemispherical, rarely flat on the inner •Me flat and much smaller ; all at last nearly unarmed: seeds grooved and tuberculated, black, 3 or 4 lines long; wing 8 to 10 lines long, widest above the middle : cotyledons 5 to 7- Loud. Arbor, .v. 2243, fig. 2132-7; Torr. Bot. Mex. Bound, t. 65 (poor). P. *QUifomian*,* Lou, in Nouv. Duham. v. 243? *P. adunc*,* Bosc; Poir in Lam. Diet. Suppl. iv. 418 ? *P. radûtia* and *P. tubercular,* Don, Liun. Trans, xvii. 441 (also earlier names, but only [128] based one on larger and the other on slenderer cones).

A tree rZliar to the sea-coast from Pe*aden>. south of San Francisco, to Monterey and San Simeon Bay, and known as the « Monterey Pine." Much interest attaches to the species, not only on aceount of iterapid growth and beautifully fresh green foliage, which make it ornamental in cultivation, but also because it is probab y the old P. *Cati/orniana,* which ha. never been identified but was said to have come from Monterey and to resemble .n its cones the Mediterranean *P. Pina.Ur* and in its large wed. P. *Cmbra,* such as we do not find near that town. P • W• » m , Hook, & Am., Bot. Beech. 392, t. 93, is a factitious species founded upon a cone of P. *MonUzum** (from Tep.c) and «» foliage of P. *inngnii,* while P. *radial** of the same authors, 1. c. 392 and 443, ,s made up of the foliage of the former specie. a n d T e of the latter, as is proven by the specimen, .in Herb. Kew. A vanety, *tonal*,* ha. been col-le*wl by Dr. Palmer on Ouadalupe, with the normal cones of P. *inngnu* but the leaves in pairs.

13. P. TODERCULATA, *Gordon.* A small tree, 3 to 20 or exceptionally 30 to 40 feet high' * to 1 foot in diameter' with a loowly branched conical top and thin light-brown roughish bark: leave. 3 or usually 4 to 7 inches long, * to j «»• wid* slightly and distantly Jrrnlate ; sheaths at first 6 lines long; bracts slightly fnnged: male flower, in an elongated spfke, cyKndriXJ to 9 line, long, with 6 involucral bracts, the outer not much shorter than the inner ««».; anther, c U * l : con^s in verticil- of 2 to 4, several of which often form on the same year's shoot, pa e leather-brown, at laat silver-gray, persisting for many year, often without opening, peduncled, strongly reflexed, 3 to 5 inches H? by 1| to 2 inchrSkk, ^cylindrical, pointed, very oblique at base; outer sea .e. much enlarged conical ly' «gular, the inner flat, all with sharp prickles: seeds black, graved,3 line, long; wing .7 or 8 lines long, wide* « or above the middle :cotyledo^C to 8. - Pin. 211; Parlat. L c. 394. P. *Californxc*,* Hartw. Journ. Hort. Soe. u. 189.

On the Coast Range, from San Bernardino and the Santa Lucia Mountains to the. Shasta region' and here and *er. on the foothill, oftbe Sierra Nevada (Forest Hill, between the forks of the American River, at 2,500 feet alti-«* ***a«Ur).* This Califomian Scrub Pine is a .null and unsightly tree or bush, winch on the east side of Mouirt « « * . ia found full of cone, when only 2 or 3 feet high *(Drew).* The name P. *tubercuhta,* originally given to a form ^ ^ s p e c i e * , * . , transferred totni after Jeffrey'. discoveries in 1852, and having been so used invariably since *f»M till be retained, inasmuch a. Hartweg-s name of *California,* though much older' was apphed only through a »««ken identification of the specie* with LOUMWS plant above mentioned, and must therefore be dropped.

H « Leaves in pain.

".P.Mu M cm,ftm,<.e. A middle^ed tree, 25 to 60 or rarely 80 to*IX*> feet high' mostlyRender (l o r j * » »17 8 fet thick), with ndduh-brown roughish bark and a patulou. top: leave, rigid, 4 to 6 inche. long, } to 1

line broad, strongly serrulate; bracts lightly fringed, subpersistent; sheaths 9 lines long, at length reduced to 1 line: male flowers oval, 6 to 8 lines long, in spikes an inch long; involucre half as long as the flowers, of 6 or 8 bracts, the outer as long as the inner : cones sessile, spreading or more or less recurved, in clusters of 4 to 7, often remaining closed and long-persistent, ovate and very oblique, chestnut-brown, 2 to 3£ (usually 3) inches long and 1 £ to 2 inches thick ; prickles short and stout or (in the southern form) making long straigbtish or incurved spurs on the outside : seeds 3 lines long, grooved and rough, black ; wing 6 to 8 lines long, widest above the middle : cotyledons 4 or 5. — Tort. L c. t., 54. ***P. Edgariana,*** **Hartw. L c. iii. 217.**

Only near the coast, where it is exposed to the sea winds and fogs, to an altitude of 2,000 feet, from Mendocino, where it grows tallest (in peat-bogs), to Tomales Point (in the most sterile soil), Monterey and San Luis Obispo. In many respects similar to the last, but readily distinguished by the leaves being in pairs and by the short thick cones. The specimens collected at Tomales Point ***(Brewer, Bolander)*** **have subterminal cones, but seem to differ in no other respect. The cones are said to persist over 30 years.**

IX. EEVISIOX OF THE GENUS PINUS,• AND DESCRIPTION OF PINUS ELLIOTTII.

FROM THE TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, Vol. IV. 1880.

No difficulty exists in the circumscription of the genus *Pimis;* floral unite with vegeta- [161] tive characters to establish it so firmly and so plainly, that nobody fails to recognize the species belonging to it But when we come to analyze and to group the 60 or 70 species of pines which are known to us, we find that they appear so similar, that all attempts to arrange them satisfactorily have foiled. The most obvious distinctive character was found in the number of leaves in each bundle, and thus the sections of 2-leaved, 3-leaved and 5-leaved pines were the only ones known to the older botanists. Spach (Syst. veg. 1834) separated *Cembra* on account of its " wingless " seeds; Link (Linnaea, 1841) relied on the number of leaves only, adding two sections, oner.with 2 or 3, the other with 3 or 4 leaves in a sheath; Endlicher (Synopsis, 1847) was the first to point out the form of the cone-scales as an important character, and his first two sections, *Cembra* and *Strobus,* were by the form of this scale distinguished from the other Pines; he retained the character of the " large wingless " seeds, to separate by it *Cembra* from *Strcbu*,* and *Pinea* from the other two-leaved pines which constituted his section *Pinaatcr.* Liter writers did not add anything to our knowledge of the systematic relations of pines: Carrttre (Coniferes, 1855) copied Endlicher, and Gordon (Pinetum, 1858) went back to the mere number of leaves to characterize the sections. Ten years later Parlatore (DeCand. Prod. xvL 2,1868) followed Endlicher in adopting the differences in the form of cone-scales as the most valuable character, and advanced a step further by discarding the proportionate size of the seeds as of sectional value. He divided his submenus *Pinus* in two sections, *Pinea* with pyraraidate and *Cembra* with dimidiate apophyses. The subsections of his *Pinea* were again based on the number of leaves, in twos, in threes, or in fives in each bundle; those with single leaves, with 2 or 3, and those with 3, 4 or 5 leaves had to find their place as best they could.

Not satisfied with such superficial knowledge of this interesting and important genus of [162] trees, I have for a number of years devoted my leisure hours to the careful study of the different species accessible to ma In the following pages I give the principal results of my investigations.

SIZE. Almost all the pine species grow up to be trees; the only shrubby one known to me is *Pinus montana,* heretofore known as *P. Pumilio;* a few make small, insignificant trees, such as *P. tuberculata*; the nut pines, or cembroid pines, Dever grow large, but several others attain the greatest dimensions ; *P. Lambertiana* grows to the height of 300 feet, with 20 feet iii diameter, **and**

• The account of thii gtnu« in Gray's Msnus!, 5 ed. 1868, pp. 469-470, if based on notes contributed by Dr. Engeltnann. The article "Pinna" (in the Linncan sense) in Johnson's new Illustrated UniTenal Cyclopedia, New York, 1877, VoL III. pp. 1166, 1257, Is also from his pen. - E M.

P. ponderosa (at least in California) comes very near it; these two are probably the largest pines known.

The AGE of pines varies between 15 to 25 years (P. *tvherculaia* and perhaps *P. montana),* 300 years *(P. mitis, P. ponderosa, P. Balfouriana),* and 500 to 600 years (observed in *P. monticola* and P. *Lambertiana).*

The BARK in some species is thin, only a few lines thick, flaky and detached in scales *(P. contorta, P. resinosa)*•, in others (e. g. *P. ponderosa)* it is several inches thick, persistent, rough, and deeply cracked. It is gray in some species, e. g. in the nut-pines, but most commonly of a brown red or cinnamon color, or sometimes deeper brown; in *P. Australis* and *P. Elliottii,* especially in the latter, it is laminated, the external layers peeling off in thin plates.

The WOOD grows rapidly, especially during the first (often the first 50) years of their age, so that annual rings are sometimes 2 or 3 lines thick; in *P. glabra* I have seen them even 6, in *P. insignia* 5 and in *P. rigida* var. *serotina* 4 lines thick; in old age or in the short seasons of high altitudes the wood grows so slowly that sometimes ten annual rings make not more than the thickness of one line.

The sapwood is always white, and it takes many years before it turns into perfect or heart-wood: in *P. ponderosa, Lambertiana,* and *mitis* sometimes 100 or even 150 years; in others, e. g. *P.flexUis* and *Sabiniana* not more than 20 or 30 years; but the majority of pines which I have examined may require 50 or 60 years to mature their heartwood. In many other trees this process takes about 20 or 30 years, in most oaks on an average about 20 years, in *Catalpa* not more than [163] 2 or 3 years. The thickness of the sapwood in pines.is usually 2-4 inches, and rarely under 1 inch; in *P. ponderosa* I have found it sometimes even 10 inches.

The wood cells and especially those more compact ones of the late summer growth, the outer Part of the layers, are often strongly impregnated with resin and thereby darker colored, yellowish or "brown, and become in thin sections semi-transparent; this is much more the case in those of the Motion *Pinaster* than of *Strobus.* The former have mostly heavier and harder wood than the latter; though we find exceptions, such as *P. contorta,* which has soft wood similar to that of the white pine or spruce. Spirally marked cells, such as abound in *Pseudotsuga* and in *Taxus,* have not been found in the pines.

The LEAVES, in the wider sense, are of seven different forms: the cotyledonous or seed-leaves, the primary leaves, the ordinary bracts, the secondary leaves, the bracts constituting the sheath of these, the bracts forming the involucrum of the male flowers, and the bracts supporting the carpellary cone.

The COTYLEDONOUS LEAVES form a whorl of 4 to 18 in number, are triangular, flat on the back, keeled above, higher than broad and mostly entire; in *P. Strobus* I find the keel slightly spinulose-dentate. Stomata are found only on the inner and upper sides, as is the case in the cotyledonous leaves of most conifers; those of *Sdadopitys* are, as far as I know, the only ones that have stomata Merely on the under and none on the upper side.

The PBIMARY LEAVES succeed the cotyledons on the main axis; in some species (P. *inops,* •P. *rigida, P. Canaritnsu;* etc.) they are also found on the sprouts. They are always subulate from • broader base, flat, keeled on both surfaces, always serrulate, even in those species whose secondary leaves are entire (P, *tdulis),* with stomata in rows on both surfaces, more on the lower than on the ttPperface.

• The primary leaves not rarely produce in their axils buds with secondary leaves, but they are tt<*t generally reduced to BKACTO *(Hochblaetter)* before their axils become productive. These t ae late triangular-lanceolate, meinbranaceous or coriaceous, entire or mostly fringed on the [164] edges, more or less persistent or mostly deciduous, sometimes articulated above their base.

The SECONDARY LEAVES constitute the foliage of the tree: they are borne on an undeveloped

branchlet in the axils of primary leaves or mostly of bracts, and are surrounded at base by a sheath of bud-scales *(Mederblaetter).* These consist of 2 short, rigid, strongly keeled, lateral bracts and a number (6-10 or more) of longer, thinner inner ones, which generally are woven together by the delicate fringes of their edges, and are then persistent with the leaves, though in time worn off at the ends; or they are loose, at last spreading and deciduous at the end of the first seasoa This is the case in all the species of the section *Strobus,* in the nut-pines, and in a few others : P. *Balfouriana, Gerardiana, Bangeana, Chihiuthuana,* **and usually also in P.** ***leiophylla.***

The secondary leaves generally occur in definite numbers, 1 to 5, in a bunch, or their number is slightly variable: some species have regularly 2 and 3 leaves (P. *mitis,* P. *Elliottii),* others vary with 3 to 5 leaves *(P. Montezumce)*; species with regularly 3 leaves have occasionally 2 or 4, such with 5 leaves are sometimes found with 6 and even 7 leaves. Where we have one (only in P. *monophylla),* the leaf is terete; where there are two, the leaves are semi-terete, convex on the lower surface and flat on the upper one when fresh, or channelled when dry. Those leaves that grow in bundles of 3 or more are triangular, the upper surface being more or less elevated and keeled; teraate leaves are generally somewhat flatter, and quinate ones higher and regularly triangular. Thus the shape of the leaf and especially its transverse section is mostly sufficient to determine the number in which they occur.

The leaves are in most species minutely but sharply serrulate on the edges, and mostly also on the keel of the upper surface. These serratures are closer together, or more distant, coarser or more delicate, but are absent only in a very few West-American species: the *cembroid* or nut-pines, P. *Balfouriana,* and most forms of *P.flexUis.* The tips of the leaves are generally entire, acute, or acuminate, rarely obtusish ; but in all the species of the section *Strobus* they are in the young and fresh leaves finely denticulate.

The stomata are usually distributed in longitudinal rows over both surfaces in the *Pinaster* .[165] section; only P. *Balfouriana* has none on the back, and thus approaches *Strobus* in this as it does in many other respects. In *Strobus* we find on the back no or but few stomata, or sometimes a single or an interrupted line of them. P. *Lambcrtiana* only has numerous stomata on the back, thus approaching *Pinaster.*

I will have to dwell somewhat extensively on the internal structure of the leaves, as it proves to be of the greatest importance for the classification of the species. We distinguish in a transverse section the thick epidermis, the chlorophyll-bearing parenchyma cells, and in the centre the fibro-vascular bundla This latter is single in the terete and mostly in the quinate leaves ; it is double in the broader triangular or ternate, and in the semi-terete or binate leaves. This difference, however, is of very little diagnostic importance, as we find occasionally single or double bundles in the same species. The fibro-vascular bundles always show wood cells on the upper or veutral, and bast cells on the lower or dorsal side, traversed by delicate medullary rays, usually obliquely diverging from the lower to the upper side. The bundles are imbedded in a mass of small (medullary ?) cells, free of chlorophyll, and are together with those surrounded and separated from the parenchyma by a sheath of larger cells, also destitute of chlorophyll.

Within the parenchyma of the leaf a smaller or lai$er number of longitudinal tubes or ducts are found, the RESIN-DUCTS, normally probably two, but very often more, even as many as a dozen or more. These ducts occupy a certain definite position within the leaf. They lie (1) close to the epidermis, *peripheral ducts,* in some species more on the ventral, in others more on the dorsal side of the leaf; or (2) they occupy a place within the parenchyma and surrounded by it on all sides, *parenchymatous ducts;* or (3) they lie close to the sheath which surrounds the vascular bundles, ***internal*** *duds.* This position of the ducts is so constant, and seems to be so intimately connected with the essential character of the plant, that I venture to adopt it as one of the principal characters for the subdivision of the genus. I must add, however, that in some few species smaller, accessory **ducts do**

sometimes occupy an abnormal positioa Thus I find occasionally in some *StroU,* especially in *P. excelsa,* where there are mostly two peripheral dorsal ducts, a third upper parenchymatous one; in *P. Bungeana,* which generally has numerous peripheral ducts all around, occasionally a single lateral parenchymatous duct is observed; *P. Canarknsis* has regularly parenchymatous ducts, but sometimes they are connected with the epidermis by a very thick bundle of strengthening cells (of which presently); *P. Laricio* has normally parenchymatous ducts, but in a specimen of var. *Pyrenaica* from the Pyrenees in Herb. Cosson I find them sometimes almost touching the epidermis cells, and therefore easily mistaken for peripheral. In *P. rigida* and *Tceda,* and also in *P. pungem indJUifolia,* which all have normally parenchyraatous ducts, I occasionally have observed a number of smaller accessory ducts close to the sheath of the vessels. In pines with very slender leaves it is sometimes difficult to discover the ducts, and in some forms they are, I believe, really absent, especially in cultivated specimens. Such may give us some trouble in their classification. [166]

A peculiar element in the structure of the pine leaves is certain cells which had been formerly named " hypoderm cells;" but as they also occur in other parts of the leaf apart from the epidermis, they more appropriately receive the name of STRENGTHENING CELLS. They are thick-walled, elongated, colorless cells, much larger than the bast and wood cells, generally of the diameter of the epidermis cells, rarely a little larger, often smaller, and always smaller than the cells of the p u n - chy ma. They give to the leaf its rigidity, and are most abundant in the most rigid pine leaves; in the softer more flaccid ones they are almost entirely wanting. Thus they are scarce or entirely absent in some species of the *Sirobus* section; in *P. Pseudostrobus* and *P. Jilifolia* they are very imperfectly developed. The strengthening cells are principally found under and close to the epidermis (whence the name hypoderm cells) either in a continuous layer or mostly in bundles, interrupted by the lines of stomata; they are generally most abundant within the angles of the leaves. Sometimes they surround the ducts, and in all the species allied to *P. resinosa* and *P. sijlvestris* they are found ouly there, and not or scarcely at any other places. In some species these cells also occur within the sheath, above and below the fibro-vascular bundles. Their presence and position are not absolutely constant, but may be relied on to some extent for diagnostic purposes. Thus the quinate smooth-edged leaves *ofPJUxilis* and P. *Balfouriana,* which would be difficult to distinguish without their cones, may be readily recognized by the strengthening cells, which in the latter surround the more closely approximating ducts, while in the former the ducts, widely apart from one another, are destitute of these cells. [167]

The PERSISTENCE of the leaves is very different in different species; in *P. Strcbus* and others they fall in the autumn of the second year; more commonly they last to the end of the third year; in softie species, e. g. *P. Banksiana,* they do not fall before they are 4, 5, or even 6 years old; iu -P. iW/twrtana/or at least in van *aristata,* I have seen them persist 12 to 14 years. When the leaves persist only a short time and are long, and the annual growth of the axis is short, they form brushes or tassels *(P. australis)* at the end of the branchlets, but where they are short and persist long *(P. Balfouriana)* they give the branchlets that " fox-tail or bottle-brush " appearance of which travellers speak. Iu youn* and vigorous trees the leaves are apt to persist longer than in old ones,

In exceptional cases nnd as a monstrosity the leaf-bundles become proliferous, the branchlet *liich bears the secondary leaves elongating and forming a regular branch.

The pines are monoecious trees which bear their male and female flowers generally on different branchlets, the male commonly on the lower, the female frequently on the upper part of the tree ; sometimes both are found on the same axis, the male below, the female above.

The MALE FLOWERS are borne on the lowest part of the year's shoot, in the axil of bracts, either crowded together in a kind of a head or elongated in a spike; the axis usually continues to elongate during or after flowering and makes a leafy brauch, which in its continuation in succeeding years

often again bears flowers. Male flowers sometimes abnormally make their appearance higher up on the axis mixed with leaf-bundles and occupying the place of such. The male flowers consist of an indefinite number of anthers sessile on a more or less elongated column, a'nd have the form of an oval or a cylindrical ament, for which they used to be taken. They are surrounded by a somewhat definite number of bracts, which assume the functions of a calyx and have been sometimes designated as such. Linnaeus, in his Syst Nat. ed. 1, speaks of a *calyx 1-phyllus.* [168] Their number varies in the different species from 3 to 15 or 16, but is fairly constant in the same species. The two exterior lateral bracts are strongly keeled, like those of the sheath of the leaves, and stouter and mostly shorter than the others; the third is placed on the upper side, towards the axis of the inflorescence; the fourth on the lower or dorsal side, opposite the supporting bract, and so forth. The innermost ones not rarely exhibit a transition to the anthers, bearing small or incomplete anther cells on the lower part of their back. In *P. resinosa* and *Canariensis* I find the involucral bracts articulated in the middle.

A table exhibiting the numerical proportion of involucral bracts in the different species, the male flowers of which I could examine, may not be without value.

3 or 4 involucral bracts I find in P. *sybesiris* and *Pinazterj*
3 to 6 in *P. densiflora ;*
4 in *P. Balfouriana*$_y$ *Canariensis,* and *Greggii* ;
4 to 5 in P. *ednlis* and *Parry ana;*
4 to 6 in P. *Pinea* and *P. HalepemU ;*
4 to 10 in P. *Pyrenaica ;*
5 to 6 in P. *monophylla ;*
6 in P. *leiophyUa, Larieio,* and *contoria ;*
6 to 7 in P. *rerinota, montana,* and *Massoniana ;*
6 to 8 in P. *Strobus, excelsa, Pence, Cembra, rigida, tuberenlata, nuricata, pungen»*$_{\%}$ *Ban'knana* ;
8 to 10 in P. *mo*ticola,JUxili*)* *insularity Chikuahuam, Tkutbergii, Larieio* var. *Pyrenaica,* and *Awtriaea, Gmlieri, inop*;*
8 to 12 in P. *T*da ;*
9 to 12 in P. *Montezumm* and *mitti;*
10 in P. *i*sig*i* ;*
10 to 12 in P. *ponderoia ;*
10 to 15 in P. *SabUiana ;*
12 in P. *Merkutii* and *Elliottii ;*
12 to 14 in P. *Khatia, glabra,* and *euttralU /*
14 to 16 in P. *Lambertiana* and *Cubemit.*

The ANTHERS consist of two parallel extrorse cells, which open longitudinally on their back; their connective, heretofore often called a bract, spreails out into a transverse semi-orbicular or almost orbicular, entire or denticulate (in most species of *Pinaster)* or lacerate *(P. Lambertiana)* crest, or it terminates in a knob or a few teeth (in most *Strubi* and a few *Pinasters* such as *P. Balfouriana* and *sylvestris).* [169]

The POLLEN has the well known bilobed form, consisting of an elliptic central portion, which emits the pollen tubes, and two lateral sacs which are said to contain air. The longer diameter measures 0.025 to 0.045 line, mostly between 0.030 and 0.040 line, while the pollen-grains of *Abies* and *Picea* are much larger and in many instances twice as large, viz. 0.045 to 0.070 line long. Thus by the pollen alone *Pinus* caii generally be distinguished from those allied genera. The different species of pines are pretty constant in the size of their pollen.

Without going into minute detail, I will only state that I find pollen-grains of

0.025-0.030 line in P. *edutU* and P. *Bamkiiam,;*
0.OOV-0.035 " in P. *BalfouriaMa, *yhe*trU, m'oMfaM. r,»i*oM, Ckihuakmana, Lnricio, tMopt, codo/ia ;*
0.^ 0 4 0 " in P. S *frobus, excelsa, Pinea. rigid*. T*d*.miii*;*
0.045 " m P. *Lamberiiam^/rxJis, Momie:*m«, Pilaster, poM'Ornaa, SabiMMMa, FMiottii.*

The property of the pine-pollen to float for a long time in the air, and to be carried by storms to very distant localities, is well known. I have found in streets of St Louis after a rainstorm from the south, in March when no pines north of Louisiana were in bloom, pine-pollen which must have come from the forests of *P. australis* on Red river, a distance of about 6£ degrees of latitude or 400 miles in a direct line.

The FEMALE FLOWER consists, as in all *Abietinece,* of a carpellary scale in the axil of a smaller, concealed bract, bearing two pendulous ovules on the lower part of the upper side. A number of such scales in the axils of their supporting bracts, and spirally arranged, form the female ament. The question of the nature of the scales, and of the ovules they bear, is not to be discussed here, but it may be stated that the best lights force the view on us that the carpellary scale consists morphologically of two leaf-oYgans, lateral to an undeveloped axis and united at their posterior edges (those turned towards the axis of the ament), and thus bearing their naked ovules on their morphologically outer but now reversed and *apparently* upper side.

The carpellary scales, which in the flower as well as in the fruit we call, in short, *scales,* [170] are either rounded, obtuse, and appressed (in *Strobus,* etc.), or they have a short *(P. resinosa, sylvestris,* etc.) or a longer (P. *ponderosa, Tceda)* or an elongated subulate, often squarrose, point *(P. contorta, inops, pungens).*

The aments are globose, oval or elongated, subsessile or peduncled, single or several together, always erect, each borne in the axil of a bract, its base invested by sterile bracts which gradually or suddenly give place to the carpel-bearing bracts, just as the involucral scales of the male flowers give place to stamens. They make their appearance on the upper part of the year's shoot, often just below the terminal bud, when we call them *mbtcrminal;* or they become *lateral,* when the axis elongates beyond them, and sometimes more aments form above them in the same season. The axis above the ameuts continues covered with leaf-bundles in some, while in others it is naked for some distance, or rather destitute of leaves, bearing only bracts; a second stage of aments or the terminal bud is always preceded by a number of leaf-bundles.

The position of the female ament, whether subterminal or lateral, seems to be connected with an essential difference in the species of pines, secondary in importance only to the leaf structure as described above, and both of these together will enable us to arrange the species in something like a natural order. It ought to be understood, however, that the relative position of the ament on the axis is not absolute and that variations do occur. Species with ordinarily subterminal aments may in young and vigorous shoots sometimes bear lateral aments; this occurs, though very rarely, in -P. *pondgvsa* and *australis,* and j>erhaps in others, but I have never seen it in nny of the *Strobus* section, nor in *P. sylvcrtris, rcsinosa, Laricio,* or its allies. More frequently subterminal aments are fouud in species which normally bear lateral ones, probably when with the formation of the aments **the** vigor of the axial growth has been exhausted; thus sometimes a second stage of aments is subterminal, while the first is of course lateral; or subterminal and lateral ones are occasionally found on different brauches of the same tree; or, very rarely, a tree bears almost entirely subtenninal aments. **This** last case I have seen in the Californian *P. muricata* and in the Mediterranean [171] •ft *Pyrenaira.* This character has to be studied intelligently among the native trees in their homes. So long as only a few hertarium specimens can be consulted it must remain doubtful, and **errors** may creep in, especially as collectors have heretofore paid so little attention to the necessity of obtaining instructive 8|>ecimen9f which, however, arc easily procured in any season of the year, prodded the tree bears at all; for always either flowers or young cones, or in spring both together, can ^ obtained.

The compound FRUIT resulting from these aments, known as the *cone* or *strobih,* matures at the **end** of the second, or in a single species, *P.* /Wi, of the third season ; during the first twelve months

it does not enlarge much; in most species it retains its erect position during that period, but in a few it becomes reversed soon after flowering and before the leaves are developed (P. *sylvestris* and *Elliottii)*; in the allies of P. *Strobus* the slender peduncle bends downwards in the second summer apparently by the weight of the swelling cone; but in the majority of the species the cones in that period assume a horizontal or somewhat declined, rarely a strictly recurved, position. Only in P. *Banksiana* it is as often curved upwards as horizontal We continue to speak of subterminal and of lateral cones in regard to that part of the axis which bore the flowers, though the branch elongates in the next year, and the maturing cone, strictly speaking, thus always becomes lateral.

The cones are, as the name might indicate, conical, from subglobose to oval or subcylindrical, mostly more or less symmetrical, often slightly oblique, and in some Californiun and Mexican species *(P. insignis, tubercidata, muricata, pattUa)* so much so, that the scales on the inner and the outer side become very unequal; in the first named species especially we find the scales on the outer, convex, side much larger and tumid; on the inner, more flat, side smaller and depressed, but singularly enough more fertile than the big outer ones. The color of the cones is from gray to light leather-brown, reddish, or deep brown, with a dull or a glossy or almost varnished surface. They vary in length from 1 \ or 2 to 12 or even, in P. *Lambertiana,* to 18 inches.

The phyllotactic arrangement of the scales is quite interesting, but not of much diagnostic [172] importance; nevertheless it will be necessary in the description of the different species to mention it, and also to state the number of the more prominent secondary spirals, two of which, inclining in opposite directions, are always the most conspicuous. The long cones of *P. Strobus, excelsa,* and *Ayacahuite,* and the short ones of *P. edulis* and *monophylla,* show the $_{T}$^ order of scales, and the 3 and 5 spirals are the most prominent ones. *P. Lambertiana* and *Subiniana* have the f £ arrangement with the 8 and 13 or the 13 and 21 spirals most conspicuous. The intermediate orders of £f and 3£ are the most common ones; abnormal orders are extremely rare.

The cone scales furnish us the most valuable characters for the classification of the species. Their exposed part, not covered by adjoining scales and more or less thickened, has been called the *apophysis;* it is rather depressed and terminates in a blunt point in the section *Strobus;* in *Pinaster* it bears its point on the usually more thickened back, the *umbo,* mostly armed with a prickle, weak or strong, early deciduous (in *P. Balfouriana, insignia, Banksiana)* or stout and persistent (in *P. rigida, Tceda, inops, pungens)*; in some species (P. *Sabiniana, Coultcri)* it becomes a thick, long, and often curved or twisted spur.

The bracts which support the scales remain concealed, but become greatly enlarged and mostly thickened and corky, and help to form lodges for the seeds, which are enclosed between them and the scales.

The cones generally open their scales soon after maturity, drop their seeds, and fall off soon afterwards; in most cases they separate at the insertion of the peduncle, but in a few instances (P. *ponderosa, P. australis)* the peduncle and the lowest part of the axis together with a number of scales remain on the branch. In some species (P. *Sabiniana, Coxdterx)* the open cones persist for several years on the tree, and in others they remain almost indefinitely, so that they are apt at lost to be partially enclosed in later layers of wood. Such are P. *Banksiana, inops, pungens, irvhgnis, muricata, rigida,* and some Mexican species. Most specimens of *Pinus contorta* retain their cones in this manner, while those of the higher sierras of California are early deciduous, proving that this character is not of great specific importance. The persistence of the cones may be connected with the peculiarity of some species to retain their seeds in temporarily or permanently closed cones, [173] when they are called *serotinous.* Such are southern forms of P. *rigi/la* (var. *serotina)* and P. *inops* (var. *dausa),* rarely P. *Tctda;* in Rome Culifomian *(P. insignis, tubcrculata, muricata)* and Mexican species (P. *patula, TtocUe* and *Grtggii)* this is still more conspicuous. The seeds of such

serotinous cones seem to retain their germinating power for many years longer than loose pine seeds, which are known soon to lose their vitality.[1]

The SEEDS are obovate, or often more or less obliquely triangular, rarely (in *P. SaUniana* and *Gerardiana)* nearly cylindrical, generally somewhat compressed, 2 to 12 lines in length, smooth or often on the lower surface ridged or slightly tuberculated, always destitute of balsam vesicles, pale gray or yellowish, or spotted, or brown, and often black. A wing is always present, and is generally several times longer than the seed; in some large-seeded species *(P. flexilis, Cembra, edulis,* and the other nut-pines, and *Pined)* it is reduced to a narrow rim, which is apt to remain attached to the scale when the seed is liberated; in *P. parvijlora, Bungeana, Gerardiana, Torreyana,* and *SaUniana,* it is more conspicuous, but shorter than the seed itself; in *P. Coulteri* it is about as long as the seed, and in *P. Lambertiana* longer. The size of the seed and the proportion of the wing to it has been considered to furnish valuable sectional characters, but it proves to be only of specific importance. The wing is always more or less oblique and widest in some species upwards, in others near the base. The base of the wing forms a rim which surrounds the seed, leaving its under side free and with its edge covering part of, or rarely the greater part *(P. Elliottii)* or the entire upper side (only seen in *P. Bankdana).* Generally the wing and its rim is completely separable from the mature seed, but in a few species (P. *Strobus* and allies) it adheres to it closely, and is at last broken off irregularly.

The COTYLEDONS, 4 or 5 to 15 or 18 in number, are mostly several times shorter than the caulicle, usually not longer than its diameter, and rarely as long or a little longer than it; this [174] seems to be the case especially where the leaves also are of unusual length, e. g. in *P. australis.*

It is easy enough and very satisfactory to ascertain the number of cotyledons where a large quantity of seedling pines is at one's disposal. With me this was unfortunately not the case; hence I had to examine the seeds themselves, quite a laborious process, rarely extending over more than six or eight specimens, and often less. In examining greater numbers more variation will probably be discovered. As it is, the different species show a tolerable constancy in the number of their cotyledons. I give here only the result of my own observations, leaving out those found in the books. I have observed —

about 5 cotyledons in *P. Bal/ourumo, Montana* (3-6), *Larieio, rigida, i*opt* (4-6), *muricata* (4-5), *gMra* (5-6), *Banktiana* (4-5);

•bout 6 cotyledons in *P. Bal/our.* w. *arutata* (6-8). *rennm* (6-7). */"»** (6-8), *intignu* (5-8), *ttbereulata* (5-3). *Tmia* (5-8), *pungent* (7). *Pinatter* (5-8), *tutu* (4-7);

about 8 cotyledons in *P. Strobu»O-\\), montieola* (6-9).*pomjora* (8-10),/«*tt»(8-9), *monophgUa* (7-10),*tdulu* - (7-10), *Parrgana, HaUpwi,* (ft-9), *ponitmt* (6-11), *Canarienm, autiralu* (7-10). *Elliottii* (6-9);

about 10 cotyledons in *P. exceUa* (8-12). *Pence* (9-10). *Cembra* (9-12), *cembroide** (9-12), *Bungeana* (11);

•bout 12-15 cotyledons in *P. Agaeahnite* (12-14), *Lambertiana* (12-15), *Pinea* (10-14), *Torregana* (13-14), *Sabiniana* (12-18), *CouUeri* (10-14).

In germination the seed-shell is raised like a hood on the tip of the cotyledons, mostly after the wing has come off, but sometimes the wing is mised high above the plantlet (P. *australis).* The axis generally soon elongates, bearing the primary leaves, but the species just mentioned behaves peculiarly in this period, almost as do many monocotyledonous trees. For six or eight years it grows not in length but only in thickness, and bears in the axils of the short primary leaves numerous tufts of long and slender secondary leaves, which give the plantlet the appearance of a coarse grass or a rush; <w»jr after it has acquired sufficient vigor the thick axis rapidly shoots up.

[1] 8«ds ftmn cloud conw of *P. amtoria,* two to eight yum old when I collected them in Colorado, and then kept four * • » «n a hot |arnt, germinated Ireely with Prof. Sargent of the Arnold Arboretum, Mua.

I now propose an arrangement of the species of *Pimts* based upon the more essential [175] characters above analyzed, and, though I by no means claim it to be a faultless one, I expect that it will deserve the character of a natural one as much as any that can be devised. I find with Eudlicher the most valuable character in the fruit scale, or rather, to speak more correctly, I find that the form of the fruit scale in this genus corresponds with a series of other characters which constitute two very natural sections of the genus. My section *Strobus* in a wider sense includes his *Strcfous* and *Cembra,* and my *Pinaster,* also enlarged, comprises all his other sections, viz. *Pseudostrobus, Tceda, Pinaster,* and *Pinca.* The subsections are distinguished by the position of the ducts within the leaf, whether peripheral, parenchymatous, or internal. Subordinate to this character is the subterminal or lateral position of the female ament aud the cone. Only after this may the number of leaves in a sheath be taken into consideration, and perhaps the presence or absence of strengthening cells around the ducts. It will be found that thus not only natural but to some extent even geographical alliances are best preserved. I enumerate only such species or subspecies (these in brackets) which I have been able to examine myself; the list, however, will be found nearly complete. The nomenclature of Parlatore in DC. Prod. xvi. * is adopted unless otherwise stated.*

SECT. I. STROBUS. Apophysis with a marginal unarmed umbo, generally thinner ; cones Rubterminal; leaves in fives, their sheaths loose and deciduous ; anthers terminating in a knob, or a few teeth, or in a short incomplete crest; wood softer, lighter, less resinous.

§ 1. EUSTRODI. Ducts peripheral. — Northern or mountain species of the Old and New World.

* Wings longer than the seeds; leaves sharply serrulate, denticulate at tip.

t Strengthening cells few, none around ducts.

P. *Strobus, monticola, excelia. Pence,*[1] *paryiflora? Bonapartęa* Ayacahuite.*

t t Strengthening cells abundant under the epidermis and surrounding ducts.

P. Lambertiana.

• • Wings much shorter than seeds ; leaves mostly entire, not denticulate at tip.

P.flexilii, (albicaulis), pygnuea.

§ 2. CEMBRJE. Duct* parenchymatous ; leaves sparingly serrulate, scarcely denticulate at tip. — Europe [176] and principally Asia.

-P. *Cmbra* Mandtckurica, Koroietui*.*

8EOT. II. PINASTER. Apophysis with a dorsal umbo, mostly armed, generally thicker; leaves 1 to 5 in a bundle, their sheaths usually persistent; anthers mostly terminating in a semi-orbicular or almost orbicular crest; wood generally harder, heavier, and more resinous.

A. Ducts peripheral.

a. Cones subterminal.

S 3. INTEGRIFOLIA. Leaves smooth-edged, their sheaths deciduous; anthem terminating in a knob or a few teeth.- Western North America and Mexico.

• Cones short subgfrbose, with thick scales, unarmed; seeds large with a minute wing; leaves 1 to & *Cembroides.*

P. Parryana, cembroidu, edmli$monophylla.[2]

• • Cones oval or elongated, scales armed with a deciduous or persistent prickle or an awn, seeds much shorter than the wing, leaves in Bves. *BafflmriaHa.*

P. Balfomrianaf (ariitata).

I 4. Bnmin. Leaves serrulate, their sheaths persistent; anthers crested or (only in *P. iylvmiru)* mtfdj knobbed. - Europe and Asia, one species in America

• Leaves in threes ; wingi much longer than seeds. *Udicm,* - East Indi* and its islands.

P. J&MM,' *umdmru? Umgifolia?*

• This synopsis isrsprlntod in the *Oartom* CkrvnkU* far July 24,1880, p. 104. - IDSL

• * Leaves in twos; strengthening cells abundant, principally around ducts; fructification biennial, cones and seeds small, wings large. *Eusyloestres.* — Old World, one species in Northeastern America.

P. *syloettris,* * *Montana? resinosa? demtifiora* ^ *Massoniana* ^[1] *1 Merkusii.*[12]

• • • Leaves in twos; strengthening cells under the epidermis and around ducts; fructification triennial, cones and seeds large, wings rudimentary. —A single Mediterranean species.

P. *Pi/tea.*

6. Cones lateral.

§ 5. HALEPENSES. — Old World.

• Leaves in threes, their sheaths deciduous; uinbo very prominent; wings shorter than the large seeds. *Qerardiaiue.*—Asia.

P. *Qerardiana,*[1] * *Bungeana.*

• • Leaves in twos, their sheaths persistent; cones smoothish; wings much longer than the seeds. *Euhakpetua.* — Mediterranean regions.

P. *HalepetuUP Pyrenaica."* [177]

B. Ducts parenchymatous.

a. Cones subterminal.

} 6. POVDEBOBJE. — Mostly American, with three Old World species.

• Leaves in fives, ducts usually free of strengthening cells. *Pseudostrodi.* — Central America and Mexico to Arizona and California.

P. *leiophyUa," tcnui/blia,jtlifolia» Pseudo-Strobe, Montezunue» (Hartwegii), Torreyana, » Arizonica* *

• • Leaves in threes, sometimes in fours or fives, their sheaths persistent; strengthening cells under the epidermis, around ducts, and usually also near the fibre-vascular bundles. *Euponderosa.* — Northwestern America, Mexico, and Canary Islands.

P. *Engelmanni,* [n] *ponderosa* [n] *(Jeffreyf), Canarientu.*[u]

• • • Leaves in threes, their sheaths deciduous. — Mexico and Arizona.

P. *CkikuakuamV*

• • • • Leaves in twos, generally with some strengthening cells around ducts. *Laridone*. - Europe to Asia and W. America.

P. *Laricio" (Atutriaca), Thunbergii* * *contorta* * (Murrayana).*

b. Cones lateral.

17. TAD*. — Mostly American, only one Old World species.

• Leaves in three*, ducts mostly without strengthening cells. *E*t*d*.* — North America to Mexico.

P. *Sabi*ia*a,"* *Coulteri* *i**ig*i*» tubereuloia* *T«da* *rigida« (m*im*),* «"W* »"»'*********

• • Leaves in twos ; cones with very rtout prickles. *PungenUi.*

f Ducts without strengthening cells. — North America.

P. *inops(clausa* [M]*), pungent* * muricata**

11 Ducte surrounded by strengthening cells. - Southern Europe.

P. *Punter*[TM]

• • • Leaves in twos, or in the tot often aUo in threes; cones with weak or deciduous prickles. *MtUt-*Emitera North America.

P. *miii* » glabra* BankiUmo**

C. Ducto internal.

I 8. ADBTEILB. Lean* in twoe to fivee; Umber very heavy and resinous. -Southeastern North America, West Indies, and one specie* in Mexico.

• Cones subterminal; leaves in threes to fives. *Enautiralei.* [178]

* *ooevpa* occidental*, *m$tmlU."*

• • Cones lateral or mortly to; leave* in twos to threes. *EUMtim.*

*P. *Uio<Ki« Cmbftu" Wrigktii**

NOTES.

1. P. *Pence,* Griseb., may after all be distinct from P. *excelsa;* it has much shorter leaves and sheaths, and, if my specimen can be relied on, a short fruiting peduncle; the structure of the leaf is nearly the same in both. P. *Pence, excelsa,* and *mmiticola* have a layer of strengthening cells all around under the epidermis, interrupted only by the stomata, and not in distinct bundles as in *Lambertiana* and *Bonapartea,* while P. *Strobus, Ayacahuite,* and *paiviflora* have scarcely any. They all have regularly two dorsal ducts only. In P. *excelsa* I have repeatedly found a third, upper, and always a parenchymatous one.

2. P. *parviflora,* Sieb. & Zucc. A branch in Herb. Haenke in the Prague Museum, marked " P. *heterophyUa,* Presl, Nutka Island/' seems to belong to this species, which is distinguished by slender, distantly and very slightly serrulate leaves, and scarcely any strengthening cells.

3. P. *Bvnapartea,* Roezl. Prof. E. Purkinje, of the Foresters' Academy of Weiswasser, Bohemia, who was probably the first to carefully study the microscopic anatomy of the pine-leaves with a view to the diagnosis of the species, and who is now publishing the results of his investigations in an extensive and copiously illustrated work, has directed my attention to the leaf-structure of this form. It deviates from all the other *Strobi* in having numerous, usually 7 ducts, 3 on the back and 2 on each of the upper sides, and having strengthening cells in numerous bundles all around and especially in the angles. I find no stomata on the back. Roezl's P. *Don Pedri* has exactly the same structure, but has 3 or 4 series *of* stomata on the back ; both evidently belong together. Though I have not been able to study the flowers and fruit, I do not hesitate to pronounce it distinct from P. *Ayacahuite,* which, like P. *Slrobui,* has scarcely any strengthening cells, and only 2 dorsal ducts.

4. P. *Cembra,* Linn. The ducts, generally in the middle of the parenchyma, sometimes nearly approach the epidermis, but 1 have always found them separated from it by at least one layer of parenchymatous cells.

5. P. *monophylla,* Torr. & Frem. The number of ducts IH excessively variable; I have found from 3 to 14 in different leaves. The leaves arc usually curved, and the upjwr side, proved to be such by the relative position of the wood and boat cells (*ee p. 165), is always directed toward the brunch. Sometime* two-leaved bundles occur. It is an open question whether the four species of the suWction *Cembroidcs* may not projHjrly be united into one, as the difference of (lowers and fruit is very slight, and that of the foliage only relative.

6. P. *Balfourùiruiy* Jeffrey, and P. *arutata,* Engelm., of the Colorado IWky Mountain*, are identical in [179] leaf-structure and in flowers, and must be united, though the cone of the former is elonguted, often even cylindrical, the upophyse* thicker and peculiarly spongy, and at maturity unarmed, while the other has an oval cone with thinner scales and awnlike prickles. In Utah and Nevada a form occur* with cones like the latter, but with abort, •tout, recurved prickles. Parlutore enumerates *arittata,* but does not mention *Balfourùuia.*

7. P. *Khasia,* Royle, and it« two allies, form a very natural little group. Leaves in this species with 2 dorsal ducts ; strengthening cells very slight and only in the corners; mole flowers 1 inch long, slender ; involucral bracts 4*2 to 14, exterior half as long as the inner ones, all apparently pointed; anthers | to 1 line long; crest only \ line wide, nearly entire.

P. *innUarù,* Endl., has similar leaves, ducts often indistinct, strengthening cells slight in the comers and some scattered under the epidermis and also near the vessels ; male flowers 1 inch long ; invulucrul bracts about 8, outer pair more than half as long as the inner ones ; anthers lew than 1 line long, crest nearly entire.

P. *longifolia,* Roxb. Ducts few (in Wnllù-h's specimens), or many (in Hooker and ThomfwonV), or none at all (Hooker's; Thuret's cult) ; strengthenïng cells strongly deveoloped in bundles all around leaf; bracts large, strongly fringed, deciduous; male flower* larger than in lost, 1-lJ inches long, thicker; anthers 1} lines long; crest | line wide, strongly fringe-denticulate; involucre not seen. The thick bundles of strengthening cells and the larger male flowers readily distinguish it from the two others.

8. P. *montana,* Duroi, is so well characterized that it is inconceivable how it conW have been taken for a variety of P. *tylvt*tru‰* unless some hybrid forms, which are said to occur, have create! the difficulty. The invulucrul bracta are always more numerous usually about 6, the anthers crested, the female ainenu Miliimile, and the young cone erect; in tyiWrii the involucral bract* rarely exceed 3, the cnut of the anthers is rwliivd to a small ridge or a few teeth, the female ameut is not longer than its peduncle and become* tveurved soon after flowering.

9. P. *rerimm,* Ait., is the only American ïepresentative of this well characteriied gruup. The 8 inrolucral •cale. are articulated in the middle, the upper part falling off early (p. 168) ; duct* almost always only S on the upper •Me of toe leaf.

some cells ™-_*P-demiJIon,* Sieh. & Zncc Leare* with nunwrona dncU, mnntly mrrotiiided *by* rtrw»Kth«uing <*1K •>•• or time within the .heath ; in a few inaUncet, in J i p u w aa well M in cultivated ipecimeiw, th« rtiwi|lUiening an aimoet wanting; mal« flowen oral, onljr S to 3 linca long, in aa elongated vpike; involncram of 3 or 4 or

rarely 5 or 6 bracts of equal length ; anthers only J line long, or less, with a small, slightly denticulate crest. Only iu Japan. Sometimes cultivated under the name of the following.

11. *P. Massoniana,* Lamb. Parlat., well distinguished from the tree thus named by Siebold and Zuccarini [180] and by Endlicher, which was named by Parlatore *P. Thunbergii* (see note 26). It is similar to the last, but has longer and more slender leaves and is a native of the warmer climate of Southern China, and is not hardy where *densiflora* and *Thunbergii* are. Ducts few or many, often with a few strengthening cells, these, cells also in the corners, very few under the epidermis, rarely some with the vessels ; male flowers slender, cylindric, 6-8 lines long, in a spike, involucrum of 6 or 7 bracts, the outer pair rather shorter than the inner ones. Griffith, No. 4992, from Afghanistan, in Herb. Ke.w., with two ducts on the upper side of the broader leaves, may belong here, which would extend the geographical area of this species.

12. *P. Merkusii,* Jungh. & De Vriese, seems to be closely allied to the last and probably belongs here, or ought perhaps to be considered rather a two-leaved *Indica.* In the poor specimens at my disposal I could not discover any ducts ; the leuves are longer and more slender, the strengthening cells similarly disposed. The involucruin consists of 12 bracts, the outer pair not half as long as the inner ones.

13. *P. Gerardiana,* Wallich. Anther crests semi-orbicular, laciniate-dentate, seeds nearly 1 inch long.

14. *P. Halepeniris,* Mill. Cones with longer or shorter peduncles, lateral and often low down on the axis, generally single, with flat or sometimes somewhat tumid scales.

15. *P. Pyrenaica,* J*peyr., fide Parlatore, *P. Brutia,* Ten., and with other synonyms, not to be confounded with that other *P. Pyrenaica,* which is a form of *P. Laricio.* This species is ao closely allied to the last that it ia often considered a variety of it. But the leaves are stouter, the more numerous ducts are surrounded by strengthening cells, which are very scarce in the leaves of the other ; in both, these cells are found near the vessels ; the mole flowers are twice as large ; the outer pair of involucral bracts is almost equal to the inner ones ; the cones are nearly sessile and thicker, generally several together, and often lateral and terminal on the same tree (pee p. 171) ; the densely clustered cones in Tenore's typical specimen in the Botanic Garden of Naples are the result of disease.

16. *P. Uiophylla,* Schiede & Deppe, has often 6 and even 7 leaves; the ducts are very small and often wanting; the strengthening cells, usually well developed in bundles under the epidermis, are, as well as the ducts, absent in Gregg's No. 821 from Zamora ; the sheaths are usually deciduous, but scarcely so in Hartweg's No. 441.

17. *P./Uifolia,* Lindl. In a specimen cultivated in Kew Gardens the ducts are sometimes internal.

la *P. MonUzuma,* Lamb., is, if I understand it correctly, a most variable species, the largest suit of different forms of which i* preserved in the Berlin herbarium; some forms have longer, others shorter leave*, or stouter or more Blender ones, 3, 4 or 5 in a bundle ; cones long cylindrical or oval or conical; the scales in the typical form aw depressed and regularly rhomboidal, in other forms they become strongly umlwnate. It is quite difficult, [181] therefore, to properly circumscribe the Hpecics ; for the present I feel obliged to unite with it even *P. Hartwegii* and a numl>er of others already inclu<li*l by Parlatore. Only a closer study on the Mexican mountains will decide whether or not several well elm meté-rued secies may be hidden among them. All those that I could examine have numerous and strong bundles of strengthening cells under the epidermis and also near the vessels, but none around the ducts.

19. *P. Torreyana,* Parry, ban the name structure of the leaves. The name was published in the Botany of the Mexican Boundary, 1859, and is therefore older than *P. lopkospcrma,* LindL of 1800.

20. *P. Arisnnica,* Engelni. in Bot. Wheeler, p. 2C0, has also this structure, and is thus distinguished from P. *PontUrota,* ue*k»A lteing five-leaved.

21. P. Efif/r/maimt; Carrière, Conif. p. 350, P. *macrophylla,* Engelm. in Widiz. Mem. p. 103, note 25, ia n tree only known from Winliicniis'single »i»ccimen gathered in 1846 on the mountains of Cosiquiriacbi, went of Chihuahua, where it is said to be abundant. The name was changed by Carrière because it clashed with Lindley's prior one ; thin, however, in considered by Parlatore t> IK? a form of *JfonUxHmtr,* but which I have not been able to examine. Our plunt differ* from thin njwcit-*, by having it* very stout leaves in threes and fours and very rarely in fives, in the strongly developed Htrviitflionintf cells under the epidermis and also around the ducts, and in the form of the cone. PurUtore doe* not mention it.

22. *P. ponderosa,* Douglas, a variable and wide-spread species of Western North America, several forms of which have bren described as distinct. The only one which may perhaps claim specific recognition is our var. *Jeffreyi* (*P. Jeffreyi,* Murr.), characterized by its darker more finely cleft lark, glaucous branchlets, paler foliage, and much larger cone*, with rather MKIHUT nliarj> nvurvnl pri«*kles and larger seeds ; but it seems that intermediate forms unite it with toe typical one. Another form which ilwrvm noli™ in var. *icopulomm,* of the Rocky Mountains, with shorter and often Innate leaves and tmaller cone- («* Eii^elm i» FJor. Calif 2, p. 125).

23. P. *Canariennis,* Ch. Smith, is ^perhaps more nearly related to P. *Laricio* than to *pondcrosa.* The articulation of the 4 involucral bracts is a curious feature which it has in common with our P. *rennosa* (see p. 168).

24. P. *Chihuahuana,* Engelm., first described from the mountains of Chihuahua, but now repeatedly found in Arizona, is well distinguished from all its relatives by its deciduous sheaths.

25. P. *Laricio,* Poir. Strengthening cells around ducts and in bundles all around leaf; the typical form has slender leaves and is tender in cultivation. Var. *Monspelienm* or *Pyrenaica* (not to be confounded with No. 15, as the author of that species himself and many later botanists have done) has slender leaves with scarcely any strengthening cells around the leaf, and is more hardy than the species. Var. *Austriaca* or *nigra* is perfectly hardy; it has the stoutest leaves of all the forms, with abundant strengthening cells. A specimen in Herb. Kew., Binnah, Griffith 4993, may belong here, thus extending the range of the species far into Asia.

26. P. *Thunbergii,* Parlat. This is P. *Massoniana,* Sieb. & Zucc., and of many authors and many gardens, [182] but is easily distinguished by its stouter, shorter leaves with parenchymatous ducts. It seems peculiar to Japan, though cultivated in Australia, whence P. *Australasiaca,* Steud., an original specimen of which I have been able to examine in Herb. Cosson. Its parenchymatous ducts distinguish this species at once from any other Japanese pine, and place it near P. *Laricio.*

27. P. *contorta,* Dougl., is a little out of place here and evidently belongs nearer to the next group, but it has the subterminal cones of this. Like its American allies it is destitute of strengthening cells about the ducts, which character distinguishes it at once from its Old World associates, and so do the subulate points of the female scales. The low-growing narrow-leaved coast form, which is found along the Pacific from Northern California to Alaska, is the original P. *contorta,* Douglas (from the mouth of the Columbia River), and P. *Bolanderi,* Parlat. (from Mendocino, California) ; it is a regular seaside tree, an excellent screen against the Pacific storms and their salt spray, just as P. *Halepentii* is on the Mediterranean ; its leaves are often entirely destitute of ducts. The broader-leaved mountain form is P. *Murrayana,* Murr., as Jeffrey's original specimens prove, which come from the sierras; P. *muricata,* with which Parlatore unites it, is very different and belongs to the coast region ; this broad-leaved form extends to Oregon and to the Rocky Mountains. While the forms of the coast and of the Rocky Mountains have very knobby, oblique, serotinous, and persistent cones (see p. 172), those of the sierras have occasionally more regular, less tuberculated, readily opening, and deciduous cones, without being otherwise distinguishable *(C. S. Sargent).* The wood of this species is white and soft, and the tree is therefore often called white pine or spruce-pine.

28. P. *SabinianOy* Dougl., and P. *Coulteri,* Don *(macrocarpa,* Lindl.), cannot be confounded by those that have been able to compare both growing ; both have very large cones with spurred apophyses and large edible seeds, but the cones of *Sabiniana* are shorter, thicker, dark mahogany-brown ; (he seeds larger, 9-12 lines long, almost cylindrical, with much shorter wings ; those of P. *Coulteri* are more slender, of a paler leather color, the seeds shorter, 6-8 lines long, and their wings longer. P. *Sabiniana* makes a round-topped tree with spreading branches and looser, more slender, and lighter foliage on glaucous branch!eta; P. *Coulteri* is a more conical tree with rigid brown-green branches and denser, coiimcr, and darker foliage. The seeds of P. *Sabiniana* are or have been a most important article of subsistence for the Indians.

29. P. *inrigni$,* Dougl., distinguished by its fresh green foliage and closely and strongly serrulate leaves. Cones generally thick and very oblique, with the scales of the outer «de large and thick, and on the inner side smaller and flat; some cones are more regular, all the scales nearly equally flat. For the synonymy I refer to Flor. Calif. 2,127, repeating here only that the original P. *tuberculata,* Don, is founded on an unusually slender cone of this, [183] and that P. *Sinelairii,* Hook. & Arnott, is a factitious specie* compounded of a cone of this and a branch of P. *Monteznmm.* The old and evidently erroneously described P. *Californiana,* Lois., is probably our species, but cannot now be identified.

30. P. *tubarulata,* Gordon, Pinet ed. 1, 211, not Don, a name at firrt erroneously given to a species sent *hf* Jeffrey, is to be retained as now in general use, and became Don's original *tubttrulata* is a mere form of *in$ignu. P. Califomica,* Hartw., is the same,. It is the smallest pine known a* a tree, fruiting often when only 2 to 3 feet high, and rarely ever exceeding 15 or 18 feet (See Engelm. in Flor. Calif. 2, 128.)

31. P. TVwfa, Linn., and P. *rigida,* Mill., have sometimes, besides the regular parenchymatonn, smaller, accessory internal ducts, thus approaching the *AustraUs* group. The cones are of a pale brown color, mostly very spinous, and very rarely serotinous. It is confined to the wet or sandy lower districts along the coast from Delaware to Eastern Texas. The most inland localities may be the Stone Mountain near Atlanta, Georgia, and Camden in Arkansas.

•*• '• *rigida,* var. *terotina, P. Merotina,* Michx., I cannot distinguish specifically from *rigida;* it is more apt to gww on wet places (whence the name *Pond-pint)* and has longer leaves (occasionally, on strong shoots, in fowir), •ad the cones often do remain closed for several years, as in also sometimes found in the northern P. *rigida.* The typical subglobose form of the cones which Michaux figures in hi* Sylva is quite |«culiar, but only found in the coast

region of South Carolina, from whence Dr. Mellichamp sends them ; further inland the cones are more elongated, often twice as long as in the northern *rigida* (Wm. H. Ravenel, Aiken, S. C.)* Prof. Sargent observed it on the Georgia and East Florida coast, but not in West Florida or in Alabama. Felled trees or posts set in the ground sometimes make sprouts bearing primary leaves.

33. P. *patula,* Schiede & Deppe. The epidermis cells of the leaves protrude so that the surface appears minutely tuberculate.

34 P. *inops,* var. *clausa,* was discovered and named by Dr. Chapman at Appalachicola, Florida, and Prof. Sargent finds it quite common on Cedar Keys. It is distinguished from the species by decidedly narrower leaves and by its cones being often serotinous, more in one tree than in another. The leaves are \ line wide, while in the species they are often £ and even nearly 1 line wide ; the sheaths in both forms are at last deciduous; young branches green, in the northern form glaucous ; involucrum of 10 to 11, in *inops* of 8 to 9 bracts ; cones larger, mostly subsessile, recurved ; in the other, mostly longer peduncled and patulous; cotyledons fewer, 4 or rarely 5, in the other 5 or 6.

35. P. *pungent,* Michx. Leaves rarely in threes and sometimes with accessory internal ducts. The cones persist sometimes 20 years or longer.

36. P. *muricata,* Don. Male flowers only & inch long in a spike of about 1 inch in length, similar to those of *tulerculata* and *insignis ;* antheral crest strongly denticulate, in the others nearly entire. Specimens have [184] been collected at Tomnles Point with subterminal cones, not different in any other respect. The cones of the southern specimens (from Monterey, etc.) have usually very long, £ inch, and stout curved spurs, especially on the outer side, and fully deserve their specific name, but others from farther north (Mendocino, etc.) are more regular, with short and thin, though very sharp, prickles.

37. P. *Pinaster,* Ait. The male flowers form a large oval head ; involucral bracts often only 3 or sometimes 4, all of equal length. Geographically and structurally this species is more nearly allied with P. *Canariensis,* less so with *Larieio,* but is distinguished from both by the lateral (quite rarely subterminal) female ament.

38. P. *mitis,* Michx. Wide-spread through the middle and partly the southern States, rare in New Jersey and not now found farther north ; westward to Arkansas and to Missouri south of the Missouri river, where it is the only species of pine ; it is found always on silicious soil; it furnishes excellent " hard pine » lumber. The outer pair of the 9-12 involucral bracts is scarcely half as long as the inner ones.

> 39. P. *glabra,* Walt. Similar to the last, with slender foliage, smoother bark (in young trees and on the branches the grayish' bark is quite smooth) and almost unarmed cones, distinguished by Walter 100 years ago, but long overlooked, until W. H. Rnvencl, about 25 years since, rediscovered it. Dr. Mellichamp finds it scattered on the coast of South Carolina, where it grows on the edge of or in swamps, and on the knolls in them, with *Magnolia, Fagm,* and *Nyssa;* rarvly on sandy soil, and never in the so-called Pine-barrens. He describes the branching of the tree as singularly characteristic, the spray usually l*ing flattened somewhat like that of Cedrus. It probably extends through the lower part* of the southeastern and southern State*, as it is ngnin found in Mississippi (E. Hilganl). The tree (known in South Carolina a* the *S^ute-Pine)* grows up to 80 feet in height; the gray bark of such old trees in flaky, and is compared by sonic to that of the sugar-maple, by others to a smoothisb white-oak bark. The leaves are usually 2J to 3 inches long, not half as thick as they are wide, while in P. *fnitis* their thickness exceeds half their width ; the extcrnaHfnvolueral bracts are minute.

40. P. *Banhuwa,* Lamb., published 1803 in Lambert's first edition, a year prior to Poirct's name of P. *rupestris,* which name, erroneously preferred by Purlatore, must give way to the former. Proliably the only pine with erect or at least patulous cones ; the small prickles of the very young cones soon disappear, so that the mature ones are unanned. The base of the wing entirely covere the outer side of the seed and separates from it, jiwt as it does in Picca, and which I have not seen in any other pine to this extent. The cones are often serotinous and ^rsint for a long time. The seeds seem to germinate most readily, just like those of P. *Tarta,* and in moist sandy soil, in old fields, and along railroads young trees spring up abundantly. It make* a moderate-sized tree, but is perhaps never over 20 or 30 feet hi$_K$h, and 1<M2 or very rarely 18 inches in diameter. Very common in Northern Michigan and Wisconsin, it does [185] not seem to extend farther westward than the Saskatchewan, where it is replaced by P. *contorta.*

41. P. *oocarpa,* Schicde. Most of the ducts are internal ; occasionally a parenchymatous one was found in the leaves examined by mo. Further investigation must show whether this species may not more proi>erly be referred to iU Mexican m-itfhliors of the *Pteudostrobi* group. Strengthening cells are abundant around, under the epidermis and also near the vessels.

42. A *amtndi**, Michx. Male flowers 2J-3 inches long, the longest of any pine, of rose-purple color ; lowest pair of involucral bracts minute. On a very vigorous nhoot I have seen the female ament lateral (see p. 170), a rare •nomaly. In the Renninatinj? plantlet, tbe'long wing remaining attached to the seed shell is raised up like a flog by the growing cotylodoiious leaves.

43. P. *Elliottii,* Engelm. For a full account see below.

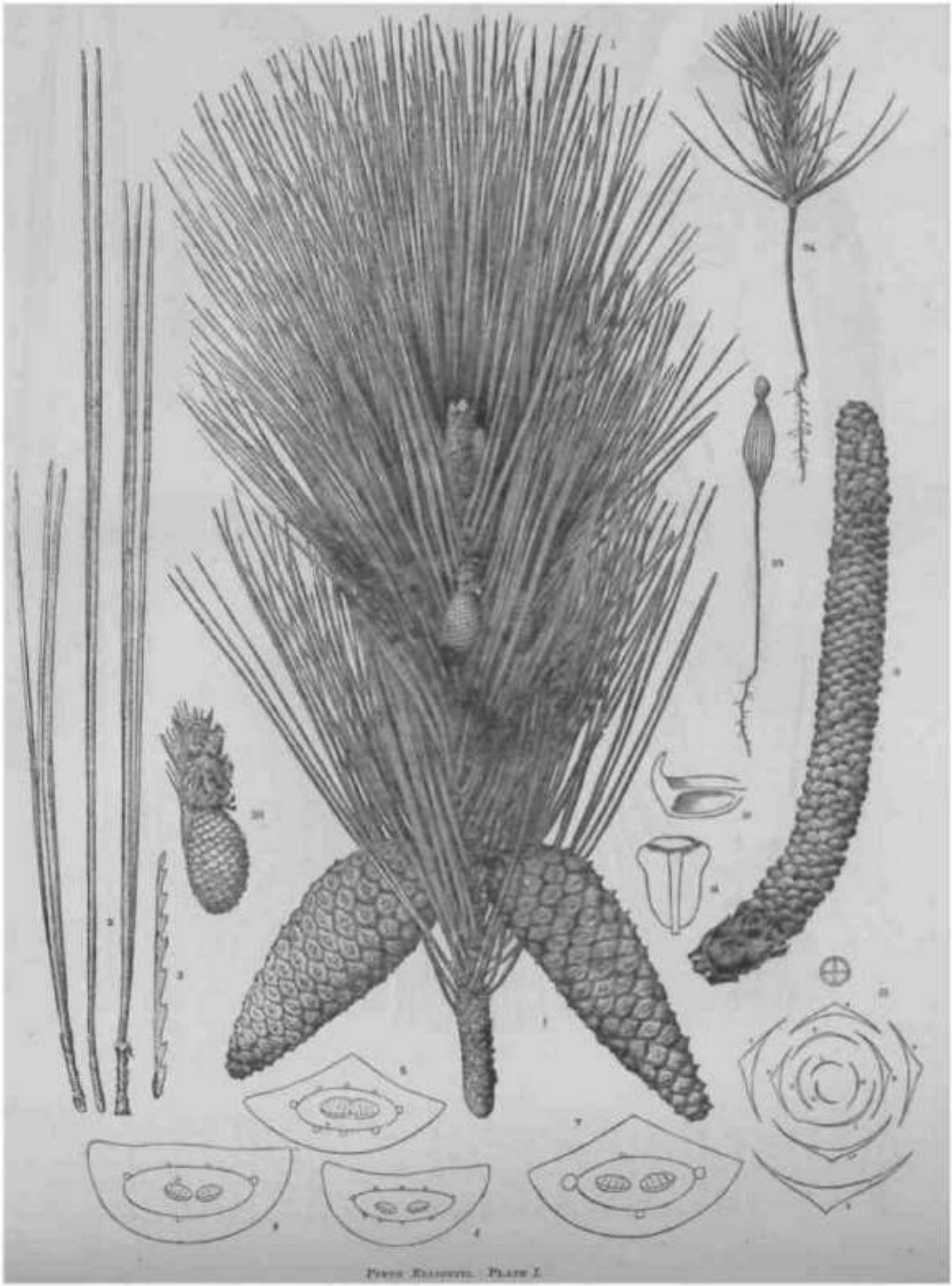
44. *P. Cubensis,* Griseb. Leaves in threes, only exceptionally in twos, 8-10 inches long, rarely longer, stout, about } line wide, rigid, strengthening cells largely developed under,the epidermis (so that their bundles sometimes extend from the epidermis to the ducts) and also near the vessels ; bracts 3-3J lines long, strongly fringed, reflexed, rather persistent; male flowers about l£ inches long; involucral bracts 13-15, the outer pair half as long as the inner ones ; anther-crests scarcely denticulate; cones 2£-3 inches long, short-peduncled, scales depressed ; seeds 3£ lines long, faintly ridged ; wing nearly twice as long, widest at base, tapering to an acutish point. The var. *tertkocarpa,* Wright, in Gris. Cat. Cub. 217, is a very curious form but not a variety. It seems that in this case the growth of the axis is entirely arrested after producing an ament, and does not even elongate in the following season ; the maturing cone, therefore, remains erect near the top of the branch. I have seen an analogous arrest of growth in the biennially-maturing *Quercus chi-ysolepis.* It is found in different parts of Cuba, in the maritime districts as well as on the mountains, and is probably the same that gives the name to the Isle of Pines. A cone from the Bahama Islands, preserved in the Kew Museum under the name of *P. Tada,* probably also belongs here.

45. *P. Wriyhtii,* Engelm. n. sp. Leaves in twos, very rarely in threes, slender, 5 to 8 inches long, \ line or less wide ; sheaths 4 lines long, with age a little shorter ; bracts small (\\ lines long), very slightly fringed and rather deciduous ; cones lateral, peduncled, recurved, oval, \\ to 2£ inches long, Rcales radiately grooved, thickened on the crenulated edge, apophyses retused, umbo immersed, prickles short; seeds 2J lines long, faintly ridged,wings (perhaps incomplete ?) not much longer, widest above the base. —Mountains in Eastern Cuba, apparently mixed with the last, Chs. Wright, No. 1462 in part, 3190. Distinguished from the allied *P. CubentU* by its slender binate leaves, short scarcely fringed deciduous bracts and smaller cones and seeds. I have not seen the male flowers. The cone-scales of both species are arranged in the § J order, the 8 and 13 spirals being the most prominent.

PINUS ELLIOTTII, EXGELM. n. sp.

A LARGE tree, 50-100, rarely to 110 feet high, 2-4 feet in diameter, with (7-15 lines [186] thick) laminated, reddish-brown bark; leaves in twos and threes, in the axils of lanceolate, long-fringed, somewhat persistent bracts, 7 to 12 (mostly about 9) inches long, £ to nearly 1 line wide, rigid, closely serrulate, acutish ; sheaths at first about } inch long, later withering to one-half that length; resin-ducts internal (adjacent to the sheath of the vascular bundles). Male flowers from the axils of similar, persistent bracts, cylindrical, elongated (1J to 2 inches long), in a short head (not more than 1 inch long), each one surrounded by an involucre, 4 lines in length, of about 12 bracts, the exterior pair strongly keeled, half the length of the inner ones; anthers with semicircular, denticulate, rose-purple crests ; pollen grains 0.037 to 0.045, on an average 0.04 lines iu the longer diameter. Female aments peduncled, mostly 2 to 4, or rarely to 6 together, oval, purplish, at first erect, but soon assuming a horizontal and (a month later, and before the leaves are well developed) a recurved position, the axis meanwhile elongating and in vigorous trees not rarely forming a second tier of aments several inches above the first ones; the bracts above the aments bear the usual leaf-bundles, so that no naked space is left; carpellary scales broad, rounded, more or less abruptly cuspidate, their bracts half their length, transverse, retuse. Cones peduncled, recurved, oval to cylindrico-conical, 3 to 6£, usually 4 to 5 inches long, 1} to 2\ inches in diameter (when closed), of a rich brown color and almost glossy; bracts thickened, retuse, or emarginate; scales in \\ order, the 5 and 8 spimls most conspicuous ; larger scales 2 inches long and 7 lines wide ; apophyses marked with grooves, radiating from the slightly prominent uiiitio, transversely divided by a sharp ridge, armed with a short stout or rarely a slender sharp prickle. Seeds triangular, 2J to 3J lines long; dark, slightly ridged, ami rough on the under side; wing 4 or 5 times as long (13 to 10 lines long), somewhat oblique, (ilitu.se, with nearly parallel sides, or usually somewhat broader below, its base covering the greater part of the outer or uj>]>er surface of the seed; cotyledons 6 to 9, usually 8.—***P. Ta-da,* var. *hdernphjilh,* Elliott, Sketch, 2, p. *iVM'*>.**

Common, in light sandy damp soil, among the sandhills near the sea-beach and along the marshes near the mouths of rivers; also found in damp clayey pine lands and with **[187]**

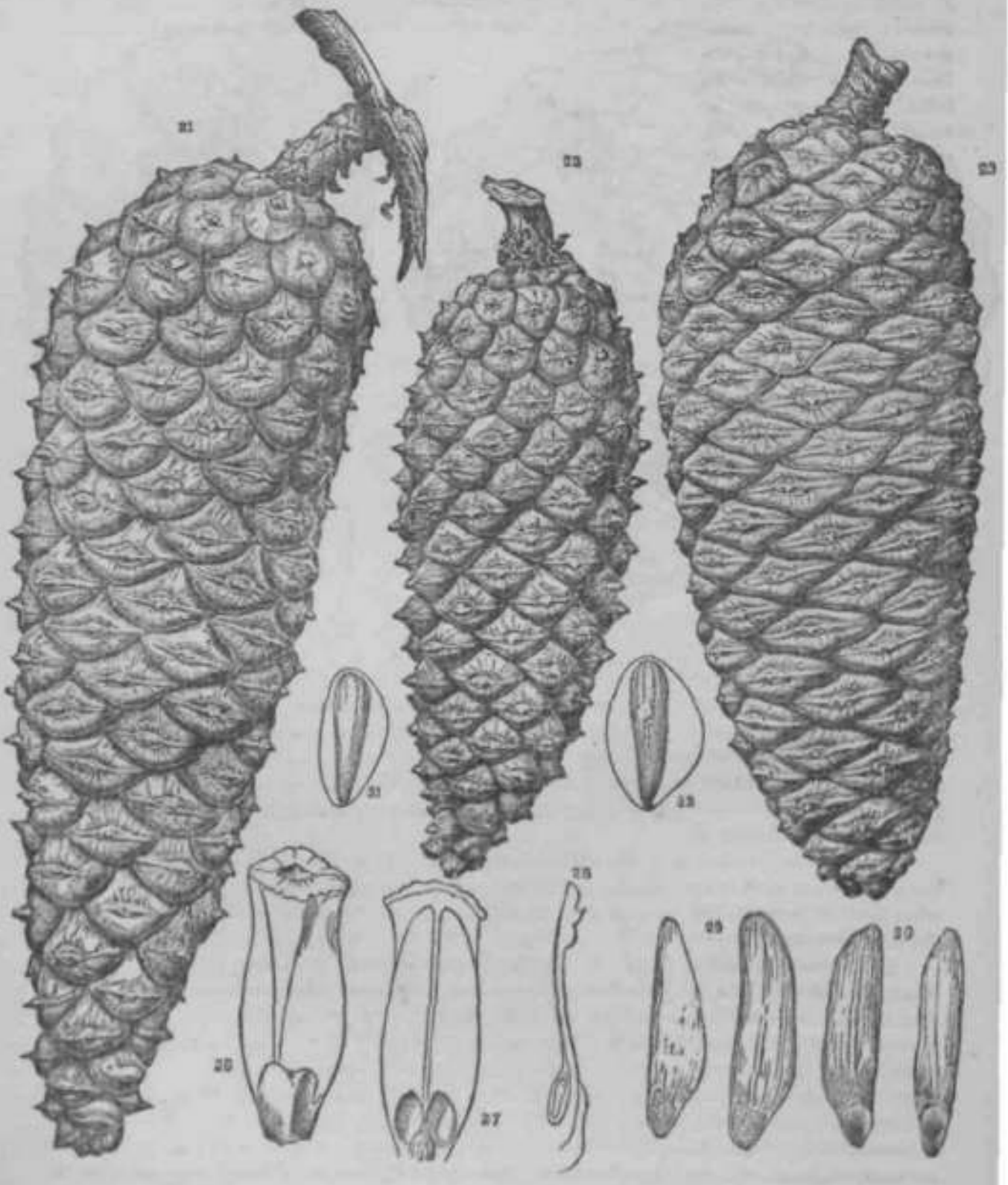


Pinus Elliottii. Plate I.

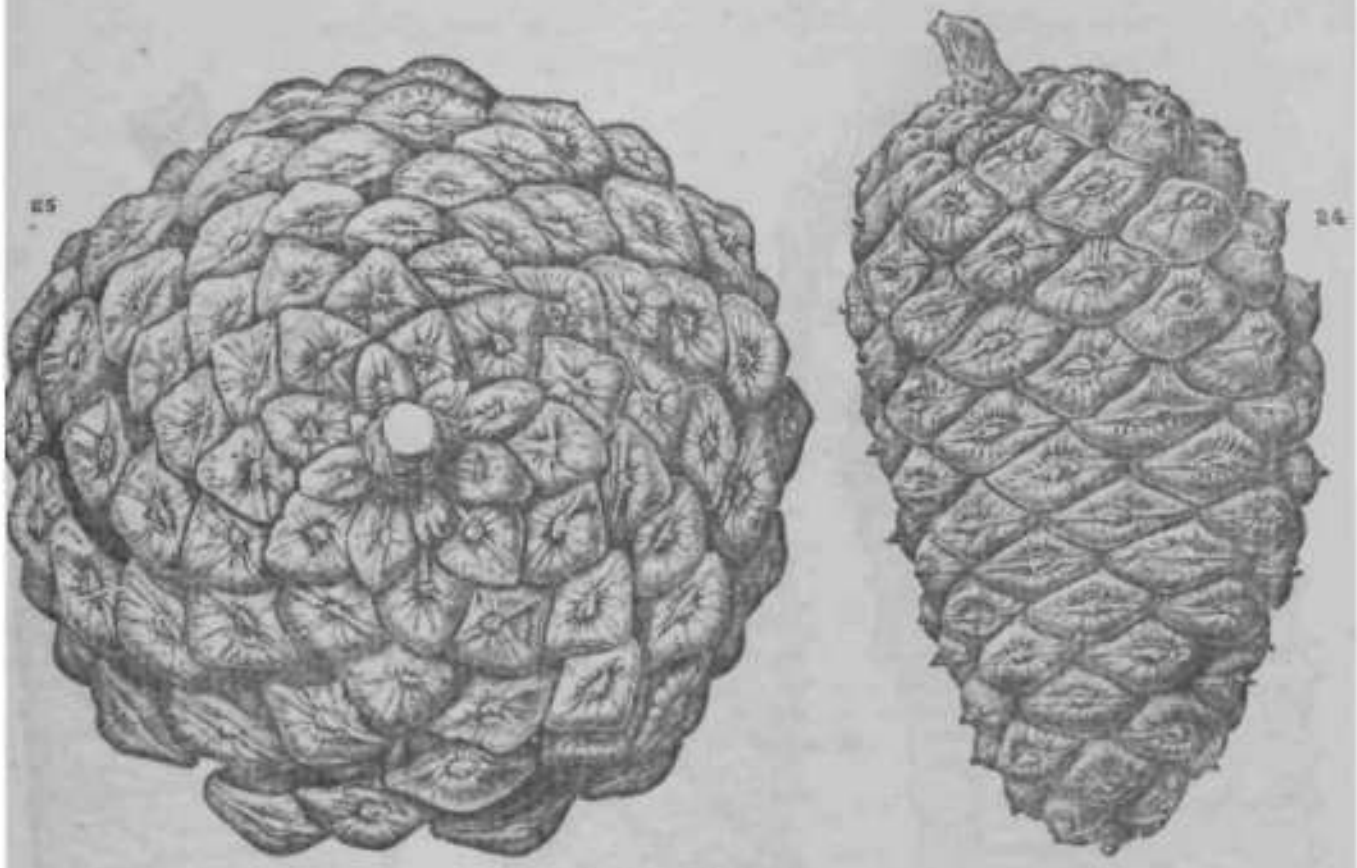
P, *riffitla,* var, *wrotitut,* in pine-barren ponds, rarely exclusively covering small tracts, am] *only* as a second **growth** in vld fiddi alon^' ill-' tuiLst, ami sparingly *as fat* us 15 to 21) miles iuL-uul, **but rover** very *Ux* from tlio iaJlutiuee of sitltwnter, *I)t. AfcJlitJtamp;* to Gnorgitt, *EUuM;* autl **Florid*,** Carolty, ***QarUaj*** **(bnnitt^ibf-**esU on ihu St. Jclm'a Kiver, wlitin; it is often cdlltfd ***8t**k-piw,*** and **is** not cut fur timber, *Sargent;* "the must common pine iit Sout.li Florida, the * short-stniw [jitit* **irf** the wood-cutturs, *itilhr,* mora slaink'r.aiul with harder wopd UIILU tlic ' **long-flfenw** pi lie/ /*, *aHstrttli*.* whieb is tlio **pTiticipit]** I'urost true of Iiv?i^ **em.** Kiddle, ami **Northan** Floridn." *Dr. A, P. f.'ftrlttr;* extc-iitiiii^ **matiilid to** AL*v*> *hamn,* " a **oommoa** tree nking ill- **boy** .»! M..ilnl.j." J/(i/nr, *Sargtnt.* PeoC **SttgB&t** wbserves tlml wliilu the kiugleaf pine r:i|ti«:l]y disappear? under tlui **txe,** Elliott's pine becomes mom ari'.I more cotomon, tlia yuuny second-growth farenu in **Florida** almost entirely consisting of this sneciicft an 1 <>r *Tada.*

Thin h tlx< **ettlknt** flowering pine of those regions, fntin *'1* to4 \TQO]U in advance of any other piiH[1], showing its tr^o-purpl^ mnl$_{ft}$ flower-December, nnd in January or February. •WWiing to kUttide ttfitl •waon, fthodding iu abundant poUen, whidi, wafted by tli i'i witiiin, is apt. to cover roads and especially **atneto, *«d** ing «l»««ts and pools of water, **far** m,d **wife, wtth** its sulphur-look- **r** flowers, comes sever ter, and then the powdnr. ^ uuWnt/u ilu with rose-imrpl« lastly *P. rigida,* v«, *serotina* widt greenish-yellow other*, _ *p.* JW«, aeit ^ *stabra* uid **PIOW,** and

PLATE II.



PART OF PLATE III.



PART OF PLATE III.

flowars. Our species Ijeai-s alumdnnlly every **yOM** U. **tout** in Sonth Ciirolmrt), different from *P.* *«*. *tralis,* which, like inuny **other** | **faitfttl** only every other gtiwon. The **eosM** al-;<i timiinc mid drop off imrli.r tlmn **tboM** .»r tliu owtKiirtt^i pines, and (thed «d flbn«dftnoe of 8oedff, which readily **geruiinate** about NVivcmUir, nnd devt*U>p llieir yniitig slams in quing.

Tliii) tree Prof". **Sargent** ooiujhUtre **by** fur tin; **bwuliemert** "f nil the Bouthurn **pines,** midily dirtinguished from UIOBH **with which** it is associated, by iU hoftvier, denser naiuls, durker foliage, **IUH**| largLT nml litmricr lirani;h«a.

Tlie red-br **own** Imrk *in* very chnnicteristir* of (his sjiecics ; it is n e a r l y laniinntcd, nnd [1SS] the outer **bmina** cxf^ti.,r,. i,, **athw** ri-i.l and **brittK oftao** very thin, plate of a **paiplttb** • color whtjn frwh, whence i l[f- **local** iiAiiiu tif ///(« /'<«««•,' **tbo** l»Lrk of P. "Hi/rWw is somtiwhiil similar, Txit thu pi tes are mud) lurj^Tr.

Tin* timber it **exedlont,** lieaw, very toiiRk OBJ D ore ros inous even **titan Out of** 7*. *atutrnlig,* which it haeniMcfl ; **af« strij tewiah-teowii** *taA* *\<-*T mim* n.W (the **in** ner per don of encb riiiti. funntit **Mrlier** in the aL-iwm, Iwinj; **pftfar;** ll'i- **n«*«*** !•**• of later growth, brown); fibre con"er than in **«wfraJti ud** nmn) tciucioit^. It g»« T* rt lem h : * tr e of 22 inches diameter, and filtout Ud years ol!, ha^l in the MB I *"A 74 aniiunl ring•«, a»(J whitjf !tap«-iK«I 21 iiuiiira thick wifh r>" to 70 rings; another of over 3 fee* **dkmr:.-** |« It f(M)t **highland** 2«in n»in **old,** liad ft **mdiiW** "f **1"** **!«««*••** heartwood with aU-it 14 rings, and 3 inches of sapwood or fiO rin»!i Ttitiu tl. . . . vange rings of the heartwood were over i •'•«•»! tbtw* of the sapwood (because of later growth) about ide. The leaves of young re-quently in twrm. in older ones as of:••» iu tlirue* ; those of tree* from **twuup;** s<>il are nj•• to be shorter **ttrnn OthBl;** ihu **itewtOfe** in nil i>f thum is **Utfl** same.

Our species is closely allied to *P. Ciibensis* (see p. 185), and further study of the latter may possibly prove them to be nothing but geographical varieties. Meanwhile the constantly Ihree-leaved foliage, the larger number of involucral bracts of the smaller male flowers, the smaller cones with smaller, shorter-winged seeds, distinguish *P. Cubensis* from our species. Of the bark, of the timber, or of the behavior of the young cones in this species we know nothing.

P. Elliottii was imperfectly known to Elliott, and was considered by him a form of *P. Tceda.* Later botanists ignored it till Dr. J. H. Mellichainp of Bluffton, S. Car., rediscovered it about ten years ago and directed my attention to it Without his diligent investigations, ample information, and copious specimens, this paper could not have been written. At the same time I gratefully acknowledge my obligations to many botanical friends in this country and in Europe, and especially to the directors of the botanical gardens and the curators or possessors of the great herbaria, who most liberally furnished me with the material to carry on my investigations of the Pines and of the Conifers in general I am particularly indebted to Messrs. Bolandef, Brewer, Parry, and Lemmon for their contributions of the Californian and Rocky Mountain Conifers, and to Messrs. Canby, Gilman, Eavenel, and Mellichamp for those of the northern and eastern American Pines. [189]

EXPLANATION OF FIGURES.

Plate L Fig. 1. A branch, gathered in September, showing two mature cones, of the preceding yean, flowering, and three young ones of the spring. One-half nat size.

Fig. 2. Leaves in twos and threes. Nat size.

Fig. 3. Their close serratures. Magn. 60 times.

Figs. 4-7. Sections of leaves magnified 80 times; 4 and 5 of binate, 6 and 7 of ternate leaves ; the dncts are seen closely appressed to the sheath which encloses the vascular bundles; these bundles are, as in most pines, double, and either separate or closely approximate and almost united ; the ducts are wide or small, few or many, in these specimens, varying from 4 to 9.

Plate II. Fig. 3. Male inflorescence, capitate, with the elongated flowers in the axils of fringed bracts.

Plate I. Fig. 9. One of the flowers, magn. 3 times, exhibiting the calycoid involucrura.

Plate II. Fig. 10. A bract, and

Fig. 11. The involucrum from the dorsal, and fig. 12 from the ventral side, exhibiting the lowest lateral pair of bracts and the succeeding inner and upper ones. Magn. 4 times.

Plate L Fig. 13. Diagram of the involucrum with the supporting bract; the 2 outer scales are strongly, the 4 next ones slightly, keeled.

Figs. 14 and 10 bis. Effete anther from above and the aide, showing the transverse erect crest and one of the longitudinally opened cells. Magn. 10 times.

Plate II. Fig. 15. Female amenta in bloom, the axis above them already elongating.

Fig. 16. The same, a little more advanced.

Fig. 17. An ament magnified twice.

Fig. 18. A female flower (carpel scale) in the axil of the broad retuae bract — only the upper, cuspidate half being visible, and below the bifid' tips of the (rather clumsily executed) ovules — in February. Magn. 10 times.

Fig. 19. Female amenta, six weeks or two months later, recurved.

Plate I. Fig. 20. One of these, magnified.

Plate III. Figs. 21-24. Closed cones of different sizes and shapes, showing their variability.

Fig. 25. Base of an open cone with spreading scales.

Figs. 26, 27, 23. Scales of a cone. Fig. 26, dorsal view, showing the bract and the apophysb; fig. 27, Tiew from above, exhibiting the impression made by the seed and the surface from which the wing had become detached ; fig. 28, section of a scale with the seed (exhibiting the embryo) and wing.

Fig. 29. Seeds from the lower, and, *fig.* 30, from the upper aide, with differently shaped wings ; in fig. 99, the rough under surface of the seed is seen ; fig. 30 shows iU upper surface partly denuded of the wing-covering.

Figs. 31 and 32. Albumen and embryo of different shapes. Magn. 4 times.

Plate I. Fig. 33. A germinating seed in November. [190]

Fig. 34. A seedling of the following spring, exhibiting the 8 cotyledon*, the primary leaves, and upward already some pairs of secondary leaves.

The plates wire drawn on stone, from nature, by Mr. Panlus Rorttrr, late of St Louia, who had made himself to favorably known, aore than twenty years ago, by the beautiful Cactus plates published in the Report of the Mexican Boundary Coamlaloa, tad who has since greatly added to his lame and his usefulness by his artistic work in the Zoölogical InsUtaU in Cambridge,

X. COLLECTED DESCRIPTIONS OF CONIFERS

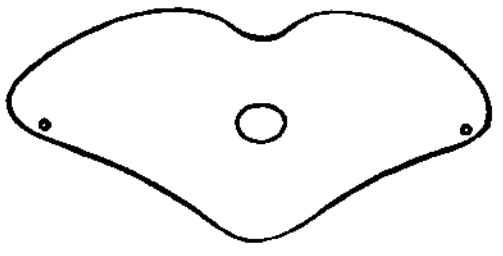
FROM THE GARDENERS' CHRONICLE.

ABIES MENZIESII and A. EXGELMANNI. — There seems to be a confusion in regard to them. In Colorado [790] they occupy different altitudes, — *Menziesii* the lower elevations, wet places, bogs, banks of mountain streams up to 8,600 feet altitude. Hence, up to the timber line *A. Engelmanni* is found, often forming large forests, or mixed with *A. lasiocarpa* (the *Abies grandis* of the Colorado botanists), *Pinus contorta, flexilis,* and *aristata. A. Menziesii* has * gray rough bark, which reminds one of an Oak, *A. Engelmanni* a thin scaly cinnamon-brown bark. The leaves of the former are certainly very stiff, and, at least in Colorado, spinous, pointed, and often flattened; those of *Engelmanni* much softer, thinner on lower, thicker and shorter on higher altitudes. Both extend north-west to Oregon and British Columbia, and there forms of *Menziesii* occur with obtuse leaves. In cultivation the *A. Menziesii* from the north-western sea-coast undoubtedly behaves very differently from that the seeds of which were obtained in the Rocky Mountains. The same difference, I suppose, exists between other Conifers common to both regions, *e. g., A. Douglasii, P. eontorta* and *ponderosa.* Now as to the light glaucous, or rather light blue variety of *Menziesii,* M. Andre" justly extolled, and very appropriately named it after Dr. Parry, who first introduced it. In several gardens at Cambridge, Mass., and the neighborhood, fine young specimens can be seen, well grown, of regular but very stiff outlines, in which even the rigidity of the leaves is detected by the eye, without the aid of the touch. Larger ones make a striking impression on the stranger in the lawns and yards about residences at Denver (Colorado) ; but he looks in vain for the tome in the mountains. The fact is, that the old tree is mostly irregular and ugly, and has a green foliage ; only the young branches of the spring, and still more the young sprouts, showing the peculiar whitish blue color, and many free* ahow scarcely any such tints. To be beautiful and striking it must be young. It is well known that the •ame color variety is found in many other Conifers. A striking example is *Abies concolor;* the young plants raised from the seeds I brought in 1874 from Glen Eyre, at the base of Pike's Peak, are whiter than that of *Menziesii,* while others show this peculiarity much less. I may a* well add the remark that *Abies concolor,* heretofore considered a most **** tree of New Mexico, proves to be common from Southern Colorado, through New Mexico, Utah, and Arizona, •ad throughout the Californian sierras. I have scarcely a doubt that the so-called *Abies grandis, Abies Lowiana,* and ^*oies lasiocarpa* (not the Oregon plant of Hooker, *FI Bor. Am.)* of these mountain ranges, are nothing but forms of this same *A. concolor.* — [June 23,1877, n. s., vol. vii.]

PORTLAND, OREGON, Aug. 6,1880.

ABIES AMABILIS. — In an expedition to explore the forests of the Pacific coast regions we, Prof. C. S. Sargent, [720] D*. C. C. Parry, and myself, three weeks ago ascended Silver Mountain, near Fort Hope, Frazer River, and found thm, at an altitude of 4,000 to 6,600 feet a fir which we recognized as the long doubted *Abies amabilis,* growing *ith *Tiuga Mertensiana. T. Pattoniana, Pinus aUricaulis,* and *P. monticola,* and rather higher than *Pseudo-Tsuga Douylarii.*

A few days ago Prof. Sargent undertook the ascent of the very mountain just south of the Cascades of the Columbia, where Douglas fifty-five years ago discovered *A. amabilis* and *A. nobttis,* and found on that classical ground, not only these two trees, but also *T. Pattoniana* and *monticola,* some *P. contorta* and a few feeble *Abies grandis.* The *amohilis* is there better developed tV"_further north, and we had photographs taken of specimens, copies of which I •end to you.



*IQ. 136. - ABIM AMAMLIB : DIAORAM OF SECTION OF LKAF SHOWINO THE POSITION OF THE RESIN-CANALS.

FIO. 137. - AMIGA AMABIMA : BRACT, SCALK, AK1) SEia)

It is a magnificent tree at about 4,000 feet altitude ;• the largest specimen, growing on the banks of a mountain *****, was probably 160 to 200 feet high, with a trunk alxnit 4 feet in diameter, branching to the ground and forming • Perfect cone of dark green foliage, The bark of the old tree is 1\ to S inches thick, furrowed and reddish gray, that of younger tree*, less than 100 yean old, is quite thin and smooth, light gray or almost white. It certainly is very do*ljr allied to *A. grandU,* but is readily distinguished by iU very crowded darker green foliage (whence the name

which I had given it in my Synopsis of the American Firs, taking it then for a form of *A. grandis,* viz., Tar. *densifolia,* was well applied), and its large dark purple cones. The technical characters ore the following : —

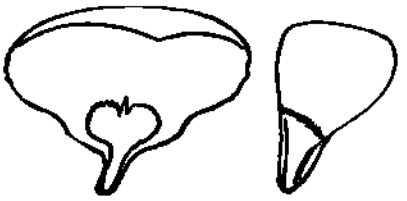


FIG. 138. — ABIES GRANDIS : SCALE, BRACT, AND SEED.

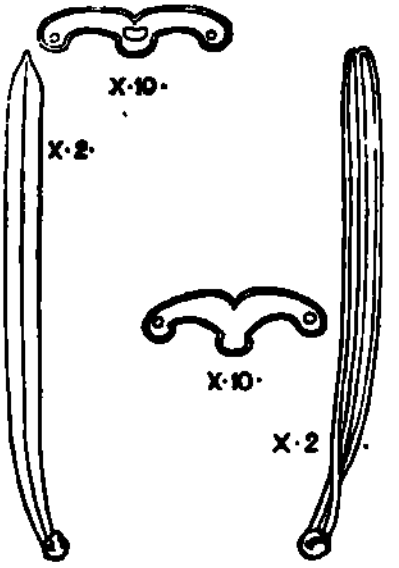
Leaves densely crowded, dark green, channelled, and without stomata above, keeled, and with two white bands below, slightly notched on the lateral and sterile branches, acute on the leaders and on the cone-bearing branches, (these acute leaves often with a few stomata on the upper side toward the tip,) resin-ducts close to the epidermis of the lower side (6g. 139).

Cones (fig. 141) deep purple, 4 and sometimes 5 inches long, 2 to 2£ inches in diameter, slightly tapering to a retuse tip ; scales in \\ order, not much broader than high, their bracts often more than half as long as the scale otovate, abruptly acuminate, deep purple upward (fig. 137).

Wings of seeds obliquely cuneate, as long as wide, or longer (Fig. 137).

A. grandis (which is common on the low lands along the rivers in Oregon, Washington Territory, and the southern parts of British Columbia, and abnormally ascends) has lighter colored leaves, usually longer, and always less crowded (distichous, with 2-4 ranks of shorter leaves on the upper side of the brnnchlete), also without stomata aliove, more deeply emarginate on the branches, obtuse or very shortly cuspidate on the fertile branchlets, acute or acuminate only on the leaders ; cones 3-4 inches long, \\ inches or scarcely more, in diameter, apple-green, and usually less resinous; scales much broader than high, their bracts about one-third the length of the scale, obcordate or retnse mucronate, light green ; wings of seeds hatchet shaped, wider than long (fig. 138).

A. amabilis has the purple cones and sharp-pointed leaves (on fertile branches) of *A. subalpina,* but this latter has not such crowded leaves, much smaller cones, and is especially distinguished by the parenchymatous resin-ducts. *A. subtdpina,* common in the Rocky Mountains, has been found also in Oregon (prolubiy only east of the Cascades) and northward, but we have not as yet met with it here.



Fio. 1S9.— ARIES AMABILIS: LEAF PROM 8TRRILR AND PROM FERTILE BRANCH, WITH SECTIONS.

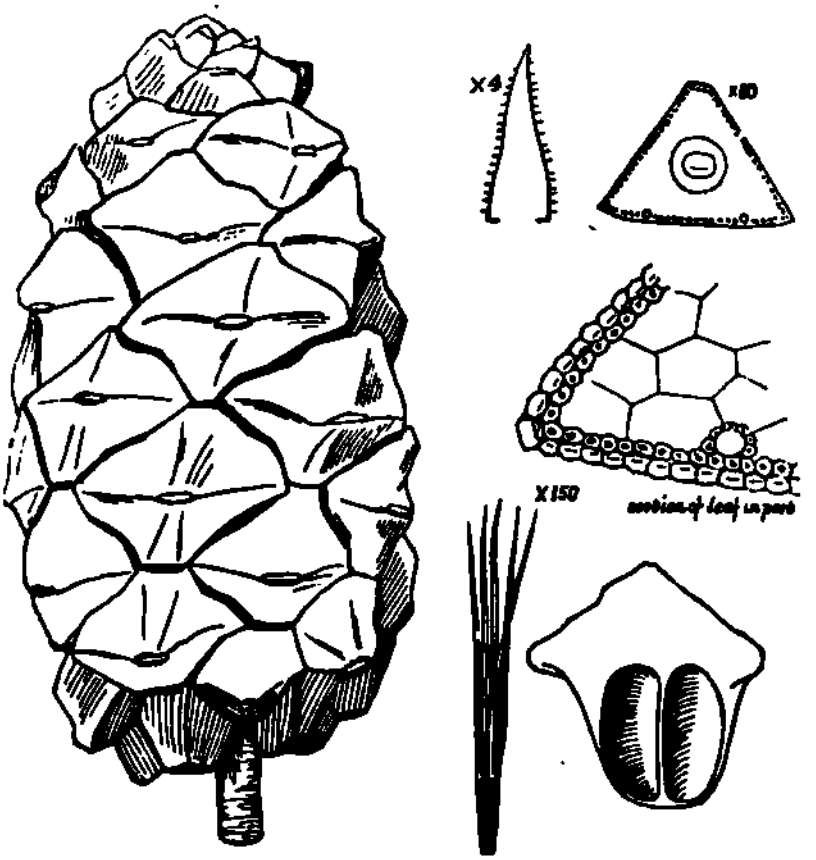
We send you a photograph of a cone-bearing branch, and, slightly smaller than natural, one of a sterile branch of an old tree (fig. 140) ;• on the latter you will see the crowded arrangement of the leaves; on the former the ahape of the cone, and the sharp-pointed leaves at its bases (fig. 141). It will thus appear that Lambert's figure of the cone-scale and bract of bin *Abies grandis,* though a little exaggerated, is in the main correct, especially as to the long, abruptly acuminate bract, the figure of which has given rise to the confusion with the California^ *A. magnified.* — [Dec. 4, 1880, n. s., vol. xiv.l

PICEA ENOELMANNI AND PICIA PU9GKNR. —In the *Gardeners' ChronicU* of December 24,1881, p. 888,1 [145] notice a reference to the lieautiful blue spruce of the Rocky Mountains, under the name of *Picea Engdmanni.* This is a mistake, which I have repeatedly met with. The spruce in question is my *Picea pungent,* formerly (but erroneously) referred to *P. Menziesii* (= *P. SUehensis),* of the Pacific coast The true *P. Engdmanni* is a second distinct species of the same mountain region, but occupying higher elevations. It forms extensive forests at an altitude of from 9,000 to 11,500 feet np to the timber line, and a scrub above it. It has pubescent reddish branchlets, square leaves less sharply pointed, and small cones ; its light cinnamon-brown bark is thin and scaly, and the leaves of young seedling* are smooth-edged. *Picea pwngens* has white glabrous branchlets, stouter, in old specimens somewhat flattened, spiny-pointed leaves, blue in young trees and in the young growth of old trees ; the cones are much longer and paler, the Urk thick, cracked, and grayish ; leaves of seedlings nomcwhM denticulate, It never occurs in forest*, but is scat-U-rwl uloiig the Umks of mountain streams at lower elevations than the other. Old tree* become l«re and quite unsightly, but the large (KIII* cones in their tops are a very conspicuous feature. — [Jan. 4, 1882, n. *., vol. xvii.]

TMI/UA PATTONIANA AND HOOKERIANA. — Perhaps you will permit me to venture a siiggmtinn in reference to two other West American Conifers which have occasioned a good deal of doubt, discussion, and hypothesis,— I mean *Ab**%* or properly *Tsuga, Pattoniana,* and *Hookeriana,* which are also mentioned iu the same page of the *Gardeners[9] Chr****** Prof. Sargrnt and inywlf have visited Jeffrey'* localities of Scott's Mountain, in North Califomia (not Oregon) «** &* mountains south of Fort Hope, on Frazer River in British Columbia, connected with the Mount Baker Rang* ** both localities (an in many others near the timber line in Oregon and California) the beautiful Tsuga now known every

• The Urge figures 140 sad 141 from these photograph* har« of naomity bwo omitted. — Eds.

where as *Pattoniana,* but in Edinburgh called *Hookeriana* — that with the angular leaves—abounds, with larger or smaller purple, or sometimes green cones. On the northern mountains only, and not in California, and where the Edinburgh *A. Pattoniana* with flat leaves is said to come from, *Tsuga Mertensiana* climbs up to the same altitude as the other, — smaller there, but otherwise undistingiiishahle from the seaside form. Now the leaf anatomy of the tree in the Edinburgh Botanical Garden, raised from Jeffrey's seeds, and cultivated there as *Abies Pattoniana,* is that of a true Tsuga, and cannot be distinguished from thut of *T. Mertensiana,* as the figure of Prof. McNaḃ in Proc. Roy. Irish Acad., vol. ii., pi. 23, fig. 2, under the name of *Pinus Pattoniana,* shows, and as I have myself found it in examining the Edinburgh specimen ; but the original figure in the so-called Oregon Committee's Report is that of the angular-leaved tree called there *A. Pattoniana,* and now generally known by this name, or sometimes as *A. IViUiamsoni.* Now, is not the flat-leaved tree called in Edinburgh *A. PalUmiana,* the mountain form of *Tsvga Mertensiana?* This I suggest as a plain solution of the difficulty. The only objection seems to lie in the reported size of the cones of this species, which are said to bë* nearly of the size of what we now call *Pattoniana,* and much larger than those of *Mertensiana;* but may there not be some error or confusion about these cones ? At all events, I cannot distinguish the Edinburgh *A. Pattoniana* from *T. Mertensiana,* nor the small mountain fonn from the colossal seaside trees of this species, and 1 find no third species.—[Jan. 4 1882, n. s., vol. xvii.]



Fio. 125. — Pnnr. LATIBQUAMA : Cowia, LEAVES, AND FRUIT-MALE. ACTUAL SIZE J LBAF-SECTIOK. MAGNIFIED.

PINUS LATISQUAMA,n. «p., I name [712] an interesting new pine, discovered by Dr.E. Palmer in 1880, in the mountains •outh of Sultillo, Mexico. It belongs to the Pinasters with peripheral ducts in the leaves and with subterminal cones. The short (1| to 2 inches long) extremely slender and slightly serrulate leaves are in fives; their lanceolate, almost entire bracta, •nd their loose sheaths are quite deciduous; the ovate subcylindrical cones, 3 inches or more long, are peduncled and subterminal, •• vrthey are produced above the uppermost leaves of the season, and between them and the terminal bud or the shoot of the following season ; their chestnut-brown, shining scales are obliquely rhomkw'd, very broad, transversely carinate, with the umbo depressed and without a Prickle; the lowest scales of the cone have the form of reflexed tubercles ; the seeds apparently large and wingless (fig. 125, p. 713).

This species, about the habit, bark, and timber of which nothing further is known, has very peculiar alliances. B» fotage ind if .heath., and the position and the peduncle of the cone, would make it a Strobu*, if the form of the •one^cdeadid not constitute it undeniably a Pinaster ; it is evidently most nearly allied to tjecembroid or Nut-Pines, »*t Medea from them by the leaves being serrulate and the cone-scales being without those bosses which are so pronu-*«it in the true Nut-Pines. The leaves are among the thinnest pine-leaves known, scarcely one-third line wide ; they »ave two very inmll ^ripheral ducts on the dor*d side, separated from the epidermis^only by the simple layer of hypoderm cells which underlie the epidermis all around the leaf. The cone here figured (fig. 126), was ^ inches long, and 1| inches in diameter when duned, if H TM c k * ''lch Io!1* Thc *''*? TM'' ^^^ *!** ''?*'' he '' J ^ ᵇT •«* unusually wide for the size of the cone, 1 inch or more broad. Seeds were not seen, but the cavity of the scale •bow. that they are probably i inch long or over, and destitute of a wing. - [Dec- 2,1882, n. s. vol. xviii.]

Pimm OOHTOBTA.-The figure of *Pinu. cmloria* at p. 45 most probably represent, the broad-leaved P. [361] Murrayana, which i. a large tree with tall trunk 3 feet in diameter in tta aierras, 1-1* foot in the Rocky Mountains t Imt young tree, w i f of coune, remain bushy, clothed with branche. to the base The wood u .oft and white, Ufa .pruoe wood more than any other pine wood I know ; and if Uiere i. any .pecific character in the wood structure

it must be distinct from the true *P. contorta* of the coast, which has heavy, resinous, hard wood, like i\ *sylvestris;* but I confess that, with the exception of the breadth of the leaves, I find no other botanical characters to distinguish the two. Well grown cones of *Murrayana* are nearly symmetrical, others are more or less oblique, like those of true *cvnUyrta.* — [Mar. 17,1883.]

. FHOM "A NEW FIE OP THE ROCKY MOUNTAINS," BY LESTER F. WARD.

ABIES STTBALPINA, *Eng. n. sp.* Tall and slim, 80 to 100 feet high, often 50 feet without branches; bark "[555] smooth, white, and covered with vesicles to near the base ; leaves 6 to 12 lines long, less than a line brood, not twisted near the base, bisulcate and somewhat glaucous on the lower (outer) side, short-pointed, obtuse or slightly einaiginate, those on the lower branches 2-ranked and spreading, those on the upper scattered, crowded, and more or less appressed, shorter on fertile than on sterile branch lets; cones 2J to 3 inches long, 1} to 2 inches thick, solitary, erect, ovate or oblong, obtuse, greenish; scales 6 to 10 lines long and about as broad, horizontal and close-pressed, brood-cuneate, unguiculate ; the rounded upper margin somewhat reflexed and resinous, pubescent; bracts short, white with a dark base, erose-dentate all round, their slightly elevated summits furnished with a strong mucro; seeds large, the wing covering nearly the whole surface of the scale ; sterile amenU 2 inches long, 3 lines in diameter, marked longitudinally and somewhat spirally by the dark centres of the otherwise light brown mucronate scales. — *American Naturalist,* 1876, vol. x.

FROM THE BOTANICAL GAZETTE.

TSUOA CAROLINIANA, n. *$p.* A small tree of the southern Alleghany Mountains with larger (6-8 lines [223] long* f~l line wide), darker leaves than the common hemlock spruce, retuse or often notched at tip, without storaata above, beneath with two pale bands, each with 7 or 8 series of stomata; strengthening cells under the epidermis on keel, midrib, and edges; cones 12-14 lines long, scales oblong, much longer thin wide, in ^ order, spreading at right angles after maturity, broad bracts slightly and obtusely cuspidate; seeds (2 lines long) with numerous (15*20) small oil vesicles on the under side, twice shorter than wing.

Mountains of North and South Carolina, on dry slopes and ridges. —Smaller, stouter branched than *T.* Cbnacfault, from which it is always readily distinguished by its larger cones with wide-spreading scales. It was first noticed in the mountains of South Carolina by Prof. L. R. Gibbes of Charleston in 1850, who sent specimens to Prof. A. Gray in 1856, and in an accompanying letter suggested for it the name of *Pinus laxa;* he obtained it from both Caro- [224] linas. Prof. Gray himself bad already collected it in 1842 on Bluff Mountain, N. C , in foliage only ; and last year Mr. A. U. Curtiss again met with it " oa Pinnacle Mountain, N. G, a long ridge commencing about 8 niilet south of Hendenonville, probably 3,000-4,000 feet high, where in groups of only few trees it occupies slopes near the summit, and even cliffs, while *T. Canadentit* abounds in the ravines of the same region ; both species are cultivated side by side at the entrance of Mr. Middleton'* place at Flat Rock, 3 miles from Hendenonville, where their branches interlock and their differences are strongly exhibited.* I have not seen any young shoots of this species, and therefore cannot say whether their leaves are spinulose-denticulate, as they are in young plants of the two other North American species. These may be distinguished thus : —

T. CANADINSIS : leaves of the mature tree smaller (4-7 lines long), obtuse with 5 or 6 series of stomata on each side of the keel below,*destitute of any strengthening cell*; scales of cone in f onler. orbicular-oblong with broad truncate bracts; wing very broad at base, tapering, scarcely longer than the seed which shows 2-3 large oil vesicles.

T. MZBTEVSIANA has larger leaves, with two bands each of 7-9 series of stomata; strengthening cells few on the edges and very sparse on upper and lowerside of leaf; cones 6-12 lines long (not 1| inches, as sometimes stated), scales oblong, mostly a little narrowed in the middle, bracts slightly cuspidate ; seeds smaller with few oil vesicles, wings twice as long as the body of the seed. —1881, vol vi.

A few remarks by Engelmann on *Abies Fra$tri* and *A. bahamea,* entitled " Notes on the Coiiifene," will be found in the proceedings of the Philadelphia Academy for Sept 19,1876, pp. 173-175, and in " Gunlcner's Monthly," 1877, voL xix., p. 308. Their substance is contained in the descriptions of these species above. — EDS.

XL NOTES ON WESTERN CONIFERS.*

FROM THE BOTANICAL GAZETTE. VOL. VII. 1882.

In another publication I intend to give a full account of the observations on *Conifera* made in the Pacific [4] States, when with ProL Sargent and Dr. Parry I explored their forests, but it seems proper that I should not withhold any longer the principal results arrived at

Abies amabilis, (Douglas) Forbes, is not a variety of *A. grandi*,* as I had assumed, but a very distinct species peculiar to the higher mountains of the Cascade Range from Oregon to British Columbia. It is easily recognized by its dense, dark-green, glossy leaves, very white underneath, usually emarginate, but on the fertile branchlets acute ; by its large very thick purple cones and oblancenlate acuminate bracts.

Abies nobilis, (Douglas) Lindley, is peculiar to the higher mountains of Oregon and has not yet been found in California nor, as far as I can learn, in Washington Territory. Its grooved leaves crowded on the branchlets, and its large purple cones with long exaert recurved bracts, well characterize it. The tree on Mount Shasta which has gone by this name (also in the Flora of California) is distinguished by its quadrangular leaves, keeled on the upper side ; its large cones considerably resemble those of *nobUis* and have often, not always, exsert and recurved bracte; it is a form of *A. magnified,* Murr., the common Red Fir of the Califomian sierras, which has bracts normally enclosed.

Pinus reftexa, n. sp. *(P. JUxilis,* var. *reJUxa,* Eng. in Rothrock's Rep. Bot. Exp. Wheeler) proves to be quite distinct *from jlexilis,* not only by the reflexed scales of the cone, but also and principally by the long peduncled cyhndric female aments, erect in the first, recurved in the second year, which associate it with the true *Strobi,* while the large wingless seeds distinguish it from the other species of that section.

P. albicaulis, Eng., is specifically distinguished from *P. fiexilis* by its subglobose purple cones with short, thick •cales, and its thin white at last scaly bark.

P. *Chihnahuana,* Eng., observed by us in the Arizona Mountains, proves to be of peculiar interest as maturing ito cones in the third year, the only American species with this character, which I have found only once more in the Mediterranean *P. Pinto.*

P. Jeffrey,* Murr.f holds its characters well wherever we have seen it from the mountains west of Mount Shasta, where it was first discovered down to the San Bernardino Mountains, affecting more particularly the eastern slopes. The glaucous branchlets with pleasantly aromatic fragrance, thinner glaucous foliage, the great size of the cones with thin, spiny recurved mucro on the scales, large seeds and more numerous cotyledons, distinguish it from P. *poiukrosa,* which has brownish-green branchlets with a turpentine odor and dark green coarser foliage.

P. *Arismica,* Eng., has also been repeatedly collected by us as weU as by subsequent explorers, and the quests * kas been agitated whether it may not be also a form of P. *pmderosa.* The fact is that five-leaved forms of this •Pecies do occur on the Califoraian sierras (Lemmon) and on the Arizona Mountains (Lemmon, Pringle), but the [5] larger number of leaves is here a casual occurrence; the branchlets show the brown-green color noticed above, the leaves are dark green and have the structure described by me in Wheeler's Report. P. *Arizonica* has glaucous branchlets, thinner leaves, constantly in fives, and of different structure; its cones are thicker and shorter with much more prominent uoibos, bat not much weight can be put on this last character.

XII. MISCELLANEOUS PAPERS ON CONIFERJE.

MORPHOLOGY OF THE CARPELLARY SCALES OF CONIFEILE.

The true nature of the female flower of *Conifem* has been an important question among botanists since fifty [469] J*», when Robert Brown first announced the doctrine of their gyranospennous characujr. Without going into ^•ttils of the history of investigations and theories, it may be stated at once that the very thorough treatment of the questt** by 0.8teniel, published a few months ago in the Nov. Act. Nat Cur., voL xxxviil, as reported by Professor Eichler

,, • Reprinted in the *Gardeners' Chronicle,* n. •., vol. xvii., **• IB. 1882, p. 280. In this a>nnection mention iihould •» made of a lecture by Dr. Enaelmann it Washington Engdmann, printed in the *Gardeners' Chronicle,* n. s., vol. iiL JniTWi*, nportod in the *SI. Louis Daily Democrat* of March 27j|tf 6, p. 402, and the *Gardeners' Monthly,* June, march 6, 1875, nndur the heading The Forest* of the Rocky 1875, pp. ^-214, poaaeea more popular than scientific Mountains, and reprinted in the *Gardeners9 Monthly* for May- interest, and are omitted from thia volume. - EDS. July of the same year (pp. 151-158,181-184, 214-217), under the title The Conifer* of the Rocky Mountains. Tub and a note on Conifers from Colorado, baaed on the observation* of

in Flora of September 1, seems definitely to settle the controversy. The results of Stenzel's examination of numerous monstrosities of female flowers of the *Abies excelsa,* obtained at the limit of tree-vegetation on the Sudetic Mountains, is that Mold's view of the structure of the fruit-scale, based on the nature of the double leaf of *Sciadopitys,* is the correct one. The fruit-scale in *Abies,* and in all *Abietinea,* in this view consists of two leaves of an undeveloped axis, or branchlet originating in the axil of the bract, and the posterior (superior) edges of these leaves being connate laterally and a little backward, as the lowest pair of leaves or bracts in *Conifcrcc* always ore, the leaves turn their back toward the axis of the inflorescence (the cone), and bear on that side one ovule each. In *Cuprcssinea,* where the carpellory scale is peltate, and often bears numerous ovules, the same morphological explanation holds good, and even in *Podocarpete* and *Taxinea,* which have no fruit-scale, we must come to the same conclusion, assuming a [470] virtual suppression of the scale. The greatest difficulty seems to arise from the position of the ovules on the dorsal side of the open carpel, which is not seen in any angiospermous plants ; however, the anther-cells, which morphologically correspond to the ovules, are in *Conifsras* ulso borne on the lower side of the stamen-scale ; and for further analogy we have to look to the *Cycadea,* and, be it boldly announced, to the Ferns. *Lycopodiacev,* on the other hand, bearing the spore-cases on the upper side of the leaf, cannot be regarded as the progenitors of *Conifera,* as has been thought. The relationship of *Coniferce* is with *Cycadeas* and Ferns, while *Gnetacea* becomes still farther removed from them. The writer of this notice has seen monstrous (proliferous) cones of *Abies Engelmanni,* in Colorado, but only at the upper limit of tree-vegetation, under similar conditions to the European monstrosities. He has also noticed the foliaceous development of the carpellary scales, in monstrosities of *Abies Canidensis,* either into a distinct or a more or less connate pair of leaves ; but only at the base, not, as in other species, at the top of the cone. — *Amer. Jourtk Set. and Arts,* 3d Series, vol. xii.

THE GYMNOSPERMY OF CONIFE&fi.*

Celakovsky, who takes a high position as a morphological botanist, mentions that in the year 1874 he pub- [311] lished in Flora an article opposing gymnospermy. He now announces that he has changed his opinion, having satisfied himself of the truth of this doctrine. The agent of conversion was a monstrosity of the Norway Spruce cone, like that from which Stenzel made out the now accepted morphology of the cone, and the same monstrosity as flint which Broun studied in the Larch, deducing from it the accepted doctrine many years ago. The essential point in this monstrosity is that the bracts of the abnormal catkin develop into leaves, and the carpellary scale before it into a pair of leaves transverse to the bract. The abietinous carpel consists of these two leaves united by their posterior edges (i. e., those next the axis of the cone) into a scale, the back of which therefore faces the axis of the cone, and bears the ovules. The lower part of these catkins is usually normal, the apex by prolification is gradually transformed in the manner here specified, and becomes a leafy branch. Dr. Engelmann, in this Journal, three years ago, gave a confirmatory account of an analogous monstrosity in the Hemlock Spruce, but in which the transformation was at the base of the cone, the lower bracts leaf-like and with a pair of leaves in their axil, the following bracts more and more scale-like; the geminate leaves in their axil were partially united, next forming a scale with a cleft or notched apex, then an entire carpellary scale, in the axil of a normal bract.

Celakovsky, having now seen the Spruce monstrosity for himself, adopts the inevitable conclusion, and applies it well to the settling of the question of gymnospermy. He declares that the dorsal origin of the ovule of the *Abietima* proves that it is no axillary production, aud thus the main support of those who take the ovule for a simplified female flower falls to the ground. Moreover, the ovules of *Conifer** in retrograde metamorphosis never change into shoots, but simply disappear. If flowers, they would be expected sometimes to become foliaceous branchleta. So Celakovsky regards it as demonstrated that they are outgrowths from the dorsal face of the leaf, analogous to the sori and indusia of Ferns. He cites the indusium of *HymenopkyUum* as an instructive analogue, only it is marginal; that of *DaxUlia* is somewhat dorsal; that of *Oyaihea* wholly so and yet cup-shaped. He goes on to say that the gymnoepermj of *Atnttintm* being thus proved, that of the rest of *Conifer** follows of course ; that Braun has seen similar pro- [319] lification in the catkins of *Tasodinea,* in which the carpel-scale was replaced by a bud; that, although the carpel-wale in *AbuHnea* consists of two leaves, the bud may in other cases develop more than two leaves, so that the lobed scale of *Cryptomeria* may be composed of as many leaves at there are lobes. Moreover, although the ovules in *Abietinea* originate from the scale, the greater part of the scale is developed after the formation of the ovules; and in *Cupnssus* the scale is developed even an late as the following spring, while the ovules are produced in the autumn. However the case may be disguised, Celakovsky asserts hit firm conviction, 1st, that an ovule can only be developed at depending on a carpel, and, H that its nucleus represents the Biacrosporantfum of vascular cryptogams. He adds that this is the logical consequence of the theory of descent, and must be true if the doetrine of the genetic connection of the vegetable world is true. He consideoa^at Van Tieghem and Strasburjpr have proved the seemingly simple •cab of *Owffmni$m* and *Tandinm* to be efl|osed of bract and carpel-scale united (which indeed it evident in To*

• Iforiew by Engt-loMnn and Gray of a paper by Dr. L Celakoriky, in Flora for June, 1879, Nas. 17 and 1&

odinem), and that Braun has confirmed this by the study of proliferous cones. As to the development of ovules earlier than the carpels they belong to, this is said to have been observed in some Angioepenns also, as in *Cuscuta,* in which at first four naked ovules appear. The anatomical organogenist may argue from this that ovules and carpels are independent productions, but Celakovsky insists that he will argue wrongly.

This brings our author to the consideration of the structure of *Taxinece.* This is environed with difficulties, and explanation is only conjectural. Here the disc, arillus, cupula, or whatever it be called, makes its appearance where no trace of carpellary scale is to be seen. Celakovsky inclines to the view that this organ, occurring in whatever form, is most probably the carpellary scale itself, very tardily developed. In *Dacrydium* the cupule is homologous with that of *Taxu$,* but oblique. *Cephalotaxuu* has no scale and no cupule, but seems to correspond with *Cupremneas,* and shows a* maturity a small flattened rudiment between the two ovules, which is probably a rudimental carpel-scale. *Qinkgo* is the most puzzling; yet it seems probable that the biovuliferous peduncle represents the abietinous carpel-•cale, the peduncle itself being its elongated base. The cupule of *Taxut* may be either a simple circular carpel, or may consist of more than one carpel. The apparently terminal* ovule of *Taxus* and *Torreya* he would regard as axillary to one of the uppermost subtending bract-scales ; for be will not concede that the ovule can be wholly destitute of a carpellary organ. Yet he might do so, in one sense ; for if the carpel may develop very late and very imperfectly or very little, it may sometimes not visibly appear at all, and so the phyllome be reduced to the ovular outgrowth.

Finally Celakovsky notes, that if the ovule of *Taxut* and *Tcrreya* be axillary to an uppermost scale, it would originate not from the dorsal but from the ventral face, i. e. from the upper side of the leaf; which [313] would distinguish *Taadnew* from all true *Conifcm* — a view which would not be destitute of important support. For both Braun and Mohl have seen apparently androgynous scales in some *Abietiruce.* In a monstrous Larch-ament, among carpellary scales with normally dorsal ovules Braun found one with ovules on the opposite face ; and Mohl describes and figures an androgynous inflorescence of White Spruce, with pollen-sacs on the outer face, and on the other a pair of knobs which from their form and position might be token for imperfectly developed ovules. But this latter case seems most ambiguous. If it was in a male catkin, the upper part of which had become female by the development of carpel-ocales in the axil of stamens partially transformed into bracts (which is the case we have before tu in a monstrosity of Hemlock Spruce), then the quasi-androgynous scale in question may have been the normal abietinous carpel-scale itself, with the polliniferous bract behind it and connate with it.

The androgynous spike of Hemlock Spruce before us is below normally staminate; above some anthers are •lightly scarious-winged at one side of the projecting tip, another has this wing developed into a bract-like body on the whole of one side; next there is a bract with a single small pollen-sac on one side of its back, and in its axil a well-towwd and biovulate carpel-scale. — *Amer. Jour*. Set. and Artt,* 3d Series, vol. xviii., Oct. 1870.

ON THE FEMALE FLOWERS OF THE CONIFERS.

~*~ Under this heading Professor Eichler of Berlin gives his latest views about this important subject in the HonataberiehtederK.Acad.derWiss., Berlin, 1881. He takes it for granted that the morphologiste of the present [419] 4*y are agreed that the male/ouerv are the aggregate of stamens which were formerly (and still by Parlatore in DtC- Prodromus) considered an ament, i. e. an inflorescence. He now tries to prove that what we call the female am«nt is perfectly conformed and corresponding in every respect to the male flower in position as well as in structure, and thufl is also a single flower and not an inflorescence.

The simplicity of such an arrangement, the uniformity in the structure of the male and female organs thus established, are certainly seductive, and in the author's opinion the difficulties in his way are readily enough removed. The Principal difficulty is found in the presence of two foliaceous organs in the female flower, one, now called the ovule-tearing or carpellary scale, inside of another, the bract, while the male flower consists of a number of simple pollen-**aring bracts (the stamens) arranged around the axis. Now, according to Professor Eichler's view, the carpellary *ale it not a distinct organ, but really only an appendage, a ventral excrescence, a ligule, if it may be called so, of a kaf (the bract), bom from it and belonging to it; he therefore recognizes only one organ, the bract, and the so-called *arpelUry scale as to appendage, —a view already indicated by Sachn. He reviews and controverts the views of pre-*4tag morphologifto. Robert Brown declared the carpellary Male to be a leaf in the axil of the bract; but this is a "torphological impossibility. 8chleiden and Strasburger took it for a flattened axis; but the arrangement of the ""dta of Teasels makes that untenable. Van Tieghem thought it was a leaf median on an undeveloped axillary bud, ** *Confirm* never do produce such median leaves. A. Braun, and after him Caspary, were the first to recognize in th•/fcafc a compound organ, consisting of two lateral leaves of Mich an undeveloped bud, connate on their lower side; |*"*t«d, and more decidedly Mohl, showed that these two leaves were connate with their posterior edge*, turning their J* toward the main axis, and Mohl happily compared the scale thus constituted with the double leaf of *Sciadopity$;* Jlfc, however, seems impossible to Professor Eichler, because nothing Mm of such an assumed undeveloped axillary *Mt and because the distribution of the veaels in the scale does not indicate a double origin, as it does distinctly in

Professor Eichler insists tbat the carpellary scale of *Coniferm,* though often apparently separated from the bract, is really not a distinct organ, but, as stated above, a ligular appendage of the upper face of the bract He shows that in such appendages the vascular bundles are always arranged in a system opposite to that of the leaf from which they originate; if they spring from the upper side of the leaf, this upper side is turned toward the upper side of the leaf, and if they come from the dorsal side, their dorsal side is turned toward the back of the leaf, and in either case the arrangement of the vascular elements is reversed. In every leaf the xylem (wood-cells) occupies the upper or [420] ventral side of the vascular bundle, and the phloem (formerly bast or soft bast-cello) lies below it or toward the dorsal side of the leaf. This is so in the coniferous leaf as in all others, and in the bract, while the ligule or carpellary scale shows the arrangement reversed, — a well-established fact. This carpellary scale wherever it exists (principally in *AbUtinea)* beam on its back one or several ovules. In *Araucaria* it is a small process, of ligular form, from the middle of the leaf-bract, with one ovule ; in *Cunninghamia* it is a narrow transverse crest with three ovules ; in *Cryptomeria* it is a jagged crest, at last much larger than the bract itself; but in *Damara* no trace of an appendage can be found. The same is the case with most *Taxodinea,* where only a certain thickening of the bract is noticeable. But in *AbUHnem* we see two apparently distinct organs ; examining them, however, more closely, we find them always cohering at base, and where they at maturity separate from the axis as in *Abies* and *Cedrus,* they fall off together, as they should do, where one is only an appendage of the other. In *Cupre$sinew* no carpel-bearing appendage at all is observed, and the ovules are as nearly axillary as possible, or, where there are many, they seem to spring partly from the base of the bract and partly from the axis itself; but the thickened upper side of the scale shows also a reversed arrangement of the vessels, " as it cannot be otherwise, where the leaf is so thickened on the inner side that at last it even becomes peltate." The other *Conifer** follow the same rule, the ovules stand in the axil of the bract; but in *Taxima* they are terminal products, surrounded by the uppermost leaves or bracts.

The proliferation sometimes observed in the female flowers of *Abietinem* has been thought to furnish proof for the axillary nature and distinctness of the carpel; but Professor Eichler is satisfied that the abnormally developed branchlet is not the development of a supposed carpellary axis, but a really new axillary production of the bract therefore between the carpellary appendage and the main axis, and that the division of the carpel into two pieces, often noticed in such monstrosities, is produced by pressure only.

Eichler then compare the ovule of the *Conifera* to the sporangium of allied vascular cryptogams, and finds in *IoeU* the sporangium on the base of the leaf where also a ligula is present, in *Lycnpodium* in the axils, and in *Pstiotum,* at the end of branchiets. The essential character of gymnospermy, however, be finds not as much in the open carpel which also occurs in some higher organized plants, as in the absence of a stigma and in the immediate action of the pollen on the ovule.

In a second paper, " Uebcr BiMungwibweichungen bei Fichtenzapfen " (Sitzungab. d. K. Ac. Wiss., Berlin, 1882), Professor Eichler gives us a careful analysis of monstrosities observed on the Norway Spruce, and of one on the Himalaya Hemlock, and tries to show how former interpreters had inisunderntood their teaching, and how these examples fully confirm his own views, expressed in the foregoing paper. He has procured the very specimens [421] which Stenzel, Willkomm, Oersted, and Parlutore had examined, analyzed them with great care, and gives figures and sections of the principal forms found. He demonstrates that the so-called fruit-scale in those monstrous cones is not divided into two lateral leaves, but becomes irregularly toothed, folded or lobed, sometimes simulating two or more leaves, and finally develops a knob and at last a bud, which may and does sometimes grow out into a branch, always on the inside of and adnate to the metamorphosed scale, i. e. on the side toward the axis of the cone, often enveloped by its folds, but never between it and the bract, which ought to be the case if the now prevailing view of the najture of the scale (as formed by two lateral leaves connate on their axial side) were true.

Unfortunately he has not hail occasion to examine Much monstrosities where these two leaves are foliaceom, partly or entirely distinct, originating not from the base but from the very axil of the bract, and not divided by any possible pressure, such as occur at the base, not at the top, of proliferous cones of *Tsuga Canadituu.* In such cones the transformation progresses from a pair of separate leaves in the axil of a leaf-like bract to the partly united, then to the small and notched scale, at last to the large ovuliferons scale in the axil of a small retnse bract.

It may be stated in passing, that the first lateral bracts at the base of a shoot, in pines at least, are *not* inclined outward or toward the supporting bract, but rather decidedly inward, toward the axis, and are overlapping on the inner and upper side of the shoot, leaf-bundle, or flower.

Professor Eichler has given us a very valuable contribution towards the solution of the interesting question he treats of; but he has not yet settled it, and it will continue to tax the ingenuity of morphologists.—*Anur.JoHm. Seu and ArU,* 3d Series, vol. xiiii.

THE FEMALE FLOWERS OF CONIFER A

Professor Eichlcr's paper on this iubjJt review*! in the May number of this Journal, has indueed Professor OtlakoTsky to n-investigate this subject, morphologically so important, and to which he had already 4er*t*4 much atUntkm. In the Abhandl. d. K. Boehni. Qes. d. Wist, he has recently published his present vfcwt, fai am extensive

article, illustrated by a plate. After reviewing the different theories and explanations enunciated eince Robert Brown's time, he dwells emphatically on the great importance of the study of the *anamorpho*e$* (us he calls those monstrosities which are the result of retrograde metamorphosis, in contradistinction to mere pathological alterations) aud of the teachings they convey. He comes to the conclusion that these are a much safer guide than the microscopic study of the genesis of the organs, which has often misled those who too implicitly relied on its teachings. Investigating the anamorphoses of the Norway Spruce, he finds the two lateral carpellary leaves distinctly indicated and more or less separated and developed. In more evolved cases an anterior and then a posterior bract make their appearance : these, Professor Eicbler had taken for a third and fourth lobe of his ligilla. It must be stated here that normally the posterior bract is the third and the anterior the fourth in order. Celakovsky comes to the conclusion that, at [234] least in *AKetinea,* Eichler's theory — that the carpellary scale is a mere emergence or ligule of the bract— Is quite wrong, and that Mohl's view (1871)[1] —that the carpellary scale of these plants consists of the two connate lowest leaves of an axillary, otherwise undeveloped, bud connate at their upper edge and producing the ovules on their hack,— is amply vindicated by all known morphological facto and is antagonistic to none of them.

He further concedes that the same explanation may possibly be the true one for all conifers, and that all morphologisto who have treated this questlon thiw far, have, whatever their views, assumed a conformity m this respect in all the tribes of conifers, and a complete homology of their female organs. But he thinks that this is not necessarily so, and that Sachs'and Eichler's emergence or ligular theory may be true as to *Arawnriea,* and that thus the cone of these plants is really and truly a single flower. In regard to *Taxodinea* and *Cupreuiiicn* he is convinced that an inner fruit scale really exists, completely adnate to the bract and soon outgrowing it, but he does not venture to pronounce on its nature, because he thus far baa no ocular demonstration of it through any anamorphosis.* Professor Celakovsky concludes that the arilliw of *Taxaeem* corresponds with the ligula of *Arawariem.* He speaks of the *terminal* position of the ovule in this tribe as of very little morphological importance, being really a lateral ovule pushed to the top of an axis.

It will be of interest to those who have been misled by contrary statements, to learn that that 0. Heer, the celebrated phyto-paleontologiHt, has shown that geologically *Abietitu** and *Taxodiru** are the oldest conifers now known, appearing already in the Carboniferous period, while *Araucarie** come up much later in the Trios and Jurassic formations. But relative geological age of the different tribes of plants is of much less importance for the appreciation of their degree of development and their position in the system than some suppose. Thus the *Cycad***, the pha> nogams most cloeelv allied to the vascular cryptogams, are, as Professor Heer states, very uncertain in the Car- [235] frttifcroot, and make their decided appearance first in the Permian rocks: therefore much later than the higher developed conifers. - *Am*. Jaum. Sd. and ArU,* 3d Series, vol. xxiv, 1882; *Bot. Gazette,* vol. vii. pp. 104-105.

PINUS SEBOTINiE, OR PINES THE CONES OF WHICH OPEN LATE, OFTEN LONG AFTER MATURITY.

Michaux was the first to notice that the cones of a certain pine of the Southeastern States "arrive at [126] Wrfwity the second year, but do not release their seeds before the third or fourth," and he therefore named it *P. mntima.* It is now thought that this tree is scarcely distinct from the northern P. *rtgida,* and I have seen specimens of the latter in which, also, some cones remained thus closed after maturity. The same fact has been observed by Dr. Chapman in a pine of Appalachicola, which he doubtfully referred to *P. inop$.* Though its much more slender and Wicate leaves also distinguish it from true *P. inop$,* every other character is the same as in that species, so that we •» justified in introducing it as *P.* inapt, w. cfouw, Chapman.

Here, then, we have two northern pine*, southern forms of which show this « serotine" character. But it seems ** generally known that quite a number of western and of Mexican pinen also often open the scales of their cones

[1] It appears now that A. Braun has expressed the same 2"* as early as 1842 in the French *Om^e ecientifaue* at Strasburg, in the report of whose proceedings it U published. He often threw out such hints from the rich treasures of his investigations, but with characteristic modesty he gave them * •clence without urging them or claiming scientific probity "Priority in them.*

rf "_J ^ writer of this ii in possession of a proliferous cone *Sequoia giganUa* which seems to prove, not only that the *TM t-scale in this .perfe* <»nd consequently In the whole tribe) » neiiiologous with that of *Abuiinnr,* in so far as it consists 7 j •* •*Ul*ry »hoot, yet that these leave* are not a W pit bat, as A. Brian has long ago suggested, in regard to *Ciipreesinece,* that there is a number of leaves, laterally coördinate and connate, bearing a number of ovules on their back.

• It might be well to draw attention to the singular fact, that in the allied gymnospermous family of *Qntlacccc,* the female flower (for such it is now assumed to be, the outer integument or utricle being considered as a two-leaved carpel) is always referred to as " terminal," whether single, double, or triple, while a terminal orpin cannot be otherwise than single* The fact is that the female flowers are here axillary in the axils of one or more of the uppermost bracts, and, if single, are pushed to the top of the shoot.

long after maturity, or sometimes never. Those of our flora are P. *contorta* (with P. *Murrayana, P. Bolanderi,* etc.), P. *muricata (Edgariana),* P. *tubcrculata,* and aboVte all P. *insignis (radiata, Montcragenris,* etc.).

The following important biological questions remain as yet unanswered, waiting for the patient investigation of students, who live in the countries where these trees grow : —

1. Do the cones of these species never open as soon as ripe, but always remain closed until some time, a year or years after maturity ?

2. Do some cones open when ripe, and others of the same tree years later, and some never ?

3. Does season, locality, or individual character of the trees have any influence on this peculiarity ?

4. At what season do the late cones open, under what physical conditions, and what is the cause of any of them remaining closed forever ?

5. How many years do the seeds of such closed cones retain their vitality, and is it possible that the seeds may germinate after the cones have fallen to the ground and rotted ?

The supposition that the closed cones were sterile or contained too few seeds, did not prove correct; it seems that all cones of the several species in question contain comparatively few seeds : the seeds of closed cones, many years old proved perfectly sweet, and therefore probably sound. — *Botanical Gazette,* vol. ii., Aug. 1877.

VITALITY OF THE SEEDS OF SEROTINOUS CONES.

On page 64 Prof. Sargent gave the results of his experiments with serotinous (closed) cones of *Pinus* eon- [62] forte, which I had collected in 1874 in Colorado, kept for more than four years in a garret, and sent to him in the spring of 1879. Seeds of cones 13 years old and 10 years old did not germinate : one out of six of 9 year old seeds, one out of eleven of 8 year old seeds, one out of three of 7 year old, and one out of four of 6 year old seeds germinated and grew up well; those of 5 year old cones did not come up. Prof. Sargent pronounces the result to be unsatisfactory. To me it seems to be eminently satisfactory. It proved that part of the seeds from cones 5 to 9 years okl had retained their vitality and that those that are older than 9 years failed; younger ones would undoubtedly have also germinated had such been experimented upon. The result shows that pine seeds of serotinous cones, or, to be more exact, seeds of *Pinus contorta,* kept under the circumstances detailed above, could and did retain their vitality a number of years, — even nine years, — while the perishable nature of pine seeds under ordinary circumstances is well known. The economy or the effect of keeping the cones closed is therefore evidently the preservation of the vitality of the seeds for a number of years beyond their maturity. What is not fully known and what will have to [63] be investigated is how and when such seeds of serotinous cones are eventually liberated and made available, and whether not a great many of them at last perish, the cones never opening. —*Botanical Gazette,* voL v., June 18801

SEQUOYAH.

In last Sunday's issue you revive the almost forgotten, though moid interesting history of the invention of the Cherokee alphabet and written language by the half-breed, Sequoyah, and mourn that to-day no man can point out the spot where moulders the dust of the Cherokee Cadmus.

His resting-place may be unknown, but his name and his memory live in the most magnificent vegetable* of this continent. The mammoth tree of California has been claimed by Englitih as well as Americans for their greatest men, and has been named by the former *Wellington** and by the latter *WathingUmia,* but a celebrated Vienna professor, Endlicher, as eminent a botanist as be was a linguist, had already, in 1847, established a genus which comprises the mammoth trees as well as the scarcely less magnificent Red Woods of California, anil had named it *Sequoia,* in commemoration of the aboriginal linguist; and as long as botanical science exinU both these wonders of the western world will perpetuate the name of the Cherokee Cadmus. — *Missouri Republican,* Sept 88, 1873.

VIII.

PAPEES ON AMERICAN OAKS.

1 ABOUT THE OAKS OF THE UNITED STATES.

FBOM TOT TRANSACTIONS OF THE ST. LOUIS ACADKKT or SCIKNCI, VOL III. 1876-1877.

, _ ^B nave l^ite »large number of oaks in the United States, which for more than a [372 (1)] Hundred years have attracted the attention of botanists, and we thought we knew them P»t$jr well, i e. we thought we could distinguish, limit, and group the species. That may have wen w, to a great extent, in the old States; but when the Bocky Mountains came to be explored ana_the regions west of them, new forms were discovered, and often on single specimens, and not »reiy on imperfect ones, species were founded and incompletely described, so that now a' straight dear path through such intricacies is difficult to find.

A striking example of the deceptive polymorphism of these western oaks is furnished by the wmmon Kocky Mountain scrub-oak. This interesting species grows on the foot-hills of the eastern <P« of the mountains of Colorado, sparingly near Denver, scarcely north of that city, but abun dantly inter 80Uthward, about the Pike,9 Peftk region, ftnd ^ence extends through New Mexico eastward" TM» Texas, and westward through Utah and Arizona into Southern California. The centre of dis- -nroution perhaps, at all events the classical locality of this species, is the mountains above C*n_pu GKy. in Southern Colorado.

In the valley and on the mouutain slopes about this place the oak thickets abound, 6-8 feet »gn, single trees occasionally 4 or 6 inches thick, and rising up to 12 or 15 feet, rareiy higher, leaves are 3-4 inches long, broadly obovate, deeply lobed, sometimes pinnatifid, traerneath stellate-pubescent; the broad lobes obtuse or retuse, often again 2-3-lobed' [373 (2)] V bear middle-sized or small oval acorns, in more or less knobby, hemispherical cups. scattered copses of these broad-leaved oaks, often of a beautiful brownish-purple in September, Jj^mpany us to within a few hundred yards of the top of the cafion, but here the character of nanse shrubs changes: the bushes are lower, the leaves smaller and in outline narrower, the lobes dinT!? *nd m06tly undivided, but 8tiU obtu9e. Now we near the Precipice itself; from the ragged and fbam We hePe and there ** a glimp8e of the y0UDg ArktMM» who8e clear, green waters toss' the pWn tWdVe OT fifteeQ hundred feet under w, throu&h the inaccessible gorge, rushing toward leaveTo* ^ o*k bU8he* accom Pan?r us even here> but now the y are onlv ±4 feet high, with teeth t«. !?Ch^* l0ng* ovat «- lan<5eolRte in outline, no longer lobed, but coarsely dentate, the acute few TMminatin8in a 8har P point: the acorns are scarcely different from those noticed before. A 3 or 4f IDOrB, and we have reach"1 the brink of the precipice itself; oak bushes here too, but only k*otfeet high, with small (1 inch long), oval, firm, almost cartilaginous, semipersistent, spiny- •malllr fI?' here tDd there Wkh onIy Very feW leeth or quite entire; the acorn8 Proportionately and -w, or the same short oval shape, or often elongated from an unusually small, scarcely knobby •onetimes peduncled cup.

We feel satisfied that we might have abundant material to characterize several distinct species, certainly 4 or 5 well-marked forms, and, indeed, they have been considered such. The first is Nuttall's *Quercus Gambelii (Q. stellata,* var. *Utahensis,* D.C. Prod.); the second is *Q. alba,* var. *Gunnisoni,* of Torrey; the third, with acutish lobes or coarse teeth, is Torrey's old *Q. undulata* of Long's Expedition, the first oak obtained from these mountains, and described about fifty years ago; the fourth, from the edge of the precipice itself, is what has often been mistaken for Torrey's *Q. JZmoryi,* or what has been named *Q. pungens,* Liebm., in part; with it occur entire-leaved forms, which seem to unite with this as a fifth form the *Q. oblongifolia,* of the same author, and *Q. grisea,* liebm. As a large and broad-leaved southeastern form, somewhat allied to *Q. Gambelii,* I consider *Q. Drummondii,* liebm. In herbarium specimens they all appear distinct enough, but, looking around us, the very abundance of material must shake our confidence in our discrimination: [374 (3)] within the compass of a few hundred yards we find not only the forms above distinguished, but numbers of others, which are neither the one nor the other, but which are intermediate between them, and clearly unite them all as forms of one single extremely polymorphous species.

If one oak behaves thus, why not others ? Thrown into a sea of doubt, what can guide us to a correct knowledge ?

Though oaks are so common and such well-studied plants, I venture in the following pages to repeat old observations, in order to combine with them some which I think are new, and which will help to throw a little more light on the subject

The TRUNK — its BARK, as well as its WOOD — is what we first contemplate, and this at once takes us to one of the principal points I wish to discuss.

That the *trunk* is that of a large, sometimes one of the largest, or of a middle-sized tree, or occasionally that of a shrub, even a very low one, is well known. On the Atlantic slope of the continent most species of oaks make trees, and only a few are known as shrubs; I can now recall not more than one species, the live-oak of the south, which occurs in both forms: usually an immense tree, it occasionally bears a rich harvest of fruit as one of the smallest bushea But it is different on the Pacific slope; there we find many oaks as trees in the lower countries, and as shrubs, usually with smaller foliage and smaller fruit, in the mountains. The lesser number of oaks seem to occur solely in one or in the other of these forms.

Examining the *bark,* we at once become aware of the fact that the popular distinction of " white-oaks " and " black-oaks " is based on correct observation. The paler, ashy-gray bark of the former, and the darker, often nearly black, color of the latter corresponds, as will be shown, with other essential characters, and well marks the two principal groups of our American oaks. The bark of the white-oaks is inclined to be scaly or flaky, that of the black-oaks is usually rougher, and deeply cracked and furrowed.

The *xoood* of the white-oaks is tougher, heavier, and more compact, — the only oak-wood which is fit to be used by the wheelwright or cooper, and is for their purposes unsurpassed. The wood of the black-oaks is brittle and porous, makes poorer firewood, and, made into [375 (4)] barrels, holds only dry substances. Undoubtedly the microscopical investigation of both classes of oak-wood will scientifically establish and confirm these-distinctions.

While many other trees, such as Pines, Walnuts, Hickories, Gleditschia, etc, grow rapidly in the first decades of their life, and make narrower and narrower annual rings as they grow older, the oaks either hold their own, the annual rings being as wide in age as they are in youth, or they grow more rapidly after the first 50, or 100, or even 150 years of their existence

The WINTER-BUDS, especially the terminal ones, show some characteristic differences; they aie larger or smaller, acute or obtuse, smoothish, or hairy, or tomentoee; *Qusrcus Garryam* CM I* mdily distinguished from all the allied Californian oaks by its large, pointed, tomentoee winter-tad*

In the LEAVES, so extremely variable in form, certain types are generally recognized. It is not here the place to expatiate on these well-known topics; but I may be allowed the observation, that those oaks, which in the perfect state have deeply-lobed or pinnatifid leaves, show in young shoots or on adventitious branchlets less divided or only dentate, sinuate, or even entire leaves*(e. g. *Q. alba, tteUata, falcata, coccinea, palustris,* etc.), while, singularly enough, the oaks whose leaves in the adult tree are entire or nearly so, often have on the young shoots dentate or lobed leaves. I need, for examples,.only refer to *Q. aquatica, Q. Phdlos,* and *Q. virens;* and even *Q. nigra* belongs here.

The *vernation* of the oak leaves has sometimes been mentioned as conduplicate, meaning that the upper sides of both halves of the nascent leaf are applied together, and this really is the case with most oaks which I have been able to examine in this early stage. We find it both in white and black oaks,—almost always, I believe, in those with broad and deeply-lobed leaves; I mention only *Q. alba, macroearpa* and *Garryana, Q. coccinea* and *paluttrig,* and also the forms allied to *Q. Prints,* even those with narrower, dentate leaves. In the more deeply-lobed, broad-leaved black-oaks, the two halves of the leaf are, besides, plicate parallel with the principal nerves.

Next to these range the oaks with the young leaves concave and imbricately covering one another. Such we find in *Q. stdlata* of the first, and *Q. nigra* of the second [376 (5)] group, both with densely tomentose, thick, young leaves. In other oaks, mostly such as have broader and more or less entire leaves, the young leaves imbricatively cover one another like those last mentioned, but are convex on the upper side, with the edges turned down or back. Such is the case in *Q. cinerea, myrtifolia, agrifolia, aquatica, chrytoUpit,* and, I believe, also in *Q. undu-* ***, and in *Q. Wislizmi* I find the same to be the case in the deeply-lobed *Q. falcata.*

The narrow-leaved oaks of both sections have revolute young leaves, the halves being spirally rolled backward towards the midrib, so that only the upper side of the leaf is exposed; the point of the young leaf is somewhat spreading so that the branchlet has a squarrose appearance, while in those with iinbricative vernation it is compact I find the revolute leaf in *Q. virens, pumila, PhMot, hetero-Pkylta,* and *imbricaria.* In *Q. CaUtim* I observe an inflexed vernation, the long bristle-pointed lobes of the nascent leaf being curved down over the still younger one.

I believe that the characters of vernation will not only help to distinguish allied species or doubt-*tt varieties, but will also assist in unravelling the intricate questions of hybridity.

The young leaves of almost every oak are coated with a dense stellate down, which in some (Q. «&*, *rubra,* ete.) is early deciduous, or it disappears later, or is entirely persistent. Besides these stellate one-celled hairs, several species, those with a clammy feeling of the young leaf, have another kind of hair, single or a few stellately connected, consisting of several cells, obtuse or clavate, sometimes branched, and often colored, apparently glandular. I notice these articulate hairs, among the white-oaks, in *Q. ttdlata,* and less conspicuously in *Q. macroearpa;* among the black-oaks, in *Q. nigra, myrtifolia, cinered, falcata, aquatica,* and *laurifolia;* in *Q. chryoolcpit* the characteristic " golden scales " are «> scales, but consist entirely of such articulated yellow hair, and the young *Q. Catabeei* has the same rusty coating.

The *venation* and more or less distinct *reticulation* of the leaves also present characters not to be "•gleeted; by them, e. g. two easily confounded Califoraian oaks, *Q. agrifolia* and *Widi&ni,* can * * % be distinguished even in sterile branchlets.

The persistence of the leaves is a good character in some species, while in others it is [377 (6)] •wdiaNe; *Q. pumila* and *laurifolia* on the eastern and *Q. agrifolia* on the western coast sometimes retain their leaves until the new ones are fully developed, and other specimens, even in *• *me neighborhood, lose them before the buds swell; some have deciduous leaves northward and P^fy persistent ones southward. The broad-leaved forms of *Q. undulata* are decidedly deciduous, while those with email, coriaceous, spiny-toothed leaves retain them through part of the winter, or. toward their southwestern limit, even into summer. Only such oaks ought to bs called evergreen

which retain the greater part of their old leaves at least until the new ones are fully grown; the leaves of some oaks persist even into the third year.

The MALE FLOWERS are* important for the diagnosis of some species, and to some extent even for the grouping'of them. I pass by the form and pubescence of the bracts and of the calyx lobes as well as the pubescence of the anthers (among all our oaks only observed in *Q. stdlata* and *virens):* even the sometimes present cusp or point of the anthers seems to be of lesser value, because variable in some species. Of greater importance is the size and the number of the anthers. The smaller and more numerous (usually from 5 to 8 or even 10, rarely only 4) occur in the white-oaks, while in the black-oaks the anthers are usually larger and fewer, as a rule only 4, in some species as many as 5 or 6; only in *Q. agrifolia,* which also shows other abnormal characters, 6-8 stamens are the rule, and sometimes 10 are found. The pollen-grains of both groups have a diameter of about 0.03-0.04 mm.

In numerous flowers of a certain tree of *Q. nigra* I have seen abortive pistils with prominent filiform styles,—singularly enough always 2, where we might have expected 3. In flowers of *Q. agrifolia* the connective of the anthers was seen to elongate, the cells to dwindle down and finally to disappear.

The FEMALE FLOWERS furnish valuable characters to distinguish the principal groups of our oaks. The pistil consists normally of 3 carpels and 3 stigmas; not rarely 4 occur, and in some Californian species *(Q. agrifolia* and *Wislizeni)* I have repeatedly seen as mauy as 5. The stigmas in our species are dilated, retuse, or eraarginate; in the white-oak group they are sessile, or [378 (7)] rarely (and that sometimes in the same species) borne on short, more or less erect, styles; in the black-oaks we always find them on longer, patulous, or recurved styles.[1] As the stigmas are measurably persistent, we often recognize this difference even in the mature fruit

The FRUIT exhibits the most important characters in the period of its maturation, first noticed by Michaux, and especially in the position of the abortive ovules, the beautiful discovery of A. De Candolle. But before I speak of these I must allude to the position of the fruit on the branch. It is single or clustered in the axils of the leaves or their scars, sessile, or more or less peduncled. In the black-oaks the peduncle is short or missing, but in the white-oaks it is sometimes several inches in length; its presence, however, is of very little specific value, as in many species either sessile or peduncled acorns are found. In some oaks this feature is connected with slight differences in the length of the petiole or the shape of the leaf; the distinction betweeu the European *Q. Itobur* and *Q. pedunculate* is based on such differences, and we have an analogous different in our *Q. alba,* where, at least here in the Mississippi Valley, the form with deeply pinnatifid leaves has usually peduncles as long or little shorter than the acorn, and the other form with more broadly-lobed leaves has shorter peduncles or sessile fruit; but sometimes we find sessile and peduncled fruit on the same tree. Some white-oaks have always sessile or nearly sessile acorns, as *Q. stellata,* while *Q. bicolor* always bears them on long peduncles.

The acorns mature either in one season or in two, and generally speaking we find the annual maturation among the white-oaks and the biennial maturation in the black-oaks, but the exceptions to this rule prove that this peculiarity is not necessarily connected with the essential characters of the two groups. We have one western white-oak, *Q. chrysoUpis,* with biennial fruit, and three black-oaks with annual maturation, *Q. pumila* of the east, and *Q. agrifolia* and *Q. hypoUuca* of the west

The biennial maturation is easily recognized in the oaks tfrith deciduous leaves; the tree is never without younger or older fruit, or, from May to September, with both ; the older [379 (8)] acorns are then seen on the older, leafless part of the branchlet, and the young, incipient ones on the younger, leafy part In oaks with persistent leaves some difficulty may arise from the pecu-

i A group of white-oaki with biennial fructification, peculiar to southern Europe ana eaatera Ada, the be* know* rtpmtntatiTft of which art *Q. Orris, Q. pMudo-9ub*r$_t$* and *Q. occidental*,* difftn from all the* by their patriot* or •t/ka bearing ligolatt, acutiih ttigmaa.

liarity that the hranchlets which had flowered the previous year, and are now maturing the fruit, often in the second year do not elongate or make new leaves or new wood, — in short, do not perform any function but the maturation of the fruit. In this case the fruit is found near the end of the branchlet, absolutely as if it were an annual fruit; but the appearance of the leaves as well as of the epidermis of the branch proves them to be over a year old, and wherever a new shoot of the present year can be discovered, the difference between this and those of the last year easily solves any doubts. In *Q. chrysolepis* this peculiarity is quite striking; very rarely (at least in the herbarium specimens examined by me) the fruit-bearing branchlets elongate and again bear flowers, which is the rule in our deciduous biennial oaks.

The cup of the acorn, an involucral organ, is in all our species covered with imbricated scales, appeadicular organs which simulate bud-scales, and even occasionally seem to assume a pseudo-phyllotactic arrangement In the black-oaks these scales are membranaceous and never thickened at base; in the white-oaks, on the contrary, they sometimes have herbaceous tips and, at least the outer and lower ones, are always more or less thickened, inflated, or knobby at base; they are very thick, e. g. in *Q. alba* and *lobata,* and very slightly thickened in *Q. stdlata* and *Garryana;* in *Q. macrocarpa* they are herbaceously tipped.

The shell of the nut or acorn is thinner in the white-oaks and thicker in the black-oaks; a much more important and striking character is, that in the former its inside is dark, smooth, and even shining, or rarely pubescent, and in the latter densely silky-tomentose, a difference which, I believe, is constant

Only one of the 6 ovules of the oak-ovary is developed, while the 5 others persist as small but distinctly recognizable oval, dark colored, pendulous bodies, outside of the seed-coat,—in the white-oaks at the base of the perfect seed, in the black-oaks just below its tip. Only in one of our species, *Q- chrysolepis,* are they intermediate or lateral, in some acorns almost basal, and in others scattered over the side from near the base to two-thirds up. DeCandolle has observed the [380 (9)] same in the cork-oak of Europe and in some Mexican white-oaks. The black-oaks with annual fructification have these ovules always suspended near the tip of the seed, and are in this aspect undistinguishable from the regularly biennial black-oaks.

•*' It is well known that in the southeastern live-oak both cotyledons are united into one mass,— a singular but isolated fact which has no systematic significance.

In the foregoing pages I have purposely left aside the very peculiar Californian *Q. damflora,* which is in every respect different from the other oaks, and thus far the sole representative of a peculiar group named by DeCandolle *Androgyne.* In many respects it is more a chestnut than an oak, for it has, just like the chestnuts, the same dense-flowered, erect male spikes, 10 stamens to each flower, very small anthers on long filiform filaments, with very small pollen-grains (0.017 mm. in dùwa-. not much more than half as large as in other oaks), and in the female flowers slender, terete, Pointed stigmas, grooved above. In place of the spiny involucre of the chestnut our plant has a •Piny cup, and is thus made an oak and not a chestnut The maturation is biennial. The shell of the not is thicker and harder than in any other of our oaks, the inside thickly tomentose, and the abortive ovules are found near the top of the seed. The wood is brittle and worthless.

It results from these investigations that our oaks, leaving again aside the one last mentioned, •nange themselves into two great groups, often alluded to above as the white-oaks and the black-oaks.

The *whiteoah* are characterized by paler, often scaly, bark, tougher and denser wood, and sesame orsubeessile stigmas, and bear the abortive ovules at the base or rarely on the side of the perfect •''•*. Besides this, the leaves and their lobes or teeth are obtuse, never bristle-pointed, though

sometimes spinous-tipped; their stamens are more numerous, the scales of the cup more or less knobby at base, the inner surface of the nut glabrous or (rarely) pubescent; the fruit generally matures in the first year.

The *black-oaks* have dark, furrowed bark, brittle and porous wood, styles long and [381 (10)] spreading or recurved, abortive ovules always near the tip of the perfect seed. The leaves and their lobes are bristle-poiuted, at least in youth; lobes and teeth acute; teeth sometimes spinous. Their stamens are usually less numerous, the scales of their cup membranaceous, the inner surface of their nut always tomeutose ; the fruit generally matures in the second year.

We may then arrange our oaks in the following order: —

QUERCUS, LINN.

I. LEPIDOBALANUS, Endl. : Amenta mascnla pendula; pollinis cellule 0.08-0.04 mm. lata ; lions feminei a misenlis dif. tantes ; gtigmata dilatata.

A. LBUCOBALANUS : Ovula abortiva infera vel raro lateralia; stamina plerumque 6-8; stigmata sessilia vel snbsesailia; DUX intus glabra s. rarisaime pnbescens.

• Maturatio annua ; nux intus glabra; orula abortifa infera.

t Folia decidua.

Q. lyrata, macrocarpa*, alba, lobata, tiellata, Garryana, tricolor, Michauxii} Prinus*, priwrides, DougUuii, vndulata.**

11 Folia sempenrirentia.

Q. dumosa Emoryi? rttieulala* virtus**

•• Maturatio biennis ; nux intus pubescens ; ovula abortWa Infera Tel lateralia; folia sempervirentia.

Q. *ehrysolepisM*

B. MBLANOBALANUS : Ovula abortiva snpera; stamina plernmqne 4-6; styli elongati demum recurvi; nux intus serioeotomentosa.

• Maturatio annum; folia persistentia s. subperaistentia.

Q. affrtfoljaU hypolcuca,"pumUaM

• • Maturatio biennis.

f Folia decidua.

*Q.palu*tru," rubra, Sonomensis, cocdnea^^ ilictfolia, Oeorgiana, CaUtbceiy falcate, nigrc^ cinerea^ aquatic^* laurifolia,[16] fatonptytti," *imbricaria, Phelhi.*

11 Folia •erapenrirentia.

Q. Wislizeni,[18] *myrtifolia.*[19]

II. ANDROGYNE, A. DeC.: AmenU mascula erecta, bad floras femloeos gerentia ; polUnis oelluUe fere 0.017 latss; stigmata UnearU.

*Q.dm*morxu*

NOTES.

1. QUSBCUB LTEATA, *Walt.,* extends as for north as *Taxodium* does, to the banks of the lower Ohio in Illinois.

2. Q. MACBOCAEPA, *Michx.,* is extreiiielj variable in the size of its acorns, and especially in the depth and the margin of its cup, which sometime* coven the acorn scarcely one-half, usually three-fourth*, and [382 (U)] occasionally entirely ; the margin in profusely or sparsely fringed. — Throutfhout the north-went, north of the Mimouri River, a low scrubby form is found, which might be designated as var. *deyretaa,* a* it is undoubtedly tlje *obtusxloba fi. depreua,* Nntt. (fen. % 2ia, which ha- smaller leaves and much smaller acorns than the species, bat is clearly a form of *macroauya**

3. Q. MICHAUXII, *NUU. Oen. %* 815, **xcl$!^-Tht* figure of Michaax, quoted by Nutull, refers to *Q. bicolor,* and none of his figures represent our plant. Elliott adopts NutUll's name, but Chapman as well as DeCandolle eon* sider it a form of *Prinu$.* Q. *PrinuM* was described by Linnnus with *fUiu obovatis utrimpu acuminatù,* which •alHciently well agrees with all the forms of *Prinus* pmper. Our plant U disUmruished by baviug the leaves oUuse, or mostly cordate, at l*se ; thicker, more leathery, and tomentose, on the lower side ; and the male flowers 10-andnMW. All the forms of *Primus* proper have a very deciduous pubescent* on the lower akk of Uw l«*f, which is acute or acotish at base.

4. Q. Pmnui, *Lbm.,* would then comprise Michaux's vmrisiies, J N * * * * , *mmUieoU,* and acuminata.

ft. Q. UYTOLATA, *Torr^* has been treated of in the introduction to this paper; the different forms, there also enumerated, ma *Gambdii* (Q. *GomUiU,* Nutt and probaUy g. *DmmmoHdU,* Liebm.) ; /I *Gmmiuni* (g. sJK var. *Cun-*

«*»», Torrey) ; *y. Jamenti,* Torrey's original plant, figured in Ann. Lye N. T. 2, t. 4 the originalfigure reproduced, with slight aUeratfons *in* Nuttall's N. Am. Sylv. 1, t. 3; «. *WrighHi,* often confounded with *Q. Envp^d* apparently one of the forms comprised by Liebmauu inhis *Q. pungens. Q. oblongijoho,,* Torr„and * J ^-------, seem to be forms with more or less entire leaves : or the latter may perhaps have to be referred to the Mexican *Q. microphylla.*

«. Q.Kn.«««, *KM.. X. A»..S*»,l,,.1;T™,,B«.U«. BnvLp.m.* 207 gQ«»&«,TmibUj*.51,

« B larger iorm 01 me Hanie. v- oCTwenaycwKi, AJICVI«., I/V. *»--. --, -, r - - fti^j^_ —

at least in part. A shrub of the southern part of California, often very squarrose, sometimes with slenderju above, bmnche. ; leave, oval, obtue, often conkte or obtuse at bwe, spinou^dentate or someUmes entire, dark l ^ » . hoary tomentose or pub**** below, from * to | or sometimes 1 inch long, fnut ses«le cup strongly tuberculate, black, between 2 and 6 lines in diameter ; acorn large for the size of the plant, oval, or small and narrow.

7. Q. EMORYI, *Torr.* Emory Rep. 1848, p. 151, t. 9. *Q. hastata,* Liebm. Quite distinct from *Q. undulata,* var. *Wrightii,* which is often confounded with it; the peduncled acorns of Torrey's figure belong to that form of *undulata.*

«e not roundish or oval and pale as in *Wrightii,* but lanceolate, cordate at base, " J ^ ^ J ^ J acorn, in all the specimens seen by me are sessile, the bright blown scales of the cup only shghtly thickened [383 (12)]

" " "t Q. «mccLATA, *HBK.,* ha. been found in Southern Arizona by Dr. Bothrock, in the expedition just mentiurned.

0. Q. ™ = » , *tit.* A shrubby form is var. *maritima,* Chapm., *Q. maritima,* Willd., from which var. *dentata,* Chapm. cannot be separated ; both have shorter and often larger acorns on shorter peduncles than the species; the former is the larger shrub, rarely as much as 10 feet high, with usually entire lanceolate leaves ; the latter often bears fruit when onl~ 1–1½ feet high ; leaves sometimes dentate or sinnate-dentate, 1–2 inches long ; vigorous ground shoots occasio» « , p,iiu» ta»d n l, «.ti»,« d«Ut. leaves 3–4 inches long and 1½–2½ wide.

v « ^f ;n thw fnm?oinc Daces that little need be added. It«

10. Q. CHBTSOLEPIS, *Lidm.,* has «. often been spoken of m^the foregong;pag^f. W. H. Brewer for the Californiructiftcation was misunderstood until the abundant material . ^ ^ ^ Y J ^ , and of the fruit, is extremely *ia Bute Survey, permitted mo to clear it up. The. size of the £+ of the lea p istent nor is i* ~~~ent ^ jil variable; and even the yellow pube^ence, which has g > » i * * ' ^ •leU j^ i y on ^ ^ches, «»«» Young vigorous shoot, or young tree, have + £ ^ £ * £ cup e x ^ y thick: this is the form usually entire ones. The acorn, are sometime., v«y large « ^ ^ a U ; Dr. PJL iew uft 0III San Berurdino Mill Torrey (P«if. R. R. ^ v. 36o, tab. 9) ha. described a. «• « J g T ta ft* Sif. Ac 1, 67 and 71, seems (from larger enpa, If inche. in the outer diameter Dr. ^ ^ > j 3 h i « Si cup. of the ordinary shape, without J^«»n.«eninHb. Brewer) to refer to,the tai;^..^"ta3l-leaved mountain form. Of this variety tWunusual thickening; hi. *Q. vaednitfolta,»*b. 1,»6 (106ed.^»•><«* n ; earliest yout h ^e Bnthererf •pecimen. are found entirely de-titute of the 7 ^ . ^ ^ ^ ^ are closely sessile. The W «»" «pecie^ usually 10 in number, are always strongly pointed, tne. WWKI * Pwition of the ovule, ha. been menUoned.

x. A t VMIH. known O802), i. quoted by the author as inhabiting

11. Q. A0B.F0UA, *Nie,* the firrt we»Um oak « *^ " ^J \ Z m , to bl known much north of the Bay of * Noatka Sound" and California, perhaps by mistake « u ^ ^ r T o f the SUte. but does not ascend the mountains. Si *TT'* ** tt eXtend, " * " I V ^ 2 S J S 5 i ev!n poo; firewood. The old leave, partially Jt u a line large almort evergreen tree, but make. « * I J ™ * ™ J in *JZ* trees the last leave, have fallen before ftU off in winter, *, that the bead, begin to look le» *'^TfSSShS!^ y°™* TCld re covew the branches.

obeerved which in spring retain all their old leaves with-

out bringing forth flowers or young shoots, — a state of which resembles the condition of *Q. chrysolepis,* above alluded to ; that species, however, performs the function of maturing its fruit, though it bear [384 (13)] no young leaves, while in this case there would b. to 8 " f ^ ^ win ike S ST ation of in number of the large

*» «• MKidmJa (Wtgr. rVp. Ub. 17), b ^ J ' ^ ' ^ V . l l e r leaveN occ«ionally pube«en», and with smaller but very the d

n T A-i v wliirh Tonrv in M^x. Bound. Rep. p. 207, refer* to *Q. c<mfertifoli«,* HBK, 1. Q. HTFOLEUCA, T mime an Arimn. oak which T « w j ^ · · · Our Plant is ^ ^ ^ ^ ^ i d p , itJI a specie* with biennial fructification and ulightly pubewent lea^p. V7 x

annual acorns, by lanceolate thick leaves with revolute margins, and a white tomentose lower surface. The 5-lobed calyx is scarcely hairy and bears 4 stamens; no bracts seen, even before the flowers open.

13. Q. PUMILA, *Walt Fl. Carol,* p. 234 ; *Michx. Sylv. tab.* 17 (where the fruit is erroneously represented as biennial, otherwise the figure is good). This interesting shrub, though first described nearly a century ago, has only, through the efforts of Dr. J. H. Mellichamp, become properly known in the last few years. Living in the immediate vicinity of its habitat, the pine barrens of the low country of South Carolina, this acute observer has aided me in the most liberal manner in studying this as well as other difficult oaks of that region.

Q. pumila is called the *running-oak* because, by the aid of its wide-spreading stolons, it covers large patches, sometimes acres, with its thickets. It is often, especially where kept down by the frequent fires, only 1-2 feet high, and has been seen loaded with flowers when only of 6 inches; in other localities it grows 8-10 feet high, with stems 1 inch in diameter. The leaves, revolute in vernation, are usually about 2 inches long, lanceolate, entire, and often undulate, only occasionally dentate-lobed, but in vigorous shoots sometimes broad ovate and deeply and acutely Iobed; another form has obovate obtuse leaves. They are slightly pubescent when young, but soon become quite glabrous, persist through the winter and occasionally beyond the flowering period. In the male flowers I find pretty regularly 4 stamens, and in the female 3 long recurved styles. The globose fruit in its shallow cup is nearly sessile in the axils of the same year's leaves. — *Q. pumila,* Walt., Michx. Sylv., Nutt. Gen., Elliott Flor. *Q. Phellos,* var. *pumila,* Mich. Querc. & Flor. *Q. cinerea,* var. *pumila,* Chapm., A. DeCand. Prod.

Var. *sericea* has similar narrow, or larger, ovate-lanceolate leaves, always silky-white underneath; the larger leaves on fertile branches grow over 4 inches long by lj inches in width, and on sterile shoots even larger. — *Q. sericea,* Willd., Pursh. *Q. Phellos,* var. *sericea,* Ait.

Over a year has passed since the foregoing part of this paper was published; of the [385 (1)] concluding seven pages, only a small edition, for private distribution, was then printed* Continued study of the genus, aided by numerous kind communications of observations, as well as of specimens, have enabled me to make the following corrections and additions.

Page 374, L 22. Low, shrubby forms of *Q. stellata* occur on the southeastern sea-coast, and of *Q. macrocarpa* on the northwestern plains.

L. 2 from below ought to read: the only oak wood. —The wood of *Q. Prinus,* however, makes an exception, being more porous than most other white-oak woods.

A careful study of the numerous American oak wools displayed by the Agricultural Department and by different States, at the Centennial Exhibition in Philadelphia, has revealed further interesting facts. The black-oaks grow, on an average, nearly twice as fast as the white-oaks, and if *Q. nigra* and the evergreen block-oaks be left aside, the disproportion will be found still greater. In the average of 20 different white-oaks, from all parts of the country, I find the growth nearly equal through the first 40 years; in 14 specimens of black-oaks the growth is more rapid in the first 30 years than between the 30th and 40th. The following little table will exhibit this more distinctly.

Average Width of the Annual Rings.

	in 10 white-oaki:	In 14 black-oaks:
In the first 20 years.	.0.8 lines.	1.6 lines.
From the 20th to the 80th year.	.0.8 "	1.7 "
" 80th " 40th -.	.0.7 "	1.2 "

The heartwood of the white-oaks is always readily distinguishable from the sapwood by its darker color, varying between dark gray and light brown, but in the black-oaks the heartwood is scarcely darker than the sap, and in some species or w>me individual* cannot be distinguished at all. Only in *Q. nigra* and the curious *Q. Emoryi* is it often irregularly mottlwl with black.

In the limited number of specimens which I could examine, the sap turned into heartwood,

	In 19 white-oaks.	In S black-oaks,
•ftw.	.22 years,.	.17 years,
having attained u thirkness of.	.18 lines.	.21 lines.

Only in these 8 Muck-oak* a line of demarcation was visible.

• The pages referred to (385-391, 14-20 of the private edition), which we omit from this reprint, were replaced by dmi* larly numbered pages in the Transactions of the Academy (pp. 1-7 of the reprint of this second part), as directed in a slip distributed with it - EM.

In a geographical point of view, we notice that the black-oaks of the present day are confined to [386 (2)] America, and are principally developed in the Atlantic part of North America. We have there 15 species, including a single abnormal type, while west of the Great Plains arid on the Pacific slope only 6 species occur, 3 of them receding from the normal type. Numerous black-oaks are found in Mexico and Central America; in DeCandolle's Prodromus 20 are enumerated with known maturation, and of 18, of which the fructification is not ascertained, some may ulso belong here. In the tertiary period the black-oaks, it seems, extended into the Old World, just as many other recent North American types did.

The white-oaks are more uniformly distributed over the temperate parts of the northern hemisphere. We have on the Atlantic slope 8 species, and 9 in the western half of the continent, only 2 of the latter abnormal.

Thus we have in our flora nearly as many white-oaks as black-oaks; but while the former are nearly equally distributed between east and west, the latter predominate eastward.

Page 375. *Vernation*— A too hasty examination, partly of specimens too fur advanced, has led me into several errors. The vernation is *conduplicaU* only in part of the white-oaks (in the European type of the genus, *Q. Robur;* in our *Q. alba, macrocarpa, Garryana,* and in all the species of the Prinus group ; probably in *lyrata, Douglasii,* and *Mata).* The *imbricate* vernation is the rule for the balance of the white-oaks *(Q. stellata, undulata, dumosa,* and *chrysolepis)* and for all the black-oaks, with the exception of the few species (p. 376) with *revolute* vernation. In the oaks with imbricate vernation the outer leaves are always imbricate, but the inner ones are imbricate or flat or even •lightly revolute on the margins in the species with thicker, firmer leaves *(undulata, dumosa, chrysolepis; Emoryi, agrifolia, nigra, aquatica, laurifolia, dnerea, myrtifolia).* In the others, with broader and more lobed leaves *(cocdnea, rubra, palustris, falcata,* etc.) the 2 or 3 innermost leaves are conduplicate. The inflexed vernation mentioned as occurring in *Q. Catesbcti,* is also occasionally seen in *falcata,* evidently in oaks with slender-lobed leaves, but it is by no means constant, and of no specific value.

The suggestion that the character of vernation would be an important assistance in classification, and in [387 (3)] the discovery of alliances of hybrids, has been verified by actual observation, as will be shown below.

Page 376. The glandular colored pubescence appears on both sides of the young leaves in *CatesbaH, sinmta,* and *myrtifolia* ; on the lower side in *chrysoUpis* and somewhat in *stellata ;* on the upper side in *falcata,* and also in *Catesbaikurifolia.* I do not find this pubescence on seedlings of these species, nor is it often seen on the youngest leaves, but becomes developed when the leaf has attained * to } of its full size.

The reticulation is generally more marked on the upper than on the lower side of the leaves, and in the black-oaks more than in the white-oaks ; an exception occurs in *Q. falcata* and (as already indicated) *agrifolia ;* in both the upper surface is almost smooth : in *cinerea* and *ilicifolia* the reticulation is much less prominent than in most others.

Page 3777 ~The mole ome'nts ^reproduced from scaly buds which are not further developed, or from the lower Ptttof branchleta, usually in the axil* of bud-seales, or rarely from the axils of the lowest leaves; thus often in *Q. Vrifdia.* They are mostly simple, but in *chryoUpU* I find them often branching, such as they are described in the Asiatio section *Pasania*'

Page 378,1. 16 and 17, strike out the comma after «connected," •'differences" and "petiole." Add *in* before "the shape."

L. 33. *Four* black-oaks with annual maturation, including *Q. Emoryi.*

Page 379 1 22 Occasionally black-oaks are found with cup-scales thickened at base ; Prof. Sargent has collected near Cambridge fruits of *Uicifolia* with this peculiarity, and it does not seem to be rare at all in northern forms *otrubra.* •

L. 6 from below. The abortive ovules are not oval and pendulous, but rather bottle-shaped bodies, suberect in toe white-oaks, hemitropous in the black-oaks.

Page 380,1. 5. *Q. Emoryi,* in every other respect a true black-oak with annual fructification, has basal ovules, another remarkable instance or mere botanical characters not always coinciding with essential ones. Hence the word "ay»,» in the first sentence of the following page, must be qualified by adding *almost.*

Page 381. The following is believed to be a more correct enumeration and more natural arrange- [388 (4)] of our oaks.

I. LEPIDOBALANUS, EndL

A. LIUOOBALANUS.

• Maturatio annna.

«. *alba, lobaia {frJJ^i), a^ana, steUata, macrocarpa, XfnOa, bicolor (Ifichauxii), Prinus, Muhlcnbergi:* (prf-**&*), *DougUuii, undulata (pungent).*

t f Foil*persistentia.

«. *ohUmgifolia, dumosa, rtticuiaia,* virens.

» The names in ptKtiththtts dttitfntte tuhspecUi.

• * Maturatio biennis.

Q. chrysolepis (vacciniifolia, Palmeri), tomentella.

B. MELANOBALANUS * : Ovula abortiva (excepta *Q. Emoryi)* supers, etc., ut in pag. 381.

• Maturatio annua, folia persistentia.

Q. Emoryi, agryfdia, pumila, hypuleuca.

• • Maturatio biennis.

f Folia decidua.

Q. rubra, coccinea, (tinctoria), Sonomensis, falcate, CaUi5'ni, %UcifoUa,palustrii, Oeorgiana, aquatica, laurifolia, nigra, cinerea, imbricaria, Phellot.

f f Folia persUtentia.

Q. Wislizeni, myrtifolia.

II. ANDROGYNE, A. DC.

Q. densi/lora.

ADDITIONAL NOTES.

Q. LOBATA, *Net,* has heretofore been known only as a large tree with slender, even pendulous branches, deeply lobed or pinnatifid leaves, the lobes often retuse, notched or again lobed, pubescent below ; with large, long, conical-pointed (therefore *longiglanda,* Torrey) acorns in a deep, almost always strongly tuberculated cup. No essential variation of this type has been noticed, unless we class a shrub-oak here, 2-6 feet high, which Prof. Brewer found on the mountains west of Shasta, and Mr. Lemmon near the Tuolumne Biver. The foliage is the same as that of *lobata,* perhaps smaller and even more deeply lobed, but the large oval acorns have their base scarcely immersed in a very shallow cup; cup 8-9 lines wide, £-4 high ; acorn 12-15 lines high, sessile or (in the Tuolumne specimens) [389 (5)] JK3d uncled. The form of the acorn and cup might justify me in considering this bush as a distinct species, but, well aware of the extreme variability of the western oaks, I provisionally append it to *Q. lobata* as a subspecies under the name of *fruticosa.*

Q. GARRYANA, *Dougl. ap.* /foaL, well known in California by the name of mountain white-oak, though not found in the higher mountains ; it extends farther north than any other oak on the west coast and is the only representative of the genus north of the Columbia River, is common on Vancouver Island (where a variety has been called *Q. Jacobi,* R. Br. min.) and according to Prof. Dawson has been met with sparingly on Frazer River; on the Columbia it extends as high up as the Dalles ; in exposed northern situations it is scrubby. Southward it seems to be limited by San Francisco Bay. It can always be reudily distinguished by its rather large, variously but commonly deeply-lobed thick leaves, tomentose or downy beneath, and by its large (5W lines long) tomentose winter bmls. *Q. Necti,* Liebm. (Hartweg, in Hb. Gray) is a form with more knobby cups.

Q. BTBLLATA, *Wang. (Q. obtusiloba,* Michx.), is of a uniform character in the middle States, but varies considerably southward. Dr. Mellichamp finds on the coast of South Carolina, 1. a scrub form, often with almost entire, undulate or angular leaves mixed with other shrubs or trees of the normal foliage; 2. a tree with normal leaves but glabrous branchlets and glabrous anthers ; and 3. a tree with flaky bark, and narrow, cuneatc leaves with oval lobes, and like the branchlets glabrous ; anthers unknown. The last two may prove to be hybrid forms between *ttellata* and *alba,* for which see further on.

Q. MACROCARPA, *Michx.,* often occurs in the north and northwest with nnusually small oblong acnYns, half or more covered by the momy enp, when it is *Q. oliwtformu,* Michx.; another form has oval acorns of the sice of those oi *coccinea* in a shallow, mossy cup ; on the lower Ohio acorns have been gathered 15-16 lines in diameter, in a very mossy cup over 2 inches wide. The leaves vary from the nearly entire, obovate, sinuate-dentate to the lyrate-pinnatifid form with alm<<t naked midrib. The branchlets, always thick, are either corky or smooth.

Q. LTRATA, *Walt.,* originally known from the banks of the southeastern rivers, is also found in the damp woods of the lower Ohio and down the Mississippi River. It properly stands between *macrocarpa* and *tricolor,* and has a good <lf* il of both. I have seen from the same localities (Mount Carmel on the lower Wahasb, *Dr. J. Schruek,* and Memphiis *J. FendUr)* specimens with the typical enclosed acorns, and others with cups, somewhat mossy on the edge, only half enclosing the acorn. The bark is flaky like that of *tricolor.*

Q. BICOLOR, *WML,* i* generally a well characterised tree with flaky bark, enneate-obovate, coarsely sinuate-dentate leaves, white below, ft-H androu* flower*, and large acorns in long.peduncled, mossy cups ; but numerous aberrant form* occur, tome with li^ht downy leaves and green below, others with much smaller [390(6)] or longer acorns ; in some the cup is scarcely fringed.

[1] The blsck-csks, many years ago, were grouped by Sptrh, sn<i liter by Liebmsjio and others, under the name of *Erythrobalanui* (red-oak*), but with other character* ami other limit* than I assign them.

Q- MICHAUXII, *Nutt.,* such as it appears in the south and up to the lower Delaware River *(Michaux, Canby, Commons),* and to the lower Ohio *(Dr. Schneck),* would seem to be a well-marked species ; but my notes, p. 382, based upon too few specimens from a single locality, are not quite correct. It is certainly *Q. Prinus palustris* of Michaux (the *Q. P. discolor,* quoted by Nuttall as synonym, is *Q. tricolor).* The tree grows in low grounds; has a gray, flaky bark; leaves (usually large, 6-6 inches long) oval or obovate, regularly (commonly not deeply) dentate acute, obtuse or even cordate at base, generally thick and very soft downy below, rarely only slightly pubescent or even almost glabrous (in Delaware, *A. Commons)* ; male flowers mostly 10-androus; fruit the largest of the Prinus group, short-pedunded, cup shallow, obtuse or flat below, with deltoid, acute, rigid, distinctly imbricate scales, without any fringe. — Distinct as this tree seems to be, a series of forms, apparently common from the Delaware *(Canby, Commons)* to the Potomac *(L. F. Ward, Dr. Vasey),* evidently unite it, contrary to the views of most American botanists, with *Q. tricolor.* DeCandolle (Prod. 1. c. p. 20) already assumed their identity ; he, however, on the next page, wrongly quotes Michaux's 0- *P. palustris* for *Q. Priñus.* The leaves of this intermediate form are in some instances purely those of *tricolor,* in others more those of *Michauxii;* the acorns are subsessile, middle sized, with a deeply hemispherical cup, and less regular, often knobby and sometimes appendaged scales. If these connecting forms were not so common in the region mentioned, I might feel inclined to take them for hybrids between two distinct species; as it is, I must consider Q. *Michauxii* as a subspecies of *tricolor.*

Q. PRINUS, *Linn. Q. Prinus monticola,* Micbx. Q. *montana,* Willd. Only after visiting the Alleghany Mountains and their eastern slopes, and seeing thousands of these trees, have I fully realized the accuracy of Michaux's description in hia Sylva, and have become convinced of the absolute specific difference of this tree from the other members of the Prinus group ; and, indeed, its peculiar bark and wood distinguish it from all other white-oaks. I suppose it to be the type of Lŭinnua's *Q. Prinus,* because it is the most common of the group in Virginia, whence the original came from: "for *procera Virginian*,* Pluk. ; *foliis_____serratis dmticulis rotundatis uniformibus,* Linn. H. Cliff. - The bark of the young tree before the age of 10 or 12 years is smooth and even shining, of a purplish-brown color; then it begins to crack and in the old tree becomes thick (often 1-2 inches and more) and deeply cracked and furrowed without peeling off, so that Michaux could, not inaptly, compare it with the bark of the chestnut, which, however, is darker. The wood ia more porous than that of other white-oaks, and is said to be not much more useful than that of black-oaks, and unfit for barrels to bold liquids. Though its proper home seems to be in the mountain districts, it is not rarely seen in the low country eastward. Westward it is common in the mountains of Tennessee and Georgia, and kas been collected on Seneca Lake in Western New York ; it is unknown in the Mississippi Valley proper. [391 (7)] - The leaves are thick, often almost coriaceous, pale below with a short and close pubescençe, obovate to lanceolate, sometimes even acuminate, those of the lower branches of the tree often much wider and larger than the leaves of the upper, fertile branches ; teeth coarse and regular, obtuse, rarely larger, or occasionally almost obliterated in the sinuate margin ; the lateral nerves usually terminate above the most prominent part of the shallower teeth, and •*» in the sinus and only in the most prominent teeth at their apex. Fruit short-peduncled ; cup deep, somewhat tnrbinate, tubercled-roiñ, as the descriptions express it; base of the scales often raised in two knobs, between which the short and almost indistinct tip of the scale next below is almost buried; acorn large, sometimes 1-1$ inches Jong and 1 inch thick.

Q. MOHLENBEBGII • *Q. castanta,* Mtihl. op. Willd. *Q. Prinus acuminata,* Michx., occurs scatteringly throughout *e middle and northern Atlantic States, in Pennsylvania only on limestone soil *(Porter),* but its proper home is the Mississippi Valley, where it entirely supplants *Q. Prinus,* more commonly on limestone hills and ridges, but also abundantly' in river bottoms. Its flaky, pale ash-colored, thin bark and very tough wood (light yellowish brown *ben mature, whence probably the popular name of -yellow-oak") distinguish it at once from *Prinus,* as do also the waall globoae or commonly ovate acorns in a subsessile, shallow, and thin cup covered with small canescent, obtusish, «^ly much thickened scales. Leaves on petiole* J-l or even 1J inches long, thinner, more membranaceous, below Pale and with an inconspicuous down, usually sharper serrate, often with inflexed teeth, and either lanceolate with a long acttmination, 5-6 inches long by 14-2 in width (the typical form of Michaux and Miihlenberg) or larger, aometimei even in fertile specimens as much as 7 inches long and 6 wide, broadly ovate or obovate with more rounded teeth, *Mch form hat often been taken for *Q. Prinui,* but w in bark and fruit identical with the narrow-leaved form.

Q. PRmoiDM, *WiM.* distinguished from the last by its low stature, smaller, more undulate than sharp-toothed leave, on Sorter (J-l inch long) petioles, and commonly by deeper cups with more tumid scales, is apparently well enough marked eastward, but westward, from Western Missouri to Kansas and Nebraska, where it abundantly bean when only 1-3 or up to i) feet high *(E. Hall, 0. C. Broadhead),* it runs into the arborescent *MitiOenbcrgii.* It is sug- *•« that annual prairie fires are the main cause of the stunted growth of this low form (while other species are not afcetad in this manner;, and that often large and knobby rooUtocks are found to produce numerous shoots, fertile

§ As Mtthlenbsrg't at well u llictiinx'i name for this very distinct species U preoccupied, it seemi fit to commonorata the celebimled Peumylviuun boUnii.fi iiame by thU oak, which he had so well distinguished.

in the first season. Prof. Gray informs me that Mahlenberg, in his manuscript *Florida Lancastrians,* considers this form a variety of his *castanea;* he enumerates the following of the Prinus Group: *Q. eastanea* [392 (8)] with *P prinoides, Q. Prinus,* and *Q. tricolor.**

Q. DOUGLASII, *Hook., i»* the only Californian oak which might be confounded with *Q. Garry ana;* but, if I understand it aright, it can always be distinguished by its small, oval, obtuse, bright brown, slightly hairy winter buds; its smaller, more sinuate than lobed leaves, which, downy in early youth, soon become glabrous on the upper side, with a bluish tinge, whence it has received locally the name of blue-oak, or blue mountain-oak. It extends not as far north as *Garryanu,* probably not into Oregon, but farther south on the lower hills and mountains of the Pucific slope.

Q. UNDULATA, *Torr.* Enough has been said in the introduction to this paper and on p. 382 about the wide limits of variation which this species enjoys; local botanists, however, are not agreed as to the relations these forms bear to each other. We are safe in arranging all the varieties in two groups. The first is characterized by larger, strongly lobed, darker green and decidedly deciduous leaves, and narrower, ciliate calyx lobes ; the second has smaller, paler, more rigid, mostly spinous-denUte, and —at least southward — more or less persistent leaves, and broader, woolly calyx lobes. In both groups the sweet and edible acorns are oval, oblong, or sometimes elongated; the subhemispherical, sessile, short- or sometimes long-peduncled cup varies from scaly to very knobby ; in the dark-leaved forms the acorns are often thicker and shorter, in the pale group slender and longer. Distinct as both groups teem to be, the original *Q. undulata,* my var. *Jamcsii,* completely connects them. Var. *Gambclii,* with broader emarginate or even lobed divisions of the large leaf, on one side runs into var. *Gunnisoni* with narrow and entire lobes, and on the other into var. *breviloba (Q. obtusUoba,* var. *brevUoba,* Torr. Bot. Bound., and probably *Q. Durandii* and *Q. San Sabeanoy* Buckley) with sinuate or broad- and short-lobed leaves. The forms of this group are found from Western Texas through parts of Colorado, Utah, New Mexico, and Arizona, but not west of the Colorado River. Var. *Jametii* is a *Gunnisoni* with acute lobes of the smaller, more rigid leaves, found thus far only from West Texas to Colorado. The transition is almost imperceptible from this to the pale-leaved forms, which southward become evergreen, in so fax as they lose their old leaves not before the new ones develop. They do not extend as far north nor east as the dark-leaved group, but farther south westward through the California desert, and into the mountains bordering it on the west.

This pale-leaved group consists principally of var. *pungens (Q. pungent,* Liebm., as to sp. Wright 664; var. *Wrightii,* p. 382, which has constantly been confounded with *Q. Emoryi)* with small (1 inch or less [393 (9)] long) sinuate-dentate leaves, the teeth very rigid and pungent Var. *grisea (Q. grisea,* Liebm., Wright 666 from West Texas) with oblong, more or less entire, often hoary leaves, which commonly passes for *Q. oblongifolia,* can scarcely he distinguished from *pungent,* ns both forms occasionally ore found on the same bush. Var. *grandi/olia,* with very large (3-5 inches long) nearly entire or undulate leaves and very long peduncles, was found by Dr. Palmer in Arizona, and by Mr. Brandegee on the upper Arkansas.

Q. ODLONQiroLiA, *Tort. Bot. Sitgr. t.* 19, not of Bot. Mei. Bound., the South California "live-oak,* a bush or a middle-sized tree with pale flaky bark ; oblong, obtuse, coriaceous, subpersistent leaves, at first soft downy, but soon glabrous on both sides (like those of *Q. alba)* ; short, oval, woolly calyx lobes, and sessile or short peduncled acorns. The leaves of young shoots are usually dentate, those of fertile trees are entire or rarely sinuate. — This species seems to come to perfection on the coast mountains and in the* valleys of Southern California from San Diego to San Lois Key and Los Angeles, but extends into Western New Mexico, where it was first discovered, and into the adjacent parts of Mexico (Chihuahua, *Dr. Gregg).*

Q. DUM06A, *Nutl* (see p. 382), the characteristic scrub-oak of the Californian roast ranges from San Francisco southward, is closely allied to the last and still more so to var. *pungent* of *Q. undulata,* but occupies a different geographical range, has more sinuate-dentate than spiny-toothed leaves, dark green aUive ; calyx lobes lanceolate, acute* The cup scales are strongly tubercuiate, or rarely almost even.*- Coulter's 661, on which Liebmann founded his *Q. berheridifolia,* is exactly this species ; but Fremont's specimens, also quoted by him, at least those in Hb. Torrey, all belong to *pungent.*

Var. *buUatay* with thicker, paler, convex leaves, persistently woolly on both sides, has been found on the Santa Lucia mountains and near New Idria by Brewer, and in Pope Valley by Bolander.

Page 383, *Q. chrytobpis* — I distinguish as a subspecies *Q. vaceiniifolia,* Kellogg, a small-leaved evergreen shrub of the tieriat, the oblong or lanceolate leaves, except in young shoots, entire, randy more than 1 inch long, the yellowish

« The Inflects appear to understand the natural relations of the tpades of this group as well as we do ; on all of them, and on no other oaks, I hare noticed a rery peculiar gall — w a gall I mnat take this excrescence to be-on the cop*, [illegible] * MV<mlto„>tW- ""ally «intraiKl*4 by fringe-like •Balsa, sometimes hollow, sometimes containing what looks like a diminutive arorn. Entomologists ara, I suppose, wtH acquainted with iheee galls. Sometime* they hare bse* taken for minute abortire acorns from the axils of ««P amlm; bat cap mlesare not lea/ orgaaa, and cannot wi il produce axillary bad*.

ecurf very deciduous or sometimes entirely absent. Anotber extreme and somewhat aberrant subspecies I name for its discoverer, *Q. Palmeri.* It is a stout and scraggy shrub, in the mountains 80 miles east of San Diego, 8-10 feet high, with very rigid and spiny, sinuate-toothed, broadly oval leaves, less than 1 inch long, scurfy on the lower side ; anthers about 10, smaller than in *chrysolepit,* emarginate, not cuspidate ; cup obconic (i inch wide, £ inch high) ; its scales Almost hidden in the dense, fulvous tomentum; nut inside densely woolly, which I find in no other white-oak ; abortive ovules basal.

Q. TOHENIKLLA, n. ip., is an oak from the Island of Guadeloupe off the coast of the Californian peninsula; which I had formerly classed with *chrytolepis* (Palmer, Flor. Guod. NOB. 88 and 89), but which appears to be well distinguished by its tomentose young leaves and bmnchlets, which latter retain this coating for several [394 (10)] years. The full-grown leaves are 8liort-]>e<licelled, ovate lanceolate acute, at base obtuse, undulate-crenate (only on young shoots spinose-dentate), glabrous above and brownish-furzy below, about 2 inches long and half as wide, and persist into the third year. Male amenta tomentose, calyx lobes oval-obtuse, anthers about 10, cuspidate ; female flowers short-peduncled. Large oval acorns (16 lines long) in a shallow cup covered with dense brown wool, from which protrude the small triangular tips of the scales. Maturation of the fruit unknown, but from the close affinity to *ehrytolepii,* probably biennial, though the apparently nearly allied *Q. Umuntoia,* Willd., has annual fructification.

Q. EifOETl, 7W. (see p. 382, where 1. 3 from below,« Whipple" ought to read *Wluder).* This form, which wnnects the white-oaks with the black-oaks, is of the greatest interest to the student, but annoying enough to the aystematic botanist. While we have several other black-oaks with annual fructification, I know of only this one with basal abortive ovules, like the white-oaks ; but the black rough bark, the wood, the small number (2-5) of large anthers, »t« long, recurved styles, the membranaccous brown cup scales, and the tomentose inner coating of the shell, can leave no doubt about it* proper position among the block-oaks. It grows from West Texas through New Mexico to Arizona, generally a* a large bush, but Dr. Palmer and the Rev. Mr. Greene have found it also a tree up to 2 feet diameter at hate and 30 feet high. Ite leaves are persistent through winter, but fall about the flowering-time.

Q. MBBA, *Linn.,* so easily recognized in its typical form, is really one of the most variable of the Atlantic species, oepecially north and northwestwardly. All the forms have a smoothish bark with rather shallow fissures, the young Jeares lose their early thick down (usually pale below and bright red above) at or soon after flowenng-time, and the "•I" of the ordinarily very shallow, large cups are smtil, closely appressed, and slightly downy or almost glabrous. The lobes of the normal leaf taper almost undivided from a broad base, bearing a few coarse or small teeth ; but other form, have leaves similar to those of *coccinta,* with divaricately pinnatifid lobes, or the leaves are smaller and more «W1j divided, with fewer lobes, much like those of *paluitri,;* their acorns are always smaller than in the typical • * • ">d the cup rather deeper. Var. *runcinata* has narrower, lobe-dentate leaves, the large, regular teeth nearly •»«». The acorns of *rubra* are between 6 and 12, usually 9 or 10 lines thick, ovoid, rarely elongated or sometime, •ubgloboee. In northern forms the cup is apt to become more hemispherical or even turbinate, and the scales not rarely ««mid at bate after the manner of the white-oaks. This form I take to be *Q. ambupn,* Michx., which by others is thought to be a variety of the next species. Some oaks from northern Illinois (Bebb, Nos. 4,5 and 7), with rather H» and looser cup-scales, and except 7, with deeply pinnatifid leaves, come near to *eoecinea,* and may possibly be hybrids of *rubr** and *coccinta.*

Q. OOOCIKEA, *Wang.,* is readily distinguished by its turbinate cups with large, loosely imbricate (when *y almost squarrose), yellowi-h-gray pubescent scale*, the acorn, mostly ovoid-globose, retuse, or oval and [396 (U)] Pointed. I have, with some hesitation, followed DeCandolle and Gray in uniting with this species *Q. tine* *"*». Bart., which has longer and more pointed buds j broader, less lobod, and firmer leaves, paler on the under side, •Waller and more pointed aooros, at least in the few fruiting specimens I have been able to examine, and a deep yellow- «*ored Inner bark. I .uspect that specific difference, may yet be discovered ; for the present I venture to introduce it • • • subspecies.

Q- OBOBHIAITA, *M. A. Curiit* confined, as far as known, to that isolated granite rock, the Stone Mountain, east of A«anU in Georgia, which is ako the only locality for *Oymnotoma* (formerly *Rudhtckia) Porteri,* Gray, and for *ImxU** ****oi»n.* Leave, gjtt|,ro,u fronl the firrt, generally lance-«val. oval or sometimes olwvate, mostly coarsely sinuate-

• Atte. *maano^orn,* ,„ ,p. amphibia. pr»m.l«, prR.ria. fc»'ju monolc. s tranc pUcentifonui l*lol« ; folii-l»'»™ (8-10) dktichls stontatoMs sine bscioulu fll.ro.is periiibeiMs ; jg««m-iSttSTi^li-r-* »£»•«.« «nm. dlam.) minuUnsim. sub lent. Terniculosis * * * (homidl. nigricntibu.) • microsporiis (0.028-0.031 "•• 1<»««s paptllosb^bteurla!^ nucroiponli |W> &1? ^ I10W *pwrt«», a couple of inches deep and a few ked ^ . ^ iurface netf tbe ^p ^

the mountain, where occasional nins and dew* famish tern- P«™r "* Francos "'"'«••;•?. Ult ,,here f,,r ~wkl,and ™* •>'<>*>• *• K'«mK »nn. fl »hin« on the n,,ked Tock, parches ^^^rT^%Ef:tM !y1869:,, wirited by Prof. Oray in April, 1875, *n.l by Mr. t anby .nd my»lf in 8fptember. 187«, when nothing was peitH-ptible but the d«»d, matted root-flb™. attached to the smsll shrirelled «,rn«. - Conn 8-4 line. In diameter. fl«t. only H line htek ; Icares S-2J incbe. long, in all the •IKKIIUCIU examined

toothed, with 2-4 teeth or lobes, rarely pinnatifid or sometimes entire or undulate ; crowded acorns small, subglobose ; shallow, flat cups, truncate or rarely rounded at base, with triangular, obtuse, nearly glabrous, appressed scales. Perhaps too near *Q. palustris,* from which the fruit is scarcely distinguishable, though the locality, the growth, and the foliage differ.

Q. LAURIFOLIA, *Michx.,* appears after all to be distinct from Q. *aquatica ;* whether entire or lobed, the leaves of the hitter mostly have a cuneate outline widest in the upper third or at least above the middle ; the calyx lobes are larger and very conspicuous, and the filaments enclosed and only the anthers exsert. *Q. laurifolia* has lanceolate oblong leaves, widest about the middle whether entire or lobed ; the calyx lobes are much smaller ; filaments exsert; this in flowering specimens of both species from Bluffton, the only ones which I could compare. A specimen from the gulf coast of Mississippi has oval entire coriaceous leaves 4 inches long and 1J inches wide, while those of the South Carolina plants are narrower, and rather approach to *Fhellos,* but never to *aquatica.* They usually persist until the budding time, but not beyond it.

Q. CINEREA, *Michx.* In specimens from South Carolina I find, together with the ordinary stellate pubescence, an abundance of yellow articulated hair on the young leaves, while in flowering Texan specimen! [396 (12)] it seems to be entirely wanting.

Q. WISLIZENI, *A. DC.* With his usual acumen, A. DeCandolle discovered this species in a small fruiting specimen, brought by Dr. Wislizenus in 1851 from the American Fork of the Sacramento River, but through a mistake of mine, he located it near Chihuahua. Since then nothing further, I believe, has been published about this remarkable oak, though an abundance of material and very full notes have been gathered by different collectors, principally by Prof. W. H. Brewer and Dr. H. Bolander.

This species is found throughout the western parts of California from Shasta to San Diego, principally in the region of the foot-hills, but does not ascend the higher mountains. In some localities it makes a " magnificent tree " 40 to 60 feet high, with a trunk occasionally 6 feet in diameter, but branching 5 or 6 feet from the ground, as most of the large Califomian oaks of both groups are-wont to do. On the coast ranges from Monte Diablo to San Diego it also occurs as a small shrub with small leaves.

The bark is pale and smoothish in younger, very rough and black in older trees. The firm, leathery leaves persist 14 or 15 months on the branches ; they vary excessively, often on the same tree, from broad ovate to narrowly lanceolate ; cordate, obtuse, or acute at base ; the margin entire, or with a few teeth or sharply and closely dentate ; shoot* or young trees have usually dentate, old and fertile ones more commonly entire leaves. In the earliest age the leaves are very slightly concave, and in vernation imbricate ; they bear on both sides articulated hairs, bat soon become glabrous; the full-grown leaves are mostly dark green and shining, and delicately reticulate, principally on the upper surface. They are usually 2-4 inches long and half as wide, or rarely narrower; petioles 5-9 lines long; in var. *JrtUesctM the* leaves are only 1-1£ inches long, oval, entire, or often very sharply and deeply lobed-dentate ; petioles 1-2 lines long.

The rbachis of the aments is stellate-canescent, or nearly glabrous ; ealyx lobes 5 or 6, large and broad, nearly glabrous or cilinte-bearded ; anthers 3-6, often pointed. Bracts of the sessile (or often peduncled) female flowers large, orbicular, merabranaceous ; the long, recurved styles not rarely 4 or 5 in number. Acorns always elongated, 9-18 lines long, immersed £ to j in the cup, which I find varying from 6-11 lines in depth and 5-6 lines in width ; cup scales elongated, acutisb, light brown, and nearly glabrous.

On one hand this species approaches to *Q. agrifolia,* with which it has often been confounded, aud on the other to *Q. SonomcTuis.*

Dr. Kellogg, in Proc. Cal. Ac. 2, 36 (DC. Prod. 16,2,79), scantily describes an oak under the name of *Q. Morehui,* which may belong here.

Q. MYRTIFOLIA, *Willd.* Willdenow's description of the foliage, which cannot possibly refer to any other oak, together with his locality, makes it certain that in Dr. Mellichamp'n very complete specimens we have his plant before us and, thanks to him, I can now re-establish this little-known and often doubted species. It [397 (13)] grows on the poorest sand ridges near Bluffton, together with *Pinus australis,* very rare there, but apparently extending along the coast to Florida. It makes an evergreen shrub from 1J-2, usually 4-5, and up to 8 feet high. Leaves rounded ovate, cordate, obtuse, or sometimes acute at base, obtuse and in youth bristle-pointed at tip, revolute on the margin, thick and leathery, persisting 15-18 month*. Leaves vary sometimes to broadly obovate, or are rarely,

distichotM, which I bare not m*en in any other specie*; sporangia J-J line in diameter, usually eniarginate alwve, almost black from their dark contents, but without any brown cells ; often remaining for a time attached by their base when their leaf has withered away. The plant, which I hare cultivated for several yean, seems to vegetate as soon as moisture is furniched, but lies dormant part of the rear ; spore* mature in May and Jnne. —This species, /. *JLtccida* from Florida, and /. *XuUaUii* from Oregon, are the only American *Ito9U»* In which the spore-case in f ntiriy enclosed in and covered *by* the velum ; and it is the only one of oars with dark all the others having white <

on young shoots, sinuate-angled ; they are usually 1-1 *i* or even 2 inches long, but on vigorous ground-shoots have been found 2£ and 3 inches in length by 2 in width. The young leaves are densely covered with a rusty, clammy scurf of articulated hair, which after a month or so disappears, leaving a glossy surface. Vernation imbricate ; youngest leaves flat with recurved margins. Ainents about 1J inches'long with stellate-canescent rhachis, 5 oval pubescent calyx lobes, and a few (mostly only 2-3) small cuspidate anthers. Fruit sessile or usually short peduncled, single or in twos ; cup very shallow, about 6 lines wide, with ovate-triangular obtuse scales ; gland ovate or subglobose, 5 or 6 lines long, covered by the cup for } or J of its length. — *Q. myrtifolia,* Wiild., Nuttall, Pursh, Elliott, only the first two of whom seem to have seen sterile specimeus ; flower and fruit had been unknown. — *Q. Phtllos,* var. arouma, Chapm. *Q. aquatica,* var. *myrtifolia,* A. DC.

HYBRID OAKS.

The question of hybridity in plants is in every case difficult to solve where its usual character, the sterility[6] of the hybrid, fails us, and where we have nothing to rely on but the rarity and individuality of a form that seems to stand intermediate between two well established species which occur in its neighborhood, and which could be considered its parents.

This is just the case in oaks. All the supposed hybrids are abundantly fertile, and those of their acorns which have been tested have well germinated; in fact, as far as I know, no [398 (14)] difference in fertility or germinating power between them and the acknowledged species has been discovered. The seedlings of such questionable individuals do not seem to revert to a supposed parent, a sport of which they might be claimed to be, but propagate the individual peculiarities of the parent; " come true," as the nurserymen express it. For how many generations this may continue, and whether in time forms approaching one or the other parent may not appear, remains to be seen. At the same time it is a remarkable fact, that, notwithstanding their fertility, they do not seem to propagate in their native woods. We may properly ascribe this to a lesser degree of vitality in the hybrid progeny, which causes them to be crowded out in the struggle for existence: one of the provisions of nature to keep the species distinct; or, as Dr. Gray suggests, fertilization by one of the parents may soon extinguish the hybrid characters. I find ten forms, enumerated below, which I consider as real hybrids; of them only a few, often only single individual, have become known. Their existence cannot well, without straining facts, be considered due to innate variability in the supposed parents. When more carefully looked for, undoubtedly more will be discovered.

White-oaks and black-oaks are too distinct to be crossed.

Among the white-oaks hybrids seem to be much rarer than among the black-oaks, or it may be that they are more difficult to discover. Of the former, I have thus far been able to trace 3 forms only which I must take for hybrids, and all of them point to *Q. alba* as one of the parents.

C- ALBA *X* MACROCARPA w sent by M. S. Bebb (N[T]o. 27) from Northern Illinois; the leAf is that of *alba,* with a persisting down on the umler *ide ; the cup is not larger than in *alba,* but a little deeper and with the prominent trian-

• On the muddy banks of the Mississippi near this city, *nets several s^eiea of *Nasturtium (palustrc, oblusum, $csri-IS/torum,* and *sinuatum)* are abundant, two hybrids occur •Wong them which will illustrate the different sexual qualities Jrtiich hybrids may possess. The fimt, an offspring of *palua-*w* *ti<f #iuua/i<m, U a normsl hybrid with aninli anthers and Abortive, •hrivt-lled pollen-grains, with iininipregnable though "Ppwently well-formed ovule*, and nmall and absolutely •w l e podg. i$_t$ i, perpnn^i j$_{iko}$ *nnwUum,* snd em* like *palustre,* abundant flowm of intermediate size, in long, virgate racemes, and, singularly enough, with uncommonly large •Hgmas. The other, a hybiil between *palustre* snd *obtusum,* on the contrary, produces good pollen and is quite fertile, *> that it might be questionable whether it really is a hybrid ; and indeed it hns all along been considered a form of *obtusum* until Mr. Eggert pointed out its intermediate character. The true *obtusum* is always prostrate and small (branches not more than i> inches long), has minute whitish flowers, petals only half as long as sepals, small orbicular an then, and elongated, suberect pods on very short pedirels. *N. fMlustre* is erect, has large oblong anthem and shorter patulons, long-pedicelled pods. The crow occurs in all forms, from the small and prostrate to the tall and erect one, often as if struggling between an erect and a decumbent habit, with some branches in one, others in another direction ; the yellow petals are longer than in *obtusum* but much smaller than in *paJustre,* anthem as in the former ; pods shorter than in *obtusum,* on longer, patulous pedicels.

gular scales of *macrocarpa.* Another specimen, much nearer *macrocarpa,* was studied by £. Hall, a number of yean ago, in central Illinois (Amer. Ent. & Bot. 1870, p. 191). The leaves are those of the latter species; the bark, the down of the young leaf and inflorescence, and the acorn, more that of *alba*; while the deep cup, covering half the acorn, is that of a small-fruited *macrocarpa,* but entirely destitute of a fringe ; its acorns develop much slower than those of *macrocarpa,* and more conform to *alba.* Of the allied oaks, *macrocarpa, alba* and *stellata,* the first develops its acorns soonest and the last latest ; these last are not larger than peas by the end of August, when those of *alba* are nearly full grown.

Q. ALBA X STELLATA. A specimen from the same careful observer (Bebb, No. 24) must, I believe, [399 (15)] be referred here. Leaves similar to those of *alba,* with the narrow lobes occasionally widened forward and retuse, after the manner of *stellata,* pubescent on the under side, as well as petioles, branchlets, and shallow cups ; cup scales distinct and regular but considerably tumefied at base ; in *alba* these scales are almost entirely changed into very prominent knobs with short obtuse membranaceous tips; in *stellata* they are lanceolate, very distinct, only slightly tumefied, and more canescent. Bark and flowers of Mr. Bebb's tree are unknown to me.

Specimens from South Carolina, sent by Dr. Mellichamp, mentioned p. 389, seem to indicate other hybrid forms of the same parents. One has the leaves and furrowed bark of *stellata,* but the glabrous brancblets. and glabrous anthers of *alba.* The other's bark is flaky like that of *alba*; the branchlets, the sinuate or obtusely-lobed leaves, and young acorns, are glabrous ; anthers unknown. Of neither have I seen the fruit.

Q. ALBA X PRINUS. A single tree, now unfortunately destroyed, was observed by Dr. Q. Vasey near Washington. Bark " rougher and darker than in *alba ;"* leaves incised-serrate, of firm texture, glossy al»ove, pale and slightly pubescent beneath ; hemispherical cups with distinct tumid scales terminating in triangular membranaceoufi tips. The leaves are more those of *Prinus* than *alba,* the acorns belong rather to the latter. Both supposed parenU grew with it t»n a gravelly hillside.

The hybrid black-oaks are much more numerous, or, to speak more correctly, more have thus far been noticed, perhaps because their leaf-forms are more various, and thus the intermediate ones are more easily recognized. The mixture of entire-leaved with lobe-leaved forms would of course be most readily discovered from the intermediate leaf-form of the illegitimate offspring; but it remains for further close examination to ascertain whether lobe-leaved species do not hybridize among themselves as well, or entire-leaved forms also mix together, producing offspring of less strikingly marked characteristics.

That we have to look for one of the parents of three of our hybrids to one and the same species, seems to correspond well with other observations, all pointing to the fact that some species of a genus are more prone to hybridize than others. This is true of *Verbena,* hybrids of which abound in this neighborhood in numerous forms as well as in a great many individuals; of most of them *V. stricta* appears to be one of the pareuts, perhaps because one of the most common species, or from some innate quality which makes it mix more readily with others; perhaps from a peculiar structure of the flower which may promote insect agency. Our hybrid Ver- [400 (16)] benas differ from the hybrid oaks in having almost always abortive anthers and in bearing scarcely any fertile seeds, while at the same time they are so common that evidently they are readily produced anew.

Our black-oak hybrids are the following: —

ProUble PfcnoU.	Nam owkr vklch dtseribsd.	Habitat.
Q. CaUsbaH, *aquatint.*	*tinuata,*	South Carolina.
Q. Cntesbeti, *lauHfolia,*		8onth Carolina.
Q. imhriearia. mV,rrw,	*tridtTUaia,*	Illinois.
Q. imhricnria. *patudris,*		Mimouri.
Q. imbriraria, *corcinca,*	*Lenna,*	Ohio to Missouri and near Washington.
Q. Phflhx, *coecinca,*	*hderophylla,*	N. Jersey and Delaware.
V. *Hid folia,* *coccinca,*		Massachusetts.

Q. CATFABAI X AQUATICA. Q. 815rATA, *Walt. Car.* 235, *DC. I* c. 74. It it quite probable that in the tree observed by Dr. Mellicbainp, several yean since, near Bluffton, S. C, we meet with Walter's obscure and long ignored species. Mr. Ravenel ban aU> oltM'rved a similar form in South Carolina, and indicated *eincrm* as one of the parvnta. Dr. M.'s tree grows on a sandy ridge with *CaUsbtti, falcata* and *virtn$; aquatica* and the rarer *cinerm* are not far o'sl

It is 40 feet high and well grown, has a " very dark, deeply cracked bark, which is red inside like *Catesbtei."* Leaves 4, rarely 5-6 inches long, about half as wide, attenuated at base into a partially margined petiole, 3-6 lines long ; leaf itself oblong to obovate, sometimes almost rhombic ; sinuate with shallow obtuse lobes to divaricately dentate-lobed; lobes obtuse, or acute and bristle-pointed, dark green and shining on upper surface, paler but glabrous and with some axillary down beneath ; leaves imbricative in vernation ; in early youth both sides, the lower more than the upper, are covered with the rusty, articulated pubescence of *Catesbai ;* male flowers with 4 large, pointed anthers. Acorns sessile ; cup hemispherical, turbinate, 8-10 lines wide, 5 or 6 high; nut oval, 8-9 lines high and 6-8 thick, i or \ covered by the cup. The leaves of seedlings are lanceolate to obovate, spinulose-dentate or sinuate, rarely entire. In the seedlings of this plant as well as of the regular *Catesbasi* none of the fulvous glandular pubescence, which is so characteristic of the young leaf of the grown plant, is yet developed. — One of the parents is doubtless *Q. Catesbai,* as, among other characters, this abundant rusty down proves; as the other, *aquatica, cinerea, or falcata* present themselves. *Falcata* is excluded by the form of its leaves ; *cinerea* might be the parent, as I formerly assumed, but the usually obovate outline of the leaf, as well as the character of the acorns, seem to point rather to *aquatica.*

Q. CATESBiW X LAURIFOLIA, a late discovery of Dr. Mellichamp, is found in the same neighborhood, [539 (17)] "in the cove with *laurifolia* and *falcata,* a tree 50* feet high, bark very much like that of the former." — leaves lanceolate to ovate in outline, the uppermost narrower and entire, the lower wider, and generally near the middle with 1 or 2, rarely with more, divaricate or even falcate, acuminate lobes, coriaceous, strongly reticulate above, persistent through the greater part of winter, 3-4* inches long, J-2 or 2£ inches wide, petioles ± inch long; youngest leaves imbiicate in bud, slightly downy Mow, densely fulvous-glandular above, soon glabrate; leaves of vigorous shoots much larger and more lobed; acorn subglobose, 7-7* lines wide, about half immersed in a hemispherical, turbinate, downy cup.

The tree and its foliage resemble *laurifolia,* but the acorns and the shallow cup of this species are qrte different; the long falcate lobes of many leaves point *to falcata* or *Catesbai* as the other parent, while the larger size of the acorn and the deep cup indicate the latter as the most probable. Notwithstanding these signs of hybridity, the probability k not excluded that we may have nothing but an abnormal form of *laurifolia* before us.

Q. IMBRICARIA X NIGRA. Q. TRIDENTATA, *Eng. in Hb. Q. nigra,* var. *tridtntata,* DC. 1. c. 64. A single tree, »ther small, which was soon afterwards destroyed, was found by me, in the autumn of 1849, on the hills 6 miles east of St Louis, in company with both supposed parents and *coccinea* and *rubra,* together with some white-oaks- Foliage as well as fruit are of such decided character that the origin of this hybrid can scarcely be doubted ; the leaves •W rather those of *imbrioiria,* with a touch of the peculiar lobation of *nigra,* and the fruit is more like that of *nigra.* Leaves elliptical to obovate, entire or often coarsely 3-dentate at the apex, occasionally with a few teeth on the sides; 4-7 inches long, two or three wide; lwse rounded or acutish ; upper surface dark, shining green, lower one pale, and to SepteniWr not yet quite glabrate ; petiole 4-10 lines long. Acorns closely sessile ; the hemispherical, turbinate, oail*ceiit cup alxmt half-enclosing the globose nut

Q. IMBRICARIA X PALU8TRI»« wo* observed by me a few yean ago 8 miles west of St. Louis, in a little dell *bere. *imbricaria* abound*; *valustrU coccinea,* and *nigra,* together with some white-oaks, were near by; the tree was only 8 inches in diameter, but in lull bearing. It had, unfortunately, to give way to a railroad track ; but ripe fruit *a« obtained, which to Mr. Meeliau of Germantown has furnished fine young plants, completely agreeing in character *ith the parent.-Leaves slightly revolute in vernation, though not a* much as in *imbricaria,* pubescent, especially **low, but completely denucktod before the end of May. Full-grown leaves, broad-lanceolate, mostly ***. * bate, entire or more frequently with a few (sometimes more) coarse, triangular-lanceolftte, [540 (IB)] acute, bruttle-pointecl teeth, glabrous on both sides; about 4 inches long, 1} wide, rarely larger; pedun- cles 3-4 lines long; cup moderately deep, turbinate at base, 6-7 lines wide, 3-4 high ; ovate, obtuse scales, canescent, with bright brown margins.

Q. IMBRICARIA X cocciWEA WM flnit described and figured by Nnttall, about thirty years ago, under the name °[C *Uana,* Nutt Sylv. Contin. 1, tab. 5 bis ; DC. 1. c. 62. The original tree was discovered by Mr. T. G. Lea, near Cincinnati, and is still in existence;' soon afterwards, Dr. S. B. Mead found another tree in Hancock Co., Illinois. My •pecimen, obtained from the first discoverer, ha* entire or sinuate or dentate or dentate-lobed leaves, 4-6 inches long and half as wide, and even in September slightly pubescent below ; lobes acute and bristle-pointed or quite obtuse; J*ae attenuated into a petiole 5-8 lines lorn;; acorns similar to those of *coccinea,* cup shallower with obtuse scales. Tfo leaves in Nuttair* figure have a cordate base. Dr. Mead's tree is similar to Lea's ; leaves apparently more cora- taot^7 entire or undulate-sinuate, 5-7 inch** long and half as wide, obtusish at base on a petiole 1 inch long; the Pttbeicence has almost disappeared on the lower side of the autumnal leaf; acorns gloliose, covered i-J by the canet- tWkt cap. Prof, Q Q Swallow found a similar tree in Missouri ; Mr. E. L. Greene sends another specimen from

•See account of thia hybrid by A. Bimun, in Bot Zeitnng, 1871, 202-3; - from Sitmngaber. Oesellsch. ntturf. Freun de *n* Berlin, D*s. 20, 1870. - ED*.

Macon Co., HL, rather more glabrous but otherwise similar; and Mr. L. F. Ward discovered one near Washington. — The relationship to *imbricaria* is unquestionable, and among the lobe-leaved black-oaks we must look to one of the forms of *coccinea* for the other parent, as the acorns and especially the cup and its scales indicate. I have not seen very young leaves, but doubt not but that they are, like those of the other *imbricaria-hybrids,* re volute on the edges.

Three years ago, I found in St. Clair Co., 111., 20 miles from St. Louis, in low, fertile woods where both *rubra* and *imbricaria* form the bulk of the forest, a hybrid which I took to be an offspring of those species ; growth of the tree and bark like *rubra;* leaves of the lower limbs ample, 4-8 or 9 inches long, 2-6 inches wide, obtuse or cordate, rarely acute, at base, the smaller more commonly oblong and entire, the larger ones oval or obovate, entire or sinuate, or with a few broad and shallow obtuse or triangular bristle-pointed lobes ; in June still downy on the lower surface, petioles £-1 inch long, pubescent; the nascent leaves revolute on the margins, but .much less so than *imbricariay* and white-ton)entose on both surfaces. — Now, since I have obtained upper branches and ripe fruit, I am convinced that *rubra,* though growing close by, is innocent of its existence, and that *coccinea,* forests of which grow on the hills a quarter of a mile off, must be one of the parents ; in short, that it is a form of *Leana* itself. The cup of the acorn is, to me, decisive ; it is turbinate, covered with rather large canescent scales, squarrose at tip, and very different from those of either *rubra* or *imbricaria,* but approaching those of *coccinea.* The globose acorn, 7 lines in diameter, one-third covered by the cup, shows 22-25 black stripes, so common in many black-oaks. The leaves of the fertile branches are cordate or obtuse at base, and almost all deeply runcinate-serrate. —This [541 (19)] instance ought to make us very careful not too hastily to judge of the parents of a hybrid from the species growing nearest to it.

Q. PHBLLOS X COCCINEA, Q. HETEROPHYLLA, *Michx^* is distinguished by the petioled leaves of lanceolate outline, entire, sinuate, spinulose-deiitute, coarsely serrate, or with simple, sometimes spreading or falcate, lobes; leaves ofdifferent form on the same tree and often on the same branch, the uppermost leaves usually entire; [7] or some trees more with entire, others more with dentate or with lobed leaves. Youngest leaves strongly revolute, pubescent above, white-downy below; becoming glabrous in summer. Acorns subglol>ose to oval, 5-7 lines long, a little less wide, scarcely half immersed in the shallow-hemispherical, somewhat turbinate, canescent cups; scales lanceolate, obtuse. Fruit of same size and very similar to that of *faleata,* but cup usually deeper and with larger scale*.

The typical specimen described by Michaux, found by him " in a field belonging to Mr. Bartram near Philadelphia," has long since been destroyed, but its offspring was introduced into Europe, and the trees now seen in Bartram's garden in We*t Philadelphia, at Marshall's place in Marshalltown, and in J. Hoopers garden in Wefttchester, as well as those of the European gardens at Verrière, Herrnhaiiften, and Prague, the latter fertile, are believed to be its seedlings. Only within the last ten or fifteen years the tree has been re-diacovered, and now numbers of individuals are known in low woods on both sides of the Delaware below Philadelphia (6 miles east of Camden, *Smith, Leidy, Burk, Mariindale,* and 2 miles west of Wilmington, *Commons, Canby),* often in groups together, probably the offspring of some few original hybrid trees.

A. De Candolle and others viewed this hybrid as a form of *aquatica,* others, as belonging to *PheUos,* while I was long inclined to follow Michaux in considering it as a distinct species. With *aquatica,* which does not grow within a hundred miles, it has no* relationship; aside from other characters, the revolute vernation abundantly distinguishes it from that species; from *PkelU** it differs in the form and size of the leaves and their thick down in youth (in *Phellot* even the youngest leaves are almost glabrous), and in the larger acorn in a deeper cup bearing much larger and longer scales. That it is a hybrid is most probable on account of its great rarity and its so very variable foliage. One of its parents is undoubtedly *Phello$;* for the other we mnst look among the lobe-leaved black-oaks of its neighborhood, *faleata, rubra,* or *coccinea.* While the sometimes falcate lobes of the hybrid and the similarity of its acorn* point to the first, and its frequency in those localities to the second, we find the texture of the leaf and its reticulation, as well as size and form of the cup and its scales, intermediate between *PheUos* and *tinctoria,* and quite different from the other two species, and thus come to the conclusion that the former must be the parents. [542 (80)]

Q. ILICIFOLIA X COCCINEA, *Robbini in Gray, Man. ed.* 5, *p.* 454, discovered by Dr. Bobbins at Uxbridge, Massachusetts in 1855, of which I have seen flowering and fruiting specimens in the Cambridge Herbarium, seems just intermediate between the two parents. " Tree 40 feet high, 19 inches in circumference, both parents within 4 rods"; leaves 4-5} inches long, nearly 4 wide, sinuate-lobed, lobes acntate, mostly bristled-toothed toward their apex; youngest ones greenish pubescent above, canescent below, at maturity strongly reticulate *(UidfoUa* is very slightly «>) and shining aWe, and with the branchiets lightly pubescent below ; cup deeper than in *ilicifoti** glabrate. The persistent though light pubescence resembles *ilicifolia,* while the shape of the leaf reminds one *of* [illegible] rather than *coccinea.*

[1] This in the CAM generally in heterophyllous hybrids, i.e. hybrid* between entire-leaved and loot-leaved •peries; the uppermost leaves of an axis are apt to be entire, while the middle one* are lobed, etc ; thos the lower branches also often bear entire leaves, while the upper ones have more lobed ones.

Several forms of oaks have at one time or another been considered as hybrids which most probably are varieties or sports of one or the other of the well-established species.

Q. OLiViEFORMis, *Mickx.,* is a variety of *macrocarpa* with elongated acorns in a deep and narrow cup, and not a hybrid of *macrocarpa* with *alba,* as has been suggested.

Q. RUNCINATA* was the name given to a form I found in the richest Mississippi bottom-lands opposite St Louis, together with *rubra, imbricaria,* and *palustris.* From its smaller and narrower, coarsely dentate, not lobed leaves, and its smaller fruit, it seemed distinct enough from *rubra,* and was possibly a hybrid of it and some other small-fruited allied oak. But the leaves of *rubra* are so variable in size and outline that DeCandolle (1. c. 60) was right in considering it a variety of *rubra.*

Q. FALCATA., var. *subintegra,* is a variety of *falcata* which I had taken for a hybrid of that species and *cinerea.* Dr. Mellichainp sent it from South Carolina and Mr. Canby from Maryland. It seems to be only a strange sport of *falcata* itself, an extreme state of var. *triloba,* with trilobed as well as entire leaves. The glandular pubescence of the young and the smoothish, not reticulated, upper surface of the mature leaf are those of the species. Fruit not seen.

Q. QUINQUELOBA I named a form of *nigra* with 5-lobed leaves, which I found on the hills of St. Louis, and at me time considered as a cross between *nigra* and *tinctoria;* DeCandolle (1. c. 64) places it correctly with *nigra.* It is not even a variety, but rather a juvenile state which had become permanent in that tree; [543 (21)] young trees or shoots of *nigra* have sinuate-dentate or many-lobed leaves, but in fertile ones the leaves are almost always more or less 3-lobed or 3-dentate at the much-widened apex. I have since seen a tree which on one fruit-bearing branch had only the leaves of *quinquebba,* while all the other branches had the regular cuneate 3-dentate *nigra* leaves. The same form occurs near Washington *(L. F. Ward,* in " Field and Forest," October, 1875, where several other real or supposed hybrids are enumerated, which call for further careful investigation *in loco).*

New material having come to hand since the above was in type, I have to add some further remarks.

The typical *Q. palutri* ha* globose or depressed acorns, but near St. Louis it is occasionally seen with oblong or «ven elongated acorns. A specimen of *Q. Texana** Buckley, sent by the author to the Agricultural Department, Washington, is evidently this form *of palustris,* though it is said to grow near Austin " on hills."

Page 394. Another abnormal type, which I cannot but refer to *rvbra,* has been sent from the bottom lands of the Comale and Blanco river*, affluents of the Guadalupe, Texas, by Lindheimer and Wright. The leaves have the cut of *coccinea ;* the large (1 inch long by less than } wide) oblong acorns are borne in hemispherical slightly turbinate <«ps, covered by small appressed, smoothish scales. The bark of the tree is " pale and smoothish, much like that of *n^Hea."* In many respects the tree seems to be intermediate between *rvbra* and *coccinea,* an " ambiguous » form.

Q. COCCINEA : numerous specimens, fresh ones from this neighborhood, and dried ones with mature fruit from different localities, have weakened my hope of distinguishing *Unctoria* from the typical *coccinea.* The yellowish-canes-<*«*, equarrose cup-Bcale« are found in all the forms of this region, but northward as well as eastward they do not seem to be so characteristic of the specie* ; there they are often smaller, more appressed, and less canescent; and this may ** the form which Michaux has figured as his *coccinea,* while his *tinctoria* has larger and paler scales. We may, then, totinguish the fallowing varieties : 1. Large winter buds, leaves with broader undivided lobes, cup-scales squarroae, •COH* oblong or globose. 2. Small winter buds; leaves with slender, deeply cut, divaricate lobes, cup-scales and •conn as fa i. 3. Buds and leaves as in 2; cup-scales smaller, more glabrate, appressed; acorns more commonly °*oid. The first may be Bartraiu's *Q. tinctoria,* the third the true *coccinea,* and the second an intermediate form. The thiid variety closely approaches what I have considered as the form *amlrigua* of *Q. rubra.*

The Oaks of Wheeler's Exped[ition] (Report, Botany, 1878, pp. 249-251), and of the **Botany** °**f California,** 1880, **II.** 93-99, are by Engelmann, but no new species are included.

In the former paper (p. 251), it i* said of *Q. Emoryi,* Torrey : « Botanically a most interesting species, as it com-Wa« many characters of the white-oak*, viz, the annual maturation and especially the position of the abortive ovules * *• but of the nut, with characters of the black-oaka, viz., the black bark and coarse wood, the small number and J» •»•• of the stamens, the long, recurved style*, and the tomentose inner coating of the shell; the leaves show, as «V do in many block-oaks, a stronger reticulation on the upper than on the lower side." In the latter publication (p. 97) 0- *chryoUpU,* var. *Palmeri,* Engelm., is raised to specific rank, under the name *Q. Palmers* Engelm. - EDS.

* Gray's M anl, 5 ed., 1868, ''4. — E »».

t In • note in the Rotonical O . L , 1882, "rii. 14, Dr. Engelmann subseqaenUy states that « Buckley's *Qutrcus Ttxma* ^wiUedly correctly placed by him with the polymorphou* *Q. rubra."* —EDS,

II. VEGETATION ALONG THE LAKES.

FROM THE TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, VOL. IV. 1880, PROCEEDINGS. [Read in 1878.]

THE country is partly flat, partly rolling, and is covered in many places with dense woods, [xx] mostly of coniferous or of deciduous soft-wood trees. Among them the "gray-oak of Canada" occurs, described by Michaux as *Quercus borealis,* or *Q. ambigua,* our most northern oak, found from Like Superior to Lower Canada and to Nova Scotia. Its acorns and leaves cannot be distinguished from those of our red-oak, *Q. rubra,* L, of which it is without doubt a northern variety with paler bark and tougher wood. It grows to be a large tree of over two feet in diameter, and its wood is highly esteemed in those regions. I cannot make much of the figure of the acorn of *Q. ambigua* in Michaux's Sylva; it does not resemble any form of gray-oak acorns I have seea Can it belong to the following *1*

The other oak of the shores of Lake Superior is a kind of black-oak, a smaller and, up there, much rarer tree, but which becomes much more common farther south, on dry land in Minnesota and Wisconsin, and seems to extend eastwardly to the New England States. Farther south it gives way to the ordinary black-oak *(Q. tinctaria ! Q. coccinea T)* which, though very variable in foliage, is always characterized by the large, thin, somewhat squarrose-tipped cup-scales: the black-oak of the Middle States. In Northern Illinois both are found. The northern black-oak has a very rough black bark; leaves coarsely, or often very finely lobed (as to resemble the foliage of *Q. palustiris)*; a turbinate cup with small, appressed, and more or less tumid scales, so that the cup appears tuberculated almost like that of a white-oak. The most common white-oak of Minnesota is *Q. macrocarpa,* popularly known under the name of burr-oak.

A few plants otherwise peculiar to the Atlantic shores also occur along the northern lakes, which is explained on the hypothesis that these shores were once sea-coasts.

III. THE ACORNS AND THEIR GERMINATION.

FBOM THE TBAN8ACTION8 OP THE ACADEMY OP SCIENCE OP Sr. LOUIS, VOL. IV. 1880.

THE structure of the acorns and the germination of the oaks seemed to be so well [190(1)] known, that I did not pay much further attention to it until my interest was excited by the information that the germinating live-oak developed little tubers, well known to the negro children, and greedily eaten by them. The notes and the specimens obtained from my South Carolina correspondents, Messrs. H. W. Ravenel, W. St. J. Mazyck (who was the first to notice this), and Dr. J. H. Mellichamp, enabled me to examine the germinating live-oak and to compare it with other oaks in this condition. I now studied the acorns, as many mature ones as I could find in my collection, and the oak seedlings which I had, as well as other seedling trees, carefully ooUected whenever I could obtain them. The following are the results.

In the tip of each acorn we distinguish, imbedded between the two large fleshy cotyledons, first, the little caulicle, and then at its upper end (toward the centre of the acorn) the two stalks or petioles of these cotyledons; between these the plumule is visible, more or less developed, **usually** only a truncate or slightly notched or emai^inate knob. These parts together are in the **different** species and in different sized acorns usually from one to three lines long and one-half to **one** line to diameter; in very small acorns sometimes smaller.

The proportion of the caulicle to the stalks appears to be constant in the same species, as I have satisfied myself by examination of numerous acorns of the same species from widely separated localities.

In all the black-oaks which I could study the caulicle is longer than the stalks. [191 (2)] Thus in *Quercus nigra, irnbricaria, pumila,* and *Kelloggii* I find it twice as long; in *Q. coccinea* and *tinctoria, rubra, ilicifolia,* and *agrifolia,* it is three to four times as long. *Q. deniri/lora,* of the section *Androgyne,* is similar in this respect to the first

A few white-oaks resemble the black-oaks in the proportion of these parts. These are *Q. macrocarpa* and *undulata}* and especially *Q. Robur* of Europe. In this and in the Californian *Q. chry-* *&pw I find the caulicle nearly three times longer than the stalks; in both of them I also notice the plumule unusually developed.

But in the majority of white-oaks the caulicle is shorter than the stalks of the cotyledons; I have seen it in the American *Q. alba, stellata, Garryana, Douglasii, Breweri, Prinus, Miihleribergii,* * *prinoides, Michauzii, bicolor, dumosa, pungens}* and in *Q. occidental*[1] of southwestern Europe. It is very interesting to find that in the hybrids of *Q. macrocarpa* and *alba,* which externally resemble niore the former than the latter, the proportion of the stalks and the caulicle is entirely that of the ^tter and not of the former. I have observed this fact in hybrids from Illinois *(Hall)* as well as from Vermont *(Pringle).*

By far the longest stalks or petioles, however, aTe found in *Q. virens;* in this species not only the cotyledons, as is well known, but also their stalks, are coalescent: the caulicle itself is very short, only about one-fourth or one-fifth the length of the stalks, and the place where they separate from the cauliclo is indicated by the very small and imperfect plumule, completely imbedded within the connate base of the stalks.

The acorns of all oaks germinate in or on the ground, the thickened stalks and the caulicle elongate; the former become 2°to 4 or nearly as much as 6 lines long, while the cotyledons themselves remain enclosed in the cracked seedshell, and from between the bases of the stalks the Plumule grows up into the ascending axis, nourished by the food contained in the cotyle- [192 (3)] dons; these become exhausted and rot away about the end of the first season, *while* the *»dicle about the same time swells up, evidently absorbing part of the matter contained in them, and thus laying up a store of food for the next season.

The process in *Q. virens* is essentially the same; it differs somewhat in that the connate stalk of the cotyledons remains more slender, but elongates more, mostly to the extent of one inch or even ftore; the caulicle and upper part of the root swells up at once, while the developing plumule forces its way up through a slit in the base of the stalk. It seems that the danger of losing connection *ith the storehouse of the cotyledonous mass through the long and slender passage of the stalk, necessitates the transfer of the food-matter to a nearer and safer place of deposit. But why, it may be **»*• is the connection so much longer and more slender than in other oaks ? At all events it suf-fi(*a> as long as it is fresh and unimpaired, to carry over in a very short time the starchy and sweet contents from the cotyledons to the tuber; and before the ascending axis is an inch high and bears as yet only a few minute bracts, the tuber is already forming and it soon reaches the size of the cotyledons themselves; it is, however, longer and more slender, of a fusiform shape, about three to four lines thick and one to two inches long, attenuated below into the long tap-root

[1] All Colorado forms of *Q. undulata* which I hare e xamined, thos* *Mh* l«fl» and deciduous leaves, vars. *Gambclii, Gunnisonf, Jamuii* * Mwtfll M the mall-and spiny-leaved form from tha edffs of the cañon of the Arkansas, which I had considered •* identical with *Q. pungent,* have short stalks, while the pale and usually persistent-leaved forms from * * • * • the true *Q. pungent* of Liebmaun, have the stalks longer than the canlicle. Finding the proportions of these parts to he constant and as indicating specific difference, I am now inclined to consider *Q. pungens,* including *Q. grisea,* as a distinct species, provided other characters can he found to confirm this view. In a few acorns of this form I have teen the cotyledons adhering together, but in the majority they were free.

The whole process is similar to the germination of the cucurbitaceous *Megarrhiza* of California, so beautifully illustrated by Gray in his Structural Botany; with this difference, that the cotyledons in that plant are raised above the ground/ while in ours they remain hypogaeous, and that the stalk is even longer, and is, together with the cotyledons, readily separable into its two component parts. In both plants a tuber forms at once by the transfer of the food-matter from the cotyledons to the radicle; in the herbaceous *Megarrhiza* the tuber becomes a permanent organ of immense size, while in the arboreous live-oak it is finally merged in the root

IV. DESCRIPTION OF SEPTORIA QUERCL

FBOM THE TRANSACTIONS OF THE ST. LOUIS ACADEMY or SCIENCE, VOL. III. 1878, PROCEEDINGS. [Bead in 1876.]

I PRESENT to you another Fungus, on oak-leaves, which show the same yellow decayed spots; but here [ccxvi] you have to look for the peritheciuni, the fruit, if we may call it so, of the fungus, to the lower side of the leaf, and it is not a black globule as in the grape-leaf, but a brown elevation, little darker than the surrounding spot I find no pore at the top, but suppose that it emits its spores through a rent. These are very different from the spores of the *Dqpazca [Labnuca],]* being elongated, usually curved and septate, or forming three or four compartments; the spores are a little longer tnan those of the grape-spots, the peritheciuni is twice as large as that of the grape.

The septate spores indicate that it belongs to the genus *Septoria,* and the fungus may bear the name of *Septoria Querci.*

• But only exceptionally. — EDS.

t The remainder of this note will be found below under " Diseases of the Grape/[1]—EDS,

IX.

PAPERS ON VITIS.

I NOTES ON THE GRAPE-VINES OF MISSOURI.

PEOM THK TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, VOL I. 1860.

IN the Transactions of the Academy (p. 156 of this volume) Prof. Swallow has published [660] an interesting contribution on the adaptation of our State to the cultivation of the grape-vine. The article, abouuding in valuable information, contains some inaccuracies, which, as the whole subject is so very interesting and important, it may not be improper here to iqdicate.

The grape-vines proper (gen. *Vitit,* sect *ViHs)* indigenous to Missouri are *Vitis attivalit* and *Vitit cordifolia,* *** their numberless varieties ; popularly speaking, they are distinguished as the *Summer Grape* and the *Winter* or *?** &*!», also sometimes called *Fox Grape.* The former grows on uplands in open woods and thickets, is of smaller dimensions, has deeply lobed leaves with rounded sinuses of the lobes, covered when young with a rose-red down, more or less naked above when old, and bears smaller bunches of larger berries, ripening and edible earlier, say in August and September, whence the name.

The winter-grape, *Vitit cordifolia,* grows in richer soil, usually in shady woods, on our river banks and in [661] their bottoms, attaining the greatest dimensions (sometimes 10 inches in thickness and 80 or more feet in height) ; it has undivided or (with us) usually slightly lobed leaves .with sharp sinuses between the lobes, entirely naked even when young or covered with a slight whitish down, and bears smaller berries in larger bunches, ripening fnd edible not before October or even November. Those that have experimented on them contend that, notwithstanding this, the wine made of this winter grape is by far superior to that made of the summer grape.

Both these species are extremely variable, and it is quite probable that, being dioecious,[1] they by hybridization Produce intermediate forms, which may become of interest to the cultivator, and may indicate the method by which to produce valuable new varieties.*

These are the principal if not the only species of *Vitit* proper, in our State, and they grow in all its counties as *«U M throughout the Mississippi valley. They are comprised in Prof Swallow's enumeration under numbers 1 to 4, PP. 160-161. His No. 1, *V. Labrutca,* is not the plant which Linnaeus has designated by this name and which to eastern {**•***• is known as such. This, the true *Vitit Labrutca,* is a plant with rusty woolly leaves (naked above when old), ^ O R very large pulpy berries of a foxy taste, whence the popular name of fox grape in the eastern States. It is found, as far as I am informed, all along the Atlantic slope and up into the Alleghany Mountains, but does not extend into the Mississippi valley. It is considered to be the mother plant of the cultivated Gatawba, Isabella, and other Amari

[1] It is an interesting fact that all the true grapes of America (tx* those belonging to the section *Cittut),* in the *ated wild state, T ^€BckwM " dodo-polygamous, while the culti- Withtfc ^ "^P[1]** *towen.* The same is the cane and fcT «*l*-*ine of the Old World, which still grows wild AnaA *J.[lmmeilte •*« in the marahy forests of the lower I ^ [m Ttt]^*ny, bring called there to this day by the old ne, mentioned by Virgil, *Labrutca,* a name which Linnaeus ••• ^properly appUed to one of the American species

[1] It it well known and sufficiently proven by a thouwid times repeated experiments, instituted with almost every variety of this plant from all parts of the Old World, that the *Viiit vx̌ni/tra,* the grape-vine of Europe, will not thrive in our climate. Soon losing its leaves under onr burning snmmer sun, it is scarcely able to ripen the few bnnches of fruit it may bear, and cannot bring its wood to perfection ; so that our variable winters almost always kill the vines down to the ground, if not carefully protected. Would it not be possible by hybridization to produce a grape-vine with the tongh and enduring leave* of oar native grapes and the luscious and juicy fruit of the better varieties of *Vitit viniftra t*

1. *Vitis Labrusca* of Prof. Swallow must be referred to *V. cordifolia,* when he describes it as a plant growing to very large size in our alluvial bottoms. The vines of smaller size on our dry ridges, which produce larger [662] grapes with more juicy and palatable pulp, undoubtedly belong to *V. astivalis.*

2. *Vitis cestivalis* of Prof. Swallow, "the largest of all our vines," "with stems like huge cables," cannot be anything but the same *Vitis cordifolia;* while the variety "of the limestone ridges," etc., probably has to be referred to **the true *V. asstivalis.***

3. *Vitis cordifolia* is erroneously considered a smaller plant than those enumerated under 2 and 3. The true F. *cordifolia* and its variety, 4. *V. riparia,* which forms complete transitions into the former, are by far the largest American grape-vines.

5. *Vitis vulpina.* Linn., differs essentially from all the other grape-vines by its smooth bark, which is never shaly, like that of all others. It bears very large berries in very small clusters, and is known in the South as *Fox Grape* (whence the Linnsean name), *Muscadine* or *Bullet Grape.* I have seen it abundantly in Arkansas, but never in Southern Missouri, though it may extend so far northward. Possibly it has been confounded with a species of grape which in Southern and Southwestern Missouri and in Western Arkansas and the adjoining Indian country is common on the gravelly banks of the smaller streams, which are overflowed during freshets. My specimens of this plant are not complete enough to class it with perfect confidence, but they indicate a close alliance and probably identity with *Vitis rupestris,* Scheele, of Western Texas, characterized by a low, bushy, rarely climbing stem ; small, roundish, glabrous leaves, coarsely dentate, almost truncate, or with a broad sinus at base ; by middle-sized berries, in small bunches of pleasant taste. It has much the growth and appearance of the muscadine, but can always be distinguished by the shaly bark of the stem and the lighter colored leaves.

The wild muscadine grape as well as its cultivated variety, the Scuppernong, has been grown in gardens about St. Louis, but has never, I believe, borne fruit, showing that our climate does not suit it

6. *Vitis bipinnatOy* Torrey & Gray, and 7, *Vitis indivisa,* Willd., cannot come into consideration in a review of our native grape-vines, which considers only their economical value, as they do not bear edible fruit. They belong to the section *Ossus* (**gen.** *Cissus,* Linn.) together with *Vitis incisa,* Nutt., which is found from Florida to Texas. *Vitis indivisa* is common throughout the State, especially in the valleys of our larger rivers. *Vitis bipinnata* is a southern species, and was not observed by me north of Arkansas, though it may occur in the southern parts of **the** State.

II. THE NORTH AMERICAN GRAPES.

FROM THE AMERICAN NATURALIST, Vol. II. AUGUST, 1868.

PERHAPS the first plant noticed on the continent of North America, even before Columbus [320] and before the Pilgrims, — a plant identified with the discovery of America itself, — was the grape-vine; it gave to the country the name *Viiuland,* and later, to a part of it, that of *Martha's Vineyard.* And yet the grape-vines, many forms of which grow from Canada to the Rio Grande, and from Virginia to California, are among the least thoroughly kuown plants of North America. Linnaeus knew two species; and that sagacious observer, the founder of the flora of North America, Michaux, added three more. These five species are acknowledged to this day as the principal fonns found in the regions between the Atlantic and the Mississippi But even in their native haunts they vary to such a degree, that both scientific and non-scientific observers have never felt satisfied about them. Rafinesque, about fifty years ago, undertook to describe and classify these forms; but, with his loose observation and lax scientific conscience, he, as usual, instead of becoming a guide, created inextricable confusion. Le Conte, long after him, did little to unravel the entanglement; and since their efforts to distinguish imaginary species, the tendency has rather been to combine what were formerly considered, even by conscientious authors, as distinct species.

I have long devoted much attention to the grape-vines of my home (St. Louis), but have become satisfied that no satisfactory solution can be obtained without the co-operation of the friends of botany throughout the whole country; no I ask, from their love and seal for our scienoe, and from the general interest which this particular investigation now commands, their friendly, co-operation.

In ^ t? arrive at satisfactory conclusions, it is necessary to study all the forms which present ... found. 1 Specimens ought to ... MUeoted in flower, exhibiting also the young shoots and develop... leav... tom... Trf tfc... iu fruit. if fruit they bear; and ripe seed should be ob... the Hff ... Soil, the locttlity. ^e accompanying plants, and the size of the vine ought to be noted • ... porrant; the exact time of flowering, and the period of maturity, are interesting data. The size, color, and ... mi iL ... tMte of the fmit; ... Presence or absence of the bloom on the ripe berry; the usual number of seeds in each; the conditions and color of the pulp,—all are points not to be neglected. It is not ... expected that Species can be founded on the variations in all these characters, but it is ... that the Mmits of variation of the different species should be defined; and that can only be ... by exact study of as many forms as possible in all their bearings. Thus far I have only seen ... n vines with perfect and with staminate flowers; purely pistillate ones may perhaps be discovered by acute observers.

^e species now known to botanists in the territory of the United States, but several of them not sufficiently defined, are the Mowing: -

L GRAPE-VINES WITH LARGE BERRIES.

1. VITIS VULPINA» *Linn.,* the southern fox-grape, or Muscadine, with several cultivated varieties, such as the ... ppernong, etc.

2. VITIS LABRDBCA» *Linn.,* the northeastern fox-grape, with numerous cultivated varieties, such as the Catawba, Isabella, Concor^ Hartfoki P^fi c, etc.

3. VITIS OANDIOAHB, JFwfflem, the mustang grape of Texas.

II. GRAPE-VTNES WITH SMALLER BERRIES.

4. Vins CARIB*A, *DC,* of Southern Florida and the West Indies.

5. VITIS CALIFORNICA, *Benth.,* confined to California.

6. ... VITIS ... STIVALIS» ^«te-» the summer grape of the Middle and the Southern States, with numerous varieties. Valley ... Oh VW# *mcnticola* (*V- wnteola,* Buckley) of Texas approaches No. 5, and var. *canucem* of the Mississippi tfc am ... approaches No- 7 ; several cultivated varieties, such as Norton's Virginia Seedling, and the Cynthiana grape, ... among our best wine-grapes.

... CORDI^OLIA, *Michx.,* the sour winter or chicken-grape of the Eastern States, and its variety *fcetida* of ... Valley, often ... inches in diameter, climbing the highest trees, and bearing fetidly aromatic berries.

... VITIS BIPA&IA, *Michx.,* the river-bank grape, throughout the United States to the Mississippi; the only grape in East Ca... same ... where ... extends sixty miles north of Quebec (Brunet) ; a valuable grape in cultivation, under the ... Taylor, and Delaware grapes. An early native variety ripens its sweet berries early in July about ...

9. ... IMABIZONICA» W- *Vf.*^d «» 7^ doubtful plant, of Arizona, with small leaves and middle^ized berries.

... VITIS HUPESTRis, *ScKcde,* the bush-grape, or (in Missouri) sand-grape, which extends from Missouri to Texas.

It ... seed§ exh^h^ ... notXn?thAt ^ lh0Be of the foTM8 enumerated above» which *I* had an opportunity of raising from ti*« next ... differences already in the seedling plant a few months old. During my absence in Europe for *<*e winn... months Processor A. Gray, of Cambridge, ha« kindly offered his assistance in communicating with ... wiah to assist me, and letters directed to me, at St. Louis, Missouri, will U forwarded to me.

III. THE TRUE GRAPE-VINES OF THE UNITED STATES*

FfiOM THE BUSHBEBO CATALOGUE, 3d ed., ST. LrOUIS, 1883.

THE grape-vines[1] are among the most variable plants, even in their wild state, in which [9 (3)] climate, soil, shade, humidity, and perhaps natural hybridization, have originated such a multiplicity and such an intermixture of forms, that it is often difficult to recognize the original types and to refer the different given forms to their proper alliances. Only by carefully studying a large number of forms from all parts of the country, in their peculiar mode of growth and especially their fructification, or rather their seeds, are we enabled to arrive at anything like a satisfactory disposition of these plants. (Table of grape seeds; figs. 1-33, page 13.)

Before I proceed to the classification of our grape-vines, I deem it necessary to make a few preliminary remarks: —

The grape-vines cultivated in that part of the United States lying east of the Rocky Mountains are all natives of the country, most of them picked up in the woods; some, perhaps, improved by cultivation ; and a few the product of natural or artificial hybridization. In that part of the country the wine grapes of the Old World can only be cultivated under glass; but in New Mexico and California they have been successfully introduced by the Spaniards, and in the latter State a great many varieties are now extensively cultivated, and promise to make one of the great staples of that region; but eastward and northward they have entirely failed, owing to the destructive effects of that now so well known and dreaded insect, the Phylloxera, of which more further on.

All the true grape-vines bear fertile flowers on one stock, and sterile flowers on another separate stock, and are, therefore, called *polygamous,* or, not quite correctly, *dioecious.* The sterile plants do bear male flowers with abortive pistils, so that while they never produce fruit themselves, they may assist in fertilizing the others; the fertile flowers however, are hermaphrodites, containing both organs, — stamens and pistils, — and are capable of ripening fruit without the assistance of the male plants.[2] Real female flowers, without any stamens, do not seem ever to have been observed. Both forms, the male and hermaphrodite, or in other words those with sterile and those with complete flowers, are found mixed in the native localities of the wild plants, but of course, only the fertile plants have been selected for cultivation, and thus it happens that to the cultivator only these are known; and as the grape-vine of the Old World has been in cultivation for thousands of years, it has resulted

• This po]ier is an elaboration of synopses of American grape-Tines by Engelmaiin, which appeared in Riley's Fourth Report of the 8tate Entomologist of Missouri, 1872, pp. 60-62 ; The American Naturalist, 1872, vi. pp. 539-542 ; Riley's Sixth Report, 1874, pp. 70-76 ; and the second edition of the Bush berg Catalogue, 1875, pp. 4-11. A French translation of the Bushberg Catalogue, by Bazille and Planchcn (Fans and Montpellier, 1876) includes this paper, p. 11 *et $eq.,* with figures 1-18 of seeds. — EDS.

i We treat here only of the *true* grape-vines, with edible berries. In the flowers of these the small green petals do not expand, hut cohere at the top, and separating from their bate, fall away together as a little five-lobed hood. The flower*, and consequently the fruit, are arranged in the well-known clusters (thyrsus). Thus they are distingtiiHhed from the */aim* grape-Tines (botanimllv known as *Amprlo}m$* and *Cif* «*#), which often rrsemhle the true grnpe-vinea very much, bnt bear no edible berries. Their flowers expand regularly, opening at top, and are arranged in broad, flat-topped clusters (corymbs).

f These fertile plants, however, air of two kinds ; some an* *per/get hermaphrodite,* with long and straight aUmeus around the pistil; the others bear smaller stamens, shorter than the pistil, which soon bend downward and curve under it; these may be called *imperfect hermaphrodites,* approaching females, and they do not seem to be as fniitful as the perfect hermaphrodites, unless otherwise fertilised.

It is proper here, to insist on the fact that nature has not produced the male plants without a definite object; and this object, without any doubt, is found in the more perfect fertilization of the hermaphrodite flowers, as it is a well-established fact that such cross fertilization produces more abundant and healthier fruit Vino-growers might take a hint from these observation*, and plant ft few male stocks in their vineyards, say 1 to 40 or 50 of their fertile stocks, and might expect from such a course healthier fruit, which would probably resist rot and other diseases better than fruit grown in the ordinary way. I would expect such beneficial influence especially in all varieties that have short stamen*. such as the Taylor. Hale stocks can be easily obtained, either in the woods or from aeedt. I* is of course understood that the males ought to belong to tb* same species (or better to the same variety) M the fetile plants to be benefited by their pollen. Europe** vine-growers may *aim* profit by this suggestion.

that this hermaphrodite character of its flowers has been mistaken for a botanical peculiarity, by which it was to be distinguished, not only from our American grape-vines, but also from the wild grapes of the Old World. But plants raised from the seeds of this, as well as of any other true grape-vine, generally furnish as many sterile as fertile specimens, while those propagated by layering °* by cuttings, of course, only continue the individual character of the mother-plant or stock.[8]

The peculiar disposition of the tendrils in the grape-vines furnishes an important characteristic for the distinction of one of our most commonly cultivated species, *Vitis Labrusca,* its wild and its cultivated varieties, from all others. In this species — and it is the only true *Vitis* exhibiting it — the tendrils (or their equivalent, an inflorescence) are found opposite *each* leaf, and this arrangement I designate as *continuous tendrils.* All the other species known to me exhibit a regular alternation of two leaves, each having a tendril opposite it, with a third leaf without such a tendril, and this anangement may be named *intermittent tendrils.** like all vegetable characters, this is not an absolute one; to observe it well it is necessary to examine well-grown canes, and neither «prouts of extraordinary vigor, nor stunted autumnal branchlets. The few lowest leaves of [10 (4)] a °*18 b[ft]ve no opposite tendrils, but after the second or third leaf the regularity in the arrangement of the tendrils, as above described, rarely fails to occur. In weak branches we sometimes find tendrils irregularly placed opposite leaves, or sometimes none at all.

It is a remarkable fact, connected with this law of vegetation, that most grape-vines bear only two inflorescences (consequently two bunches of grapes) upon the same cane, while in the forms Wonging to *Labrusca* there are often three, and sometimes, in vigorous shoots, four or five, or rarely even more in succession, each opposite a leaf. Whenever in other species, in rare cases, a third or fourth inflorescence occurs, there will always be found a barren leaf (without an opposite inflorescence) between the second and third bunches.

Another valuable character, discovered by Prof. Millardet, of Bordeaux, is found in the structure °* the branches (* canes," as they are usually called). These contain a largo pith, and this pith is Inversely separated at each node (point where a leaf Ji <* has been inserted), by what is called a diaphragm. Th[686] diaphragms consist of harder, solid pith, of the •Ppearanoe of wood, and are examined best in canes 6 «> 12 months old, when the pith has turned brown and. 'be diaphragm is whitish. A longitudinal section through the cane will best exhibit them. They are, in most •Pecies, 1 to 2 lines thick; but in the Biverbank grape, ^*Wi *ri P[aria]* » 'he diaphragm is not more than J [10] t line thick; and in the Sand, or Rock grape, *Vitis* **petf rit, it is very little thicker. For us here, the distinction of these species is of no great practical im-P^noe; but, as a considerable demand for them has sprung up in Europe, it is well to characterize them accurately; and this character holds good in winter, when all others of foliage or fruit have disappeared. There is only one American grape-vine, ^•o in other respects an aberrant form, the Southern Muscadine grape, *Vitis vulpina,* which [18] ^Jjj^y destitute of such diaphragms.

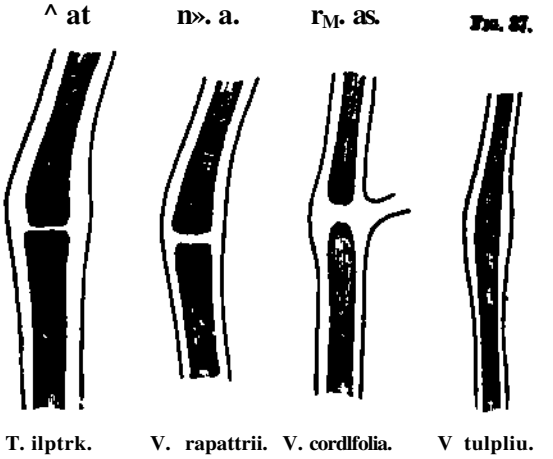


Fig. 37.

/ [Cat Pe]Preents the diaphragms of different species. Fig. 34, *Vitis riparia,* with the thinnest, and % 36, *Vitis cordi/olia,* with a thick diaphragm; *Vitis cestivalis* is similar to this last, and *Vitis*

[8] Some observations (rether IOOM, to be sure) seem to point to the possibility of the sexual characters of the grape-vines becoming changed under oertain circnmsUnces; and, though I have not seen a case of this kind myself, nor heard of an instance where fertile vines in cultivation 'organ to bear sterile (male) flowers, there is no absolute impossibility in it, as we know that other plants (willows for example) occasionally sport in this manner.

* A vignette representing this form of tendril appeared at the end of this paper, but is not reproduced. — EDS.

Labrusca scarcely thinner; but fig. 35, *Vitis rupestris,* has a diaphragm not much thicker than the first. Fig. 37 shows *Vitis vulpina,* without any partition.

It is well known that some species of *Vitis* grow well from cuttings, while others are difficult to propagate in this way.

Easy to propagate are *Labrusca, MorUicola Riparia, Rupestris,* and *Palmata.* Almost impossible to propagate by cuttings are *Candicans, JEstivalis, Cinerea, Cordifolia, Vulpina,* and probably *Californica. Arizonica* and *Caribcea* I do not know in this respect That the southern cultivated forms of *JSstivalis* grow more or less readily from cuttings is stated further on (page 16).

The structure of the bark of the young canes shows also differences in the different species, but as the characters are to some extent of microscopical detail they are here omitted. The bark of the mature canes is ashy gray (*V cordifolia, V. cinerea),* to red or brownish (*V. cestivalis)* ; it peels off after the first season in large flakes, or in narrow strips or shreds; only in the Muscadine grape the dark gray bark does not peel off at all, at least not for a number of years.

Young seedlings of all the grape-vines are glabrous or only very slightly hairy. The cobwebby or cottony down, so characteristic of some species, makes its appearance only in the more advanced plants; in some of their varieties, and not rarely in the cultivated ones, it is mainly observed in the young growth of spring and is apt to disappear in the mature leaf; but even then such leaves are never shining as they are in the glabrous species, but have a dull or unpolished, or even wrinkled surface.

The form of the leaves is extremely variable, and descriptions must necessarily remain vague. They are usually cordate at base, either with an acute and narrow sinus (*V. cordata,* and many other species), or with a broad and wide one (*V. riparia* and *V. rupestris).* Leaves of seedling plants are all entire, i. e. not lobed; young shoots from the base of old stems, as a rule, have deeply and variously lobed leaves, even where the mature plant shows no such disposition. Some species (*V. riparia),* or some forms of other species (forms of *V. Labrusca* and *V. cestivalis),* have all the leaves more or less lobed, while others exhibit, on the mature plant, always entire, or, I should rather say, *not lobed* leaves; the leaves of *V. rupedris* and *V. mdpina* are never lobed. Only the leaves of [11 (5)] flower-bearing canes ought to be considered as the normal ones.

The surface of the leaves is glossy and shining, and mostly bright green, or in *Rupestris* pale green; or it is dull above and more or less glaucous below. The glossy leaves are perfectly glabrous, or they often bear, especially on the nerves of the lower side, a pubescence of short hair. The dull leaves are cottony or cobwebby, downy on both or only on the under side, and this down usually extends to the young branches and to the peduncles, but, as has been stated above, often disappears later in the season.

On both sides of the insertion of the petiole or leafstalk into the branchlet, we find on very young, just developing shoots, small accessory oi^ans, which soon disappear; they are the stipules. In most species they are thin, menibranaceous, rounded, *t the top somewhat oblique, smooth in some, downy or woolly in other species. They are most conspicuous and elongated in *Vitis riparia,* iu which I find them 2J-3 lioes long; in *V. rupestris* they are 1J-2J lines in length; in *V. candieans* and *Califomica* scarcely shorter, in *V. Labrusca* 1J-2 lines Jong; in *V. astivalis, cordtfolia,* and most others, they are only one line long or less; in very vigorous young shoots they may sometimes be larger, just as their leaves are also larger than the normal.

Not much of a distinctive character can be made out of the flowers. It is observed, however, that in some forms the stamens are not longer than the pistil, and very soon bend under it, while in other forms they are much longer than the pistil, and remain straight till they fall off. It is possible that those with short stamens are less fertile than the others.[4]

The time of flowering is quite characteristic of our native species, and it seems that the cultivated

[4] Compare note on page 9.

varieties retain herein the qualities of their native ancestors. The different forms of *Riparia* flower first of all; soon afterwards comes *Rupestris,* next *Labrusca* and its relatives, and later *JZstivalis* comes in bloom. One of the last flowering species is *Cordifolia,* and still later, *Cinerea. Vinifera* seems to flower soon after *Labrusca,* but it is not cultivated here, nor is *Vulpina,* which is probably the latest of all. *V. candicans* apparently blooms about the same time that *Labrusca* does.

Riparia begins to open its flowers about St. Louis three to five weeks earlier than the first blossoms of *jEstivalis* are seen in the same locality. In favorable situations and in early seasons they make their appearance in this vicinity as early as April 25th, at other seasons sometimes as late as May 15th, or even 20th, on the average about May 10th, and generally about the time when the Acacias (Black Locusts) bloom, both filling the atmosphere with the sweetest perfumes. *Cordifolia,* and, after this, *Cinerea,* on the contrary, bloom from the last days in May to (in late seasons) the middle of June, when that weed among trees, the fetid Ailantus (misnamed the Tree of Heaven), exhales its nauseous odors and the beautiful Catalpa expands its gorgeous bunches of flowers. *V. palmata* (Vahl), of which we do not yet know much, seems to be the latest flowering grape-vine with us, flowering even after *Cinerea.* Thus we are not likely to have any grape-vines in flower *here* before April 25th or after June 20th.

One of the botanical characters of the grape-vine is found in the *seeds.* The bunches may be larger or smaller, looser or more compact, branched (shouldered) or more simple, conditions which, to a great extent, depend on variety, soil, and exposure ; the berries may be larger or smaller, of different color aud consistency, and contain fewer or more seeds (never more than four), but the seeds, though to some extent variable, especially on account of their number[6] and mutual pressure, where more than one is present, exhibit some reliable differences. The big top of the seed is convex or rounded, or it is more or less deeply notched. The thin lower end of the seed, the beak, is short and abrupt, or it is more or less elongated. On the inner (ventral) side are two shallow, longitudinal irregular depressions. Between them is a ridge, slight where there are one or two seeds, or sharper where the seeds are in threes or fours ; along this ridge the *rhaphe* (the attached funiculus or cord) runs from the *hilum,* at the beak, over the top of the seed, and ends on its back in an elongated, oval, or circiilar well-marked spot, called by botanists *chalaza.* This rhaphe is on that ridge represented by a slender thread, which on the top aud back of the seed is entirely indistinct, or scarcely perceptible, or it is more or less prominent, like a thread or a cord. In our American species these characters seem pretty reliable, but in the varieties of the Old World grape-vine *{Vinifera),* several thousands of years removed from their native sources, the form of the seed has also undergone important modifications, and can no longer be considered so safe a guide as in our species. [12 (6)]

But different as these seeds are among themselves they have a. character in common, which distinguishes them from all our American grape seeds; their teak is narrower and usually longer, and their large chalaza (the area on the back of the seed) occupies the upper half and not the centre of the seed ; in the American species the beak is shorter aud more abrupt; the chalaza, usually •mailer, and often not circular, but narrower, is placed in the centre of the back. Any one who wishes to satisfy himself of this need only compare a raisin seed with any of our grape seeds, if the following outs are not plain enough.

The size and weight of the seeds varies greatly in the different species, thus *Labrusca* and *Candicaiu* have the latest, *Cinerea* and *Riparia* the smallest seeds, but even in the wild state we find variation, e. g., in *sBstivalis,* still more in *Cordifolia,* and most in *Riparia.* In *Vinifera,* the European grape, however, the variations are much greater, greater even sometimes than our figures •how. Some have laid stress on the color of the seeds, which varies between brown and yellowish, tat that seems to me to go too far for our purposes.

• A mingle eeed it always thicker, plumper, more rounded ; two eeeds are flattened on the inner, rounded on the outer side ; thrwe or four tocdi an more aleoder and angular ; thrat different variations may often be found in berriet of the same bunch.

The cuts of 33 grape seeds, here represented, illustrate the different characters which have been mentioned above. The figures are magnified four times (four diameters), acccompanied by an outline of natural size. They all represent the back of the seed.

Figs. 1 and 2, *Vitis Labrusca,* seeds of wild plants ; fig. 1 from the district of Columbia, and fig. 2 from the mountains of East Tennessee. The seeds of the cultivated varieties do not differ from these ; they are all large, notched on top ; chalaza generally depressed and no rhaphe is visible in the groove, which extends from the chalaza to the notch.

Figs. 3 to 5 represent seeds of cultivated forms, which all show evident signs of hybridity, and acknowledge the parentage of *Labrusca* by the form and size of the seed as well as by the irregular arrangement of the tendrils. Fig. 3 is the seed of the *Taylor* Grape, which stands near *Riparia.* Fig. 4 is the seed of the *Clinton,* which has, perhaps, the same parents. Fig. 5, seed of the *Delaware Grape,* which possibly may be a hybrid of *Labnuca* with *Vinifera.*

Figs. 6 to 8, *Vitis candicans;* seed similar to those of *Labrusca,* but broader, generally with a shorter beak, and less distinctly notched. Figs. 6 and 7 are from Texas, the latter broader and with a broader beak; fig. 8 comes from South Florida, and is still broader and shorter.

Fig. 9, *Vitis Caribcea,* similar to the last, but smaller ; seeds short and thick, and deeply notched.

Figs. 10 and 11, *Vitis Californica,* seeds often smaller, scarcely or not- at all notched, rhnphe indistinct or quite invisible ; chalaza narrow and long. Fig. 10 represents a single seed (one only in a berry) from near San Francisco ; fig. 11 is one of four seeds from San Bernardino, in Southern California.

Fig. 12, *Vitis monticola;* seed very similar to those of the last species, thick, notched, without a distinct rhaphe, and with a long and narrow chalaza.

Figs. 13 and 14, *Vitis Arizonica,* from the Santa Rita Mountains; seeds small, slightly notched, with a more or less distinct but flat rhaphe.

Figs. 15 to 17, *Vitis astivalis;* seeds rather larger, cord-like rhaphe and more or less circular chalaza strongly developed ; all the seeds are from wild grapes gathered about St Louis ; the seeds of the cultivated forms, Northern, and Southern, are similar. Fig?. 15 and 16 are from berries with only one Qr two seeds ; fig. 17 is narrower, and from a larger four-seeded berry.

Fig. 18, *Vitis cinerea,* a seed similar to the last, with the same strong rhaphe, but smaller in size, and often single.

Fig*. 19 and 20, *Vitis cordifolia;* seeds also similar to the last two, but rhaphe not quite so prominent, mostly single or in twos, rarely more in a berry; fig. 19 comes from a larger berry, with more seeds, found near St. Louis; fig. 20 is a single seed, from the District of Columbia.

Fig 21, *Vitis palmata;* seed large, almost globose, with a very short beak, a narrow chalaza, no rhapbe visible, top slightly depressed.

Figs. 22 to 25, *Vitis riparia* ; needs similar to the last, but smaller, though quite variable in size. The seeds all come from wild plants : figs. 22 and 23, from Goat Island on the Niagara Falls ; fig. 22, a single brood seed; fig. 23, from a three-seeded berry; fig. 24, from a two-seeded berry from the shores of Lake Cbaraplain, in Vermont; fig. 25, seed of the June grape from the banks of the Mississippi below St. Louis. The seeds are obtuse, or very slightly depressed on top, chalaza rather flat, elongated and gradually lout in a groove which encloses the scarcely prominent rhaphe.

' Figs. 26 and 27, *Vitis rupestris ;* fig. 26, from a two-seeded berry from Texas, and fig. 27, from a four-seeded one from Missouri. The top of the seed is obtuse, not notched, and the rhaphe very inconspicuous in the Texan seed, or invisible in that from Missouri.

Figs. 28 to 32, *Vitis vinifera,* from the Old World. Different forms are introduced here for comparison with the American species, and to show how much they differ among themselves. Fig. 28 represents a seed out «f a lot of grapes (or raisins) found with an Egyptian mummy, and probably now 3,000 years old, or older. The specimens are preserved in the Egyptian Museum of Berlin. The berry obligingly donated to me was as large as the larger European cultivated grapes, and enclosed three seeds*. It will be seen that it is the largest pt the *Vinifera* seeds figured here, showing perhajw a slight mollification of the seed in the nges that intervened between its and our times.

Fig. 29, *Brusca,* the native species of Tuscany (Northern Italy), fig. 30, *Riesling,* cultivated on the banks of the Rhine; fig. 31, *Gutedel (Chasselas),* from the some region ; fig. 32, *Black Hamburg,* from a grapery near London. All these seeds are easily distinguished from all American grape seeds, by the narrower and usually longer beak (or lower part), and especially by the large circular, though not very prominent, chalaza, which occupies the [14 (8)] upper, and not the middle part of the seed. These five specimen seeds represent the principal forms, but not all European grape seeds entirely agree with them.

Fig. 33, *Vitis vulpina* (or *rotundifolia),* from the South Carolina Muscadine grape, different from all other grape seeds, just as the plant differs from all the other grape-viues; seed very flat, with straight sicka, very ibort beak, wrinkled, or rather folded on both surfaces, notched on tup, with very narrow chalaza and no visible rhaphe.

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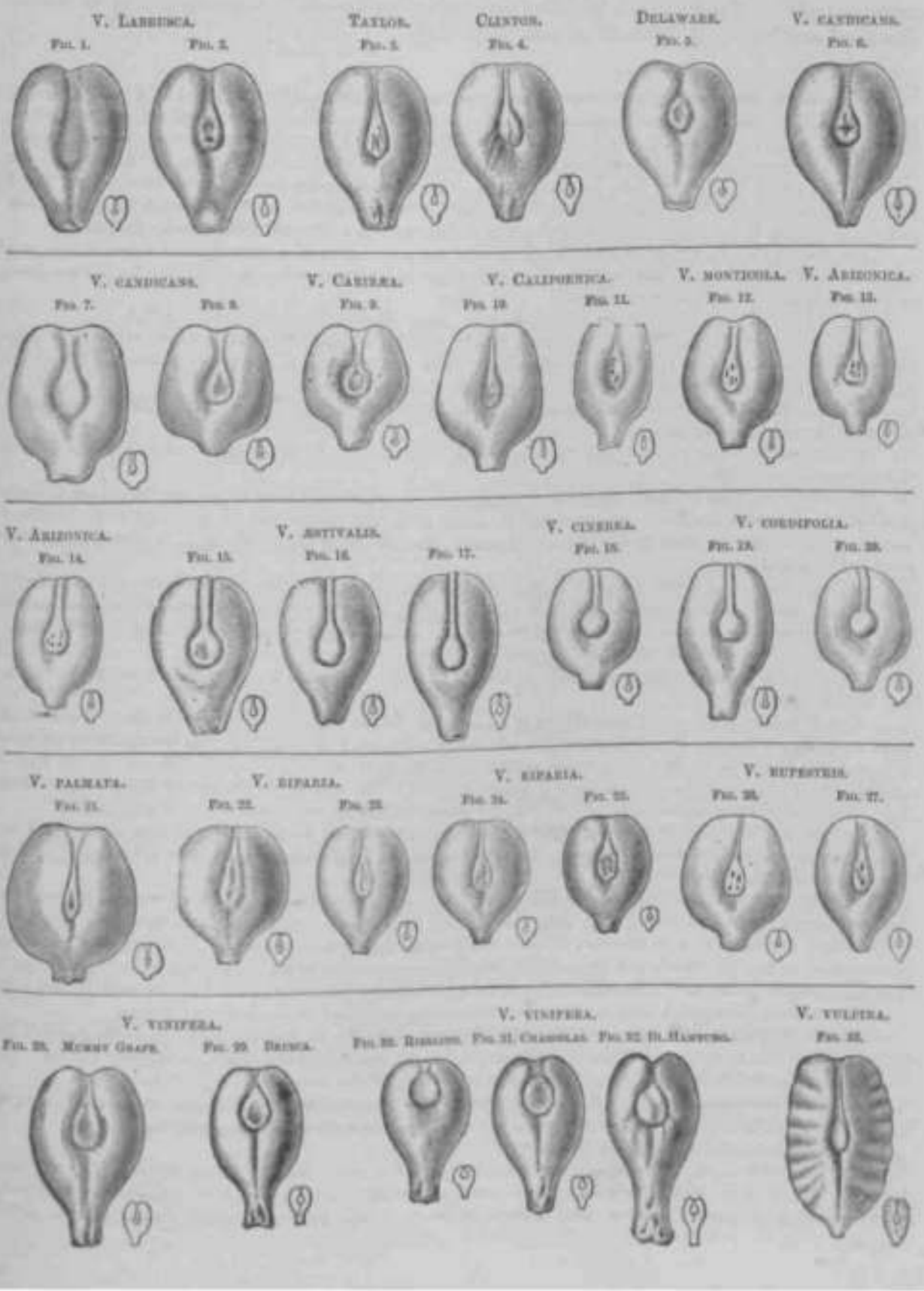

The North American grape-vines may be systematically arranged in the following order: —

I. True grape-vines, with loose, shreddy bark, climbing by the aid of forked tendrils, or sometimes (in No. 12) almost without tendrils.

A. Grape-vines with more or less continuous tendrils.

1. VITIS LABRUSCA, *Linn.,* the northern Fox-grape, the mother of a great many cultivated varieties and hybrids.

B. Grape-vines with intermittent tendrils.

a. Leaves pubescent or floccose, especially on the under side and when young, often becoming glabrous with age.

* Bhaphe on seed indistinct

2. VITIS CANDICANS, *Engelm.* The Mustang grape of Texas.
3. VITIS CARIBJEA, *DC.* The West India grape ; rare in Florida.
4. VITIS CALIFORNIA, *Benth.* The California grape.
5. VITIS MONTICOLA, *Buck.* The Mountain grape of West Texas.
6. Vms ARIZONICA, *Engelm.* The Arizona grape.

* * Rhaphe on back of seed very conspicuous.

7. VITTS ASTIVALIS, *Michx.* Summer grape of the Middle and Southern States, with several varieties.
8. VITIS CINEREA, *Engelm.* The Downy grape of the Mississippi Valley.

b. Leaves glabrous, or sometimes short-hairy, especially the ribs beneath ; mostly shining.

* Rhaphe on back of seed conspicuous.

9. VITIS CORDIFOLIA, *Michx.* Frost grape of the Middle and Southern States,

* * Rhaphe indistinct.

10. VITIS PALMATA, *Vahl.* Red grape of the Mississippi Valley.
11. VITIS RIPARIA, *Michx.* Riverside grape of the United States and Canada.
12. VITIS RUPESTRIS, *Scheele.* Rock or sand grape of the Western Mississippi Valley and Texas.

VITIS VINIFERA, *Linn.,* the Wine-grape of the Old World and California, would find its systematic place here.

II. Muscadine grape, with (on the younger branches) firmly adhering bark, which only in the older stems scales off; aerial roots from inclined trunks in damp localities ; tendrils intermittent, simple; berries very large (7-10 lines thick), very few in a bunch, easily detaching themselves at maturity ; seeds with transverse wrinkles or shallow grooves on both sides.

13. VITIS VULPI.VA, *Linn,* (ROTUNDIFOLIA, *Mich.).* The southern Fox-grape or Muscadine.

Rafinesque, Le Conte, and others, have in times gone by attempted to distinguish and characterize a good many more species, while on the other hand, Director Regel, of the St. Petersburg Botanical Garden, has lately tried, rather unnaturally, to contract them and unite them with Old World species. *Vitis vinifera* has resulted, according to his views, from the hybridization of several of these species.

I now propose to give a short botanical account of the 13 species enumerated above, leaving to the author of this treatise the task to add the important practical remarks which the subject calls for.

1. VITIS LABRUSCA, *Linn.* Usually not large; climbing over bushes or small trees, occasionally reaching the tope of the highest trees; distinguished from all the other species, as has been stated above, by its continuous tendrils and consequently by its continuous (2 to often 4 or 6) dusters of flowers and fruit; stipules middle-sized, about 2 lines long, or less ; leaves large (4 to 6 inches wide), thick, of firm texture, entire or in some forms deeply lobed, very slightly dentate, coated when young with a thick rusty, or sometimes whitish down, which in the wild plant persists on the under side, but almost disappears in the mature leaf of some cultivated varieties; berries large in middle-sized, or, in many cultivated forma, rather large bunches, bearing 2 or 3 or even 4 seeds, large, notched, without visible rbaphe. (See table of seeds, page 13, figs. 1 and 2.)

This species, usually known as the Fox-grape, or Northern Fox-grape, is a native of the Alleghany Mountains, and of their eastern slope to the sea-coast, from New England to South Carolina, where it prefers wet thickets or granitic soil. Here and there it descends along streams to the western slope of the mountains, but is a stranger to the Mississippi Valley proper.

As the *Labnuca* generally grows on granitic soil or granitic detritus, which may favor the vine, I would suggest to plant Catawba vineyard* in the granitic regions of our Ozark Mountain*, and would expect favorable results there.

By far the largest number of varieties of grape-vines now cultivated in our country are the offspring of this species; a few produced by nurserymen, but moat of them picked up in the woods ; they are easily recognized by the characters above given, and most readily by the peculiar arrangements of the tendrils as above described. Large and downy-leaved varieties of *V. irstivalis* are, in the West and South-west, not rarely mistaken for *Labnuea,* but the two may always be distinguished by the character* indicated. [15 (9)]

It is also the species which has most generally been used as one of the parents (mostly the mother) in artificial hybridization, and as it is the most individualized or specialized of all our (perhaps of *all* known) grape-vines, its characters unmistakably prevail in the hybrids, and rarely leave a doubt as to where to refer the questionable iorni; of which I shall have to add a few words below, under the head of *Hybrids.*

2. VITIS CANDICANS, *Engelm. (V. mustangensis,* Buckley.) The mustang grape of Texas; a tall climber, with rather large, rounded, almost toothless leaves, white cottony on the under side, bearing large berries, which, like those of the wild *Ldbrusca,* show different colors, greenish, claret, and bluish-black; and which, in its native country, are made into wine. In young shoots and sprouts the leaves are usually deeply and elegantly many-lobed, which, with the contrast of the deep green upper and pure white under surface, would make this species a most elegant vine for arbors, if it could be protected from severe frost. This may be done by laying it down and covering it with soil. In Texas it grows in the lower country, as well as on the calcareous hills, aud extends even into the granitic region. It has also been found in Florida, where many Texas plants are again met with. The Florida form, at one time taken for *Vitis Caribcea,* but quite distinct from it, has shorter and comparatively thicker seeds. (Fig. 8.)

3. VITIS CAMBiEA, *DC,* is a West Indian species which has lately found its way, with other tropical plants, into Southern Florida. It has a downy, cordate leaf, not lobed, but characterized by the small but very Rharp, distant teeth. Its black berries are small and mostly bear but one or two seeds. I find the Florida seeds (fig. 9) which were kindly sent to me by Mr. A. H. Curtiss, the discoverer, larger than those of the West Indian type.

4. VITIS CALIFORNIA, *Benth.* The only wild grape of our Pacific coast; alow bush a foot or two high, in dry beds of streams in Southern Oregon; it becomes a tall climber in Southern California, with a stem 3 inches or more in diameter; it is distinguished by its cordate, rounded, whitish, downy leaves, and small black berries in large bunches; the obtuse but scarcely notched seeds (figs. 10 and 11), without or with only a trace of a rhaphe, and with a narrow, long chalaza. No use is made of this species, but it has lately been recommended as a grafting stock for European vines in California vineyards which have beeu attacked by the phylloxera. For even this grape-vine, which is a native of a country originally entirely free from the insect, is as proof against it as any of our Mississippi Valley vines.

5. VITIS MONTICOLA, *Buck.* Usually a small, bushy vine, rarely climbing over higher trees ; branchlets angled; young stems, petioles, and leaves cottony, downy, the down gradually disappearing, remaining only here and there in floccose bunches; stipules very short (J line long); leaves deeply cordate, with a rounded sinus, very shortly 3-lobed, *lged with small but broad teeth, rather wrinkled on the upper surface, but the older ones very smooth and often conspicuously shining below (especially in the dry specimens); usually small, not more than 3 inches across, only on vigorous shoots 3 or 4 inches wide; tendrils intermittent, in the smaller, bushy forms, often withering away; bunches of fruit, compact, short; berries 4, or rarely 5 lines in diameter; seeds obtuse or slightly notched, chalaza rather narrow, extending upward into a broad groove, but without a visible rhaphe.

This is one of the smaller species, and is peculiar to the hilly, cretaceous region of Western Texas, not extending to the lower country nor to the granitic mountains ; common about San Antonio, New Braunfels, Austin, etc.; also occasionally cultivated about San Antonio, when the bunches, as well as the berries, become larger. This plant has given rise to a great deal of speculation and controversy. About fifty years ago, the Swiss botanist, Berlandier, collected it in West Texas,[6] but it was not till twenty-five or thirty years later that Prof. Buckley named and published it. Unfortunately his description was so insufficient that no botanist could recognize the plant; only the Texans of those regions, who well knew "the little mountain grape," understood what he meant Buckley's mention of a middle-sized, green, very palatable berry has misled French botanists to look for this plant among the numerous forms of *Labrusca,* and Prof. Planchon therefore changed the name to *Vitis Berlandieri.* In justification of Buckley's description it is now said that there exists a form of this species, especially about Fredericksburg and on the borders of the Llano Entacado, with somewhat larger, green berries, which I understand Mr. J. Meusebach is trying to fed out, and to introduce into cultivation. The species will readily grow from cuttings. [16 (10)]

«. Vim ARIZONICA, *Engelm.* is closely related to the last, and has similar seeds, but the flat rhaphe, though rarely prominent, is broad and sometimes inconspicuous; branchlets angular; leaves cordate, with a rather open, founded sinus, not lobed, or with 2 short, latent lobes; floccose, cottony when young; glabrous, thick, very rigM, and (especially on the upper surface) rough, when older; berries small or middle-sized, reported to be of luscious taste.

7• VITIS JBSTIVALIS, *Michx.* Climbing over biiRhea and small trees by the aid of forked, intermittent tendril; branchlets rounded, bark of the mature ones mwtly red, and scaling off in large flakes ; leaves large (4-5 or 6 inches

• On his aperimtni I found the fimt phylloxera *M1«, which » thu" ^dentally preserved, prove the existence of the to*ct in Amerim (doubted, howiw, by no one now) long before it became known to science here or in the Old World, and •*•* prove its existence an far south as Texas.

wide), of firm texture, entire, or often more or less deeply and obtusely 3-6 lobed, with rounded sinus, and with short and broad teeth; when young always very woolly or cottony, mostly bright red or rusty; at last smoothish but dull, pale or glaucous beneath, and never shining; stipules very short and rounded, mostly rusty-downy; berries middle-sized, black, 5-7 lines, in southwestern forms even 8-9 lines in diameter, coated with a bloom, when well grown in compact, often cylindrical bunches ; seeds rather large, mostly 2 or 3 in each berry, rounded on top, showing a very prominent, cord-like rhaphe, and more gradually attenuated into the beak than is common in our species.

This is the well known summer grape, common throughout the Middle and Southern States, usually found on uplands, and in dry, open woods or thickets, maturing its fruits in September. It is one of the most variable of our grape-vines, and hence has seduced many into the establishment of numerous nominal species, while others, and among them myself, have assumed too wide limits for the species, and have classed under it forms which now, since we know them better, have to be kept separate. Among the latter I mention *V. moidicola* and *V. cinerea,* which are described in their proper places. Among the former I must still retain with *V. mtivalis* the form that had been distinguished by Buckley as *V. Lincecumi.* This latter, often more bushy than climbing, has larger berries, leaves often deeply 3 to 5-lobed, and coated with a thick rusty down, or tomentum, which is often quite persistent. Forms with very large, woolly leaves have often been taken for *Labrusca,* and this species, abounding in the sandy post-oak *(Quercus stellata)* woods of Eastern Texas, and there known under the name of post-oak grape or sand grape, but extending also to Arkansas and Missouri, has thus been quoted for the Western and Southwestern States, to which the true *Labrusca* is an entire stranger.

This species is one of the most important ones for us, and in the West at least has already taken the place once accorded to the *Labrusca* fonns in our cultured, not only for their greater, aye absolute, resistance to the phylloxera, but also for their intrinsic value as wine (and even table) grapes, notwithstanding the superior size of the *Labrusca* berries. Unfortunately the typical forms cannot be propagated by cuttings, and there ore a number of varieties which, originating from a southern home, are not quite hardy here, but, on the other hand, have the advantage of being readily propagated by slips, in some favorable localities. Their leaves are thinner than those of our type, and woolly only in the first youth; the bunches are larger, more shouldered; the berries, though small, are much sweeter and more juicy. They comprise, among others, the *Cunningham* with less divided, and the *Herbemont* and the *Lenoir,* with deeply lobed leaves, the two former with lighter colored, the latter with deep black berries. Unfortunately no wild plant from which these varieties might have sprung is yet known, but must be looked for in the mountains OF hills of the Carolinos and Georgia, and only when found in a wild state can we correctly judge of their botanical status. About their viticultural relations, the body of this work has to be consulted. I will only state here that a slight suspicion exists of their being hybrids between *V. astivalis* and some form of *Vinifera,* though the seedf are entirely those of the former, and also the resistance to phylloxera. The variety *Leturir,* often named *Jaquez,* and in Texas *Black Spanish,* has been introduced by millions into Southern France, and is there found to furnish not only an excellent stock whereon to graft their own vines, but also to make a superior wine directly, and one very rich in the deep coloring matter so highly prized there.

8. Vrris CINEREA, *Engdnu* Closely allied to *jEstivalis,* with which I had formerly united it as a variety, of pretty much the same size, rarely taller. It is distinguished by its whitish or grayish pubescence, which, especially on the branchlets is quite persistent, even into winter; by the angular branchlets, the hair being especially developed on the angles; the cordate often entire, or slightly 3-lobed, more or less gray-downy leaves, which often resemble a linden leaf, with a rounded, but usually rather narrow sinus; by the large, loose inflores- [17 (11)] cence, which opens its flowers rather later than any other of our species; bj the small black berries, about 4 lines in diameter, without a bloom, of a pleasantly acid taste, until frost sweetens them, and by the small, plump seed with a short beak.

This species is found in rich soil in the Mississippi Valley from Central Illinois to Louisiana and Texas, especially in bottom lands and along the banks of Likes, in situations where we scarcely ever meet with *+£stivali$.* It is quite abundant in such localities near St. Louis.

9. VITIS CORDIFOLTA, *Michx.* This is the tallest of our climbers at home in our deep tattom woods, but often also a low trailer over bushes and hedges, well known as the Winter, or Froet grape, flowering late and maturing late its strongly flavored, shining block berries.

The plant is glabrous, or the branchlets and lower surface of leaves somewhat hairy ; branchlets indistinctly angular (in this rwpwt intermeiliate between the last two species) ; diaphragm at the nodes of the branches thick, rarely, at the lower nodes, wanting ; leaves rather large, 3 to 4 inches wide, or more, not lobed at all, or slightly 3-lobed, cordate, with a deep narrow, or wider, but always sharp sinus, margined with conspicuous, rather large sharp-pointed teeth ; stipules *hort; flowers in large, unually loose clusters, blooming rather late; berries small (3 to 4 lines through), black and shining, with a peculiarly disagreeable and strong flavor; edible only after froet; •eed, with slight or strong rhaphe.

A cofiinon plant from the Middle States southward to Texas ; not known, I l>elieve, in Northern New York or New England, but not rare in Pennsylvania and New Jersey, and found also near the city of New York ; *very* common in the deep soil of the western river valleys, where it takes its fullest development. There the trunk sometimes reaches thirty to thirty-eight inches in circumference (Southern Missouri, along the Iron Mountain Railroad) ; whether the trunk found by Mr. Ravenel at Darien, Georgia, measuring forty-four inches around, belongs to this species, I cannot tell, but his supposition that it was *sEstivalti* is quite improbable ; the statement of newspapers that a grape-vine in Gulf Hammock, in Florida, hod a circumference of sixty-nine inches, is considered a " fish story • by Florida botanists.

The acute, mostly narrow sinus of the leaves, the email stipules, the broad diaphragms, the character of the seeds, the circumstance that it don't grow from cuttings, and the late flowering time, abundantly distinguish this species from *Vitis riparia,* with which it has been thrown together so long and so obstinately.

10. Vrrra PALMATA, *Vahl,* has been cultivated in the Jardin des Plantes in Paris for perhaps one hundred years or more, and has thence found its way into other European gardens, without, however, as it seems, having attracted the attention of botanists, siuce its first publication, in 1794.

VahTs description is accurate enough, with the exception of its native country, which he gives as " Virginia," a negligence or ignorance which we must not criticise too severely in botanists of a century ago. The seed was originally brought to Paris probably by French missionaries, who, as is well known, roamed about in the Mississippi Valley one' and two hundred years ago. Soon after the publication of VahFs description of this grape, above mentioned, Michaux discovered this interesting species " growing abundantly on the bunks of the streams in Illinois," and named it *V. rvbra.* He don't seem to have recognized the vine which he might have seen growing under his eyes in Paris, and eventually he merged his specimens of this *Vitis* in his herbarium under *V. riparia.*

. Last fall Mr. H. Eggert, of St. Louis, re-discovered this long neglected plant on the banks of the Mississippi, opposite Alton, and collected it there again this summer, when it proved to be the latest blooming of all our species (far from blooming yet to-day, June 10th). There can be no doubt of the identity of this plant with Vahl's *V. palmata* and Michaux's *Rubra,* nor of its entire distinctness from *Riparia.* It is found, with this last one, covering willow thickets and other bushes in low grounds, overflowed during high water. Its bright red branches, from which the bark separates in large flakes, conspicuous between the smooth but dull, darkish foliage (much darker than *Riparia),* show at once how appropriate Michaux's name is. The diaphragms are thick. The leaves have a broad sinus, and are shallow or often deeply 3, rarely 5-lobed, the lobes usually drawn out into long and slender points; the under side is often somewhat hairy along the nerves ; Rtipules middle sized, 1 \ to 2 lines long; flower-bunches large and loose, on long stems ; berries rather small (4-6 lines through), black, without bloom ; seeds 1 or 2, very large and plump, rounded, with very short beak, notched on top, without a visible rhaphe.

Our plant is readily distinguished from *Riparia* l>y the thick diaphragm, the red branches, its late [18(12)J flowering and its Moomlm, late ripening berries; from *Cordifolia* the form of the leaves and of the seeds, and its ready growth from cuttings, easily separate it.

11. VITIB RIPARIA, *MicJix*, the grnpe-vine of the river banks, has lately acquired a great deal of importance, as it has now become the principal grape-vine relied on in France for the renovation of their failing vineyards, for which its yigorotis growth, adapted to almost all climates, its perfect resistance to the insect, its easy growth from cuttings, and its ready taking of grafts, seem to peculiarly fit it.

This species climbs over bushes and small trees, or trails over the rocks on our river banks. It is also found inland, always near water, on larger trees, where its trunk may become 6 inches thick. The branchlets are rounded, n°t angled 5 the diaphragms very thin (J to } line thick) ; the atipules large (2-3 lines long) and very tbin, and per' •kt longer than in most other specie* ; leaves of a light green, shining glabrous or often hairy l>elow, with a wide, Kmnded, op even truncate sinus; they are more or less trilolxjd, margined with large, sharp-pointed teeth. The bandies are mostly small and compact; berries small (4 or rarely 6 lines in diameter), black, with a bloom, sweet •** TOy juicy, scarcely pulpy ; seeds (figs. 22 to 25) obtuse or slightly notched, with a narrow chalaza, rhaphe indistinct <* •wy thiu.»

It has the widest Reogrnphical distribution of uny of our grape-vines, and is the hardiest of them all. It extends northward to Lake St. Jean, ninety miles north of Quebec, and to the banks of the Upper Mississippi in Minnesota, and the shores of Lake Superior ; in the South it ÎH common on the banks of the Ohio and in Kentucky, Illinois, Mi^ •ouri and Arkansas/ and in the Indian Territory. I have not seen it from Louisiana or Texas, but a form of it is

J^e Fwncb now distinguish several types of *Riparia,* ourering somewhat in their minor characteristics. See our •Uwultunl Remarks.

*- Peculiar form of *Riparia in* s plant which I found J8"]1 «W» in the BoUnic Garden of Berlin, under the of PifCi *Solonis,* and about the hiitory of which nobody skills to have known anything. Lately this plant has Wn taken up in France with that zeal so characteristic of that nation, as something possibly of particular interest for their viticultural pursuits. It is "distinguished from the ordinary form by the. long and narrow, almost incised, crowded teeth of the scarcely three-lobed leaves. The name is undoubtedly

found in the Rocky Mountains of Colorado and New Mexico, and perhaps in Southern Utah. It is the earliest flowering species about St. Louis, according to season, between April 25th and May 15th, and matures earlier than any other. In St. Louis it used to be brought to market, before we had cultivated grapes, sometimes as early as July 1st, from the rocky, sun-exposed banks of the river below town, and was, indeed, known as the June grape. From that time on ripe fruit is found, according to locality, through August and September. It is singular that our vintners, as far as I can learn, have never made wine from this species, nor tried to cultivate and improve it. The berries probably seem too small, and they may have expected better results from the larger fruits of *jEstivalis;* but the experiment might yet be made, and our woods might be examined for larger-fruited varieties, which really do occur, e. g., along the Lakes and on Niagara, near Detroit, etc.

As has been stated above, this species has been confounded with *Vitis cordifolia,* to which indeed it bears a certain resemblance ; but the characters enumerated, especially those of the diaphragms, the stipules, the form of the leaf and its base, its flowering time, and above all the seeds, distinguish them as well as any two species can be distinguished, even if the difficulty of one and the readiness of the other to grow from cuttings be not taken into account*

12. VITIS RUPESTKIS, *Scheele,* mostly a low, bushy plant, often without any, or with weak, deciduous tendrils, and not climbing, under favorable circumstances becoming stouter and climbing pretty high ; branchlets rounded, diaphragm thicker than in *Riparia*$_y$ but thinner than in other species ; leaves rather small (about 3 inches wide), broadly cordate, rarely very slightly lobed, mostly broader than long, usually somewhat folded together, with broad, coarse teeth, and commonly with an abruptly elongated point, glabrous, shining, of a very pole green color ; stipules almost as large as in lost species, 2-2£ lines long, thin ; berries small or middle sized, sweet, and in very small bunches ; seeds obtuse, with a slender or almost invisible rhaphe.

This grape-vine, of very peculiar aspect, is a native of the billy country west of the Mississippi River, from the banks of the Missouri to Texas, and is also found on the Cumberland River near Nashville; its favorable localities are gravelly banks or bars of mountain streams, overflowed in spring, more rarely (in Texas) on [19 (13)] rocky plains. In Missouri it is called Sand grape, in Texas often, on account of its luscious fruit, Sugar grape ; with us it flowers won after *Riparia* and ripens in August, and is said to make a good wine. In France the *V. rupettrii* is uaed, like the last species, as a grafting stock for French vines; it grows easily from cuttings, and is said to make vigorous plants, j>erfectly resistant to the insect.

VITIS VINIPBRA, *Linn.* Here would be the place to introduce the grape-vine of the Old World, as it is mo*t neaily allied to the lost-enumerated specie*, especially to *V. riparia.* Though many of its cultivated varieties bear berrien as large, or even larger, than tho«e of any of our American grape-vines, other cultivated forms, and especially the true wine-grapes, those from which the best wines are obtained, and also the wild or naturalized ones, have fruit not much larger than that of the ul>ove named native R]>cr.ic8.

This plant, together with the wheat, belongH to those earliest acquisitions of cultivation, the history of which reaches beyond the most ancient written records. Not only have the sepulchre* of the mummies of ancient Egypt preserved us its fruit (large sized berries) and seed, but its seeds have even been discovered in the lacustrine habitations of Northern Italy. It is a mooted question where to look for the native country of this plunt, and whether or not we owe the different varieties of our present *Vinifera* to one or to several countries, and to one or to several original wild species, which, by cultivation through uncounted ages, and by ace Mental and repeated hybridization, may have produced the numberless forms now known. These remind us forcibly of the numerou* forms of our dog, which we cannot trace, either, but which can scarcely be derived from a single (auppoeed) original wild species. Director Regel, of St Petersburg, ascribes them to the intermingling of a few species, well known in their wild state at this day. The late Prof Brauu, of Berlin, suggested that they are the offspring of distinct upeciea yet found wild in many parts of Southern Europe and Aaia, which thus be considered not the accidental offrpring of the cultivated planU, as is generally believed, but the original parent Rtock. I may add, from my own investigations that the grape-vine which inhabits the native brents of the low banks of the Daniibe, — M bottom-woods," as we would call them,—from Vienna down into Hungary, well represent* our *V. cordifolia,* with iU stems 3, 6, and 9 inches thick, and climbing on the highest trees, its smooth and shining, scarcely lobed leaves, and its small, black berries. On the other hand, the wild grape of the thicket* of the hilly countries* of Tuftcany and Rome, with its lower growth, somewhat cottony leaves and larger and more palatable fruit, which " don't make a be/1 wine," an an Italian botanist expressed himself to me, reminds us notwithstanding the smaller size of the leaves, of the downy forms of *Riparia,* or

a corruption of " Long's/' «nd the plunt comet from the Upper Arkansas Rivrr, nherr Mnjor I/>ng, on hit return from bU expedition to the Rocky Mountains found, SA he reports, »h«oallentgFapea. Seeda may hare been brongbt home *** U* plant raissd as " Long's." A manuscript of the viticulturist Brenner, prwnrtd in the Carlarub* library, spoke of a certain grape-Tine ss "Lougà, from Arkansas," snd it i* reported thst Ung'n iaatill growing In tbe lite Mr. Rmnnor'* ffnnlen it Wi»ln<-h, near Hfidelbsrg, snd thst it is identical with *SoloniM.* A* an rumple of curious speculate interpretation it mar *U* stated that some ritkulturiat bad read for *SoUmii lanis* (an oriental grips), and for *Arknn Caucasus*

perhaps of some *JEstivalis.* It was known to the ancients as *Labrusca*^ a name improperly applied by science to an American species, and is called by the natives to this day *Brusca.* The grape-vines of the countries south of the Caucasus Mountains, the ancient Colchis, the reputed original home of these plants, greatly resemble the Italian plant just described.

The European grape-vine is .characterized by smoothish, and, when young, shining more or less deeply 5, or even 7-lobed leaves; lobes pointed and sharply toothed; seeds mostly notched at the upper end; beak elongated; rhaphe indistinct; chuiaza broad, high up the seed. In some varieties the leaves and branchlets are hairy and even downy when young; the seeds vary considerably in thickness and length, less so in the shape of the rhaphe. It is well known that the plant grows readily from cuttings, and that it easily and almost invariably succumbs to the attacks of the phylloxera, which, accidentally introduced into France, probably with American vines, has done such immense damage in that country and in the rest of Europe, probably since 1863 (though only discovered as the virulent enemy in 1868), and is spreading more and more. In California, where thus far the *Vinifera* has been successfully cultivated, the insect also begins to miike its appearance in some localities. That it was the cause of the complete failure in all the efforts to plant the European vine east of the Rocky Mountains, is now well known.

13. VITIS VULPINA, *Linn,* (known also as *V. rotundifolia,* Michx.), the Southern Fox-grape, Bullace or Bullit grape, or Muscadine of the Southern States, is entirely different from all our other grape-vines, and is mentioned here only to complete the list of our species. It is too tender for our climate, and never flowers or fruits here. It is found in damp thickets or on mountain slopes sometimes a low bush, and again climbing very high, with entire, never forked, tendrils; branchlets without any diaphragm (see fig. 37); leaves small (2, or at most, 3 inches wide), rounded, heart-shaped, firm and glossy, dark green, smooth, or rarely slightly hairy beneath, with coarse and large or broad and bluntish teeth. The bunches are very small, of few very large berries, which fall off singly, like plums. The peculiar seed has been figured and described' above (page 13, fig. 33). In the South some of the varieties are highly esteemed, especially the White Scuppeniong.

HTBRIDITY.

Plants so intimately related among themselves as these, are apt to hybridize, and their offspring is usually fertile, not, like many hybrid animals (the mule) or plants, incapable to propagate. We have a number of artificial hybrids among grape-vines, whose history is well known, and which tear as well as the true species, and their seeds are fertile. But we also find other vines in the woods or in vineyards, which, from their diameters, we must conclude to be spontaneous hybrids. There is, of course, a good deal of experience and judgment necessary to decide what may
** justly claimed to be a hybrid, and what only a variety within the limits of some va- [20 (14)]
riable species, and the opinions of different persons may honestly vary on these points.
But whoever has studied the great variability of many plants will hesitate long before he calls to his aid the often fanciful help of hybridity in the explanation of doubtful forms. Where species are so well marked as e. g., *Labrusca* is, it is not difficult to recognize some of its characters in a hybrid offspring, though the general looks of the questionable plant otherwise may not conform to our idea °f *Labrusca* at* all; but in other cases, where species already stand near one another, the matter becomes much more difficult But there is another way, unfortunately a very tedious one, to assist itt such investigations, viz.: to sow the seeds of hybrids and study their offspring; for it is a fact that seedlings of hybrids are apt to revert to, or at least to approach to, one or the other of the parents. One of the most striking examples of both positions here taken is furnished by the well-known Taylor or Bullit gmpe. The vigorous growth of this form, its thin diaphragms, its glossy, glabrous foliage, its small clusters of rather small berries entirely destitute of foxy taste, all seem to point to it as a cultivated variety of *Riparia;* but when we come to examine the tendrils we find that they are irregular; sometimes intermittent, sometimes more or less continuous (I have seen six in succession, which can only point to *Labrnsca),* and just so the seeds differ from *Riparia* seeds by their great size and their form (see page 13, fig. 3). Now it so happens that Taylor seeds have been planted by the million in Europe, in order to raise resistant stock for grafting, and the general experience is that one cannot find two seedlings in a hundred alike, and similar to the mother-plant; •ome approach the *Riparia* type, and others show the *Labrusca* parentage distinctly. Thus, to give

only one example, one of such seedlings — the now frequently cultivated *Elvira* — is a Taylor seedling with a close approach to *Labrusca.*

It would further the study of our grape-vines considerably if some of those that have the zeal, the leisure, and the opportunity, would institute such experiments with doubtful forms.

Pursuing this interesting subject further, I may add that where nearly allied species grow near together, and bloom about the same time, they are more likely to hybridize than such species that are separated by wide space or different period of flowering. With all these considerations- we must not forget that with the innumerable opportunities given everywhere for hybridization we find comparatively so few spontaneous hybrids in the vegetable world. Hybridization is an abnormal, I may say, an unnatural process, which is usually prevented by countless obstacles. If it were not so, we would meet with more hybrids in our woods and prairies than with genuine species; but how rare are they, and what a find it is for a botanist to discover one! .And this is the more to be wondered at, because the genital organs of the plants, though mostly united in one flower, are usually so organized that self-fertilization is made difficult, or is excluded, and that cross-fertilization is the rule. We may put it down as a law that honest nature abhors hybridization.

IV. COLLECTED DESCRIPTIONS OF VITIS.

FROM ADDENDA TO GRAY'S MANUAL OF THE BOTANY OF TUB NORTHERN UNITED STATES. NEW YORK, 1868. -

2. VITIS JESTIVALIS, VAR. ? CINEREA, *Engelm.* Branchlets and both sides of the almost entire leaves canescent, even when mature ; berries very small, black and shining, very acid until after frost — Rich bottom lands in the Mississippi Valley, Illinois, and Southward. [679]

3. V. CORDTPOLIA, *Mickx.* Has the small berries black without bloom, the small seeds rounded above and with a prominent rhaphe. Unfit for cultivation.

3a. V. RIPARIA, *Michx.* Leaves larger, usually incisely 3-lobe<l, the lobes long-pointed ; panicles small, rather simple ; berries larger and mostly with bloom ; seeds larger, obtuse or somewhat obcordate and with an inconspicuous rhaphe. — May, earlier than *V. cordifolia.* Thickets and river-banks, from Vermont to Michigan and Illinois. Several varieties in cultivation : the most esteemed white oue is the Taylor-Bullit Grape. The celebrated claret-colored Delaware Grape seems also to belong here.

FROM BOTANICAL OBSERVATIONS IN SOUTHERN UTAH, NO. 4, BT DR. C. C. PARRT (AMEK. NATURALIST, VOL. IX. MAY, 1875).

30. VITIS ARIZONIGA, *. «p. Young branchlets, leases and inflorescence densely floccofle-tomentofle, adult naked or usually (at least ou the nerves of the leaves) beset with short hairs ; leaves (small) orbiculate, cordate, with a wide (sometimes very broad) sinus, acute, with irregular, sharp, often very pointed, rather small teeth ; rarely S-4-lobed with rounded sinuses ; tendrils intermitting,[1] branched; fertile inflorescence and bunches of berries shorter than leaf; berries small or middle-Rized (2-3$ lines in diameter); seeds mostly 2-3, usually obtuse with a small but prominent cbalaza and more or less indistinct rhapbe. *Vitii cutivalit,* var. ? Gray, PL Wright, pt 2, p. 27. Torrey, Poo. It. Rep. 7, Bot. p. 9. — Common along the streams of Arizona, where it was first collected by the botanists of the Mexican Boundary, and of some of the Pacific Railroad Expeditions; later by Dr. Palmer, who made an especial study of it and gathered numerous specimens in mature fruit ; Dr. Parry's collections are from southwestern Utah. [260]

With some hesitation I venture to introduce a new species in this intricate genus, and especially in the *Cordifolia* group ; but as this form cannot well be united with any of its allies, it will have to try and stand for itself. The forms belonging to the *Cordifolia* group are difltingniHheil by their more or less entire have* and small berries; they eiteud over the whole breadth of the continent from northeast to southwest, and are: *V. cordifolia,* with larger

» *Intermitting* tendrils we find in those specie* of *VM$* where two leaves with opposed tendrils nre •ticcfwdtM by a third loaf without a tendril, and so on in smrcewion ; the ordinary orcurrrnee in all our gra|ie-vines, with the exception of *V. Labnuea* and iU cultivated varieties; in [209] them* the tendrils are *continuous* ; i. e$_{M}$ each leaf has a tendril opposed to it; all this only in wellgrown canes. This char* arter difttingniAhes at once all forma of *Vitis Labntten. Branched* tendril* are found in all our ipeciea, with the exception of *V. vulpina,* which bean *timpU* tendrila,

[smaller J broadly dentate, glabrous leaves and smallest berries in larger bunches, rhaphe usually strongly developed on the top of the seed as a well-marked cord, — from New England to Missouri, Nebraska, and Texas; *V. riparia,* with larger, incisely dentate, usually sharply 3-lobed, glabrous leaves, larger berries in small bunches, rhaphe slightly visible on top of seed, — from Canada to the Rocky Mountains and to Texas ; *V. Arizonica,* with smaller, broadly cordate, sharply dentate leaves, floccose at first, glabrous afterwards, middle-sized berries in small bunches, rhaphe more or less indistinct on top of seod ; *V. Californica,* with middle-sized, narrowly cordate, broadly dentate, always tomentose or canescent leaves, small berries in large bunches, rhaphe invisible on the broad seed, —found only on the Pacific slope, 60111 the Sacramento Valley southward.

The fruit of *V. Arizonica* belongs, like that of *V. riparia,* to the better class of American grapes ; while that of the two others is scarcely edible, this is said to be quite luscious, and will in time no doubt be cultivated in a warmer climate. Dr. Palmer's seeds have germinated well with me, but the vines perished in the climate of St. Louis, after a lingering existence of several years. The seeds show a remarkable variability in form and markings, so as to weaken to some extent their specific value, I find them generally obtuse, but eniargiuate and even notched on top ; the jshalaza is small, but usually quite prominent and is narrowed upward into the rhaphe, which on the top of the seed becomes inconspicuous, or in some instances remains quite prominent.

Dr. Parry's specimens from southwestern Utah are distinguished from all the Arizona specimens I have seen, by having somewhat lobed leaves. Their sterile flowers exhibit the usual form, longer anthers on long straight filaments, which in the bud are inflexed ; in the fertile flower-bud the stamens are shorter than the pistil, the filaments straight and scarcely as long as the short anthers, and after fecundation recurved. I could discover no difference in the condition of the pollen of both kinds of flowers. This seems to be the ordinary form of the fertile flowers in our wild species, and in some cultivated ones, while some other stocks bear fertile flowers with long stamens, thus constituting the incompletely polygamous character of our grape-vines; purely pistillate flowers I have never seen, and doubt whether they exist.

V. MISCELLANEOUS NOTES ON VITIS.

FROM BULLETIN OF THE TORRBT BOTANICAL CLUB, VOL. VI. 1878-1S79.

Vitis cordifolia, L, and *V. riparia, Mickx.*,* are still mixed up in the opinion of many [233] of our botanists, and trouble them, whenever they are obliged to touch them. The observations made this spring have again confirmed my long-settled conviction of their absolute specific difigjrence, and may help others to better distinguish them.

Vitis riparia was in bloom here in the last week in April, and in favorable localities (on the *>cky, sun-exposed banks of the Mississippi,) even before the 20th of that month. *V. cordifolia* bloomed fully four weeks later, and even into this month of June, long after *Labrusca,* and a little before *jEaivalis.* As this spring was an unusually early one, it is better to compare their flowering with that of well-known trees; thus *Riparia* bloomed after the apple-tree, and about the time when the first garden roses and the first Acacia *(Robinia)* blossoms made their appearance; *Cordifolia* bloomed when the flowers of Ailantus exhaled their nauseous odor and Catalpa blossoms were just opening.

The young, half-grown leaf of *Riparia* is glossy shining (on the upper surface), and is supported by a pair of conspicuous, white, membranaceous stipules, oblong or linear-oblong, two or three lines in length; the mature leaf is scarcely wrinkled, and of a bright deep green color, and usually has a broad, at the base truncate, sinus.

The leaf of *Cordifolia* is always dull, even when young, perfectly smooth, and paler green, and its rounded short stipules are mostly less than one line in length; the sinus, though it may be wide, is always acute.

I need not repeat that the shape of the leaves in typical specimens is distinct enough, but that forms occur, which, without the help of other characters, it would be difficult to keep apart; and this made undoubtedly the great difficulty in the distinction of both species.

• A tabulation of the differences here enumemted is given by Millardet in La Vigne Amtocaine, Oct 15, 1878, PP. 225, 22«, and iu Not** Mir 1M Vignw Aimhicaines, Bordeaux, 1881, p. 104. - EDS.

There i3 generally a hairy (rarely cottony, as in *Labrusca* and *JEstivalis)* pubescence on the under side of young leaves, especially along the ribs; more so in *Cordifolia,* less in the other species; in the former this pubescence sometimes remains throughout the season, and rarely even veiges to the arachnoid down of *JSdivalis.*

In this neighborhood *Riparia* matures its fruit in July and August, further north in September, earlier than even *Jistivalis; Cordifolia* not before October.

Now, having distinguished the species, let us see about their geographical distribution. *Riparia* is the northern and western, *Cordifolia* the southern and eastern form; in the Middle or Central States they both occur together. I have found *Riparia* on the Great Lakes, on Niagara, on Lake George, and have it from Vermont; it is common in Missouri and Illinois, and extends to the , Rocky Mountains of Wyoming, Colorado, and New Mexico. How far south of the Ohio it is found I have now no means of ascertaining. *V cordifolia* is common throughout the Middle and Southern States, but I have seen no specimen north of New York, nor west of Missouri

I may add that *V. jEstivalis* extends through the whole *Vitis* region of eastern North America, from New England to Texas, and from the Atlantic to the great plains, but not to [234] the mountains beyond. *V. Labrusca* is our most local species, being confined to the Alleghany Mountains and the region between them and the Atlantic, unknown in the Mississippi Valley or beyond. Whatever has been called so there, or in Louisiana or Texas, is a large and downy-leaved form of *JSstivalis,* always readily distinguished by its "intermittent" tendrils, while *Labrusca* has more or less "continuous" tendrils.

Will local botanists assist me to more accurately define the geographical limits of our species of *Vitis f* And may I request them to collect fertile flowers as well as sterile, the only ones found in most herbaria ? — [June, 1878.]

In the June number of last year I have enumerated some of the characters which distin- [310] guish *Vitis riparia* from *Cordifolia.* I can now confirm all I have said there. Our present spring being later than the very precocious one of last year, *Riparia* bloomed about May 10th and *Cordifolia* begins now, May 27, to open.

Another, and a very valuable, character to distinguish *Riparia* not only from *Cordifolia,* but from all other species of *Vitis,* has been indicated by Prof. Millardet of Bordeaux, and is fully confirmed by my observations made on specimens from all parts of their geographical area. [311]

The dissepiments or diaphragms, as they are called, which at each node interrupt the medullary tissue, and which are best studied in vines of the previous year, are in *Riparia* very thin, only | to £ of a line in thickness, while in *Cordifolia* they are £-1 line thick, and in *JSstivalis* a little thicker yet

Pursuing these investigations through all the species of *Vitis* attainable, I find that the Rocky Mountain *Vitis* and that from Lake Superior have been correctly referred to *Riparia,* while *V Artzonica,* about the relationship of which I had soipe doubts, is certainly distinct from *Riparia.*

All true *Vitis* have such diaphragms at each node, while all the species of *Ampelopsis* and of *Cissiis* are destitute of them. But the startling fact appears that *V vulpina* of the South in this character is different From all other *Vitis* species and affiliates with *Cissus,* its pith being continuous and not interrupted.

V. cordifolia, thus completely separated from *Riparia,* approaches, strange as it may seem, close to *sEstivalis* in the diameter of the diaphragm, in its period of flowering, and even in its seeds, and the connection seems to be made by that western entire-leaved and small and black-fruited form of *sEstivalis,* which I have distinguished as *Cincrea,* to which downy-leaved forms of *Cordifolia* approach almost too closely.

All the species of *Vitis* contain in their foliage more or less of a fragrant principle, **most probft-**

bly Cumarin, which the dried leaves retain with such tenacity, that even after % yea« in the herbarium they exhale this very distinct odor. than in any other species.

FROM THE TRANSACTIONS OP THE ST. LOUIS ACADEMY OP SCIENCE (PROCEEDINGS), VOL. IV. 1880.

cross 2 ? A l S S f c T o n e of oUr mo i DpOrtant ^ ^ V, LahnU ^ or the Northern Fox ****> doe8 »* : [xliv] W riven I! ? r. ? * ^ ^ of thG eMtom 8l0pe This ^ *" ^ improved b* Nation and «« given rise to all our larger-berried varieties, as Isabella, Catawba, Concord, etc.

west J. ; ^ ' or Sum ... abundant throughout a great part of the United States, but does not grow wild ... ng, t s Herbemont, and farther S? of Michaux, also known in this neighborhood as the June grape, and the River-bank grape. Grows along ... of the others being found at ... the ... found on the eastern ... Mountains. It also grows in Texas. But in the East it does not seem to occur south of Pennsylvania. it is an early grape, and sweet and very palatable.

PhilJl T^"^ or Winter ***?*> does not ^ ow north of New York and ... Illinois, but at Washington and to t w S S V !" most Common grape, The trunk of this ^ is the ... Of * W l « ^^etimes from eight ... in diameter» at least in the river bottoms of the Mississippi Valley, and climbing the highest trees. ... irun is rather disagreeable.

quantTh% French *" now obtaining from the woods in this ... a large number of cuttings and an immense quantity of seed, principally of Fl *riparia,* but also of other species, having discarded the *Labrusca* entirely. As the ... does not grow wild in this region, there is no danger of getting here hybrid varieties. Our wild grapes are ... in France as stocks to graft their own vines on, in the expectation that the American stock will resist the destruction of the phylloxera, which has made such sad havoc among their grape-vines. It has already destroyed one entire fourth of the French vineyards, thereby crippling materially the prosperity of the country.

FKOM THE BOTANICAL GAZETTE, VOL. VIII. 1883.

The ... *V. palmata* of Vahl ... been cultivated in the Paris Botanic Garden for a century or more, and has [254] found ... in other European gardens without, as it seems, attracting the attention of botanists. On very ... s of rivers in Illinois, some eighty or ninety years ago, Michaux discovered this *Vitis,* which he, with the herbarium specimens before him, stowed away with his *Vitis riparia,* leaving, however, with it his original ... *Vitis rubra, abundat ... Illinois* but never even mentioning the name in his Flora. When, twenty-six years ... I studied Michaux's collections in the Jardin des Plantes, I was struck with the peculiarity of the ... specially with that which is preserved in the General Herbarium ;* its seeds were so odd that I almost suspected a confusion. In this country It seems to have remained quite unknown; in Torrey and Gray's Flora it is but ... that it might ... a form of V. ... Vahl's statement that it came from VirginU is, of course, erroneous, not more so than many other American localities published in those, geographically, dark ages.

Mr. ... Eggert ... had the good fortune to ... this species last fall, and, collecting it again this summer furnished observations and specimens which permit me to complete the history of this long neglected plant

... PALMATA, Vahl. A ... climber with red branches (and often also red petioles), young shoots angular ... old ones loosing the bark in large flakes; diaphragms rather thick; stipules very short, rounded early deciduous; leaves ... cordate ... smooth» porous (or on the nerves beneath with short, straight hairs), dull and rather dusky green, ... mostly deeply ... or sometimes lobed ... lobes when long, widest in the middle, con- ... caudate-acuminate, with few coarse teeth ; flowering racemes compound, long peduncled ... without any bloom, rather small (4 to 6 lines in diameter) ; seeds large for the ... notched on top, single, and then nearly globose, or in twos, when they are hemispher- [255] ... flat ... the ventral side ... beak very short; chalaza ... elongated, groove without any visible rhaphe.

Michaux found ... abundant on river banks in Illinois, but ... may have confounded it with *V. riparia,* which is very abundant there. Mr. Eggert collected it in Missouri, on the Mississippi, in low bottom land, opposite Alton,

I ca ... in hunting through Michaux's *Vitis,* also ... well characterized specimen of *V. rupestris,* ... that sheet of *V. riparia.* As Michaux never botanized ... want of the Mississippi, where *V. rupestris* is found, from Missouri to Texas, it remained a question where he could have obtained that specimen, which had no label attached to it, until a few years ago Dr. Gattinger discovered the species on sand-bars in the Cumberland River near Nashville, a region well explored by Michaux.

not far above the mouth of the Missouri River, where it ia found with *V. riparia,* flowering later than any other of our species here, in this very late season apparently not before the 15th or 20th of June ; it matures iu October, and the berries remain on the vine till November and later; their taste is sweet, without any disagreeable admixture. The plant, like *V. riparia,* grows readily from cuttings.

The species resembles *V. riparia* in the broad sinus of the leaves and the form of the seeds, but it is distinguished by the deep red color of the stems, which are angular when young, not terete, the thick diaphragms, the very small stipules, the dull, dusky color of the leaves and the form of their lobes, the bloomless berries, the large seed, and the late flowering period. With *V. cordifolia* it has very little in common, except the thick diaphragm and the bloomless berries. The absence of a prominent rbaphe on the seeds distinguishes it at once, and no other species could possibly be confounded with it.

VI. ON DISEASES OF THE GRAPE*

FROM THE TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE (PROCEEDINGS), VOL. II. 1861.

DR. ENOELM ANN exhibited specimens and numerous drawings of two species of fungi, which infest our vine- [165] yards to such an extent as to materially diminish the crop and influence the culture of the grape, at least that of the Catawba, in our region. The first is a species of *Botrytis,* and perhaps the same as Berkeley's *B. viticola* (very near *B. acinorum,* Pers. ?). It makes its appearance in the latter part of June, on the lower downy surface of the leaves of the Catawba variety of *Vitis Labrusca* (the only one extensively cultivated here), forming irregular oon-fluent spots. The horizontal fibres of the mycelium have a diameter of 0.005 line, finer and whiter than the hair of the down with which they are interwoven ; the erect fructiferous stems, about 0.3-0.4 line high, and a little thicker than the horizontul fibres, bear numerous horizontol branches, upwards gradually shorter, the last divisions of which form very short pedicels, always 2 or 3 together, bearing oblong or oval, very deciduous pores, 0.006-0.011 lino in the longer diameter. About the same time the mildew appears on the pedicels, and often also on the yonng berries when they are of the size of small peas or smaller; Dr. E. never saw it on full-grown berries. Those attached on their surface or on their pedicels soon fall off; but the most material damage is done by the mildew infesting the leaves, whereupon the greater part of the berries will gradually turn yellowish-brown at their base, shrivel from that point, a&mme a club shape, and at last dry up entirely, usually remaining adherent to the withered racemes. This he designated as the *Brown RoL*

The second kind of rot, the *Black Rot,* is brought on by a very different fungus, which he believed was undescribed by botanists. It evidently belonged near Eh re n berg's genus *Nczmaspora,* and ought to bear the name *ampelicida.* It makes its appearance only on nearly full-grown berries, exhibiting in the first stage a discolored spot on the side, but never at the base of the berry, about 2 lines in diameter, with a dark dot in the centre. This spot soon becomes light-brown and remains so, while the surrounding part of the berry gets darker, and exhibits a rough or (under a magnifier) pustulous surface; gradually now, the berry shrivels up and turns black. The individual fungi are little spherical bodies (0.07-0.10 line in diameter), formed under the surface in large numbers, which growing, elevate, and at last burst the epidermis, then open at their apex by a small jagged hole, and shrivelling with the berry, eject a more or less curled or twisted thread, which, moistened, becomes gelatinous, and shows the innumerable oval sporules (0.004-0.005 line long), each imbedded in its coat of mucilage.

These kinds of fungi are found either on distinct vines, or sometimes also on the same; they an very rarely seen on grapes cultivated in yards and on hou^ea, but are very common, not to sty universal, in our [166] gardens and vineyards, in some seasons more so than in others. It is said that vineyard* farther north, e. g.9 in Northern Illinois, are free from these pesU.

Whether other dittom* aftsint in the destruction of the grape, as wine-growers will have it, he cannot, from his own experience determine. He h;i* never seen'the *ErysipKc,* which is so destructive to the gooseberry, and to vines in graperies, on grapes cultivated in the open ground.

• This communication is quoted verbatim by Hon. I aid or Bush, io Proc Aoter. Pomolog. Soc., Session of 1879, pp. 17-lfc — EM.

OAK AND GRAPE FUNGI.

Some fifteen years ago I presented to the Academy an account, with- microscopic drawings, of two of [ccxv] the most destructive fungi of our grape-vines. One of them is the " Mildew," a downy white coating on the under side of the leaves, the peduncles of the just-forming fruit, and the very young berries themselves, causing the leaves to wither and the young fruit to shrivel and fall off. That fungus was classed as *Botrytis,* and is now known as one of the *Peronospora,* another one of which constitutes the potato disease. This appears at the time of flowering or soon afterwards.

The second, and I believe, more common and destructive fungus, attacks the full-grown, yet green berries, and destroys them. After penetrating the tissue with its mycelium, it appears on the surface of the berry as a minute discolored spot, always on the side, which enlarges, and produces black pustules visible to the naked eye, which at last kill the berry and cause it to dry up, emitting at the same time their millions of spores. This fungus, described as *Phonut viticola,* makes its appearance in the latter part of July and in August

I exhibit to you to-day another grape fungus, which is new to me, and seems to have been unknown to those grape growers with whom I have conversed. A yellowish-brown spot, a few lines in diameter, appears on the leaf, on the upper side of which a good eye, or a glass, will discover a number of very minute black specks. These are little globules, 0.13-0.15 line in diameter, which have a little opening at the top from which they emit their micro-acopical spores by the thousand. These oblong or oval spores are one-celled, and have a diameter of 0.013 or 0.014 line.

Thia fungus belongs to the family of *Conùmycetes,* and to that group which live on decaying vegetable matter. Theae yellow spots are the decaying substance, but their vitality has been destroyed by the mycelium of the fungus ; those still more minute threads which penetrate the tissue in every direction, exhaust and kill it, and thus form what we may call their fruit, the perithecia, which when mature emit the spores. It belongs to the genus *Depazea,* of which many apeciea, mostly leaf-inhabiting, are described, and it may be called *Depazea Labnue**-Grape-leaf spot.

This parasite makes its appearance earlier than the others mentioned above, viz., just before and during [ccxvi] Ae flowering period, and attackTas far as known, only the leaves, which, where abundant, it kills, and thus cripples the plant; it ia also found, though rarely, on petiolea and peduncles. Dr. Wislizenus informs me that it attacka indiacriminately all grape varieties, but more the lower leaves of a stock than the upper ones; while he finda the phylloxera galla on the uppermost not yet full-grown foliage.*

It is necessary to remind you, that though *« know a P6"* mftny form9 of fungi) We knmr *"" m hiatoTy of «*jr • very few. It is certain of some, and very probable of many, that they constitute transition states of other more *«Uy developed fund, and only when we shall have become acquainted with the different phases of their develop-«ent, shall we be able to appreciate their importance and counteract, perhaps, their destructive action. - 1 . c. vol. iii. »878, (Bead 1876).

FROK TIM BOSHBEBO CATALOOU«, 3d ed., ST. LOUIS, 1883.

The diseases of the rame-vines an principally occasioned by animal or vegetable parasites. I leave [47 (16)] others, who are more conversant with the subject, to treat of the former, and will merely state here that our •Pecies have all grown up with the phylloxera, and would have long ago been extinguished, or rather never could have lived, if that insect had such power over them; but they as well as the insect live on, the latter having no other nourish-»««t than the grape-vines and their roots: you may call it an accommodation between them.

More important for us in America are the fungus diseases, which do our grape crops more harm than the Phylloxera. It is said that in Europe they have discovered over 200 kinds of fnngi which live on the different [48 (15)] P«to of vines, but fortunately only a few of them are really injurious. These are, above all, the mildew of «>• leaves and the black rot of the berries. In Europe they have, besides our mildew, which has lately been introduced, the *OUivm* and the *Anihracrum.*

The *Mildew, Pamotpon viHcola,* appears in frost-like white spots on the under side of the leaves, hairy as well •• glabrous ones, hen in Missouri generally from the beginning of June, fostered by the sultry and damp or wet weather «Mial at that season; in the Ensteni States it seems to come on later in summer and in the fall. Though most common Ol»««leaves, It sometimes also infests the petioles of the leaves, the stems of the bunches, and the very young berries. *«*, even if it does not attack the latter, the effect on the leaves alone, which turn brown in spots and are eventually Partially or completely killed, destroys the fruit, the berries shrivelling *from the bate,* turning light brown without falling °* This is here sometimes termed Brown *Rot.*

• Two paragraphs, referring to *Septoria Quern,* are omitted here, but will be found on p. 410. - EDS.

The fungus at first pervades the cellular tissue of the leaf; then, a few days later, the minute fungus stems protrude through the stomata (breathing pores) of the lower surface, forming little upright branching plantlete, which might be compared to a miniature spruce tree, singly not visible to the naked eye ; they bear at the end of the branchlets the summer spores *(conidia),* which mature, are discharged, spread by wind or otherwise, and, when moistened, germinate with astonishing rapidity. Late in the season the fungus produces what are called the resting spores (oospores) in the interior of the leaf-tissues, and, while the others propagate the parasite in summer, these larger and more enduring ones keep alive through winter and insure its growth in the following summer. Thus it is seen that the dead mildewed leaves, containing the resting spores, really do preserve the germs for the next season's mildew. These leaves ought to be destroyed by carefully gathering and burning them, or by burying them *deeply* in the ground. The direct destruction of the fungus has been often attempted, and by different means, especially by sulphur-sprinkling, but without any marked effect; a dry spell of weather, however, arrests it most effectually for the time being.*

The *Peronospora* has since 1878 made its appearance in Europe, —like the phylloxera, accidentally introduced from this country, —and has added another terrible infliction on the wine-growers there, which threatens to be worse than the *Oidium,* which years ago used to decimate the grape crops of Europe.

A few words about this *Oidium* may be in place here. This is a mildew-like fungus which appears on the *outside* of the *upper* surface of the vine-leaves, and bears its fewer spores on smaller, not much branched, stemlcts ; it destroys the vitality of the leaves, and with it the crop, just as our mildew does. Its resting spores are unknown and with its life-history we are not so well acquainted, but we know that sulphur sprinkled over the leaves will destroy it. It made its first appearance, as far as it is known, about 1845, in graperies at Margate, near London, and spread rapidly and destructively over a great part of Europe and the islands, especially Madeira, where the grape culture was almost annihilated by it; but it seeuis to be now less common or less injurious than it was years ago, and may possibly have run its course, just as other epidemics are apt to do. It is unknown where it originally came from ; some suppose that it originated in America, but it has never appeared here in the form under which it is known in Europe; whether in another form, is still questionable among our best mycologists ; at all events we have thus far only one destructive form of mildew here, the *Peronospora.*

The second great fungus pest of our vineyards is the *Black Rot, Phoma uvicola.* On the berries but never on the leaves or stems, generally about the time that they are full grown, in July or August, very rarely on half-grown berries in June, a light brown spot with a darker central point is observed on the side and not near the stem ; this spot spreads, and darker, shining nodules or pustules, plainly visible with the naked eye, begin to protrude above the epidermis ; at last the whole berry shrivels up, turns bluish-black and the pustules roughen the surface, and each one opening at its top emits a whitish worm-like thread, which consists of innumerable spores glued together with a mucilaginous coating. In this condition the spores are inert, but ruin will dissolve the mucilage and liberate and wash down the spore*, or they will with the dead berries fall to the ground. What then Ywcomes of them, whether they enter the soil, or how they propagate the fungus, is as yet unknown. At all events it seems advisable to gather all the affected berries, if such a thing can be done, and destroy them.

In Europe they have another fungus disease of the grape, called in Germany *Brenner,* in France *AnthracnoM,* and described under the name of *SpKaceloma amptlinum,* which by some authorities has been supposed to be another form of development of our Block Rot, above deHcritwl ; this, however, seems very doubtful. We have, as it seem*, never bod the *Sphacehma,* nor they the *Phoma.* The former attacks all the green partR, leaves, young stems, or green berries, and forms open wounds which might be compared to nicer*, while our *Phoma* is restricted, as far as known, only to green berries, without breaking up the tissue* or forming ulcers. The *SpKaceloma* seems to be an old disease in Europe, known already in the last century. MycologisU are now carefully studying these questions.

• The ate of sulphur, or crude carbolic arid nixed with quicklime, as a manure, wot suggested by Engelnunn to 1879. Proceeding! St. Louis Aaul. TOL W. p. xxxii. — Ed.

X.

PAPERS ON EUPHORBIACEJE,

I. EUPHORBIACE.E OF THE MEXICAN BOUNDARY.

FEOM BBPOBT OK THB BOUNDAET SDBVBT, VOL. II., PAET 2, BOTANT, BY JOHN TOBBKT, 1869.

§1. ANISOPHYLLUM.

EUPHORBIA PETALOIDEA : p tulo-ramosissima ; foliis oblongis oblongo-linearibus linearibusve retusis mu- [185]
cronatis; glandulis albo-appendiculatis; seminibusltevibna
a. NICOLLETII : foliia styliaque brevioribua, anthodiis cymuloaia; aeminibus ovatis.
ft. «TBBIIEDU: foliia anguatioribua; stylis longioribua; anthodiis cymuloeig.
globos* N DTTALLII : foliis linearibua; antbodiis alaribus; appendiculis orbicuJatis; stylis elonimtis seminilm. « A 8Ub
* *annaria,* Nutt. PI. Arkana. p. 171, non HBK.

keen f o n S ^ u ^ T 1 8 : prio 81mill9> ^ «PPendiculi minimi rtTli brevee Of * « « TMrietiea a. and *8.* have not
•nm- « the di8trict» explored by the Boundary Commiaaion, but they probably occur there THA •». inevar y-»
wmmoniiiTeiaa. Wright's 18M, belongs to vnr. A, a New Mexican form.

Am ! ! ? u i ORD. A 8EaPEN8 //B ^ £ * « « * » « * ^ Nutt !• «• P- " 1. In the southwestern parts of North [186]
eastern « («oundant on the Mexican boundary line) and throughout Central and South America, but not in th*
states. *E. micropKytla,* Roth, from India, is the same plant.

E OPHOBBU BKVOLDTA, n. *ip.*: erecto-patuhi; foliia linearibus wvolntia obtusia basi subajqualibos BtinnU.
setaceis anthodiis aUril W: Rlanduli8 an 8U8te appendiculatis; stylis «cnrvi« apice bifidia; capaula acute'aneulaU
••minibl.. Grande; J T * 1 1 *CUte "'Ku'atia tranavewe rugoaia. (Gravelly hills near Rock Creek; *Bigehw.* On the *Kin*
rr rignt, No. 1830) New Mexico; *FendUr.* No. 789. Very slender, 4-5 inches high; leaves 6-10 1Z
long and ½ line wide. Habit like a small olender *E. peUMdea,* but styks and seeds very different

of t h ^ T? , HO. IA P0LTCABPA ^ t t fio « 5M ^ P- M- D«7 *»'« "ear San Diego, California; Parry, Slb«. Banks
to h«* iSi* f *T Emr*- Sonor*: rr ^ <(N0> *im n* ♂ Verj TariaUe p1 14 tf a the fOT « which I ref«
(•nd thlTi y ucaon g to iL 8erii gmOOth o r Un<lulate> pp61 ^8 none op 8maI1 or IftrRe ; plant smooth or pubescent
only species always with ahort patuloua hair.). Collected by all the botaniata from the Upper Gila to San D i L. The
exception of ° i *' 'Yf' ^nil0pk UuM which M fa *1 bmw bu* *»* 8mooth «»d P»be«»nt forms with the

nt^ZtoT- Al OR ZONICA n ? : «**•>!»** S fol 8 e w htft ««b«quali ovati*obtain pilosis; .Hpal!* fncon
turbinato postice i ... bui Ion^iug H«ncaUtis; appendicihuR ghndula purpurea multo majoribus oboratis tubo
bll«; caogk i ^viorihw; «tylig erectis ad medium bifidia ovario puberulo lonRioribiw, stigmatibus filiformi
8teii 4I5 1 P°? J 8em ilb »fl nip»o-verrucoBW a'l angiilM acntoR crenulatis. Sierra Yanou, Sonora, July &L,*/
«ne in d h i j j * Wgh 5 IeaVC8 line8 lon ^ ^ Bm WI(Ie ^ vei 7 8TM»» involucmm with the appenda^

EUPHORBIA PEDICULIFERA, *n. sp.* : procumbens, cinereo-pubescens; foliis ovatis obtusiusculis; stipulis e basi lata lanceolatis; glomerulis parvifloris in ramulis alternis terminalibus; involucris hemisphæricis; glandulis magnis; appendicibus transversis crenatis; stylis patulis pubescentibus ad basin fere bifidis; stigmatibus divaricatis; capsula acute angulata pubescente, seminibus compressis angulatis sulcis 4 profundis transverse inctia. Sonora; *Wrinkt* (No. 1848), *Schott.* Spreading 6-12 inches. Leaves 3-1 line, long, oblique. Involucrum large. Seed. 0.7 line long, deeply 5-lobed, similar to some insects.

EUPHORBIA FENDLERI, *Torr. & Gray, Bot. Pope's Rep. p.* 19. *E. rupicola,* Scheele in Linneea, 22, p. 153, non Boiss. Common iu New Mexico and Western Texas; *Lindlieimer, Wright, Bujtlow.* Sonora; *Thurber.* Variable in the form of the leaves and the shape or presence of the appendages.

EUPHORBIA ALBOMARGINATA, *Torr.* jr *Gray, I. c. p.* 18. Common in the whole region between Western Texas and the Great Colorado, and southward into Mexico. It is No. 330 of Drummond's second Texan Collection.

EUPHORBIA CINERASCENS, n. *sp.*: ereeto-patuk s. subdecuinbens, pubescenti-c&nescens; foliis e ba»i lata obliqua ovatis s. suborbiculatis obtusis supra glabratis ; stipulis lanceolatis minutis mox deciduis; glomerulis lateralibus; involucris canis ; glandulis (plerumque purpureis) angustissiinis marginatis; stylis brevibus pilosis; capsula acute angulata cana; seminibus ovatis acute angulatis laeviusculis. On the Rio Grande; *Wright.* Chihuahua and Sonora; *Thurber.* Bishop's Hill, near Monterey, Mexico ; *Gregg.*

0. APPENDICULATA : foliis utruinque cinereis; appendicibus majoribus truncatis crenulatis; stigmatibus longioribus. San Felipe, California; *Dr. Le Conte, Thurber;* and San Gabriel; *Bigelow.* Stem 4-6 inches high; rounded leaves, often tawny red, l£-2 lines long; flowers few. Mr. Thurber informs us that this plant is called [187] *Yerba de la Golondrina* in Sonora. The Mexicans believe it to be a certain cure for the bite of a rattlesnake and other poisonous animals. The bruised fresh plant or the dried, steeped in wine, is applied to the wound. A tincture of the plant is sometimes kept in the apothecaries[9] shops of that country. According to Dr. Gregg, the name *Golon* drina* is applied to all the prostrate *Euphorbia.*

EUPHORBIA iNiEQUiLATERA, *Sonder in Linnaa,* 23, *p.* 105. I cannot distinguish from this plant of the Cape of Good Hope a species of the plains of Nebraska, Kansas, and Texas, and which extends into New Mexico, California, and Oregon. There it has been collected since the explorations of *NicoUet* and *Fremont* by almost every traveller (e. g., *Fendler,* 791, 795, 803 ; *Wright,* 666, 1823, in part, 1846). The same plant has been sent from Florida by *Blodgett* and *Chapman,* is found on the West India Islands, is undoubtedly the *E. Nilagirica,* Miq., of India, and has also been observed in New Holland; but it seems unknown in other States east of the Mississippi.

EUPHORBIA GLYPTOSPERMA, n. *sp.*: erecto-patula seu detnum decumbens ; foliis e basi valde obliqua (latere inferiore prod net a) fequilatis oblongis s. oblongo-linearihus obtusis versus apicem subeerratis a, integriosculis ; stipulis setaceis laciniatis, anthodiis alaribus demuin in glomerulos luxos laterales confertis; appendiculis brevibus integris seu crenatis; stylis brevibus apice bilobis, stigmatibus subglobosis; seminibus ovatis argute rugosis ad angulos acutos crenatis. *E. polygonifolia,* Hook. Fl. Bor.-Am. fide spec, auctoris, non Linn.

0. TENERRIMA : foliis parvulis angustis apice vix crenulatis ; involucri minuti glandulis vix seu non appendiculatis. On the Rio Grande; also on the Arkansas, and extending to the Upper Missouri. (No. 1853, 1855, and 1856, *Wright.)* From a few inches to a foot high. The larger northern forms have leaves 3 to 6 lines long and 1 to 2 lines wide. In *0.* the leaves are 1 to 3 lines long and £ to 1 line wide; involiicrum in the latter only 0.3 line long. Seed very sharply cross-ribbed, similar to that of *E. prostrata,* and notched at the angles.

EUPHORBIA BTICTOSPORA, *n. sp* : erecto-patula, foliis e basi obliqua subcordata orbicuiatis neu ovatis argute serratis supra subnudis; atipulis subulatis ciliatis ; glomeralis lateralibus sessilibus ; glandulis angustis appendiculatis; Btylis ovario pubero brevioribus patulis indivisis ; stigmatibus 3 capitatis; capsula puberula ; seminibiis angustis acute angulatis exsculpto-punctotis. From Kansas *(Fendler,* 798), to Santa Fe* *(Fendler,* 797) and Dofia Ana *(Wright,* 59), New Mexico, and CoraUitas, Chihuahua; *Thurber.* Stem 3-6 inches high. Leaves 2-4 lines long; apparently near *E. prostrata,* but styles and seeds very different

EUPHORBIA PROSTRATA, *Ait.* This variable and often mistaken species is found from Western Louisiana *(Dr. Hale)* to Texas ; *(Lindheimer,* 533); *(Berlandier,* 1100, 2530); *(Wright,* 1848 in part, 1855 in part). It seems to be a common plant in the West India Islands, Mexico, and South America. It occurs in Africa and India. *Euphorbia tenella,* HBK., and *E. callibrichoidei,* HBK., are forms of the same species, which can always be recognized by the dil-ate angle* of the capsule and the sharply rugose seeds, notched at the angles.

EUPHORBIA DIOICA, HBK. *(E. aneeps,* Benth. *R callibrichoides,* Schauer, etc.), a common and very variable plant of Mexico, Central America, and the West India Islands; has been collected by Dr. Antisell on the upper Rio Grande.

VAR. f INDiviSA, distinguished by the annual root, the less coriaceous, less oblique and less distichous leaves, the more scattered involucre, and the undivided Rtylm; has been found near the Copper Mines, New Mexico, by Mr. Wright (No. 1845), and in Sonora by Mr. Thurber (No. 003).

EUPHORBIA BIRRULA, n. *sp.*: patula *eu (lerumbens; caule patenter piloso; foliis e bad valde obli- [188] quo obtusiuscula seu subcordata obiongis wppe fa lent in oMnris argute proweque serrntis, subtus pilntfe; stipulis lanceolatis laciniatis; glomerulis lateralibus ap|*n<1icibus anpu*tis interns seu crenulatis; stylis ovario glabro brcvioribut patulis ad basim fere bififlin; seminibiiA nvatis lievibus costatn-nngulatis. Western Texas and New Mexico (No. 658, 1843 and 1844, *Wright.* No. 796 and 804, *FcndUr).* Stems 4-6 inches long. Leaves 3-fi lilies long, 1-3

ines broad, sharply and coarsely serrate; seeds larger than in all the foregoing species, 0.8 line long, remarkably

EUPHORBIA VILLIFEBA, *Seheele in Linnaa,* 22, *p.* 153. Western Texas; *Berlandier,* 2084; *lAndheimcr,* 530; *Wright, Thurber.* In various parts of Mexico; *Gregg.* Root annual, stems erect, often a foot high.

7 f c ™ EUPHORBIA HYPERICIFOLIA. " w. *Sp.* 1, *p.* 464. New Mexico; *Wright* (No. 1842 in part). Chihuahua- /wrwr. rhe true Linniean plant probably comes from the West Indies and other tropical countries, and has also* een sent from Florida by Dr. Chapman. It is distinguished by smaller anthodia, generally disposed in denser clus-ters, smaller capsules, and smaller, paler seeds. The common North American form, which has also been collected abundantly along the boundary, has larger and more scattered anthodia, larger capsules and larger blackish seeds, and may be distinguished as var. *communis,* as it seems to be the more common form throughout the warmer countries •round the whole globe. ««"«»

EUPHORBIA PILUUFEKA, *Linn. fi.* DISCOLOR : diffusa; foliis e bad valde oWiqua ovatis subrhomboideis acutius-culis serratis, purpureo-maculatis, stipulis subulatis, capsula parvula pilosa, seminibus minutis ovatis acutis undulato-tuberculatis. Sonora; *Thurber. Wright,* No. 1842, in part. Mr. Blodgett found it in Florida. Stems ½-1 foot long. Leaves 1-1½ inch long; differs in shape and color of leaves from the usual forms of *E. pilulifera*; hair of the stem, as in all forms of this species, yellow and jointed; involucre only ½ line long; heads 3-4 lines in diameter; seed scarcely "lore than J line long.

EUPHORBIA CAPITELLATA» w* *V"*• annua, erectiuscula sen demum diffusa ; caulibus elongatis puberulis, foliis e basi valde obl^ oblongo linearibus subnudis argute serrulatis mucronatis; stipulis lanceolatis laceris; glomerulis densis terminalibus fele aphyllis; involucri glandulis longius stipitntis, appendiculis orbiculatis s. late obovatis integra; stylis ovario hirto lonjiorlbus ad medium, bifidis; stigraatibus filifonnibus divaricatis; capsula puberuLr seminibus ovatis acutatis angulatis rugoso-tulwrculatifl. Valleys at San Bernardino, Sonora; *Wright* (No. 1849)! Stems 6-10 inches long ; leaves 6-8 lines long, 2 lines wide; heads white, showy, 4-6 lines in diameter.

cord EUPHORBIA P*CNANTHEMA, ft. *sp.:* perennis, erecto-patul^ canescente-pubescens; foliis e basi lnta obliqua ata ovatis s. oblongis obtUBiusculis s«pe mucronulatis integris s. subserrulatiB, scabris; stipulis lanceolatis fissis; Homenilis terminalibus multifloris quasi involucratis; involucris pilosulis (primariis) late orbiculato-appendiculatis C»cundarii8) subnudis; stylis fere ad basim fissis patulis; stigmatibus divaricatis clavellatis; capsula subglobosa pub 80611161 8em »bu8 acute angulatis tTatisverse rugulosis punctatisque. Mountain sides near Lake Santa Maria Chihuahua; *Wright.* Numerous etenw 6 inches high, from a thick ligneous root; leaves 4-5 lines long. General appearance of a small labiate plant with terminal involucrote heads. Similar in many respects to the lust, but more ***> more hairy, leaves shorter. Remarkable for the different involucres on the same head, reminding one of *J*ydmngea* or some *Umbcllifera.*

EUPHORBIA LATA. *R dilatatn,* Torr. & Gray, Bot Pope's Rep. p. 19; non Hochst. in Richard. Flor. [1891 £ atoll We8tem Texa8» San Pedro ; *Wf yf*^ No. 184L ○* ^ Cimaroa; *Fendkr,* No. 794. Eagle Springs;

EUPHORBIA ACUTA, fi. jp.: perennis, multicaulis, erecta, foliosa, hirsuta; foliis e basi obtusa subiequali lance-olat 18 ac Jtati« cartilagineo-mucronatis supra nudis; Btipulis filiformibus mox deciduis; anthodiis versus caulis ai»i-cem alanbus s. peeudoaxillaribus sparsis; invoiucris heraispharicis appendicibus truncatis crenatis lobatisve; stylis patulis u^tra medium bilobis, ovario cano longioribus capsula cana ; seminibus subcubiciR acutis acute angulatis lcevi-17 ^ 8 ^ ^ praiPiea We8tern Te»»» alo!1g tlje S*11 Pedro and Pec08 river8» *C-J *Bigdow, SchoU.* (No. 1739 and »» *Wright.)* Stems J-1 foot high; stiff rigid, leaves 6-10 lines long, *Z-6* lines wide, well characterized by the verr •wte point; seeds 1 line long.

EUPHORBIA ANQUSTA, ». *ip.:* perenni*, erects elatior, rigida; foliis lanceolato-linearibus basi acuta nub»qual-ibus acutis integris demum glabratis; Btipulis subulutis minutis deciduis; anthodiis pseudoaxillaribns sparais; appen-dicibus t ? 1 1 ^ 8 crenatil1 MBp e wlo ○ W erectis; stylis brenbus erectis apice bilobis; capsula cana acutangula; seminibuR ovato-cu acutall Rulil! transverse rugosis foveolatis. In rocky places Western Texas; *Limiheimer,* No. 69 ·. *Wright,* No. ennid I ? W ^ the Rio Grande? *SchoU_ ISnfA* W6 inche8 1]I^h ; 8everal 8tem8 fon« a forge black ptr!· long roo^ with few or numerous elongated branches; leaves few, 6-15 lines long, 1-2 lilies wide. Seeds 0.8 line •tiongly marked.

EUPHORBIA FL0EIDA» n- V-: nnnua, erecta, pntulo-ramosii, Rlaberrimft; foliis lanceolato-linearibus sou line-aribus in petiolis atten«*tis serrulatis mucronatif; stipulis lineari-aubuLitis nnpe 2-3-fidis; involucris aluribus in cym-ulas terminales l***''001186 HunculisiJetiolmnloiiKe superantibus; lobis involucri ovatis acutis neu acuminatii ciliatis seu rarius lacerin; appendicibiw magnin (involucre ipso majoribus) orbiculatw seu ovatis petaloideis inteffris • stylis ovarium fcquantibus seu superantibus basi coalitis ad medium seu ultra bifidis; stigmatibus filiformibus' capsula obtuse angulata; seminibus pubcubicis acute sngulatis tevibiis transverse 2-costatw. Sonora; *Wright* (No*

1829), *Thurber, Schott.* Stem J-1 foot high; leaves 12-18 lines long, 1-1J line broad ; margin revolute, and eerratures thereby often invisible. Involucre with large bright white appendages, 3 lines in diameter.

EUPHORBIA TRACHYSPERMA, n. *sp.*: annua, erecta, glaberrima; foliis e basi subsequali obtusa seu angiistata oblongo-lanceolatis serratis mucronatis; stipulis filiformibus seu subulatis setaceo-h'ssis; anthodiis alaribus demum in cymulas paucifloras terminales s. laterales confertis ; appendicibus angustis albis; stylis ultra medium bifidis; capsula obtusangula; seniinibua subcubicis faciebus laeviusculis, angulia acutis crenatis asperatis. San Pedro; Sonora; *Wright,* No. 1832. Slender, erect, about 1 foot high, branched erect, few; leaves 9-12 lines long, 2-3 lines broad; seed 1 line long.

EUPHORBIA EXSTIPULATA, n. *sp.*: annua, erecto-patula, ramosa, glabriuscula seu minute Aparsiraque aspera; foliis lanceolatis seu lanceolato-linearibus argute serratis basi aequali in petiolein brevem angustatis ; stipulis subnullis s. glanduliformibus; anthodiis alaribus solitariis; pedunculis petiolo brevioribus; appendicibus anticis plerunique 2-lobatis, posticis majoribus 4-lobatis; stylis ovarium ad angulos scabrum aequantibus, profunde bipartitis; stigmatibus fiJiformibus; seminibus magnis subcubicis verrucosis et transverse 2-3-castatis. Western Texas; *Wright* (1833 and 1838). New Mexico; *Fendler* (No. 790). Sonora; *Thurber, Bigelow, Parry.* Stem about 6 inches high; leaves about 1 inch long, 1-2, rarely 3 lines wide, sometimes not ubsolutely opposite, but a little separate; seed 1 line long, with thick cross-ribs. A transition form to the next sections.

§11. ZYGOPHYLLiE.

EUPHORBIA HEXAGONA, *Nutt. in Spreng. Syst.* 3, *p.* 791. *E. hctcrantha,* Nutt. in Trans. Amer. Phil. Soc. [190] (n. ser.) 5, p. 173. Rio Coleto, Texas; *Thurber.* "Many years ago Mr. Nut tall gave me specimens of this plant, named *E. hexagona.* Part of these were sent to Sprengel, who first published a description of the species in the work quoted. Eight years afterwards Mr. N. described the plant under another name. It is remarkable for being polygamous ; most of the involucres containing only male flowers."— *Torrey,* MSS.

EUPHORBIA BILOBATA, n. *sp. :* annua, erecta, gnicilis; foliis oppositis breviter petiolatis lanceolato-linearibns acutatis integris glabriuMculi-s rainei* angustioribus; nnthodiis alaribus cam pan u latin ; glandulis bilobis, appendiculis binis lanceolatis sen abbreviafe; stylis vix basi connatin ad medium bilobi* ; RtigmatiluiR erectis subteretibus ; capsula loeviuscula, seniinibus o vat is acutis angulato-tuberculati*. Near the Copjx»r Mines, New Mexico; *Bigelow.* Eastern Sonora; *Wright (So.* 1831). Stems 6-15 inches high; leaves 10-15 lines long, 1-2 lines broad ; seeds 0.8 line Inng, strongly tuberculite and almost angular. Glands remarkable ami very constant in shape ; appendages white. Near *E. hexagona;* distinguished by the acuter more uniform leaves, bilobed glands, terete fttigiunto, and smaller tuber* culate seeds.

EUPHORBIA BIFURCATA, n. *sp.:* glabra; caule erecto diehotomo; foliin oppoaitis ovatia sea obovatis in petiolem gracilem subtetiuilongmn anguu*tati argute scrratis obtunis liasi glnnduloso stipulatis; anthodiis alaribus breviter pedunculatis ; lobia 5 ovatis truncatis fimbriato-multifiilis ; ^landula singula cyathiformi late albo-appendiculata, appendice trans verso, emar^nato; stylis basi coal it is ad medium bifidis, stigmatibus filiformibus. Moist places, Valley of the Limpio, July; *Bigdow.* Over a foot high; leaves 1 inch long, i inch wide; petiole a little shorter than leaf.

§111. CYATH0PH0IM5.

EUPHORBIA DCNTATA, *Michx.; fi.* RIGiDA : humilior rigida; foliis pan*i« coriaceis reticulato-venosis scabris marline revolutis. Head of San Pedro River; *Wright (So.* 1837). Near Monterey, Mexico; *Dr. Edwards, y.* CUPH06PERMA : erecta, stricta, dentata seu]iarce \rt\ona ; folii* lanceolatis neu lineari-lanceolatit elongatis nubdentaU4 ; capsulis glabris seu pilots; seminibiiH majoribiiA ttilierctilaUHnn^ulatis. Copper Mines, New Mexico; *Wright (So.* 1834), to Sonora; *Schott.* Ojo de Gabilari, Chihuahua; *Thurber.*

EUPHORBIA HFTEROPHYLLA. *Linn. (E. qtntlwphora,* Murr.) Var. GRAMINIFOLIA : foliis angnsto-linearibns. Crevices of rock* and dry beds of rivers. Rio San Pedro, Texas ; *Bigdow, Schott, Wright* (No. 653). South of El Paso ; *Wright* (No. 1835).

EUPHORBIA BARBELLATA, n. *sp.*: annua, erecta, Kiabriuscula ; foliin «par»i« linearibus «eu lanceolato-Iinearibut •eu ovatis lobntiw^ue breviter jwtiolatis pam» argute deiitatiit, oubtun ad nervum mciiium jwirce pilonin, basi pilis longioribui confertiii barl«tis ; folii* floralilniH o vat in M»U e lifmi dilatata elon^ntin, bani naeis ; nnthodiis Klomeratis mnju*culis ; glandula singula wnsili lohi* ifhiHo-dnitatiM lin*vinn*; Mylinbreviltiiscrectifi ba^i vix connatuad medium bifldts. OQ the Rio Gramle, near En^le Pom; *Wright.* Rio Krio; *Biyhw.* Near *E. hrUrophylla,* bat floater, leaves very ftharply serrate, involucre Lirpr, *ntyU** shorter. Leaver 2-4 inches long, } or] inch down to 1 or 2 lines wide* Beard of coaiM hair at bate of leaves *very* coim|»icuoum

EUPHORBIA COLORATA, *n. sp.*: erected, glaberrima; foliis breviter petiolatis sparsis patulia elongate- [191] linearibus revolutis integris ; foliis floralibus basi paullo dilatatis puniceis subinde circinatis ; glandulis 1-2 stipitatis cyathiforniibus compressis margiiie revoluto scepe crenulatis involucri lobos laciniatos coloratos superantibus; 8tyli8 brevibus purpureis erectis longe connatis, apice bifidis, stigmatibus acutis demum recurvia. Dry arroyos, Aqua Zarco, Sonora, May ; and Santa Cruz, Sept.; *Thurber & Capt. E. K. Smith.* Specimens incomplete, nearly a foot high. Leaves 3-4 inches long, scarcely more than a line wide ; floral leaves shorter and about 2 lines wide, deep crimson. Distinguished from *R heterophylla* by the narrow revolute leaves, etc. Margin of involucre and styles also purplish. Capsule glabrous and seeds tuberculate, as in the allied species.

EUPHORBIA RADIANS, *Benth. PI. Hartweg, p.* 38. Plains between San Bernardino and Santa Cruz, Sonora, April; *Capt. E. K. Smith.* Dry vulleys near Buena Vista, Mexico; *Dr. Gregg, Dr. Wislizemis.* Mexico; *Berkmdier* (No. 116 and 1375). Root tuberous ; flowers in early spring, before the leafy shoots put out.

EUPHORBIA ERIAMTHA, *Benth. Bot. Sulph. p.* 51. Sonora; *Wright* (No. 1841 ?).

§ IV. UMBELLATJE.

EUPHORBIA WRIGHTII, *Ton. <6 Gray, Bot. Pope's Rep.* On the San Felipe and the San Pedro, Western Texas; *Wright* (No. 1827).

EUPHORBIA MULTICAULIS, n. *sp.* : annua seu biennis, multicaulis, humilis, erecta, glabra; foliis lineari-oblanceolatis acutis mucronatiH semilatis basi aii^uatiitH sessilibus; umbellis trifidis, ramis bifidis, bracteis lanceolatis, •uperioribus ovato-lanceolatis acutis; involucri gluwlulis transverse ovatis ; stylis basi liberis ad medium seu ultra bifidis; capsule coccis dorso verrucosis; seiniuibus lenticuliuibus Irevibus fuscis. Sonora; *Thurber.* About a dozen stems from a tapering root, 6 inches high, and with erect branches; leaves 4-6 lines long, 1 line wide. Nearly allied to *R obtusata.*

EUPHORBIA DICTTOSPERMA, *Fisch. dt Mey. Ind. Scm. Petrop.* 1835. *E. Arkansas* Engelra. & Gray, PL Lindh. 1, p. 26. Western Texas ; *Wright.* Var. MEXICANA : annua seu plerumque biennis, e basi erecto-ramoso ; foliis versus apicem crenato-serratis, lobia involucri subintegris; ovarii coccis dorso solum verrucosis. Valley of the Nagas, Balson de Mapimi, *Dr. Gregg;* Western Texas ; *Wright* (No. 1824). y. LBIOCOCCA: capsulis lavibus seu vix hinc inde verruculosis. Texas; *Drummond ;* II. 327. Near the Colorado, of Texas ; *Wright.*

EUPHORBIA TETRAPORA, n. *sp.*: annua, erecta, glaberrima; foliis cuneatis obtusis seu plerumque retusis emaiv ginatis obco^l^ti^ve ; umbeilis trifidis; bracteis spathulatis seu superioribus orbiculatis basi truncatis ; comubus involocri setaceis glandulara transversam saquantibus ; capsula dorso l«vi ; seminibus facie ventrali 4-punctatis, dorsaU laviusculw. Georgia *; Boykin.* Louisiana ; *Hale.* Texas; *LindJumer, Wright.* Near *E. Peplvs,* as is the following ipecies, but distinguished by the capsule aud the seeds.

EUPHORBIA PEPLIDION, n. *sp.:* annua, erecte, glaberrima, e basi ramosissima; foliis confertw e basi angustaU lineari-oblanceolatiR obtusis-, uwbellis 3-fldis dichotomis, bracteis lanceolatis acutis; comubus involucri glandulam ip«am aqnantibus liuearibus obtusin; cajwulae coccis obtusis non alatis seminibus facie ventrali 2-sulcatis, doreali Punctato^xsculptis. Sandy soils, Western Texas; *Wright* (No. 1823). A small plant, 3-4 inches high, much branched from the base, of the habit of *E. exigm.* Seeds very similar to those of *R Peplm,* 0.6 line long.

EUPHORBIA PEPLOIDES *Nutt. in Trans. Amer. Phil. Soc. (n. ser.) b,p.* 172, non *Gouan. R longicruris,* 8cheele in Linnoa, 22, *p.* 152. Western Texas; *Wright* (No. 1822); *LindJuimer* (No. 529 and 698) ; *Drum-* [192] TM*»d* (coll. II. No. 331). If *E. peploides,* Gouaii, of Southern Europe should prove to be a distinct species, Scbeele's name must stand for ours.

EUPHORBIA BRACHTCERA, n. *sp.* : annua (7), mnlticaulis, ramowi, erecta, glaberrima; foliis in petiolum bre-^imum angustatis lanccolati'a neu lineari-lanceolatis acutis mucronatis ; umbella 3-fida seu raro 4-5-fida; ramis Pluriesbifidia; bracteis inferioribus ovato-lanceolatiB iroperioribiis rhombeo-orbiculatis mucronatis; glandulis brevis-M«« obtuseque commit*; seminibus mnjuKiilis ovatis maculis irregularibus seepe confluentibus leviter impresRis. Western New Mexico ; *Wright* (No. 1821). Many stems a foot high from a stout but apparently annual or biennial *** 5 leaves 6-9 line*' long about 2 lino* wide, putnloiw (not erect as in *R esulfrformis)* regularly lanceolate ; upper P«.of the stem quite ramose ; horns *hort*r than in any of our species, and sometimes almost rudimentary. Seed 1 line in length, similar to tbow? »f *E. ejnthrfarmis, montana* and *Itenuriana.*

EUPHORBIA MONTANA, w. *sp.* ? pc-rennip, plaWrriina; caulibus pluribus ascendentibus ; foliis brevibuR lanceolatis ovatis obovatis seu ralmrliicnhtbi acutis seu obtu8i^ hnri MiWnde subconlatis subfiessilibus coriaceis glaucis ; bracteis omnibus orbiculato-trianKularibus, rarius subconluti.*, superioribus subinde transverse ovato-triangularibus, omnibus cuspidatis ; glandulis semilunatis, cornubus triangulatin brevibus; seminibus maculis plus minus impressis obscuris confluentibus mulique notnti*.

ORAtiuoR: caule lenuiori ; foliis minoribus sulwrbiculatis obovatw seu lanceolatis.

£ ROBUSTA : caule robustiore; foliis bracteisque majoribus crassioribus late ovatis sea ovato-cordatis. -

The vor. a. in New Mexico; *Fendler* (No. 786); *Wright* (No. 661, 1825). San Luis Mountains, Sonora; *Copt E. K. Smith.* Stems 4-8 inches high, leaves 2-3 lines long, in young specimens imbricate and red.

Var. 0. on the" upper Platte *{James, Nuttall, Fremont)* is a much stouter plant. Leaves 6-6 lines long, seeds larger. Dr. Wislizenus collected intermediate specimens near Albuquerque.

EUPHORBIA CRENULATA, n. jp.: annua, erecta, glaberrima; foliis obovatis acutis in basin attenoatis minute crenulato-serrulatid mucronatis ; umbella 6-fida, bracteis inferioribus lute ovatis acutis, superioribus transversis, omnibus tenuiter serrulatia mucronatis; involucri glandulis longe tenuiterque cornutis; seminibusovato-subglobosis cinereofuscis, maculis obscurioribus irre^ulariter confluentibus parum impressis. California ; *Hartxoeg* (I960). Near Monterey; *Dr. Parry.* About 1-2 feet high, simple or branching above; leaves about 9 lines long, 5 lines broad, involucels broader and shorter; seed nearly a line long, unusually dark for this section. One of the very few peploid *Euphorbia* with crenate leaves.

EUPHORBIA ESUL^EFORMIS, *S. Schaner in Linnasa,* 20, *p.* 729. Near the Copper Mines, New Mexico ; *Wright* (No. 1820) ; *Bigelow.* On the Nnece*, Western Texas ; *Wright* San Luis Mountains, Sonora; *Capt. E. K. Smith.* This species seems to be scarcely distinguishable from the Mexican *L\ campestris,* Schlechtendal. The original specimen of the latter, however, bus longer and more slender horns ; the seeds are wanting. The original specimen of *B. esulaformis* has similar but smaller seeds than our plant; the horns are also very short and incurved, the gland itself is truncate and notched. *Euphorbia brachycera* and *E. montana* come very near to this species.

VAR. t 8UBDEMATA: foliis oblongo-linearibus brevissime petiolatis, inferioribus integris obtusis, superioribns versus apicem mucronatum dentatis, bracteis ovatis obtusis aape grosse dentatia. San Francisco Spring, [193] Sonora ; Parry. The seeds were not ripe. This is, perhaps, a distinct species, but it must remain as a variety until more complete specimens are obtained.

EUPHORBIA LATHYRIS, *Linn.,* is somewhat naturalized around Monterey, California. It was doubtless introduced by the Spaniards. We have it also from Saltillo, Mexico, where it was collected by Gregg.

|V. SPARSIFLOILE.

EUPHORBIA MISERA, *Benlh. Bol. Sulph. p.* 61. Near the sea, San Diego, California; *Parry.* A straggling bush, about 3 feet high, abounding in a milky juice. Nuttall found it at Santa Barbara.

EUPHORBIA ANTISYPHILITICA, *Zuce. Jcad. Mon.* 1, *p.* 292. Rocky and gravelly hills along the Rio Grande, from the Presidio del Norte to Laredo; *Bigcbw, SchoU.* Remarkable for its long terete nearly leafless branches, which resemble an *Equiietum* or an *Ephtira.*

CBOTON FRUncuLoeuM, *Engdnkmm.:* caule basi faiticoso; foliis ovatis vel lanceolato-ovatii aoumi- [194]
natis acutisve subcordatis remote minutissime denticulatis etflanduloais supra viridis puberulis subtuf dense stellato-pubescentibus; floribus monoids pedicellatia, masculis racemoeia 10-6-andris 6-petalis, foamiueis apetalis; atylis profunde bipartitis, laciniis elongatis tUiformibus. Mountain aides and rocky ravines, Western [196]
Texas; Chihuahua and 8onora. (No. 639 and 1803, *Wright)* ; the latter a dwwàout form. No. 176,177, and S97 colL 1846; No. 134 and 997 coll. 1847, *Lindheimer.* No. 3212, *Berianďur,* in part; the specimen* with hairy fruit being a *kichocarpa,* Tonr. Leaves 1 to 2(inches long, and half an iuch to an inch wide, pubescence of the under surface often of a yellowish tinge. Infloresceuce terminal and axillary in the upper leaves. Humiliate flowers 10-30 or mon. Petals 6, oblong. Stamens exaerted; filaments smooth. Dink Mobed, glandular. Fertile flowen uraally 3, mile, apeUbus; disk indistinct. Capsule globoee-trigattric, covered with a abort caneecent stellate pubeacence.*

• Suppknentary Notes on Euphorbiam of the Boundary apprar in anolte paper, p. 440, note. — Ice.

IL EUPHORBLE OF A COLLECTION BY L. J. XANTUS IN LOWER CALIFORNIA.

FUOM THB PBOOBKDINO. OF THE AIIBBICAN ACADEMY OF AUTS AMD SOIBMOIS, TOL. V. 1861 ; IN AH AKTICLS BY ASA GRAY.*

107. EOPHOBBIA LEUCOPHYLLA, *tenth. Bot. Voy. 8ulph. p*. 60. These specimens, from the original [168, 169] locality of the species, perfectly agree with Bentham's description, hut would be called rather grayish-hoary than snow white; the leaves are very deeply and almost pectinately dentate, supported by extremely short petioles ; the appendages of the dark red or almost black glands are very unequal, as they commonly are in *AnisophyUum,* and in no species more so than in *E. adenoptera,* Bertol. *(E. dioica,* HBK.). the posterior ones being always the largest; in the specimens before me the posterior appendages are one line broad and half as long, the anterior ones •caroely more than half a line broad and somewhat shorter ; they are always crenate or even deeply incised, [170] the posterior more so than the anterior ones. Ovary and capsule together with the styles hairy, but the stipe gk-btoua: styles longer than ovary, distinct, about two thirds divided : stigmas scarcely davellate. Seed oval, sharp-angled, slightly undulate, nearly 0.5 line long.

108. EUPHORBIA SETILOBA, *Engdm. in Bot. WiUiamon, Pacific B. B. Sep. 5, p*. 364. Identical with the plant from the Lower Colorado, described in the report above cited. Root thick, but evidently annual; many stems from a few inches to a span long, almost verticillate from the very base, an arrangement which is vejy striking in the Califomian *E. polycaJTnA* the European *E. Chamatyce,* but not so distinct in most other *Anuophytta.* Lower leaves coarsely serrate ; uppeVonee entire; in the Colorado plant all nearly entire. Involucra minute, scarcely a third of a line long; the gland, perpendicular, not horizontal, dark red, with conspicuous white lacm.ate appendages· Male flowers, 6-8; in the original specimens scarcely ever more than 3. Ovary and capeule "vered ™J> *<>* T i T T * (not hispid) . rtvle. nearly * Une lona very slender, their branches remarkably club-shaped; seeds scarcely 0.4 lines U ^ngSTaSi^ ru-oee. — Distinguished- * •- * - 1 " ***~>* ^thejitinthe porterior^rt of the involucrum, the Jhapt of the appendages, and the more acute and much more rugose see*. - *E.* ««o6a ha. also been collected by Dr. Newberry in the sandy deserts west of the lower Colorado nver.

109. EOPHOBBIA PonrcABPA, *ton*. Bot. Voy. Silph. p*. 80. No doubt identical with the original form, collected in the «me neighborhood, bnfwith rather larger leave, than Bentha^escnbes The V « M k '. ky me in Bot Mex. Bound. p. 186, undoubtedly belong here, a. aim, *E.ocdMa,* Nutt. in Hb. Hook., from San D,ego, Ooilte* No. 1448 in Herb. A. Orav, and specimens collected by Dr. Newberry near Los Angeles and in the [171] H^W^^^o^fdS^bed, and P-gJ-* ^ **J2*J££ *f 1 Pedro Hirer in Arizona under the name of *E. micnmen,* in DC. Prod, ined., by the very small mvolucres (0.8 toe name 01 ZZ ne long), the entire absence of appendages on the small yellow, not purple, glands, and the extremely short styles with .obgL«e stign ^The lentfo of *e style, in these *Eupko***, however, . not a very safe charactera. this •pecimen from San^ucas, and some other, from Arizona and the Colorado de*rt prove: they have suberec sty «* •borter than the ovary (^ly about \ Une long), while most forms from the State of California have elongated styles with divaricate clavl branches, twice a. long a. the ovary. My remarks about the variability of the plant may be extended t... oblong. or oblong-linear, and obtuse at the base, but in spe· ^3^nNeTb^Tig7na"17; d ihem almi' orbicular and deeply coriate at the be*. The • « S TeidrSS£ ^ppTIId umS on the lower side of the stem, lan^eolate-subulate, mostly entire and cilia*, in the specimen from SanLncas, however, glabrous. Stem and leaves usually glabrous, somet.mes w,th a few "•ttered hain. or «,ti»l, nnh^oent The pubescent forms have alway. very narrow appendages, and the pubescence ^ ^ *X ^ E Z Z L %* — « 0.4 line long, .hailed, with the ride, almost smooth, or "•"ally more or lew distinctly undulate.

UO. EUPHORBIA HTPKBICIPOUA, *Lim.* rar. OOHUCHM, *Engelm. in Bot.* Jfo. *Bound, p*. 188 *E.Predii, Qn.* none, Fl. SicuL 1, p. 6 3,1-™» in DC. Prod. ined. - Botoief. weighty authority ha. notconvinced me that the fajZ^JTny'Jkr flower heads, smaller capsule*, and smaller and paler seeds, is dutinct from onr ^ « £ ^ ^ i KXb««»n» natuValized in Italy, where it ha. been de*ribed under different J ^ i l S JftSSSL* Bertol., and *E.* iWu,'te); nor-. I distinguish *E. Mocarpa,* K«oU*h. from tbeTTlndie. and South America, by any duwcter beside, the pubwcent capsu^a, Intermedmte form, unite all the* form..

HI. EOPHOBBIA OTI«OCI.ADA «. v.: frnticosa? rami. basi ligneMentibu. teret.bn. gracthbu. strict,, gla-*««•: folii.nmd.temMi.interno.lioelong.to mnltoties brevioribu. lineanbu. seu. ^o.W^^^bu c'rte8" « •anosuli. (dedtate oonduplicaU.) subtu. puberuli. .upr. .ubnudu in petiolum brevi-imum attonoati.; cym» ter-

• The specimen, m all coll*tod in th. vicinity of Cap. San Lucaa, - E M .

minalis umbelliformis puberulae radiis ternis iteratim dichotoinis ; pedicellis bracteas anguste lineares et involucra magna aequantibus ; involucri bemisphaerici extus intusque minute puberuli dentibus orbiculuto-ovatis fimbriatis dentatisve, glandulis 5 transversis bikbiato-cyuthiformibus appendice iis duplo latiore (alba seu roeea) orbiculata integra suffultis ; bracteolis paucissimis linearibus fimbriatis ; floruin musculorum numerosissimorum stipitibus demum exsertis; flore fceniineo breviter stipitato erecto glaberrimo; stylis distinctis { bifidis ovario aequilongia ; minis clavatis divaricatis ; capsulse coccis globosis; seminibus ovatis obscuris depresso-tuberculatifi ecarunculatis. — Base of stem unknown, probably fruticose ; the slender branches below ligneous ; internodes 2-3 inches long. Leaves very deciduous, on the branches in threes, 4-7 lines long [the larger almost an inch long], and 1-1J lines wide, on a petiole less than a line long. Cyme 1-1 £ inches in diameter. Involucres with the large appendages 4 or 5 lines wide. Bracteoles very few (probably 5) outside of the 20 or 30 male flowers. Styles scarcely half a line long. Cap- [172] Rule 21 lines in diameter; cocci with a slight groove on the back : seeds about l£ lines long, blackish-brown, covered with flattened tubercles. — Distinguished from the closely allied Mexican *E. peganoides,* Boiss. Cent. Euph. p. 21, by the small size of the bracts, the pubescence of the involucre, the Rhape of the glands, the large and entire appendages, and the short stipe of the ovary. The seeds of *E. peganoides* are unknown.[1]

III. EUPHORBIACEiE OF THE IVES EXPLORATION.

FROM REPORT UPON THE COLORADO RIVER OF THE WEST. WASHINGTON, 1861, PART 4, BOTANY.

APHOR.V SERRATA, *Torr. Hot. Mex. Bound. Surv., p.* 197. Gravelly places on the Upper Colorado ; January 25 to April 1. [26J Flowers greenish white.

CROTON (HEXDECANDRA) PROCUMBENS, *Eschsch.; Torr. I e. p.* 195. On the bottom lands of the San Diego River, California ; November 9. Grows in tufts two and three feet high.

EUPHORBIA IN.EQUILATERA, *Sonder in Limuca*; *Engelnu in Mex. B. Rep., vol. //., intd.* Mojave Valley. This in the same us Plant Fen* 11., No. 803 ; an almost prostrate form, with small narrow leaves, which are only towards the end very slightly denticulate ; seeds scarcely undulate or nibbed. This species has a very wide extension ; it is found in Florida and the West India Islands, in the west from Nebraska to Texas and to California and Oregon (in India, *E. Nilwjirica;* in South Africa, *E. inctquiUxtera* and *E. setigera),* and in New Holland.

EUPHORIIIA MKLAXADENIA, *Ton. in Hot. WhijrpU, P. R.' fop IV.% p.* 135. ' *E.* «Mm«f<iM, R, Engelm. in Mex. •B. Rep. II., ititxl. In sandy arroyon, Camp 15, forming niaU; January 15, in flower, but without fruit. Many prostrate stems, a foot and more in height, from a ligneous root. The specimens before me are distinguished from those

[1] Notes to the *Euphorbia:* of the Botany of the Mexican Boundary Survey, by the author, Dr. Kngi'linnnn.

Puge 185. *E. ptbilmdea, y. Nuttallii* is distinguished by M. Boiasier (Out Kuph. p. 10) under tho name of *E. zyjophylloide*%* no doubt correctly. Another of M. Boinsirr'.s nrw species, *R. polyclada,* from Texan, *>nt by Wright nnd Kindheitner, seems to be only a smaller flowered form of *E. yctaloidea* with narrower apiwndoge* an«l smaller seeds.

P. 186. *E. cineni9censf* 0. *appeiidiculata* intuit give way to the earlier name of *E. nulanadtdui,* Torn»y in Bot. Whipp. p. 135. — *E. ei*rra*ems* will hare to be named *E. wt'niadenia, $. tubinnppeudieiilain.*

P. 187. *E. imrquiUtUra^* Snnder. A carrful examination of the original Hprrimen of *B. arrpyUifoHn,* Pen. Syn. 2, p. 14, pnnervrd in Herb. DeTandolli* (a fragment of whir), hm boen kindly rommuniratod to mr), proret that thin 'u thr type of the Amoricaii forma, refemnl by me to *K.* iH<n/wi/<i/« *m ;* they will therefore hare to ñear Prnmon'a name. M. FV>i«•ler, diacriminating perhaps t» nirely, <H>n»i«ni the A*inti<* ãnd African forum aa distinct, and compritoa them under the name of *E. mnjmira.* Hoc hut., to which *E. iturquiliUrra* and nainy other nynonymei are referred.

The following two new specie*, of the »e<'tion *Tiihymnlia.* Wire collected by Dr. Newb*rry in the recent eii^lition under Lieutenant Ivrn : _

EuPHOkBU NTHtziiLfiBA, *Rmjelm. in LUut.* /rr:t [173] *t* perwim., enrcu, gUbcrriiua, Kl*ure«r«nt; Miu breve o rat is integris breviter euapidatia in petiolnm brevem attenuatiit; umliella; trifiilw brocteis inferioribui rhombeia, taperioribus transviTnis ciihpidatiit; involucri glnudulia itipitatia cn-natùi inciaiavu nee cornutis, lobis glandulc«is emarginatia ; stylis ovario longioribus basi coniiatia. — Kaat of the Lom'er Colorado, lat 3#°t alt. 2000 fevt. Dr. J. 8. Newberry, in Lieutenant Ivea's Kxjwl., Manh 26, in flower. — Amply di»tinguUhed from *E. monUina* and other allied ipeciea by the peculiar shape of the glands and lobes of the iiivolucrum. Stems 8-12 inches high. leaves *5-7* lines long and 3-4 line* wide. Fniit and seeds unknown. — (By an overnight this name was substituted for *E. i*eim9* 'employe*I in Ivrs's fa-port, part 4, p. 27, snd has priority of publication ; tee Bot. Talif. 11. 75. -En*.]

KrriinKRiA UBIHA, *Engrlm. I c :* perennia, multicanlia, glaUrrima, jnninr toU luritla; foliis oblaureolatis integris baAi atifnutati^ sulweMulibus patulU ; umbellss 5-fidir bmcUis rtmpiilatia, inferioribus obovatim, stifjerioribus suborbiculatis; involiirri glandulis tramtvemiji crenAti^ lobis ovatis menibrmsat^eiji; stylis ovario multo brrvioribus vix baid connatia. — BSM> of the San Franrimxi MnunUin^ Ut 86°, alt. about 7<*>0 feet; in flower at the etui of April. Dr. J. 8. New* brrry. — Fmm the nearly alii*) *E. esuitr/ormis* it is iliitin* giii«heil by the iWnw of horn* on the glanda, 4W. Stilus of the vrry young specimens six inches high. Ltavi* ft to 6 lines loug snd 1} to 2 lines wide. Fruit and seeds unknown*

obtained by Dr. Bigelow by haViD8 UneqUal glands to *e involucrum> tho8e tehind being much longer than those in front; and especially by their p8tikid r08e,,colored appeDdage8, The _ Ii TM DOt opaque, as ^ Torrey says, but reddish gray.

variabfeTS'of S... ? ' ^ ' / ^ ***•* 49; ***"•'* ^ * ** " *"* This fc one of the TM« fin,r.n America, if I understand it correctly. A form with narrow hispid pubescent leaves and very ^ appen.ag ? WM collected with the lMt» and >n the Purple Hills, forming dense mats on the sand of dry arroyos. otner, and the most showy form - the same that was found by Mr. Schott and Dr. Parry at San Diego, and of which a gPeCU? en from UlC 8ttmC l0Cality i8 *in* Dr Hooker>8 ^rbarium, labelled by Nuttall *E. ocdlata,* — was collected at Wh wiguna, and was seen from Los Angeles to the Colorado. This showy form has almost smooth uniform leaves, and •ery large white appendages to the dark glands.

fiW ^UP f0RBIA 8ETIL0BA* * •¥** •» *- *• -&P-, •* «, *» 364. Gravelly beds of arroyos at Purple Hills. Also in but £1 wan * ? * Md Proutbly the wliole year round. Nearly allied to the last, with the same rough pubescence, lucr^t « i 1 " 8 ^ ^ nOt only by the deeP laciniate appendaea, but •*» by *• •!«<* naked inside of the involucre. 1 find them in Dr. Newbeny's specimens generally triandrous, as Prof. Torrey has already noticed in the original specimen sent from Fort Yuma by Major Thomas.

in VI Eu / TBBIA (TITHYMALUS?) LURIDA, n. *sp.:* e basi perennante multicaulis, glaberrima, junior tota rubra ^noa; foliid oblanceolatis acutis baai anguatutis subsessilibus patulis; unibell© quinquifida bracteis, cuspidatis, inferi- ^^us obovatis seu oblanceolatis, superioribus suborbiculatis; involucri parvi intus pubescentis glandulis transversig 81-Mtt bis oVat^ menibrftUacei8 pulKMcentibua; stylis ovario ljeviui ulto bievioribus vix basi connatis bilobis. Campe ^^2, San Francisco Mountain; commencing to bloom at the end of April. I introduce this plant as a new species with a good deal of hesitation, as the specimens are scarcely enough advanced; but, though the fruit is as [27] y unknown, the plant seems to be well distinguished from any of the known North American or Mexican ^"ea. From the very similar *E. etulaformU* and its allies it differs by the absence of horns on the glands, and by the vei7 Bhort styles.

aid *f* ^m8 of the f Ottng 8Peciinen8 J118* coming mto fl°*er •» «*incnes nig> witn &* leaves brownish red; upper e^of leaves greenish red; leaves 5-8 lines long, and 1J-2 lines wide; involucre 1 line long; linear bracts of the ^we flowers numerous, hairy. So that it in more nearly allied with *Tithymaliu* than with *Etula.*

^ EUPHORBIA (ESULA?) INCIBA, n. *tp. [E. tchizoloba,* Eng. Proc. Am. Acad. V. 173]: perennis, e baai ramosa erecta 6h!:n !eiM^Ua> glaberrilna» gl«uc«8cens; foliis brovibus ovatis brevissime cuspidatis in petiolum brevem attenuatis; mbellsa trifida bracteis cuspidatis, inferioribus rhombeis, superioribus basi truncate transversis; involucri mnjnsculi wa subnndi glandulis stipitatia transversis truncatis crenatis seu irreguLuriter indsis nee cornutis; lobis involucri Pjeę truncatis glanduloeo-incraHaatis profunde emarginatia seu irregulariter bilobis; stylis ovario leevi longe exserto J|Wgioribua baai connatia bilobia. Camp 62, Lmg Valley. Sterna 8-12 inches high; leaves 6-7 lines long and 3 or 4 **** wide *x* involucrum about two lines long, and, with the conspicuous glands, more than that in diameter. Flower «nd of March \ very nearly allied to *Euphorbia montana,* Engelm. in Bot. Mex. B. Expedition, with similar "habits] ^**> amba^ but amply distinguished from this and all other peploid Euphorbias by the large involucrum, the oj6noe of nor na, and the incised nearly naked lobes. In all the allied species the lobes are membranaceoua, ovate, ***** •"d °& the inside villous. The bracts at the base of the male flowers are almost wanting, and the few occan- **"/ found are nearly naked, while in most species they are pubescent or villous. The styles, much longer than the *y tre united at the lower third and bifid at the upper third. Stigmas clavate; fruit and seed unknown. This species is too nearly allied to some of our peploid *Etui** to be separated from them, though the glands are hornless.

IV. ON THE GENUS EUPHORBIA IN DECANDOLLE'S PRODROMUS.

FROM THE AMERICAN JOURNAL OF SCIENCE, 2D SER,, VOL. XXXIV. 1862.

AFTER an interval of five years a continuation of the Prodromus, constituting a part of the [288] tn volume, has just made its appearance, containing a monograph of the suborder *Euphorbim* 7 & Boitsier. The celebrated author has in this work described and arranged with admirable care, ^•aentiousness, and lucidity the heretofore almost unapproachable mass of species of one of the TM* awnerxma genera of plants spread over the whole globe. He has, with great propriety, retained 18 emtl*«tly natural genus as Linnaeus constituted it, retaining as subdivisions some of the mimer- 0U8 8«nei* into which former authors from Ilaworth to Klotzsch and Garcke have sought to divide it

M. Boissier describes 693 species, which for the greatest part he had seen and carefully analyzed himself, and adds 30 others as incompletely known, thus constituting the most numerous genus known, after *Panicum,* of which Steudel enumerates 864 species, and larger than *Senecio,* of which DeCandolle knew 601 species. These species are arranged into two great divisions, the *Appendiculatce,* with *petaloid* appendages to the glands of the involucrum, and the *Exappendiculatce,* without such appendages. The former, containing 253 species, are for the greater part found in America: the latter, with 440 species, principally inhabit the Old World. This division of the genus is probably the most natural that could be made, though the first five species of the division are called by M. Boissier himself *Gymnadenice,* thus referring them properly to the second division, and [289] though other closely allied forms, such as *E. corollata* and *E. Ipecacuanha,* had to be widely 'separated on account of the difference in this particular.

The *Appendiculatce* are divided into 11 sections, the first and largest of which is *Anisophyllum* with 176 species, the best known representatives of which with us are *E. maculata* and *E. hyperifiifolia,* here called *K Preslii.* We have in our flora 36 species of this section ; one of these, *E. Preslii,* is spread over the whole of North America; 6 are found in the Mississippi valley or east of it; 3 common in the West Indies, extending into Florida (of these *E. hypericifolia,* L, proper, is not mentioned as a Florida plant by M. Boissier); 24 are peculiar to the western plains, Texas, New Mexico and Arizona, and 2 are exclusively Califomian. Several of the 24 southwestern species extend farther south into Mexico, and 2 of them, *E. prostrata* and *E. serpens,* which latter extends up the Mississippi and its confluents, are wide-spread species found through the warmer parts of the whole globe.

M. Boissier lias recognized several forms as distinct species in which I have only been able to see so many varieties of one polymorphous species. Thus the old *E. hypericifolia* comprises his small-flowered and fruited tropical *E. hypericifolia* proper, our larger-flowered, larger and darker-seeded *B. Preslii,* and several tropical and eastern forms, as the hairy-fruited *E. lasiocarpa,* the large-seeded *E. Brasiliensis,* and others. *E. zygophylloides* was very properly separated from *E. pelaloidea,* but *E. polyclada* I suspect is only a form of the latter. *E. micromera,* which I had taken for a form of *E. polycarpa,* seems well distinguished. I may add here that the western *E. scrpyllifolia,* formerly united by me to several forms of the Old World under the name of *E. incequilatcra* and *E. glyptosperma,* has lately been found by Mr. T. J. Hale in Wisconsin; as also *E. Geyeri,* first discovered in Illinois, which last seems to preserve its distinction from *E. petaloulca.*

The second section, *ZygophyUidium,* comprises 4 species, of which 3 belong to the sOTthwest and one to Mexico.

The 25 species of the 3d section, *Cyttarospcrmum,* are all inhabitants of the warmer parts of America, 13 being Mexican, and only one of our species, *E. bifurcata,* perhaps an intermediate link between this and the former section, is doubtfully referred here.

Sections 4 and 5 contain few (only American) species, none of them belonging to our flora.

Section 6, *Petaloma,* consists of 3 species, two of which, *E. marginata* and *E. tricolor,* belong to the west and southwest, and the third is a closely allied Mexican form.

Sections 7 and 8 are small and almost entirely South American.

. The 9th section, *Tithymalopris,* on the contrary, is entirely North American, 7 species belonging to our flora and one to Mexico. JE *corollata,* including *E. paniculata,* is the wide-spread aud well-known representative of this section. The heretofore imperfectly known Michauxian species, *E. pubentUsima* and jR *mercurialina* have been restored by M. Boissier, after a careful examination of the original specimens in Richard's herbarium, now in the hands of Mr. Franqueville of Orleana. The former, however, may be a variety of *B. corollata.* M. Boissier has from the some source aaoer-ÎT*[1]!!?-[11]*[1] '' ^y*S*^*ifolia,* Michx., is a form of *B. Curtisii,* though another specimen, in the herbarium of the Jardin des Plantes in Paris, is a form of *E. Ipecacuanha.*

Trichottmgma, the 10th section, comprises 5 species, all of them Western Mexican, two of which reach into our boundaries. The two species of the 11th section belong to South America.

• The second great division, *Exappendiculatce,* is divided into 16 sections, 2 of which only are represented in the North American flora.

Sections 12 to 14 contain few species, none of them belonging to our flora.

Section 15, *Poinsettia,* with 11 species, is almost entirely North American, or properly [290] Mexican; 1 or 2 species extending farther south, and 6 reaching into our. flora. The best known representative of this section, *E. kderophylla,* has been restored, recognizing *E. cyath^hyra* and *E. grarmnifolia* as varieties of the Linnaan species. The New Mexican *E. cuphcspcrma,* which I had described as a form of *edentate,* is here described as a distinct species. *E ennrdU* ought to have been mentioned as also occurring in Arizona. It may be remarked that the name of Arizona does not occur in this or other botanical publications, as a district formerly of the Mexican State of Sonora; just as Louisiana even yet, after 50 years of separate existence, sometimes is used in botanical works for the Upper Missouri country.

Sections 16 to 25 with ll^species, almost all belong to the Old World; they include the *Euphorbia* with succulent stems, those with the forms of *Cactt.*

Section 26, *Tithymalus,* comprises the great mass of the *Euphvrbu** of the Old World. Of the 302 species constituting it we furnish only 23, most of which belong to the southwest; 5 other* have been sparingly introduced from Europe into the Eastern States. The subjection %-**<*• is the only sub-section of *TUkgm^m,* whose species, 19 in number, all beong to the New World: 4 of them are peculiar to the Southeast; one comes over from the West Indies to the southern extremity of Florida, and allied as it appear, to the Chilian forms, is peculiar to southeastern New Mexico. Of the sub-section *Gdarrhxi* <<** <*tuse g ") , out of 108 species we harvé only 5 native species, distributed from the Alleghany Mountains to Western Texas and Cahfomj The largest snb-section, *Mm* (with, two-horned glands), comprising 139 specifcounte m O,K flora 12 epecies, 2 of them in the Middle and Southern States, and all the rest belonging to Texas, New Mexico, and California.

The 27th section is constituted by a single species, an Australian shrub.

We find the name of two of our published species, viz., *E.*<—Engelmj Gray s Manual and *E. FMdana,* Chapn„ in his Southern Flora, replaced by *E* OA«Xtca, Steud. & Hochst and *E. ph;* Sw, names which have been published only on labels in distributed collections, while *E: R^cliam,* Shuttlew., has not been substituted for *E. Curtim* though published m the TTe ToZJng table exhibits the geo^phical distribution of the 80 species of I ^horbia, credited by M. Boissier to the Hom of the United States. The immense extent of this flora may

T^XElmT™* ^ats, or the ^ ^danual, which however should naturally include the wooded part of Missouri, and exclude Northern Illinois and Wisconsin or the northwestern Pmirie region. I adopt, however Prof. Grays limi^^M~ "g Flora of the Southeastern and Southern States, east of the Mississippi, or the 1unite of Chapman s Hwa. IIL Horn of the western Prairie Region from the British Possessions to the Rio Grande. IV. Fl^ ofle Ro^y Moulns, including the greater part of Washington and Oregon,- the whole of Utah, C i New Mexico, and Arizona. V. Flo™ of the Pacific ^ * » £ » £

Some specie, extend thn^h most of these regions, while others are common to several of them. •nd other, i .re S t e d to a single one; some extend into the extreme hmits of our flora ftom the s o n t h e X ^ e , alljlnt The secies, therefore, may be divided according to their geogmphfcal extension into the following 12 classes:—

1. Species common to the greater part of our territory. I class here *Euphtrbu,* /V^tt, *arrpens,*

serpyllifolia, maculata, corollata, dent at a y Jieterophylla, and ***dictyosperma,*** though some of them are common only to the eastern, others more to the southern or western regions, and some [291] extend only to the edges of some of the floral districts: 8 species. 2. Species peculiar to the flora of the Northern and Middle States. I refer here a single species *E. Geyeri,* somewhat artificially it must be confessed, because it more properly belongs to the northwestern Prairie region; but thus far it has been found nowhere but in Northern Illinois and in Wisconsin : 1 species. 3. Species common to Gray's and Chapman's district: 6 species. 4 Species peculiar to the southeastern flora: 8 species. 5. Species common to the southeastern and the western flora: 3 species. 6. West Indian species extending into Florida: 4 species. 7. Species peculiar to the western and southwestern Prairie flora: 19 species. 8. Species common to the last and the following region: 3 species. 9. Species peculiar to the Mountain region of the west and southwest; many of these, as well as of section 7, undoubtedly extend into Mexico: 20 species. 10. Mexican species extending into the last region: 3 species. 11. Species common to the western Mountain region and the flora of the Pacific slope: 2 species. 12. Species peculiar to the Pacific slope: 3 species.

GEOGRAPHICAL DISTRIBUTION OF EUPHORBIA WITHIN THE FLORA OP THE UNITED STATES.

	1. Anisophyllum.	2. Zygophyllidium.	3. Cyttarospermum.	4. Pedaloma.	5. Tithymalopsis.	10. Trichosterigma.	11. Poinsettia.	2a Tithjrraalua, 4. Ipecacuanhse.	2a Tithjrraalua, 6. Galarrhei.	2a Tithjrraalua, 10. *i*	Total.
1. Common to whole country	4	..	..	..	1	..	2	..	1	..	8
2. Peculiarly northern	1	..	..	..	..	..	..	..	..	..	1
3. Northeast and southwest.	2	..	..	..	..	..	..	1	2	1	6
I. Northeastern flora	7	..	..	..	1	..	2	1	3	1	15
1. Common to whole country	4	..	..	..	1	..	2	..	1	..	8
3. Northeast and southeast	2	..	..	..	..	..	..	1	2	1	6
4. Peculiarly southeastern	..	..	..	..	5	..	..	3	..	..	8
5. Southeast and west	2	..	..	..	..	..	..	..	..	1	3
6. From West Indies	3	..	..	..	..	..	..	1	..	..	4
II. Southeastern flora	11	..	..	..	6	..	2	5	3	2	21*
1. Common to whole, country	4	..	..	..	1	..	2	..	1	..	8
5. Southeast and west.	2	..	..	..	..	..	..	..	..	1	3
7. Peculiar to Prairie flora	8	1	1	2	1	..	1	..	2	3	19
8. Prairie and Mountain flora	3	..	..	..	..	..	..	..	..	..	3
HI. Western Prairie flora	17	1	1	2	2	..	3	..	3	4	33
1. Common to whole country	2	..	..	..	..	..	2	..	1	..	5
8. Prairie and Mountain flora	9	..	..	..	..	..	..	..	..	..	3
9. Peculiar to Mountain flora	9	2	..	..	..	..	3	1	..	5	20
10. From Mexico	1	..	..	..	..	1	..	..	..	1	3
11. Mountain and Pacific flora	2	..	..	..	..	..	..	..	..	..	2
IV. Western Mountain flora	17	2	..	..	..	1	5	1	1	6	33
1. Common to whole country	2	..	..	..	..	..	1	..	1	..	4
11. Mountain and Pacific flora	2	..	..	..	..	..	..	..	..	..	2
12. Peculiar to Pacific flora	J	..	..	..	..	1	..	..	..	1	3
V. Pacific flora	6	..	..	..	..	1	1	..	1	1	9
Flom of the United 8utea	M	3	1	2	7	2	6	6	5	12	
				61				29			80

The following manuscript or herbarium names of Engelmann are taken up by Boissier in De-Candolle's Prodromus, 1862, xv. ii. *E. ovalifolia* and *K rhytisperma* were first published by Klotzsch (Pflanzeuklasse Tricoccae, 1859, pp. 26 and 34.). — E D S.

B. (uperifolia = E. strigosa, no. 267.
E. astyla, uo. 125.
E. atroruberuss E. Ipecacuanha, var. gracilis, no. 391.
E. Baueri. no. 70.
E. calliadena = & hispida, no. 111.
B. coiwongruitnea = K serpyllifolia, Tar. consanguinea, no. 141.
E. disticha, no. 93.
E. Engelmanni, ßL depressa, no. 138.
E. floribunda, no. 122.
E. fruticulosa, no. 115.
E. Greggii, na 683.
E. grisea, no. 130.
A *horUnti$=zE.* Engelmanni, no. 13a
E. hypericifolia, var. *micranUui*= E. Lypericifolia, no. 51.
£. leptoceia, 0. creuulata, no. 564.
E. Lindheimeriana = E. longicruris, no. 562.
£. maculata, 0. detonsa, no. 156.
E. melanadenia, *fi.* sul)appendiculata,.no. 89.
E. notataszE. serpylii folia, var. consanguinea, no. 141.
E. ovalifolia, and /3. schizosepala, no. 139.
E. pilosula, no. 123.
£. prostrata, /9. vestita, no. 158.
£. rhytisperina, no. 142.
E. serpens, van. radicans and Indica, no. 80.
E. tubserrata=E. serpyllifolia, var. consanguinea, no. 141.
E. tomenteila, no. 90.
E. umbellulata, no. 126 (pp. 40, 1263).
E. villifera, /9. nuda, no. 147.
E. Xanti, no. 222.
E. zygophylloides, vars. cymulosa and flagelliformis, no. 77.

V. EUPHORBIACEiE OF WHEELER'S EXPLORATION".

FROM REPORT UPON UNITED STATES GEOORAPDICAL SURVEYS ... IN CHARGE OF FIRST LIKUTENANT GEORGE M. WHEELER, VOL. VI., BOTANY, BY J. T. ROTHROCK, 1878.

CROTON COIRYMBUL06C8. — *IUMJ* erect stems from a ligneous base, a span to a foot high, simple below, [242] branching upward ; stipules subulate, deciduous; petioles about half as long as the oval or oblong, mostly •cutish, leaves, which are j-1 \ inches long, the lowest ones broader and shorter and often acutish at base, all triplinerved at base, penninerved upward, whitish below, greenish-gray above; stellate hairs slightly united to scales above, *lmost free and loose below ; inflorescence short, loose-flowered, corymb-like, 6-8 lines wide, mostly monoecious ; pedicels 2-3 lines long, much longer than the flowers; male flowers with 6 spatulate or lanceolate bearded petals alternating with the 5 lobes of the disk ; 6-13 stamens with bearded filaments; female flowers mostly apetalous ; [illegible] Mild to Mow the middle or usually to the base, and together with the ovary and the oblong (3 lines long), capsule stellate scaly; seeds linear-oblong, 2 lines long, delicately punctate-reticulate.—Camp Bowie, New Mexico, Rothrock, 1874 (506). Through Western Texas (JTrigAt, 641, 1805) into Mexico (Saltillo and Buena Vista, *Grtgg,* Hi 288). This species was first described by Torrey in Bot Mex. Boundary, p. 194, under the name of *C. Lindheim-* «»*»»«««, in which Miiller, DC. Prod. 15, 2, 579, followed him. But Scheele's plant thus named and described in Linnasa, 25, 580, is an annual, mistaken by him for a shrub, which was collected by Lindheimer near New [243] BraunfeU, Tex., in 1846, and distributed in his sets under No. 526, and lately rediscovered along a railroad in the Indian Territory by O. D. Butler. This plant was by Mttller taken for Nuttall's *C. eUiptiau,* from St. Louis, which ia, however, identical with *0. numanthogynui,* Michx., and in Gray's Manual, ed. 5, 438, the same species was •«•» described as *C. eutrigyruu.*

CBOTON TEXENSIS, *MUU. I* c. (MB. — An annual, erect, dioocious plant of the southwestern plains, Texas and New Mexico, 1-^ feet high, canescent or greenish-gray (when it is *C. virens,* Mull. 1. c. 690), with linear-oblong leaves *H* inches long on petioles H inch lon 8. without any &*''**', stellate hair free, not scaly; flowers apetalous; •tamens usually 10-13 ; filaments hairy ; styles twice or'thrice 2-cleft at base, and, like the capsules, stellute-canescei >t; seeds orbicular-ovate, somewhat compressed, with a small deciduous caruncle below the apex. — Santa Fe\ N. «*., *Rothrock,* 1874 (37), originally described by Nuttoll as *C. muritatui,* a name already preoccupied. *Hendecan,* *• ftaamnf, Klotuch, and //. *multiflora,* Torr., are other synonymes for this plant. NuttalPs name refers to the • * » • knobs or almost spines on the capsule, which are covered with prominent tufU of stellate hairs. The styles «• twfae or often three times cleft, to thai there are 12 to 24 stigmas.

AOALTPHA LrNDRBtMRRi, *MM.* I. * 875. — Many weak, ascending, downy stems from a thick ligneous root, a •P* to a foot high, branching from the base ; leaves lanceolate-ovate, acute at both ends, serrate upward, hairy, on

short petioles, lower ones broader and shorter; slender, dense-flowered, terminal spikes 2-3 inches long, staminate upward; shorter spikes from the uppermost leaf-axils; bracts oval, deeply dentate; styles divided into many very slender, long-protruding, red branches. — Ash Creek, Arizona, *Rothrock,* 1874 (299), and through New Mexico to Western Texas. — Very near the Mexican *A. phleoides,* Cav., with which Torrey, Bot. Mex. Bound. 199, was inclined to unite it The slender spikes with the delicate bright red fringes give the plant a very elegant appearance.

JATROPHA MACRORHIZA, *Benth. PI. Hartw.* 8 ; *Mull. I. c.* 1087, var. SEPTEMFIDA. — Stems a span to a foot high, glabrous, very leafy ; leaves glabrous, with the nerves of the upper surface puherulent, cordate, with an [244]
acute sinus, broader than long, divided about j or more into 7 ovate or ovate-lanceolate, incisely dentate, aristate lobes; stipules (2-3 lines long) setaceously divided; petioles about J-J the length of the leaf; cymes densely many-flowered, short-peel uncled, somewhat puberulent, with subulate-setaceous, entire, or the lower ones setaceously ciliate, bracts; sterile flowers £ inch long, with lanceolate, aristate, usually entire calyx-lobes, half as long as the spatulate petals; 5 (or rarely 6) exterior and 3 longer interior stamens, all united to about half their length, bearing equal, linear-oblong anthers; calyx-lobes of fertile flowers broader, larger, spinulose-dentate; styles 3, each with 2 oblong stigmas ; capsule obtusely triangular, oblong, £ inch or more long ; seeds linear-oblong (4-£ inches long), with a large hoodlike,xut-fringed caruncle. — Sulphur Springs, Arizona, *Rothrock,* 1874 (546), and to Southern New Mexico, and Chihuahua, *IVUlizenw.* Leaves *in* the smallest specimens *(IFislizenus,* Chihuahua) 2 inches long by 2J inches wide, in Rothrock's largest, 6 by 8 iuches, always with 7 lobes and usually with 2 smaller additional ones at base. Evidently a form of the Mexican *J. macrorhiza,* and with the same curious caruncle of the seed, distinguished by the longer petioles, the much more deeply divided leaves, with more numerous and more deeply cut-toothed lobes, and an acute (not wide or truncate) sinus. Torrey's *J. multifida,* Bot. Mex. Bound, p. 198 (not Linn.), is evidently the same thing, as already suggested by the author himself, and probably nearer Bentham's type than our plant, as the leaves are said to be only 3-5-lobed.

EUPHORBIA (ANISOPHYLLUM) A L BOM A RG IN AT A, *Torr. 4 Gray in Paeif. R. R. Report,* 2, 174 ; *BoU Mex. Bound.* 186 ; *Boissier in DC. Prod.* 15, 2, 30 —A prostrate, much branched, glabrous, glaucous perennial, with orbiculate-conlate, entire, rather fleshy leaves (2-3 lines wide) and conspicuous, triangular, membranaceous, whitish stipules; involucres axillary, solitary, or sometime* crowded into foliaceous cymules, broadly campanulate with conspicuous, white, transverse, entire or undulate appendages of the glands ; capsules triangular; seeds reddish-gray, linear or oblong, smooth or sometimes very slightly undulate. — Zuñi, *Rothrock* (173 *in part),* 1874, to Fort Tejon, California (274), 1875, and generally from Western Texas to Southern California and into adjoining Mexico. A very distinct specie*, cosily recognized by its glaucous color and whitish stipules and white appendages. In Arizona [246]
it is called " Rattlesnake Weed," as it* acrid juice in considered an antidote against the venom of that reptile. In Mexico, to this, as well as to other allied species, known under the name of *Golondrina,* great medicinal virtues are ascribed.

EUPHORBIA (ANISOPHTLLUM) FLAOBLLIFORXIS, *Engdm. in Haydax't Bull. Qeol and Geog. Surv. Terr-* 2, No. 3, 243. *E. pcUdoidea,* var. *Jbigelli/ormis,* Engelm. in Bot. Mex. Bound. 185. *E. tygophylloidet,* var. *flngelliformis,* En#elm. in Boiss. 1 c. 29. — A glabrous annual, with prostrate or ascending branches a span to a foof long; linear or oblong-linear entire leaven, acutish at both ends, 4-6 lines long, 1 line wide; conspicuous triangular incised stipules and alternate loose-flowered leafy corymbs ; involucres broadly campanulate, with 2-4 large, concave, narrow-margined or inappendiculate glands ; broad triangular capsule ; smooth gray seeds thick and short, triangular, acute. — Camp Goodwin, Oila Valley, Arizona, *Rothrock* (339), 1874. Apparently a common plant in the aandy valleys of the Rio Grande *(Wright, Brandegee)* and Gilo, but very randy collected. Dr. Rothrock's specimens have a ligneous, very stout, tapering root 3 lines in diameter, with many utenw (1-1} lines thick) from the neck, just as we sometimes see other annual *AnisophyUa, E. hyperitifolia* among them, an that they simulate and actually become perennials ; real perennials, however, Mich as the next *perie», have r> lindric or tuberous mota, usually with slender and even filiform hones to the stem*, which are buried beneath the surface. The slender leaves and the short, leafy, alternate flowering branchleto, much shorter than the inteniodes of the elongated stem*, character!* thin species at once. Like the California *E. oeellata,* it is distinguished by large cup-shaped glanda, usually 1CM than four in number, and scarcely or not at all margined.

EUPHORBIA (ANMOPHTLLCM) FKKDMCRI, *Torr. S Gray, Pan/. R. R.* Op. 2, 17a; *Bot. Mex. Bound.* 186; *B>iu. L c.* 3*. *E- rupirola,* Srheel*, not BOIJW. - Olnlimuii; many miberect or attending, nhort, rigid Plcnt or » JIT™ E, nKlh from * I"TM"11*1 ***• thick lwiv«S "Mnpu-ly triangular-ovate to lanceolate, 1-*J line* long, entire, often ittkUh; fttipulen mihulate or noniewhat lanceolate, involucre* in terminal and lateral leafy crmulen ; K»nds with narrow or with longer, nometime* triangular, entire or dentate or lnlwl, greenish or r«Mi»h appen- [246]
<Mflevw without any; ne«.U qiiadranKular-oUonR, undulate and irroliiruiate. —SanU Fe, *Rotkrork* (13), 1*74; number 1003 is the same from Aruona. Not rare from Wentem Texas through New Mexicu ami Southern Colorado

to Arizona. A diminutive, suberect bush of many stems and branches, very variable in the width of its leaves but «adUy recognized by the characters enumerated.

EUPHORBIA (ANISOPHYLLUM) POLYCARPA, *Benth. Bot. Sulph.* 60; *Bot. Mex. Bound.* 186; *Boiss. I. c.* 44. —A perennial, often flowering in the first year as an annual, prostrate or erectish, glabrous, sometimes pubescent (or even tomentose in a variety), with orbicular-cordate or oblong entire leaves, always with linear, delicately ciliate stipules ; involucres axillary, rarely crowded into few-flowered cymes; appendages of the dark red (or, when dry, black) glands wrge and conspicuous, or smaller; seeds gray-reddish, linear-oblong quadrangular, smooth or slightly undulate. The typical large-flowered, glabrous form is found principally along the Pacific coast from Cape St. Lucas to the southern port of the State of California; inland, and especially in the California Desert und up the Qila, where Dr. Rothrock collected it in 1874, a larger, wide-spreading, very much ramified form is found, with smaller, glabrous or pubescent, oblong or oblong-linear leaves J-1} lines long, with smaller involucres, very small, almost or entirely inappendiculate glands, and very short styles, but seeds of the same size and form as in the type. The stipules of all forms are alike, ™ear, entire, minutely ciliate. *K micromera,* Boiss. 1. c. 44, seems identical with this last form, and we will have to çonsider *E. melanadenia,* Torr. Pacif. R. R. Rep. 4, 135, as a tomentose variety, as suggested by S. Watson; an intermediate form is *E. dnerascens,* Engelm. Bot. Mex. Bound. 186.

EUPHORBIA (ANISOPHYLLUM) SERPYLLIFOLIA, *Pers. Ench.* 2, 14; *Boiss. I. e.* 43; *Gray, Man.* 432. *E. inasquitokra,* Engelm. Bot. Mex. Bound. 187 ; not Sonder. — Zuñi, *Rothrock,* 1874 (173). An extremely variable species, ut readily recognized by its glabrous, obovate leaves, acute at the unequal base, broader and serrulate at the rounded JP5 8tipules setaceously divided; involucres in lateral leafy clusters; seeds gray, linear, acutely 4-angled, tyjntly wrinkled or pitted. The closely allied *E. glyptosperma,* Engelra., may always be distinguished by the [247] °*oad semicordate base of the leaves, the lower half of which is protracted and almost auriculate, and by the sharply cross-ribbed and at the angles notched seeds. The form collected at Zuñi is auberect, nearly a span high, with leaves more sharply serrate than usual, and more distinctly rugose.

EUPHORBIA (ANISOPHYLLUM) PEDICULIFERA, *Engelm, Bot. Mex. Bound.* 186 ; *Boiss. I. c.* 48. —Plant, pale dull ****** covered with a short, scanty pubescence ; many prostrate stems from a perennial root, a span to a foot long; leaves rather large (6 lines long or more), oblique, oblong, obtuse, entire ; small stipules triangular-subulate ; involice* in few-flowered, lateral leafy cymes 5 glands with broad, dentate appendages; capsules canescent; seeds oblong, 2K tf^' 8tr°ngly marked with 4 deep transverse grooves, deeply notched on the edges. — Cienega, near Tucson, Ariz., *Xotorock,* 1874 (576). A native of our extreme Southwest, from Arizona to Southern California and into adjoining M e*ico; well marked by its larger, dull grayish-green leaves, and especially by the (for the section) large, deeply 8*ooved and notched seed*, which curiously simulate some insect.

EUPHORBIA (ANISOPHYLLUM) HYPERICIPOLIA, *Linn.; Bot. Mex. Bound.* 188; *Gray, Man,* 432. —Two forms werecollected by Dr. Rothrock in 1874. The common form (672) from Camp Crittenden, Southern Arizona, is that of *•.* States, called *E. Preslii,* Guss., Boiss. 1. c. 22, glabrous, with rather small, blackish, much cross-wrinkled f**-. The other form (72o), from Camp Lowell, Southern Arizona, has seeds larger than the last, in size between oee of *E. Brasiliensis,* Lani., and the large-seeded *E. Bahiensis,* Boiss., and in form similar to them ; all of these •e thick, short, almost ovate-cubic, black seeds, with few prominent tubercles arranged in about 2 interrupted ™»verse ridges. Our plant is nearly glabrous ; leaves very pale below, with long, sparse cilia on the upper edge W^K the baae-"~The different species allied to *E. hypericifolia* require further study, as it is a mooted question tether the pubescence of the plant and even that of the capsules, and the size, the color, and the markings of the j**Jj constitute here specific differences. If they do not, then we have here one of the most polymorphous f* •pread over all the warmer countries of the globe, and most difficult to define by floral and carpological, [248] 0111 *«ly recognixed by the vegetative characters.

^ UPHORBIA (POINSHTIA) CUPHOSPBRMA, *Boiss. I.* c. 73. *E. dentata,* var. *cuphosperma,* Engelm. Bot. Mex. Bound. 190. 4 •fender, erect annual, 1-11 feet high, simple or with few erect branches, nearly glabrous, with few bristly hair* k'wa-linear, 1-2 inches long, upper involucral ones longer and a little wider, but scarcely discolored at base, all teeth on the involute, scabrous margins; the large involucres in loose clusters, deeply camanulat tubular glands; seeds short and thick, triangular, truncate at base, -naged and tuberculate, with a minute caruncle. —Cienega (Creek), Arizona, near Tucson, *Rothrock,* 1874 (577). A rare plant, found only once before, by Wright, mistaken by me for a form of *E. dentata,* but well distinguished from that species (wbich extends far into Mexico) by its involucres and seeds. *E. dentata* has much smaller turbinate involucres, with broad glands, and smaller ovate or nubglobose, minutely tuberculated seeds.

ArfJ? D? !! 0EBU (TTOTIIALUS) DICTTO6PIRMA, *Fisch. dt Mey.; Boiss. 1.1* 135; *Gray, Man.* 434.-Camp Grant, ****** *Bothrock* (370), 1874.

f°"?»»U (TITHTXALOT) CAMPBTUB, *Cham. S SchUdU. Linn.* 1830, 84; *Boiu. I e.* 146. *E. etubtformu,* Schau. » Linn. 1847, 720; Bot Met. Bound. 108. — Several erect stems, 1-1} feet high, from a stout perennial root;

glabrous leaves linear-lanceolate; lower branches sterile with narrower leaves, upper ones flower-bearing; terminal umbel 5-rayed; exterior floral leaves ovate-lanceolate, interior ones shorter, but all longer than wide; involucres turbinate-campanulate, on pedicels of nearly their own length; glands semilunate, with short horns; styles longer than the ovary, united at base, bifid upward ; seeds ovate, gray, marked with irregular, shallow, dark impressions.

Willow Spring, Arizona, *Rothrock,* 1874 (213); and southward and south westward throughout Mexico. — Tbe narrow leaves, especially on the sterile branches, and the narrow floral leaves, distinguish this species from iU allies in the Southwest, and approach it, in habit at least, to the European *E. Esula.*

VI. COLLECTED DESCRIPTIONS OF EUPHORBIACEJE.

FBOM ENGELMANN AND GRAY'S PLANT* LINDHEIMERIAN*, PART I. (BOSTON JOURN. NAT. HISTORY, V. 1845).«

171 PILINOPHTTUM LINDHEIMERI [24, 25} 174 EcPHORBIA BICOLOB [25]. 178 CNIDOBCOLU8 8TIMULOSUB [26].

EUPHORBIA GEYERI, *Engelm. mss.:* depresse, bumilis ; foliis oblongis retnsis integerrimis glaberrimis; stipnlirt setaceo-multifidis; involucri appendicibus petaloideis ; senrinibus minoribus quam *in £. polygonifolio, cinerew.* — Beardstown, Illinois, and Upper Missouri, *Geyer.* Near *E. polygonifoluL* [52]

302 E. ARKANSAKA [53]. 303 E. MARGINATA, 0. ULOLEUCA [53]. 306 APHORA HUKHJB [64]. 307 TRAGIA BBEVIBPICA [54].

FROM GRAY'S MANUAL, SECOND EDITION, 1856.

4. E. HUMISTRATA, *Engelm. mss.* Procumbent, puberulent or hairy; leaves elliptical with an oblique obtuse base, serrulate towards the apex, sparocly hairy underneath (J-J inch long, sometimes with a brown spot nl>ove); peduncles rather shorter than the petioles, crowded in lateral clusters; involucre deft on the hack, its appendage* orbicular or truncate and nearly entire ; pod acutely angled, puberulent; seeds ovate, 4-angled (| line long).— With the lurit — Branches 6-20 inches long. Distinguished from tbe next by its broader leaves, slit involucre, and rounder, granulated (not transversely grooved) seeds. [386]

18. £. COMMUTATA, *Engelm. mss.* Stems branched from a commonly decumbent base (6-12 inches high); leaves obovate, the upj>er all sessile, the upper floral roundish-dilated, broader than long; pod obtusely angled, cnwtless ; seeds ovate, pitted all over; biennial, annual, or perennial ? —Along water-courses, from Virginia toward the mountains to Ohio and westward. — Leaves often peroiateut over the wiuter on sterile shooU, turning red, like those of the European *E. amygdaloula.* Seeds 1 line long, larger than those of *E. Peplus*; with which thitf hai been confounded ; but the character of the pod and seeds readily distinguish it. [389]

FROM TORBEY'S DESCRIPTIONS OF PLANTS COLLECTED . . . BY W. P. BLAKE (PACIFIC R. R. RIFTS. BOTANY, VOL. V. APPENDIX, 1857).t

EUPHORBIA SETILOBA, *Engelm. mss.*: pratrata, pilis brevitms patulisiwepe glanduliferii tota puberula; fdb'is minutis e basi vix obliqua subcnnluta ovatis obtusU ; Rtipuli* rainuti* deciduiii ; glomerulis lateralibus ; involucris dono profunde fissin, appendiculi* in lacinias 3-4 Riibuiatan ilivini*; rtyiis elongatw fere ad bonin bi6dit, Mtigmatibus clave]latin divaricatis; carwula hispidula ; scininibus ovatis acuUtis transverse rugulosis. Near Fort Yuma. Stem 3 inches long. Leaves 1 line long, reddish. Apjwndages of the gland* white, very conspicuous, almost tetaceou*. There are only about three male flowers in each involucre. [964]

PROM CHAFMAN'I FLORA OF THE SOUTHERN UNITED STATE*.

EUPHORBIA CCRTIBII, *Engtlm* Pmontb ; ntcin» filiform ; brancbcn montly 3, erect, sparingly divided; leaves tbin, linear or linear-oblong, obtuse, nhort-prtioled, spreading or recurved ; involncret minute, scattered, on long capillary pedicel*; glamN green, margined by the white crtnato appendages ; cupitile erect, tbort-iUlked, fonnd-angled; seed globose, smooth. — Low pine barren*, Florida to North Carolina. Aug. — Plant 6 to 9 iod*» high, tometinie* branching from the bane. Leaven Hi inch<* lon«- — i Fini "1****, I***-] [401]

E. DBLTOiDKA, *Engtlm. ined.* Small, perennial; items (8-4 inchm long) diffune, glibiani; lami 01 line long or lew) petioled, obliquely deltoid, conlate, or renifonn, upriiikled with •bort bains the margins narrowly revolute;

• **rm) joint spaciei, th^ dwriptiom of which «n- by r;rny. are in<lic«U<d mprrly by *numu* — Ens.

t Tomy'a BoUny of Whippk'a ExpfdiUoo CUDU1M without dwriplaI'Mi Uw aaauMripi name *E. leptocera,* Engelm. Report, ...

tipules minute, entire, involucre single, terminal (always 1) turbinate, P ^ ^ J ^ ^ ^ ^" tSSEta ly
oblong glands without appendages ; styles very short; capsule (immature) acutely 3-angled, glabrous. - South Florida,
Ourtiu. — [Second edition, **1863.]**

FBOH PARRY'S BOTANICAL OBSERVATIONS IN SOUTHERN UTAH <AMEBICAN NATURALIST, VOL. IX. 1875)

KMnrauPirct..*. Annual,«*slender, pale-gree, ^^^^XS^T ding [350]
branches ; leaves linear, nearly equal at base, acutish or acute at * £^5 ? £ £ 3 f £ £ £ appen
kcre. campanulate, on moderately long peduncles in the ^ %^ £ %£ £^JL - 8t Geo^, in loose
dages; style short, somewhat erect; capsule sharp-angled, seeds^°J^ ml .. y b Ued inwardwhea drying; invo-
drifting sand. Plant about a span in height; leaves H mch ^ b^ ^^ ^^^ numerous, with ^ ^ ^
lucres M line long, and with the greenish-white appendages ^^ ^^ ^TM TM J J^ ^ nthet thic i, obtusely angled,
feathery bracts between them, styles about the ^ ^ J ^ ^ trVlilar *I E. revduta,* Engebn, but that
•^•^wtthirinutegiwiile^^ in . . ^.slender turbinate involucres
has a dark purplish^reen color, revolute not involute leaves^v«7^m - haracte ,, rf our species po nt [351]
on short peduncles, and smaller, sharp-angled, strongly cross-ribbed seeos. io»« r-
to an alliance with £ *sygophylloida,* Bows.

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i- J u i?n»«imiinn to a new Euphorbiaceous genus from California,
TETRACOCCUS, b a manuscript name applied by »**»£» J^ J^ g j . ^ Feb. 6,1885, pp.
•hoitiy before his death, and published nearly simultaneously by Parry l " « . _ E ^
13-14) and Watson (P m Amer. Academy of Arts and Sciences, voL xx. pp. 37SWJ73;. *».

0.38 mm. wide) and a little smaller (0.026-0.029 mm.) almost smooth microspores, and may be distinguished as var. *Parryi.*

The only other species of Isoëtes, thus far found in the western mountains and on the Pacific slope, are, —

boSTES PYGMJSA, *Engdm.—Veij* submerged, few (5-10), short (J to 1 inch), stout, rapidly tapering [215(26)] dark-green leaves, with very short, often even square epidermis cells, without stomata or bast-bundles ; circular sporocarp with a very narrow velum ; macrospores 0.36-O.50 mm. wide, marked with smaller and more regular, rarely confluent, rather sharp points ; microspores (0.024-0.027 mm. long) brown, very minutely papilloee or almost smooth. - In large patches in mud, covering gravel, deeply submerged in running water, on the Mono-trail, eastern declivity of the Sierra Nevada, 7,000 feet alt., *If. Bolander,* 1866. Closely allied to the last species, distinguished by ito stout, short leaves without stomata, and the markings of the larger macrospores, etc.; in many respects near 7. *lacuitrii.*

l80teE8.N0TTAi.Lii, *A. Broun* A» *litt.*-Terrestrial, trunkscarcely lobed; leaves (20-60,3-7inches long)3-angled, slender, firm, erect, light-green, with numerous stomata and 3 peripheral bast-bundles ; sporocarp mostly oblong, entirely covered by the vehun ; macrospores (0.35-0.52 mm. wide) densely covered with minute but prominent, rounded warts ; microspores (0.025-0.028 mm. long) papillose, deep brown. -.-On damp flats or springy declivities in Oregon; on the Columbia,V *Nuttall,* 1833 ; Camass Prairies of the Cœur d'Aleine*, *Chs. Geyer,* 1843 ; Wilkmette Valley, *E. HaU,* No. 693,1871. Thin but firm leaves, as most land Isoëtes have, with three strong bast-bundles corresponding to the 3 angles. Trunk rhombic in transverse section, only " " P f ? ^ ^ [1] ^ ^ a shallow groove into two lobes. Closely allied to */. nJanpoda* of the Mississippi Valley, which Mr. HaU lately discovered also in Terns, but resembling in the velum the two Florida species I. *Jtecdda* and *I. Ouymanu*

boteB ECHiKMPoaA, *Dur.,* var. BRAUKII, *Engelm.* - In the Uintah Mountains, at 9500 feet alt., *S. Wato**. The westernmost and the highest known locality of this species.

II. THE SPECIES OF ISOËTES OF THE INDIAN TERRITORY.

FBOM TM BOTANICAL OAZKTM, VOL. III. 1878.

Isoars, HELANOPODA, */. Gay,* originally found in Central and Northern Illinois, then in the neighboring [1] Wgion. of Iowa, seems to te pecuL to a lit of pniirie country extending from northeast to southwest, from Illinois to low.: the Indian Toxitory and Texas. Mr. E. Hall who *f* ^ * * * * ? * * TM " * *?* * ** some year, ago in Dallas county, Texas, and now Mr. O. D. Butler sends it from the Indian Territory. However the other character, may vary, the macropores everywhere readily characterize the plant They are the smallest of any of o«secies, b u T S n the samSporangium, between 0.25 and 0.35 nun., very rarely as much as 0.40 mm. ,n diametaTmarked wUh influent knobs and curved and twisted (worm-like), low, sometimes almort indistinct, elevation*, Ttoble, of cour^only under a strong magnifier. The velum or membranaceous fold, which more or less completely cover, t h ^ w case, or *is,* rarely, wanting, is in this species usually narrow, or sometimes wider ; in the southern form, it cover/aLt one-thW of the upper half of the spom»gium. Full-grown specimens are J-l inch in diameter at the almoTaTwaw black and shining base of the leaves; these, smaller and fewer in the northern forms, •» **ZTJSSZL*S^berand *llM* inches in length, and, a. I have de^bed diem in Gray's Manual, W*ngular, with 4 peripherical fibrous bundle, and with numerous stomata.

I8OI«8 BDTLIBI, «.»., I name an allied species discovered by Mr. Butler, near the latter, in drier soil a much •"•Her plant with earlier (Winning of June) maturity. It is at once recognized by its larger macrospores, 0.60-0.63 mm. 'm diameter, *S** \Z distinct knob, or warts, which rarely run together The b«e o f the pknt . onjr i inch thick, the .lender leave, with dull whitish bases, only 8-12 in number, are *W* or 7 inches long, of exactly the -unertroctuw a. t h J o f T u s t species. Velum very narrow or almort none. Microspore. aculeolate in both, in *•>• latter species a little larger than in the former.

' The specie, of IsoetoVVre usually, as is well known, moncecious, the extenor sporangia beanng female or mac-«*PO», the interior, later developing ones, male or microspore.. But *I. rndanopoda* is oftener dioecious than mon-•oiotta, Mr. Butler examined hundred, of specimens and found about one-third monoecious and two-third. dioxiou., •«d of these the male and female plants in about equal number* Of *!«**» Butleri* he never could find a monoecious Plant; all the specimens which he found as well as those which I examined, were dioxioiu, both sexes in about equal number*

III. THE GENUS ISOËTES IN NORTH AMERICA.*

FBOM THE TRANSACTIONS OF THE ST. LOUIS ACADEMY OF SCIENCE, VOL. IV. 1882.

§ 1. HISTORY OF ISOËTES IN NORTH AMERICA.

THE *Isöetes,* insignificant and apparently sterile as they are, were long overlooked or [358 (1)] ignored by our botanists, so that until thirty or forty years ago very few specimens were collected, and none were distinguished from /. *lacustris,* if we except Nuttall's guess at his Oregon discovery; but the genus has attracted so much attention, and lately so many forms have become known, that it seems to me an interesting task to trace up the history of the discovery of the different species and their varieties, and of the area of their distribution, and then the date of their publication, before I enter into their scientific description.[1]

* The revision of Eastern Isoëtes by Dr. Engelmann, in Gray's Manual, 5th ed., 1868, 675-677, has been omitted from this volume. The original description of /. *aaccharata,* which appeared iu it, is given as a foot-note at the proper place. — EDS.

[1] 1. DISCOVERY. —1806 (?). The first notice which we hnve of an *isoHts* in North America is given in Pursh's Flora, ii. 671, where he states that *"Isoetes lacustris"* grows in the bottom of Oswego River, near the falls, and adds his *v.* v., which means that he saw it living, and therefore probably found it himself; and as he travelled through the regions near the Great Lakes in 1806, it was probably in that year that he met with it I have not seen Pursh's specimens, but doubt not but that it will have to be referred to /. *cchinospora,* var. *Braunii,* the only form thus far known from Western New York.

1815. Th. Nuttall collected "/. *lacustris"* abundant along the inundated gravelly and miry shores of the Delaware at Gibsonville (now a part of Philadelphia) on Aug. 22, according to the label of a specimen in Collins** Herbarium, presented to me by E. Durand. It proves to be /. *riparia.*

1820 (?). Louis von Schweinitz obtained in the Catskill Mountains in New York /. *lacustris.* Some of his specimens are now found in the Herb. Philad. A cad. Natural Science, and one in the St. Petersburg Imperial Herb. Some of them are labelled "Catskill Mountains," and others " Bethlehem," tho latter, which was von Schweinitz's residence, probably by mistake. One of the specimens was loaned by the late Elias Durand—>in whose possession it was —to Durieu de Maisonueuve, who founded on it his I. MACRO- [359 (2)] SPORA. No date being indicated on the labels, the above-mentioned year is a mere guess.

1825 (?). Jens Vahl collected in Greenland a small *Isotics,* referred to /. *lacustris,* which proves to be one of the forma of /. *echinospora.*

1831. J. W. Kobbinn gathered an *IsoHes* near Uxbridge, Mass., which I recognize as /. *riparia.*

1832. C. J. Moser. who collect*! for the German *Unio Itineraria,* obtained specimens on the I/eliigh River, near Bethlehem, Pa., and near Philadelphia, both of which were distributed to the rotwcrilwra an /. *lacustris.* One of tbeae (in Herb. Bernhardi, now in the Herb. Missouri Bot. Gard«n) represents /. *Engelmanni;* another, which I have seen in Europe, it /. *ripnrin.*

1834. Th. MotUU discovered an *IsoBcs* on the Columbia River in Oregon, which I saw in E. Durand's Herb, with Nuttall's own label, /. *opaca ;* it was afterwards named I. NuTTALLH. About the same year Drummond collected "/. *lacustris* " on the Saskatchewan, according to Hooker's Fl. Bor.-Am. ii. 268, which I have not been able to compare and to identify.

1840. J. W. Bobbins found /. *lacustris* near Uxbridg*.

1842. Rugel discovered an *Isoetes* in Lake Imonia in Florida, which was soon afterwards distributed in Europe by Shuttleworth under the name of 1. FLACCID*. None of his specimens are believed to exist in America. In the same year N. Riehl and myself found near St. Louis, Mo., the species which from my specimens was by A. Braun named I. ENGELMANNI.

1843. Chas. Geyer found in Western Idaho /. *NuUallii,* according to A. Braun, who examined the specimens in the Kew Herbarium. In the same year E. Tuckerman collected /. *tacudris* in the Echo Lake in New Hamjwthire.

1844. Win. Zantzinger rediscovered the *Isoldes* on the banks of the Delaware, near Philadelphia, His sfiecimens, sent to me, are the type of my I. BIPAKIA.

1845. T. W. Robbins found in Massachusetts /. *echinospora,* var. *Braunii.*

1848. E. Tuckerman discovered near Boston the specief which was by A. Braun named for him, I. TI/CK-ERMAKI.

1850. A. W. Chapman found in Northern [860 (8)] Florida a peculiar *Isoetes,* which proved to be a large-spored form of /. *flaccida,* and was named var. CHAP-MAM.

1858. E. Hall discovered in his fields near Athens in Central Illinois the species which was afterwards named by J. Gay I. MELA NO POD A.

1856. I found /. *echinospora,* TOT. *Braunii,* in Uke Winnipiseogee in New Hampshire, the type of I. BRAUNII, Durien.

1857. D. C. Eaton obtained /. *Bvgelmanni* for the first time in the New England States.

1860. Win. Boott found near Boston the form of /. *ethinospora,* which was named from his R)ieeiniens I. MUll-CATA by Prof. Durieu, the present /. *echinospora,* var. *mu-^{m}ricnta.*

1862. Th. C. Porter discovered near Lancaster, Pi,, the largest American *Isnfte.% I. Rngtlmanni,* TIT. YALIDA* III the -wine year O. Vaney found /. *mef/tnopodn* in Iowa.

1863. J. Macoun obtained /. *echinospora,* nx. *BrmmH,*

§ 2. MORPHOLOGY OP ISOETES.

The species of *Isoetes* are the simplest vascular plants known. They consist of a short trunk[2] with root-fibres at itf base and leaves on its top, normally without branching and without any axillary productions.[8]

in West Canada. In the same year Wm. M. Canby discovered in Maryland I. SACCHARATA.

1865. Leidy and Porter collected /. *lacustris* near the outlet of Lake Supeiior. In the same year /. *Tuckcrmani* was rediscovered near Boston by Wm. Boott.

1866. Charles Wright discovered I. CITBANA in Eastern Cuba, In the same year H. Bolander found two new species in the Sierra Nevada of California, I. BOLANDKKI and I. PYGMAA.

1867. Wm. Boott got near Boston the species named after him I. BOOTTII, now known as /. *echinospora,* var. *Boottii.*

1869. Wm. M. Canby discovered on the Stone Mountain in Georgia the curious little I. MELANOSPORA. In the same year S. Watson found /. *echinospora,* **var.** *Braunii,* in Utah.

1871. £. Hall gathered beautiful specimens of /. *NuttUlii* on the Columbia River, and in 1872 traced /. *melanopoda* to Texas.

1873. T. P. James got /. *echinospora,* **var.** *Braunii,* in Nova Scotia, and C. C. Parry found /. *Bolanderi* in Yellowstone Lake, in Wyoming.

1875. G. D. Butler discovered in the Indian [861 (4)] Territory the species named for him I. BUTLEKI, and with it a new locality for /. *melanopoda.*

1878. C. G. Pringle found in Lake Cham plain the form of /. *echinospora,* which I have designated as var. ROBUSTA.

1879. M. E. Jones met with /. *Bolanderi* in Utah.

1880. A. Gattinger discovered near NashviUe, Tenn., /. *BxUleri,* var. IMMACULATA.

1881. I collected /. *lacustris,* var. PAUPRRCULA, in Grand Lake, Middje Park, Colorado; and C. G. Pringle found the •ame in Northern Culifornja.

2. PUBLICATION. — 1753. Linnieus published in his S|*cies Plantarum, ed. L, his *Iso&es lacustris,* the only spc-CWB known to him.

Neither Michaux nor any of the older writers on American plants knew of any North American *Iso&es.*

1816. Pursh, Fl. Am. Sept. iL 671, mentions "/. *lacus-.<rit,*[tf] from Oswego River, Western New York, which is most Probably /. *echinospora,* var. *Braunii,* the only species thus kr known from that region.

1818. Nuttall, Gen. iL 258, has "/. *lacustris* " from the miry shores of the Delaware, near Philadelphia, which cannot be any other than /. *riparia* ; he also gives Pursh[f]s habi-*•*• In the same year Barton, Fl. Philad. ii. 218, has "/. *teustris"* from Philadelphia, which may include both /. *ri-*«*» ana /. *Engclmanni.*

1824. Elliott knows no *Iso&cs.*

1826. Torrey, Comp. FL North. & Middle States, gives •a habitat of "615, /. *lacustris,"* bottoms of lakes, evidently without having himself seen it In the Flora Cestrica of the •Mte year Darlington does not mention the genus.

1827. Sprengel, Syst Plant, iv. 9, knows only /. *laau-*v with three varieties.

1888. Beck, in his Botany, repeats Pursh'a and NuttalTs localities.

1840. Hooker, Fl. Bor.-Am. ii. 268, mentions "/. *locus-** from the Saskatchewan. This may be the *na *lacuMrii* or a form of *echinospora,* either of [362 (5)] Which **may** be expected in those regions.

1843. Torrey, Flora of New York, ii. 514, "/. *lacustris,"* a mere repetition of Pursh's statement

1844. Bory investigates the genus, which until then had been very much neglected, and adds to the three then known **species (/. *lacustris, Coromandelina,* and *setacea)* three new** ones discovered in Algeria by Durieu de Maisonneuve.

1846. A. Braun, in Regensburg Bot. Zeitung, No. 12, briefly characterizes /. *riparia,* Engelm., from Philadelphia; /. *Engelrmnni,* A. Br., from Missouri, and /. *flaedda,* Shuttlew., from Florida.

1847. The Amer. Journ. Arts & Sciences, n. ser. iii. 52, publishes a translation of the above notice.

1848. A. Gray, in the first edition of the Manual Bot. North. States, p. 640, distinguishes the then known three **northern species, /. *lacustris, I. riparia,* and /. *Engelmannu***

1858. Darlington, Fl. Cest. ed. ii. p. 402, mentions "/. *lacustris* " as growing in shallow ponds in his district. This must refer to /. *Engclmanni,* the only species growing there in such localities.

1856. A. Gray, Manual, ed. ii., gives an almost verbal reprint of the first edition.

1860. Chapman, FL South. States, p. 602, describes /. *flaccid** as growing in " lakes and clear streams " in Middle and West Florida. In the same year £. Tatnall, Cat. PL Newcastle Co., Delaware, enumerates /. *riparia* and /. *Engelmanni,* both of which names here probably staud for the latter.

1801. Durieu de Maisonneuve, Prof, of Botany at Bordeaux, in Bull. Soc. Bot. France, viii. p. 164, distinguishes and characterizes the two North European species /. *lacustris* apd /. *echinospora,* heretofore thrown together.

1864. The same author, 1. c. 101, 102, indicates four American *Isoëtes: muricata* from Massachusetts, *Braunii* from New Hampshire, *macrospora* from the Catskill Mountains, and *melanopoda,* Gay (or Gay and Durieu), from Illinois. In the same year A. Braun published a most important treatise on the genus in his account of the *Iso&cs* of the Island of Sardinia, in which our species are frequently referred to.

1867. In the fifth edition of Gray's Manual, [363 (6)] p. 676, I for the first time published *I. echinospora* as an American species, differing in several varieties from the European type—var. *Braunii (I. Braunii,* Dur.), **var.** *muricata* **(*I. muricata,* Dur.), and var. *Boottii [I. Boottii,* A.** Braun in litt.), all of them from the Northeastern States ; also /. *Tuckermani,* A. Braun in litt., from Massachusetts, and /. *saccharata,* Engelm., from Maryland.

1874. In Dr. Parry's Botanical Observations in Western Wyoming, Am. Naturalist, viii. 214, 215,1 gave an account of the three western species : /. *Bolanderi,* Engelm. ; /. *pygmcea,* Engelm., and *I. NuUallii,* A. Br. in litt

1877. My notice of/, *melanospora,* Engelm., from Georgia was published in the Trans. Acad. Sci. St. Louis, iii. 395, note.

1878. In Coulter's Botan. Gazette for January, p. 1, I gave an account of /. *Butlcri,* Engelm., found in the Indian Territory west of Arkansas.

[1] A very complete account of the structure of the trunk is given by H. Mohl in Linmea, xiv. (1840)181, and of the whole plant and its morphology by A. Braun in the *lsoeVe** der Inse Sardinien, Monatsber. d. Berliner Acad. Wissensch. 1864.

• Abnormally the *Isoëtes* trunk has been seen divided,

The TRUNK is generally depressed, broader than high, or flatter in some species (/. *Engdmanni),* and thicker and more globose in others (/. *mclanopodd),* but its form is not constant; it is concave on the upper side and even somewhat funnel-shaped where the leaves are ingprted, while the under side shows in almost all the N. American species two grooves and in many exotic ones three grooves, dividing the trunk more or less deeply into two or into three lobes. The number of lobes rarely varies, so that among the many hundreds and even thousands of American specimens which have passed through my hands, I have found only a single, normally bilobed, one with three lobes; this was an /. *ripiria* from Philadelphia. In the 3-lobed species the transverse [364(7)] section is rather circular, but in the 2-lobed ones it is usually oblong or often somewhat rectangular, narrower in the direction of the grooves and wider in the opposite direction; the vertical section of the trunk shows a thickness of from 1 to 6 lines, and the transverse diameter a width of a few lines to more than one inch. Iu the centre of the trunk we find a small ligneous body, fibres from which enter the leaves and the roots. The mass of the trunk is a white parenchymatous or rather cortical tissue, the cells of which are filled with starch. The growth proceeds from the central ligneous body outwardly in two or three directions, corresponding to the two or three lobes, so that these lobes would spread laterally if their enlargement were not limited by the decay of the older (the preceding year's ?) parts. We thus find that at the period of the most vigorous growth, about the beginning of fructification, the extreme lateral portion of the lobes becomes discolored, brownish, atrophied, and at last black, and is separated from the living tissues by a distinct line of demarcation, and at last generally falls off at the end of this or the beginning of the next season as a black mould-like mass. In some species, e. g. /. *lacustris,* and in colder climates the atrophied cortical parts continue to cohere for several seasons, and in the Mediterranean /. *Hystrxx* they do not seem ever to be detached, so that the trunk of this species reaches a larger size than any other.

The decaying portions are pushed obliquely upwards when the base of the trunk grows faster than the upper part (often in /. *Engelmanni,* and much more so in the Australian /. *tripui),* or horizontally outward (the ordinary case), or downward when the upper or leaf-bearing part expands more than the lower, root-bearing part This last is the case in /. *llystrix,* where the dead parts are turned downwards.

As the growth of the trunk takes place from the centre outward, the roots, originating from the youngest parts, start from the groove itself; and fresh and living whitish ones are only found in or near this groove: as they get older they are pushed to the sides, and finally die, becoming brown and black. The moss of roots found on *Tsoëtes* specimens are mostly the entangled dead fibres, which, by the way, often conceal spores of the previous year, and therefore must be carefully examined when no fresh spores are attainable. The root-fibres, sometimes longer than the [366(8)] leaves, are always dichotomously, and often many times, branched.—The upper, concave surface of the trunk bears the leaves, the innermost or youngest ones often yet immersed in the trunk.

The LEAVES are subulate or sometimes almost filiform tubular organs from a broad raembranaceous sheathing base, mostly more or less quadrangular (broader and with sharper edges on the upper or ventral, narrower on the dorsal side), or in our terrestrial species more triangular and keeled on the back. Their sheathing bases form the *bulb,* which can be compared to the bulb of liliaceous plants; in fertile specimens it is always larger and thicker than the trunk, and in some of the larger ones, e. g. /. *Engelmanni* and /. *melanopoda,* attains a diameter of one or two inches. The leaves above this base contain four longitudinal air cavities, *lacunar,* se|>aroted from one another by two dissepiments, a transverse and a median one, and irregularly divided by very thin transverse **pta.* The dissepiments are of different, pretty constant thickness in the different species, **thinnest**

ID oooaeqaence of eome tígnry ; I ɹnrwlf hare mo P-cinun of /. *Tucktrmani* with four distinct tranche* of rn from a tftngU trunk. I. Ooehel found a proliferous I *Im*m* with lateral ahoote in place of ipomjMH, Bot Zeitong, 1S79, No. L

in the amphibious and thickest in the terrestrial species, consisting in the former often of only 2-4, in the latter of 6-9 layers of parenchymatous cells; the median dissepiment is generally a little thicker than the transverse one. The anterior *lacuna* are mostly somewhat larger than the posterior ones.

The epidermis of the leaf consists of rectangular cells, mostly much longer than they are wide; only in /. *pygmcea* are they comparatively 6hort, and sometimes even square. In a few species the epidermis is entirely destitute of stomata, in the others it is pierced by stomata which communicate with the air-ducts, over which alone they are found. The presence or absence of stomata furnishes a very important character for the diagnosis and classification of the species. It was formerly thought that the submerged species had no stomata, and those species which bear their leaves more or less exposed to the air were provided with them; later discoveries, however, have shown that this rule does not always hold good, for we now know submerged species with stomata and emerged ones without them, and we have one submerged species (/. *echinospora)* in which the typical European form is destitute of stomata, while the American varieties show either a few [366 (9)] stomata, often difficult to discover, or, rarely, numerous ones; so that in this interesting species the question arises whether the presence or absence of stomata *alone* can specifically separate forms otherwise scarcely distinguishable, as that acute observer of these plants, A. Braun, has maintained, or whether the stomata do *not* always play that important part in classification generally assigned to them. Below will be found directions for the investigation of the stomata.

The parenchyma of the leaf consists of a few or several layers of chlorophyll-bearing cells, (1) under the epidermis, (2) around the central bundle of vessels, and (3) forming the dissepiments, which cross each other in the centre of the leaf.

An important element in the leaf structure is found in the peripheral bast-bundles, which are present in some and absent in other species; and their presence often, but not always, coincides with the presence of stomata. When present they commonly form four bundles, two in the two anterior angles of the leaf, and two where the median dissepiments connect with the anterior and the posterior wall of the leaf; in /. *Nuttallii* I find only three bundles, the anterior median one being wanting; in /. *Cubana* six bundles are visible, the two additional ones being located where the transverse dissepiment unites with the outer wall. In some rigid-leaved land species, e. g. /. *melanopoda,* often several smaller accessory bundles are found scattered under the epidermis.

The examination of the fresh *Isoètes* leaf is not very difficult; particles of the epidermis are easily removed, and show the stomata, when present, very distinctly. Where there are few stomata, the epidermis from different parts of the leaf must be examined, and especially from the tip, as they are more apt to be found there. In dried specimens the leaf must be soaked, the *alga* which often adhere to the surface have to be carefully scraped off, after which I make several sections \ or J line wide, lay them open by a vertical slit, detach the central bundle, and then scrape very gently the inner surface so as to remove the parenchymatous cells which obscure the appearance of the stomata. This process can be aided by an immersion of the specimen in a weak solution of caustic potash. The work is often a difficult one when the specimen is very old or poorly preserved, and requires a good deal of patience. Sometimes the application of iodine will [367 (10)] very distinctly show the stomata by coloring their guard-cells blue when only these contain amylon, but of course not when the other cells are also filled with that substance A magnifying power of 150 to 250 diameters is best adapted to weU exhibit the stomata.

To find the bast-cells it is necessary to make the thinnest possible transverse sections of the leaf, boil them well, and, if they do not then show under water as bundles of minute, thick-walled darkish cells dose to the epidermis, very distinct from the much larger epidermis cells, the application of a solution of caustic potash, to clear the preparation, will readily bring them out The ••me magnifying power which we use for the examination of the stomata may be applied for the •tody of the bast-bundles.

I would advise any one who desires to study the structure of *Isoëtes* leaves to commence with well known species and good (if possible, fresh) specimens, and make himself familiar with the manipulation and with the appearance of their parts under the microscope before he proceeds to study unknown and difficult specimens.

The arrangement of the leaves in the species with two-lobed trunks is at first distichous, and in /. *melanospora* it remains so through life; in all the others the leaves soon enter into a more complicated phyllotactic order; in the larger ones, with many leaves the \\ and even the §\ order is found.

The number of leaves varies from 5 or 10 (/. *pygmcea, I. melanospora)* to 100 or even 200 (/. *Engelmanni,* var. *valida),* and their length from £-1 inch (in /. *pygmcea)* to 1 or 2 feet (in some forms of /. *Jlaccida* and /. *Engelmanni)*; their color from light and fresh yellowish-green (/. *Engelmanni)* to dark and dull green (/. *lacustris)*; their rigidity is greatest in the terrestrial species, and also in some submerged ones; and least in most amphibious species, which often float their leaves on the surface of the receding water, or in some submerged ones, the leaves of which, taken out of the water, collapse like the soft hair of a wet pencil. The submerged species vegetate and retain their verdure throughout the winter (whence, it is said, the name of the genus is derived: *Isoëtes,* equal at all seasons), but the others lose their leaves soon after their maturity in [368 (11)] autumn, some of our terrestrial ones even already in summer.

The broad membranaceous sheathing base of the leaf is without air cavities, stomata, or bast-bundles ; in sterile leaves it gradually contracts into the leaf itself. Those leaves are usually sterile which develop at the beginning and the end of the season. The fertile leaves have in their base an excavation which bears the spore-case, *sporangium,* adnate with its back to the midrib. Above this excavation, and separated from it by a deep transverse depression or slit, we find a stipule-like organ of triangular more or less elongated shape, cordate at base, appressed to the leaf, which is termed the *ligula ;* it is small, and in not very fresh leaves often mutilated and difficult to make out. The morphology of these parts is obscure, and their diagnostic value not great

The sporangium is oblong or circular (both forms often seen in the same species), from \ to 1 line long in /. *melanopoda;* 1 to 2 lines in /. *pygmcca, Tuckermani, echinospora,* and *saecharata;* 1J to *2*\ lines in /. *lacustris, Bolanderi,* and *Jlaccida;* often a little larger in /. *BiUleri* and *NxUtallii ;* 2 to 4 lines in /. *riparia, Engclmanni, melanopoda,* and *Cabana;* and in larger forms of /. *Engelmanni* I have seen it 8 to 9 lines long. It is somewhat flattened, and often slightly concave on the ventral side; it is entirely naked, or (the usual case) it is on its sides and principally upwards partially covered by a fold of the ventral side of the leaf-base, the veil *{velum)*; in a few species (/. *Jlaccida, melanopoda,* and *Nuttallii)* this fold extends over the whole sporangium, completely covering it *{velum completum).* The sac of the sporangium is composed of two layers of cells; the outer, epidermidal layer consists of elongated, often variously bent or hooked and curiously interlaced cells, mostly thin-walled and transparent; in some species (e. g. /. *riparia, I. saccharata, I. melanopoda)* groups of brown, thick-walled, (so-called) sclerenchym-cells are mixed with the transparent ones, giving the spore-case a dotted appearance visible even to the naked eye. The spore-case is traversed by numerous parallel strings.

Some sporangia, called *macrosporangia,* contain larger or female spores *{macrospores* or *gynospores);* others are tilled with the minute or male spores *(microspores* or *androspores)*; these are called *microtporangia.* Almost all the species are monoecious, bearing macrosporangia [369 (12)] on the base of the outer, and microsporangia on that of the inner leaves. I am not aware that any exotic species behave differently, but here we have two species which deviate from this norm. /. *melanopoda* in Illinois as well as in the Indian Territory, from both of which localities I have examined several hundreds of specimens, is polygamous, i.e. monoecious as well as dioecious, and shows about an equal number of male, female, and monoecious plaute. The allied /. *BuiUri*

is apparently always dioecious, no monoecious plants having been discovered among about one hundred examined. In /. *melanopoda* I have sometimes seen leaves with microsporangia irregularly interspersed among those that bear macrosporangia.

The macrospores are little spheroid bodies between one-fourth and three-fourths of a millimetre in diameter. Their surface is divided by a circular rim into a lower hemispherical and an upper three-sided pyramidal part, the three faces of which consist of spherical triangles and are separated from one another by three elevated ridges. The crusty surface of these spores, chalky-white or •whitish in most species and dusky (when wet black) in /. *melanospora,* is rarely smooth, but generally sculptured and differently marked. The three upper triangles are sometimes marked differently from the lower hemisphere (especially in /. *Tuekermani)* or are smoother than that (often in /. *melanopoda).* To examine the spores well it is necessary to soak the leaf-base, carefully remove some of the wet spores and let them dry on the slide, for they must be examined dry, and best under.a power of 50 or 60 diameters; but, to study the sculpture well, a power of 100 to 150 diameters is necessary. With the aid of this we find the macrospores — 1. Minutely tuberculated or warty; the warts small and mostly somewhat depressed, distinct or sometimes somewhat confluent, **in /• *pygmcea, Bolanderi, saecharata, melanospora, BviUri,* and *NuttaUii***

2. With larger, broader tubercles, generally more distant and .distinct, but also here and there confluent, worm-like; thus in *I.flacdda, melanopoda,* and *Cubana.*

3. With tubercles elongated into spines; these are simple and very fragile, or here and there confluent and forming sometimes short crests: /. *echinospora* and its forms.

4. With crests and ridges, distinct or anastomosing: /. *Uicwstris, Tuekermani,* and [370 (13)] ***riparia.***

5. The confluent crests form a regular network: *I. Engdmanni.*

The Inicrospores are minute bodies of an ash-gray or a dusky color (dark gray in *I.pygvuea, Bolanderi,* **and** *mdanopoda,* **deep brown in /.** *melanospora, Butleri,* **and** *Nuttallii)* **and of a somewhat** triangular-oblong shape, nearly straight on one and curved on the other two edges, more than half as wide as they are lon«, between 0.020 and 0.040 mUliinetres in the longest diameter. Their surface is smooth or minutely papillose or spinulose, the edges smooth or somewhat cristate. Their. «ke furnishes good characters, but the condition of the surface much less so. They ought to be examined under water and with a power of about 400 diameters.

% 3. BIOLOOIOAL CHABACTBBS.

After the maturity of the spores the leaves wither or rot away, the sporangia decay and set the spores free, which scatter near the base of the plant, often being retained between the matted roots.* The cellular mass of the macrospores develops into a *prothallus,* which bursts the spore-case through the opening of three valves which correspond to the three upper faces of the spore, and forms an archegonium, which is fertilized on coming in contact with the zoospores emitted from the micro-•Pores, and thus gives rise to the young plantlet whenever moisture and temperature favor thig process.

The gemination of the late-maturing water-species probably takes place in the succeeding "Pring, at least in the more northern localities; in our land and marsh species it may be observed won after their maturity in summer or in early autumn.

I have studied the whole process in /. *Engdmannx,* which I kept in cultivation for several **yean.** At the end of July the spores were perfectly mature and the leaves were coming off. On the 28th of that month I spread out both kinds of spores on a muddy surface, and kept them slightly

• It i. therefor, proper to examine among the roof for n«« wbenerer none can be found on the plant; one or the <*»» **may** be dtooTend then, **and** help out the diagnoeto, which otherwise **may** rat in otacunty.

covered with water, and fully exposed to the hot sunshine of that season. Three weeks [371 (14)] later the first green points were seen, and continued to come up until the end of October, while at that time the earlier ones had already developed 5 to 8 leaves, £ to 1J inches in length. The contents of the large or female spore-cell first developed into a dense cellular mass; this, enlarging, split the cell-coats as above described, and protruded obliquely upwards a minute conical point, green inside, while on the lower edge of the opening, but still between the three valves (the lower hemisphere of the spore-case not being ruptured or perforated at all), a much smaller and rounded knob, the origin of the first rootlet, showed itself, bearing a large number of extremely fine capillary fibres; the bulk of the prothallus remained enclosed in the hemispherical part of the spore-case as a lateral knob, while the first leaf and then the first rootlet elongated; the spore-case was thrown off only when the former had acquired a length of 3 to 4 and the latter one of 2 to 3 lines, the capillary fibres still continuing at the origin of the rootlet Soon afterwards a second leaf and a second rootlet were formed, both opposite to the laterally protruding spore-mass; after that new leaves and new roots spring up in distichous order between the older ones, the youngest in the centra In twelve months the young plant, not yet fertile, shows the bilobed flat or rather concave trunk, 2 to 4 lines in diameter, with both ends strongly elevated, their edges already showing small masses of black decayed tissue (the remnants of the first year's growth): The leaves of these yearling plants, 10 to 15 in number, are 3 to 4 inches long, have abundant stomata, but as yet only a single very slender bast-bundle, median on the upper surface.

The species of *Isoëtes,* perhaps 40 to 60 in number (according to the views taken of the different forms, whether species or varieties), are distributed over the whole globe, apparently more abundant in the temperate than in the tropical zones. In North America we have 13 species, with 12 varieties, to which I add one from Cuba; from Mexico we have received as yet none. More are expected to be found when the attention of collectors is more earnestly directed to them.

Most of the species may be called water-plants, growing in stagnant or in slow-running water; a few are always submerged and are found out of water only in abnormal conditions, e. g. in unusually dry seasons. The majority are of amphibious growth, entirely or par- [372 (15)} tially submerged during the wet seasons, in winter and especially in early spring; but at the growing season they partially get out of the water, leaving only their trunk and lower part of the leaves immersed. These species do not come to perfection when completely immersed, though they may not be entirely infertile; it seems that partial exposure to the atmosphere is necessary to their well-being. A variety of the amphibious species are the tidal ones, which are alternately emerged and submerged during the changes of the tides; they are found in the estuaries of some of our Atlantic rivers. Then we have a few species which we are justified in ealling terrestrial, as we find them, when fully developed, on dry land; but it seems that for their germination and their growth in early spring they also require moisture and water; we therefore find them on low or flat grounds which may be overflowed in spring, or in springy localities, but they fully develop and become fertile only when out of water. /. *mdanopoda,* which belongs to this class, normally matures in June or early in July, and its leaves wither before the end of that month; by keeping it immersed, however, I have kept it fresh and growing throughout the summer, but under these conditions it remained perfectly sterile. Those terrestrial species which grow on arid hills around the Mediterranean must require even less moisture, and are probably satisfied with temporary drenchings.

The submerged and the amphibious species are generally found, some in soft mud, others between gravel and stones; the amphibious ones generally in deep mud. Our terrestrial species grow mostly in heavy, retentive soil

§ 4. SYSTEMATIC ARRANGEMENT.

Oar 14 species can be classed, —

1. According to the development of the trunk: thus we have 13 species, all our North American ones with a *bilobed,* and only the single Cuban one with a *trilobed trunk.*

2. According to their mode of growth: —

a. *Submerged species,* which normally always grow under water: /. *laeustris, I. pygmaa, I. Tuchermani, I. echinospora,* and /. *Bolanderi.*

b. Amphibious species, which grow in water but have their leaves usually emerged: [373 (16)] /. *saecharata, I. riparia, I. Jtaecida, I. Engelmanni, I. melanospora,* and probably /. *Cubana.*

e. Terrestrial species, which grow during the greater part of their life on dry (or moist) land: *I. melanopoda, I. Butleri,* and /. *NuttaUii.*

These divisions seemed to be the most natural ones so long as but few species were known, and when other characters, such as the presence or absence of stomata, seemed to correspond with and to confirm them; but since we know more species and more about them, we have learned that structural and biological characters do not always go together; and, moreover, that some species are in some forms submerged and in others almost amphibious (/. *echirwspora),* and that some amphibious ones become sometimes almost terrestrial (/. *Engelmanni).* A less important objection is that the biological characters cannot be made out in herbarium specimens.

8. According to the condition of the velum: —

a. A partial or narrow velum in /. *laeustris, I. pygmaa, I. Tnckermani, I. echinospora, I. saecharata, I. Bolanderi, I. riparia, I. Engelmanni, I. HoweUii, I. melanopoda,* and /. *Cubana.* In /. *Butleri* the velum is almost completely absent.

b. A complete velum in /. *melanopoda, I.flaecida,* and /. *NuttaUii*

The anatomical structure of the leaves, viz. the presence or absence of stomata and of peripheral bast-bundles, furnishes us valuable characters, and, though somewhat difficult to ascertain and therefore less practical, may after all have to be placed in the first line, as it seems to correspond best with the essential characters of the plant

4 According to the presence or absence of stomata on the leaves :—

a. Without any stomata are only /. *laeustris, I. pygmaa,* and /. *Tuckermani* The typical European /. *echinospora* also belongs here, but the different American forms of this species must be classed among the next though some of them have only very few stomata, often difficult to make out

h. With stomata (generally abundant): /. *echirwspora* (American varieties), /. *saecharata, I. Bohnderi, I. riparia, I. melanospora, I. Engelmanni, I. Howellii, I. Jlacdda, I. melanopoda, I. Butleri, I NuttaUii,* and *I. Cubana.*

5. According to the presence or absence of peripheral bast-bundles: — [374 (17)]

a. Without bast-bundles: /. *laeustris, I. pygmaa, I. Tuckermani, 1. echinospora, I. tucharata, I Bolanderi, 1. riparia,* and /. *nulanospora.*

b. With bast-bundles: /. *Engelmanni, I. Howellii, I.Jlaccida, I. mdanopoda, I. Butleri, I. NuttoUU,* and /. *Cubana.*

The comparative size or the sculpture of the spores, and the number and length of the leaves, famish no legitimate grounds for classification; still it may be mentioned here, that the largest macrospores (0.45 to 0.80 mm. in diam.) are found in /. *laeustris, I. Butleri,* and 7. *riparia;* the smallest (0.25 to 0.45 mm.) in /. *nulanopoda, I.ftaccida,* and /. *Engelmanni,* var. *valida.*

The largest number of leaves, 50 to 200, are observed in the last-mentioned form, in *I. melanoPoda,* and in /. *NuttaUii;* the smallest number, 5 to 20, in /. *pygmaa, I. nulanospora, I. saecharata,* «nd *I. Bolanderi.*

The longest leaves (15 to 25 inches long) we meet with in /. *Engelmanni, L jlaccida,* and /. *Cabana;* the shortest (£ to 3 inches long) in /. *pygmcea, I. melanospora,* and /. *saccharata.*

The following classification of our species is proposed as the best I can find, though by no means a faultless one: —

I. TRUNK BILOBED. — A. Submerged species with quadrangular leaves, without, or in 4 and 5 with few or many, stomata and without peripheral bast-bundles; velum incomplete. 1. /. *lacustris.* 2. /. *pygnuea.* 3. /. *Tuckcrmani.* 4. *L cchinospora.* 5. /. *Bolanderi.* — B. Amphibious species with abundant stomata in the quadrangular leaves. • Without peripheral bast-bundles (these are intermediate between the submerged and the truly amphibious species.) t Velum partial. 6. /. *mccharata.* 7. /. *riparia.* t t Velum complete. 8. /. *melanospora.* * * With peripheral bast-bundles. 1 Velum partial. 9. /. *Engelmanni.* 10. /. *ffowellii.* f t Velum complete. 11. *I. Jlaccida.* — C. Terrestrial species, maturing when entirely out of water, with abundant stomata and peripheral bast-bundles in the nearly triangular leaves. • Velum partial or almost wanting. 12. /. *mclanopoda.* 13. /. *Butleri.* « • Velum complete. 14. *I. NuUallii.* [375 (18)]

II. TBUNK TRILOBED, numerous stomata and bast-bundles in the quadrangular leaves; velum partial. 15. /. *Cubans*

§5. GEOGRAPHICAL DISTRIBUTION.

Only a small part of the North American continent has been well explored for Isoëtes, and there, from Massachusetts to the Chesapeake Bay, they appear abundant enough; farther south; and in the whole interior and western part of the continent, they have thus far been found only in a few localities. Some species are quite local, as is the case also with many species of the old world, while others are widely distributed. Our two northern species are identical with, or closely allied to, European forms; all the others are quite distinct from such, so that there is scarcely more than a generic analogy between the species of our middle and southern regions with the Mediterranean ones or those of other regions of the globe.

The old Iinnaean *Isoëtes lacustris* is the only species which has been found to extend from the Atlantic to the Pacific States, and it probably occupies a northern belt of the northern hemisphere, though it seems not to have been discovered as yet in Asia. The American forms allied to /. *cchinospora,* tbe other North European species, are the most common in the belt of northern States as far west as Michigan, and have been detected also on the western slope of the Rocky Mouutains. Of the others, /. *Engelmanni* extends from Massachusetts to Georgia, and westward to Missouri, though thus far not found anywhere else west of the Alleghany Mountains. /. *Jlaccida* is peculiar to Florida, and /. *Bolandcri* to the lakes of the western mountain chains, the Rocky Mountains as well as the Sierra Nevada. /. *melanopoda* occupies parts of the Mississippi Valley from Central Illinois to Northeastern Texas, while /. *NuUallii* is the only species found in the valley of the Columbia River. All the other species seem to be nearly or quite local;—/. *pygmcca,* in the Californian Sierra, but most of them on the Atlantic border. Thus /. *Tuckcrmani* occurs only near Boston, /. *saccharata* on streams emptying into the Chesapeake Bay, and /. *melanospora* only on that peculiar and botanically so interesting rock, the Stone Mountain of Georgia. Some species which seemed local have lately assumed a little wider range, though yet quite restricted. Among these I mention /. *riparia* of the banks of the lower DeUware River, which occurs also farther north, and *I Butleri,* first known only from the Indian Territory, now also found in Tennessee There can be no doubt but that some of the apparently local species will yet be found in a more extended area, when botanists will include in their researches these obscure and inconspicuous planta.

From the warmer parts of North America we know only /. *Cubana,* from Cuba; none have yet toned up from Mexico.

The Mowing table will explain itaelf: —

	Total species and varieties.	I. lacustris.	paupercula.	I. pygmæa.	I. Tuckermani.	I. echin. Braunii.	robusta.	Bootii.	saccharata.	I. Bolanderi.	I. saccharata.	I. riparia.	I. melanospora.	I. Engelmanni.	gracilis.	validia.	Georgiana.	I. Howellii.	I. flaccida.	I. melanopoda.	pallida.	I. Butleri.	immaculata.	I. Nuttallii.	I. Cubana.
Greenland	1	....	.....	..	....	1	..	..	...	.	...	....	.....	...	...	.....	...	.....	....		....	..	.. ..	...	.. ..
Nova Scotia	1	....	.....	..	...	1	.	.	..	.	....	.	....	.	.	....		.....	.....	....	.. ..	...	.....	....	....
Maine	2	..	....	.....	.. .	1	....	....	..	..	...	1	....	....	....	....	.	.....	.....	....	.. ..	...	...	....	....
New Hampshire	2	1	....	.....	....	1	.. ..	.....	.. .	... .	.. .	.	....	....	1	....	...	.....	.....	....	..	..	. .	.	.
Vermont	4	.	....	....	.	1	1	.	...	...	....	1	.....	.	1	....	.	.....	.....	....	.. ..	..	..	.	.
MaasaohiiHetU	8	1	....	....	1	1	.....	1	1	....	....	1	. ..	1	1	....	.....	.....	.....	.....	.....	....	.	.	.
Rhode Island	2	....	.....	....	....	...	....	.....	.		...	..	....	1	1	. .	.	.....	...	. .	.....	.	. .		.
Connecticut	1	.. .	.....	....	....	....	.....	.....	....	....	...	.....	....	1	.. .	. ..	...	.....	.....	..	.....	..	...	..	..
New York	8	1	.....	.....	....	1	.....	.....	..	.	.....	..	.. .	1	....	...	....	.....	...	.....	.....	.. ..	.	. .	. .
Ontario	2		..	....	....	1	.....	....	.	.	.	1	..	...	...	...	.	....	....	.....	. .	.. ..	..	..	. .
Michigan	2	1	.....	....	....	1	.....	.....	.	..	...		....	.	....	.	. ..	.....	.....	. ..	.....	. .	. .	. .	.
Pennsylvania	4	.	.....	.. .	.	1	.....	..		.		1	...	1		1		...	.....	. ..	.. ..	.. ..	. .	..	..
New Jersey	4	..	. ..	.....	...	1	.....	.....	..	....	...	1	...	1	1	.	.	.....	.....	....	.....	...	. .	.	. .
Delaware	8	..	.....	....		.. ..	.....	...	.	...		1	...	1	.	1	.	.....	.....	....	.....	.....	.....	.....	. .
Maryland	1	..	..	..	.	.	. ..	.. .		.	1		. .		.	.	..	....	.....	...	.....	.....	....	.	. .
Virginia	1	..	..	...	.	.	.	.....	..	..	.	.	.	1		.	1	....	.. ..	..	.....	.....	.. .	.....	.....
Georgia	2		. .	.. .	...	. .	.....	...	.	.	..	..	1	.	..	...	.	....	. ..	1	.....	..	..	. .	.
Florida	1		.....	.....	...	.....	.....	.....	..	...	...	...	.....	...	..		...	....	. ..	.....	.....	.....	1	.....	....
Tennessee	1		...	.. .	.		.....	.....			..	...	. .	..		...	..	....	.....	1	.....	. .	.	...	. .
Illinois	1	.	. ..	...	.		. .	...	..	.	.	.	..	..	....	.	....	...	.....	1	.....	.....	.....	.....	.
Iowa	1	..	...	.. .	.	.	.	.	.	...	.	.	..	..	...	.....	...	.	...	.	...	. .	.	.	.....
Missouri	1	.	.. ..	..	.	..	..	..	..			.	.....	1	...	.....	.....	...	..	1	.	1	.....	..	....
Indian Territory	2	..	....	.. .		.	...	. .		..			....	...	....	.....	.....	...	..	....	1	....	.. ..	.	..
Texas	1	. .	.	...			.	.. ..	.			.	...	.	...	..	...	.	..	....	..	.. ..	. .	.	. .
Colorado	1	....	1	....	.		.	....	.		...	....	. .	.	.	.	....	..	. .	..	...	...	....	....	....
Utah	2	.	.. ..	.		1	.	.		1	...	..	...	...	..	.....	....	....	...	...	...	....	..		..
Wyoming	1	..	....	....	.	.	.....	....	. .	1	...	..	....	...	.. .	....	..	....	...	...	...	....	. ..	1	....
Idaho	1	.	...	.. .				.	..		..	..	.. .		...	...	....	.....	.....	....	...	. .	.....	1	. .
Washington Territory	2	....	.. ..	...	..		....	. .	...	1	....	....	.....	.. .	...	.	..	1	...	...	.....	...	...	1	..
Oregon	2	.	.	.	.	.	.. ..	. .			..		...	..	...	.....	..	.....	.....	....	.....	....	.. ..		.
California	3	..	1	1	..	. .	. .	..	. .	1	..	. .	..	..	.	.....	..	.....	.....	.....	.....	.....	.....	....	1
Cuba	1	.	. .	...	.	.	.	.	....	....	. .	. .	...	..	.	.....	..								

8 species and varieties have been found in Massachusetts.
4 . . . . . " Pennsylvania and New Jersey.
5 . . . . . New York and California.
9 . . . . . 10 States, Territories, or Provinces.
15 . . . . . 15 States, Territories, or Provinces.

[377 (20)]

§ 6. ENUMERATION OP THE SPECIES.

1. TRUNK BILOBED.

A. Submerged, normally growing under water, only in unusually dry seasons coming above the surface; leaves quadrangular, without peripheral bast-bundle*; velum incomplete,

• Without stomata.

1. I. LACUSTRIS, *Linn.* Leaves stout, rather rigid, obtusely quadrangular, acute but scarcely tapering, dark or olive-green, 10 to 25 in number, 2 to 6 inches long; sporangium oblong to broadly elliptical, not spotted, with a rather narrow velum; ligula triangular, short or somewhat elongated; macrospores 0.50 to 0.80 mm.[1] in diameter, marked all over with distinct or somewhat confluent crests; microspores smooth, 0.035 to 0.046 mm. in the longer diameter. — Syst. Veg. I. 1753; Durieu, Bull. Soc. Bot. France, 8, p. 164, 1861; Gray, Man. ed. 5, p. 675.

Var. PAUPERCULA with fewer (10 to 18), thinner, shorter (2 to 3 inches) leaves and smaller spores (macrospores 0.50 to 0.66 mm. diam.; microspores somewhat granulated, 0.026 to 0.036 mm. long).

A northern species of Europe and America, generally gregarious on gravelly soil in the bottom of lakes under 1 to 4 or 5 feet of water, farther south only on mountains; maturing in September and October. Catskill Mountains, N. Y., *Schweinitz;* Echo Lake, Franconia Mountains, N. H., *Tuckerman, Engelmann;* in Massachusetts, in Fresh Pond, near Cambridge, *W. Boott*, and Uxbridge, *J. W. Robbins;* Brattleborough, Vt., *C. C. Frost;* Sault de Ste. Marie on Lake Superior, *Porter and Leidy.* The variety in Grand Lake, Middle Park, Colorado, over 8,000 feet alt., *Engelmann*, and in Castle Lake, near Mt. Shasta, California, 7,000 feet alt., *C. G. Pringle.* 3 the original Linnæan species, formerly confounded with others, and first clearly established by Durieu, l. c. ays readily recognized by its rigid, rather thick lually tapering dark green leaves, wh lla aken out of the water, and by the size and scul the spores. The variety *paupercula* vestern mountain specimens, and is characterized by the .niller proportiln. of .11 parU, and especially of the (for the specie.) unusually .mill micro-

[1] I adopt, for the smaller measurements, the metrical system, which will gradually but surely supersede the old and clumsy method; while, in the larger measurements, as the length of leaves, I still adhere to the foot and inch as the one yet best understood. Th. mUlimetr. U, as U well known, equal to very nearly half

spores. Durieu, 1. c. 11, p. 101, distinguished a form with exceptionally large macrospores (0.70 to 0.80 mm. diam.) as /. *macrospora* from a single specimen from the Herb. Acad. N. S. PL Had., with the label " Cats kill Mountains" in the handwriting of Schweinitz ; but others show sometimes spores of similar dimensions, e. g. specimens from Lake Superior; and such have also been found in Europe, though there the spores rarely reach a size of over 0.65 to 0.70 mm.

2. I. PIGMiKA, *Engdm.* One of the smallest species, with a few (5 to 10) short (} to 1 inch long), stout, rigid, bright green leaves, abruptly tapering to a fine point, with very short, often almost square, [378 (21)] epidermis cells ; orbicular sporangium not spotted, with a narrow velum; macrospores 0.36 to 0.50 mm. thick, marked with minute, rather regular, distinct or rarely confluent warts; microspores 0.024 to 0.029 mm. long, almost smooth and brown. — Am. Naturalist, 8, 214.

Found only once, deeply immersed in a cold alpine stream on the eastern slope of the Mono Pass, California, 7,000 feet alt., *H. Bolaiider.*— This curious diminutive species is a close ally to the last by the structure of the leaves and the mode of living, but is widely separated from it by the sculpture of the spores; the shortness of the epidermis cells is quite peculiar to it, and so are the close transverse partitions ; the walls of the leaf and the dissepiments are thinner than in the last, consisting of only a few layers of cells. The minute tubercles of the macrospores are most distinct on the lower surface, but become sometimes confluent on the upper side.

3. I. TUCKERMANI, *A. Braun in litt.* A small plant with very slender, tapering olive-green leaves (10 to 30 in number, mostly 2 to 3 inches long), the outer recurved, walls and partitions rather thick for the diameter of the leaf; sporangium mostly oblong, white or rarely brown-spotted, the upper third covered by the velum; macrospores 0.44 to 0.56 mm. diam., the upper segments marked with prominent, somewhat parallel and branching ridges, the lower half reticulated ; microspores smooth or nearly so, 0.026 to 0.032 mm. long. — Engelm. in Gray, Man. 1. c. 676.

In several ponds and streams near Boston, maturing from August to October; first discovered by *E. Tuckerman,* 1848, in the Mystic River very near where it issues from the pond; in the same locality and in Mystic, Spy, and Horn Ponds, *W, Bootty* "always immersed in fresh water, sometimes only a few inches below the surface, often in places which are subject to a tide of almost two feet in height, generally gregarious and carpeting the bottom with an olive-green turf." The leaves are usually not longer than two or three inches and, at least the outer ones, recurved; occasionally, in slender specimens, probably from deep water, I have seen them straighter and over 5 inches long. The sculpture of the spores is very characteristic; wavy, somewhat branching ridges run from the three upper commissures in right angles; on the lower surface they interlace, covering it with an irregular network. Some specimens collected by Mr. Boott at the end of October seem to indicate a second growth, as within the circle of niicrospore-bearing leaves, and after the outer ones with their macrosporangia had fallen, an inner growth bearing macrosporangia was noticed. One of his specimens is of particular morphological interest, as it shows four heads or leaf-buds from the same healthy and vigorous trunk, three close together on top and a fourth on the side, separated from the others by a deep incision in the trunk. This division of the axis did not result from any proliferation of the leaves, but most probably from a lesion of the centre of vegetation, and is of very rare occurrence in this genus,' where the simplicity of the axis is so particularly marked (see above, p. 358).

4. I. IOHINOSPORA, *Durieu.* One of the smaller species, with 10 to 30 or 40 soft bright green or [379(22)] sometimes reddish leaves, gradually and regularly tapering from a thick base to a very slender elongated point absolutely without stomata, 2 to 4 or sometimes 5 inches long; sporangia orbicular to broadly oval, unspotted, with a narrow velum; macrospores 0.40 to 0 50 mm. thick, densely covered with delicate, erect, truncate, or slightly forked spinules; microflpores 0.030 to 0.034 mm. long, almost smooth. — Bull. Soc. Bot Fr. 8, 164.

Only in Europe from Northern Italy to Germany, France, and England, extending to Lapland and Iceland, but apparently not in America.

In this country we have a series of form* which have been distinguished by eminent authority, especially on account of the presence of stomata (so various in number and often so difficult to discover) and of a slight difference in the form and size of the microscopic spinules which cover the macrospores. I have thought best to unite them specifically with the European type, though it seems strange that in the European plant stomata should be absolutely absent, and it must remain subject to individual judgment, if not doubt, which view ought to be preferred. Nearest to the European true /. *echinotpora* stand* the var. *Braunii,* and the other extreme is var. *mnricata,* — wide-ranging forms of a single type. The name difficulties, the same doubt*, and the same solution we find in studying some foreign forms, and especially those allied to /. *vdata* of the south of Europe.

• • Stomata few.

I. •CHIHOBPOEA, w . BRAUKII, *Engelm.* Rather small, with 13 to 1ft green or reddish-green, erect or spreading, mher short (3 to 6 inches long), tapering, soft leaves, generally with few stomata towards the Up only; tporan-Ja orbicular to broadly elliptical, spotted, generally } or even j covered by a broad velum ; macrapom 0.40 to -.50 mm' thick, randy a little longer, covered with broad, retuse npinules, sometimes somewhat confluent, and

then dentate or incised at tip; microspores 0.026 to 0.030 mm. long, smooth. — Gray, Man. L c. /. *Braunii,* Durieu, U 11, p. 101.

The most common species of our flora from New Jersey and Pennsylvania northward and northwestward, sometimei on gravelly soil, at other places reported from soft mud, in ponds or slow-running streams, also near the banks of larger lakes or under the influence of tidewater, normally submerged from a few inches to several feet, in dry seasons sometimes getting out of water; associated with *Eriocaulon septangulare, Lobelia Dortmanna, Sparganium, Scirpus, Eleoeharis,* etc New Jersey: in tidewater of Tom's River, a slender long-leaved form, *C. F. Parker, C. K. Smith,* and others ; in a lake in Morris Co., *T. C. Porter.* Pennsylvania : Montrose, Susquehanna Co., *A. P. Garber;* Great Lake, Pocono Mountain, *Porter 6 Canby;* Presque Isle, Erie, *A. P. Garber.* New York : CatskiU Mountains in the lake near the hotel, *G. W. Clinton;* Round Lake above Bolton, west of Lake George, on white sand, and in Lake Placide, *L. Lesquereux;* Luzenie Lake and in Niagara River below Buffalo, *G. W.* [380(23)] *CHnton;* at the head of Goat Island, Niagara, between stones, *G. Engelmann;* Oneida Lake, /. *A. Paine;* in Oswego fliver, *F. Pursh,* probably (see p. 358). Massachusetts : Mystic Pond near its lower end, gregarious in soft mud in 1 foot of water, also in other parts of the Rame pond, and in Spot, Spy, and Horn Ponds, on sandy bottom, all near Boston, *W. Boott;* Hammond's Pond, *W. G. Farlow;* Concord Brook, gregarious, on firm bottom, if. *Mann;* Beaver Pond near Beverly, /. *L. Russell;* Uxbmlge, in Graftou Pond and several other ponds, *J. W. Bobbins.* Vermont: Mt. Mansfield, in the Lake of the Clouds, *C. G. PringU, H. Mann,* on gravelly bottoms, 1 to 2 feet deep; Lake Dunmore, *A. W. Chapman.* New Hampshire: Lake Winnipiseogee, in mud with *Gratiola aurea, Eriocaulon,* etc., *G. Engelmann* (these specimens were the types of Durieu's /. *Braunii), H. Mann, W. Boott;* Echo Lake in the Pianconia Mountains (where Mr. Tuckerman and myself had found /. *lacustris), W. Boott.* Maine : Moose Lake on Kennebunk River, *C. E. Smith.* Nova Scotia, Shelburne, *T. P. James.* Greenland, in the south, « Tessermint," /. *Vahl* (perhaps this is the true /. *echinospora ;* I could not well analyze the small and poor specimen in my possession). Westward the species has beeu found in Western Canada (Ontario) near Hastings and in a lake northeast of Belleville, on a muddy bottom, /. *Macoun.* Michigan : Bellisle in Detroit River, *H. Oilman.* Utah: ,lake at the ,head of Bear River in the Uiutah Mountains, at 9,500 feet alt., & *Wotson;* this is the most western mid highest, quite isolated, locality known to me.

Thin form is most closely connected with the European type ; the leaves are perhaps not quite so finely tapering ; ttomata can always be found, at least near the tip of the leaf; the sporangia, white in the .type, are sotted with blown sclerenchym cells ; the macro«pores I cannot distinguish either in size or sculpture ; the microspores I hnd a little Bmaller. I may state hare that the name of /. *Braunii* is preoccupied, as it has already been given to one of the two species of the Tertiary deposits, the well marked spores of which have been discovered »t he German Brown Coal strata ; Prof. Braun therefore proposed for our plant, if it should eventually be considered distinct, the name of *I. ambxgua.*

Var. ROBDSTA, ^/I/similar to the last, but much stouter, with 25 to 70 leaves' 5 to 8 inches long, with tbindant stomata all over their surface ; velum covering about one-half of the large, spotted sporangium; macrospores 0.36 to *0M* mm. thick, with the sculpture of the last; microapores the same as in lost.

In Lake Champlain, on the north end of Me La Mot* on a firm sandy soil with silt, m 1 to 2 feet of water, *C G. Pnngle.* Larger and stouter than any form of the last, but principally distinguished from it by the abundance of stomata.

V«r. BOOTTII, *Engdm. I. c* Leave, erect, .oft, bright gwen, fewer (12 to 20). short (4 to 5 inches long) ; rtomata, molly few, near the tip ; .pomngia nearly orbicular, pale-.potted, §, or more covered by the. brood vdum; macro.pon* 0.39 to 0·50mm. thick, with longer and .tenderer, delicate, generally simple spinule.; [381 (24)] microspores 0.026 to 0.030 mm. long. —/• *Boottii,* A. Braun in lit*.

Near Boston, in the Round Pond, Wobnrn, 2 to 3 feet under water, and in the brook of Toflt Swamp, Lexin$_{K}$-t»n, wmetimes ont of water, *W. Boott.* Very striking on account of the delicate green color of its soft leave* ai.d the long and slender .pinulcor the spores.

Var' MDRICATA' *Engelm' 1. e.* Leaves (15 to 20) long (6 to 12 inches), flaccid, bright green, with very few ««maU: moranthum broadly oval, pale-.potted, about half covered by the velum ; macrospores a little larger (0.40 to 0.58 mm. thick), with .horter and more confluent, therefore sometimes almost crest-like spinule.: macro.pore. slightly rough on the edge*, O028 to 0.032 mm. long. - /• *murieata,* Durieu, L c

In the .hallow and more rapid part, of Wouura Creek, and in Abajona River, the main source of Mystic Pon.1, »••» Borton' scattered over a clean gravelly bottom and always submerged, *W. Boott.* Remarkable for iU long flaccid km and the shorter .pinule. of the macrosporea, which form wineUme. cresU so that Durieu could compare it with *I-riparia.*

»• I. BOLASDUI' *Mngdm.* On* of the .mailer .peciea, with erect, .oft, bright green leave, tapering to a fine P*»t, 6 to » or SS n number, 8 to 4* inch. long, with thin wall, and ,*rtition«, and generally not many atomata; •pwngtam broadly oblong, mostly withont any *\»*«, with a narrow velum 5 ligula triangular; macirwpora. 0.80 to 0.40 or rarely 0.46 mm. thick, marked wHh minute low tubercle, or wart*, rarely confluent to wrinkle*; microspore.

tt Velum complete.

8. I. MKLANOSPORA, *Engelm.* One of the smallest species, with a flat, only slightly bilobed trunk ; leaves few (5 to 10, 2 to 2½ inches long), distichous, slender, tapering, light green, spreading; sporangium orbicular or almost obcordate, ½ to 1 line long, entirely covered by the velum, unspotted ; ligula short-triangular, obtuse, or about semi-orbicular; macrospores 0.35 to 0.45 mm. in diameter, roughened with distinct or rarely somewhat confluent warts, dark colored • microspores 0.028 to 0.031 mm. long, smoothiah or slightly papillose. - Transact. St. Louis Acad. Sci. 3, p. 395 note •'

Stone Mountain, near Atlanta, Georgia, covering the bottom of shallow excavations on the naked granite surface, a few inches deep and a few feet in diameter, holding about one inch of light, black soil, and at best a couple of inches of water supplied only by rains and dews, and completely dried up and baked for weeks or months under the action of the glaring southern sun on the bare rock, when only the little shrivelled trunks with their black withered matted roots remain, to revive under a fresh supply of autumnal rains (with *Amphianthu* pusillus),* discovered by *W. M. tanby,* observed since by *A. Gray* and myself; maturing in May and June. A cake of them taken home with me began to sprout soon after being moistened, and, vegetating in the room through winter, fully developed in early summer, and afforded a fine opportunity for studying this curious little species, interesting on account of its native locality, its endurance of drought, its mode of growth, and the phyllotactic arrangement of its leaves, its entire velum and its' <krk spores ; it seemed to thrive best when only the base of the leaves was covered with water. The trunk is unusually flat and only slightly grooved underneath and on one side, only about £ to 1 line thick and 2 to 4 lines in the longer and not much more than half as much in the shorter diameter ; distichous leaves soft and slender, their dissepiments confuting of only two layer* of cells. The sporangia, J to J line wide, readily separate from the leaf-bases, so that they are sometimes found adhering to the trunk after the leaf itself has already fallen away. The macrospores, only 8 to 20 in each sporangium, are black when moist and dark gray when dry ; in some I [384 (27)] find the warts much smaller than in others, but never wanting ; microspores also quite dark brown.

* * With peripheral bast-bundles.

t Velum partial.

«. I. ENGELMANNI, *A. Braun.* Our largest species, with numerous (26 to 100) long (9 to 20 inches or more) W»t green leaves, with abundant stomata; sporangium usually oblong to linear-oblong, unspotted; velum narrow ; tigula elongated from a triangular base ; macmspores 0.40 to 0.62 mm. thick, delicately honeycomb-reticulated; micro' •pores 0.024 to 0.028 mm. long, generally smooth. — Flora, 1. c; Am. Jour., 1. c ; Gray, Man. 1. c.

Var. GBACILH, *Engelm.* Often submerged, with fewer (8 to 12) leaves, 9 to 12 inches long; the bast-bundles •ometimes quite small, or only two of them. - Gray, Man. L c.

Var. VALIDA, *Engelm.* The stoutest of all our species; leaves 60 to 100 or even 200,18 to 25 inches long, keeled °& the upper side ; sporangium often linear-oblong (4 to 9 lines long), } or often £ or even] covered by the broad velum, macrospores rather smaller, 0.32 to 0.48 mm. thick; microspores 0.024 to 0.027 mm. long, spinulose. — Gray,

Var. GEORGIAN*. Similar to the type; leaves few (in the only specimens seen 15,10 to 12 inches long), rather •lender; oval sporangium with narrow velum; macrospores larger, 0.48 to 0.56 mm. thick; microspores 0.028 to 0.031 *m. long, smooth.

fa ponds and ditches, immersed in mud, rarely found in slow-running streams, in company with the ordinary vegetation of such localities, *Bide*, Polygonum, Lycopus, Carice*t Lurtia,* etc.; mature in summer; probably throughfy the Mid<Ue 8tatM| but ^^ ** *only* found — from Massachusetts: Arlington Brook, Alewife Brook, West Cambridge, Wage Brook, Woburn, *W. Boott.* Rhode Island: Newport, *W. G. Farlow.* Connecticut: Meriden, *F. W. Hall* — to the iVT York: Peekik>H» w *H. Ijeggeit.* New Jersey: *E. Durana\ C. F. Austin,* and other*. Pennsylvania: Bethlehem, *J.* Afastr, *E. Durand, F. IVolU;* Delaware Water-Gap, *S. W. Knipe;* Darby, /. *G. Hunt;* Philadelphia, *E. Durand, 1* E. Smith,* and others. Delaware : *IV. M. Canby, A. Common*.* Virginia: Salt Pond Mountain, with Parnassia ***rtfolia, IV. M. Canby.* Miraouri: St. Louis, *N. Riehl,* and *G. Engelmann,* 1842, in a single locality, where it *»• soon afterwards destroyed by cultivation: not found otherwise west of the Alleghany Mountains. Var. gracilis •eems to be a northern fonn: Bmttiehorough, in Clark's Pond, 0. *C. Fro*t* • Colebrook's, in a shallow stream with gr1TeU3r bottom, *J. IV. RMin*;* New Haven, in fresh water on a tidal shore, *D. C. Eaton;* Newport, *Bridge*, G. Th •JJ**';* Passaic River, near low-water mark, /. *Enni*.* Var. *valida* was discovered in Pennsylvania near Warrior's j^Huntfngton Co., and 8mithvillc, Lancaster Co, *T. C. Porter;* and in Delaware, Wilmington, *W.* nby. Var. *Gtcrgiana* comes from a mountain stream, Georgia, the Hnrseleg Creek, a tributary of [385 (28)] Coosa River, Floyd Co., in slow-flowing water about a foot deep, *A. W. Chapman.*

The trunk of this species is larger than I have seen it in any other, and more variable in form; sometime* it is 4ttit» ft^ Jus J« ^ ◦Ver0M *nck w^e» ••P^wlly in var. *valuta,* or it is thick ; and I have «een it even twice as high as it ***•> 4| lines wkb in the largest transrerae diameter, and 7 lines high; this, however, is a very unusual form.

• TIM original description in r*j<rxluccd tbova, pp. 401, 402. — Eon.

The plant is submerged in spring with the leaves partly floating; later, when the water recedes, the older leaves are spread out on the mud, but the later growth becomes erect; var. *gracilis* is often more or less submerged, and its weakly development is probably owing to this circumstance, while var. *valida* is the stoutest form we have, and one of the stoutest in the whole genus, perhaps only /. *Malinveriana* of the rice fields of Lombardy surpassing it. A very email form, only 5 inches high, has been collected in a springy place on a rocky hillside near Wilmington, Del., by A. Commons, otherwise not distinct. The Georgia variety, characterized by its larger spores, ought to be further studied. In my Missouri specimens I find, among many of the ordinary type with white sporangium, a few where this organ is uniformly brown, not spotted. The dissepiments of the leaves consist, the median of 3 to 4 and the transverse one of 2 to 3 layers of cells. The well-marked reticulation of the macrospores is formed of very thin, fragile laminae, not of thick ridges as in some other species.

10. I. HOWEIXII, *Engelm, n. sp.* Middle-sized, leaves (10 to 25) bright green (5 to 8 inches long) with thick dissepiments ; sporangium oval (1& to 2£ lines long), unspotted, J to £ covered by the velum ; subulate ligula as long as sporangium; macrospores 0.43 to 0.48 mm. in diam., rough, with prominent rounded single or sometimes confluent tubercles.

On border of ponds at the Dalles of the Columbia, Oregon, /. *dt T. J. Howdl,* 1880, not quite mature in June. I insert this species, which has just been communicated to me through the kindness of Mr. Q. £. Davenport, while the manuscript is in the hands of the printer ; this must excuse some discrepancies in the foregoing pages, where no reference could be made to it The new species is distinguished from the similar /. *Bolandtri* by the longer leaves, larger, more prominently marked macrospores, and especially by the distinct peripheral bast-bundles, which.place it near the foregoing one, by the thick dissepiment consisting of 4 to 6 layers of cells, and by the unusually narrow and long ligula ; the tubercles of the spores are quite prominent, as high as-they are wide, rounded at top; microspores light brown, smooth. — Among the specimens of this species, and probably collected with it, I find a single one similar in the structure of the leaf, but without a trace of a velum, the sporangium being entirely naked, and only attached by the median line to the leaf base; it in unfortunately immature, and can only be indicated as a probably new species, /. *nuda.* This would not be the first instance of two species growing together in the same pond or lake; in Mystic Pond we find /. *Tuckermani* and /. *echinospora,* var. *Braunii,* in Echo Lake the [386 (29)] Litter and /. *lacustris*, and in Europe not rarely this together with /. *echinospora.*

11 Velum complete.

11. I. FULGCIDA, *ShiUtUworth, in iched.* A slender plant of light green color ; leaves often very long, 10 to 35 in number, 15 to 24 inches long, sometimes entirely submerged, or partly flouting on the surface, or entirely emerged ; tpocuigia oval, 2 to 3 lines long, entirely covered by the velum ; macrospores 0.30 to 0.42 mm. in diam., covered with many or rarely few comparatively large fluttish tubercles, distinct or confluent into labyrinthiform wrinkles; microspore* not seen. —A. Braun in Flora, 1. c ; Anier. Jour. 1. c.; Chapm. Fl. So. States, p. 602.

Var. RIGID*, a smaller form with still more slender, erect, dork green leaves (about 10 to 15 in number, 5 to 6 inches long).

Var. CBAFMANI, larger, light green leaves floating (about 30, 18 inches long); sporangium orbicular ; spores larger, macrospores 0.44 to 0.55 mm. in diam., marked as the type, or, especially on the upper side, almost smooth ; microspores 0.027 to 0.030 mm. long, slightly papillose.

Florida, on the muddy bottom of lakes or swamps, first found by Dr. Rugel in Lake Iramonia, north of Tallahassee ; lately rediscovered by A. P. Qarber in a hummock, near Manatee, on the muddy border of shallow ponds in water from a few inches to 1§ feet deep, the long leaves floating or spread out on the mud, the inner ones erect; mature in April and May, disappearing in June. Var. *rigid** was found by the same collector on the wet borders of Lake Flirt, not far from Lake Okeechobee, in August, entirely emersed and erect Mr. A. H. Curtiss seems to have met with a similar form in a muddy swamp on Indian River ; not one of all these had any mature misrospores. Var. *Oapmam* was discovered by A. W. Chapman near Mariana, West Florida, filling a lakelet of pure limestone water about one foot deep, formed by one of those (in that region so common) subterranean streams, where it comes to the surfisw before emptying into Chipola River, together with *Nasturtium laeustn;* bat the *I**U$* has not been seen in it since: its larger macrospores, sometimes quite smooth, distinguish it from the other forms. — This peculiar species, the only one thus far found in Florida, is distributed over the whole State. It cannot be classed with the submerged species, for, though evidently often in deep water, the leaves elongate, seek the surface and float on it. The closed •slum and the peculiar sculpture of the macrospores readily distinguish it from its allies.

C. Terrestrial species, maturing when entirely out of water, with abundant stomata and peripheral baflt-bandles, thkk dissepiment*, and small air cavities in the Marly triangular leaves.

• Velum partial or almost wanting.

12. I. briaht ~ MiLiJiopoDA, /. flay. Polygamous; trunk subrfobose, deeply bilobed; leaves slender, stiff, met, bright green, ,unally black at ba» (15 to 60 in number, 5 to 10 or rarely even 18 inches Ion*) ; sponmgla mart/

XII.

SHORTER MISCELLANEOUS PAPERS.*

I. REMARKS ON NELUMBIUM LUTEUM.

FBOM THB TKANSACTIONS OF THE ST. LOUIS ACADEMY OP SCIENCE (PKOCEBDIMOS), VOL. II. 1860.

THB *NdumUum,* common in our stagnant waters, is not only one of our most showy [136] plants, with the largest leaves aud the latest flowers, with edible nuts and large edible tubers; but it is also one of the most curiously constructed plants, following with astonishing regularity its peculiar but very simple laws. Its morphology has attracted the attention of botanists before this, and Mr. A. TitScul has done much to develop its peculiarities; Prof. Caspary has studied the plant very intelligently, without, however, publishing as yet anything about it The ample material at my disposal has, I believe, permitted me to add observations which may have been beyond the reach of u»y predecessors.

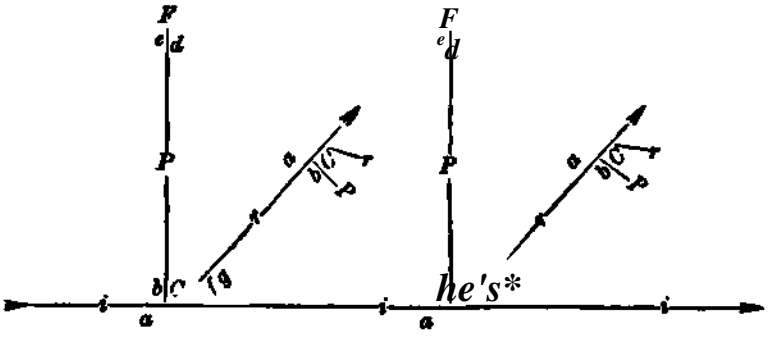
The structure of the embryo is sufficiently well known. The lower leaf (always on the side of the rhaphe and the periphery of the torus) of the large green plumule shows at the base of its petiole a rim, extending around the stemlet, indicative of the stipule which characterizes all the succeeding leaves. The stipule of the second much smaller leaf includes the third, and the stipule of this a fourth leaf, all of them preformed in the seed. After these distichously arranged leaves have been developed? the young stem reclines in the mud, and henceforth begins the new mode of vegetation which ever afterwards characterizes this plant The stem, growing now horizontally in the mire at the bottom of the pond or lake, has an upper, or dorsal, and a lower, or ventral side; it (as well as the organs produced from it in a vertical direction) has an anterior and a posterior side m regard to the direction of its growth. This stem is terminated by a bud, which consists of two bud-scales (Niederblaetter), *a* and *b,* in opposite directions, with very short, confluent nodes, and one large leaf, *C,* with the stipule, *$,* in the direction of the second scale, succeeded by an elongated internode, t, *hich at its end bears a similar bud. The roots consist of numerous fleshy fibres, beset with simple fibrill*, and originating from the node just behind the lowest scale.

Now, the plant prepares for propagation also in the simplest and most constant manner: one flower is produced from the axil of the second scale and one branch from that of the leaf; [137] these parts are always preformed aud distinctly visible even when not developed. The long «nd stout flower-stalk, *P,* without any foliaceous organs at its base, bears on its top the flower *F,* •nd just under it two opposite bracts, *d* and «.-the lower one, *d,* having a direction opposite to the •Spotting scale, ft. The branch, r. has at the base of the long internode and opposite to the sup- Porting leaf two bud-scal*. / and *g,* one above the other; the internode is terminated by a bud

• Amngwl •jritrra«tically.

exactly like the one described before; so, however, that the scale *a* has a direction opposite to that of/and *g;* consequently, *b* with *P* and *C* with r have the same direction as/and *g.*

The following diagram will explain the arrangement and the repetition of the different organs:



STEM.—The long internode, not quite cylindrical, but depressed and somewhat channelled above, is traversed by 6-9 principal air channels or tubes, of unequal size, arranged in a circle, with numerous smaller peripheral and one central one. The nodes are almost solid, but beyond them, in the next internode, the tubes are continued even with their irregularities and peculiarities, adding new ones when the plant becomes stouter. In both axillary productions, the peduncle and the branch, the arrangement of the tubes is reversed. In the full-grown plant the internode is commonly 12-20 inches long and 5-8 or even 9 lines in diameter. I usually find a pair of small tubes above, 2 or 3 pairs of large ones on the sides, and a single middle-sized tube below. In the embryo a pair, sometimes more or less confluent, occupies the side of the lowest leaf, an odd one the side of the second leaf, and 4 or sometimes 5 others the intervening spaces. The stem of smallest size has a small pair above, a large pair on the sides, and a middle-sized pair below; in larger stems a seventh odd tube appears between the lowest pair, and in full-grown ones an upper pair of small ones completes the circle of nine tubes. In the peduncle the same system of tubes is reproduced (not always so regular) in an inverse order, so that the small pair is found on the anterior side, or on the side opposite its supporting scale. The branch has at first always six tubes, the smallest pair on the lower side opposite to the supporting leaf. This arrangement, however, is usually only visible near the origin of the branch, because the upward tendency of the developing leaf and flower, which in the bud are directed downwards, imparts to the tender, growing shoot a rotation half around its axis, thus righting themselves, and bringing, in the anterior part of the internode, the pair of small tubes to the upper side. Where circumstances, such as hardness of soil in very dry seasons, prevent this rotation or twist, the different organs curve from under the branch upwards to the light As the branch grows, more tabes are added in the succeeding internodes, just as in the parent stem, from which henceforth it does not differ at all, shooting up a flower and a leaf at each repetition of its simple cycle, and gradually overrunning the whole bottom of the pond with their network.

Thus the plant continues to grow until some time in August, after the flowering period is passed, it prepares for winter by depositing in the now shortened and thickened internodes or [138] joints a large quantity of staich as food for the young plant*, which in the succeeding season spring from the terminal bud at the Up and the axillary bod at the base of the tuber. These tubers are 5-10 inches long, 1-2 inches in diameter, somewhat spindle-shaped, depressed, and not randy angled and furrowed, and weigh 2-8 ounces; they are traversed by the same system of tubes as the summer stems; the tubes, however, are mostly of a more irregular shape and more or less compressed. Our pUot having no truly perennial rootstock like its relatives, the *lfymphaaeem,* the tubers and *Umx* buds are the only parts which live through winter, much like those of the potato.

.... *T*^m*r*AU *** foliaceoM *0T*&**. w>th the exception of those in the flower proper, are either oistichoudy alternate, or they are superimposed in the order detailed abova The lowest scale, «, is

about 3 inches long and envelops the whole bud ; the growing stem, enveloped by the stipule, bursts through its very thin back, while the leaf aud the flower-bud, wrapped in the second scale, *b,* pass out on the upper, open side, leaving its upper part, when entire, between the leaf and the stipule; at last, it usually divides into two halves, with lateral positions.

The second scale, *b,* is 3-5 or sometimes even 6-8 inches long, bears in its axil *alwayt* the flower-bud, and originally envelops that and the leaf, but not the stipule; it remains on the back of the peduncle, or, where that remains undeveloped, of the petiole.

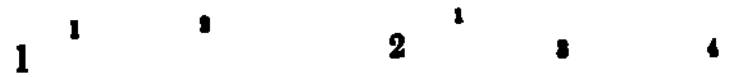
The peltate, orbicular leaf, *C,* has often been described. I allude here only to the 6 tubes of its stalk, arranged exactly as in the smallest branches, the smallest pair on its *posterior, grooved* side. The epidermis-cells of the upper surface are very small (0.007-0.010 line diameter) and angular, each with a little knob, which together produce the velvety, water-repelling surface; the lower surfece is formed of a single layer of much larger cells (0.020-^0.025 line) with tortuous walls, and is kept distended and separate from the parenchym of the leaf by a kind of framework built of cells, which forms a network of meshes filled with air. Only the upper surface has stomata. At the base of the leaf a stipule, in shape and texture similar to the scales, in full-sized specimens 2-2J inches long, envelops the axillary bud as well as the continuation of the stem; while the latter, growing out, leaves it on its upper side, the branch penetrates its back, thus placing it between itself and the atom, or at last splits it in two.

The first opposite leaves of the flowering branch may be classed as bracts; from the very similar exterior sepals, they may be distinguished by their position, smaller size, and persistency; they are already observed in the smallest bud, of O.t line diameter. The succeeding organs of the flower are arranged in much more complicated phyllotactic orders.

The lowest, superimposed scales of the leaf-branch are close between the branch and the stem ; the lowest one is only 6-9 lines long, notched or unequally bifid; the second is 1J-2 incl.es long, of the form and texture of the other scales, not perforated by any organ, but often at last severed in two halves.

FLOWBB AND FBUIT. — A few observations must suffice here. I will only mention that the prolonged and thickened commissure of the anthers forms a hook, which in the bud is curved over the «rus, that of the inner filaments much more than that of the outer ones. The pollen grains are smooth and globular, 0.04 line in diameter. I find the number of carpels, and consequently of nuts, on the torus between 12 and 31, arranged in two or in three circles: 9-15 in the outer, 3-11 in the second, and 1-6 in the third circle, when present The carpels, in the smallest flower-buds examined, *«w indicated by cellular protuberances on the receptaculum in the same plane as the smaller cellule masses destined for anthers, of 0.05 line diameter; the torus, growing up, gradually encloses them, leaving only the stigma free. The knob of the carpel is always directed towards the periphery of the torus, and the micropyle of the anatropous ovule towards the centre; the channel of the perforated •tigma leads into the cavity of the carpel near the short funiculus, away from the micro-Pyle. The cotyledons form with the edge towards the rhaphe, consequently in the radius of [139J the torus, and the lowest leaf of the plumula turns its back to the rhaphe and the periphery.

BODS. —The bads especially those which persist through winter, include the whole plant with •U its organs (except the complicated parts of the flower iUelf) completely preformed, and repeated several times. A bud of 2 inches in length contained the primary orgaus *a, b* and *C* four times, and the branch r twioe repeated, the first branch consisting of two internodes, thus: —



In 1 the leaf was 20 lines long; in 2, 3 lines; in 3, } line, and in 4, J line long; each one of the seven cycles distinctly showed the flower-bud and the branch-bud at their proper places.

PHYLLOTAXIS. — The attempt to harmonize the very unusual disposition of the organs with the ordinary laws of phyllotaxis has produced some very odd theories. A rather specious explanation seems to be the following: the flower might be the termination of the main stem, which has five distichous foliaceous organs, C, a, *b, d,* and *e;* the lowest leaf, C, bears one branch, r, and the second, a, another branch, *i,* which at last becomes the continuation of the stem; in the first the twin scales / and jr, in the second the leaf *C,* stand opposite to the supporting organs. Thus all the foliaceous organs would be distichous, but the branches *r* and *%* would not harmonize, *r* being left without a leaf *C.* The principal objection, however, to this explanation is the unmistakable continuation of the structure in what I have considered the stem, while in the peduncle it is reversed just as it is in the branch.

USE. — The tubers and the seeds of *Nelumbium* are edible and highly nutritive, both being replete with amylum; but they have been eaten only by the aborigines.[1] The boiled seeds closely resemble chestnuts in taste. Some of the largest tubers, obtained about the end of September, I had cooked; they were not done as soon as potatoes, and retained much more firmness; baked, they were much more palatable than boiled, and hud a pleasant, sweet, and mealy taste, considerably resembling that of sweet potatoes, without anything reminding one of their growth in stagnant water. The decomposing tubers become gray, and at last black, the inside assuming a beautiful purple color, and a very fetid odor, somewhat resembling that of rotten potatoes. The purple color is produced by deep purple globules forming in the cells, one in each, and considerably larger than the starch granules; undoubtedly some rudimentary fungoid production.

FROM PARRY'S PHYSIOGRAPHY OP THE ROCKY MOUNTAINS, APPKNDIX (TRANS. ST. LOUIS ACAD. OP SCIENCE, PROCEEDINGS, VOL. II. 1865).

NUPHAR POLYSEPALUM, n. *tp.*: foliis late ovatis sinu angusto profunde cordatis; floris magni sepalis 9-12 concavis mediis maximis, petal i* 12-18 spatulatis retunis, stuminiim numerosissimonim antberis apice truncate- [883] appendiculatis filamenta demum recurva eequantibus seu eis brevioribus, ovarii urceolati strinti radiis stigtna-tosis 13-21 disci umbilicati marginem crenatum fere attingentibus; bacca versus apicem constrictura nee rostratum sulcata.

In small lakes, in tbe higher Rooky Mountain*, from the sources of the Platte, near Long's Peak, lat 40°, to those of the Columbia River, lat. 44°. Dr. F. V. Hayden collected it in the then (fept- W. F. Raynold's Expedition, on Jnne 20,1860, in a small lake, between Henry's Fork and Snake Fork of the Columbia River, at an altitude of 6,500 feet. Miss Merrill, in the year 1862, brought from Gibson's Lake, near Long's Peak, some of the large reddish sepals, verifying her vague account of the plant; and, finally, Dr. Parry gathered ample material and full notes, which have been largely used in the following description, in Osborn's Lake, in the same region, at an altitude of 8,800 feet, where it grows with *Menyanthe* trifoliate, Utricularia intermedia, Sdrpus, Carex,* etc.; he found it in flower in August, the temperature of the water being at the time 58 degrees.

The leaves are more like those of *Nuphar luteum* of Europe than those of our *N. advena,* being oval in outline, not deltoid-orbicular, and with a narrower, more closed sinus, the obtuse lobes more gradually separating from one another. In *N. advena* I find the sinus often of 75 degrees; the lobes are then triangular, with acutish point*; but this form of tbe sinus, and shape of the leaf, is by no means constant, for whenever the substance of the leaf is more fully developed, the lobes become broader, more obtuse, and the sinus, of course, narrower, as I find it in specimen, from Arkansas ; while sometimes, as in specimens fa>m Houston, Texas, the sinus become, closed up, and tbe lobe, even overlap.

Ma ^ILlT⁶*! of 0Ur §PiCfai WeW floatSn K when onserved ; five of them were 8|-9i inches long and (4-7* inches wide; the*, five leaves, and five of *N. luUum,* give each an average proportion of length to width as 10 to 8, while the ^/^L^ bai leaven * o*ma ffom diffelwit *** of the Unitod 8ut «* *v" lh* P">P°rtk» of 10 to 9. The diff- - - small enough, bnt in the appearance of the leaf is quite striking. I notice, also, a differ** in tbe ven- - th- J" of UWi> 'lb"* ipecie^ *m Wn* in o" "P^^ »~»J three time, as many reins eon* nected *SZlf* with the midribs,i»ue from the bsae, while in both the other specie. I observe only about twice *m* many

[1] The Charlton word for *Nelumbium,* Mi ri wWch O-11" <*»** * —* «• «W to derive if* MM fro. the India, a plant very abundant thm and highly «tm>cd by Uie Indians.

from the midrib as from the base. It may, in this connection, not be ont of place to state that, as far as my observations extend, all the species of *Nuphar* can be readily distinguished from all those of *itymphcea* by their venation, the former having by far the largest number of secondary ribs connected with the midrib, while in [284] *Nymphaa* most ribs are basilar, and few only come from the midrib.

The flowers of our plant emerge a few inches above the surface of the water; they are the largest of any known *N\iphar,* and are composed of from 9 to 12 sepals, many more than we find in any other species, whence the name The sepals being concave, and " the inner ones curved in, partially concealing the greater part of the dense mass of stamens," the flower becomes "globular cup-shaped,[11] and is about 3 inches in diameter, while, when fully laid open, it measures 4J-5 inches. The sepals are arranged, not, as it was at first supposed, in 3 or 4 whorls of 3 sepals each, but in ^ disposition, or, perhaps, the outer ones in { divergence, gradually changing into ^. The sepals increase in size and petaloid appearance from the outermost or first to the 7th or 8th, when they decrease again in size, but become of more delicate petaloid structure and color; the three outer ones are oval, 1±-1} inches long, green with yellowish margins; the 2 or 3 next ones are orbicular, fc-24 inches long, and of a yellowish green color; the following ones are the largest, 2J inches long, 3 inches in diameter, transverse in shape, broadly spatulate at base, and retuse or truncate above; they are yellow, and often "tinged with the red of a deep peach blush, especially in fading;" and the innermost are smaller again, spatulate-orbicular, often emarginate, 1-1i inches long, yellow, or, especially on the edges, reddish brown. Dr. Parry ha| repeatedly olwerved transitions between these inner sepals and the petals.

The petals themselves are spatulate, truncate, 12-18 in number, "9 lines long and 6 lines broad ;" in the dried specimens I find them only 5 lines long and from 2 to 4 lines wide; in Dr. Parry's specimens they are " deep red in the middle and yellow at the base and tip."

The stamens, much more numerous than in the allied species, together with the anthers and the appendage, are deep red, relieved by the bright yellow color of the (oval, hispid, as in the genus) pollen, the outer ones broader and shorter, the inner ones narrower and longer; at maturity they are recurved.

The Btigmatic disc is deeply umbilicate, and bears 13-21 (usually 16-19) stigmatic rays, which extend near to the irregularly crenate margin ; it has a green or a deep red color, or red, edged with yellow, and has, in the dried specimens before me, a diameter of 9-11 lines. In *N. luUum* the disc is similarly formed, while in all the western specimens of *N. advena* (I have no others at my disposal) I invariably find the disc entire or undulate, and the rays not extending to the margin.

The fruit found by Dr. Parry, only half ripe, is "smooth, glossy, deep green, and furrowed, especially [285] towards the top ;» dry, it is 1+ inches long, and 1* inches in diameter.

The flowers of Dr. Parry's plant are more highly colored than that of Dr. Hayden'a, and may preserve the name Of var. *pictum,* which the discoverer has applied to the species; it seems to bear the same relation to the duller colWd northern form that *N. luteum,* var. *rubrcpetalum* (Caspary in Schriften der phys. okon. Gesellsch. zu Koniggberg, ** 2, 1861, tab. l)f does to the common European plant; in that variety the stamens as well as the disc are yellow, like the sepals' only the petals, and especially their upper surface, are " brown blood-red." On page 60, Prof. Cospary alludes to our *N' advfna* as being more frequently found with red petals and points of stamens than with yellow ones, a fact which will be new to many of our botanists, as, at least in the Western and Southwestern States, a red tinge W not been observed by them.[1]-July 27,1860.

IL ON THE DIMORPHISM OF DRABA BRACHYCARPA.

FBOM TBB TIUHSAOTIOWS OF THI ACADEMY OF 8CIENCI OF 8T. LOUIS, VOL. II. 18*2.

THIS humble white flower is at this season very abundant on the grassy hills about [154] **town,** associated with *Draba Caroliniana,* the pretty *Houdonia minima,* with *Androuue ooeidentalu, Planiago putilla, Ranunculus fatckuUiHs, Myosurus minimus,* and the completely natuttliaed *Captdla.* In ordinary or in wet springs the flowers are all regularly formed and comparatively large, having a diameter of about 2 lines; in very dry springs, however, such as the present **one,** .a **form with** very inconspicuous flowers beoomes common, which in isolated specimens in the

[1] Aft* this was written, I weired torn Prof. A. *Gny* t I wpsli, wd·tipped petels md wddUh orwy and stlgmatie [illegible] found [illegible] with t dwc ; the ouW •Umeni only showed a .light red tinge just [illegible] oo U»o*ter,an^^ red blush on the inner I I *hrlw* the poUnifcrom pert.

herbarium might be taken for a distinct species, but, studied on its native hills in thousands of specimens, clearly proves to be nothing but a depauperate or abortive state and not even a clearly defined variety.

During a late excursion to our commons in company with Dr. Hilgaid, he ascertained that on the northern slopes of hills and sinkholes, and near the edge of ponds, the plant had the ordinary appearance, but on the sunny and dry or even arid southern slopes not a single one among the thousands of specimens could be found the flowers of which were not quite inconspicuous; in intermediate situations the size and organization of the flowers were also intermediate.

These incomplete flowers are smaller in all their parts than the regular ones; the sepals are erect and rather persistent; the petals always shorter than the sepals, but variable in size, shape, and number, or even entirely absent; the stamens always abortive and often reduced in number; the ovary shorter but fertile.

The petals (ordinarily broadly obovate-spatulate, retuse, over 1 line long) are here linear-spatulate, entire, emarginate or bilobed, &£ line long, 2 or 4 in a flower, often of unequal size in the same flower, or entirely absent. The slender filaments bear a bilobed cellular head, often not more than 0.05 line long, representing the anther, but without any regular structure. He found in single flowers 4, and often 5 or 6 of them, without petals, or associated with 2 or 4 rudimentary petals. It appears that in some incomplete tetrandrous flowers the pairs of stamens adhere to [155] the base of the corresponding exterior, and the pairs of petals to that of the interior sepals; the 8 organs forming rather one than two cycles.

How these female plants, as they must be called, which, this spring at least, form the immeasurably largest part of the whole crop, can be fertilized by the few complete ones growing in the neighborhood, is not easy to understand.

Does not this dimorphism obtain in other species of this genus, in *Lepedium* and other *Cruciform,* and would not several so-called species fall, if correctly understood, under other fully developed ones as incomplete forms ?— *Journal of Proceedings,* April 15,1861.

IIL STRUCTURE OF THE FRUIT AND SEED OF RIBES.

FROM THE TRANSACTIONS OP THE ACADEMY or 8CIKNCE or ST. LOUIS, VOL. II. 1862.

DR. ENOELMANN exhibited several drawings illustrating the structure of the fruit and seed [180] of the genus *Kibes.* His investigation of what constituted the pulp of the Cactus fruit (see p. 166) had induced him to examine the juicy fruits of allied families. It seemed strange that the structure of the gooseberries and currants, so common everywhere, had not, as far as he could ascertain, attracted the attention of vegetable anatomist*. The only allusion he found to it was in Schleiden's Grundzttge (ed. 3, p. 408), where it is said that the pulp of the berry of *Ribes* seemed to be formed by the dissolution of the cells which originally constituted the testa itself. Dr. Engelmann found this pulp to consist of the arillus and of the modified epidermis of the testa.

The arillus of *Ribes* is a fleshy or juicy dilatation of the funiculus; in the currants, at least in *R rvbrum,* it is very short, cup-shaped, lobed, often obcordate, and embraces the base of the seed; in the gooseberries *(R. Grossularia* and *R hirtellum* were examined) it is much larger, as high and sometimes as large as the seed itself, entire, and attached to the funiculus, all along the [181] rtaphe. The substance of this arillus is rather firm, and consists of very small cells, in the oommon gooseberry between 0.01 and 0.05 line in diameter. The arilli of different seeds are apt to coalesce.

The epidermis appears as a seemingly gelatinous transparent coating of the seed. It consists of simple, prismatic, 5- or mostly 6-angled, connate cells, each, in the different species examined, 0.06-0.10 line in diameter, and 0.3-0.5 line high, near the rhaphe much shorter. The contents of the cells are very pale red or colorless, the green or buff color of the seed appertaining to the testa itself. In some cultivated varieties these cells may finally become detached, forming a true pulp; but in the fruits examined by him such was not the case. If that part of the funiculus which forms the rhaphe at last becomes detached from the seed, as has been stated, it must be after a separation of these epidermis cells.

Dr. Engelmann noticed that the inner coating of the carpellary cavity of *B. rubrum* consisted of a singular deposit of crustaceous and brittle, striated cells or cell-walls, which he had not observed in any other species examined by him. —*Journal 0/Proceedings,* June 2,1862.

IV. REVISION OF THE (ENOTHERiE OF THE SUBSECTION ONAGRA.

FROM GRAY'S ENUMERATION OF PLANTS OF DR. PAIIRY'S COLLECTION IN THE ROCKY MOUNTAINS, SUPPLEMENT 2 (AMEIL JOURN. SCI. AND ARTS, SECOND SERIES, VOL. XXXIV. Nor. 1862).

A large suite of specimens enables me to clear up some difficulties which have environed the following [333] species of *(Enothera.*

1. (ENOTHERA CORONOPIFOLIA, *Tort. & Gr. Fl.* 1, *p.* 245; *Gray, PI Fendl. p.* 43 : perennis, rope multicaulis, humilis, erecta seu erecto-patula, pulierulo-canescens, strigosa seu hispida; foliis infimis lineari-spathulatis, cateris pectinato-pinnatifidis ; *tubo calyrû ad faucem dense viUoso; petalii suborHculatU integris* stamina equantibus pistillo brevioribus; capsula ovato- seu lineari-oblonga *torulosa ban ħune in pediceUem brevissimum attenuate subereeta; seminibut magnit ovatû turgidis subobtusis varie oblique truncate tubereulatis.* My specimens were collected by Mr. Fendler (No. 222) near Santa Fe\ along water-ducts, and by Dr. Hayden on the sandhillsof the Loupfork, on « Running Water." Stems *-1 foot high: flower white, turning deep red, about an inch in diameter: capsule in Fendler's specimens about an inch long, in Hayden's only about 4 lines long, thicker than in the allied species : seeds yellowish-brown, about a line long, thick, beset with tubercles arranged in longitudinal rows.

2. (ENOTHERA PINNATIFIDA, *Nutt., Gen.* 1, *p.* 245; *Ton. dt Gr. Fl. I, p.* 494. *(E. albicaulis,* Pursh, Fl. 2, p. 733: DC. Prodr. 3, p. 51, non Nutt *(E. Purshii,* Don. Syst 2, p. 688. *(E. Purshiana,* Steud. Norn. 2, p. 207: annua seu biennis, humilis, diffiwa (rarissime erecta), puberula, rarius sursum hirsuta; foliis imis obovato-Rpatulatis acutis seu obtusis integris, cieteris pinnatifidis sspe ciliaiis; *tubo calycis ad faucem nudo; petalts late obcordatis $eu prof and, emarginatis genitalia euperantibus ;* capsula lanceolato-lineari *torulosa $euUx iuberecta; uminihu ovatis turgidû utrumque apiculatu fovcoldtu uriatxm inter costai diipoiitu deganter notatis.* Sandy soil on White River, Upper Missouri, *Nuttall, Geyer in NieoUefi Expedition, Dr. Hayden;* Las Vegas and Santa Fe, New Mexico, *Dr. Widitenus, Mr. Fendler;* the hitter's specimens, few in number, bearing his private number 239, were distributed with others of the next species under No. 223; Southern New Mexico, *Wright* (referred to *(E. coronapifolia* in PL [334] Wright 1, p. 09.) AH the specimens I have seen are either annual (sometimes simple and one-flowered) or, nroally, biennial, with rosulate entire radical leaves; branching from the base, diffuse or even decumbent; an erect farm was collected by A. Gordon on the Upper Canadian River, No. 29, similar U> the last species in habit 8tems ntually 4-6 inches high, but, according to Nuttall, the decumbent branches sometimes 2 feet long. Flowers 2J-3 inches in diameter, white, turning pale red: capwile 1-1} inches long: seeds very regularly and prettily pitted between the longitudinal rib*, O.6-A7 of a line long, yellow. Don and 8teudel have changed Nuttall's earlier name, bat hit munt stand, and Humboldfs plant, described five years later under the same name, may receive the name of *(E. Hmmboldttu*

3. (EroniiRA ALBICAULB, *NutUiU in Fran. Cat.,* 1813, *A Gen.* 1, *p.* 245; *Ton. & Gr. Fl.* 1, 495; *Gray, PL Wrija.* 1, p. 69, *S* 2, *p.* 56 : perenniis glubra, puberula seu hirsuU; caulis *eortice aUMa fnembranaceo nitenU;* foliig maxime variia; *piialis orbicuUtio-ovatis* in unguem plu« minus attennatis *integru* stamina superantibus pistillum •quantibut; *eapeula e bati cramore uttili lineari dimricata vtpe ftexwma teu dtfUxa; ieminihu minoribus linearifaftMotatt Iambus.* A common plant on the western plains, extending into Oregon, New Mexico, and Chihuahua, as variable in habit, growth, and foliage as it is common, but always easily recognized by the unvarying character* of the

flower and fruit as above indicated, and also by its white glistening stems and branches, the epidermis of which is apt to peel off in the manner of many Loasacese. The white flowers, 1£-1 j inches in diameter, at last turn pale-red; the very slender capsule, connected by a very thick base with the stem, is usually 1$-1£ inches long, and spreads at right angles, or is curved or twisted in various directions. Seeds smooth, dark-brown, lance-linear and usually very acute at one end, and 0.8 line long; var. ft. has smaller (0.6 line) and obtuse seeds. According to foliage and pubescence I arrange the specimens before me under the following varieties : —

a. Foliifl basi in petioluin brevem attenuatia.

Var. a. NUTTALLII : erecta glabriuscula seu puberula, simplex seu ramosa; foliis linearibus sen lanceolatis seu oblongis integris vel plus minus dentatis. Here belongs *CE. pallida,* Dougl., with ite variety *leptophylla,* Torr. & Gr^ as already indicated by Prof. Gray. Nuttall describes this form as sometimes 3 feet high, and Geyer notes that in the sandy plains of Devil's Lake and at the sources of St. Peter's River it forms shrubby bushes of the size of Spartium scoparium, growing even 4 feet high ; but it seems more usually between one and two feet high. Leaves 1-2 j inches long and 1-6 lines wide. One of the broadest leaved forms is Fendler's N. Mex. No. 224.

Var. 0. RCNCINATA : branchiato-ramosa, patula, glabra, puberula seu canescens; foliis lanceolatis grosse seu sinuato-dentatis. This is *CE. pinnatifida,* Gray, PI. Fendl. p. 43 (description and most of the specimens No. 223, all those with the private number 243). Fendler gatherèd it near Santa *F6* ; Fremont in his 3d Expedition collected a glabrous (No. 222) and a very canescent (No. 178) form, the latter with singularly short but apparently fertile capsules, scarcely 3 lines long.

b. Foliis basi lata truncata sessilibus. [335]

Var. *y.* BREVIFOLIA : tota glaberrima, erecta, ramosissima ; foliis late ovatis abbreviatis grosse dentatis. Sandhills south of £1 Paso, *Dr. Witlizenu*,* No. 99. Leaves dark green, while all the other forms are pale or grayish, 4-6 lines long, acutish, or often rounded at the end.

Var. *b.* TRICHOCALTX : erecta, parce ramosa, canescenti-hirsuta; foliis lanceolatis seu lanceolato-oblongis sinuato-dentatis. Las Vegas, New Mexico, *Dr. Wislizenus,* No. 473. — This is no doubt Nuttall's *CE. trichocalyx,* Torr. *A* Gr. Fl. 1. c, the specific identity of which with *CE. albicaulis* Prof. Gray has already indicated. The long hair on the stem, ovary, and especially the calyx, consists of a single cell, remarkably broad at base, tapering to an acute point; — it is however the form of hair 1 find in all long-haired *CEnothera.*

V. REMARKS ON VIBURNUM AND CORNUS.

FROM THE TRANSACTIONS OF THE ACADEMY OF SCIENCE OF ST. LOUIS, VOL. II. 1866.

DR. ENGKLMANN made some remarks about the fruit and seed of different species of *Vibwr-* [269] *num.* Unfortunately botanists too frequently neglect to gather the ripe fruit, and the herbaria that he consulted furnished but scanty material for the interesting investigations he had instituted, and which he intended to prosecute. The fruit, he stated, was described as an oval drupe or berry, red, dark blue, or black, with a juicy and edible pulp, and a crustaceous stone containing the minute embryo in a fleshy albumen. He found the berries of different sizes, and generally more or less compressed, but, on the whole, offering no useful diagnostic characters, as might be expected of such a pulpy fruit The pulp contains, as is well known, saccharine matter (especially in our common " black haw," *Viburnum prunifolium),* or it is more or less acidulous (a g. in the " tree-cranberry, *V. Opu-IUM)* ; but he had found as a remarkable exception one species, the rare *V. acabrellum,* specimens of which, collected in Mississippi by Prof. E. Hilgard, were examined, with a pulp as oily as that of any *Nytta,* or of *Oka* itself.

The most important diagnostic characters are found in the stone and the albumen. The stone is either flattened or it is thick, even, or marked with longitudinal grooves and ridges; the albumen it described as fleshy, but he would rather call it horny, and it contains some oil; it is even and uniform, principally in the flat-seeded species, or more or less folded, or (as it is termed) ruminated, especially in the thick-seeded species.

In the following table are enumerated all the species the fruiU of which he could examine: —

3. *Lantana* with species 8-11; leaves finely or coarsely dentate, glabrous or often with stellate pubescence, cymes even or, rarely, radiate, berries bluish-black, stones strongly marked, compressed or tumid. This section might be subdivided according to the form of the stones above described.

4 *Tinus* with species 12-15; leaves perennial (always?), entire or minutely sinuate- [271] toothed, cymes even, berries purple or black, often shining, stones tumid with ruminated albumen.

In explanation of the measurements given in the above table he would add, that he had, in conformity with the usage now almost universal among men of science, adopted the French decimal measure, and hoped it would supersede, even in common life, the inconvenient measure of feet, inches, and lines. For those not familiar with it, it will suffice to state that the millimetre is about equal to half a line.

Dr. Engelmann had observed similar, though not as strongly marked differences in the fruits and stones of the different species of *Cornus.* Thus, the stone of our common *C. asperifolia* (a small tree with us) is subglobose, small, nearly smooth, marked with very slight furrows; the eastern *C. circinata* has Jarger stones, marked by indistinct undulations; the low, shrubby *C. sericea* of our swamps bears a stone twice as large, and quite knotty, with thick ridges; our Dogwood, *C. florida,* has a larger and elongated stone, acute at both ends, and slightly grooved; the stone of the nearly allied Califoniian *Cornus NuMallii* is still larger, obtuse at both ends, and scarcely grooved, and that of the northern *C. Canadensis* is from a rounded base elongated to a pointed tip, and is perfectly smooth. He solicited botanists to furnish him with ripe fruit of any species of *Viburnum* and *Cornus* within their reach, so as to enable him to prosecute these investigations.

VI. PAPERS ON GENTIANEiR

NEW SPECIES OF GENTIANA, FROM THE ALPINE REGIONS OF THE ROCKY MOUNTAINS.

FROM THB TRANSACTIONS OF THE ST. LOUIS ACADEMY or SCIENCE, VOL. II. 1862 (DISTRIBUTED MAT 5, 1868).

GENTIANA (AMABELLA) ACUTA, *Michx.,* var. NANA. : pusilla, subsimplex ; calyds 4-5-fidi lobis inoquali- [214] bus tubum corolla ceenileo-virescentis aquantibus; laciiiiis corolla fauce ciliis paucis ornate ovatis obtusis.

On alpine slopes, together with *0. pro$trata* in mats of *Silent acaulis; Parry,* No. 309. — Stems 1f-8 inches high, flowers 4-6 lines long; distinguished from the ordinary form by the short and broad lobes of the oorolla, which bear a few (1-4) single cilia at their base, and by the short oval anther*.

G. acuta is evidently but a form, a geographical variety of *0. AmartUa,* as Dr. Hooker has indicated, and which is confirmed by our dwarf variety and other forms collected in Colorado by Messrs. Hall & Harbour (No. 473) ; the characters of acutish lobes of the corolla and small seeds do not hold good ; Dr. Parry's No. 307 has seeds as large as *G. AmartUa* from Prussia, and several forms have quite obtuse lobes. I have even some doubts about [916] the specific difference of *G. tenuis,* which is characterized by smaller flowers, short, obtuse or retuse lobes of the corolla with sparing fringes, and (in my specimens) very indistinct glands at the base : specimens of *0. acuta,* with strictly erect branches, smaller, greenish flowers, and small needs, seem to approach it almont too closely.

PL 9, Fig. 6, represents two specimens of our plant; 7, a flower; 8, corolla laid open; 9, pistiL Fig. 7-0, 4 times magnified.

GENTIANA (AMARELLA) HETEROSEPALA, n. *tp.:* annua, humilis, erecta, simplex, pauciflora, glabra; foliis inflmis obovato-spatulatis, superioribus ovatis ba*i lata flessilibus obtusis sen subacutis margine (sub lente) scabrellis ; floribus aingulis breviter peduncuiatiR ; calyci* 6-fidi lobin 2 maximis ovatis acutis corollam fere leqnantibuk, reliqnis 3 brevioribus lineari-subulatifl ; corolla besi indistincte giandulifern fauce ciliis paucis barbate laciniia Uneari-obiongis obtusis tubum dimidium wiuantibu* patulis ; antheris ovato cordatis; pis[f]illo lineari.

Northern slope of the Uintah Mountain*, east of the Great Salt Lake; beginning to flower at the end of August; *H. Engelmann,* in Capt. Simpson's Exped., 1869. —A very slender plant, 2-4 inches high, usually with 4 pairs of leaves of a delicate pale green color, the larger ones 6-10 lines long, 4-6 lines wide; flowen 6 lines long, pale grayish-blue ; dli» of throat few, in two fascicles at the base of each lobe. Remarkable for the great disparity of the calyx

lobes; in that respect near *0. tanpatrit,* but vray different oth«wt«, and, like *0. Umtii,* a connecting link between Groebacb's Amarelta »ml Arctoplul*. — PI. VUI-, Fig. L One or Hit >«««* epwimciu); 3, a riiigle flower; 3^ cnlyx, pprcaJ out; 4, coralU, kid open ; 6, pi«UL Fig. 2-*, 4 Umi» nugnifted-

GENTIANA (AllCTOI'HIL*) WISLIZENI, it. 171.: annum, erccta, nunnsa, *a\abrn* ; fulii-t (mb lontv) innr^iiii; •coiml-tu, imis pjMUulotia obtutu, sn-perioribu « hut lotions BCHHJ lanceolatin D n iiw fib nhtrai tuculh, luiiUhM MBtb ; cyjiia contracta Uirmfonui; calycis membranacei Lruucati latera-liter fissi spathacei lobis herba-ceis linearibus lulu* cqo mulio brevioribus corollae lultunt <li-midium fere attingentibus ; corollae Iacinj» ovato-lanceo-latis a Blitweuli tubo angusto semim liiltituto UIAI glandu-lif«ru bi» lirvrioriVii* l*>i Uhs-vit-r W W i i vd OUIKLMCUIU ; ovario capsulaque Uneui-Iut-eolata subsessili.

Mountains of Ditto* in lie State of ChihuaLiu, 7,000-8,000 feet high, in pine wood*; ilnrcn in Octuber; *Dr. A. Wislizenus*, 1846. — Stems 10-12 iuebe* high, rtriodjf «wet; leaves 1-1| inche* long, 3-1 lines wide at Urn; calyx 9 lines luiig, nlii to the *hue*; pot); ttliiMh mrolln, 6 lines Iwig, willi A strongly nuirL-i k l , or tWllnlJ^ with an irregularly *luntote or ciliaU- inembmon at the bw of «Mb lulxs H«(U "fid, round*J, 0.3 lint- IUII^J. —. Abundantly dirtuigttinlwil bj the spathaceous calyx, which i» not fouml in itiiy odfaur allied ipenie^ llimi^li not rare in i! «f tmtkitu Pneumonan-thUH! Gelaniha.

GENTIANA (CROSSOPETA-trjt) n,vRiir.i.i..iT.i, *a. tjt. : a* caulibus i ["•mniii luuiatUi 1-4-caulis, bamttu, v,k«""rriniA, uniflora ; faliw ecntMulU ob-tusis mu^tw icttuMlnn *tut-*tilagineo-crenulatis, inftmiih-neari-oblongis in petiolum hilutnbad vaginam«nUjtt uUtuuuii, uultnU pimd» linMnbui Iw emnatim inferioribus 1 donfnrt" l«« »U«JTt4tu, mraimlt *t-4* bud lations (lomii ntbMHacu fat* ItttolucrtnUbiu wruli* t o»lyci« *-6di luW* tri«njpil»lo-UuwUlii lubo KIO ra longioribiu

PLAT» VII. — GweruKi WISLIZENI.

tabtra corolla locge exeedentflnu, enerioribtu ptulo lntiuribue uuugine merohnuaeeo wejiias rkntntfa; corolla laciniis lineari-oblongis obtusis erecto-potulio ouugiite cwiiio btrviter ciliolic versus Opkf m duntnliB m-bit ptufuiidit cultpanlilaiu intu* rul Ui*iin iiLiinentomni csltoiu fjltuidalifeni fe» ilnplo longiori-boa; ovario ovalo bui uttmuiua, stigmatibus semiorbiculatis sessilibtii; (wminilnm aquamalMia;

Ou tlio »l|.]iie ntujniit or Mimnt Flurw, in tlte Snowy Range, Colorado, *Dr. Parry*; flowers Septemliw.— A perenni-JU, 3-1 *inches* htt-b: radical IMTM 1 inch !nni(and 3-4 liitc* wide ; rinyin pair of raulijiB lnavtM on thd lower lutlf of llk- *lmrt it«n 1|-1| iiK-lm lung, narmwwi lit bto*; Uio 2-4 upper tnrolucnl leitnt roach bnp«lcr at btM; «-Iji iiboiit 1 incb imd curalta 1(Inches long ; lobes of corolla deep azure blue, about 1 tad) long, 3 line* *MV\V* ; tuba inakl* greenish yellow, willi Jiorl p«n Jwb-brown filamenti; lower put of tbc tila-uictitd attwrlHxl in the middle, UM *tna t&gm* boa* with long *uai* slender frimjwt; ubkinp ^Utids between lii« tatar* of l«e fila-ments rcry marked ; nerdc (un-rijK-) Trrr «iiniUr to iboan uf UM n)li>il *U. irinita,* rot^rfi from aoalea, whirb proptHjr an deaio-oatnl -nadclea, pmlnhlin^ eptdar-mia-«dU. Oar tpacic* it hi *may* twfwtt tb« Awcrka» Irepresenta-tive •*f tb« EuroptM *G. ciliata*; botli an ptmnriaU *itb abort lintsnelea, wkb dllil*] baaaa *tt* the IUa—rtl awl abort «fml «n-ries, but tb* aa»a» an TBJ 4U-ferent.[1]

GENTIANA (CiKmmo- [117] rnrix*) PROnuTA, war. AJUKIANA : OTBti* obtusis mucronulatis seu

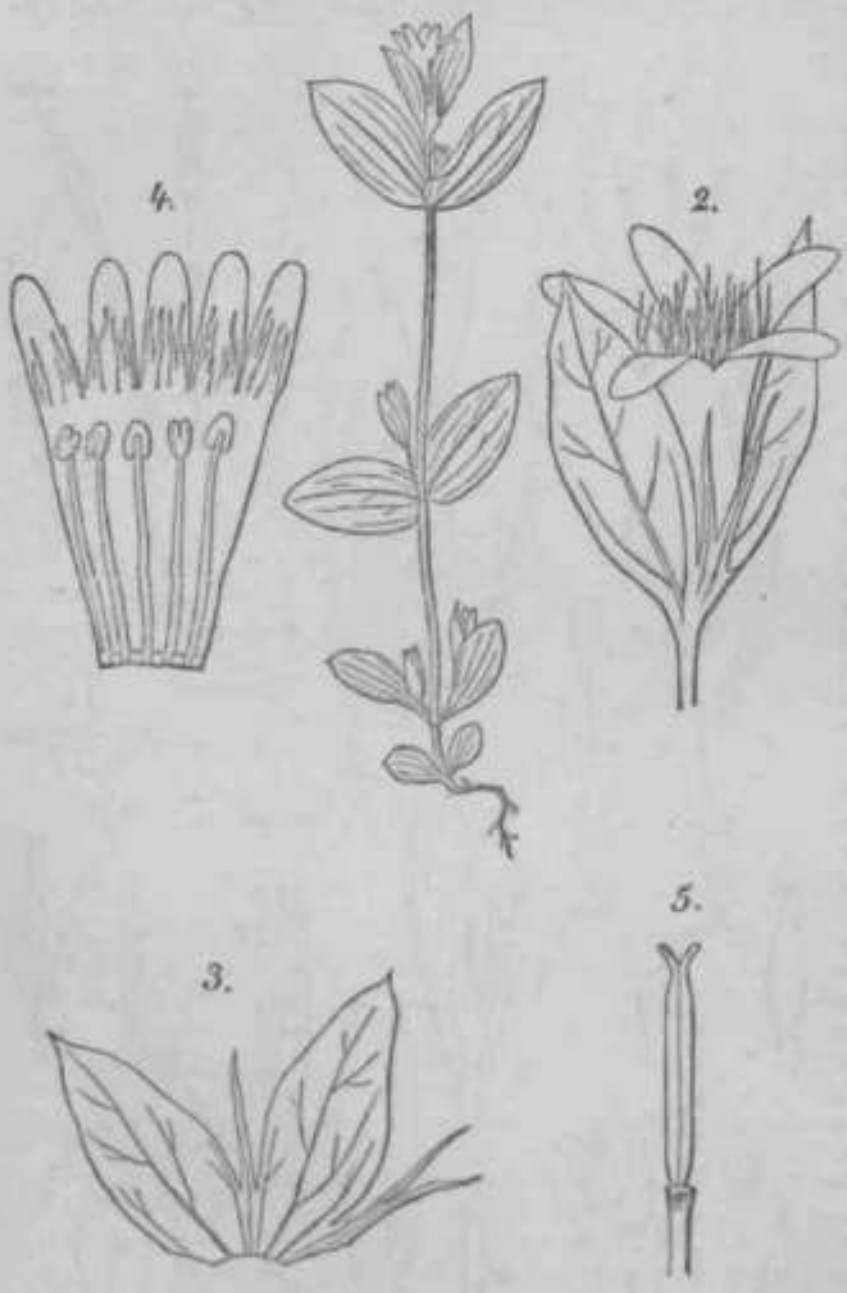


PLATE VIII. ~ GENTIANA HETEROPHYLLA.

[1] The section *of Crossopetalum* m«y Wtmofird t[>u> i -
a. Lepidosperma.

1. *G. crinita,* Frael. ; annua, in pedunculis elongatis multiflora, crossopetala. — Our American *G. detonsa* can be distinguished only by the narrow bases of the leaves ; the characters taken from the shape of the ovary are variable ; whether the original European *G. detonsa* is distinct, I cannot at present ascertain.

2. *G. lanceolata,* Gris. : perennis ? in pedunculis elongatis pauciflora, leiopetala.

I. 9. tiir*<Jhto, Ess- : perennis, in pedunculis subnullis aniAVn, aoaaopeuU.

k Pleurospermæ.

4, fl. nihcta, Lina. I pmasii. in pedunculis brevibus pluriflora, crassiusculata.

S. *O. H+yirt, (Jt*j* : annul, Ea p*dmcaft» elongata exi-IK Woj»Ula.

IV •«•» oC tb« MMBI *0. mmtiijtm, 9.* sacrosulpe, and Ut pnaatal *O.* aiaaraurt*, ill with fringed corolla, — unknown.

mntici*', floribiu parvU *i-Miu* arurew, calycis corollæque lobii aortii, ptid» truu^iiklaa jilermwmo intogrw; capsula lincari-ublon^a ill hUjiituiu brevriii attenuata.

On Mount *k'ltm* and other nljimo p«il.s of the Snowy ranges, Colorado, Parry, Nft. 3<X}; /Ai« ^ *Ihrb<>vT,* No. 475; Russian Arriic Amfriiiv Ckmiwi in Ilurb. Urey. — A veiy small form, t-^i inches tiigU, fuuylu or wilh A few aaocwUtig or pruettoMi linuichw Trom ilii! hue; iWua dwayg 4-portal (in tlw Knri,y*im pWt, which I have been unable to compare, they are said to 1«} 8-jnvrttnl), duup *mro blue, fij-fl linn bnj;, Marady 1 liiui in ilumieter; cAp*uJ<! tn|>uriii^ nt !«*;, ii'L nlini|i'.Iy mtmilodt nmli fiiu-lv Ktriuliit*:, ^ lino lam,

I[1]!. IX., Rg. in, 3 ffpecimotu of the smaller form, onL «/n; II, a flower; 19, c-Ki.Ujt, Uiil n]*n ; 13, pistil; 14,<*p*ule,—ali4tuuMtnag-uiOed | 15, ivdi, 10 *Ham* magni-

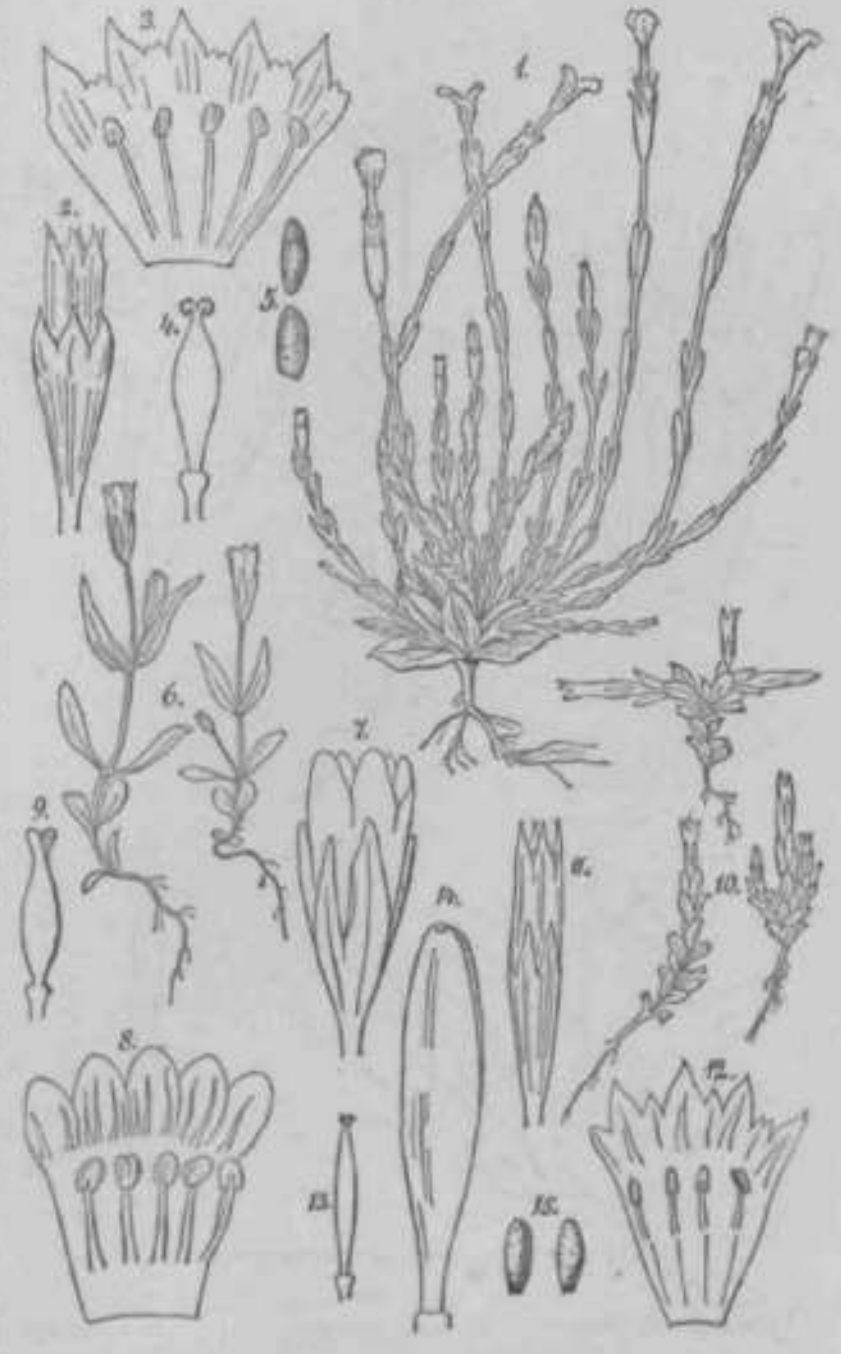


PLATE IX. — 1-5, G. HUMILIS. 6-9, G. ACUTA, VAR. 10-15, G. FRONTRATA, VAR.

GENTIANA (CHONDROPHYLLA) HUMILIS, *Stev. in Act.* tf«g.3,p.S48, *tx Grit, in IHf.* /W. 0, *p,* H*fi; '/. Krriwstu, Ttimy in Kn-m. lnl £xpuL, p. »1 ; at>Hi^ muUt, grassy baivki of Upper Clear Creek, Bear Cnnk. and oUwr iinmntain streams, with *PMyyo**'* ntiinntm,* alnvmt hidden atiii'iig gnuM and •odps; Parry, No, 131; //itif (^ *ffiirinttt,* No. 474; on ib« WIIL.1 I'JTCT Mountain*, ftwal; fluwrn Junn aud July.— SUpy (w l Of aweudiu^, rarely pnM-trate, one-flowered, fragile, succulent stems, 1-6 inrben litjfli : polo green leaves, with « braid white margin, cuspidate «inuemnalc,— loftertwci orbicular or OMU, rtxuLiie,—«ii-line once linear-oblong, ouunaUi at base and sheathing ; fl,,wcr* on •!»« or longer peduncles, *4~li* line* long, with spreadin green with UL>btKl wbile ami iniif-parent /pJd* (tfnuy tanocMir*) on a short stipe, itjrU Jiort wiih tt*ur*ed stigmas j c*i*nU on a rfipo of dlf-ferent Ixtii, iwiullj- niwd ai«->*« the eonJIa, but •UUKIIIDM andowwl »« < *i*l U»«»r at but, burrtJntf •Wo-•*!• Uuwtijh tins iDiorumetiu, a» •PP*» « Ibfl Jftft-hand bnuifth -f OBI-figure; valves of capsule at last widely opening, u Ih* figure tbom, and giving ij|p pjjmj K f,^ angular appearance; seeds irregularly linear-oblong, nearly ¼ line long, finely striulate, very similar to tho» of tk, last

Spacimwrt fr™ OM Altai UtmnuiH* tr« «b«il«t*Iy MrtitW with ours with [218] liwaml K wbieh in lb« furrow ban acnk awl in our* oUu* lobes. Pl. ». Fig. 1-5.

GESTIASA (FhnniauyrBt) PAIUIYI, M. *tp.:* cnuiibu« e ntrtiee peranni MoefldeiiiilinB vet owctL* spitlituu pu ftimjjliciUuit foliwtis p*nciflorw; fulii* yljiur-eacujitibu* « \wa tutu ovato~«ubtvtauJt» *omit* wa ktih obtmhiKults KU aaitw pataiis, sumuii* miguHtiunlnni cuiuaiu navkubtia *Bxaa temltn* invotumntfW; floribtu

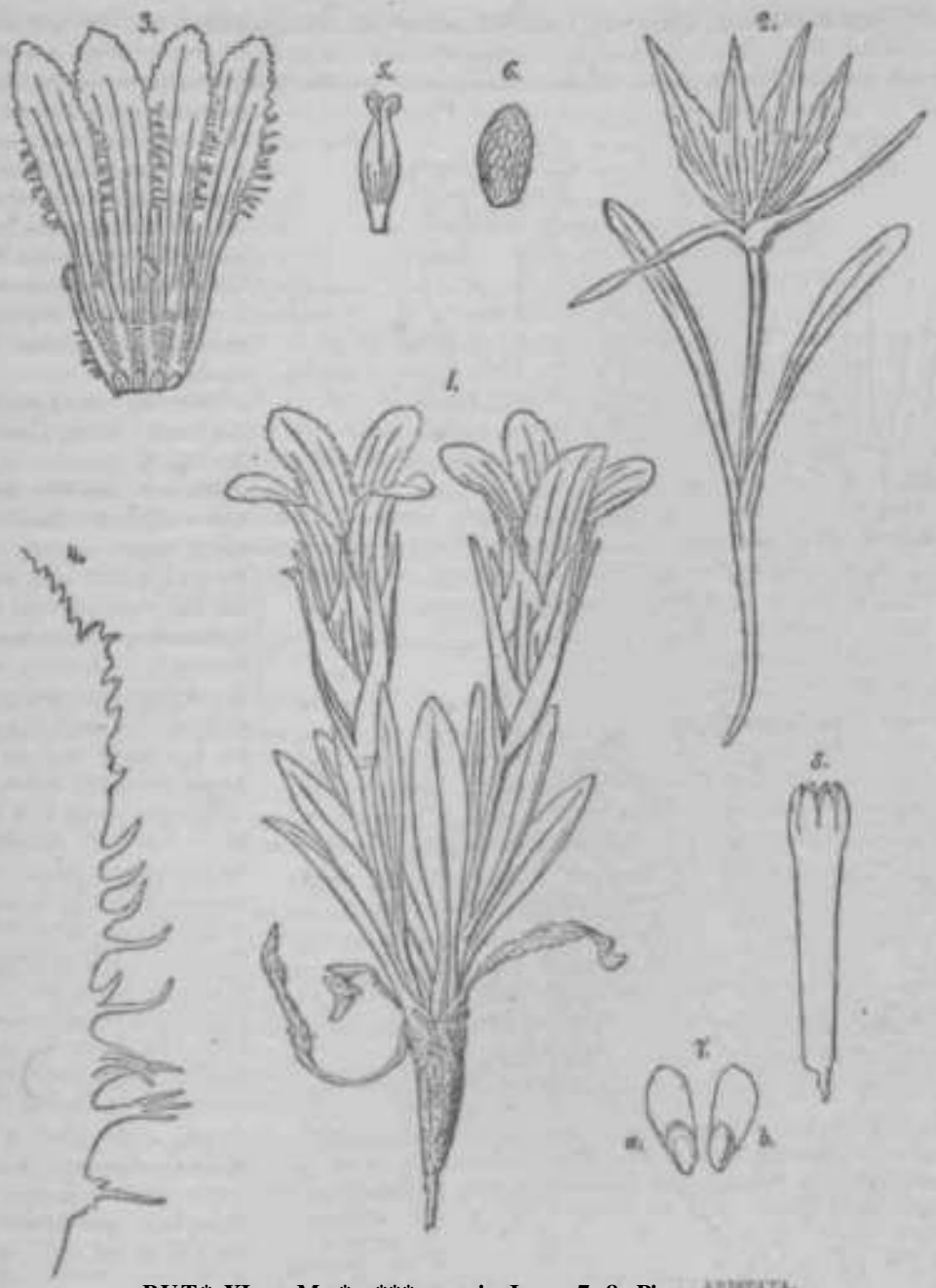
PLATE X. — GENTIANA PARRYI.

inJycio 5-tidi *iitu* jiliin mtuu* <p*iliaewo-fim lobb luicnrilnui tubo RUO lir-M-orilnui; corolttc a|M>rUt InW otiaiuii.i> calyct-m bU impetaiite, lf late olawutu hruviuiiMi Ij* plicM bi&lo* viz crarin hrwwlnto t*a in

Nfltr the 1 UK- Snowy Itan^u* *QAvm&t*, Parr%* JJii. 3Jt4, llif 1'ttuul-liiiii'rtl lunii : //all £ *Hathmcr,* 2*u. 47", l«rtlj" * iwir-n.*-WvtJfirtti; MiJdk-Park, J'ar-ry, varitty ; a Kino wtlli n«rrn* Itovvs hu alm> been collected by Frwufmt, Civaiifcld,mJ Howud,MFinf. Unj lofonu* ino. Flmrcr* ill Au^ntaL — A VITT Mnbng ipcdvaj the *Uxgb* dark jiurplidi Utw bwcai eonbwt-faiK l«««tir«lh with tbc bruit |H!B luivaa ; atum A-D iiichet b^b, km ln-LS or 16 liurf lonfTi and from 1 10 [l< liu» wklr, si: on the tdj.'es; Soiren 1^-18 lisa Jong, eitcWil by » pair of boat-ahaped bnctei ealrx wiii iU *whtxt* Iltmw ktbet half a* lun|; am Uw tut* of tlic uiniUit, oitii* a- fOKetiBM monorltM «Jit amiue«irl« ; lolwita* tbecon4Li«b. Uw tube, irkbr tipmrd* dMU at baw] at long u the lotaa, — 1 1 M ft oiJyf!uo,Gr»., diff«» *by* iu Aovcn, tlneaw of fcn>tf»-erttm, larjp! nval loW« of otln, mil \bn lcii^t suti ib»pd at Vm A JV.na<m, Qrb^ abd Mfrtn^a, PHIL, W kog fdlin ilit iuUi many

Pl. X. represents the broad-leaved fnnn nf EMM species; in tba figure on the left lUe th# *appmum,* leaf is bent down, to show the shape of the calyx •ml (if the litvi-u ; small ll.™..r bttili with tbetr bnoU tin MM CM ibt i

* Notes on several of Engelmann to Crk/i Euiutwtiitton al PUivi» o* (K» IUWIY »««W»« (Aawr. Joanj. «ei. u^j Art*, M «r. ml. i- 257, NM*. 904-tio. A Umrt xwiailma bf Dr. ftb- A !Urt»ur, U lit* PiwAMUagt «f



PUT* XI, — M, *•«***« nmimJ.m, 7. 8, Pixvn ARISTATA.

GENTIANEÆ OF WIlt-KLKlt'S BXPEDITIOH.

FROM EXPORT, ETC. VOL. Vl Bonar, »r J. T. IUmi«n», 1878.

ERYTHRÆA CALYCOSA, *Buckley; Gray, Synops.* 112.—Simple or branching from an annual or biennial [1878] base; erect stems quadrangular-winged; leaves linear-lanceolate (about 1 inch long), lower ones broader, as long as or longer than the internodes, rather contracted, petioles as long as or longer (or the upper ones shorter) than the large flowers (8–10 lines in diameter, rose-colored, with yellow centre); calyx about the length of the flower-tube; lobes of corolla oblong, acute, scarcely shorter than their tube; seeds small, 09 (1 : mm. long.

In the Gila Valley, *Rofhrock,* 1874 (325), and southeastward into Mexico, *Or egg,* etc —Stems 1-U feet high, the tallest of our species; leaves 1-1| inches long, distinguished by its large bi- or tri-colored flowers with acutish lobes. *E. venusta,* Gray, with which it has been confounded, is a smaller plant with larger deeper-colored flowers, broader obtuse corolla-lobes, and usually longer anthers and larger seeds.—The anthers of the different species of *Erythraa* are of different shape and size, from orbicular and oval to oblong and linear and J-4 or 5 mm. in length; all become at last spirally twisted after they have shed their pollen, the longer more conspicuously so, the shorter much less. The stigmas of this genus have often been misunderstood, probably because mostly observed in dried and pressed specimens. They are never capitate or funnel-shaped, but always bilobed. Before maturity, they remain closed, and only after the anthers have shed their pollen do both halves separate and spread out, just as the Gentians behave. In the form of the stigma I find valuable characters for the grouping of the species, and especially for the distinction of the American ones from those of the Old World. The stigmas of the former are flabelliform and broader than long; those of the latter are orbicular-ovate or oblong to linear ; shortest in *E. tpicata* and *lineari/otto,* and longest in *major,* where they are twice as long as wide, and in *maritima,* in which the length is 3 or 4 times as great as the width. *E. australis* from Australia, as well as *Cicendia* from Europe, have stigmas like [190] the American species, but *E. Chilensis* (at least a specimen collected by Ochsenius in Valdivia, which I refer to that species) differs from all the others in having elongated, cuneate, emarginate stigmas.

The seeds of *Erythraa* are identical with those of a large group of *Genttaneas,* which comprise perhaps all of Grisebach's *Chironiea* and *Chloreas,* being very numerous and very small, from \ to scarcely more than J mm. in the longer diameter, and, when fully mature, globose or oval, with their surface favose-reticulate.

The North American genera belonging to this group may be arranged thus : —

1. Stamens inserted in the tube : ERYTHRAA. EUSTOMA.
2. Stamens inserted in the throat: SABBATIA. MICROCALA. — CHLORA, CHIRONIA, and SEBJCA of the Old World also belong here.

My investigations have convinced me that the genus *Cicendia,* or at least its typical and original species, 0. *putilla,* is nothing but a reduced form of *Erythrva,* distinguished from it only by its small oval anthers, less than O5 mm. in length, too short to twist much, but still, when drying, sometimes twisting a little. Its stigma is by no means capitate, but regularly bi-lamellate, and, much like that of the American species, triangular-flabellate, and broader than long. The flowers are 4-parted, which often occurs in genuine species of *Erythrcea;* seeds 0.4 mm. long, large for the size of the plant. It will have to bear the name *Erythraa jnuilla.*

ERTTHRAA DOUGLASII, *Gray, FL Calif.* 1, 480; *Syn.* 113. — Slender, a span to a foot high, loosely and pnniculately branched, usually sparse-flowered ; leaves from oblong to linear, acutish ; flowers on strict, slender pedicels, 4-5 lines wide ; lobes of the pale pink corolla obtuse, much shorter than the tube ; anthers usually only 1 mm. long, style short, stigma about 1 mm. wide ; seeds subglobose, 0.4 mm. in diameter. — Arizona, Utah, and northwestward to Oregon. This plant has !>een confounded by Mr. Watson with his *E. NuttaUii,* which, however, is a smaller and more leafy plant, with larger flowers and much larger seeds (0.65 mm. long), but much smaller stigmas.

GBNTIANA[1] HUMILIS, *SUv.; Grueb. in DC. Prod.* 9, 106; *Engelm. Tram. Aead. 8t. Louis, 2, pi. 9>fig$.* [191] 1-5; *Gray, Syn.* 120. — Biennial, with large, broadly oval, rosulate, white-margined basal leaves, and few or

[1] The presence or absence of folds or plait* between the lobes of the corolla and the mode of attachment of the anthers to the filament separate the Gentians into two large aud very natural sections, already recognized by old authors : *Gcntianella,* Borkhaosen, Gray, has a corolla without folds and the anthers yersatile; *Pneumonanthe,* Necker, Gray, has a corolla with folds between the lobes and fixed anthers. It will not be useless to explain the term *vermUiU* in respect to anthers, as many seem to misunderstand it, so that they speak of versatile anthers as accidental and unconnected with • physiological process. The fact is that in *Gruiianei/a* tho anthers are introne in the bud and alter it first opens ; but as soon as the flower is fully expanded (generally toward the middle of the day) the anthers gradually assume a horizontal position (the notched base raised and turned toward the as yet immature and closed stigma), open the cells upward, and begin to shed their pollen. Toward evening, the now effete anther is turned over backward, and on the next morning wo find it hanging on the hack of the filament, the notched JjJJST end turned np and the empty cells directed outward. *Thm* in about twelve hours it has described an almost com-PltU dftU. In my figures of Gentians in the Transactions of the Academy of St Louis, vol. 2, pi. 7, 8, 9, and 11, versatile anthers are erroneously represented as turning indiscriminately outward or inward. This is a mistake, as the above account of the living art ion of the anthers shows. In the figures of *O.* Attmi/u and *prottraia,* pi. 9, the anthers are also figured as versatile in that unnatural manner, while in these species they are constantly erect and introne, as well before opening as when effete,

In *PHcunumantki* the anthers remain fixed in two forms. In one section, comprising mostly smaller plants, with smaller flowers *(O. prmtrata, venut, AlUiicn,* Atfmi/u, *utricu-/on,* etc.\ they are introrm. In another section, the true perennial large-flowered *huumtmanthe$,* to which we moat add also an annual, *G. DaugUuiana,* and the European *O. cruriata** they are extrores. In the genera /foZento, /V«n* *nufytu, Swertia,* and *Prascra,* all represented by plants collected in these expeditions, we. find the same arrangement of versatile anthem an in *Oatiimvlla.* It there/ore seems proper to enumerate, first, the Gentians with fixed anthem, and next those with versatile anthers, ami tken, Joining them, the other genera with similar versatile antbeffi arrangement.

many ascending Btems of a pale yellowish-green ; cauline leaves small, linear-oblong; flowers single, terminal; *coroUa greenish or whitish,* 4-6 lines long, tubular, with acute lobes, and short, notched folds; anthers oval, introrse; *capsule clavate-obovate, on a long stipe,* usually much exceeding the corolla; seeds oblong.

Wet, grassy spots in the higher Rocky Mountains; also in Asia. The long protruding capsules (trumpet-shaped when open), together with its pale, sickly look, give the little plant a very curious appearance.

GKNTIANA PEOBTRATA, *Haenke ; Griseb. 1. c.*; *Engelm. L cfigs.* 9-14 ; *Gray, Syn.* 120. — Annual, small, weak, 1-2 inches high, with horizontal or decumbent branches; leaves only 2-3 lines long, ovate, green with narrow white margins; *flowers azure-blue,* 4-parted, terminal on the branches, 6-6 lines long (or in luxuriant specimens sometimes larger) ; lobes ovate-lanceolate; appendages half as long, similar or sometimes notched ; anthers oval, introrse ; [192] *capsule linear-oblong, short-stipitate,* enclosed in the corolla; seeds oblong. —Alpine regions of the Rocky Mountain*, also in Asia, and rare in Europe, where it is said to have usually 5-parted flowers.

GENTIANA FRIOIDA, *Haenke; Griseb. I* e. I11; *Gray, Syn.* 120. — Cespitose stems, 1-5 inches high, with fibrous roots ; leaves linear to spatulate, thickish, pale, 1-3 inches long, their bases forming a long sheath ; calyx half as long as the corolla, with subulate lobes and, frequently, a cleft tube; flowers 1-3, crowded on top, funnel-shaped, H inches long, yellowish or greenish-white, spotted with red and brown; lobes broad-triangular, acute; reddish plaits wide, oblique, undulate-crenulate, almost entire; anthers free; seeds broad, narrowly winged, with crested ridges.

Springy places, in the alpine regions of the Rocky Mountains, and in Asia; very rare in Europe. — A very handsome plant in the color of its flowers. Its mode of growth is entirely different from any other of our species. The flowering stems bear in the axils of their lowest leaf-pair, within its long sheath, or breaking through it, leaf-buds which in the succeeding year produce flowering stems, while the base of the old stem withers away. The roots are therefore of only one year's growth, thin and filiform, never thick, as those of most other *Pneumonanthes,* nor is there a real caudex.

GBNTIANA PABBTT, *Engelm, Trans. Acad. St. Louis,* 2, 218, *pi.* 10; *Gray, Syn.* 121.—Few ascending stems from thick fasciculate roots, about a span high ; leaves glaucescent, thickish, about 1 inch long, broadly ovate to oblong-lanceolate, with a sheathing base, especially in the lower ones ? the uppermost boat-shaped and keeled, involucrating the single or few clustered flowers, concealing the calyx and often almost equal to the large deep-blue corolla ; lobes of calyx linear, short, sometimes almost obliterated, shorter than the campanulate often once- or even twice-deft tube; corolla 1* inches long, somewhat ventricose, its lobes short, broad, acutish, not much exceeding the narrow deeply 2-cleft appendages; anthers free; seeds linear-lanceolate, wingless.

Moist grassy places in the alpine and sub-alpine regions of Colorado and Utah.

GENTIANA AFFINW, *Grieeb. L c.* 114 ; *Gray, Syn.* 122. — Many stems, from a stout rootstock, with thick fasciculate root*, a span to a foot high, mostly ascending; leaves from oblong to lanceolate or linear ; flowers [193] small for the section, 1-lJ inches long, usually clustered in the axils of the upper leaves, rarely few; bracts lance-linear; calyx-lobes linear, unequal, usually shorter than their sometimes cleft tube; lobes of the blue corolla acute, plaits bifid, anthers unconnected; sessile stigmas lanceolate; needs narrowly, or sometimes more broadly, winged.

YTot, grassy places in the Rocky Mountains of Colorado and Utah. The numerous thin seeds are borne on the whole inner surface of the capsule, which thus not only has the function of a placenta, but really seems to be nothing hut a thin, membranaceoua expansion of the placenta themselves, forming a free sac within the capsule, which originates from the commissures of the carpels, and remains attached to them only, and is at last otherwise entirely unconnected with the walls of the capsule. It in probable that all the *Pneumonantlus* with ovules from the entire inner surface of the capsule have this structure, and that in the others the ordinary arrangement of commissural placenta Prevail*.

GBRTIAHA BIRRATA, *Gun. Fl. Norveg.* 10 ; *Gray, Syn.* 117. *G.* (fctonw, Rottb. Fries, Gray's Manual, 5th ed., 387. —Low, simple specimens, a few inches high, with single flowers, 1-11 inches long. Mount Graham, Arixona (751), at 9,000 feet altitude.

The Norwegian specimens of this plant in my herbarium have much smaller flowers than ours and much smaller scales. The "scales" which roughen the surface of the seeds prove, when moistened, to be transparent vesicles, single Protruding cells of the epidermis. In the Norwegian form these vesicles are small, oblong, or cylindric ; in the American specimens they are much larger and mostly hemispherical; in the allied *G. crinxta* I find them large and oblong.

GWTTIAHA BABBILLATA, A p t * . *Trans. Acad. SL Louis,* 2, 216, pi. 1 1 — Has thus far been found only in the mountain* of Colorado, near the timber-line, and *w* a very distinct species, which can in no way be confounded with ***rata* or *simplex.* I have already, in the first account of this species, given the diagnostic characters, and have •ho stated that it is the only perennial one of the section *Crostopctalum* in America, somewhat allied to the Eu- [194] Topuau *0. cMcUa,* also a perennial species, which u**l to IK claimed as an annual; *barbeUata,* however, has •ted* similar to those of *serrata,* though much smaller, while *cUiala* has the winged seeds of *simplex,* and has an indefinite number of leaves. I have since had the opportunity of studying *barbellata* iu the mountains of Colorado, and

found that it possesses a creeping, filiform rhizoma, 2-3 inches below the surface, from which at intervals filiform •terns arise. These bear, at their thickened upper end, where they reach the surface of the soil, an undeveloped terminal bud of indefinite growth, and lateral annual flowering stems, the scars of which, enveloped by withered leaf-bases, can be traced sometimes for five or six years back. The vegetation of the plant is accomplished in the following manner. Each season the terminal bud develops two pairs of basal leaves ; from the axil of one of the outer leaves the single flowering branch originates. Inside of the two leaf-pairs just mentioned, we find a third and a fourth pair undeveloped, about half an inch long, which are to grow into the basal leaves in the following season ; and within these the four leaves of the next succeeding season, now only half a line long, are already preformed. The flowering branch, usually 3 or 4 inches high, normally bears one pair of leaves in the middle, and a second involucral pair just below the almost sessile flower; the four sepals are opposite these four leaves, and the four corolla-lobes alternate with the sepals, and so on. In the axil of one of the third pair of basal leaves preparing for next year, usually alternating with, or sometimes opposite to, the present flowering branch, the bud of next year's flowering apparatus is already four lines long; it shows plainly the two pairs of leaves and the calyx, and, in a very rudimentary state, also the corolla. Thus each year's vegetation exhibits at the flowering period (August and September), on the primary axis, two pairs of leaves for the present, two pairs for the next, and two for the third year, a secondary axis with two leaf-pairs and the flower, and another preformed secondary axis with the rudiments of the same organs for the next year. No other Gentian has, as far as I know, such a typical growth, with the regular preformation of all the organs ; but we find the same among other plants in other families, a striking example of which is furnished by our *Ntlwmbium.* The regularity in our Gentian is not as absolute as in *Nelumbium;* for occasionally two flower- [195] ing branches are found on the same plant, or three pairs of leaves in place of two, or, very rarely, the upper involucral leaves bear one or even two axillary flowers.

GENTIANA WISLIZENI, *Engelm. I.* c. *pi.* 7 ; *Gray, Syn.* 119. —Annual, erect, a foot or less high, with the habit and the many-flowered thyrsoid-paniculate inflorescence of the next; leaves from lanceolate to ovate, 1 inch or less long, with an obtuse or subcordate base ; calyx of barely half the length of the tube of the corolla, with very small teeth, its membranaceous tube cleft, and often, in age, dejected; corolla pole purplish, 4-6 lines long, acute lobes fringed above the base; capsule linear ; seeds subglobose.

White Mountains of Arizona, *Rothrock* (799), in 1874. This is the only known locality within our flora of this rare plant, which was discovered by Dr. Wislizenus over thirty years ago in the mountains west of Chihuahua.

GENTIANA AMARELLA, *L*$_f$. var. ACUTA, *Hook. f. Gray, Syn.* 118. *G. aeuta,* Michx. — Annual, 2-20 inches high; stems wing-angled, usually much branched; lowest leaves otavate, petiolate, upper ones lanceolate sessile; inflorescence paniculate or strictly thyroid, with shorter erect or in some forms with elongated patulous peduncles; calyx deeply 5-cleft; herbaceous lobes lance-linear, somewhat unequal, often as long as the tube of the bluish-purple corolla, the lobes of which are oblong, obtusish, beset at base with copious (or in the diminutive alpine form, few) sets; sessile capsule linear ; seeds RUI globose.

Grassy places in the mountains of Colorado and northeastward. The true European *Q. Amardla* has usually 4-parted flowers. *

HALKNIA ROTHBOCKII, *Gray, Proe. Amcr. Aead.* 11, 84; *Syn.* 127. — Annual, a span or two high, loosely flowered; lower leaves small, spatulate, those of the stem distant, lance-linear, the uppermost closely approaching subverticillate ; flowers cymose-subumbellate, on slender peduncles, often in sevens, nearly 6 lines long, bright yellow, ovate, acute lobes a little longer than the campanulate tube, the five spurs curved, horizontal or ascending, half as long as the corolla; stamens from the throat of the tube; anther* versatile ; seeds subglohoee-ovate.

On Mount Graham, at 9,000 feet altitude; in flower in September, *Rothrock* (733), in 1874. Evidently [196] allied to three Mexican species which have also umbelliform cymes; the innermost involucral leaves bear single flowers, the outer ones usually two, and a later secondary flower i« borne on a shorter peduncle behind a primary one. This is the only Western specie* yet discovered. PLATE XXI. Natural die. 1. Flower, 6 diameters. 2. Mature capsule, cross-section, about 6 diameters. 3. Vertical section through flower, about 10 diameters.

PLEUROGYNI' ROTATA, *Grimb.; Gray, Syn,* 184. *Swertia rotata,* L. — Stems ft-10 inches high, the smallest ones one-flowered, others thyrsaid-bnmched, many-lowered ; leaves lance-linear ; sepals linear, acute, at long as the milk-white (j-1 inch wide) corolla, acute at both end*.

Moist, *gn»y* places in Colorado, sometimes in large patches, and then disappearing again for years. The spreading flowers of this and the ucxt two genera afford the U*t opportunity of uWrving the action of the versatile

f PLRITROOYNK, *EtchKh.* — Frwt snnnals of cold or alpint regions, with opponito learn, few or numerous whiti»h flowers in a fastigiately much-branched panicle ; corolla rotate, often 4-parted, in our speHes with a pair of nectarifcrous Pits at U» ba*e of the lobes siirronnded by a funnel-shaped crest or • MnjH nralc; stamens versatile; ortry lamtolaff*, taring the linear stigmas decarnut down the sides on the sutures; ovule* abundant on the broad placorta both stiles of the sutures ; capsule oval, i mil wassail J seeds oblong, smooth.

anthers as they slowly tarn from the introrse to the horizontal, and then to the extronely reversed position, a* explained above. The glands on the base of the corolla-lobes are distinct enough, but the surrounding scale is apparently not, as it is ignored by many botanists; I have seen it variable, longer or shorter, but always present; when fully developed, it forms a complete crested or fringed funnel. The stigma of this plant is most peculiar, formed as it is directly on the commissure of both carpels and representing a broad stigmatic line commencing abont { line below the non-stigmatose apex, running down the sides to the same distance above the base, so that we have here a two-carpellary ovary with two lateral, but without any apical stigma. This line is beset with elongated stigmatic cells or papilla about 0.1 mm. long and £ as wide. At the proper time numerous pollen-grains are found adhering to the stigma, many of them developing their tubes. The seeds I have been able to examine were not fully matured, but such as they are, they appear oval-oblong, not flattened nor margined, but slightly angular and nearly 0.5 mm. in the longer diameter.

SWERTIA* PERRNNIS, L.; *Gray, Syn.* 124. —A span to a foot high; lowest leaves oblong or obovate, 2-4 [197] inches long; upper few and narrow, sessile; flowers 1 inch wide. —Colorado and Utah mountains, in boggy places ; also in Europe and Asia.

FRASBRA SPECIOSA, *Dougl. in Griseb. Gent* 329; *Hook. Fl* 2, 66, *tab.* 153;* Gray, Syn. 125. — Biennial; stem stout, 2-6 feet high, very leafy ; leaves in fours and sixes, nervose, the radical and lower cauline ones linear-oblong, 6-40 inches long, acutish or obtuse, the upper narrower and shorter; flowers numerous, in a long leafy thyrsus; lobes of the greenish-white (rarely bluish) dotted corolla oval-oblong, acutish (6 lines long), bearing a pair of contiguous and densely long-fringed glands about the middle, and a distant transversely inserted and setaceously multifid scale4ike crown near the base; anthers versatile; capsule compressed contrary to the deep boat-shaped valves ; oblong seeds flat, margined. — Willow Spring, Arizona, *Bothrock* (251), in 1874; Colorado, *Wolf* (790), in 1873. A mountain species, found in the Rocky Mountains and westward to California and Oregon.

GENIOSTEMON, *Engdm. & Gray,* is characterized by Gray in Contributions to North American Botany (Proceedings of the American Academy of Arts and Sciences, voL xvi. n. ser. vol. viii. 1880, p. 104>—EDS.

VII. COLLECTED SPECIES OF ASCLEPIADEJE.

FROM ENQEUIAN* AND GRAY'S PLANT* LINDUEIMERIANJB, PART I. (BOSTON JOURN. NAT. HIST. VOL. V. 1850).

272. ASCLEPIAS (OTARIA) LINDHKIMERI, *Engelm. dt* Gray [42]. 273. GONOLOBUS CYNANCHOIDES, *Engdm, & Gray*

FROM THE REPORT ON THE MEXICAN BOUNDARY, VOL. II., BOTANY, 1859.

ROULIHIA UNIPARIA, *Engdm. mm.* (*Gonolobus unifarius,* Scheele) [160].

ACIRATEB AURICULATA, *Engdm.* twi.: caule erecto glabro; foliis sparsis linearibus filifonnibus ; umbellis [160] pluribus axiUaribua multiflorus breviter pedunculatis; pedicellw pilosis calyce extus viloso ; corolla* laciniis ttflexia; eucullis gynostegio globoso seasili brevioribus apice leviter tridentatis margine involutis basi latiflsime Wswiculatis; folliculi* lanceolatis longe rostratis brevibus.. Dry ravines near the Copper Mines, and along the •tabus, JQM and July; *Bigdaw.*

84B00tTlMIlA HITEHOPHYLLUM, *Engdm.* «»• '> ToW- ta VuXl **&"»& ^P- V. p. 362 [161]. A«3L1PIAS HIVOLUORATA, *Engdm. mm.* [163]. ASOUBPIAB BEACHYBTBPHijyaf^eki. *mm.* [163].

FROM FAERY'S BOTANICAL OBSERVATIONS IN SOUTHERN UTAH (AMERICAN NATURALIST, VOL. IX. 1875).

[1]. ASCLIPIAS LEUCOPHYLLA, *n. $p.* Erect, taU; leaves (upper) sessile with a broad cordate base, [348] tapering to a sharp bristly point, white tomentose; umbels many-flowered, alternating, lateral and terminal; ?«di<*U a Httle shorter than the peduncles; calyx tomentoae; corolla woolly outside; hoods as long as the short-thickened nectariMal tube, slightly spreading, ovate, obtuse, rounded on the inner margin ; born from the lower part of

[1] ftWKRTlA, *L.* — Wotfe-stemmed pcrennUl* ; leaves oc-**ta»ny altornata, the lowest ones UprrinR into an rlonf»Ud, marglDed petiole; inflorescence thyrsoid ; flowers blue; corolla rotate, with a very short tube ; nectariferous pita at the bane of its lobes crested with a fringe; anthers versatile; seeds flat, winged.

the hood, broad ascending, horizontally incurved over the cusps of the anthers; pollen-masses lance-linear, slender, slightly curved.

Dry sandy " washes " of the Virgen River, flowers in June, fruit not seen. Stem 3-5 feet high ; upper leaves 3J-4 inches long, l£-1£ wide near the base, gradually enlarging downwards, white toinentose on both sides, becoming mottled when old. Peduncles about 1 inch, pedicels } inch in length; (lowers about the size of those of *A. Cornuti,* with yellowish green corolla and yellow crown. This species is closely related to two other white-woolly south-western species, viz.: *A, vestita,* II. & A., and *A. eriocarpa,* Benth.; the former of which has also long-acuminate [349] leaven, but those of the latter are oblong and obtuse at both ends; all these have a short-stalked crown, broad ovate truncate or rounded hoods, and a short broad horn.

In *A. leucophyUa* the hoods are largest and fully as long as the anther-tube, rounded and not dentate at the upper inner edge; the broad falcate horizontally incurved horns originate from the base and lower half of the hood ; cartilaginous margin of anthers long, obtuse-angled at base; pollen-masses slender, f line or more long; pistils glabrous.

In *A. eriocarpa* (Hartweg's original specimen in herb. A. Gray, Remy in Mus. Paris) the hooda are shorter than the tube, angular or forming a tooth where the upper and inner margins meet, with two distinct saccate lateral projections; the broad, falcate, horizontally incurved horns originate from the entire midrib of the hood or its upper half; cartilaginous margins of the anthers shorter, sharp-angled below; pollen masses and pistils as in the last.

In *A. vestita* (Douglas[1] original and Bolander's specimens in herb. A. Gray) the short hood reaches to the top of the anther-tube and has a long horizontal tooth where the upper and inner margins meet; the broad obtuse horn, incurved but more erect and exsert than in either of the allied species, originates from the middle and loQpr part of the tube; cartilaginous margin of anthers Bhort, rounded below; pollen-masses only £ line in length, broad in proportion and more curved; pistil hairy.

209. ASTBPHANUB UTAHBN8IB, TL #p. Glabrous, slender, spreading stems from a thick cylindric root; [349] linear or filiform leaves; axillary few-flowered umbels; dull yellow minute flowers; corolla deeply campanulute with sub-erect cucullate lolies with inflexed points; follicles slender, long-acuminate, smooth; seeds scaly. Drifting sandhills near St George, the fleshy roots penetrating to a great depth, giving origin just below the surface to the slender branches, that twine on adjoining shrubs or swing loosely on the scorching dry sands. Flowers in May; fruit in June.

This very peculiar little Asclepiod has its nearest relatives at the Cape of Good Hope, with one or two stray species in the West Indies and South America. The whole plant is of a grayish green color, the thick cylindric root light brown ; the branching stems from less than a span to over a foot in length ; leaves about one inch long, J line wide; flowers about 1-1} lines wide. The corolla i* almost closed by the cucullate inflexed points of the lobes, and is glandular papillose internally, so that here these lobes themselves assume the shape and perform the functions of the hoods of other Asclepiads, to allure and retain insects to assist in the fertilization of the pistil. The pendulous broadly oval pollen-masses are only one tenth of one line long; slender follicles 2-2^ inches long; comose seeds usually rough by scale-like protuberances.*

VIII. PAPERS ON LORANTHACK&

FitoM OEAT'S PLAHTA FtxDLiiuANji (MEMOIRS AMIR. ACADEMY, H. a., VOL. IV. 1849).

281. PHORADRTDRON JUNIPIRIHUM, *Engdm. m$s.*: glabrom, canle articulato divaricatim ramodssiiDO [68] nmisque teretibus; ramulis compressis; folii* squanueformibus connatis truncatis vix cuspidatis pelviformibos breve ciliatis; spicis famineis lateralibus oppositas abbreviate bifloris; floribos bractea inferior© majore et duabos lateralibos in cupulam connatis ciliatis faltis globosis 3-(rari«me 4-)lobis. —[M] Parasitic on the two kinds of 8hrub Cedar (Juniperus) which grow on the hills and elevated plains about Santo Fe\ and on no other tree; sometimes faming clusters of more than a foot in dianieter ai^ thjee-foorthi of t foot in height Wherever they aw found,

• Dr. Enfeimann also contributed the article on Aacie-*P**m* to Bothrock't Botany of Wheeler's Expedition, 1878, 187-189; bat It contain, no new species. Deacriptions are g w o C /Miofrtfa *cymmekoideM,* Gray, *P. HnmriM,* v«r. *nmuypkiilai* Gray, *A$depia$* ftuNrfveniJa, Kngelm., and *A. mnm*m9* rar. *mdmrticUlata,* Oraj.

A. EOraoftBiAFOLiA, *Engtlm.* fa fcrfc, *l»* described by Gray In Contribntiona to North American Botany (Proceedings of the American Academy of Arts and fletaeea, TOL XVL 1880, p. 104). A. 8uLLiVAjrrii, Jftyslm., fe described in Ora^s Manual first edition, p. 866.

GONOLOBUS RBTICFLATUB, *JSngelwu mm.,* is described by Gray (Proceedings of the American Academy of Arts and Science*, rol. xii. 1876, p. 75). — KM.

they abound on many neighboring trees. The berry is globose, glossy, of a light champagne color, with a tinge of led when driedi" *Fendl.* — The specimens are all fertile and in fruit; so that it is not known whether the plant has the anthers of the genus, but of this there is little doubt, as the species is apparently too closely allied to the *Phoradendron Californicun^* Nutt., which is " parasitic on a *Strombocarpus."* (Prosopis).[1]

282. ARCEDTHOBIUM OXYCEDRI, *M. Bid). ? (A. gradle,* Engelm. mss.). 283. A. OXYCEDRI, *M. Bieb. ?* [59] *{A. robtutum,* Engelm. mss.)

FROM GRAY'S PLANT* LINDHEIMEHIAN*, PART II. (BOSTON JOURN. NAT. HISTORY, VOL. VI. 1850).

PHORADENDRON FLAVESCENS *(Nutt.)*: ramis teretibus; foliis oblanceolatis obovatis nunc orbiculatis obtusis [212] in petiolum brevem attenuatis trinerviis; spicis niasculis subverticillatis folium aequantibus, articulis 4-5,15-35-floris; fcouiineis suboppositis folio brevioribus, articulia 3-4, 4-10-floris; floribus depresso-globosis annulato-carinatis

1 The genus *Phoradendron* has recently been briefly indicated by Nuttall (in Jour. Acad. Philad. n. Her. 1, p. 185), but was unknown to Dr. Engelmann when he communicated to me the subjoined characters of *Viscum, Arceuthobium,* and *Spiciviscum,* Engelm., and of some species of the latter, the name of which I have necessarily changed to *Pfwradcndron.*

1 VI8CUM, *Linn.* Flores diu>ci *campanulali. Fl.masc.* Perianthufll 4-fidum ; *anthem lobis totis adnatcc multicclu-*foft*, *poris plurimis dUhiscentes. Ft. fern.* Calyx tubo cum ovario connate, niargine iutegro, limbo obsolete. Corolla 4-petala, summo calyci inserta. Ovarium inferum, unilooulare ; ovulo unico pendulo: stigma sessile, obtusum, subbilobum. Bacca pulposa, corolla persistente coronata, raonosperma. — Frutices gerontogei, foliosi, parasitici; foliis oppositis ; floribus masculis glomeratis terminalibus ; frcmineis in spicas vtioulaUs breves terminales congestis, in quavis bracteae axilla singulis.

I have examined only *Viscum album,* and based the characters on that species.

2. SPICIVISCUM, *nov. <rn.* [lego PHORADENDRON]. Floras dtaci *globori. FL mate.* Periaiithium 3-(roro 2- s. 4-)lobum ; *antherm lobis imis adnato, transverse biloculart*, Porit «. rimuliM veriicalibus duubus dehiscent*. FL ftm.* -•Perianthium S-(raro 2- s. 4-)lobum. Ovarium inferum, unitocolare; ovulo unico pendulo: stigma sessile obtusum. Btcca pulpona, perianthio persistente coronuti, monospenna. — Frutices Araericani foliosi a. aphylli, i«nu»itii-i; floribus in spicas axillares loiigiores interrupts* articulatas s. abbre-•i*t** dfKMitis, sape pluribus supra quievis bracU« axillam rhachidi immersU; bracteu abbreviatis connatU vaginulam pelviformem formantibus.

«. ARCEUTHOBIUM, JIT. *Bieb.* Flores diced, oroit, *"*prmL Fl. man* Perianthium tripartitum, *anther* fobis* •Wrfiit abate, *globome, unilocularrs, rinula trntuversa dchis-*«»*•. *Fi./mm.* Perianthium brevissime stipitatura, Wden-'*tum. Ovarium inferum, uniloculare ; ovulo unico pendulo: stigma sessile conicum. Bacca (pulposa f) corolla persistente coronata, mononpernia. — Frutices gerontogei et Americani, •l*ylM, articulati; foliU ad squamas connntas pelviformes vtdnetls ; floribus axUaribus torminalibus<iue, mascuUs 1-3, terMiJJdgU.

PHORADENDRON, NUTT. P»J

• *Aphyila.*

1. [P. OAUFOR* trim, *Nutt. 1.1* MounUins of Califor-•• Perhaps same as the next]

*• P. ttrKtPBRtNUM, *Rnqelm. supra.* SanU Fi.

• • /b/iosa.

8. P. FLATRnrtKi, JViitt. Z. e.! ramis teretibus ; foliis obmtls in peUolum attenuatit 3-oenriiR, junioribus puberulis; spicis folio brevioribus; bracteis truncatis ciliatis; floribus in quovis articulo 6-10 depresso-globosis annulato-carinatis parce pubescentibus 8-(raris8ime 2-)lobis. *(V. finvescens,* Pursh.) — On *Platanus* and *UlmuB,* in the woods of the lower Ohio and from there south ; on *Populus,* along the Kio Grande below Santa Fé *(Dr. Wislizenus).* A well-known species ; flowers half a line in diameter.

4. P. ORBICULATUM, ft. *sp.* \ ramis teretibus; foliis orbiculatis s. ovato-orbiculatis breviter et abrupte petiolatis indUtincte trinerviw pubescentibus demum glabratis ; spids folio brevioribus puberulis, etc., ut supra. — On different species of *Quercus;* on *Q. nigra,* sterile hills of Arkansas *(Engelm.)*; on several oaks, San Felipe, Texas *(Lindheimer).* — Leaves on the older branches exactly orbicular, 6 to 10 lines in diameter ; young leaves somewhat longer than wide. J>etiole8 a line and a half long : flowers half a line in diameter.

5. P. TOMENTOSUM : tomentoRum; ramis teretibus; foliis obovatis s. oblanceolatis obtusis in petiolum brevem breve attenuatis, senioribus subtus obscure trinerviis; spicis masculis folium longe superantibus ; bracteis trunratis, articulis elongatis multi-(15-25-)floris ; spirits foemineis folio RUD-brevioribus opixwitU s. verticillatis ad apicem caulis]>aniculatim congi*stis, articulis brevioribus sub 8-floris ; floribus itinnersis deprasso-globosis annulato-carinatis puberulis 3-(rarisRime 4-)lol»is. *(V. tomentosum, DC.* Prodr. 4. p. 670). On *Algarobut* and one or two other *Mimowot%* near Rinconadu, Northern Mexico, *Dr. Gregg.* — No doubt the same as De Candolle's plant, which was collected in Northern Mexico by Rerlandier, also on *Mimosca.* Leaves an inch or one and a quarter long, and half as wide. Sterile spikes one and a half to two and a half inches long : female spikes only about au inch long : flowers very similar to those of both the foregoing species, and of the same size or rather smaller. Fruiting spikes slightly elongated, an inch to an inch and a half long: berries one line and throe-fourths to two lines in diameter.

6. P. LAXCEOLATUM, fi. **p.* : glaberrimum ; ramis teretibus ; foliis lanceoiatis elongatis subfalcatis obtusiusculis in petiolum breviHsimum sensim attenuatis 3-5-nerviis ; spicis masculiri folio brevioribus ; bracteis triangularibus connntis ; articulis 8-18-floris ; foribus immersis globosis S-(rarius 4-) IOWR. — On •' Live-Oak," Rinconada, *Dr. Gregg.* — leaves 3 inches long, half an inch wide : sterile spikes an inch and a half to two inches long. Flowers less than a line in diameter ; distinguished from those of the foregoing species by being destitute of the horizontal edge, and entirely glabrous, as is the whole plant. Anthers very distinct, similar to the common form of two-celled anthem, opening longitudinally, while in the other species they open by two pores. — Apparently near *V. Schicdcanum,* DC., but distinguished by the terete branches.

biflnchlets sterile; the next joint producing two leaf-buds; the 2 to 4 following joints bearing flowers, one of which is terminal. The usual state probably is, where only the last two joints bear flowers, the ultimate one a terminal, and the next below two lateral flowers; that is the state described by DeCandolle: "floribus fioeinineis ad ramulorum apices tribus." But in the specimen before me most branchlets bear from 6 to 9 flowers, on the last [214] three or four joints, one or two in each axilla. Flowers minute, 0.3 of a line wide and 0.4 long, on very short, enclosed pedicels, which apparently are elongated immediately after flowering. Pedicel of the young fruit (ripe fruits not seen) half the length of the fruit,

2. A. AMERICANUM, *Nutt.*: caule ramisque fasciculatis teretibus gracilibus patulis; squamis truncatis in vaginulas dilatatas cupuliforuies connatis; floribus masculis axillaribus terminalibusque nee spicatis. — Oregon, on Ptnui, NuttalL — Considerably resembling the slender forms of var. a. of the next species, but smaller, slenderer, and at once distinguished by the terete branches, the fasciculated branchlets, and much dilated vaginulte. Female plant and fruit unknown to me.

3. A. CAHPYLOPODUM, n. *$p.*: ramis oppositis seu dichotorois compresso-quadrangulatis; squamis truncatis bPeviter cuspidiitis in vaginulas snbcylindricas cupuliformes connatis; floribus axillaribus terminalibusque plerumqne in spicam simplicem s. corapositam aggmgatis, masculis singulis vel binis ternisve, fcemineis in quavis axilla singulis ; boccis exserto-pedicellatis patulis s. recurvis. — Var. *a.* MAORARTHRON : caule compresso vix angulato ; minis pleruraque gracilioribus ; articnlis plus minus elongatis; floribus famineis sparsis et in ramulis brevibus paucis seu in •picas simplifies aggregati*. — 0 . ? BRACHYARTHRON: caule tereti robusto; ramis robustis articulis abbreviatis diametro vix longioribus; floribus focmineis in spicas den saw compositas aggregatis. — I have comprised under this name different forms, which, when better known, will probably have to be separated as distinct species. My specimens are HO incomplete that I cannot even satisfactorily determine whether the different forms which constitute the first of the two varieties will finally be retained under one species. — Var. a. has been found in Oregon (only on *Pintu pondtrota), Gqfer;* in New Mexico (only on *Pinn$ eddii), Fendler,* 282; and in California, *Dotiglcu.* — The specimens from New Mexico (only male and female flowers seen) have short female spikes, bearing 2 to 5 flower*, or the flowers are scattered on the branchlets: the flowers are elliptical, 0.4 line wide and 0.5 long, almost sessile. GeyerV Oregon plant (I have seen only a fruiting specimen) has more elongated many-flowered female spikes; the flowers apparently ovate; pedicel hardly one-third the length of the (not quite ripe) fruit. The Californian plant (nude and female flowers and fruit) is much stouter: male flowers twice as large as in the specimens from New Mexico, and not rarely 4-parted ; female flowers in more elongated spikes, elliptico-orbicular, small, 0.4 to 0.5 line in diameter; the recurved Pedicel more than half the length of the fruit, which is 2 lines long and 1.3 wide. — Var. 10. has been collected in Mexico by Coulter. I can hardly doubt it to be a distinct species; but my tneans to distinguish it are at present too limited. The stout terete stem, the short joints which are hardly longer than wide, the crowded compound or penJded spikes which resemble those of the following species, and the larger ovate (not elliptical) flowers appear to indicate tpecifio distinction. Fern, flowers 0.6 line wide and 0.8 line long; fruit 2 lines long and 1.2 lines in transverse diamW.,the pedicel more than half as long as the fruit: male flowers not seen.

4. A. CRTPTOPODUM, n. *tp.*: caule ratniaqne acute quadrangulatis robustis articulis brevioribus ; squamis truncatis in vaginuins cnpulatos connati*; floribus in spicas densas compositas congestis, fceraineis ovatis in quavis axilla singulis; baccis breviiwime incluso-pedicellatis erectis. — Santa Fe\ only on *Pinu» bradiypUra,* A. [215] Fendler, "No. 283. — Hooker's *A. Oxycedri* from the Hudson Bay country appears to belong here: the figure •hows at least suheetsile, erect fruits; but the segments of the male flowers are broadly oval, while those of the New Mexican plant tie lanceolate.

PROM "THE TRANSACTIONS or THE ACADEMY OF SCIENCE OF ST. Lours, VOL. III. 1878.

Dr. Engelmann exhibited a living specimen of the Black Spruce *(Abbs nyjra)* fresh from the Adiron- [lxxxiii] **** or New York, infected with a diminutive punwite of the mistletoe family, which he had named *Arceu. bobim** miiutem. All the upecies of this genus inhabit Conifers. One occurs on Junipers in the Mediterranean and Caucasus regions of the Old World. A second was found by Humboldt on Pines on the highest mountain* of Mexico ; •nd •everal more have been found since on our Rocky Mountains and wentward, mostly alao on Pines. The peculiarity of thU species, discovered almut the name time lant Rummer, by two different persons in different pnrta of the State of New York, tablet iU spring flowering (nil the other* bein« autumnal), consists in the occurrence of the sexes in distinct colonies in different tree*, mal* ami female plant* never, tlm* far, having Wn found together on the mime tree* ; and in the greu abundance of individuals on these tree*, where th» flowering plant* almost always occupy the three-yea*. fj* bftnehWta, while the two-year-old one* exhibit germinating plantleU like small knot*. The necessary inference • that that* paradUt an propagated, or we should rather My multiplied, by stolon-like fibres, almost analogous to the B-y l t a n of Fangi, spreading under the bark of the growing branches and always from the older to the younger

ARCEUTHOBIUM ROBUSTUM, *Engelm. PL Fendl. p.* 59; *A. cryptopodum,* Engelm. PI. Lindh. p. 214. — Stout, 2-4 inches high, 2-3 lines thick at base, paniculate, much branched, brownish-yellow to dark olive-brown; staminate plants smaller than the pistillate ones; staminate spikes with much-compressed, adpressed buds; flowers mostly 3-parted, 1j-1£ lines wide; anthers attached above the middle of the ovate, acute lobes ; ripe fruit 2} lines long.

Only on *Pinus ponderosa,* Colorado, New Mexico, and Arizona ; Camp Apache (tf. *K. Gilbert,* 1873) and Mount Graham *(Rothrock,* 787), 1874. Flowers in June. Fruit mature in August and September. The closely allied *A. occidental*,* Engelm., is distinguished by more elongated spikes, ventricose, divaricate buds of the staminate, mostly 4-parted, larger flowers, with lanceolate, acuminate lobes and anthers attached below their centre ; it also occurs on *Pintut ponderosa,* but more frequently on other conifers. Both persist for several years, the female plants always longer than the male.

FBOM THB BOTANY OF CALIFORNIA, VOL. II., BY SEREHO WATSON, CAMBRIDGE, 188O.»

PHORADENDRON, NUTT.

• Leaves foliaceous, mostly dilated upward from a narrow base. [105]

1. P. FLAVESCENS, *Nutt.* Branches terete, pubescent when young (as also the spikes), often a foot long or more: leaves oblanceolate to obovate or orbicular, J to 2 inches long, obtuse, 3-nerved, at last glabrous : bracts connate into a •hort truncate cup : flowers depressed-globose, the calyx-lobes ciliate on the margin: staminate spikes opposite or verticillate, usually shorter than the leaves, 3-7-jointed, the numerous flowers mostly in 4 to 6 rows on each side and occupying nearly the whole joint, very fragrant with the odor of pond-lilies ; anthers transverse, opening by 2 pores : pistillate spikes usually opposite, shorter (rarely 6-6-jointed), the flowers (2 to 7 on each ride of a joint) in not more than three series : berries white, 2 lines in diameter. — Engelin, PI. Lindh. 212. *Viscum flavescens,* Pursh, the common glabrate spatulate-leaved southeastern form.

Var. MACROPHYLLUM, *Engelm.* Leaves large (2 to *2*\ inches long), broad, often 5-nerved, glabrate : flowers larger, in stout short-jointed spikes. — Wheeler's Rep. vi. 252.

Var. viLLOSUM, *Engdm. I. e.* Leaves small or middle-sized, orbicular to spatulate, permanently pubescent or tomentose : spikes slender, rather short. — P. *vUlosum,* Nutt. I. c.; Engelm.. PI. Lindh. 212.

The latter variety is common throughout the State, chiefly on oaks, from S. California to Oregon, and eastward to New Mexico and Texas; the former occurs on *Populvs, Platan**, Fraxinus* and other trees, from S. California to New Mexico. Var. TOMENTOSUM *(Viscum tomentosum,* DC.) is found in Northern Mexico, on *Mimosea,* and is densely tomentose, with slender elongated spikes.

2. P. BOLLEANUM, *EichUr.* Puberulent, at length glabrous: branches terete, less than a span long: leaves Jthick, spatulate to linear, 6 to 12 lines long by 1 to 3 wide, nerveless, obtum'sh : spikes opposite or rarely in fours, with connate minutely ciliate bracts ; the staminate of two 6-12-flowered joints, the fertile of a single 2-flowered joint: antbera transverse, opening by pores : fruit white, lj lines in diameter. — Fl. Bros. v*. 134-. *Viscum BoUeanum,* 8eem. Bot Herald, 295, t. «3. *P. paucijlorum,* Torrey, Pacif. R. Rep. iv. 134.

On conifer*, mostly *Jnniperus,* from the Geysers *(Brewer)* to San Felipe *(Palmer)* and into Arizona and Mexico ; al*> on Guadalupe Island, *Palmer.* A specimen on *Abies concohr,* from Duffield's Ranch near Auburn *(Bigelow),* is larger and with larger broader leaves.

•• Leaves reduced to short mostly connate scales : spikes opposite, mostly few-flowered.

a. P. CALIPORNICUM, *Nutt.* Pubescent or at last glabrous : branches terete, slender, a foot or two long : scales broadly ovate, acute, spreading : staminate spikes of 2 or 3 (rarely 5) flower-bearing jointe, each with 2 to 6 ovate-•ttliglobote flowers : anther-cells oblong, opening by a longitudinal slit: fertile spikes sometimes with nearly as many jf' nte and flower*, the jointo elongated (often an inch long) in fruit: berries reddish, 2 lines wide. — PI. Gambel, 185 ; Engelm. PL Lindh. 213.

Southern California and Arizona, on various *Mimoseas* and *Cassi**, Larrca,* etc.

4. P. JUNIPERINOM, *EfUfdm.* Glabrous, stout, densely branched, 6 to 9 inches high : branches terete, the ultimate branchleU quadrangular : scales broadly triangular, obtiiBwh, connate or distinct, ciliate: staraiimte spikes of a •ingle G-8-flowered joint (rarely two) : anthers transverse, opening by pores : pistillate spikes 2-flowered : berry globote, whitish or light red, 1 \ lines wide. - PI. Fendl. 58.

Var. LIBOCEDRI, *Engdm.* Hranche* a foot long or more, slender : joints more elongated, the ultimate ones more •ktrply quadrangular.

On different 'species of *Juniper**,* from Truckec Paw southward and through S. Nevada and Arizona to New Hideo: the variety on *Libocedru* decurm*,* from the Yuba River to San Bernardino.

• The generic rhiirirtera it* omitted from this \m*r, having been given elwwhere. Ai stated on p. 104, only the folkwilg ***** of *PKonuUminm* ire found within the limits of the United States. - EDS.

ARCEUTHOBIUM. A small genus, represented in S. Europe by a single species, and in America ran- [106] ging from the northern border of the United States to Mexico, chiefly in the mountains.

• Staminate flowers all (or nearly all) terminal on distinct peduncle-like joints, paniculate.

1-A. AMERICANUM, *Nutt.* Slender, dichotomously or verticillately much-branched, greenish yellow ; staminate plants sometimes 3 or 4 inches long (£ to a line thick at base), fertile plants much smaller: flowers small, the staminate a line broad or more, with ovate-orbicular acutish lobes, the pistillate a half to one line long : fruit 2 lines long. — Engelm. PL Lindh. 214, and Wheeler's Rep. vi. 252.

Only on *Pinus cmtorta* (and apparently *P. Banksiana* in the Saskatchewan region), from Wyoming to Oregon and southward to Colorado and California (Little Yosemite Valley, *Bolander).* Flowering mostly late in autntnn apparently, but found by Parry in Wyoming in flower in July ; fruit mature in August and September. Its shoots creep along within the tissue of the bark on young branches of the pine, and in the autumn bud out in the form of little knobs among the bud-scales at the end uf three-years-old limbs, developing into flowering plants the next season. When once established it may continue to sprout from the same base for many (30 or more) years, causing hypertrophy of the wood and bark of the limb and often its final destruction. Fruiting and flowering branchlets are often seen in juxtaposition in the same whorl, but without leaf-bearing branchlets, and never in superposition.

The type of the genus, *A. Oxycedri,* Bieb., of the Old World, is allied to this, but distinguished from it and from all American species by its staminate flowers being all terminal on short branchlets and usually in threes, scarcely a line wide ami with orbicular lobes, and by the much smaller oblong fruit, less than 1£ lines long. The northeastern *A. pusillum,* Peck, of the Adirondacks, growing on *Picea nigra,* also belongs to this section.

* * Staminate flowers axillary (with a terminal one), forming simple or compound spikes.

«- Slender, greenish-yellow : accessory branchlets of fruiting specimens flower-bearing.

2. A. DOUGLASII, *Engelm.* Similar to the last, but smaller, J to 1 inch high: branches subereot, solitary, or with accessory ones behind (never beside) the primary ones : flowers in short (usually 5-flowered) spikes; the staniinate less than a line wide, with orbicular-ovate acutioh lobes : fruit 2J lines long. — Wheeler's Rep. vi. 263.

Var. ABIBTINDM, *Engelm.* A larger form, 1 to 3 inches high (the fertile smaller), with spreading or even recurved few-flowered branchlets : staminate flowers 1| lines wide : fruit scarcely 2 lines long.

On *Pseudotsuga Douglasii,* from New Mexico to S. Utah and N. Arizona ; the variety on *Abies concolor,* in Sierra Valley (/. *G. Lemmon)* and S. Utah, *Parry.* Flowering apparently in October. Distinguished from the last by its usually smaller size, the superimposed (never verticillate) accessory brnnchlet*, lateral flowers, and larger fruit Its creeping stronia buds out all along the branch, and not between the bud-scales only as in the last Another [107] Tariety, with very small fruit, is found on *Picea Engelmanni* in Northern Arizona.

«- -•- Stouter, greenish-brown : accessory branchlets of fruiting specimens mostly leaf-bearing.

3. A. DIVARICATUM, *Engelm.* Stouter than the last, 2 to 4 inches high and a line in diameter at base, olive green or pale brownish ; branches spreading, often flexuous or recurved : staminate flowers few and scattered or in 3-7-flowered spikes, a line wide, with ovate acute lobe* : fruit 1J to 1 j lines long. — PI. Wheeler, 1874, 16, and Wheeler's Rep. vi. 253. *A. campylopodum,* var, Engelm. PI. Lindh. 114.

On *Pinus edulii* and P. *mmophyUa.* from New Mexico and S. Colorado to Arizona and 8. Utah, anil to lie looked for on the latter species in S. California. Flowering in August and Septemlier. Intermediate in size and color between *A. Douglasii* and the following species, but well characterized by iU slender habit, spreading growth, and •mall and rather scanty male flowers.

4. A. OCCIDENTAL!, *Engelm.* Stout, 2 to 5 inches high, 2 to 2} lines thick at bane, particularly much-branched : staminate plant* brownish yellow, smaller, the pistillate commonly of a darker olive-brown color: staminato flower* in long dense spikes, often 9 to 17 on a single axis, their'bud* ventricone with the upper edge curved outward; calyx 3-5- (usually 4-) parted, 1} to 2 lines wide ; anthers senile below the middle of the lanceolate acuminate lobes : fruit 2| lines long.

Var. ABIETIVUM, *Engelm.* More spreading and less densely branched, the accessory branches in the fruiting plant bearing fertile flowers as often as they do leaf-buds. — *A. abietinum,* Enftelm. Proc Atner. Acatl. riii. 401.

On various conifers of the Court Ranges and Sierra Nevada *(Pinut insignis, P. Sabiniana,* and *P. pondsrom),* from Salinas Valley and Walker's Basin to Oregon. It is the only American specie* found abo on *Junipsrus* (Silver Mountain, *Bmcer).* The variety occurs on *Abies grandis* in the vulley of the Columbia, *Hail.* Flowering in August •ad September.

The closely allied A. TAOINATUM, *Eiehler (Vismm vaginahim,* HBK.), upon the pines of the Mexican ttountoiJia, of which only incomplete material has been collected, ban shorter spikes ami smaller mostly 3-parted stamina* •ovvew with broader and shorter lobes. A. ROBUSTUM, *Engelm.,* on *Pinut pondtrosa* in the Rocky Mountains and Artiona, ha* shorter spikes than *A. ocddmtaU,* with shorter flat appressed itaminate bods, the S-partad flowers

(opening in June) with shorter and broader lobes, bearing tbe anthers above their middle. Of the only remaining known species of this curious genus Seemann gathered on the Sierra Madre of Mexico a staminate specimen, in bud only, which is distinguished from all others by its greater thickness and by the long spikes of large verticillate 4-parted flowers, mostly 6 in a whorl. It may therefore bear the name A. VERTICILLIFLORUM.

IX. SPIRODELA.

FROM THE BULLETIN OF THE TOBRET BOTANICAL CLUB, VOL. I. 1870.

IN reply to a recent communication of specimens, we have received the following letter [42] from Dr. Eugelmann. Although he thinks the publication unnecessary, we yet venture to print it, as he differs from Mr. Austin in relation to the endopleura, and, of course, the subsequent terms of the series. Mr. Austin notified us that he had not had access to his materials for comparison with other speciea— *Editors of the Bulletin.*

Only to-day I finished the examination of your interesting *Lemna.* As Prof. Hegelmeier, the accurate monographer of the family, will no doubt give us a full description and figure of this plant, from your specimens, I think it superfluous to try to anticipate him in a much less complete and satisfactory manner, but I may say that the fertile fronds are unusually small, only 2J-3± mm. in the longer diameter, mostly with 6-6 ribs, or at most 7; and with 3-5 or sometimes 6 roots. *foliaccous organs;* spiral vessels (even in the roots), pigment cells, and both forms of crystals, acicular and glomerate, as in the common form of *polyrrhiza;* stomata smaller, only 0.14-0.16 mm. in larger diameter (whereas in that they are 0.20-0.25 mm. long).—*Spathe* a complete sac, as in *Lemna trisulca, gibba,* and *minor;* not a mere circular bract, as in *L. paucicostata* and others. — *Anthers,* } mm. in transverse diameter, larger than those of other species, different from those of all *ZmncB* (and thus confirming the genus *Spirodela),* by longitudinal and not transverse dehiscence, as, ia feet, Hegelmeier already surmises from Griffith's coarse but reliable figures of the East Indian plant *Pollen-grains* spinulose, as in the whole family, as often elliptical as globose, 0.018-0.023 mm. fe the different diameters and sizes; smaller than those of our *Lemna paucicostata* (0.023-0.027 mm.). — *PigtU,* as well as anthers and utricle, strongly dotted with purple (in alcohol, brown), SUIH cuticular cells — *ovule,* hemitropous; horizontal, as in Z. *minor;* and, in the 10 or 12 flowers now examined, *always single;* spiral vessels in funiculus, which only occur again in *L. gibba,* [43] in this family; exostome almost closed, while in all others it is open or even (in Z. *paucicostata* and *perpuMla),* incomplete, with the endostome strongly protruding.— *Seed* horizontal and slightly compressed, the dark spot of the chalaza distinctly visible, even through the utricle, and, as in all 1-ovuled species of *Lemna,* directed backward to the base of the frond; rhaphe distinct, no spiral vessels observed in it; seed (apparently—the specimens examined were uot completely matured) smooth as in *Woljla,* not ribbed as in *Lemna/* cellular spongy testa very thick; operculum distinct; endopleura, as usual in *Lerniue,* dark brown, thin; endosperm (albumen) considerable. — *Embryo* cylindric, almost as long as the seed, as usual in the family [what Austin calls albumen " a/' his "a" is the starchy albumen; what he calls embryo is the plumule]. I take it to be a mostly 1-onded small form of *S. polyrrhiza.*

In all the specimens examined I find the singular circumstance of the first (anterior) stamen **ljr being developed and protruding (but never as far as in other species), and the second or posterior one and the pistil being enclosed. Is this owing to the hour of the day. when collected ? It would be worth while to find out whether in *Lemna* the first stamen may be developed, in the morning, and the second at noon or in the afternoon.

Nor. is, 1870.

X. SPECIES OF ALISMACE^E.

FEOM TOKBEY'S BOTANY OF THE MEXICAN BOUNDARY (REPORT, ETC., VOL II. PART 2,1859).

SAGITTARIA CAXYCINA, *Engelm. mss.* var. a. MAXIMA, van *fi.* MEDIA, var. *y.* FLUITAIIB. S. LOVGILOBA, *Engelm.* [212] in *herb. (S. simplex).*

FROM GRAY'S MANUAL OF THE BOTANY OF THE UNITED STATES.

FIRST EDITION, 1848.

ECHINODORUS, *Richard, Engelmann.* E. SUBULATUS, *Engelm. (Alisma subulata,* L.) [460]. E. ROBTRATUS, *Engelm. (Alisma,* Nutt.). E. BADICANB, *Engelm. (Sagittaria,* Nutt.). SAOITTARIA VABIABILIS, *Engelm.* [461].

SECOND EDITION, 1856.*

ECHINODORUS PABVCLUS, *Engelm.* E. ROSTRATUS, *Engelm.* E. RADICANS, *Engelm.*

1. *Sagittaria falcata,* Pursh. 2. S. VARIABILIS, *Engelm. (S. sagitttfolia,* Amer. autb., Ac.) — Var. OB- [439] TUSA *(S. obtusa,* Willd.). — Var. LATIFOLIA (S. *latifolia,* Willd.). — Var. DIVERSIFOLIA. — Var. BAGirriFOLiA. — Var. ANOUSTIFOLIA. — Var. GRACiLis *(S. gracilis,* Pursh). 3. *S. heterophylla,* Pursh. — Var. ELLIPTIC A. — Var. RIGIDA (& *rigida,* Pursh). —Var. ANGCSTIFOLIA. — Var. FLUITANS. 4. *S. simplex,* Pursh (& *acutifolia,* Pursh, Ac). *S.pu$iUa,* Nutt. (Alisina subulata, *Pursh). S. natans,* Michx. [440]

FIFTH EDITION, 1868.

In addition to the species of the previous edition, this contains *Sagittaria lancifoiia,* L. (S. falcata, *Pursh)* , *S. variabHis,* Eogelm., var. HASTATA (including *S. hastata,* Purs«h). — Var. PUBESOENB (5. *pubescent,* Muhl.). *S.* CALYCINA, *Engdm.* — Var. SPONGIOSA. — Var. FLUITANH. — Var. ORANDIS. *S. graminea,* Michx. (5. *acuti-* [494] *foGa,* Pursh. *S. simplex* of Amer. authors, not of *Pursh).* — Var. PLATYPHYLLA.

FROM ADDITIONS TO THE FLORA OF THE UNITED STATUS (BULL. TORREY BOT. CLUB, VOL. IX. 18S2).

Sagittaria natans, Michx., ha* been noticed by Mr. C. E. Faxon, since a number of yean in Charles River, [4] Mas*, "at the depth of 2 to 4 feet, and entirely ul»ove the influence of tide-water," and abo, as he informs me, in Neponset and in Ipswich Rivers, where Mr. J. Robbinfton found it. It flowers there from the middle of June to the end of July, but never perfect* fruit, and thus *in* evidently not at home in those northern waters, where it has a precarious existence by stolons; these can only winter where deep water protects them from frost. The seed was probably first brought there from the South by water-fowl who diuwmiiinU* so nmny water-plants. Scape and phyllodia 2-4 feet long, barely reaching the surface of the. water, lcaf-hlwlefl rurvly dt'Vfln[>ed, and then linear-lanceolate; raceme as well as pedicels often elongated in order *U>* reach air and light; flowen 0-7 lines wide, o|«*tiing in forenoon,submerged again toward evening, only one or two of the lowest whorl fertile, the other* all male; male flowen with 6 exterior and 1 or 2 central stamens; filaments about as long as the nearly orbicular anther*, bulbous at bane and smooth; pistils of the female flowen numerous, minute, erect, style as long as the ovary ; fruit (never matured in the North) in southern specimens marked by several (5 or 7) denticuUte crest* on back and side*. *SagiUaria* jmfOfe, Punb, must be considered as a subterrestrial form of thi* species, distinguished only by it* sin, and by a 3-crested achene. *S. graminm,* with which I bad confounded the northern form, is distinguished by the great number of [6] stamen* and the papillose filaments, even where the fruit cannot be compared.

XL TWO NEW DKECIOUS GRASSES OF THE UNITED STATES.

FROM THE TRAKIACTIOKS OF THE ACADEMY OF ficimci OF 8T. Locta, VOL. I. 1S69.

THE grasses, though usually hermaphrodite, show a tendency to a separation of the sexes, [4»1J and polygamous flowers are not rare among them. About 25 to 28 genera, one-twelfth of the whole number known, comprising only 75 to 80 species, about one seventy-fifth of all species,[1] •*• owenbed as having moncecious and mostly beteromorphous flowers.

* The entire account of *Echinodorus* and -"•'"• •• this and the fifth edition was contributed t Engelmann, but the work is so easily access of the species is undertaken hm. *8»giU*ria M^frrn,* Eo. rim. 4Guy *(8. *rW«*a,* Nott) b characterized by Gray ... n., 27. — Eds.

[1] In the latest work no Or—«, *Steudel's Glumaceae,* published in 1855, aboat 6,000 spsdss of grasses are described,

Only two genera of dioecious grasses are known to the books; of these, *Spinifcx,* Linn., with 6 species from the East Indies and Australia, bearing on some plants staminate and on others complete flowers, is only incompletely dioecious; the other genus is *Gynerium,* HBK., with five South American species. Some other dioecious species of genera, generally hermaphrodite, are noticed ; such as *Calamagrostis dioica,* Lour., and *Guadua dioica,* Steud. The unisexual grasses mostly belong to *Oryteee, Phalaridece, Paniceoc,* and *Rottbodliem;* none have been known among the tribes *Stipae, Agrostidece, Chloridece, Avcnacecc, Festucea,* and *Hordeece.* They were unknown in the northern temperate zone, with the exception of *Zizania* and *Tripsacum* of North America and the cultivated *Zea,* all with heteromorphous staminate and pistillate flowers on the same plant. The dioecious grasses of our Flora are both species of *Brizopyrum;* Eragrottis reptans* is mostly dioecious, and other species of this genus seem to be imperfectly so. In the following pages two new dioecious North American grasses are described, both types of new and very distinct genera, and both, it is believed, belonging to *Chloridece.*

BUCHLOE, Nov. GBK.

Floras dioBci, heteromorphi. [432]

Planta mascula: spicul. 2-3-flon*, in .pici. unilateralibus distich*. Glum* du. unmem*; .inferior m«lto minor. Pale, d*L,* -quilong., gluma. excedente.; inferior trinervis, mucronata; superior binerv,s rnufca. Squwml. bin* trancat^ emanate. Stamina tria; anther, linear*. Ovan. nunmentuu, nullum.

Planta famine. : .picul. uiiiior. in .picas 1-3 breve, capituliforme. obbquas vag.ni. fohorum supmorum ,nvoloenta. congest. ; flosculosummo tabercente .quamam involucriformem trifidam simulante. Glnnuedu*; .p.cul. ,nfi-«• gluma inferior 1-3-nervu', apice herbaceo Unceolato-subulat. *u 2-3-fida, Utere .nfenore klu,n» .upenons dorso •dnata; glum, rdiquarum .picuUrum inferior*, (quoad capitulum intern.) liber., multo m.nores membranace.„ ov^o^aLlaUe, acuUe. uninele., glum, .uperiori (extern.) b«i cum rhacbi incrassata connate, mvolucrumsimuUato demu^cum, qua^i o«eum, ovaUe, enervi-„ pallid* apic* herbaceo nervoso tnfid^. Pa^.nfenor (quoad «pit»lum interna) breWor trinervi^ herbaceo-tricu.pi.laU; palea superior brevor binerv.s. aiuamul. ^ u . flonbu. »-c«li.. Staminorum rudimenU 3 minuU. Ovarium lenticular*, brev«.me stip.Utum^Rkbrum ; stagmaU rty » 8 «ctU terminalibu. multo longiora, pilu simplicibu. plumosa, ex apice Aon. e«erta. Caryops.sl.bera, n cap.tulo «-«», deaum toto Suo £tm, «iblenticularu, extu. (verso, palewn infeno«m), ubi embryo, plana, intu. convexa

GL™ planiUerum Americ. Sept«trionali. aridarum ^ ^ ^ ^ ^ ^ Z ^ Z ^ ^ B Z ' perenne, rtoloniferum, humile, .pane pilosum vel gkbriu»culum; hgoua *1*A*M.-BUM<*,* pro mmu longo *Bubolochloi* nomen vemaculum « Buflalo-graie," gr.ee reddit

BOCHLOl DACTTL0IDI8.

Syn. plantæ masculæ : *Sesleria dactyloides,* Nuttall, Gen. i. p. 64. *Sesleria* (?) *dactyloides,* Torrey, in Emory's Rep. 1848, p. 153, Pl. X. ; id. in Whipple's Rep. Pacif. R. R. Expl. iv. p. 157. *Calanthera dactyloides,* Kunth (?) in Hooker's account 18. *Triodia spec.,* Bentham, in Pl. Hartweg, no. ITS Hartw. Corrig. p. 347. — Drummond, Tex. iii. no. 378. Lindheim T Pl. Tex. exsicc. 50». Fchl « ,N . M«x . MO. Berlandier, no. 1612 and 1614. Hartw. 350 (fide Gray).

Syn. plantæ femineæ : *Antephora axilliflora,* Steudel, Glum. *L* p. H 1 . - D - —, T» U. 359. [433] Wright, 1849, 785 ; 1851–52, 2079 (fide Torrey).

This remarkable plant is found in our western territory, Nebraska, Kansas, and New Mexico, down to Texas and Missouri name of a part of the "*Buffalo-grass,*" well known to hunters and trappers as one of the most year, subsist and fatten the immense herds of buffalo and the cattle of the hunter and the emigrant. Bto-U-tto.

**T unequally diktriboted in abont 800 groera, many g•QAtelninf only a single spedea, while *Finieum* alone com• prises 264, *Amdnftfm* Ml. *Mr*gr*tis* 247, and *ftduca* SS9 numbers.

^."**Wfii»i *+i*mium.* Hook, U from the eastern sea• • * ^ A **H*mm.* TWr.. from the saline soils of the MlMoari region and of Utah. The flowm of both MM are conform, but the •Uminate plants are readily diitinguiahed from the piftillaU ones by their more Blender growth, the •pikes orerfeopping the lean* ; while in the pUtUlate plants the UtUr m longer than the iplkea.

es

PUTI III — Bt'CHU)* OiCTTbOIPU'

of NuttalL who published an account of it, in his - Genera," a. early as 1818, the male plant ha, been «U«tad ligr almost every botanist traversing those regions. The female plant had escaped the observers until it was described by Stendel, in the year 1855, from Drummond's Texan specimens, as a totally different plant and Wongwg even to a different tribe. Though Prof. Torrey had already, in Emory's Report, 1848, ****** P'''***** £ £ £ ! £ grass being a dioecious plant, the possibility that Nuttall's *SaUria daetyloida* and Steudel's *Antophor* axUhJbna* could b T L male and the femaleof t h e U e sjecies was not even suspected, till finding both together m a colfcction sent by my brother, Henry Engelmann, who, as geologist, accompanied the topographical corps attached to the armyjrf Utahf I was struck with their similarity. My surmise, much doubted at first, became a certainty when I discovered among .ome male planta, collected by A. Fendler, about Fort Kearney on the Platte River a m o n a d s specimen, showing both male and female flower, on different stalk, from the same rhizoma. A figure of this important specunen

en o! tt XII.

" ^ That" *ol* l a n t X L t from *Se*ria* has already been .tated by To^rrey 0- c p. 154), and indeed by Nuttall himself (L o. p. M), and both have pointed to if affinity to *Atkeropcga** or *Ckondronum* The deunptionnow^given fully confirm, both position./ It also leaves no doubt that it is not an *At^ra,* nor a all paniceou^ i » p »

naine, therefore, had to be given, and I have preferred to propo- an abbreviated » f ^ * *> pc ular and widely known name of « Buffalo-gnus ,• retaining of course Nuttall's original .pecifio appeUatxon- The synonymes of the male pUnt, supplied through the kindness of Prof. Gray, a. ^ * 7 * £ £ S J C i ^ S ^ E as *Colanthtra,* whioh, moreover, is quite unmeaning; nor can I learn that a genus *Lattoneg** « · .

The Buffalc-gn*. grows in dense tufts, sending out stolons. These, in most herbanum specimens, we only a few i n c h e d with internodes of H »-bes in length ; Lindheimer, ^ ^ r f j ^ - — t a j [434] New BmunfeU, Texa* with stolon. 1-2 feet long, the internode. often me*«mng over 3 and even a^much ».» inehe.. The male plant seems to throw out more numerous runners than the female, and may often overspread and kill it out, which would account for

* . ^ ^ o r •L^labrou. ; deaths striate, gUbrou, singly bearded at the throat.

Leaves 2–4 inches long, ½–1½

The flowerin stems of the male plant are^or rarely 8 inches ^ ^ ^ ^ i ^ S f i t t j len 1-1-thL the leaves, and W 2 or 3 ^ » * £ £ ^ ^ 15 minutely puberulent spikelets, and bear on the lower, outer sule of the flattened, d e n t a t e ^ J J * ^ . ™ V , e i l t o d by a bri9tle. The .pikelets are alternate in two row. s the u p m o s t .pikelet »''***;«??*. ^ ^ « a l among chlorideons grL^s, some- 8 or rarely 3 line, long with 2 or sometime. 3 **''**£% £ but' "ming upward, towards the upper end of what obliquely distorted; the glumes are broader on ^ J ^ J V , ^ The .mailer lower glume U, a. in thi. the .pike, they cover the upper edge of the flower* leaving the lower edgi i«e. more eon.picuoag.

whole tribe o f gn«e,, inside o f the spike^ and the ^ ^ ^ ^ TMTM* * « O T • - * • - Lower glum. ovato-lanceolaU, w.tb .• '« » m«gm £ £ £ ,, £ gm ikelet of ^ •pikc, it i. much Urger, mneiorlate, one-third or one-fourth the length of the flower | on w> re~* r and almost equal to the upper glume.

Upper glume twice as long as the lower on, ^ j ' j J vat ^ obtusish, with a strong middle nerve which sometimes runs out into a point or a short awn betwe__ as teeth ; in a specimen from Fort Kearney, I find on the lower side a second nerve running out into third nerve on the upper side is very indistinct ; other spikelets of the same specimen show the ordinary structure.

Lower palea convex, obtusish, 3-nerved, middle nerve in the lower flower running out into a mucro, in the upper one mostly even with the membranaceous margin.

Upper palea as long as, or a little exceeding, the lower one, which partly envelops it, 2-nerved, 2-carinate, obtuse

"* 1 S Z JLSlL S) S at the margin, and i«ide of the lower palea, minute, triangular-tn.ncate, undulate or •margi- nata.

a . i- .k ,,) « . .nthen linear, bifid at both ends, 1 line long; filaments much .K - 8 t o T : " • • c ^ e l ' l " ' * r l l n S w ^ r ^ l in wa^globular, .moothish, 0.017 line in diameter. [435] shorter. Pollen-grain. of the dry B !» t h e r , , m C ^ , " - X 1 dually W ^ very rarely 3-1 inches high;

The talk of the female plant » much shorter than ^ |T "^ JJ / ^ uppermo ; t leaves Irving as involucre, it U Wfy to the ton, tlu, bnsul ventrico., £ ^ j £ £ f t ViS£L — -He befween both top for the flower-beada, The* hca-U, «» I I B « B R ' n fl n t t t · n e d pedicel on the side of the upper leaf; sometime, a l « m ami on the ride of the lower one, the o her on a " J j · J j P ™ , -,,, r f t W J J , nre nothing but the A W M bnoticed .tillhigher, and on ^ ^ ^ Z Z J ^ v n * , * * to . many lateral .pike- of «mmon peduncle or rhacfr,. terminating the, r t e m ^ n . 1 the b ^ ^ ^ ^ OM_nowtnA

Uj. male plant, in postion *m* well a. i n ^ « ^ J * only more tracted, tuni oUkluely downwanls. Where the number of spikels dt ? ^ j t t £ Z Z £ £ *or,* in M - W I bxt when the numLr U Ugar;

PLATE XIII. — MONANTHOCHLOË LITTORALIS.

been able to examine Berlandier's specimens, female plants in flower, and those of Lindheimer, who collected both sexes, the females more abundantly than the males. The ripe fruit is unknown to me.

Stems 5-8 inches high, much branched, erect or often at last decumbent and rooting; upper branches mostly short, 4-6 lines long.

Leaves short, rarely more than 3 lines long, very rigid, strongly nerved, apparently permanent in winter, mostly crowded at the ends of the stems and branches. The upper leaves all bear axillary buds more or less developed. Spikelets (between 3 and 4 lines long) solitary, terminal, enclosed by the uppermost leaves, which form a complete and uninterrupted transition to the floral envelopes, the uppermost leaf, without the intercession of glumes, representing the lowest palea of the spikelet This uppermost leaf or lowest palea has a doubtful and intermediate character, and might be taken for one or the other, or for a glume, whenever it is empty; but often it includes an hyaline scale, which cannot be anything else but an upper palea, and therefore characterizes this lowest organ of the spikelet as the lower palea of the lowest always incomplete and neutral flower. It cannot be supposed that a glume is missing or abortive, as we can follow the regular succession of bud-bearing leaves to this lowest floral leaf or [438] palea. The upper palea of this lowest flower, when present, is usually extremely thin and transparent; it is small or large, flat or reflexed, nerveless or (very rarely, like the other upper pales) bicarinate; • it is entire, lanceolate, or ovate, or einarginate, or bilobed, or sometimes divided into two unequal lanceolate parts, placed side by side, and in some flowers (see PI. XIII. Fig. 6) laterally protruding from the base of the lower palea and rather oddly placed on both sides of the spikelet.

The second flower is like all the others pedicelled, and is mostly perfect, that is, staminate or pistillate ; in a very few instances (see PI. XIII. Fig. 5, and PI. XIV. Fig. 20), it was found neutral and either with a somewhat foliaceous lower palea, or with both paleae smaller than in the other flowers; rarely it is reduced to a single palea, which is herbaceous or membranaceous; in a single instance it was almost entirely suppressed, and the third flower, above and on the same side as the lowest one, appeared to be the second. The rare case where two single, empty pale® alone are left of the two lowest flowers approaches nearest to the regular structure of grass flowers; these pales then assume the place and apparent function of glumes, and the spikelet then resembles that of *Kmleria,* for example, in the arrangement of its parts. The normal variability in the formation of the floral envelopes of this grass thus furnishes an interesting clew to the morphology of these organs. The third flower, usually well developed, is sometime* (oftener in the female than in the male plant) reduced to a mere rudiment.

In female plants I have never seen more than 2 pistillate flowers, and very rarely a rudimentary fourth flower; male plants show often 3 staminiferous flowers, usually with an upper abortive one. The spikelet therefore is destitute of glumes, and consists of 3-5 flowers, of which always the lowest, Bometimes the second, and usually the uppermost one, are neutral or rudimentary, and of which 1-3 of the middle ones hear ntamens or pistils.

The lower jwileu of the fully developed flowers is ovate-lanceolate, obtuse at the warioat point, and envelo|* not only the upper palea but also the base of the tipper flowers; it is faintly 9-11-nerved in the upper and indistinctly 3-nerved in the lower half, thus representing, as it would seem, both parts of the leaf, the sheath and the blade; nothing like a ligula, however, can lie found.

The upper palea it narrower and a little longer than the lower one, especially in the male flower*, obtuse [439] and scarioiiA at tip, and in the female closely envelops the pistils. In the staminate flower it is bicarinate on the back; in the pistillate flower these keels are developed into wings, which are rolled around Urn upper flowers, as is indicated in the diagram*. No scales *(lodiculrr)* were seen in either flowers.

Stamens scarcely longer than the pale*; anthers linear, deeply bilobed at both ends, longer than the filaments. In the pistillate flower 3 minute triangular bodies seem to represent the stamens.

The stipitate ovary is elongated, triangular, with one angle towards the lower, and two towards the keels of the upper palea ; it is deeply bifid, the lobes terminating into straight erect styles. Simple hairs of the feathery stigma scarcely dentate.

The systematic position of this grow it certainly a doubtful one, and the opinion which I venture to offer, that its next allies must be looked for among the *Chloride***, a tribe principally distinguished by ita one-Aided compound spikes, may appear paradoxical. I take it to be the most reduced form of this tribe, where a single and incomplete »|>ikelet only is left of the one-sided spikes. Thus *Monanthochlri* would find iU place near the similarly creeping ttynodon, and with those other waftide-grame*, the *Spartimt.*

Happily, to confirm my portion, I find in Torrey[1]* lately established p-ira* *Munroa* (Whipple'ft Botany in Pacif. R R. Rep. iv. 158), the old *Crypti* *fpt<trro$*%* Vutt., an intertimliiite not «|uite ao much reduced form of a gnu*. *Munroa i** evidently nearly allied to *M'tnanthohlot,* but haa, inMeml of one, three »pikelet«, included between the uppermost leaves, on a *terminal* rhnchtn; two lateral oblique ami nnc-»i<M, and the terminal one ftrftight. Prof. Torrey has already noticed the oljiiijne position of tlu<> Kluim* of tlu<? lntiTal npikeletn, which, together with the one-sided position on the rbachis, is characteristic of *Chiond#e.* The terminal spikelet i« more regularly formed, as is also

• In this COM the lower palea aim U leu leaflike, tnd hai only a short foliaceoiu cusp.

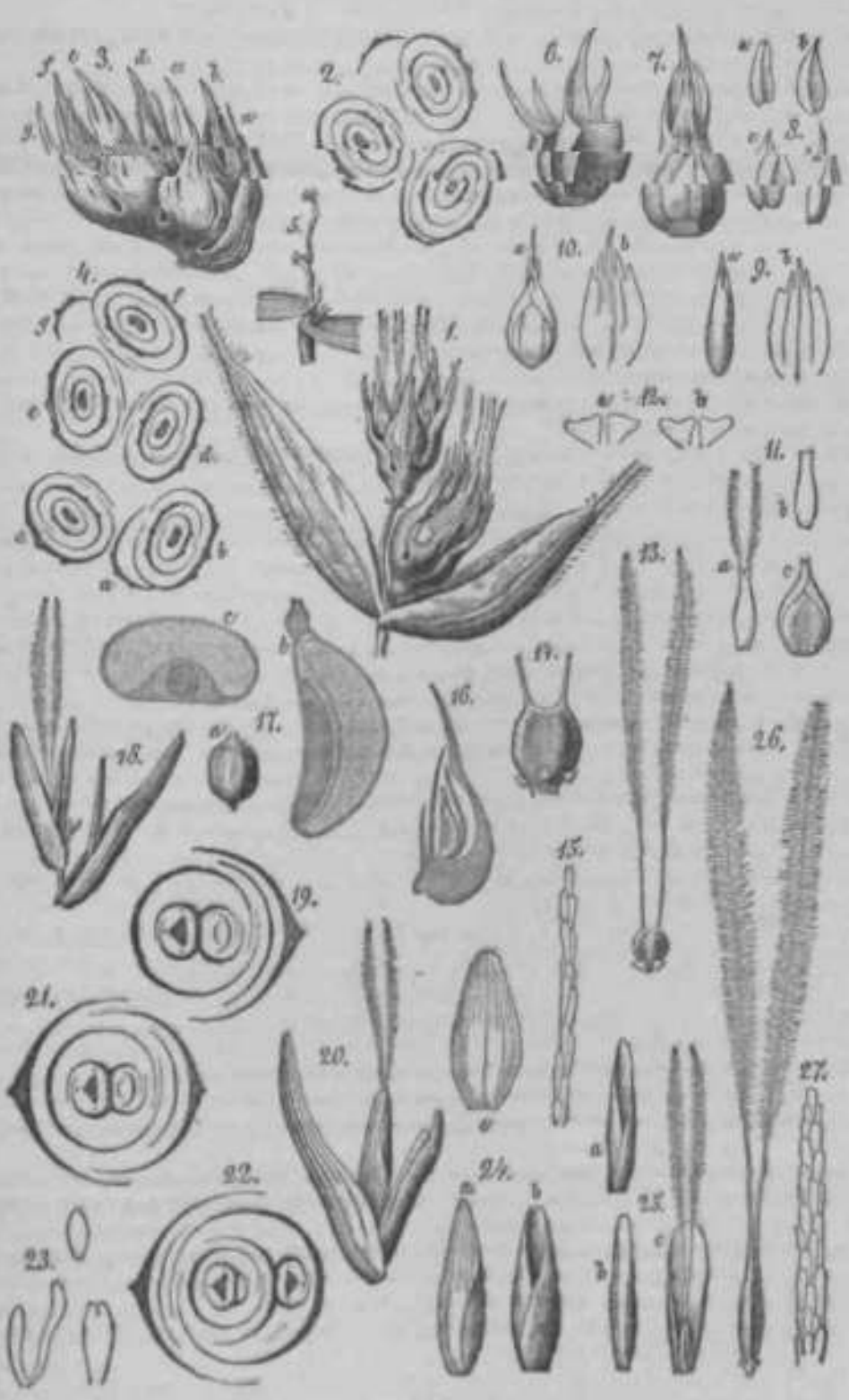


PLATE XIV. — BUCHLOÉ AND MOLANTHOCHLOÉ.

the terminal spikelet in the staminate spikes of *BvdiloZ* (see PI. XIII. Fig. 8). This terminal spikelet, which, from its position, cannot be oblique, is, in *Monanthochloë,* all that is left.

The elongated feathery stigmata, protruding from the apex of the flower, are found in all three of the genera mentioned, as also in *Spartina* and other chlorideous grasses, though not in all of them.

The principal difference of *Monanthochloë* and *Munroa* from *Chloridea* proper, consists in their spikelets being terminal or arranged on a terminal rhachis, and not on lateral more or less digitate spikes. If this dif- [440] ference should be deemed too important to let them stand in this alliance, they must be classed with *SesUriev,* a tribe already distinguished by Koch in his German Flora, but since overlooked by the latest writers ôn grasses, though so well characterized and distinguished from *Festucece* by the flowers being arranged in terminal, sometimes onesided spikes, and by the elongated stigmata protruding from the apex of the flowers.

EXPLANATION OF PLATES.

BUCHLOË DACTYLOIDES.

Plate XII. Fig. 1. A female plant with stolons, in fruit.

Fig. 2. A larger and a smaller stalk with male spikes.

Fig. 3. A specimen bearing both male and female flowers. These figures are of natural size; all the others are more or less magnified.

Fig. 4. An unusually short staminate spike in the position of the pistillate spike at PI. XIV. Fig. 3, and with scarcely more spikelets, to show the analogy of both.

Fig. 5. Diagram of the same.

Fig. 6. A two-flowered spikelet, seen from the inside of the spike, so that the lower glume is exhibited.

Fig. 7. A tri-flowered spikelet.

Fig. & Terminal spikelet of a spike, with larger lower glume.

Fig. 9. Flower open, with the stamens.

Fig. 10, a, *b, c.* Different forms of the lower glume.

Fig. 11, a, *b, e.* Same of upper glume; c shows an npper glnme with a secondary nerre, —a rare occurrence, found occasionally in specimens from Fort Kearney.

Fig. 12. Lower palea: a, of the lower flower, midrib running out into a point; ft, of the upper flower, blunt.

Fig. 13. Upper palea: a, from the inside and partly folded, showing also the scales ; *b,* same, unfolded, also with the scales; *c,* same, from the upper flower, both nerves at point much closer than in the lower flower.

Plate XIV. Fig. 1. Two heads in flower, in their natural position ; the involucre] leaves somewhat opened.

Fig. 2. Diagram of the lower of these heads, *a*; the upper head, *b,* has also 3 fertile flowers, but their arrangement is exactly reversed.

Fig. 3. An elongated head with 5 fertile flowers, showing their arrangement in a one-sided spike; «, the lower glume of the lowest spikelet; $b_{\%}$ lowest spikelet, ss well ss *d* and/on the off side of the rhachis; *e* and e, two spikelets alternating with these, on the near side of the rhachis ; *g,* last sterile glume, the rudiment of the sixth flower.

Fig. 4. Diagram of same ; the letters correspond with those in the last figure. [441]

Fig. 6. Rhachis of 3 spikelets, with the base of 2 involucnl leaves, in the axil of the lower one a bod.

Fig. «. Lower and upper glume of the lowest spikelet of a head in fruit; the npper is attached to the back of the lower glume.

Fig. 7. One of the other spikelets, seen from the inside of the head, exhibiting the lower glnme, part of the upper one, and the npper half of the lower pales,

Tig. 8. Different forms of the lower glume: a, narrow and obtuse; ^ foliaceous at the upper halt -s rery rsre occurrence.

Fig. ». Lower pdw of tl» I m , „ «, *tnm* th. (arid*, ralM up; », ovtoid* unfold.*

Fig. 10. 8un.oftb.fmlt: «, ftom th. inrfd., feUUd rand th. «pp« p*>, both donu* MTT» of which «• v U U; teMiM, t| | odd dd.

Fi(. 11. Upper p.1- : «, fiora tb. | aMr rid*, with th. attipMta protruding; *i. mm.* fro. tbt tort. diowtag both nerrwj «, upper pal* totalingtht rip*««d. *mm* from tb. iiuld.; MdNvUbb.

Tig. 11. 8nln: a, truncate. », •mMRbMle-bOobfd ; mon magnifed.

Fig. 18. Omjr with th« rtyl^ moN nugnHUd. At Uw bw of th* o»mry CM of UM S mdlnentory * • • • • Mid both m l * IT* TWfe.

Fig. 11 Onry• .till mot. m ^ M , IUV. »\\\ \ta« n d M t t j *iMU ; scales removed.

Fig. 16. Part of a stigmatic hair, highly magnified.

Fig. 16. Vertical section of a fruit-bearing spikelet, exhibiting both glumes (the outer upper one the longest much thickened), both palea and the rain.

Hg. 17. O«ta : «, M from th. mm teMr ,«. (turned towards the upper palea); *b*, horizontal, and *c* vertical section of same; a and b mag

MONANTHOCHLOË LITTORALIS.

Plate XIIL Fig. 1. Female plant in flower; here and there the small spikelets are recognized by the protruding stigmata. Natural size; all the other figures are magnified.

Fig. 2. Top of a stem of the same plant, showing the manner of ramification, the different leaves, the bifid scales which form the lowest leaf of each branch towards the stem, and which correspond to the upper pale©. The figure shows the lower stem leaves, which have BO branches in their axils, with smaller, narrower sheaths, while the upper branch-bearing leaves have large ventricose sheaths.

Fig. 3. Spikelet consisting of the foliaceous lower palea, including a hyaline scale, and two flowers. The plan is the same as in the female flower, PI. XIV. Fig. 22.

Fig. 4. Single flower, open, showing the stamens.

Fig. 5. Spikelet with first and second flowers neutral, and both upper ones staminate.

Fig. 6. Top of a branch, exhibiting the uppermost leaf, A, with an axillary branch, composed of the lowest bifid, 6, and two regularly formed leaves; the lower palea of the lowest flower, *c,* is less foliaceous than usual; upper palea of same divided in two thin scales, d_t *d,* lateral to the [442] flowers; three staminate flowers, «,/, *g.*

Fig. 7. Diagram of same.

Fig. 8. Diagram of a similar spikelet, in which both parts of the upper palea are hidden in the cavity of the lower one; second flower reduced to a single hyaline scale; third and fourth flower staminate; fifth, rudimentary.

Fig. 0. Diagram of another spikelet in which the lowest flower is reduced to a single herbaceous lower palea, the second one to a small merabranaceous scale, corresponding to an upper palea; third and fourth flowers staminate, and fifth rudimentary.

PUto XIV. Fig. 18. A very simple female spikelet, laid open; exhibiting a lower flower (consisting of 2 empty pale*, the lower one herbaceous, the upper membrauaceous and revolute), a second pistillate, and a third rudimentary flower.

Fig. 19. Diagram of same.

Fig. 20. 8pikelet composed of an empty foliaceous palea representing the lowest flower; an empty second flower, with the lower palea foliaceous at *tip,* the upper one bilobed; a single pistillate flower, and a rudimentary fourth flower.

Fig. 21. Diagram of same.

Fig. 22. Diagram of a spikelet, in which the lowest flower consists of 2 empty pale*; the second and third flowers bear pistils. This is the usual form of the pistillate spikelet; the upper palea of the lowest empty flower is often wanting.

Fig. 28. Form* which the upj>er i«lea of the lowest flower sometimes assume.

Fig. 24. Lower pal" * pistillate flowers: a, outside view; *b,* inside view, slightly unfolded; c, same, fully unfolded, so as to show the nervation.

Fig. 25. Upper palea of same: *a,* outside view, showing the wings partly rolled in; *b,* inside view ; c, same, unfolded, exhibiting the ovary and styles.

Fig. 24. Ovary and styles, with the rudimentary stamens at base; more magnified.

Fig. 27. Part of a itigtnatic hair, highly magnified.

Tin principal figures were drawn by Mr. P. Boetter, the analyses by the author.

How. - While this article Is going through the press I have an opportunity to examine the true *AnUpkcrn* as Steudel, <* *Anihtphar** is the author Schreber, writes it The 4-5-flowered head of .picnic has certainly a very great resemblance to *• *tmd** head* of *Buehtoi,* there are the same eiterior indurated glumes, forming together an involucrum, the same subulate Il*m towards the centre of the head, and the pale* of the fertile flower have the same direction, the lower one towards the centre, And ^ n|)per 0M ^^ ^ oat, ide of the head. But the outer involucral leaf is the lower glume (AS Kunth, ARnwt. i. 100, tad Budl. Qta. p, 85 have it; while SuwdeU Glum. i. p. 111. <»IU it less correctly an involuoruin), the inner is the upper one; Una comes a menibrananeous palea constituting the lower sterile flower as in many *Panic***, towards the outside of the head, and towards the inside the fertile charteceons flower; the analogy, therefore, is a superficial one only ; but it is interesting to obssm here spin, as so ofUn elsewhere, how different organs may assume the ttnie appearance and the same functions. T specimen examined is f Vcnenuela Collection.

The following names for grasses are also to be noted : —

B»*«nvA imrciroma, *Btgdm. S Qt*9. VU*tm* Undheim*uii* part 1 (Botton Joum. Nat Hist TOI. T, 1845, *ttl»p.ft>orftprintX

AamunMAMMAUMA.Kng4m.imUU. Vis^ to Bot. Oaartlt, voLfi. 1884,pp. 76, 77.-KDS.

XIII.

LISTS AND COLLECTED DESCKIPTIONS OF PLANTS.*

L CATALOGUE OF A COLLECTION OF PLANTS MADE IN ILLINOIS AND MISSOURI, BY CHARLES A. GEYER; WITH CRITICAL REMARKS, ETC.

FROM THE AMERICAN JOURNAL OF SCIENCE, VOL. XLVI. 1843.

MR. GEYER, who is an excellent collector, is now absent on an expedition to the Rocky [94] Mountains and Oregon, as announced in the last volume of this Journal (p. 226). Being unwilling to adopt the common plan of selling his collections to subscribers before they are actually made, he prefers to seek some needful aid in the prosecution of his arduous undertaking, by offering to the botanical public sets of the following plants, collected in 1842 near St Louis, Missouri, and around Beardstown on the Illinois River. This collection (which is duly mentioned on p. 227 of VoL XLV.) consists of the following species: —

1. RINUNCULUS MICRANTIU'S, *Nutt.* Apparently common in the grassy river bottoms, and on fertile grassy bills in Missouri and Illinois. It *is* very near *R. abortivus,* but apparently well distinguished by its pubescence, and the more orbicular, very seldom cordate or reniform lowest leaves. 2. R. FASCICULARIS, *Mute* 3. MTOSURUS MINIMUS, *Linn.* Certainly a native plant.[1] 4. ISOPYKUX BITKRNATUM, *Tort. <£ Gr.* 5. DELPHINIUM TRICORNE, [95] *Michx.* 6. TRAUTVETTERIA PALMATA, *Fisch. <£ Mey.* ; an entirely new locality for this rare plant, which has heretofore been found only in the Alleghany and Rocky Mountains. 7. TIIALICTRUM AKEMOKOIDES, *Michx.* 8. BRASBNIA PELTATA, *Pur*h.* 9. CORYDALIS AUREA, *IViUd.* ; the smaller, glaucous variety of the banks of the western rivers. 10. CARDAMINE LUDOVICIAXA, *Hook.* 11. C. IIIRSUTA, *Linn. 6*.* VIRGINIA. 12. SISYMBRIUM CANESCENS, *Nutt.* 13. DRARA BRACHYCARFA, *Nutt.* 14. D. CAROLINIANA, *WalL* 15. LEPIDIUM VIROINICUM, *Linn.* 16. POLTGALA PURPUREA, *Nutt.* 17. P. INCARNATA, *Linn,* 18. P. VERTICILLATA, *Linn.*

19. VIOLA PEDATA, *Linn.* 20. V. DELPMNIFOLIA, *NtUt.*; common in rich prairie soil in Illinois and Missouri,

• Arranged chronologically an far an practicable. — EDS.

[1] We now ought to be careful observer* of such plants as are apparently common to both continents ; in after yean it will be much more difficult to decide which are natives and which introduced. Many European plants, now common weeda east of the Alleghany Mountains, have not yet found their way to the Mississippi valley, but undoubtedly will arrive in a short time. Other plant* are here already at common as they are in Europe, from whence they were derived, or in middle Asia, perhaps their original home. It behooves us therefore to note the progress of these intruder*, and distinguish from them the true natives.

We are able to distinguish several different classes of such plants: —

1. *Nnrly allied geographical specie*,* where <HM takes the place of the other in the other continent; such as *Quertus aiba* in North America, and *Q. ptduneulata* in Europe ; *Carpinus Americana* and *C. Betulus; Polygmum Prrswmia* n. sp. *(P. mite.* PITS.) and *P. mite,* Schrank ; *Andromu* otndrntalii* and *A. ilcngaia; Lucopus rinuatus* and *L Suropvus,* and many others.

*. *G*VrQp*i*>l **r<Hu$,* where no specific distinction ≤*n be discovered between the natives of both continent*, ** wbm the American and European variety CAD always be distinguished by some points of minor importance. 8uch are *Sium lati/olium, Circma lutctiama, Samolus Valerandi* (if it does not belong to the first class), *Castansa* vetoo, *Lepidium ruderale. Astragalus kypoglottis, Erwphorum graciU, Myth gurus minimus,* etc

3. *Identical plants,* true natives of both continents, especially arctic or at least northern plant* ; alto marine apecies and cryptogamic plants; r. g. *Potentilla anserina. Campanula rotundi/olia, Epilobium spieahim\ Conns foucica, Phrttgmite* ammunis, Salicomia kerbaoea, Glaum maritima,* most *Equiseta,* etc.

4. Naturalized plants, spreading with the progress of civilization; of theae we have in the neighborhood of 6t 1Mim, *Taraxacum Dens-Leonis, Marrubium vulgar*, Trifb-Hum rrpens, Bromus staUinns, Virbascum Thnpsus,* and *V. BUtttaria* (perhaps belonging to the third class), *N*p** *Cntaria, Arrtium minus,* etc *Cick&rium Iutybms, EtMmm* [illegible], and other*, 1 have not sera in the Watt

It is difficult to deriile to which of the«e classes *Datura Stramonium* and *P^rinlncn oleracea* should be referred. *Datura* is perhaps introduced in Europe as well as America, and possibly did not reach this country from Europe. £W* *qmm Canadenm* and *(Knathera Hennis* art now at wtttty natwmlind in Europe, as *Taraxacum* is ia

M. MACROSPERMA, n. *sp.*: calycibus 5-fidis, laciniis calycis fructiferi ovatis trianguloribus acutis 2 inferioribus 3 superiores duplo superantibus, omnibus erecto-conniventibus flavo- s. ferrogineo-hispidissimis ; racemis basi subfoliatis ; pedicellis fructiferis calyce brevioribus basi adpressis ; calycibus horizontalibus ; tubo corolla denique calyce longiore ; nucibus maxiuiis. Texas, prairies, April. *F. Lindheimer.* —Nuts of same color as both others, but twice as large as those of the last, and larger than those of any European species examined by me ; uncinate hairs of the calyx very long, stiff, spreading in all directions ; flowers not so crowded as in both the foregoing species.

87. PUACELIA PURSHII, *Buckley, in Sill. Journ.* xlv. 171. 88. PUYSALIS PENNSYLVANIA, *Linn.* Some of the specimens have smooth, and others pubescent or hairy calyces ; these last ones constitute the P. *lanceolate,* Michx. 89. PENTSTEMOX PUBESCENS, *Linn.* 90. COLLINSIA VERNA, *NutL* 91. GRATIOLA A UREA, *Mvhl.* ? 92. HEDEOMA ruLEGioiDEs, *Pen.* 93. H. HISPIDA, *Purth.* 94. PYCNANTHEMUM PILOSUM, *Nutt.* 95. MONA&DA FUNCTATA, [99] *Linn,* 96. DRACOCEPHALON VIRGINIANUM, *Linn.* 97. SCCTELLARIA GALERICULATA, *Linn.*

98. VERBENA PANIC UL AT A, *Lam.* With undivided leaves, the true *V. paniculate;* and with the lower leaves divided, lobed or hastate, *V. hastata.* Linn., which can hardly be called even a variety. As Lamarck's name is equally applicable to both forms, it probably ought to be preferred to the Linnaean name.

99 to 102. Four hybrids of different species of Verbena, which together with several others that abound in this neighborhood, Mr. Geyer appears to have found equally abundant on the sandy wastes near Beardstown, and on the sandy islands of the Illinois River.

The names, chosen according to Schiede's proposition, indicate the parent plants; but it is often difficult enough to detect the parentage ; indeed, to ascertain which is the male and which the female parent is probably quite impossible if actual experiments be not instituted. Generally both parents grow near the hybrid, but as these Verbenas are perennial, the hybrids, being unable to produce seed, propagate the more readily by stolons, and spread in some localities so as even to exceed one or the other of the parents in number. In such cases we have to rely entirely on the resemblance of the offspring to some tme species in the vicinity. All these hybrids, however, are known to he such by their luxuriant growth exceeding that of their parents, by their sterility, and mostly by their local appearance in places where their parents are common. We find, as is naturally to be expected, many hybrids which resemble one of their parents more than the other; and hence many intermediate hybrid forms may be observed, so as to furnish all the connecting links between two very distinct species; this of course not proving the identity of such species, but rather the reverse. No hybrids are more common here than those between *V. itricta,* Vent, and *V. urtiagfolia,* Linn., awl I possess specimens not only of *V. urticnfolio-itricta* (near *V. itricta),* and of *V. itricto-urtiatfolia* (near *V. urticafUia),* but of several intermediate forms, the extremes of which might be taken for mere varieties of *V. itricta* and of *V. urtivrjolia ;* or they may be produced by seeds from these plants, adulterated by some pollen from the other species. The difficulty is increased by the fact that these doubtful hybrids produce more seeds than the [100J nearly intermediate hybrids, though far less than the true »pede*. In the course of time, if they propagate at all, they may revert again to their parental species, especially if the very probable supposition be true, that, when the ovary of these hybrids is fertile, the pollen is inert.*

99. V. PANICULATO-STKICTA : more hirsute than *V. paniculate* but not canescent like *V. itricta;* leaves much narrower than in *V. itricta,* subseasile or decurrent in a short petiole, simply or doubly or incisely serrate ; spikes more crowded than in *V. paniculuta,* more fascicled, not paniculate ; calyces hairy, somewhat gray, longer than ift *V. panieulata;* corolla intermediate in *ize and color, much paler than in *V. paniculata*; style peniHtent for some time on the ripening fruit, as in *V. paniculata.* Grows in abundance on the sandy, sometimes overflowed, banks of the Mississippi opposite St. Louis, with other hybrid forms, and with *V. itricta, V. urticafolia,* and *V. bracUaa. V. paniculata* it very rare there, perhaps destroyed by the growing bu»he«, which now cover the formerly grassy spot*. Nevertheless, the narrow leave*, deeper colored flowers, and persistent style prove sufficiently that *V. paniculata* is one of its parents. Flowers in July and August.

100. V. URTICAFOLJO-BBACTBOSA : decumbent like *V. bracUom,* but large, upreading sometimes two or three feet; leaves small, like *V. bracUc+a,* lactniato ; spikes fascicled, filiform ; fluwer* distinct, as in *V. urtiemfoiia ;* bracts longer than the calyx, but not more than half as large as in P. *bractmm;* corolla larger than in *V. urticafolia,* with a longer tube, very pale purple. The parent* of this hybrid cannot be mistaken ; the growth, the leaves, the bracts are of one, the spikes, ami the smaller size and pakr color of the corolla of the other. On sandbars and sandy islands in the Mississippi (3t Loui*) and Illinois River* (Beardstown). Flower* July to September.

101. V. sTRicTo-CRTicAroLu: an inlcrenting hybrid between two very distinct npecies. The plant Is more canencent than *V. urtictrfolia ;* the leaven shorter pctioli-d, wmiPtimm nenrly nemiile, or firmer texture, and not simply serrate, but generally doubly or even incisely Semite; sometime* even «o much indued or lobed that I would have bten inclined to look to *V. Kastata* or *V. brocUom* for an explanation, but w« cannot admit the action of three

• For farther remarks on this snhject see Transactions of the St. Louis Andemr of Science, voL I., Journal of Proceedings, fippt 5,1*59, pp. 676,676; and Botany of the Upper Miaouri (Hayden, In TraMacUont of tas Amrfcan Philosophical Society, 1862, a. t. vol. xii p. 80S). — EDS.

species in the formation of hybrids. The spikes are filiform, the flowers compact*r than m *V. urticvfolia,* but [101] not as densely imbricated as in *V. strictm* or *V. panicutota:* the calyx much longer than in *V. urtw/oUa,* canescently hairy • corolla large, intermediate in size between both parents, and pale purple. This w the most abundant hybrid here, and both parents are amongst the most common weed* about St. Louis. Flowers in July and August.

102. V. UETIC*POLIO-PAX«CULATA: leaves petioled, lanceolate, with simple, double, or sometimes uiosed serratures, generally elongated; spikes thin, more properly filiform than in any of our species; calyx and corolla interme- S K j ^ L . a n d «>lor, between both parents. It resembles some varieties ot the true F.^Wato, but the dark purple Ewers and the thick cylindric fruiting spikes at once distinguish it. St. Louis and Beardstown; grassy

^ £ S £ £ hybKn^et,nd here the corresponding one. -or. nearly ambling the other p «*
Which I designate by the same names, reversing the order, viz.: — M«i-d«i«J#<*.*i

V. STRVCTO-PANICCLATA: greener, narrower, more petioled leaves, darker flowers, than *V. panu^atc^lncta.*

V. BEACTBOso-BiiTic*roLiA : adscendent, with large lobed leaves, and thinner spikes.

V. OETICWOLIO-STEICTA s canescent, with sessile leaves, and thin filiform spikes.

V. PANICULATO-URTICÆFOLIA : with broader leaves, thinner spikes, paler and smaller flowers.

Then there is the *V. angustifolio-stricta* and *V. stricto-angustifolia.* Hybrids of *V. angustifolia* with any but *V. stricta,* any but *V. urticæfolia,* or have m other hybrid found by me introduced plants hybridize in their native country is unknown to me.

103. A»»0 J c. OCCDENTALH, *Punk.* 104. LTSIMACHU EEVoum. *Nutt.* J^J^^^DATA, *Lam.*

108. PHLOOHIUM TENNOE, ifff**. 107. P. SAO,™**, *linn.* 108. ^C*^ * °"*™*B?* ^. M . S ^ T1021 LIOUSTRIKA, *WilU.* 110. QQEmcFmo»*f,IFrf«. ill 1. QQ. ALBA, Lt«« ^^ TT ^ MO«A Jf««.?

McH^ao^A. l» 1H. 3. KOA Mjj* 1- S. *u* g.rm* ^ " aU v T to' ^TdLinct species,

117. POTAMOOETON DIVERSFOLS, Ihrto., ^ " ^ ^ / ^ i e d o v j or cylindric spikes. P. diwrn/oli^, «. characterized by the narrower, only 5-nerved upper leav^,^F "T - ^ few•flowered head., fiut some- eapttotu., the common form, has more oval 7-nerved upper leaves^d " ^ ^ uit is nerally alikfc The fruit, or timesHe lower head, of our variety are . * J J ^ j n £ T £ £ "«* - 5 « ^ « « * ^ ^ ™* nnt, i. always compressed, wingod on the back, »ith Uo twwra .- but b no mean8 —ne^ y so. The •ppearim* muricate; and in *fi.* they are often nearly or e n M r » * « «., forms nl1, a or Tj circumvolution, embryo describes 1| spind circumvolution; the embryo of most otner species '» ' *
I know but one .pecies, *P. d^us,* which exhibit, 2| '*' ?' » £ £ • £ , fc ^ ^ fnrnishe9 the best characteristic

It may not be amiss here to remnd » o ^ mthj. «^ for e^ ple, proves that p. ^ ^ ^ Linn., is mark.todUting.mh the diftVrent spec.es ° ^ ^ ^ ^ J ,, t e h ^ n f o n n d It *P fnarinu** occur, not only on tb. Nicollet's Expedition). Specimens of *Potamogeton*

. JUNCUS MARGINATUS, *Rostk.*

121. DaL,iH,u« srAT.,ACB«. * « . 122. C»r«»u9 MLL.HO.KO.DES, F-M. 123. bourn CAPILLARIS, *Röm. & Schult.*

12k U«.,OC,,AE,. «KO,N &*«». 'alec. - 259. A species whkh haB freqnently tee, found ^ the U ^ t ORUM GRACILE ^ £t L * ^/o/^-my specimens at ^received ta. Pennsylvania and from Ohio, were so labelled — but is easily distinguished by its triquetrous, s S i X 4th an the linear yellowish seeds. The true *E. angustifolium,* Roth., is the largest of all the species, est (1½ inch) wool; leaves 1 or 1½ lines broad, channelled; peduncles smooth; *E. latifolium,* Hoppe (*E. polystachyum,* [103] Auct.), has flat leaves and scabrous peduncles; and both have obovate, dark or light brown seeds.

I propose the following disposition of these species, acknowledging, however, that I have studied the American varieties from dried specimens only, never having observed any living ones: —

E. LATIFOLIUM, *Hoppe:* culmo trigono, foliis planis apice triquetris, spiculis P - m , .luncnU. scabris, nucibus obovatis. *E. polystachyum,* β, Linn.

α. NIGRO-CARINATUM : squamis floriferis plumbeis, carina nigricante, nucibus acutiusculis brunnel Germany; probably throughout Europe.

β. VIRIDI-CARINATUM : squamis noriferi. ob^uris, carina vire^nte, nucibu. oUusU, Int^centibu. M^cho- setts, Oh'.

V'°* « L i #-«o#;««..lii foliiM canaliculntiii apice triquetrin, ipiculin pluribut, peduDculis lævi uatæ.

B .a. foliis triquetris, spiculis pluribus, pedunculis scabris, nucibus lineari- »»• (flavioanUbti.) if. pW^tod^f*, y., linn. S. I ^ « S Hoppa.

a. PLURINZRYIUM : pedunculis tomentoso-scabris, squamis floriferis pallidis, nervis pluribus pallidioribus strlatls, nucibus obtusiusculis. Germany.

0. PAUCINEBVIUM : pedunculis scabris, squamis floriferis pallidis, nervis paucis (3) pallidioribus notatis, nucibus acutis. Illinois, Ohio, Pennsylvania.

126. CABEX ROSEA, *Schk.* 127. C. MTJLTIFLORA, *Muhl.* 128. C. ARIDA, *Ton. A Schw.* 129. C. CRISTATA, *Terr, db Schw.* 130. C. WILLDENOVII, *Shck.* 131. C. TORREYANA, *Dew.* 132. C. SHORTII, *Tvrr.* 133. C. LAXIFLORA, *Lam. f* 134. C. MEADII, *Dew. in SiU. Journ.* vol. xliii. p. 90. 135. C. UMBELLATA, *Schk.* 136. PANICUM VIRGATUM, *Linn.* 137. P. PUBESCENS, *Lam.* 138. P. SCOPARIUM, *Lam.* 139. P. CLANDESTINUM, *Linn.* 140. DIGITARIA FILIFORMIS, *EIL,* •ar. FLORIBUS MAJORIBUS. 141. ARISTIDA STRICTA, *Michx.* 142. MELICA SPECIOSA, *MuhL ?* 143. FESTUCA HUTAKS, *WiWL* 144. DIARRUENA AMERICANA, *Pal. de Beauv.*

145. ATHEROPOGON APLUDOIDES, *Muhl.* 146. A. PAPILLOSUS, n. *$p.*: culmis csspitosis basi foliatifl; foliis [104] lanceolato-linearibus planis inargine et ad nervum medianuni infra supraqueex papillis serrato-ciliatis ; spicis 1-3 subterminalibus biserialibus unilateralibus multifloris; gluinis papiiloso-hispidis; valva corolla perfect® exteriore trifida, valva corollae neutrius brevissima hyalina ex basi triaristata.

Sandy soil, Beardstown, 111. — Very near *A. oligostachyui,* Nutt, and resembling it closely, but distinct by the broader and hispid (not setaceous and smooth) leaves, the hispid (not pubescent) glumes, and the hyaline glume of the abortive floret (not half as large as in *A. oligostachjpu).*

147. ANDROPOGON SCOPARIUS, *Michx.* 148. POA HIRSUTA, *Michx.* 149. P. PECTINACEA, *Michx. t* 1496. HORDEUM PUSILLUM, *NtUt.* 150. WOODSIA PERRINIANA, *Uook.*

II. DESCRIPTIONS OF NEW SPECIES IN ENGELMANN AND GRAY'S PLANTS LINDHEIMERIANiE.*

Fkox TOE BOSTOW JOURNAL OF NATURAL HISTORY, VOL. V. pp. 210-264 (pp. 2-6« OF REPRINT), 1845; VOL. VI. pp. 141-240, 1850.

PART I. 1845.

1. RANUNCULUS TEXENBK, *Engelm.*: caule erecto ramosissimo basi hispido; foliis petioiatis, inferioribns [2] ovatis sabcordatis denticulatis, superioribus linearilanoeolatis, basi petiolorum menibranaoeo-dilataU bractdsqae ciliatis; petalis ft oblongis sepala ovata obtusa longe superantibiis; staminibus plurimis; carpellU subgiobosis acntis minntim tuberculosis in capitulum globoflum congestis. — Margin of ponds, Ac., near Houston, April* A [3] •pan to a foot high, with conspicuous bright yellow petals.

8. R. TRACHI8PERMU8, *Engelm.*: canle ramoso glabro ; foliis petiulatis, inferioribus plerumque orbiculato-OTatit obtusis subintegriN superioribus lanceolatw lineari-lancwlatwve denticulate, basi petiolorum membranaceo-dilataU bracteisqne snbciliatis; sepalin 3-4 ovatis reflexi* petala 3-^ft minima Hneari-spathulaU roperantibiw; •Uminibos ft-10; carpellU compressis obtusis undiqoe tuberculosis in capitulum oblonguui iwu cylindricum congetiis. Margin of ponds near Houston, Ac., April, May.

3. R. TRACHI8PERMU8. *fi.* ANOU8TIFOLIU8, *Engelm.* mil.: foliA omnibus lanceoUtit lineari-lanceolatisTe; and yt (an spec 7) LnrDHvncni, *Engelm. mm.*: foliis inferioribns oratis; sepalis 3-ft ovatU obtaiit patentibus peUla 3 Unaui-•pathulaU aquantibus; carpellU comprMs obtusiunculU tuberculous in capitulum globoaum oongertia. — Netf Houston, 4c, but not growing together with No. 2.

KRAMERIA. Profawor A. Brann. after examining the flowers of spades of thin genus, has suggested that [4] the natural affinity of *Kramer*# is with *Ugumirumr,* rather than *Polygalac***. And, indeed, at least in *K.* fanes* *lota,* the two lateral glandnlous petals *cover* hi *f»tiration* the stamroa; they cannot therefore belong to an Interior circle, as Bentham supposes. The ovary in nne-carptllary (againut the type of *Pol^latetr)* and irTrgularly one-sidrf, like the ovary of *l*g*mino*w;* it in imperfectly bilocular, by the infcrtion of the placenta, as in some *Ltgumim^m;* but in both cases the cell* are alwayn *ide by nide ; on the contrary, in *Pol^alne*** one in before the other. *Kramffi** may, than, be connideml a pentarwlroo« *Uguminnmi,* where one or two «Umina are abortive. In *K. lantriaia,* it to the lowest ntamen. opposite the three connected peUK which is wanting; but, in mmr flowers, a sterile *fOmmt* occupies thU place; it correspond* with the free loth stamen of most papilionaceous flower*, as the four others, which

* An armmt of the region in which LindhHnw e*!1.rted. contribQtsd by Dr. Rn^lmsnn to Part II. pp. 234-240, U [illegible] botanical intu''+ BsMLlWi^. [illegible] f* ^^ oontoilli • »«»>»' for which the authors « J*.Uy mpos^tUs; the descriptkas of tW being by Gray, tftev sre tndirftttd by nans only. As ** the rrmftitxUr of this |«rt of I be reprint, asw CWMAT, *Mmpkarbiacrm, Afigmoem^ GrmmimK^ At*, snd *Lomntkux** srs omitted, the descriptions tbtss oiUsn hsvinf bssa bmgbt together elsewhere. — Ed.

are united in *K. lanccdata,* are analogous to the tube of nine connected filaments. The lateral sessile petals correspond with the cariiia, and the three others, whose claws are connected, with the alee and carina; the five sepals alternate with them, as the stamens alternate with the petals. The fruit resembles somewhat the iudehiscent spiny legume of an *Onobrychis*; and, in all the specimens we have examiiied, it is one-seeded when ripe.

17. HTPEBICUM GYMNANTHUM [4]. 24. SIDA LINDHEIMERI [5]. 52. *Lythrum foliotum,* Engelm. mss. (L. alatum, y. *Torr. dt Gr.)* [8]. 58. LUDWIGIA LINEARIS, var. PUBERULA [9]. 61. GAURA LINDHEIMERI [9]. 63. CYNOBCIADIUM PINNATUM, *DC. p.* PUMILUM [10]. 72. LIATRIS ACIDOTA (L. *mucronata,* Torr. & Gr.) [10], and 73. 0. VBBNAUS [11]. 97. HELIANTHUS PRASCOX [13]. 111. *KgUUt Texana,* Engelm. mss. (K. Arkansana, *Kutt.)* [14]. 134. EUTOCA HIBSDTA. *(Phacdia hirsuta,* Nutt) [18]. 135. SOLANOM TEXENBE [19]. 141. GERARDIA SPICIFLORA, *Engdm.* m«.[19,—not described]. 144. SCUTELLARIA CARDIOPHYLLA [19]. 151. MONARDA LINDHEIMERI [20]. 157. DIPTERACANTHUS NUDIPLORU8 [21]. 107. ERIOGONDM LONOIFOLIUM, *Nutt., Benth. 0.* PLANTAGINEOM [22J. 168.. POLYGONELLA KRicoiDES. *(Gonopyrum Americanum,* Fisch. & Meyer) [22]. 185. *Xyris $cabra,* Engelm. mss. (X. Caroliniana, *Walt,* 0 ? scabra) [27]. 187. HYPOXIS EBECTA, 0. *STIVALIS. 188. *H. leptocarpa,* Engelm. mss. (H. ERECTA, y. LEPTOCARPA) [27].

EUSTYL1S. Perigonium hexaphyllo-partitum, confonne, patens; tubo nullo ; segmentis obovatis planis, [28] tribus interioribus motlice minoribus. Filamenta distincta, e basi lato subulata, antheras subpanduriformes post anthesin immutatas Bquantia: connectivum latum basi apicemque versus pnesertim dilatatum, loculis marginalibus. Stylus elongatus (stamina ad»iuanR), ad apicein infundibuliformis, trifidus; lobis bitidus, purtitionibus in stigmata filiformia recurvia attenuatis. Habitus, bulbus, cap9iila, etc.,omnino Nemostylis. 189. E. PURPUREA. *(Nemostylis f purpurea,* Herbert) [27].

190. GYMNADENIA NIVEA. *(Orchis nivea,* Nutt) [28]. 191. SPIRANTHBS VERNALIS [28]. 198. SCILLA (KAMASSA) ANGUSTA [29]. 217. VESICARIA AURIOULATA [32]. 237. PBUNUS GRACILIS [35]. 239. *Gaura exaU **h* Engelm. nu». (G. lungiflora, *Spach)* [36]. 261. HELIANTHUS MAXIMILIANI, *fi.* ASPERRIMUS [41]. 268. SENECIO AMPOLLACEDS, Hook. vnr. a. QLABERRIMUS, and 269 var. *0.* FLOCCOSUB [42]. CONVOLVULUS LOBATUB [44]. 278. L1TH08P1RMUM BREVIFLORUM [44], 279. EUTOCA 8TRICTIFLORA [45]. 280. K PATULIFLORA [45]. E. GLABRA *(Phaceliaglabra,* NutL) [46].

884. CASTILLEJA INDIVISA, *Engdm.:* piloftchispida ; foHis integris lineari-lanceolatw acutis basi pleraque [47] rotundatis, floralibus apice ovato-vel obovato-dilaUtis coloratis; spica demum elongaU ; calycis lobis late obovatis •pice ooloratis truncatis retusisve corolla paulo vel vix longioribus. — Valde affinis quoad flores C. *coccinev,* et quoad folia 0. *liOiotpermifoluti,* ab ilia imprimis foliis indivisis, ab hac statura s»pius elatiore differt, foliis acutioribus et eapsulia majoribua. *Benth. in DC. Prodr. irud.* — Prairies from Houston to the Colorado: March to June. Also collotod by Drummond and fierlandier.

— BRAZORIA[471 286. B. TRUNCATA. *(Phy^osUgia truncate,* Benth.) [48.] 287. B. SCDTELLAEIOIDW [49]. 288. P»««o«W»U nrTBRMKDU. *(DrococepKalum intermedium,* Nutt.) [49]. 28ft. VERBENA BIPINNATIFIDA. *{Giandularia •VMMio^Wa,* Nutt.) [491 290. DIPTEBACANTHUS (J MEIOPHANES) MICRANTHU* [49} 298. OXTBAPHUS PILOBA ? Utfwua *ovata,* Puwh. *Calymenia pilon,* Nutt) [51]. 296. POLYOONUM OBISTATUM [51 j 298. ARISTOLOCHIA LONGI-**<>** [51]. 311. *Potamogeion natam,* L. var. [55> 312. SISTBINCHIUM MINUS [55].

PART II. 1850.

»30. VBMCARU MCUBVATA, *Engdm. imd.* [147].» 335. PABONTCHIA LINDHEIMERI, *Engdm. xned.* [152].

M0. TAUHUM ArBANWACUM, M. *,ip i* TM*Vlc** tubeiwa; caule adwendente herbacw ramoso patulo [153] fcl«*o ; folib Unceolatis s. lineari-lanceolatis subsemilibus carnosis; floribus axillaribus singulis ; pedunculis •°P» basin aiticnlatis bibracteoktis, froctifcris reflexw ; nepalis ovati^ acuminatis tricarinatis, fructiferi* subpernistenti-*••; PHalU oratin mucronatis ; sUminibus sub-25; seminibus lineis gyraUs carinatis et striis tenuissimis tmnsTeniis •legMOer aoUtis. — On the Sabinan, and more abundantly, on the Liano, rare about New Braunfels, on rocky soil or •Wat naked rock*; in (lower principally in July and August, but also at other seanon*, always after heavy rains. — 8001 white, fleshy, tuberom, often bifurcated. Stems 8-16 inches long, ascending, nuch branched. Leaves lJ-2 or •*•» 3 inches long, »-4 lines wide. Peduncle 4-5 lines long. Sepals of the same length ; petals 5 lines long and •wide, orange to red; filament* ml; ntyle and stitftna orange. Seeds elegantly marked, black, larger than in any *• » North American ppecien. — Dirtinct from all other upeciee described by DeCandolle, by the single flower*.

68a TALIMDM BARMEirroiicM,«. V: w*''0* cnu**; caule P1^11111*0; lmm'' (lebilibui wTMentonis aacendenti-* foliodt; foliia carnaib late ovatis cunpidatis bani attenuatis MibneMilibus ; cymis axillaribus bmoteatis subtrifloris Wm oompoaitk) venui apicem laxe paniculate; floribas lonpe peilicdialw ; wpalin ovatis cnnpidatM membranaceu [illegible] tnb-15; •eminibua nlgrii nitentibus sub lente tenuiter tubercuUtis. — New BrmunfeU, among

• The feteripdont of tpedct qaoUd htrt by name only, an by Gray. - EDB,

shrubs on the banks of the Gnadaloupe. July, September. — Stems prostrate ; branches weak, ascending, supported by the shrubs under " which the plant grows, often 6-10 feet long ;" — the specimens before me are 2-4 feet long. Lower leaves 2£-3£ inches long, 1-11 wide. Pedicels 6-12 and more lines long, thickened at the apex. Sepals about one line long ; flowers apparently 4-5 lines in diameter, purple. Capsule about one line long, almost [154] globose. Seeds smoother than in any other of our species.[1]

SIDA HETEROCARPA, *Engdm. :* stellato-pubescens ; caule erecto ramoso ; foliis basi subcordatis obtusis [163] crenato-dentalis, inferioribus lanceolatis, superioribus linearibus; tuberculo sub basi petioli subspinoso; petiolis brevibus stipulas setaceas et pedicellas solitarias s. fasciculatas superantibus; carpellis 5 nigris divaricato-birostratis apice pubescentibus latere tenuiter rugulosis, dorso membrana tenui evanescente clausis. — Roadsides, waste places, Houston, Texas, with *S. spinosa.* Annual ? Flowers in August and September. Distinguished from *S. tpinota* by the narrower dentate-crenate (not serrate) leaves, and smaller black (not light brown) carpels, ruguloee (not lacunose-reticulated) on the sides, with a prominent point on the back, broader, shorter, more divaricate not erect beaks. The seed escapes through the back, not through the regular opening at the top.

359. *Vitis candicans,* Engelm. (V. aestivalis, *Michx.)* [166]

[1] Besides these two species, we have in the flora of the United States thrve others very different from these, but nearly related to one another, namely, the well-known *T. tereti/olinm,* Pursh, *T. calycinum.* En gel in. in Wisliz. Rep., and *T. parviflonnn,* Nutt.; all three now in cultivation with me, and are well distinguished. *T. calycinum* is very ornamental ; the large flowers have sometimes six to ten petals,

PORTULACA.

Mr. Lindheimer has discovered two und escribed species in Western Texas. As these plants are so difficult to preserve and so unsightly when dried, he did not collect specimens for distribution; but from his seeds both were raised by me last season and prove very remarkable plants, one from its near alliance with *Portulaca oleracea,* the other from its great difference from that species. I arrange the sjiecies of our flora (all of them annuals) in the following manner.

* *Spatkulatct:* glabem'mae; caule tereti; foliis spathulatis obovatis ; sepalis alato-carinatis cum o|«rculo capsule ma tune deciduis ; petalis flavis emarginatU s. bilobis ; capsule annulo circulari tuiuido.

1. P. OLEKACIA, *L* : foliis obovatis sptthulati* apice rotondatis; alabastro compreato ovato acuto; sepalis carinatis ; •teminibus 7-0 ; stigmatibus 5 stylum brevem superantibus ; seminibus minoribus minute sub letite ven-uculosis nigris. — St. Louis, very common ; flowers open in direct sunshine between 9 and 10 o'clock, A. M., August.

2. P. RETC8A, n. *tp.*: foliis cu neat is retails, sen *emnrgintUU;* alabaatro compretto orbicnlato obtuto; sepalis late carinato-alatis; staminibus sub-15 (17-10, Lindh., in plantis parvulia 7-10); ttigmatibns 3-4 stylura «quantibus vel eo brevioribas; seminibos majoribos sub lento erhinato-tnbercuUtis nigricantibua. — Granite region of the Liano in Western Tens. Flowrs open in direct sunshine between 8) and •1 A. M. (in 8t liooia, in Angust), always before th* common species. — Distinguish*! from the nearly allied *P. olrracea* by the broader retuae leaves, and broader calyx ; by the larger, more distinctly tuberculated, somewhat paler aeeda, Bach larger style, and shorter and fewer stigmata. Number of stamina variable. In large specimens (boshes several feet in diameter, stems at base 6-7 lines thick, prostrate or a* wading) tb« nnmber counted wan 15. Stigniate almost Invarirbly 4, rarely 8.

•• *Fmmmoiaim:* gUberrims ; caul* angulato ; foliis super!-•ribne laneeolatis; sepalis vix carinatii port antheain uoJdois 5 petelit plenim<|oe vmicoloribus acutinscu-»•i- *P*lm* ala dmkri Ute tx cal/d. but tacu.

3. P. LANCEOLATA, n. *sp.*: *sub-tmcttL*; foliis inferioribns spathulatis obtusis, superioribus lanceolatis acutis; petalis obovatis 8. oblauceolatis acutiusculis s. cuspidatis; staminibus 7-27 ; stigmatibus 3-6 ; capsula turbinata versus apiçem ala circulari lata cincta ; seminibus majoribus echinato-tobercu* latis cinereis.

a. VER8ICOLOR ; petalis majoribus obovatis rubris basi flavis; steminibua 12-24 ; stigmatibus 6-6 linearibus; capsule ala orbiculari plana.

p. MINOR ; petalis minoribus oblanceolatis ssspe totii flavidis rarius apice rube^is; staminibus 7-12; stigmatibus 8-4 ovato-oblongis; capsula ala subpentagona undulate.

Granite region of the Liano, in Western Texas. — Sterna in smaller plants a few inches high, erect, with erect branches; in larger specimens a foot or more high, as- [156] ceuding, very much branched. Leaves J-l inch *long,* 1-3 lines wide. Flowers 4-6 lines in diameter, very pretty in the larger forms, open from 8-9 o'clock, A. M. (St Louis, An* gust); earlier than any other species. Capsule with the win& which is formed by the enlarged bate of the deciduous calyx, 2-2} lines in diameter. — The seeds of both forms are absolutely identical, so that the difference in the number of stamina and stigmata, and in the size and color of the flower, cannot constitute them distinct species, as Mr. Lindheimer suggwta. He adds that the leaves of a. have an acidulous, and those of *0.* an insipid mucilaginous taste.

•• *Teretifotu*:* ad axilla piloste ; caule tereti; foliis plui minus teretibus, basi paulo productis; sepalis membranaoeis ecarinatis cum opereulo capral* mataraj deciduis; petalis violaceii; captula margine circulari tumido.

4. P. FiuttA, *L.*: tepalU lineari-oblongia, petalis ovato-oblongis obtusis retails a. emarginatb dnplo bwvioribua; ataminibas 15-26 stigmatibus 6-6 wb*quantibus ; seminibM minatis nigris ofaeis minute tuberculatia. — Texas, New Mexico, Mexico, etc — Flowers open from 9-11 or 12 o'clock in bright sunshine, 4-6 lines in diameter: stigmata glandular, hairy on the margins only, purple.

5. P. GILLIKMI, *Hook.* : sepalis orbienlato-ovatis petailft orbiruUto-obooniatis ter quaterve brevioribus ; steminlbas nnmerodMimU (60) ttigmaUbus sub-6 exaertis longt bftrl-oribua; mninibus paulo majoribna tnbmnUtit dnwrii nitentiboa. — Common in caltivatkw, Mid here and th6f» almost naturalixed; originally from ChilL Flowtn 2O-2* lines In diameter, open from 8 or 9 to 2 or 8 P. M. in MB* •bine. StigmnU glandular, hairy on U» maigKnt *nd [illegible] *. •nrfaea, jmUowlah or [illegible].

EYSENHARDTIA SPINOSA, *Engelm,*: fruticosa ; ramis squarrosis racbidi spicarum persistente lignosa spinosis; [174] foliis 6-8-jugis; foliolis minutis ovatis acutis adpresse pilosis; spicis pauciiioris ; calycis obconico-campanulati dentibus triangularibus obtusis insequalibus ; vexillo profunde bilobo ; staniinibus subdiadelphis ; *ovario 4-ovulato* et stylo apice uncinato pilosis. —On Lake Eucinillas, north of Chihuahua, *Dr. Wislizenus;* in flower, August and September. — A rough-looking, in many respects remarkable shrub, 2-3 feet high, with black bark. Leaves 4 to 6 or 7 lines long: leaflets l-1£ lines long. Spikes an inch long, with a stout persistent rhachis : flowers at first white, then rose-colored : uppermost (vexillary) filament shortest and almost free, adhering to the tube only at its base: style strongly hooked.

379. *Sopkora $empervirens,* Engelm. mss. (S. speciosa, *Benth.)* [178]. 388. PBUNUS MINUTIFLOBA, *Engelm. ined.* [186]. *Lythrum ovalifolium,* Engelm. mss. (L. alatum, tar. ovalifolium, *Gray)* [187]. 394. CENOTHEBA SKRBULATA, C. NNIFOLIA, *Engelm.* [189]. (611.) GAURA SUFFULTA, *Engelm. mu.* [190].

PABSIFLORA TENDILOBA, *Engelm.:* petiolis brevibus eglandulosis; foliis supra pilis brevibus subscabris [192] flubtua glabriusculis trinerviis reticulatis basi biglandulosis subcordatis trilobis, lobis lateralibus lanceolato-linearibus elongatis cuspidatis horizontaliter divergentibus vel recurviitis, medio brevissimo in fol. inferioribus integro in superioribus breviter trilobo; Htipulis setaceis; pedunculis binis petioium bis superantibua; cirrho elongato simplici; floribus exinvolucratis apetalis ; calyce 5-lobo virescente. — On the Liano ; coll. in October. — Apparently near *P. norfnalii,* L., of Jamaica, which is unknown to me. Herbaceous, sub-erect, slender. Petioles 2, the peduncles 3-3J lines long. Leaves rather rigid, with revolute margins, 5 or 6 lines long, but from 3 to 5 inches in transverse diameter ; the lobes about 3 lines wide, the lateral ones sometimes bearing a posterior tooth or lubule. Flowers 8 or 9 lines in diameter. Only a single specimen was gathered by Lindheimer.

DAUCOSMA, *Engelm. it Gray.* [210]. 404. D. LACINIATUM, *Engelm.* <* *Gray.* [211].

STMPHOBICABPUS BPICATUB, *Engelm.:* foliis obovatis obtusi8 brevissime petiolatis supra demum glabratis [215] Bubtus pubescentibuB paliidis ; floribua (15-30) in spicas axillares arete glomeratas congestis; corollis intus barbatis ; baccis rubris. — Shady Juttom woods, New Braunfels. A small shrub, 2 or 3 feet high, with numerous slender branches. Leaves about three-fourths of an inch Ions, half an inch wide; the lower leaves wider, almost orbicular. Spikes from 4 to 6, or in fruit 8 or 10, lines long. Flowers a little smaller than in *S. glomeratus,* to which our •pecies bean a strong affinity. It is, however, distinguished by its smaller, obtuse leaves, the spiked flowers, the larger and apparently more juicy fruit, and the broader, more compressed seeds. Of the numerous flowers in each Bpike only a few mature fruit.

407. FEDIA (VALERIANELLA) BTENOCARPA, *Engelm. mu.* The fruit is not only much smaller and [217J »©» Blender than that of *F. radiata,* but the proportion of the empty cells is different; these being much •mailer than the seed; while in the former they are about equal, and in *F. cannata* (which has a different habit,) —**ger. Cauline leaves often deeply dentate at the base, or almost pinnatifid, but sometimes entire.

FIDIA AllARELLA, *Lindh. msi.* : glaberrima, erect*, vewus apicem dicbotomo-cymosa; foliis inferioribus Bpathulatu hasi longe attenuate superioribus oblongo-linearibus sewilibufl vel basi subcordatis, omnibus integris obtusis ; frttctibuB minimus Bubgloboso-ovatis obtuse auriculatis hispidis, loculis Bterilibus fertili subgloboso inulto augustioribus bievioribusque pene obliteratis. — Coroanche Spring; flowering in May. — Plant 8 to 12 inches high, in habit similar to *F. radiata* and *F. itenocarpa;* but the leaves are entire in all the specimens; and the fresh herb haa a bitter taste, ·Which the other species have not The fruit is much smaller than in any other species known to me ; the sterile cells many times smaller than the seed, their cavity almost obliterated.

337. LIMUM RUPEBTRE, *Engelm. intd.* [232]

PAaaiPLORA AFFINIB, *Engelm.* : herbacea, scandenR, elate, glabra; foliis trilobis subtua glaucis petioliaque [233J eglandulotb, inferioribus Bubconlatis, BUjHsrioribus ba«i Bubacutis, lobu subajqualibus obovatis obtusis seUceomueronatiR integris; stipulu wtaceis ; pedunculis binis petioium aquantibus vul superantilms 3-bracteatis, cirrho tatermedio elongato'simplici ; petalis calycis lobis obtusis brevioribus et angUBtioribiw (flavescentibun) ; Iwiccis (caeru-[1]«o-atris) stipiteni Baquantibiw. — Comanche Spring, climbing high over trees, in shady places. August-September. — Near *P. luUa* in aspect; from which it is distinguwhed by the bracteate jieduncles, the deeply lobed leaves, the l^^r flowers, smaller Bewls, AC. Lower leaves 3 inches long, and 4 wide, less deeply lobed than the upper, which •«• deeply divided Petioles 4-12 lines long Peduncle* 12-15 lines long. Bracts 3, rarely 2, subulate, oblanceoiate, °» obovmle, mucronate, often di«UnU Flowers 16 lines in diameter ; the fiiiibrilhii as long as sepal*. JJtipe half an *»* In length, longer in proportion than in any other of our specie*. Berry of the same diameter. Seeds ovate, ttoeronate, trannvenely rugose, smaller and more turbid than in *P. UUa.* — DeCandolle's division of the genii*, *Wch would separate this specu* from *P. Uim* on account of the bract, must be erroneous; moreover, *P. lutta* has ** "ptrigoniuni •. calycem 5-lobuui,[11] but 10-lubum, as well as our [illegible]*

• Thi foUowing gtoerm and siwcta Jointly TISIHIHI by I merisne, psrt 2, were fimt pubHuhiHl in *n* psp-T, by AM Omy, [Olm]J and Eagtlmann, and riiuiutratml in Plante LinJliei. | on ntw gen«ra and species of *Cvmpotita* from Texas (Proc.

III. DESCRIPTIONS IN GRAY'S PLANTJE FENDLERIANiE.*

FROM THE MEMOIRS OF THE AMERICAN ACADEMY, N. S., VOL. IV. 1849.

13. THALICTRUM FENDLERI, *Engelm.* : dioicum : foliis petiolatis; petiolulis primariis brachiatis Tel refractis [5] stipellatis ; foliolis cordato-rotundatis trilobis; filanientis apice viz incraasatis ; antheris setigero-mucronatis ; carpellis sessilibus oblique ovatis complanatis costatis carinato-alatis stylo recurvo triplo longioribus ; cat. fere *T. Cornuti.* — About Santa ¥6. *(T. Cornuti,* of which a few specimens gathered on the Mora River were distributed with this species, has the fruit terete, with the prominent ribs all equal.)

17. *Corydalis montana,* Engelm. mss. (C. nurea, *IVUld.* var). [6]

29-31. S18TMBRIUM INCI8UM, *Engelm.:* annuum vel bienne; caule glabrinsculo sea puberalo sea glanda- [8] laso-piloeo; foliis pinnatisectis, segmentis lanceolatis vel lineari-lonceolatis inciso-serratia; petalis flavis lanceolato-spathulatis calycem saperantibus ; pedicellis calyce ter-quaterve longioribus, fractiferis (roceino fractifero elongato) patentibus capillaribus siliquas lineari-filiformes erecto-patentes subiequantibus; valvis indistincte uninerviis. — Banks of streams in New Mexico; Santa Fé Creek and Mora River ; June to August

DRTMARIA NODOSA, n. *sp.:* aunua, diffusa, trichotomo raiuosissima; runiis basis nodosis tumidis brachiatis; [12] internodis superne glanduloso-pnberulis ; stipulis filiformibus ; foliis linearibus canaliculatis glabria; floribus in dichotomia ramulorum pedunculatis ; sepal is lanceolatis acuminatis trinerviis; petalis ad unguem bipartitis, lobis oblongo linearibus retusis s. emarginatis calycem superantibus ; staminibus 6 disco camoso quinquelobo-insi-deiitibus ; ovario breviter stipitato Hubgloboso pluriovulato; calyce persistent* clauso capsulam duplo breviorem [13] includente ; seminibus circa 3 asperis. — Cosiquiriachi, in the State of Chihuahua ; flowers in June and July.— About 6 inches high, much branched and diffuse; branches at right angles with the stem. Styles of two shapes, short with minute stigmata, and longer than the ovary with 3 distinct recurved stigmata; both forms on the same plant, and both flowers apparently equally fertile.

72. TALINUM CALYCINUM, *Engelm., Wiilizen. Report,* 1848, p. 88 [redescribed]. [14]

DISPOSITION OF PERENNIAL GERANIA. [26]

Perennes ; pedunculi biflori; valvulae capsuhe laves, plus minus pilosie ; seniina reticulata sen rugosa,

* Pedicelli deflornti erecti seu suberecti.'

1. Q. RiCHARDSONir, *Fisch. & Mcy. G. albiflorum,* Hook.; Torr. *A* Gray; non Ledeb.: caule erecto cam petiolis glabriascalo; pedicelliA tenuiter gLmduloso-pubescentibus ; filament is basi pilosis calycera et stylos pilosis tertia parte connatos nqoantibus; valvis capeuhe parce piloHiusculis ; rostro glanduloso-pubescente ; petalis albis. — [27] Distinct from the next by the greater smoothness, the hairy and much less connate styles, the pilose (not short-dliate) filaments, and the more delicately reticulated seeds.

2. G. MACCLATUX, *Li tin.:* entile erecto cum petiolis retrono-piloso; pedicellis glanduloso-pubescentibos 5 filamentis basi breviter ciliatis calyce sty Usque nudis ultra medium connatis subbrevioribos; valvis capsuln longe pilosis ; rostro glanduloso-pubescente.

3. G. PEHTAGTHUM. *Engdm. in Wiul. Rep.:* canle erecto cum petiolis retrorso-pabescente ; pedicellis glandaloso-pabescentibus; filamentis basi pilosis calycem et stylos nudos ima parte solum connatos saquantibns; valvis eapsuin pilodosculis ; rostro Klanduloso-pubesceute. — Eastern Mountains of New Mexico, on Wolf Creek. — Nearer (7. *manlatum* than any of the others : diitingoiiihed by the characters above enumerated; also by the finer, more closely adpressed pubescence, the smaller leaves with narrower segments and much more prominent veins; inner sepals with colored margins, emarginate or somewhat bilobed : seed not seen.

4. G. FRIMONTII, *Torr.*

fl. G. MIXICAKUM, *Kuntk.*

• • PediceUi deflornti declinaU sen refractL

← Florae violacei.

6. G. cjBPiToeuM, *Jama.*

r. Acail. Arts and 8cL vol. L 1846, pp. 46-49). The jo«bs» pr»fli«d and UM fint pagination M tho* of PlanUi UadhiiiiMrisiisj ; the second pscinatioa is that of fint Publication.— ED*

40* Vn*omALm>HBlMiRi[S17. 4«]. 411 RIICIBL-UA CTUmiACIA [11S-«1». 4S-47). 415. KBBMUA BELLIDI-toLU[M0.471. LINDHUMUI 434, US. L TEXANA [225-226. 47]. Ml- *TtrotoneOxm Tmmm* (Halsa Ts»M» *Gray),* [227. 48]. BAURATTIA. 48S. R CAtVA (Sinufc ciilra, *Orap)* [288. 48]. AOA88IZ1A. 487. 646. A. SOAVIS [229-280. 49>

• An secooat of UM route trsvtiwd by Ftndkr, contribntod to this piper by Dr. togtlmiDD *(pp.* M)9 is emltlA — EM.

7. G. GRACILB, n. «p.: caule crecto divaricato-ramoso cum petiolis et pedicellis retrorso-piloso ; filamentis basi piloso-ciliatis calyce et stylis pilous ima parte solum connatis brevioribus; valvis capsula pilosiusculis; rostro pubescente. — Pine woods, on the mountains of Cosiquiriachi, State of Chihuahua; collected in October, by Dr. Wisliaenm — Resembling the last; but erect, more hirsute pubescent; the flowers, fruit, and seed smaller; stamens shorter ; styles hairy, more deeply divided; and the peduncles much shorter, mostly of the length of the pedicels. — Near *G. Mexicanum,* Kunth ?

-i- -i- Floras albidi.

8. G. HERNANDEZII, *DC:* caule divaricato-ramoso cum petiolis patentim piloso; pedicellis glanduloso-pilosis; filamentis basi breviter ciliatis calycem et stylos pilosos ad medium connatos aquantibus ; valvis capaulae parce piloeiusculis; rostro glanduloso-piloso. — Pine woods, on the mountains of Llanos, State of Chihuahua ; collected in October, by Dr. Wislizenus. Leaves 1J to 2 inches in diameter, the upper truncate at the base; peduncles as long as, or shorter than, the pedicels; flowers white, about 8 lines in diameter.

18a CALLIANDRA ? HERBACEA, *Engdm.*: caule humili erecto flexuoso adpresse piloso; stipulis lanceolatis [39] nervosis; foliis longe petiolatis ; pinnis a-4-jugi*; foliolis 20-30 obliquis oblongis obtuaiuBculis abate supra - glabris subtus laxe reticulatis adpresse pilosis ; capitulia florum binis folio brevioribus, pauci-(8-10-)Boris; calycibus tubuiosis 4-4-dentatis, dentibus tnbo subbrevioribus ciliatis ; tubo corolla* calyce triplo longiore dentibus obtusiusculis apice parce pilosis ; staminibus 25-30 corollam longe superantibus. - Between San Miguel and Las Vegas; flowering inAugust-Plantapparentlyperennial,6inche8high: leaves with petioles 3 inches long: leaflets 3 lines long: heads •boat 1 inch in diam K on peduncles of 1 inch in length. Flowers polygamous: a fertile flower which I examined had 4 calyx and 4 corolla teeUi; a sterile one, 5 teeth: stamens united at the base, more so in the fertile flower. Ovary elongated, with many ovula and the tumid sutures glabrous.

C. CURORTS, *Engdm.*: fruticow, humili. ; ramuli. petiolisque brevilm. eglanduloei. pubescentibus ; folik S^jugi. rariu* l.jagi.; U U b fr-12-jugi. minuti. orati. obturi. «» acutiuwulu supm gkbn, eubtus mkn.; et,puh. •abnkU.rigidi.e4cU. .ubptnrstentibue; cpitulis brevitcr peduncuktie «ngul.s b.m.ve p«ttc..(4-8.)flon.; flonbu.

erijcJn tar qaaWve .upenT ad mediumTfida extu. parve pilo« (purpumX bta knceokt,. .cut,. .ub»quahbn.; Mnibo. JolyadelphUba.! in tubum connati. eUmgati. tenui-imi. circiter 36; oyano hnean-lanceokU, .atum iner^ato gkberrimo; .tylo ten«i»imo capilkceo rtamina .upemnte; rtu^te P ^ ^ - n j l ^ j J ~ » J •tipiUto acuminate (immatuio) albo-Kriceo ma^inibu. ralde incmwaU. ~ bn » ^ - f hh ^ ^ ^ l T n *Or*;* flowering i. April. - Stem. «iu.m»e, mnch bmnched, 3 to 12 inch* higb,.tout Leave, 4 to8ta.kii: l-«eU|tollinelong.Peduncle. 7to 4 or 6 line. long. Stamen. « inch long. - p - J ^ * * ' n ^ ». W . finch wide, whit, silky. whUe the ovary U perfectly gkbrou. !.- Th. .pecimen. of Dr. Wuluenu., from Etach.mba, jn.nulkr, more branched; the leaflet .mailer, obtu*. more hairy, and not more £•* byuga*Jhe lobe, of the «*olk recurved. Dr. Gregg collected in the Cafion of Ojito Luger .pecunenN with * - » » .*. * * * - * ^ « *to-n,* with the lobe, oftbe corolk erect - Apparently near C. *Gdtjomva* and *C. Xalapauu,* Benth^ but weU dieUnguiahed by the very wnall leafleU, Ac

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IV. DESCRIPTIONS IN *GRAYS* PLANT* WRIGHTIANJL

*I** r» 8-rr.~K.An Co.mu.CT,ox. to K»OWL»O^ VOU IIL A.no» 6,1852. AKP VOU V. 1863.

PABT I. 1852.

30. sandy soil. mesa P*«OL*CA « « , *Engd*. PL LinA.* 2, ,. 154. Valley of the Rio G»d.>hb.rB J I - . £ [13] The long rtyle and the bmadly winged eepal. are decwire a. to the identity of tin. .pecm The thVaWrfllTrouffhn«- a. thow of LindheimerV q»cimen^ but opaque and black, not grayuh. The

»• *-Jitom uA* minute."] - To the character of the *SpatkuUU** in PI. Lindh. 1. c add : *Operculo eapnla acut* ~b* * * • ««Wete *Hmin* unL plum* induct*.* I had overlooked thi. remarkable fact; but it eonrtandy occur, m •II the •peeiM of ^^ ^ t j ^ both European and American.

« i » . P. *ntMA Linn.* W. Teia. to New Merico. I have before me .pecimen. from six different localities * » the BTMO, w-twJd. collected by Undheimer and Wright, differing from one another in the .i» and *PPe*™« •f the mfe and in the .b.n* of the eanwile; but the* difference, vary »o much that even varietie. can hardly be •''''•Wt-fart. In MXH the camule U unall with a long .tipe, the operculum conic, the aeed. very minute, and more « W« thblng with metallic lu.tr*. In other, the cp.ulc i. more than twice a. large, the operculum KmigloboM, the '''*?• » «y abort, aod UM much larger M«d* black and o|«iue.

TALINUM AURANTIACUM, *Engtlm. PI. Lindh. I c.* Common throughout Southwestern Texas. Also found [14] by Dr. Wislizenus in the Jornada del Muerto.

33. T. AURANTIACUM, /3. ANGUSTISSIMUM: foliis anguste linearibus; pedunculis ad basin vel viz supra basin articuiatis ; sepalis magis membranaceis quam petala brevioribus; stylo stamina eequante ovario vix longiore. — Bottoms of Live Oak Creek, and on the San Felipe; July.

34. T. SARMENTOSUM, *Engelm. PI Lindh. I. c.* On the Liana; June. Root thick, tuberous. To characters add: *BraeUolis subulate.*

35. T. SPATHULATUM, n.' *sp. :* caule erecto gracili folioso; foliis camosis oblanceolato-spathulatis breviter cuspidatis in petiohun sensim attenuatis ; cymulis axillaribus bracteatis laxe trifloris versus caulis apicem in paniculam dispositis; bracteis ovatis cuspidatis minutis deciduis; floribus longe pedicellatis [corolla ex. cl. Wright flava]; seminibus nigris nitentibus tuberculatis. — Mountains of New Mexico east of the Rio Grande; August. Well distinguished from the nearly related *T. sarmentotum* by the narrower, spatulate leaves (2-3 inches long, and half an inch or more wide), by the short ovate bracU, the larger capsule, and the very much larger seeds, which are much more distinctly tuberculate.

NOTES ON LINUM.

LINUM, *L.* (Dehiscence of the capsule only, or at least most readily, through the false dissepiments!) [25]

Sect. ADENOLINUM.

1. LINUM PERENNS, *Linn.* Collected for the first time in Mexico by Dr. Gregg, in dry valleys near Saltillo, Sept 1848. Secondary dissepiments incomplete, with capillary fibres on their margins, much as in *L. Boottii.*

Sect. LINOPSIS.

§ 1. Capsules 5-valved ; the secondary dissepiments more or less membranaceous, but entire; styles united to above the middle, mostly to near the apex.

2. L. MULTICACLE, *Hook. — L. hudtonioides,* Planch., is a mere variety. Styles mostly united almost to the tips. Capsule obtuse, as long as or a little shorter than the calyx ; the secondary dissepiments entirely raembranaceous, falling away to let the seed escape. Texas, from the coast (Houston and Victoria) to the West (N. Braunfels, Pierdenales, etc.). — Sepals persistent, even after the full of the capnule, while in all other species they fall off when the fruit ripens.

3. L. ARISTATUM, *Engdm. in PL U'isl. p.* 101. Loaves sometimes with stipular glands. False dissepiments for the greater part inembranaceous, with a narrow falciform cartilagineoiiK part exteriorly and inferiorly. — Between El Paso aii«l Chihuahua. Wright's No. 72 is a smaller form of this specie* ; the sepals rather less arintaie ; the flowers and capsules a little smaller, and with a large and perpendicular ligneous root

4. L. RIOIDDM, *Punk.* Glaucous ; stem simple below ; leaves, at least the upper ones, glandular-serrate, without stipular glands; pedicels thickened at the end, forming a cup-shaped exterior caliculus; styles almost entirely united ; filament* subulate from a triangular base; capsule not seen. (My specimens were collected by Oeyer, on the Upper Missouri)

Var. PDBERULCM. Glaucous ; steins very much branched from the base, puberalent, or rarely glabrate; leaves erect, linear, 1-nerved, niucronate, a pair of stipular glands at their bane ; pedicels equalling or exceeding the calyx 5 sepals glandulofie-ciliate, the exterior 3-nerved ; filament* with an ovate-triangular base, toothless; styles united to the summit; capsule rather shorter than the sepals, ovate, acutiah, 5-valved, the secondary difwepimenU almost entirely inembranaceous. —Santo Fé, to the Cimarron River, *FendUr,* No. 85. Prof. Gray in PI. Fendl. considered it a variety of *L. Berlandieri,* and in PI. Lindh. p. 157, as belonging to *L. rigidum.* From the former it is distinguished by the glaucous appearance, the linear leaves, and especially the small capmile with the almost entirely membranaceoos secondary dissepiments. From the latter, the absence of the calculate nip Mow the calyx, the smaller flowers, and the entire leaves appear to separate it [Dr. Engelmann inclimvl to consider thin a distinct species; but the capsules of true *L. rigidum,* in the Hookerian herbarium, show precinely the same structure* and others rightly named "L. *rigidum"* by Planchon have manifest stipular gland*, although he bos not noticed them; so that it would be wrong, I think, to separate the present plant specifically. It i* evident that the stipular glands do not furnish reliable specifl* distinctions. — A. G.J

5. L. BBRLA* DIERI, *HonL* Green ; leaves lanceolate or lanceolate-linear; stipular glands often present, bat not •Iways; filament* lanceoUte-subulate at th« bane; mpnuics glohone-ovnte, Piilmcute, 5-vslved, the secondary dissepiments partly (the upper and inner half) memhraniiceotm. — From Galventon to the BTSJOS, N. BraanWs, [«6] •nd the Pierdenales, *LimlMmer,* Ac On the Aon Pedro River, *Wrùfit.* - The Istter approaches A slightly glaucous form, with narrower and more rigid leaves, which occurs on the Cimarron *(ll'Mm**, tmilm,* mils* viftk

No. 85), often only two or three inches high, but much branched, with manifest stipular glands; the capsule ovate and acute. It appears very near to *L. [rigidum* var.] *puberulum;* but the structure of the false dissepiments is decisive.

§ 2. Capsules 10-valved.

• Styles united at the base or below the middle.

6. L. BOOTTII, *Planchm.* Annual; styles in northern (St. Louis) specimens united at or below the lower third only, in Texan specimens <*fi. Planchon)* almost to the middle ; capsules globose, acute, 10-valved ; the secondary dissepiments incomplete, with numerous hair-like fibres on the margin. —No. 86, PI. Fendl. belongs here, and not to *L. rigidum.* This is the only one of our species with a 10-valved capsule, where the styles are somewhat united.

• * Styles free to the base,

t Secondary dissepiments incomplete.

7. L. RUPESTRE, *Engelm. in PI. Lindh.* 2, *p.* 232. Capsule globose-ovate, acute or cuspidate, like that of the foregoing species, but smaller; secondary dissepiments exactly the same; distinguished principally by the perennial ligneous root, the oubulate leaves, the smaller flowers and fruit, and the entirely free styles. — Found by Lindheimer about New Braunfels and Comnnche Spring; by Wright (No. 71) on Turkey Creek. Dr. Gregg collected it near jSaltillo in June, and a variety, which may be named 0. *cymulosum,* on the battle-field of Buena Vista in May; this latter may be distinguished by the small and crowded cymes at the end of the branches.

8. L. GREGGII, n. *tp.* : viride, glabrum, canlibus plnribus e rhizomate ligneo adscendentibus a basi fraticulosa lamosis angulatis; foliis alternis inferioribus oblanceolatis superioribus lanceolatis patulis; glandulis stipularibus geminis rarius inconspicuis; cymis virgatis dissitifloris contractis; pedicellis calyce eoepius longioribus; sepalis lanceolatis acutis trinerviis margine glanduloRis; filamentis bosi brevi dilatatis 2-denticulatis; stylis liberis ; stigmatibus coheerentibus; capsula deprewo-globosa cuspidate calycem subsquante 10-valvi, dissepimentis secundariis racompletia. —Near Saltillo, Sept. 1st, 18 W, *Dr. Gregg,* No. 387. —Stems about 10 inches high. Leaves similar to those of *L. Virginianum,* the capsule and seeds of the same size. Distinguished from *L. rupestre* by the broader leaves, much smaller flowers and fruit, the singular united stigmata, which I have found in all the flowers (and many of them) examined by me, and the hairless false dissepiments. Apparently near *L. Mexicanum,* but that species has opposite leaves, &c

t t Secondary dissepiments complete and similar to the primary ones: capsule splitting into 10 closed cocci.

9. LINUM VIRGINIANUM, *Linn.* Biennial (or perennial?) with a fibrous root (all the others have a tapering simple root).

Var. 0 OPPOBITIFOLIUM : caule erecto ; foliis plurimis oppositis obovatis seiLoblongis obtusis; panicula j>atuJa; ^ p[illegible] integerrimis late ovotis acutis; petalis flavis. — Little Rock, Arkansas, in springy morasses with Sphagnum. Flowers smaller than in the usual form.

Var. y. ANCJCSTIFOLIUM : caule stricto ; foliis erectis; panicula contracta Rpareiflora; sepalis lanceolatiscapsulam flnperaQtibuft, interioribus glandulosis; petalis sulphureis. — Western Arkansas, on sandy hills in open woods. •Mowers and fruit larger than in the common form.

81. *Zanthoxylum digynum,* Engelm. in litt. (Z. Carolinianmn, *Lam.)* [31].

84. RHD8 MICROPHTLLA, *Engelm. in litt.:* fruticosa; ramulis verrucoflia; foliis impari-pinnatis 3-4-jugis, rha- [31] *MI alata; foliolis sessilihus pan^is ovalibus obtusis v. mucronatis basi acutis integerrimis seu levissime crenulatis Pilosulis; floribus dioicis amentnceiR pnecocibus basi tribracteolatis; pctalis ciliatis; drupa globosa subcompressa glandtilari-piloaa, puUmine I«vi. — Maiyins of thickets, on the top of hills, in the large pmirie between New Braunfels •*» San.Antonio, 15 miles from the former place, 1850; also gathered, without developed flowers, in 1846. It blos•oma in March, and ihows ripe fmit in May. A large shrub: stems one or two inches in diameter, branching above, ^ J * numerous small branchlets. LeafleU 3 or 4 lines long. Dwk 5-lobed, the lobes emarginate, A true *Lobadium* *** pinnated leaves.

^ftw *candicans,* Engelm. in«l. (V. cnrincea, *Shutttocarth)* "[32]. I I I R ^ 8ERICEA, *Engelm. ined.* [37]. ASTRAQAUra LIMDRIIMBRI, *Engelm. intii* [52]. DESMOIMUM WISUZ.EM, *Engelm. ined.* [53].

PENDLERA, *Engdm.* rf *Gray* [77]. SAKVITALU ANGUSTIFOLIA, *Engelm. in coU. Gregg* [112} POROPHYLLUM AMPLttiCAUU ,*Engelm. ined.* [120].

PART II. 1853.

Clematis coccin[illegible]*f* Kngelm. mat. (C. Viorna, var. coccinea) [7]. *Carydalis curvutUigua,* Engelm. (C. aurea, Willd. var.) [10J.

V. DESCRIPTIONS IN ENGELMANN'S BOTANY OF THE UPPER MISSOURI.

FROM HATDEN'S REPORT ON GEOLOGY AND NATURAL HISTORY, IN THE TRANSACTIONS OF THE AMERICAN PHILOSOPHICAL SOCIETY, N. B., VOL. XII. 1861, pp. 182-209*

NASTURTIUM CALYCINUM,! *Engelm.,* n. *tp.:* annuum erectuin seu diffusum, hirsutulum; foliis cau- [184,730] linis anguste oblongis sinuatis seu subpinnatifidis basi auriculata arete sessilibus vel semi amplexicaulibns; racemoeis confertifloris demum elongatis; pedicellis flore flavido et silicula ovoidea acuta parva bispidula cum stylo gracili vix longforibus ; calyce persistente. In aspect as well as in the style (fully a line long on a silicle 1$ line in length), this species resembles some *Vucicarüe,* but the numerous seeds are those of a *Nasturtium.* The stem is about a foot high, often much branched and diffuse. The ovate-lanceolate acutish sepals commonly persist until the valves of the pod have fallen. The pubescence of the pod consists of very short and pointed thick-based simple hairs (A. Gray). Sandy bottoms of the Yellowstone River; Fort Sarpy to Fort Union.

MACHJSRANTHEBA VISCOSA *(Dieteria vicoa,* Nutt.). [105]

LITHOSPERMUM BREVIFLOBUM, vor. PUNCTULOSUM, *Engdm.:* hispidum, caulibus e. radice perpendicular! [203] pluribus, erectis foliis Hnearibus; floribus pseudo-axillaribus minutis; nucibus minoribus undique ezsculpto punctulosis. Sandy bottoms about Fort Union at the mouth of the Yellowstone River. The flowers are absolutely identical with those of the last *[L. breviflorum* otherwise the much greater roughness anil the curiously punctate nuta would seem to indicate specific difference.

VI. FROM GRAY'S MANUAL OF THE BOTANY OF THE NORTHERN UNITED STATES.

The following species are named by Engelmann, who contributed notes on *CuBcuta, Euphorbia, Alisma, Sagittaria,* and *Echinodorus,* to the second edition; also on *Vitis, Callitriche, Pinus, Juncus, Naias, Lcmna, Wolffia, Sparganium,* and *Isoetes,* to the fifth edition. — ED&

SECOND EDITION, 1856.

Cirrium JUipendulum, Engelm. (C. Virginianum, *Michx.,* var. filipendulum) [283]. SPAROAVIITM IURTCARFUK, *Engelm.* n. up. [430]. *Cyperus tenuior,* Engelm. (C. Engelnianni, *SUud.)* [492]. EBIOFHORUM GRACILI» *Koch,* var. PAUCINEBVIUM, *Engelm.* [502].

FIFTH EDITION, 1868.

GORTDAUB AURBA, *WULL,* var. VICRANTHA, *Engdm.*; var. OCCIDEHTALIS, Engelm. (0. *montana,* Engelm.) C. CURVUIUQUA, *Engelm.* C. CRTSTALLINA, *Engdm.* [62]. ASTIR ANOMALUS, *Eng4m.* [235]. CALUTRICHB AUSTUII, *Engdm.* [428]. QUERCUS BUBKA, *L^* var. RUNCUTATA, *Engdm.* [454].

VII. NOTE ON POLTGONUM TENUf.

FROM THE PROCEEDINGS or THE ACADEMY OF NATURAL 8C«NOE« OF PHOADELFHIA.

^OLTOONVV TENUB, *Miekx. a.* covmJNB: majut; nucibns majoribas (•esquilineam longis). *fi.* MICROSFER- [76] Him : minus, graciliu*; nucibus vix linearo longis. *y.* LATIFOLIUM : humile; foliis oblongis; ipidt eoarctalb; bracteis superioribus (aristo destitntis) muticis. Ifeisner, in the Prodromus, is wrong in taying that the nuts an sub-opaque or rough on the edge ; they are perfectly smooth and shining, with concave aides and an acumination. —• [Mar. 1863, as a note to a paper by Asa Gray on plants collected in the Rocky Mountains by Hall ft Harbour.]

[9] It hss bren thought brat not to print the entire lint, which is a reprint, with some sdditiont, of the list of plmnU ttatifitd by Engehnsnn, sad published in the Report of the •toftlary of War for 1858, vol. ii. pp. 7)8-744, and PrellniaarySspofftof Explorationa in Nebraaka and DakoU in the rmra 1855-1857, by Lieut O. K. Warm. Washington, 1859. pp. 152-178. — EDS.

t Fint published In Preliminary Rtport of Explorations in Nebraaka and Dakota, 1855-1857; litot 0. K. Wa T. E. Catslsgiis of Planta, - EDS.

VIII. BOTANY OF SIMPSON'S EXPEDITION.

FROM REPORT OP EXPLORATIONS ACROSS THV GREAT BASIN OF UTAH IN 1859, IN CHARGE OF CAPT. J. H. SIMPSON. WASHINGTON, 1876.

CERCOCARPUS LEDIFOLIO8, *Nuttall in Torrey & Gray** Fl. N. Am.* 1, *p.* 427; *and in his continuation of* [435] *MicKaur's Sylca,* 2, *p.* 28, *U* 51 ; *Hooker, I.* c. *pi. t.* 324. — Mountain-Mahogany of the inhabitants of Utah.

This small evergreen tree ia so well described by Nuttall in both works mentioned that not much remains to be added. His figure, however, is not a very faithful representation. He says that it grows much like a peach tree, at most 15 feet high, and that the trunk is sometimes as much as a foot in diameter. On the expedition it was found to grow rarely as a tree, but usually branching from the base, or several stems from one root; its height was from 8-15 feet, and the stem* seen had the thickness of 3-6, or, at most, 10 inches. The bark is light gray, tough, smoothish, with superficial longitudinal wrinkles and short transverse scars. The wood is hard, heavy, very close-grained, light reddish-brown, with white sap; medullary rays very numerous, but extremely fine, scarcely visible with the naked eye; the wood is similar to cherry-wood, but harder and heavier. A specimen before me has a diameter of 16 lines, 14 lines of which are wood, showing 24 annual rings, so that each ring has a thickness of not much more than £ line. The shoots, or longer branches, have a white, smooth bark, with joints or internodes of about 1 inch in length.
The leaves, however, are usually crowded at the end of lateral branchlets, a few lines to 1 or 1* inches in length [436] closely covered with circular scars. Leaves very thick and leathery, persistent, lanceolate, acute at both ends, entire and revolute at the margin, with a thick midrib, prominent on the lower surface, 9-14 lines- long, 2f-3$_{f}^{n}$ lines wide, on a petiole l*-2 lines long, to the lower part of which adhere lanceolate, brown, scarious stipules. When young, the branchlets as well as the leaves are covered all over with short, curly hair; when older, the leaves become glabrous and glossy on the upper surface, the lower remaining hairy and assuming a rusty color. The sessile flowers •re produced in June from the axils of the uppermost leaves of the preceding year's growth, either single or* 2 or 3 together; short searious bracto envelop the base of the cylindrical, woolly, calyx-tube, which is 3 lines long; its Wobed, white limb, 3-4 lines in diameter, is very woolly externally, and less so internally, and bears about 20 or 25 «»ked$_{f}$ slender filaments, with reniform anthers J line in diameter. Immediately after flowering, the silky-feathery *yle becomes elongated, and carries up with it the detached limb of the calyx; at maturity, the style becomes • twisted, feathery tail of about 2 inches in length; the inconspicuous, linear, hairy fruit itself is about 4 lines long, •nd remains hid in the persistent calyx-tube; at its top and base I observe a beard of very curious, stiff white bristle*, less than a line in length, thicker in the middle, and tapering toward both extremities. The fruit seems to be •omewhat persistent, as I find it in specimens collected in spring before the flowering-season. About the time of Jfewering, the young leaves begin to develop at the end of the branchlets, leaving the flowers between them and the W e t of the year before. I generally find four or five leaves of the same year's growth at the end of each branchlet; tkey probably fall off when about 15 or 18 months old. This fine tree, discovered by Nuttall on Bear River, north of the Salt Lake, and near "Thornbeitfs Ravine" in the Rocky Mountains, was found by the expedition on the Lookout Mountains and other mountain-chains of the basin.*

The name of " Wild Sage," now so familiar to every traveller in our western mountain-deserts, was first [444] Wed by Lewis and Clarke, in the narrative of their adventurous expedition, to designate several species of *Arte-*Ma* or *Wormwood,* distantly resembling the true garden sage, *Salvia officinalu,* by their gray foliage and aromatic odor. It teems that now this name has, by common use, been restricted to the larger shrubby species, which give a Peculiar character to the arid plateaus of Western North America, and which are of the highest importance to the traveller as " furnishing the sole article of fuel or shelter which they meet in wandering over these woodless deserts," as already Nuttall informs us in his genera of North American Plants, 2, p. 142. He states that the " Wild Sage " is his *Artemisia Colufnhien$i$m* which name was by him improperly substituted for the prior name of *A. cana,* described fcy Pttnh from the original specimens of Lewis and Clarke. Torrey and Gray, in their Flora of N. America, 2, p. 418, doubt whether this really it the " Wild Sage " of those travellers, and come to the conclusion that that name was krthcrimhiately applied to teveral shrubby species ; they further state that the plant given by Governor Lewis to Pursh as "the Sage" in the herbaceous *A. Ludoviciana* found on the homeward voyage on the Missouri River.

I have now the meant, through information obtained from Mr. H. Engelmann and from Dr. F. V. Hayden, to throw a little more light on this question, which is not without importance for botanical geography. The two species here ia question aw: —

ARTEMISIA CANA, *Pur*, FL Am. Sept. &* p. 521 ; *Torrey A Gray, Fl N. Am.* 2, *p.* 418. -Shrubby, with woody elem 8-4 inches in diameter, 8-4 feet (on the Yellowtone, *Dr. Hayden*) or 2-6 feet high (on the Laramie

• Tht account of *Cadacea,* which ctroe here, is reproduced shove (pp. 229-239). — Eot,

Plains, *H. Engelmann).* Stem covered with a light-gray bark, which is separated into many layers of loose shreds connected by smaller transverse fibres, and is readily torn off. Wood light, porous, pale-colored, with very many darker brown medullary rays, easily separating along the division of the annual rings. These rings, or layers, are from £-1 line in thickness, as stems of 1½-2 inches diameter show about a dozen rings, and are consequently as many yean old. The stems are rarely cylindrical, but mostly compressed, knotty, and variously twisted, and often stunted ; they are sometimes divided from the base, but oftener bear short and thick branches higher up. The annual branchlets are crowded along the older branches, 8-12 inches long, densely coated with a soft, white pubescence, and crowded mitli silvery-gray leaves, and bear toward their upper part and on the numerous short and erect lateral branchlets a profusion of small flower-heads, forming a spiked or contracted panicle, interspersed with short leaves. The leaves are flat, linear-lanceolate, entire or (the lower ones) rarely lobed, 1-2 or 2J lines wide and 1^—2 inches long, the upper ones becoming smaller. The flower-heads are mostly sessile, or nearly so, hemispherical, about 2 lines long and wide; outer scales of involucrum shorter, foliaceous, and canescent (sometimes the lowest ones larger than the flowers, and pointed) ; inner scales nearly as long as flowers, brownish, scarious, obtuse, cottony-fimbriate on the margins. The flowers are all perfect, usually 5, in some specimens as many as 8 in number, \\ lines long ; ovary glandular, and, when bruised, with the odor of wormwood.

This is the " Wild Sage " of the Upper Missouri (above the mouth of the Yellowstone) and the Yellow- [445] stone River, and of the Laramie Plains, but it does not seem to occur west of the Rocky Mountains, as Torrey and Gray (/. c.) already state, and Xuttull (/. c.) must have confounded it with other species, when he contends that it is "still more abundant on the barren plains of the Columbia River," and that it grows 6 to 8 or 12 feet high.

ARTEMISIA TRIDENT AT A, *Nuttall in Trans. Amer. Phil. Soc. (n. ser.)* 7, *p.* 393 ; *Torrey A Gray, Fl.* 2, *p.* 418.— Trunk, bark, and wood very similar to that of the last species, but trunk often larger, and usually even more twilled and knotty, with veiy numerous 6hort and stunted branches, which are repeatedly divided into a great many smaller branchlets ; ultimate annual branchlets fascicled, erect, only 3-6 inches long, canescent or silvery, very leafy at bate, rather naked upward, bearing strict, rather compact, paniculate spikes, composed of sessile or usually pedunculate spikeleta or glomerules of 3 to 6 or 8 sessile heads. Leaves silvery-white on both surfaces, crowded at the bane of the branches, and often fascicled on short or stunted sterile brunches, narrowly wedge-shaped, 1£-2 lines wide at the obtuse tridentate or trilobed end, narrowed down into a more or less distinct petiole; usually 3-6, rarely 8, lines long. Inflorescence interspersed with short and narrow, undivided, cuueate or spatulate obtuse leaves. Heads of flowers narrow, obovoid, nearly lj lines long, not much more than half as wide, with short and obtuse, canescent, exterior scales, and longer, scuriou*, interior scales, ciliate on the sidua. flowers in some specimeift 3, in others often 4-fl in each head, all |>erfect. Bcarci'ly metre than 1 line long; ovary quite glandular and with the odor of turpentine.

This is the " Wild Su^e " of Utah, ami, perhaps, of the whole region west of the Rocky Mountains, where it seems to supplant the more eastern *A.* ra/ia. Nuttall, who first described it, calls it a shrub about a foot high, and us such it apjHjars in the mountains of Colorado ; but in Utah it is the largest and most abundant species, uvually 2-4 feet high, rarely attaining a height of 6 feet, and then not straight, and with trunks of 3-6 inches in diameter; sometimes the smallest bushes have trunks fully as thick as the tallest ones, short and chunky. East of the mountain*, in the ran#e of *A. cana,* it ever remains an inconspicuous shrub, lost among the more common species. Near Camp Floyd specimens were collected bearing white tomentose excrescences of the size of a pea, or larger, undoubtedly galls caused by the sting of insect* ; the name have been observe* 1 on thin species in Colorado.

The other species of *Artemisia* collected by the exjxMlition were *A. CanadauU,* Michx., at Bridger's Past; *A. Ludoviciana,* Xutt., at Sweetwater, Iirid#i'r'« Pass, Round Prairie, etc. ; *A. dracunculoida,* Punh., on the Sweetwater ; and *A.frigida,* Willd., on the Upper Sweetwnter River.

SARCOBATTH VERMICTLATUH, *T»rrnj in Kmon/i Report* (1*48), *p.* 149. *Batis* (?) *termiculata,* Hooker, Flor. Bor.-Am. 2, p. 128 (18*0). *Sarcnbatut Maxximilumi,* Nee* in Pr. Mnximil. Trav. Enj?I. ed. p. 018 (ex Torrey) ; Seubert in Bot Zeitung, 1844, p. 733, cum tab.; Lindley in Hooker, Lond. Joum. Dot. iv. p. 1 (184ft). *Frtmontia* «rmucu-lorù, Torrej in Fremont's First Report, 1843, Rept. 1843, p 93, and Fremont's Second Report, 1846, p. 317, [446] tAb. 3. *Sarcacanthus,* Nuttall in PI. Oamiwl. p. 184. JftirrofeiiiM irrmim^irijt, Tnrrey in Sitgr. R*p. p. 169, in Stansh. Rep. p. 394, in Hot. Whipplc, p. 13O.[1] — *Pulpy Tliom* or *Pulpijleaml Thorn* of Lewis and Clarke ; *Qrtamoood* of the present travellers and settler*.

This curious and iiiifiortiint plant in found on the nrid saline plain*, principally on clayey soil, which*in the wet season is moist, and on the border of twit-like*, often mveriiitf *hr^c* patrhe*. fmm hclnw Fort Pierre on the Missouri *(Or. Haydtn)* to the Upper Plntte River *(Frmwnt, II. Enyrtmnnn),* ami Upper Canadian *(Or. James)* east of the Rocky Mountains to the plain* of the Columbia (/>irù *ami <%irkf, Pougl<u, Frrmmty,* Utah *(Fremont, Stansbury)* through the Basin to Carson Valley (//. *Engtlmann)* and down to the Uila River *(Em>ry).* Though discovered and noticed by

[1] Compart a Watson's Itarùion of the American (henopodiscec in Proc. Am. Ac. ArU Sc. vol. ix. p. 82 (1875).

Lewis and Clarke (1804) and collected by Dr. James (1819), this shrub was first described, 1840, by Hooker, in his North American Flora, from Oregon specimens, and was doubtfully referred by him to *Batis.* A few years later, it was again described by Nees, in his account of the plants collected by the Prince of Neu Wied, as a new genus under the name of *Sarcobatus,* and very soon afterward, and without a knowledge of the publication by Nees, again by Torrey under that of *Fremontia.* It is a great pity that this last name had to give way to priority ; though at present a much handsomer and showy Californian shrub bears Fremont's name, the wide-spread *Greasetoood* of the western mountains and deserts would more fitly have commemorated the bold and hardy pioneer of explorers to the millions who now do or in time to come will know and value this plant.

The GREASEWOOD forms a scraggy, stunted shrub, 2 or 3 to as much as 6 or 8 feet high ; in Utah it is commonly 3-4 feet high. The stems are scarcely ever more than 1 or 2 and rarely 3 inches thick, knotty, flattened, twisted, and often with irregular ridges and holes (the scars of decayed branches) ; sometimes, however, many straight shoots issue from a single base, J-J inch thick, so straight as to be used for arrows. They are covered with a compact, smoothish or slightly roughened, light-gray bark. The wood is very hard and compact, of light-yellow, in the core light-brownish, color, with very thin annual layers, in younger plants about J, in older ones J, of a line or less thick. The oldest stems seen showed 20-25 rather indistinct rings, and were consequently so many years old. The numerous smaller branches have a smooth, shining, white bark, and are beset with white spines at right angles ; these spines are indurated branches of two kinds. The sharper and shorter ones are real spines, scarcely ever more than £-1 inch long ; they bear leaves only, or, in the axils of these, female flowew, and are terminated by a sharp point and never by a staminate spike. The other spines are brunchlets which did bear such a terminal spike, which, after flowering, has fullen away ; they are 1-2 inches long, sometimes even longer, when they are apt to bear also lateral spines. The flower-tearing branches are very often secondary axillary productions closely under the sterile primary branch, which constitutes the •pine, so that the spines often appear as axillary to the flower-bearing branches. The leaves are thick and pulpy, linear, or often narrowed toward the base, flattened or even slightly channelled on the upper surface, and [447] keeled on the lower one, at least toward the base, leaving a triangular scar after falling off. They are f-1 inch, rarely as much as 1* inches long, and \ line, or sometimes, in the upper half, even 1 line, wide; in young and vigorous •hoots, I have seen the leaves flatter, Hborter, and broader, almost lanceolate. Their surface usually is perfectly glabrous ; in specimens from Carson Lake, however, I find the younger leaves covered with a rough and sometimes branched pubescence. The leaves are sometimes on the lower part of the branches opposite, but commonly alternating in f order. The sUminate and pistillate flowers are both very imperfect, but very different in their arrangement and •tructure ; they usually owur on the same plant, though some plants seem to bear scarcely any but staminate, others only pistillate, flowers. The sUminate flowers are crowded into a deciduous spike or ament, terminating the branches. This spike is, before the flowers open, 3-5 lines long and 1* lines thick, and very compact, exhibiting only the rhombic •urfaces of the scales ; afterward it elongates to the length of 6-9 lines, showing the deciduous anthers under and -J*tween the separated scales. The spike consists of 25-35 peltate angular scales, pointed at the upper end, which cover 3-S broadly oval anthem, sessile on the rhachis, * line long, 2-celled, opening laterally. The fertile flowers are uwally solitary in the axils of the leaves and sessile; in some specimens I find a secondary flower just below the Primary one, and sometime* even below a branch, springing from the same axil; sometimes they are aggregated on abbreviated brancblete, forming irregular cluster*. The flower consists of a tubular calyx with an inconspicuous rim, investing the lower half of the ovary, which is terminated by two unequal subulate stigmas, lateral in regard to the •tern. In the fruit, this rim is enlarged to a broad, circular, spreading wing, 3-5 lines in diameter, green or sometimes red, which surrounds the upper third of the fruit The flattened vertical seed, enclosed in the membranaceous utriculus, is about I line in diameter, and contains a spiral embryo without an albumen, as already demonstrated and figured by Professor Torrey in Fremont's Report.

The Qreasewood is found in flower from June to August.

The form from Carson Lake seems to be distinguished not only by the pubescence of the younger parts of the Plant, bat also by it* more wiuarrwe growth, its subdicecious flowers, and its aggregated fertile flowers and fruits; but the Gwasewood of other localities is also often subdicecious, so that when first described it was considered a truly dioecious pUnt

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8p*>ttB IN CRAY'S BOTANICAL CONTRIBUTIONS (PROCEEDINGS OP THE AMERICAN ACADEMY OF ARTS AND SCIENCES).

f ^ *0-mpamila kptoearpo,* Engelm.in herb. (8pecularialeptocarpa,*Gray)*and(7.*intermedia* Engelra. in herb. (Specu- ***** Wflotm, *Orny)* [187(^x1.' 82]. LiSPEDltA LEFTOSTACHYA, *Engdm. in herb.* [1876. xn. 5,]. VERXOVIA LETTER- l u w t **g4m. in loi.* [1880, xvi. 78].

IX. DESCRIPTIONS AND NOTES FROM THE BOTANICAL GAZETTE.

BAFTIBIA BULPHUREA, n. *ftp.* — Simple, with spreading branches, glabrous; leaves on very short petioles, [66] leaflets obovate, somewhat rhombic, obtuse or occasionally emarginate; stipules small, lanceolate, subpersistent; spikes rather short, with deciduous bracts, and sulphur-yellow spreading flowers; pedicels shorter than the broad campanulate calyx; broad ovate acutish teeth, shorter than tube, woolly inside; style much longer than oval ovary (5 lines long); stipe of globose pod exsert.

Prairies, Tabaksi County [Indian Terr. *0. D. Butler],* rare, flowers in May. *B. leucantha* differs by its larger growth, deciduous stipules, longer spikes of white flowers which open much later, and longer pedicels, short style (3 lines long) about as long as the linear ovary. *B. spharocarpa* is well distinguished from our new species by its cttapitoee growth, more erect branches, strict spikes with erect deep yellow flowers, pedicels shorter than calyx, the lobes of which are triangular lanceolate, very acute, as long as the narrower tube, and sparingly woolly inside; style much longer than the oval ovary (6 lines long); stipe of pod scarcely longer than calyx. The new species is so much intermediate between the two just mentioned that it suggests the idea of hybridity. — [1878, vol. iii.]

CATALPA BPECIOSA, *Warder** — A middle-sized tree, with grayish-brown, much cracked or furrowed, at last [1] slightly flaky bark, and light, yellowish-gray wood ; leaves large, truncated or more or less cordate at base, slenderly acuminate, soft downy on the under side, inodorous; flowers in large and loose panicles; tube of the corolla conical, longer than wide, its lower part scarcely protracted ; upper lip before its expansion longer than the other lobes and enveloping them, lower lobe bilobed, inside of corolla slightly marked at the throat with red-brown lines [2] and with two yellow bands at the commissures of the lowest with the lateral lobes; stamens and style as long as the tube; pod terete, strongly furrowed; wings of seed about as long as the seed itself, rounded at the ends and split into a broad coma.

Common in the low, rich, sometimes overflowed woodlands near the mouth of the Ohio, along the lower course of that river and its confluents, and in the adjoining lowlands of the Mississippi; in the States of Illinois, Indiana, Kentucky, Tennessee, Missouri, and Arkansas; according to Michaux abounding near the borders of all the riven which empty into the Mississippi farther south; whether the localities, cited by him, of West Florida produce this or the Eastern species, is at present unknown. — Flowers in May. — This tree has quite an interesting and instructive history. It was already known to Michaux and to many botanists and settlers of those regions; even the aboriginal Shawneea appreciated it, and the French settlers along the Wubosh named it for them the Shawnee wood (Bois Chavanon), and prized the indestructible quality of it* timber; but the botanists, even the subtle Rafinesque, who roamed over those very regions, seem to have taken it for granted that it was not distinct from the Southeastern *Catalpa biguonuridei.* To me the fact that these trees, then not rarely cultivated in St. Louis,[1] produced their larger and more showy flowers some 10 or 15 days earlier than the Eastern or common kind, was well known as early as 1842, and their blossoming has since been annually recorded in my notes on the advance of vegetation, but I had not the sagacity or curiosity to further investigate the tree. It was reserved to Dr. J. A. Warder, of Cincinnati, to draw public attention to it. He was struck with its beauty in the streets of Dayton, Ohio, where a few stragglers were cultivated, and described it cursorily in his journal, the Western Horticultural Review, vol. iii. p. 533, without deciding whether a distinct species or a variety, and without assigning a name to it. It was soon named, however, privately as it seem*, by him and bis friends, *Catalpa sptcxosa,* and was propagated as a more ornamental form. Thirteen years later I find in the catalogue of J. C. Teas's nursery, Baysvillc, Indiana, for 1866, *Catalpa tpeciosa* offered, the 100 one-year old seedlings for $1.50. But only within the lost few years the beauty and importance of the tree has made a greater impression on the public mind, principally through the exertions of Dr. Warder himself, Mr. E. E. Barney, of Dayton, and Mr. R. Douglas, of Waukegan, 111. The latter was so much struck with the future importance of this species that in the autumn of 1878 he collected on the lower Ohio 400 pounds of its seed for hit own nursery and for distribution to all parts of the world.

Catalpa specioia replaces *C. bignonioidti* entirely in the Mis*i*8ippt valley. It is readily distinguished from it by its taller and atroighter growth, its darker, thicker (J-1 inch thick), rougher and scarcely exfoliating bark (in the older species it is light gray, constantly peeling off and therefore not more than 2 or 3 lines thick); its softly downy, slenderly acuminate and inodorous leaves (those of *bignonivide** have a disagreeable, almost fetid odor when [3] touched), marked with similar glands in the axils of the principal veins of the under side; by iU much leaf crowded panicle and by it* much larger flower, fruit, and need. The flowers I found 2 inches in the vertical, and a little more in the transverse diameter; in the other they have 1} inches in each diameter; the lower lobe it deeply notched

* Reproduced in the Gardener's Monthly, April, 1880, pp. 116-118. —Eos.

[1] It seems singular that the common Eaetcrn species has iu our streets almost completely supplanted the native.

or bilobed in *speciosa,* entire in *bignmioides;* the tube in the former is conical and 10 lines, in the latter cainpanulate and about 7 lines long; in the first slightly oblique, in the other very much so, the upper part being a great deal shorter than the lower one, so that the anthers and stigma[9] become uncovered; the markings in the flower of the old species are much more crowded and conspicuous, so as to give the whole flower a dingy appearance, while ours looks almost white. The upper lip of the corolla before expansion extends beyond the other lobes and covers them like a hood in the Western species, while in the Eastern it is much shorter than the others and covers them only very partially. The pods of our species are 8-20 inches long, 17-20 lines in circumference, dark brown and strongly grooved when dry, the placental dissepiment very thick ; in the Eastefti species the pod is nearly the same length, but only &-12 lines in circumference, ite grooves very slight, ite color pale, and the dissepiment flat In both species the pod is perfectly terete before the valves separate, after that the valves of ours remain more or less semiterete, while the much thinner ones of the other flatten out, so that they *seem* to indicate a compressed pod. The elongated seeds, winged at both ends, are of about equal length in both species, but in *tpeciosa* they are much wider (3J-4 lines) and the wings have more or less rounded ends which terminate in a broad band of rather short hair; in *bignonwidcs* the seeds are only 2J-3 lines wide, with pointed wings, and their tips terminating in a long, pencil-shaped tuft of hair.

Our tree is larger, of straighter growth, and being a native of a more northern latitude, is hardier than the Southeastern species; the wood of both is extremely durable, perhaps as much so as that of our red cedar, and has the advantage over it of a much more rapid growth, and of possessing only a very thin layer (2 or 3 annual rings) of destructible sap wood. But of these qualities, and of ite adaptability to many important uses, others, and especially Mr. Barney in a recent pamphlet, have given a full account. It is already extensively planted m qur Western prairie States, and especially along railroads, for which it is expected to furnish the much-needed timber in a comparatively short time.*—[1880, voL v.]

FRAXINUS QUADRANGULATA has, at least about Allenton, in St. Louis County, Missouri, hermaphrodite [63] flowers. Mr. O. W. Letterman finds it there common on rocky hills where it is a small tree or shrub with blunt angles of the branchlete, and in rich bottom-lands, where the tree is large, and the angles of the branchlete sharp, and even winged. Leaves are sometimes in threes when the branchlete show six angles. The terminal buds are gray-downy. In both localities the flower, are hermaphrodite. The calyx is practically absent, or indicated only by two obscure knobs or two minute scales, alternating with the stamens; the anthers are sessile and (before opening) reniform, their two crib being united above ; stamens somewhat persistent at least to the beginning of May, when the young obovate-oblong fruit* already somewhat twisted (which twist is more marked in the^mature fruit), have «*ched about half their fall size. How does the species behave in other parts of the country (The style of * W t a *Americana* is very slender - much longer than the ovary ; that of F. mrtdw does not much exceed the ovary.-[1880, Vol. v.].

• I may here remark that *Oatalpa,* probably like all ito *Uies, is proteramlrous, the anthers open in the morning *nd the lobes of the stigma separate and become glutinous towards evening, the upper lohe remaining erect, the lower taming down close upon the style. I have not ascertained How they are impregnated, as at that time the anthers are •ttrte, and by the following morning the lobes of the stigma •» again closed.

• At the meeting of the St. Louis Academy of Science, J*n. 19, 1880, Dr. Kngelmann stated that "a native Caul pa was found growing in Southern Illinois, Indiana, and South-** Missouri, and was called 'Shawnee wood' by the early *n*oh settlers, on account of ite use by the 8hawnee In-**•*•. Michaux knew this tree ninety years ago without **kg*khing it from the old species found in Georgia. *«ty ysan ago a number of them were growing on Main **l 8eoond Strcete, in the gardens of Chouteau and the Catholic Bishop, and a few are still standing on Third Street, near Plum, and others in different parts of the city. This variety *• botaakally different from the majority of Oatolpns found in *• tlty now. It is of larger growth, with larger and more • W y blossoms, ami it blooms from one to two weeks •srli«r. 1* the fomte of Missouri it attaint a height of sixty f«*t; *• trnnk Is straight, and it is altogether a most beautiful **» Htw Madrid Is th« centra of ite geographical distribution. It grows rapidly, and is almost indestructible in water. Gate-posts on the farm of the late President Harrison, in Indiana, have been standing for eighty years. The wood admits of a fine polish, and the sap-wood becomes heart-wood in two or three years, whereas it takes the cedar twenty-five years to attain ite durable quality. No better wood could l« found for railroad ties if the wood turns out to he solid enough to bear the shock, and the railroads are already preparing to use it for this purpose. It should be planted on our prairies, where it would be found a most valuable tree for many purposes." — *Transactions,* vol. iv. 1882, *Journal of Proceedings* [\\

In a notice of Brooke's wood sections (Bot Gazette, vol. Tiii. 1883, p. 338), Dr. Engelmann states that "in a hasty examination of the specimens, catalpa wood is found with a few accessory lines which might readily be mistaken for annual rings but for the want of the pores always accompanying the vernal wood in this genus. Such accessory rings (false annual rings) are rare in the woods of our temperate climate, but in a specimen of *Finns Elliott it,* of South Florida, I find such rings quite numerous, and difficult to explain and to distinguish from true annual rings. In wood of the same species from farther north no such appearanoe is obstrvtd, the annual rings being clear and well marked." — KDS.

SOME ADDITIONS TO THE NORTH AMERICAN FLORA.

DICENTRA OCHROLEUCA, n. «p. Stem erect, 3-4 feet high, leafy, leaves glaucous, large (lower ones a foot [223] or more long), 3-pinnate, ultimate divisions deeply cleft into lanceolate-linear lobes ; flowers panicled on very short pedicels, about 15 lines long, ochroleucous ; membranaceous sepals suborbicular ; exterior petals slightly saccate at base, upwards narrower, somewhat concave below the acute tip, and scarcely spreading; inner petals widened above into a deep purple circular tip, crested with two very broad flat and elongated appendages ; stamens subulate scarcely cohering.

In valleys of the Santa Monica Mountains near Los Angeles, Cal., where it grows with the rather rare *Ccanothiw spinoms,* the rootstock of which, named red-wood, furnishes the principal firewood there. — Together with *D. chrysantha* this handsome species constitutes the subgenus *Chrysocapnos,* in which the crest, single and inflated in the true *Dicentras,* is formed of two distinct lamellae, flat and large in our species, short and curly in *D. chrysantha.* This latter is a coarser plant with much smaller golden yellow flowers (6-9 lines long) and deeply concave, spreading outer petals.

TSUGA CAROLINIANA, n. *sp.* [supra, p. 382]. T. CANADENSIS *[I* c.]. T. MERTENSIANA [/. c.]. YUCCA [224] MACROCARPA, *n. ftp.* [supra, p. 299]. JUNCUS RUGULOSUS, n. *sp.* [supra, p. 275]. [225] MONANTHOCHLOË LITTORALIS [supra, p. 500]. — [June, 1881, vi.]

ESCHSCHOLTZIA CALIFORNICA. The different forms of this common and extremely variable plant deserve [235] to be studied more carefully at their homes, where they are found in such untold abundauce. It is quite possible, as indicated in the Flora of California, that the several species into which it had been divided, may be sustained by reliable characters. All the forms, however, are said to be annuals with colorless juice. Now, on the sandhills of the ocean, quite close to the well-known Cliff-house near San Francisco, I found last October a form with long perennial roots, i inch thick, abounding in orange-colored juice, and bearing several stems ; leaves shorter than the internodes, often opposite, flowers 1 inch wide ; torus broadly margined, capsule about 2 inches long, seeds reticulated. Iu most respects it represents the typical form of *E. Californica,* but the perennial rootstock seems to [236] distinguish it; annuals, to be sure, in mild climates not rarely last for several years, e. g. *Solatium nigrum* in Southern California, but in these the stem becomes ligneous and no rootstock forms, the normal tap-root not losing its characters, even if it does become 3 or 4 years old. It is barely possible that *E. Californica* is one of those perennials which will flower as seedlings in the first years, and that then the aridity of the climate in many instances kills it, root and all; but if so, why has this occasionally (?) perennial character not been observed before ?

PORTULACA SUFFRUTESCENS, n. *sp.* — Erect, about a span high from a stout, branching and apparently perennial rootstock, ligneous at base; leaves terete, about 1 inch long, with sparingly hairy axils ; flowers clustered at the end of the branches, large (7 to 10 lines wide), yellowish buff-colored ; petals obcordate or emarginate ; stameus numerous ; filaments, like the 5 or 6 stigmas, red ; seeds dark, with metallic lustre, tuberculate.

In Western New Mexico, at the copper mines, *C. Wright,* 874, coll. 1851 ; *Cones* 4 *Palmer,* Fort Whipple, Northern Arizona, 1865; found by myself, 1880, on rocky banks in the Santa Rita Mountains, Southern Arizona*

Very near *P. pilosa,* with which I had formerly united it; the seeds of both are similar, their tubercles, magnified 40-00 diameters, appear very prettily as overlapping excrescences with a toothed free edge ; both have dark seed*, ours with a metallic lustre, the others more dulL The number of stamens in different flowers was about 40 ; while in *P. pilosa* it is stated to be 15 to 25, but in cultivated specimens of the latter I have found as many as 50 ! The color and size of the flower, the larger leaves with sparing hair in the axils, and the stouter stems and perennial (?) rootstock distinguish it from its purple-flowered annual relative.

ROSA BPITHAMEA, *Watson, FL Cal.* 2, 444. — In the deep shade of the Big Trees of Frwno County, Cal., where scarcely anything else grows, I found what I take to be a form of this pretty little species, blooming in September. I may designate it as

Var. suBiNERMis : stems a span high, glabrons or more or lew glandular hispid, with a few scattered setaceous spines (none stipular) or spineless; stipules short and narrow with short narrow divaricate free points ; leaflets mostly 5, thin, pale below, elliptical or nearly orbicular, nbtute, tharply nerrate and glandular serrulate; rhachis glandular-pubescent and often npinuloae, petiolule of terminal leaflet almost it* own length ; flowers single (1J to 1} inches wide) rose-colored ; peduncle ali^htly glandular, calyx tube globose, naked, lobe* entire.

The atom* of the name season bear the flower*, us is the case in *R. foliolosa* of Texas; or is it in this Instance an autumnal form ? There nuty be character* enough, especially the absence of any utipular *pine», to dintinguinh specifically this southern form from the northern type, but considering the great variability of roses it is thought best to keep them together for the prenent

The western roses, and to some extent all onr roses, are in some confusion and what my cursory visit to [S37J the Pacific coast may have done to clear them up is offered here.

ROSA NUTKANA, *Presl,* is common in Oregon and northward, but I have-not met with it in California ; it is characterized by very broad and stout stipular and cauline spines, which are particularly abundant on annual shoots, and by large single flowers and large globose or depressed fruit. *R. Durandii,* Crepin, from Oregon, appears to be a form of this species with glandular calyx tube, which in the type is glabrous.

ROSA PISIFORM IS, *Gray,* stands next to this and not to the following. Like it, it has well-developed stipular spines, but they are slender and more terete ; corymbs few-flowered, fruit smaller; young shoots mostly densely covered with dark red-brown slender spines and spiny bristlgs, by which the plant can be distinguished at any time, even without flower or fruit 1 found it from British Columbia down to the neighborhood of San Francisco and Monterey.

ROSA CALIFORNIA, *Cham. A* ScW., a bush often 4-6 feet high, along streams, bears its flowers in large compound corymbs ; its annual shoots are glaucous, covered with stout straight or often curved or even hooked glaucous spines ; form of fruit variable, oblong or globose, with a more or less distinct contracted neck. — Common about San Francisco, thence northward to the K la math River and southward to Los Angeles and San Bernardino.

ROSA OYIINOCARPA, *Nutt.,* in the rich woods of the Oregon Coast Ranges, with stems 1J-2 inches thick and 8 feet high, otherwise mostly a slender bush ; annual shoots densely covered with glaucous or gray bristly spines ; distinguished from all other roses, I believe, by its naked fruit (globose or elongated, sometimes pointed at both ends), from which after flowering the *united* calyx lobes separate, bearing at their base the stamens.

CAMPANULA SCABRELLA, n. *sp.* — Several leafy stems from a stout rootstock, a few inches high, 1 to several-flowered, the whole plant canescently scabrous with very short rough pubescence; lower tufted leaves spatulate, obtuse, attenuated below, stem leaves sessile, lanceolate, acutish ; flower* erect, lance-linear lobes of calyx as long as tube ; ovate-lanceolate lobes of corolla as long as its tube, scabrous outside ; style shorter than corolla ; capsule erect, oblong, 10-angled, opening near the upper edge.

On bleak rocky ridges of Scott Mountain, west of Mount Shasta, under scattered trees of *Pinus albicaulis* and *P. Balfouriana* with *Anemone Dnimmondii,* Wats.,[1] *Veronica alpina, Polygonum Davisim,* and the charming *Epikhium vkordatum,* in August The thick tap-root penetrates 3 to 5 inches between the fragments of rock; lower leaves 1 inch long, the upper not much shorter; branches strictly erect, peduncles naked, flowers nearly } inch [23Q] long.

Distinguished from the closely allied *C. uniflora* by the habit, the canescence, and the form of the capsule. Careful study of abundant materials proves that *C. unijhra* will have to comprise all the forms from Colorado and Utah Which have been named *C. Langsdorffiana* or *C. Scheuchzeri,* among them the specimens of Parry and of Hall with denticulate calyx lobes, and similar ones gathered by myself; they have erect elongated capsules tapering below, opening near the top; corolla divided nearly to the middle, often I inch wide ; stems 3 to 4 or 8 to 10 inches high, 1 to 4--*wered. True *C. ScKetuKzeri* (or *lini/olia)* conies from Alaska ; its corolla lobes are short, J or less of the tube, the •hort ovate capsule is nodding and opens at base. The confusion arose in great part from the carelessness of collectors, who are mostly satisfied with nice flowers and neglect the less conspicuous fruiting specimens. Among several dozen •Pasimens from the Rocky Mountains and Alaska, gathered by different collectors, I find only few with the character-*•*» capsules, and these I collected myself. Fruit and seed are such important organs that they ought always to be fcunted up, and of every plant; this necessity is well known in *Composite* and *Umbellifera ;* but it is true of all plants, •*d ought to be well borne in mind by collectors. Such neglect is one of the causes why the species of *Vitis* and *P*ciaUy the *Caciactm* were not better understood long ago. —[July, 1881, vol. vL]

STILLAHIA OBTUSA, *n. sp.* — Qlabroua, stems weak, prostrate, much branched, leaves subsessile, triangular- [5] ovate acute, smooth-edged 1-nerved and the delicate reticulated veins uniting into distinct intnunarginal nerves ; flowers single, pseudo-axillary, H unclc8 nearlv M lon* M the leave8 P^10118 or curved in fruit» ^P**8 0Yate obtTM« nerveless scarcely meinbranaceou* on the margin, petals (always ?) wanting; capsule ovate obtuse scarcely exsert, • * * (under the lens) covered with oblong linear pectinate tubercles dark brown. — Western Colorado on the tribu-*••* of Qunninon River, alt 9,000 to 10,000 feet, in damp grounds, *T. S. Branfajtt.* Closely allied to *S. crispa* of **• northwest, but readily distinguished by the form of the sepals, the capsule and the seeds; in that species the sepals •*• lanceolate, broadly margined and 3-nerved, the cnpwile exsert, acntish, the seeds larger, reddish and nearly smooth. * *oorealU,* with which *crispa ha** nomctimes been unitwl, has a wmilar calyx, capsule and seeds, but is distinguished by to elongated lance-linear leaves, finely serrulate on the edge, the intramarginal nerve very indistinct

CAMFAHULA FLAVIFLORA, n. *sp.* — Erect, glabrous, a finder to a span high from a filiform rootstock bearing similar subterranean stolons, usually 1-flowered; leaves lanceolate to linear-lanceolate 1 to 2 inches long, 2-3 lines

[1] Well distinguished from *A. muMJUia,* not only by its larger fruit and long style, but also by the oval, not circular, out-*•• «f the mort finely divided leaves, the terminal dirUion of which U long atiped, not sessile.

wide, the lowest ones sometimes broader, all more or less dentate or denticulate ; flower erect, calyx tnrbinate, lobes lance-linear mostly dentate, several times longer than the tube and exceeding the tube of the corolla ; corolla shallow, wide open, 4 times wider than deep, divided to the middle or beyond; lobes ovate acute spreading or at length reflexed ; capsule erect ovate or turbinate as long as the connivent calyx lobes or shorter, opening at top.— *C. Lang$-dorffiana* of the Rocky Mountain floras, not Fischer ; *C. Scheuchzeri,* Gray Flora in part.

Common in subalpine meadows, near streamlets, at an elevation of 7,000-9,000 feet, Colorado; Clear Creek valley, Middle and South Parks. The large and very shallow flowers of a reddish-purple color and the filiform branching rootstocks distinguish this species at once from *C. uniflora* with which I had united it (this journal, 6, 238). The usually erect stems become sometimes decumbent and several-flowered when overgrown. *C. uniflora* is found only on bare alpine slopes, usually with *Dryas* and *SUene acaulis,* at about 12,000 to 13,000 feet alt. It grows from a stout several-headed rootstock, bears deeply campanulate mostly horizontal flowers J inch in length and [6] an erect fruit; the leaves are usually marked with a few small glandular semi-transparent teeth in notches.

ERIOGONUM ALPINUM, n. *sp.* — Few heads from a very stout candex; the whole plant (except the flowers) densely white tomentose ; leaves nearly orbicular, 1 inch wide, attenuate at base into a petiole of the same length ; scape (about 4 inches high) with a verticil of 3 or 4 lanceolate, foliaceous bracts above its middle; umbels solitary, involucrum broadly campanulate (3 lines wide) with 9 to 12 short, erect teeth ; flowers very numerous, attenuate at base, glabrous in and outside, yellow, 2£ lines long. — On Scott Mountain, Northern California, together with *Campanula scabrella* (see page 237) on stony ridges about the timber line, *G. E.* The large single yellow heads look very much like those of some alpine composite ; the plant is a counterpart to the glabrous rose-flowered *E. pirolafolium,* Hook., found on the opposite Mount Shasta in similar situations.

JUNCUS CANALICULATUS, n. «p. [supra, p. 275]. —[1882, vol. vii.]

THE BLACK-FRUITED CRAT.EGI, AND A NEW SPECIES.

We know within the limits of our flora of two black-fruited *CraUegi,* both from the western half of tbe [127] continent. Mr. Q. W. Lettennan has now discovered a third one along Red River. These three species may be distinguished from our ordinary red-fruited ones, to be designated as Sect. *Erythrocarpus,* as Sect *Melanocarpw,* and may be characterized by their black or black-purple or bluish fruit; leaves, at least at first, appresaed hairy [128] on the upper and glabrous on the under side; flowers in corymbs, styles usually 5; spines mostly short and stout, often recurved. The three species are: —

C. DouoLAsn, *LindL,* the westernmost species, from British Columbia to California, with broader, thinner doubly serrate leaves, the upper ones on the shoots lobed, and with broad, incised-toothed stipules; calyx lobes usually entire; fruit smaller, black-purple, ripe (in Northern California) in August; nutlets 2 to 3 lines long, strongly ridged on the back; spines J to 1 inch long.

C. RiYULAKis, *Nutt.,* in the Rocky and Wahsatch Mountains of Colorado and Utah, with narrower, more rigid, lanceolate-orate, singly serrate leaves, only the upper ones of the shoots broader, doubly serrate or rarely slightly incised, with narrow glandular-incised stipules; calyx lobes usually glandular; fruit larger; nutlets 8 lines long or over, usually strongly ridged on the back; spines few, \ to 1 inch long.

C. BRACHYACANTHA, *Sargent & Engelm.* A tree 20 to 30 feet high, or sometimes larger, with smoothish or, in very old trunks, rough bark; spines on the whitish branches numerous, stout, short (3 to 6 or 8 lines long), mostly curved, sometimes terminating the branches; leaves lanceolate-oblong to ovate or rhombic, 1} to 2 or 2£ inches long, attenuate into a short petiole, thick and almost coriaceous, appressed-serrate, shining, with ribs almost obliterated, those of the terminal shoots larger, broader, slightly lobed, with large foliaceous dentate or subentire stipules;[1] flowers small for the genus, with broadly lanceolate entire calyx lobes and 5 styles; fruit depressed globose, about J inch through, black-blue with bloom; nutlets (3 lines long) with two slight grooves on tbe nearly smooth hack.

In the Red River region, first collected by *Drummond* (Louisiana Coll. 1832, No. 105in part); Webster Parish, La., *C. Mohr,* 1880, both without flower or fruit; Concord, Texas, *C. S. Sargent,* March 29, 1881, with flower bods; west of Lon^view, Texas, *G. W. Letterman,* Aug. 19, 1882, with mature fruit, " they looked from a distance like plum trees with small blue fruit, the ground under them was covered with the fallen haws." The species is easily recoffnized by it* coriaceoun, nhining, almost ribless leaves; in *C. Dovglasii* they are broader, menibranaceoua, and dull, in *C. rimdarU* intermediate lietwcvn the two.

1 may add here that Prof. Sargent rediscovered the obscure *C berbenfolia,* Torr. & Gray, which was founded on a single flowerless specimen, in the *very* region, near Opelousas, Western Louisiana, where Dr. Carpenter [129

[1] The itipnles of *Cratctgiis* are not often noticed, and I am not sure that they poawM roach constancy or diagnostic value, Generally they are found only or at least are most penUtent on tbe shoots; they are always oblique and petioled or stipulate broadly triangular to linear, mostly iodstd-dcnUto or sometimes glandular-dentate, rarely entire.

first collected it about 50 years ago; it is a small tree with dark ash-gray branchlets bearing numerous long (1 £ to 2 inches long) stout, straight spines; leaves spathulate or obovate, obtuse, attenuate into a short petiole or almost sessile, simply eerrate towards the upper part, j to 1 £ inches long ; those of the shoots similar or acutish, often doubly or incisely senate or slightly lobed, with linear glandular stipules, all persistently pubescent; compound corymb woolly; flowers large, calyx lobes linear, entire; styles 3 j fruit unknown. — [Nov. 1882, vol. vii.]

PLANTAGO PUSILLA, *Nutt.* — The ordinary form of Missouri and Illinois, where it is common, and as far as [175] I can see of the Eastern States, where it is much rarer, has linear or tilitbrin entire leaves, scapes 2 to 4 or rarely 6 inches high, obtusish or subacute bracts of the length of the orbicular sepals, and short oval slightly exsert capsules, 4 seeds, about 1.3 mm. or 0.6 line long.

Var. MACBOSPEBMA is a larger form, 4 to 7 inches high, with longer, much exsert capsules ; seeds nearly twice the length of the last, 2.4 mm. or 1.2 lines long. — Saline soil of the western plains; on the Cheyenne River, *NicoUet,* and near the mouth of the Yellowstone River, *Hayden.*

Var. MAJOR, much larger and stouter, leaves lanceolate-linear, often 1j to 2 lines wide, the larger ones laciniate with few long teeth or lobes; scapes densely woolly at base, with the elongated spike often 9 inches high; bracts acute, longejr than the sepals; seeds intermediate in size between the two other forms. — Near Atoka, north of Red River in the Indian Territory, *0. D. Butler.*

Dr. A. Gray thinks that be has proofs that this species, or probably the second form of it, is the lost *P. elongate,* Puwh, Fl. Suppl. p. 729, but even if so, Nuttall's name, now well known since more than 60 years, [176] ought to be retained in place of a doubtful and very inappropriate one. — The three closely allied species, P. *Bigehvii* and P. *pusilla* with 4 seeds, and P. *heterophylla* with numerous ones, have all pitted seeds, well seen only in perfectly mature specimens. The seeds become gelatinous when wet — [Feb. 1883, voL viii.]

MORPHOLOGY OF SPINES.

In an illustrated paper lately laid before the German Botanical Society, Dr. I. Urban, of Berlin, proves [338] that the spines of *Auraniiaea* are not, as has been generally assumed, abortive branchlets, such as we find in *Cratagui, QUdiUchia,* and many other ligneous planU. He shows that they are the abnormally developed basal leaves or bud scales of the axillary bud. A pair of these scales is found on both sides of the bud; sometimes both of them are developed into spines, and then the small bud itself is found between and a little above them. In other cases the scales axe unequally developed into a small and a lnrj^r spine, but more frequently only one of them grows out into a spine, In this latter case the spine assumes an almost axillary position, and the rest of the bud, with the other lateral (originally opposite) minute scale, is pushed sideways and upwards, so that it assumes the position generally ascribed to it by those who have treated on this subject, seemingly above the spine, thus simulating a secondary bud above the primary one, which would be the spine. But the bud will always be found a little sideways of a line drawn from the centre of the axil upwards, and the other lateral bud scale can always be discovered on the other side of the bod. Where there are a pair of unequally developed spines the case becomes quite plain.

In connection with this and other strange developments of different organs into spines, it occurred to me that my observations on the morphology of the spines of *Fourquiera,* made nearly thirty years ago, seem to have escaped botanists; though I have often spoken of them, I have never published anything about them.

A small specimen of *Fouquiera iplendens,* sent to me from New Mexico, vegetated well enough for many months, continuing to make its fasciculated spatulate subsessile leaves from the undeveloped branchlets ill the axils of the spinea, without showing any further growth, till after a heavy thunderstorm and rain with sultry weather, a vigorous ghoot sprang suddenly from one of the uppermost of these axils and developed scattered leaves of the same form, bat larger, and borne on long (say i inch long) horizontal petioles, while the leaf-blade was nearly erect. In the (all these leaves began to wither and to fall, but not, as one might have expected, at the insertion of the [339] Petiole on the axil, nor at the junction of the blade with the petiole; the withered upper half of the petiole •eparated from the persistent indurated under part in a diagonal plane, so that this indurated part was stoutest at its insertion on the axis, and ran out into a sharp point, while the deciduous part of the petiole was thickest at its consection with the blade, and fell off with it, leaving a spine which persists as long as the stem does, and which from its •*il produoes the short spurs with their fasciculated leaves mentioned above. The formation of these different axes •nd their leaves resembles tout of *Larix,* but the morphology of the spines is, as far as I know, quite unique.* — [1883, vol. viii.l

• This was noted by Charles Wright, long ago. See Plant. Wrightian., ii. 63. - EDS.

X. DESCRIPTIONS FROM THE BULLETIN OF THE TORREY BOTANICAL CLUB.

CRATAEGUS ARBORESCENS, *Ell,* is not uncommon in the rich alluvions of the Mississippi River, near St [4]
Louis, and probably inhabits the banks of this river and its lower tributaries down to its mouth. It has not been recognized of late, and seems to be quite rare in herbaria, and is probably not in cultivation. I have not much to add to Elliott's, Torrey and Gray's and Chapman's descriptions, but may say that in this neighborhood it is the largest species of the genus, making trunks from 8-12 and, as Mr. Eggert informs me, even 18 inches in diameter, 6-7 feet high, fluted or grooved, and with a broad top, rarely bearing any thorns. The leaves, cuneiform at base, undivided or, at the end of the shoots, 3-lobed, resemble in form those of *C. tomentosa,* but are smaller, much thinner and smoother, even when young, often with soft down in the axils of veins underneath ; flowers in loose corymbs, only 7 or 8 lines wide ; calyx smooth, neither pubescent nor glandular, with triangular acute lobes ; styles 0 ; drupes depressed-globular, 4-5 lines thick with 5 (or rarely more) stones grooved on the back, light red or rarely orange-colored, persisting through winter, when those of our other species, *C. coccinta, Crus-galli, subvillosa*^ and *tomentosa,* drop off.—[Jan. 1882, vol. ix.]

ROSA MINUTIFOLIA, n. *sp.* — A much-branched shrub, 2-4 feet high; shoots pubescent, densely covered [07]
with straight or slightly curved, red-brown, bristly, at first pubescent spines, their leaves with broad, divaricately auricled stipules, and mostly 5 leaflets ; fertile branches bearing numerous terete, subulate spines, some of the shorter and more persistent ones often in pairs under the branchlets ; leaves fasciculated on short spurs, narrow stipules divaricately auricled, leaflets minute (only 1-2 lines long, the lowest pairs the smallest) oval, simply incised-dentate, pubescent, not glandular ; flowers single, j-1 inch wide, on tomentose, bractless peduncles from between the leaves; calyx-tube globular, densely setose-hispid, a thick nectariferous ring contracting its opening ; petals suborbicular, scarcely emarginate, deep rose-purple or white ; central ovules borne on short stipes ; styles distinct, short, woolly.

Described from specimens sent by Dr. C. C. Parry and M. E. Jones. A most striking and lovely species, distinguished from all other roses by its minute, deeply incised leaflets. The young shoots have larger, distant leaves, with fewer, but larger leaflets, the terminal one the largest, sometimes 4 or 5 lines long ; fragrance faint This species is quite peculiar among its American congeners, and even among the roses of the Old World, so that it is difficult to determine its true position. In aspect and habit it comes nearest to the *Pimpinellifolvt* on account of its single [98]
bractless flowers, its numerous acicular spines, and its small leaves ; but it recedes in its pinnatifid calyx-lobes. — [Aug. 1882, vol. ix.]

Through the kind exertions of Miss F. Fish of Sauzal, mature fruit of this interesting species, described in [127
the August number of the BULLETIN, has been obtained and is being widely distributed, so that we may hope soon to see it in cultivation. The fruit is globose, crowned with the persistent erect calyx-lobes, deeply red-brown, bristly-hispid ; seeds generally few, bearing the woolly, at length deciduous style.

In the description of the flower it ought to have been mentioned that the outer calyx-lobes are pinnatiftd, which however is alluded to at the end of the article. The locality is Sauzal, not Sanyal, as printed. — [Oct. 1882, voL ix.]

FROM WATSON'S LIST OF PALMER'S PLANTS COLLECTED IN 8. W. TEXAS AND NORTH MEXICO (PROCEEDINGS OF THE AMERICAN ACADEMY OK ARTS AND SCIENCES, VOL. XVIII. 1888).

EPHEDBA PEDCNCULATA, *Engelm. nut.* £. ASPERA, *Engelm. nut.* [157]

XIV.

GENERAL NOTES.

I. ON THE CHARACTER OF THE VEGETATION OF SOUTHWESTERN TEXAS.*

FBOM THE PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, VOL. V. 1851.

THE Flora of the immense territory of the United States bears a peculiar common character, distinguishing it from other regions of vegetation. This character consists in the [223] prevalence of some families and more especially of the *Composites,* of the occurrence of others only in this part of the globe (e. g. *Magnoliacem),* and in the great number of species of many genera known in other countries only by a few living representatives or among the fossil remains of the brown coal (tertiary) formation. Such genera are the oaks, the pines, the horse-chestnuts or buckeyes, the maples, the grapevines (Fftw), the birches, the walnuts and hickories. The magnolia, the Gleditschiae, and the sweet gum *{Liquidambar)* are in Europe only found among the fossils. Herbaceous plants exemplifying this character are the asters, Solidago, Helianthus, Asclepias, etc.

But as we may naturally infer, this large territory shows different regions of vegetation, produced or influenced by climate, conformation of the surface, geological character of the soil, and perhaps other causes not so readily appreciable.

Such different areas are the northeastern Alleghauies and their slope to the Atlantic; the wmthern part of that mountain range and its eastern slope to the ocean; the subtropical region of Florida, so different from that of Texas though in the same latitude; then the western slope of the Alleghanies towards the immediate valley of the Mississippi; the northern and the southern part of that valley itself, the latter including Northeastern Texas; again the region of the Western plains and deserts; that of the Rocky Mountains, of the Pacific coast, and finally the peculiar flora of Southern Texas, or of the Rio Grande valley.

Though I have never explored that country myself, the extensive and beautiful collections of my friend Ferdinand Lindheimer, together with his very full notes, enable me to attempt a sketch of the character of that flora.

And I here take the liberty of again reminding you of a remark made from this place a day or two ago by one of our highest authorities, in speaking of palneontolqgical collections, and which cannot be too often repeated and inculcated; that is, it is not only the collected specimen itself, which ia valuable, but the notes, the data in regard to exact locality, association with other forms, and all circumstances tending to enlighten us in regard to it, are absolutely necessary to give [224] to the specimen its full value.

Southwestern Texas, as I regard it, to judge by the character of its vegetation, has its natural boundaries to the northeast on the Brazos, or more properly between this and the Colorado River; to the southeast in the alluvial plains which extend from the Gulf coast into the interior, and *hich bear more the character of a subtropical vegetation; to the south and southwest by the Rio

• See ato in account of the western part of Texas in Boston Journal of Natural History, vol. vi. 1857, pp. 34-40. - EDS.

Grande, or most probably by the northern slope of the Mexican table-land southwest of that river; and to the northwest by the mountains and plains of *New* Mexico.

The geological character of this country is well known through the investigations of Prof. Roemer, to which the notes of Lindheirner and others have added some details. The whole of this country, with slight exception, is of cretaceous formation; the rocks are calcareous, with cherty mixture, and of horizontal stratification, rising in several plateaus or terraces one above the other, over the alluvial lands of the sea-coast; the plateaus often with steep declivities, and not rarely broken up into level topped hills with terraced slopes. The rivers and brooks are clear streams often with wide, shallow, gravelly beds, which, becoming dry, are exposed a great part of the year, and having on many places perpendicular rocky banks. Along the fertile fcnargins of the larger streams the usual forest trees of the Southern States are found, not unfrequently also with the cypress *(Taxodium distichum),* and on the slopes, fine cedar woods *(Juniperus Virginianus)* frequently close the view; other pine trees are unknown in this district. On the thin soil of some parts of the country, scattering post-oak woods occur, but on the whole larger timber is scarce.

The climate is mild, not too warm in sHinmer, — in fact, it is said to be not as warm as that of the central portion of the Mississippi valley is from June to August; in winter occasionally ice is seen, but quickly disappears. Farther to the northwest the extremes are greater, and in the southern part of this region frosts are unknown. Spring opens with February, rains occur at that time and often as late as May and June; a season of general drought follows until the September rains again revive the vegetation. It is then that early flowering shrubs often once more begin to blossom, and many annuals again sprout up and bear flowers for the second time, assuming an almost ligneous stem and apparently perennial root, so that it sometimes becomes difficult to decide whether they really are annuals. Some plants, the representatives of which farther north blossom in spring, [225] put forth their flowers only in September or October; as *Oxalis vespertttimis,* the near relative of the common *0. violacea ;* and *Ulnuts crassi/olia,* closely allied to *U. alata.*

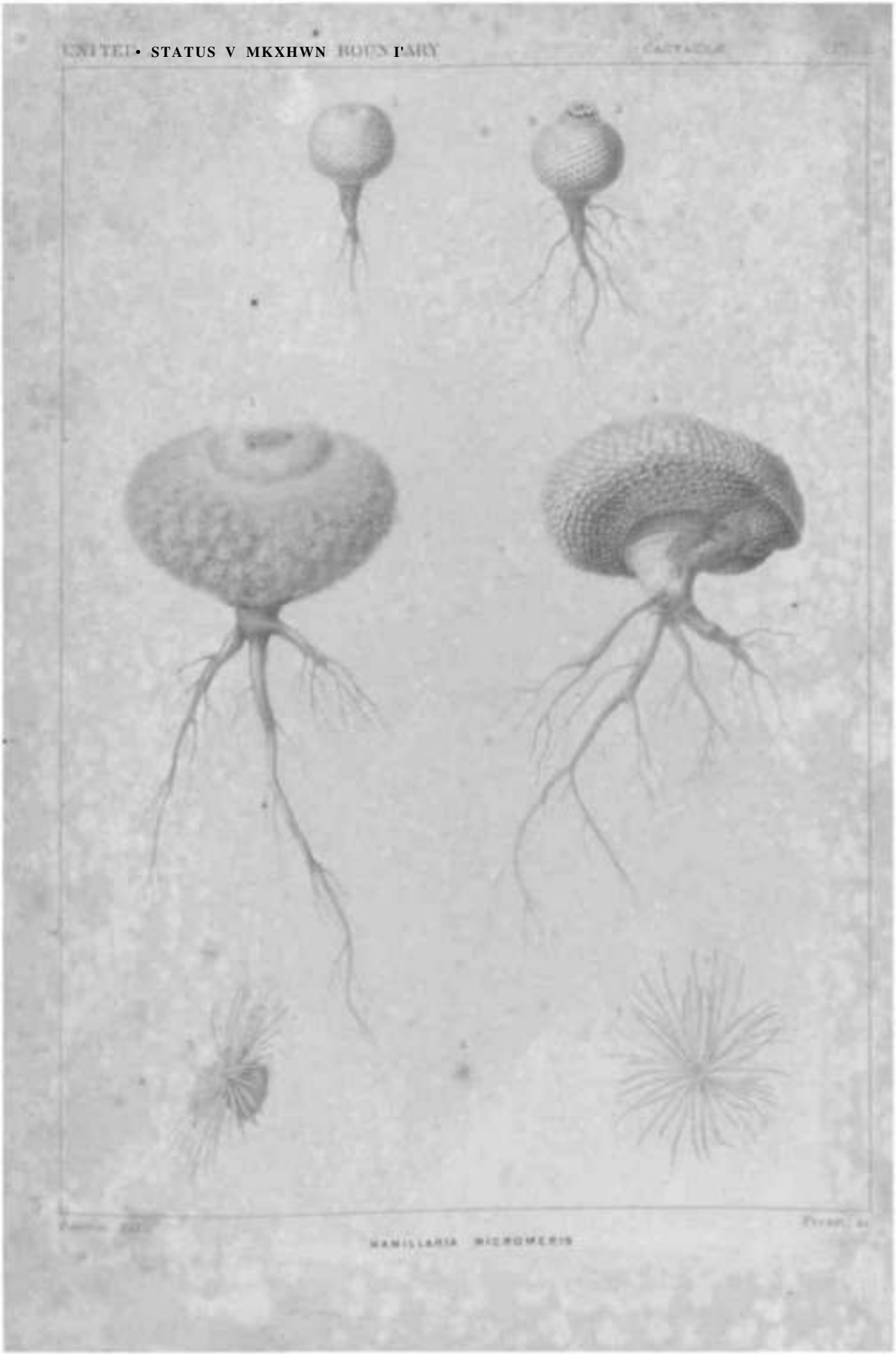
As we may expect, the Flora of Southwestern Texas partakes to some extent of the character of the vegetation of the adjoining districts. We find there the *QSnotJierce* and *Gaum,* the Buffalo* grass, and many other plants from the northern plains. The now well-known Compass Plant of the prairies *(SUphium laciniatum)* is also found there.[1] The western mountain region sends down to the calcareous plateaus a number of grasses, *Yucca angustifolia,* some *Portulacaccce, Nyctaginaccee,* and many others.

From the table-lands of Mexico, and particularly its northern slopes, we find in the region we have now in view the *Bolivarice,* some *Malpighiacect,* some *Zygophyllacect,* besides the *Miinoscm* and *Cactacece,* to be mentioned more fully hereafter; mostly genera or families not found farther north or east, but species not occurring farther south.

Many herbaceous plants of different families are quite peculiar to that country. Of these I will mention only *Butosma Texanum,* which with *Peganum Mexicanum;* A. Gray, mss., found south of the Rio Grande is, in America, the only representative of the Rue family. So are the congeners of the remarkable *Hermannia Texana,* common only in South Africa.

But the striking character of the vegetation of that region consists in the diminution of trees into shrubs; they do not disappear entirely as in the western plains and deserts, which extend into northwestern Texas; nor are they generally the same species which elsewhere grow op to be laige

[1] It is perhaps not without interest to learn that Mr. Undheiraer has with the com puss, verified the so-called polarity of the radial leaves of this plnnt I have no doubt but that sunlight is the determining cause of thin peculiarity, as my friend Mr. I. A. Upham of Milwaukee has sngpe«t«L But whether it is the desire, if I may so express niywlf, of obtaining as much light an possible on both surfaces of the leaf, or perhaps rather a tendency to avoid the burning ruys of the noonday sun by presenting to it the edge of the leaf, or both causes together, I leave undetermined. We, at all events, owe our thanks tn Major Alvord for having, with a pertinacity which only a thorough conviction of the truth of the fact could have given him, forced the knowledge of a circumstance so interesting to physiological botany on the unwilling miud of naturalists.



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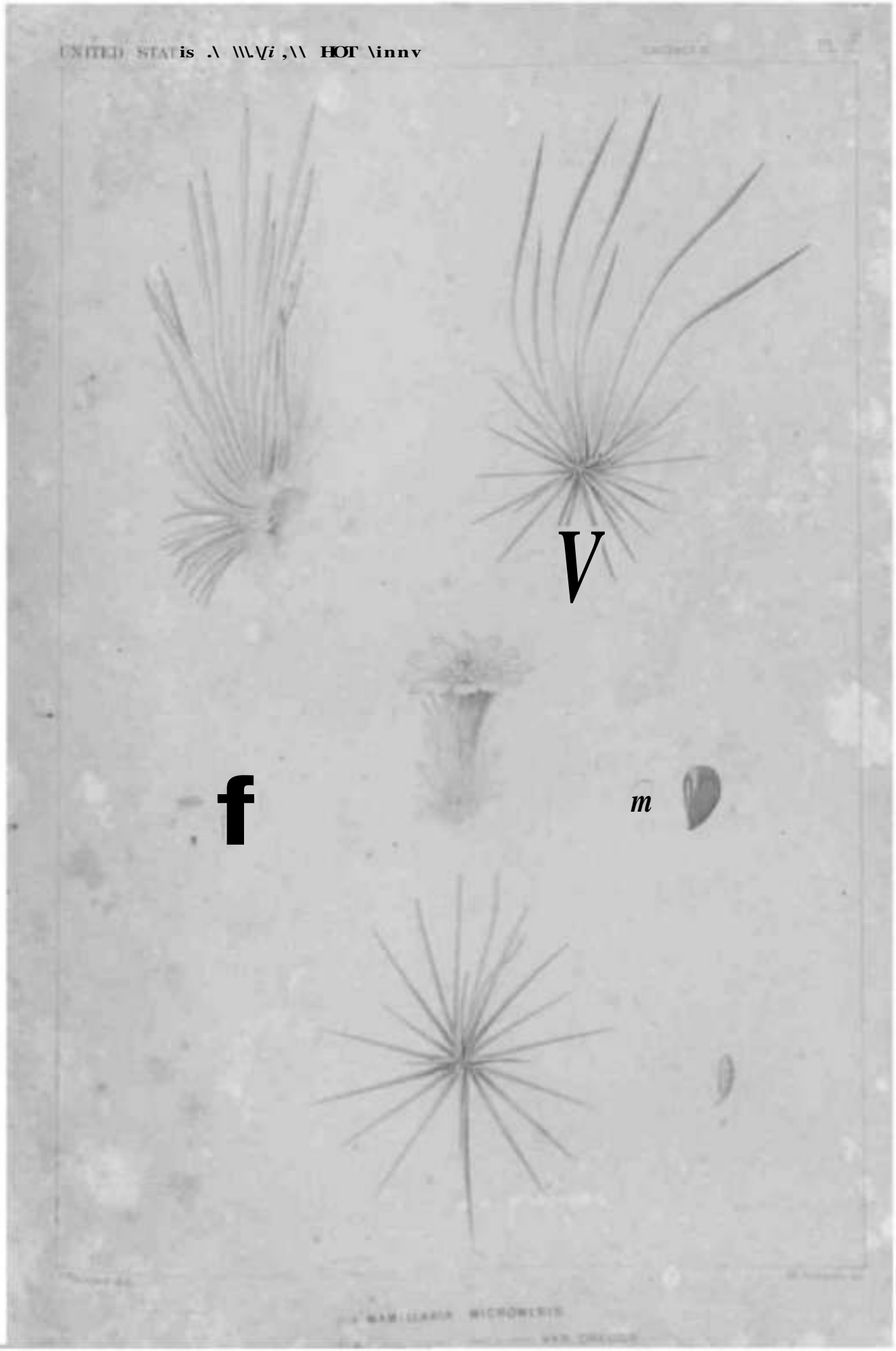
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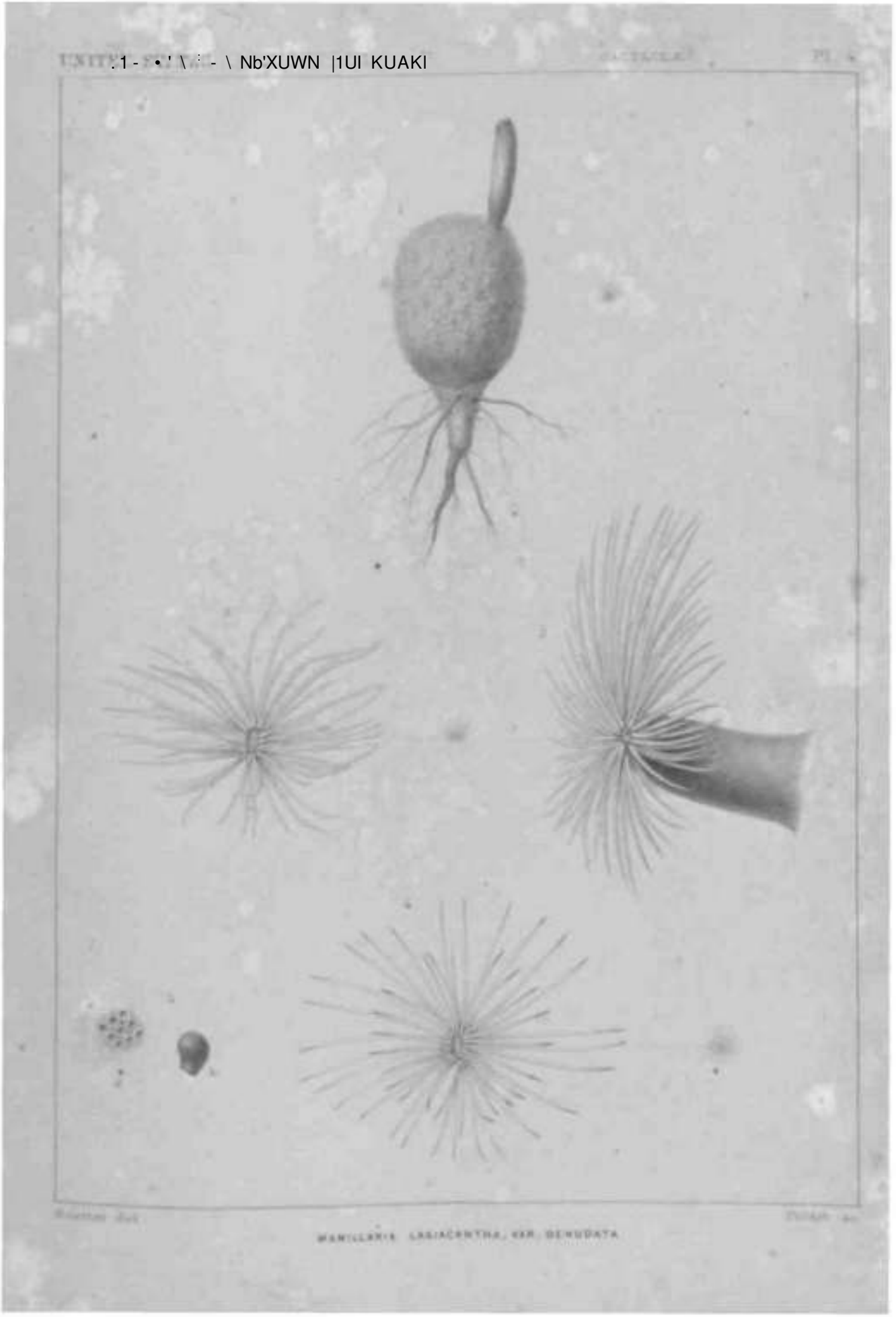

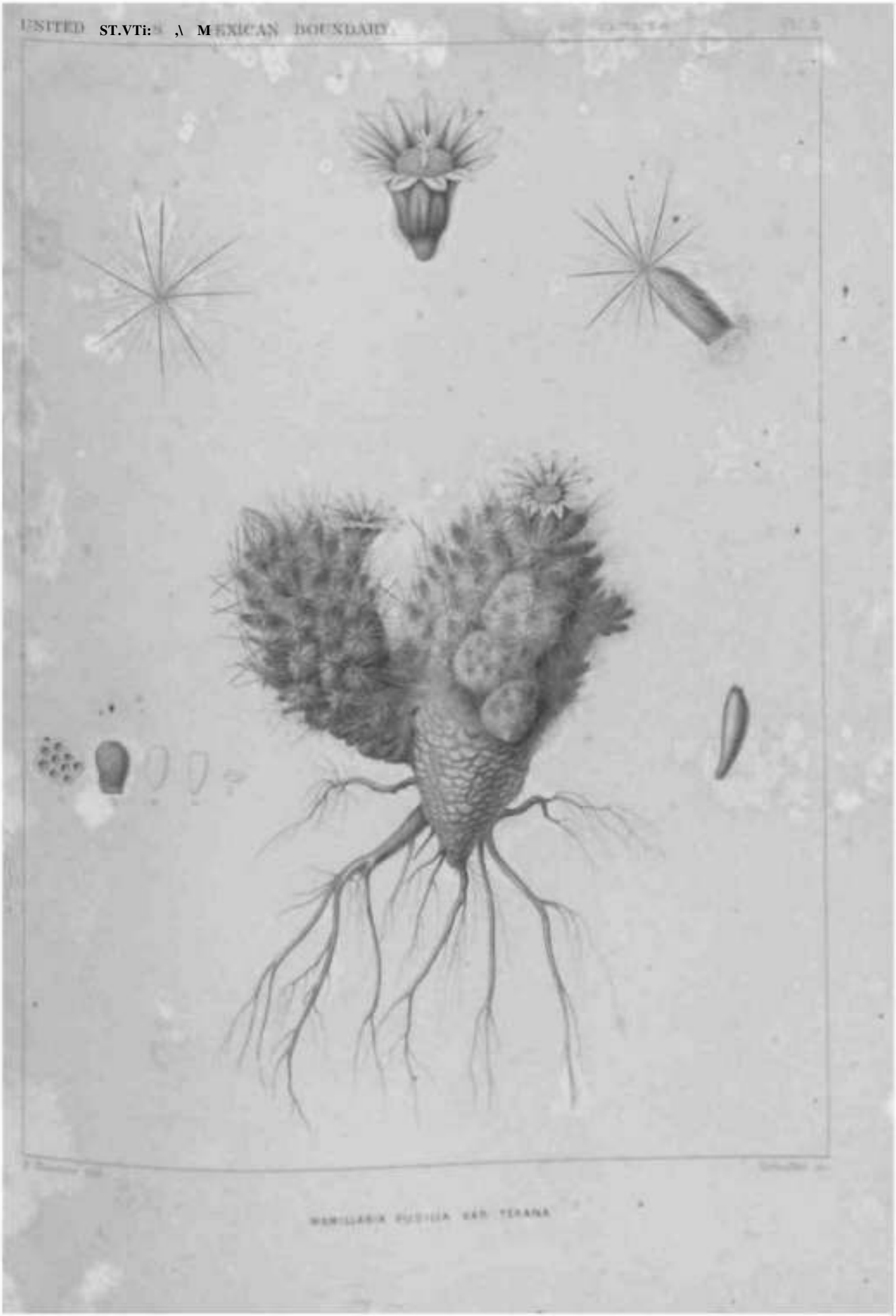
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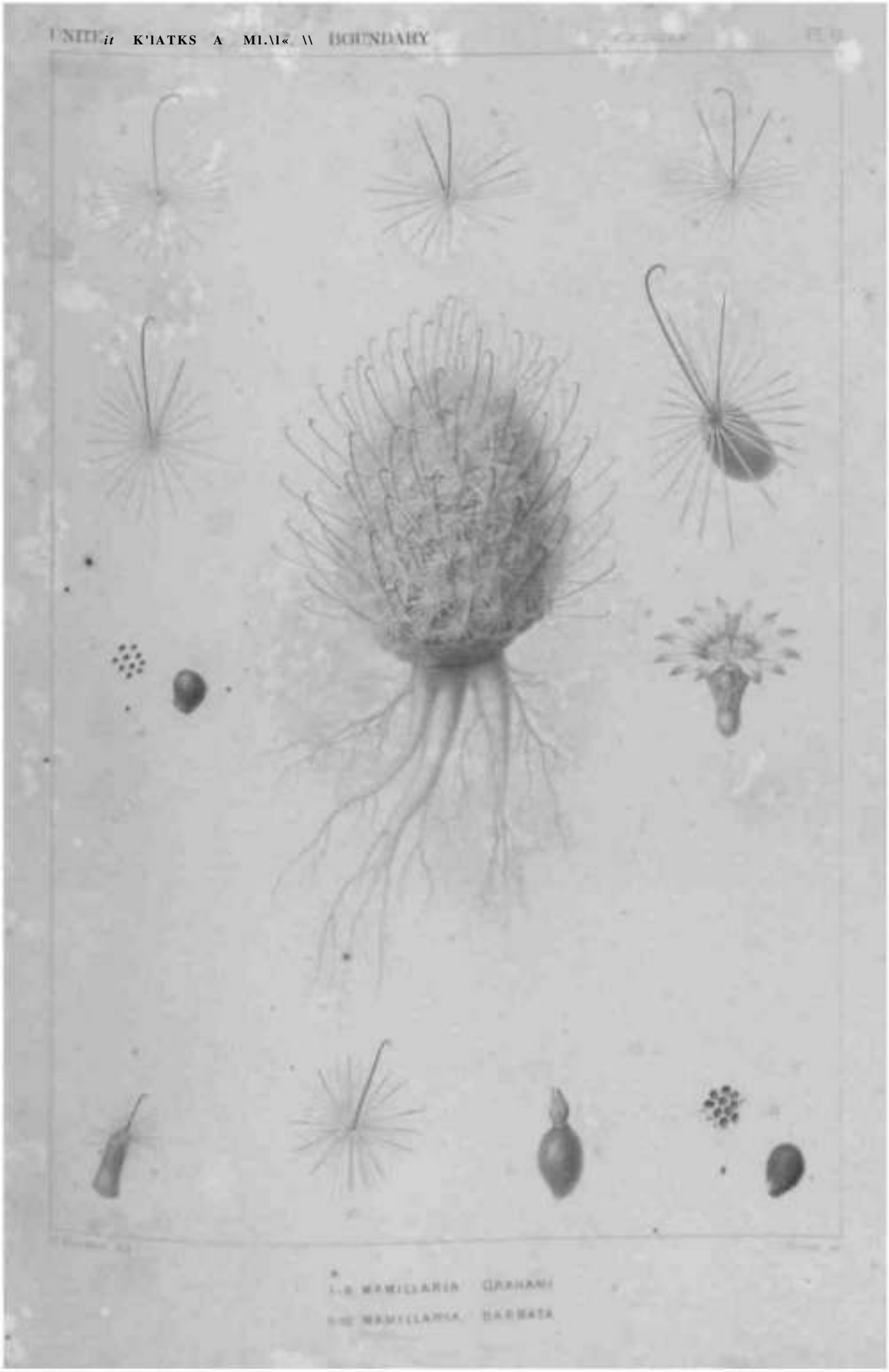
MAMILLARIA FUSCATA VAR. TEXANA



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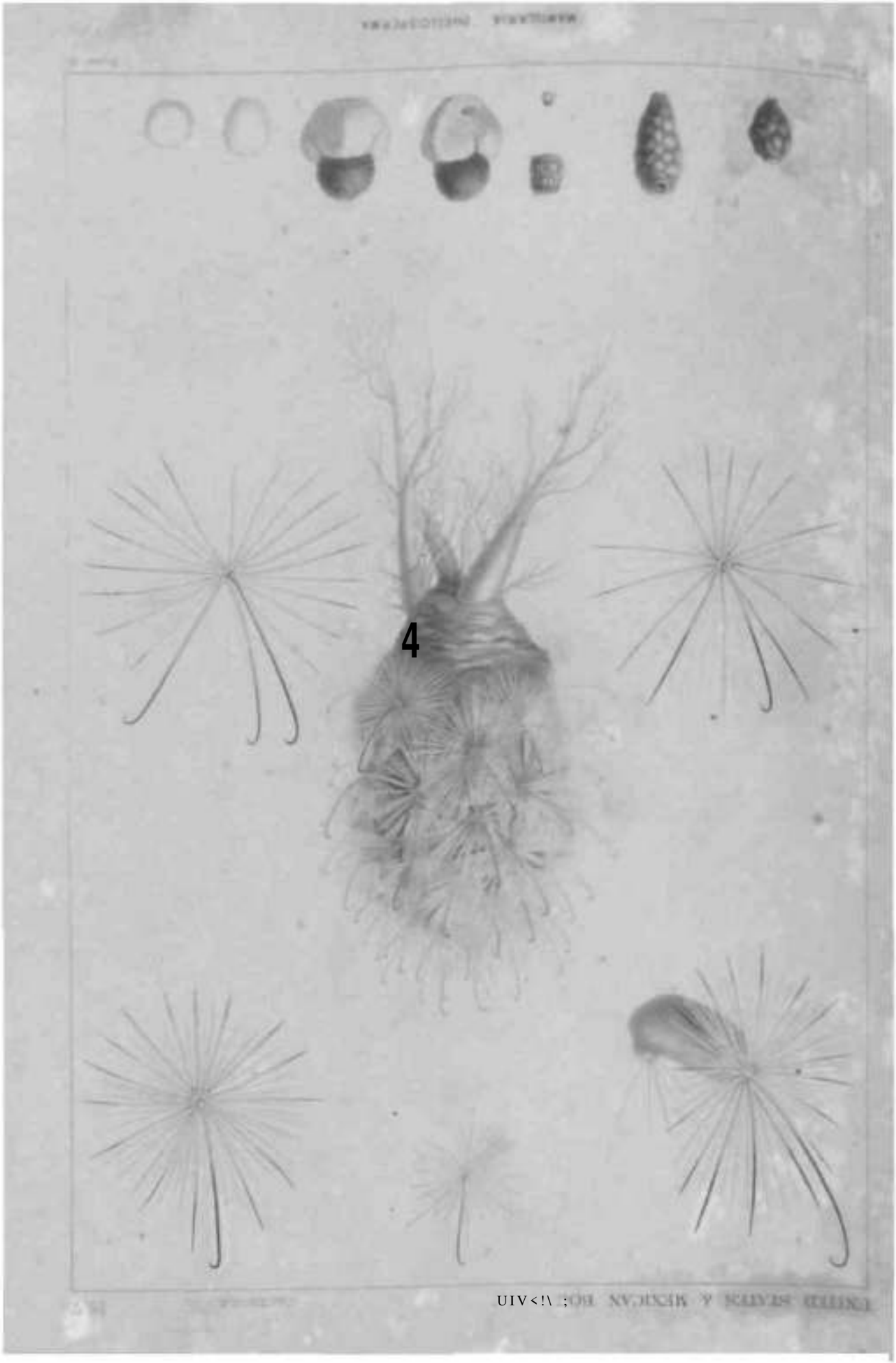
7-12. MAMILLARIA BARBATA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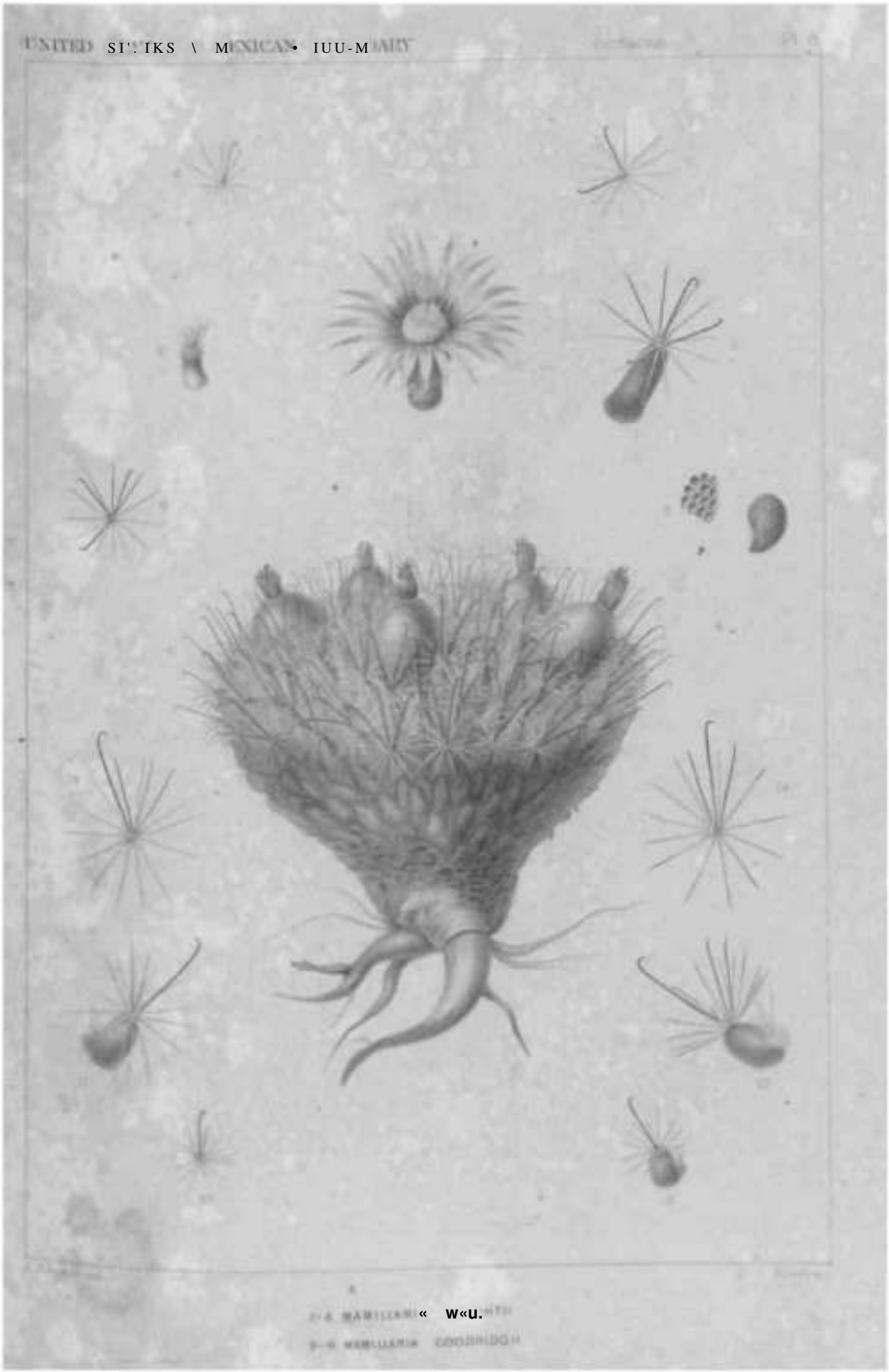

1-4. MAMILLARIA WILDII.

5-8. MAMILLARIA GOODRIDGII.

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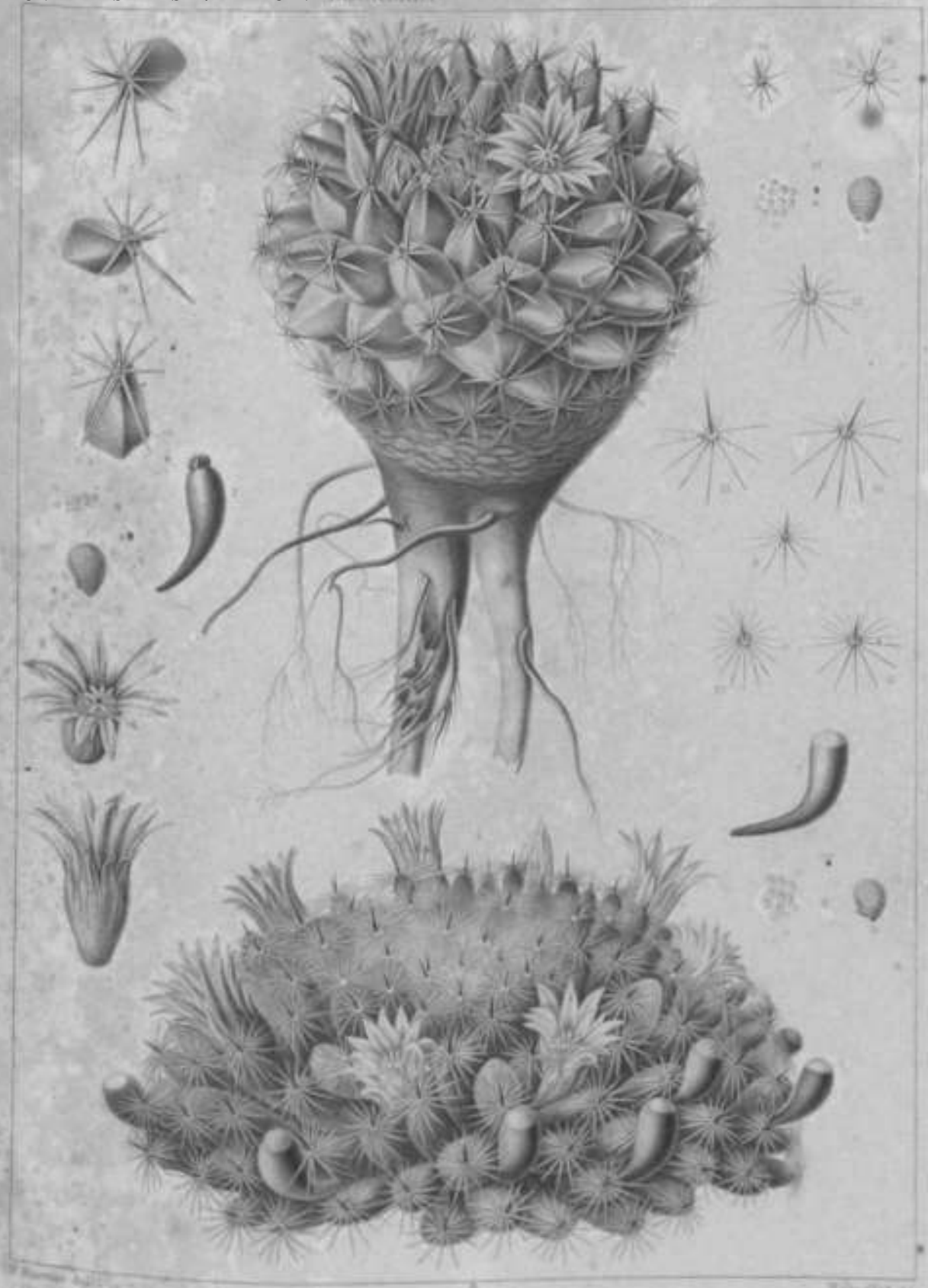

1-5 MAMILLARIA MELACANTHA
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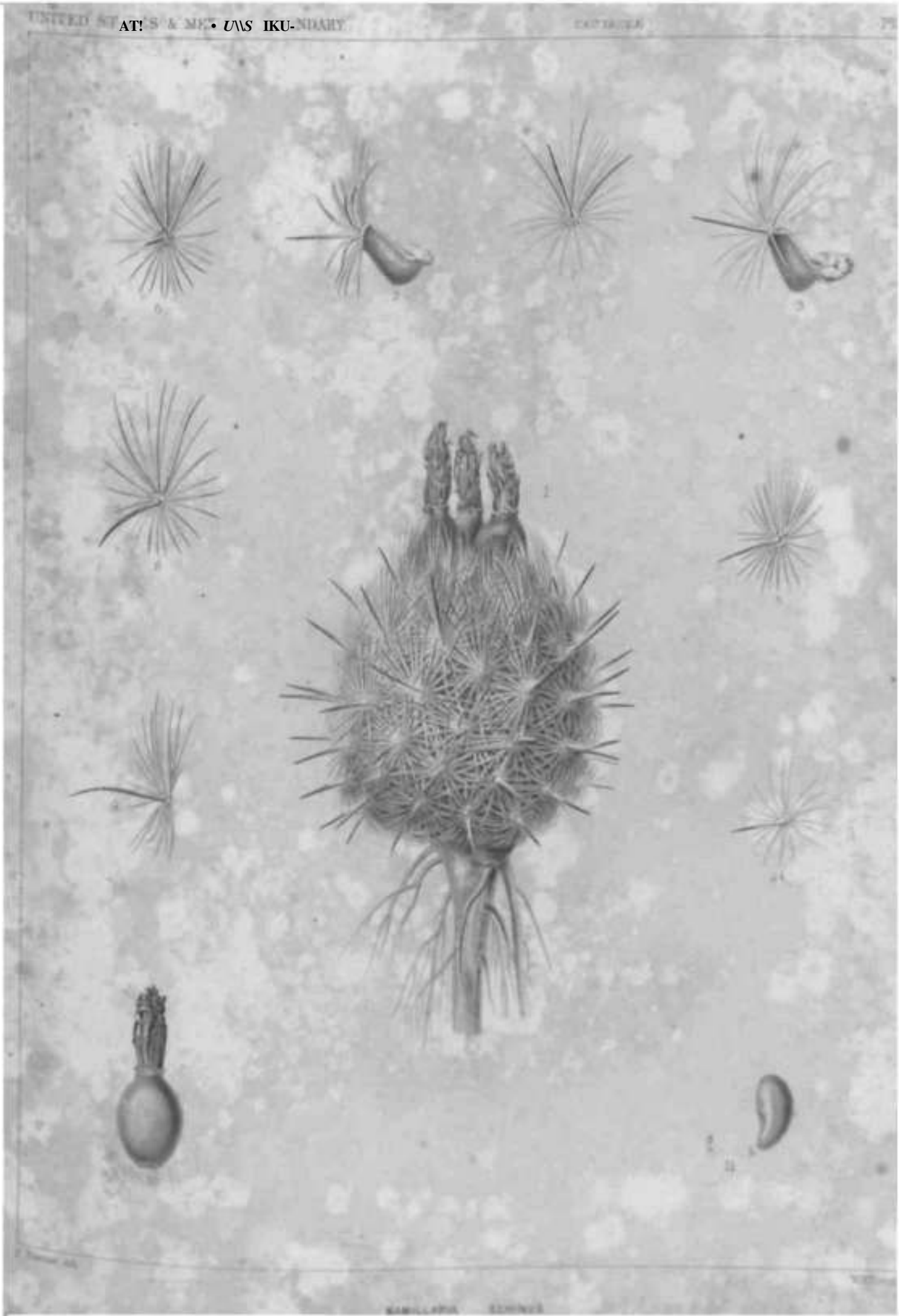
6-14 M. WISLIZENI VAR APPLANATA
16-20 M. GUMMIFERA



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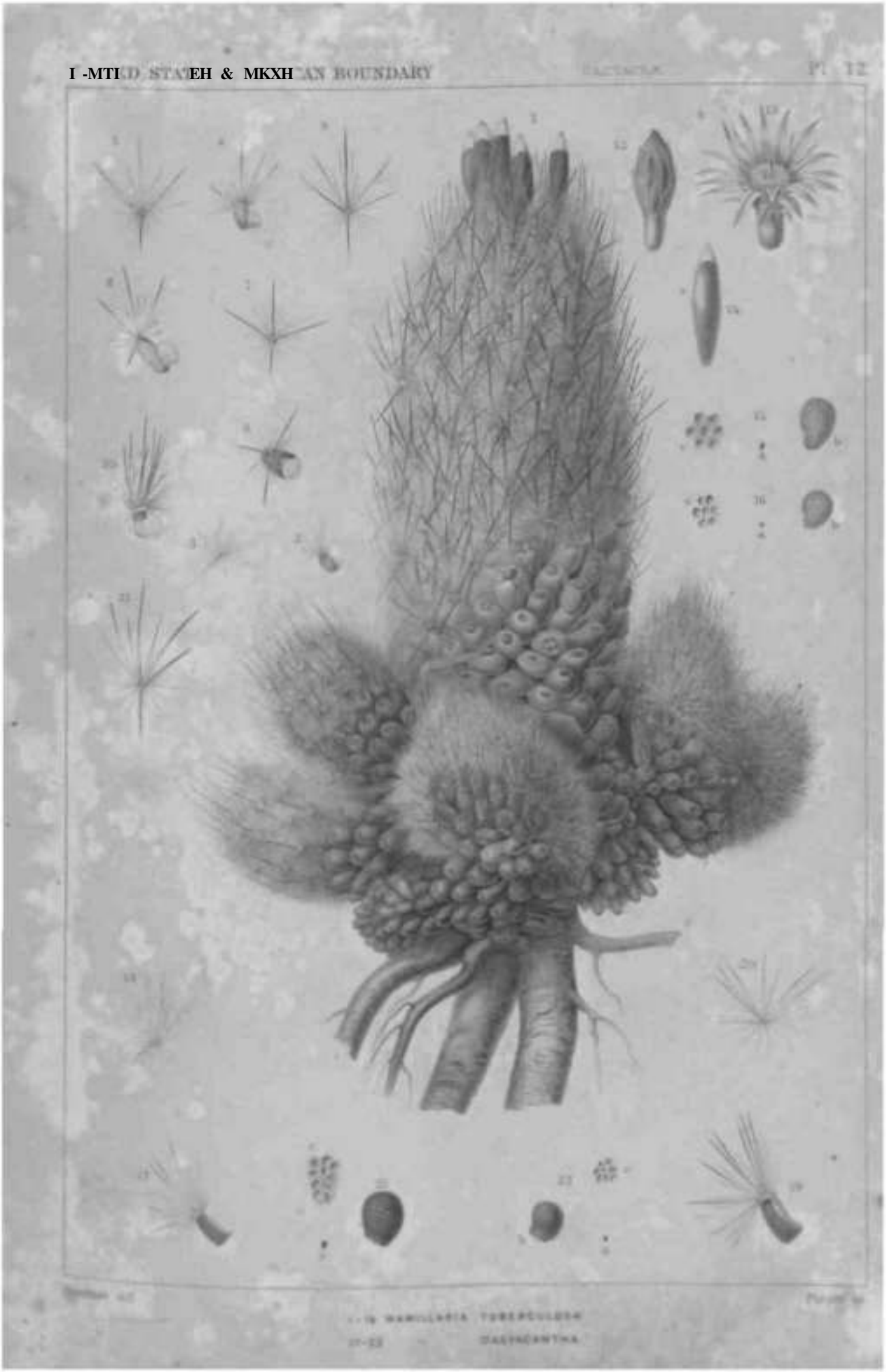

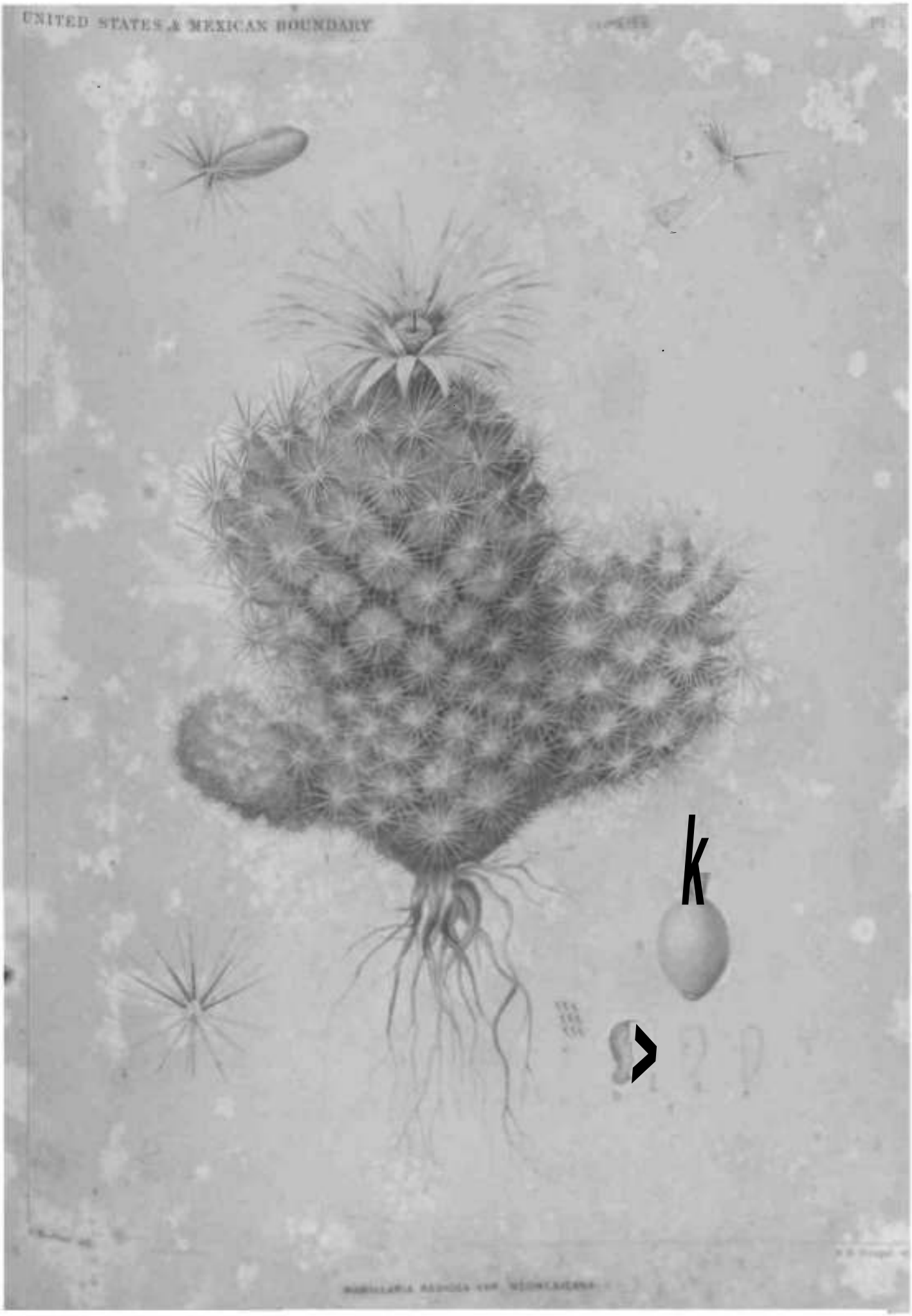
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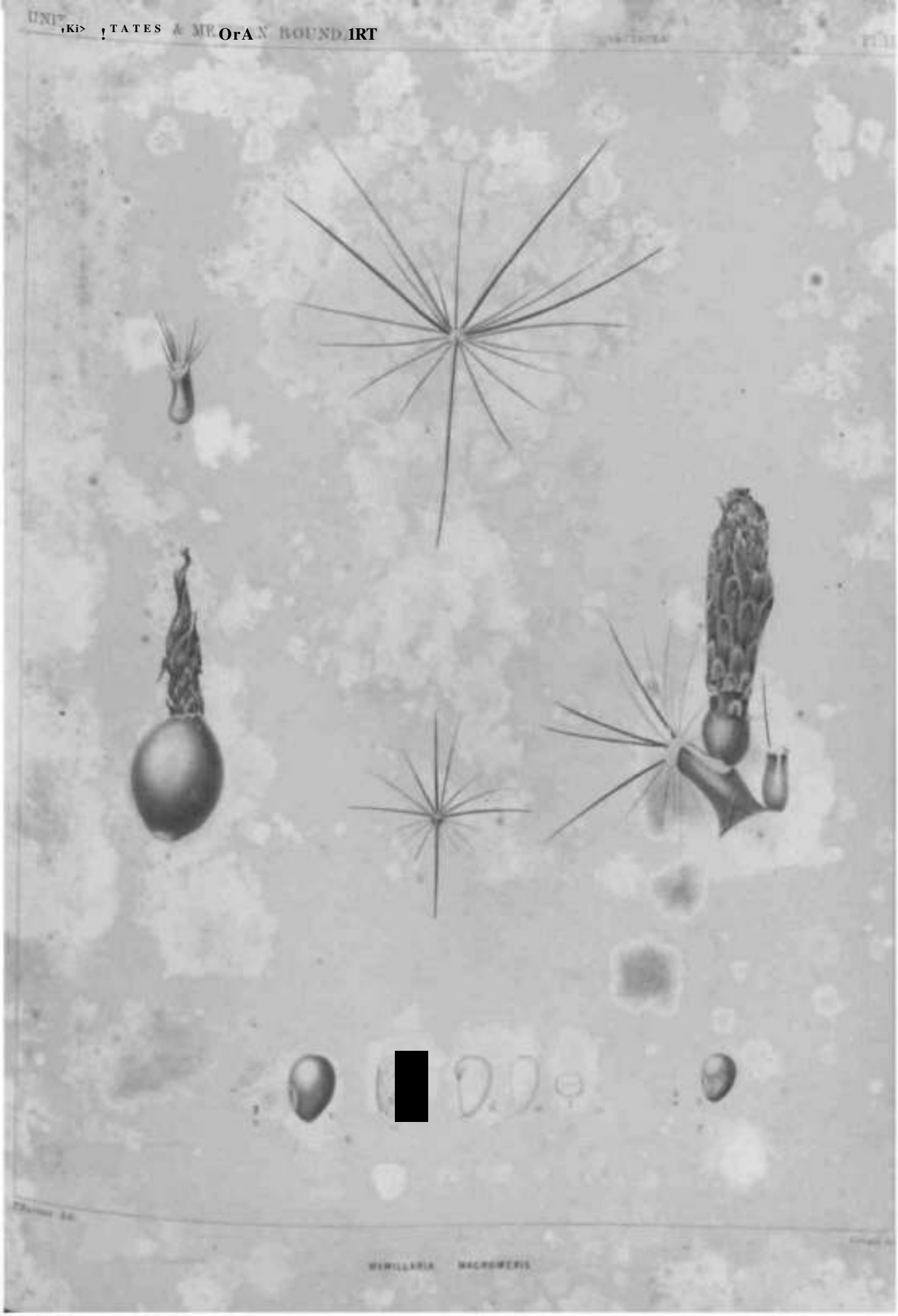
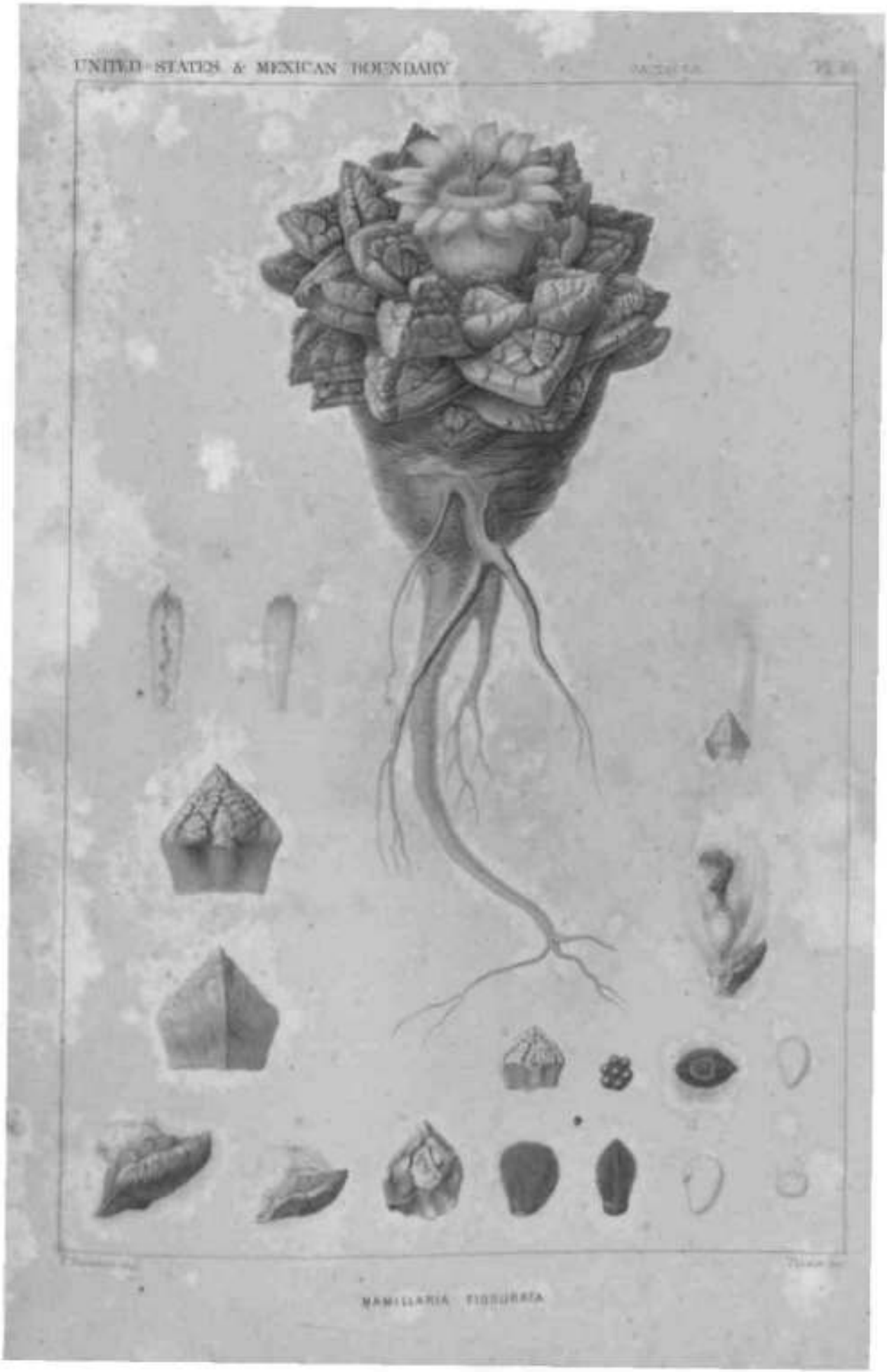
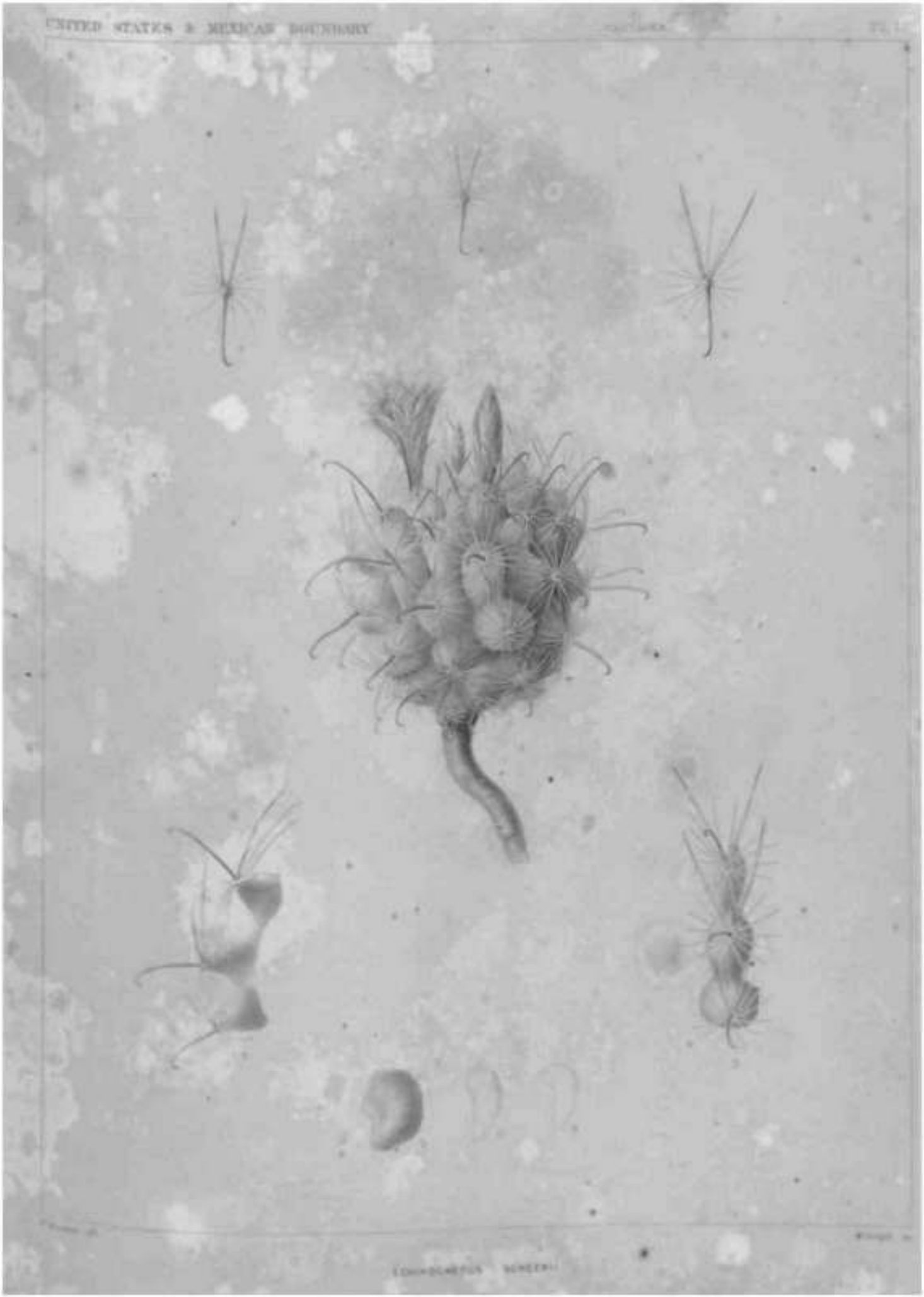
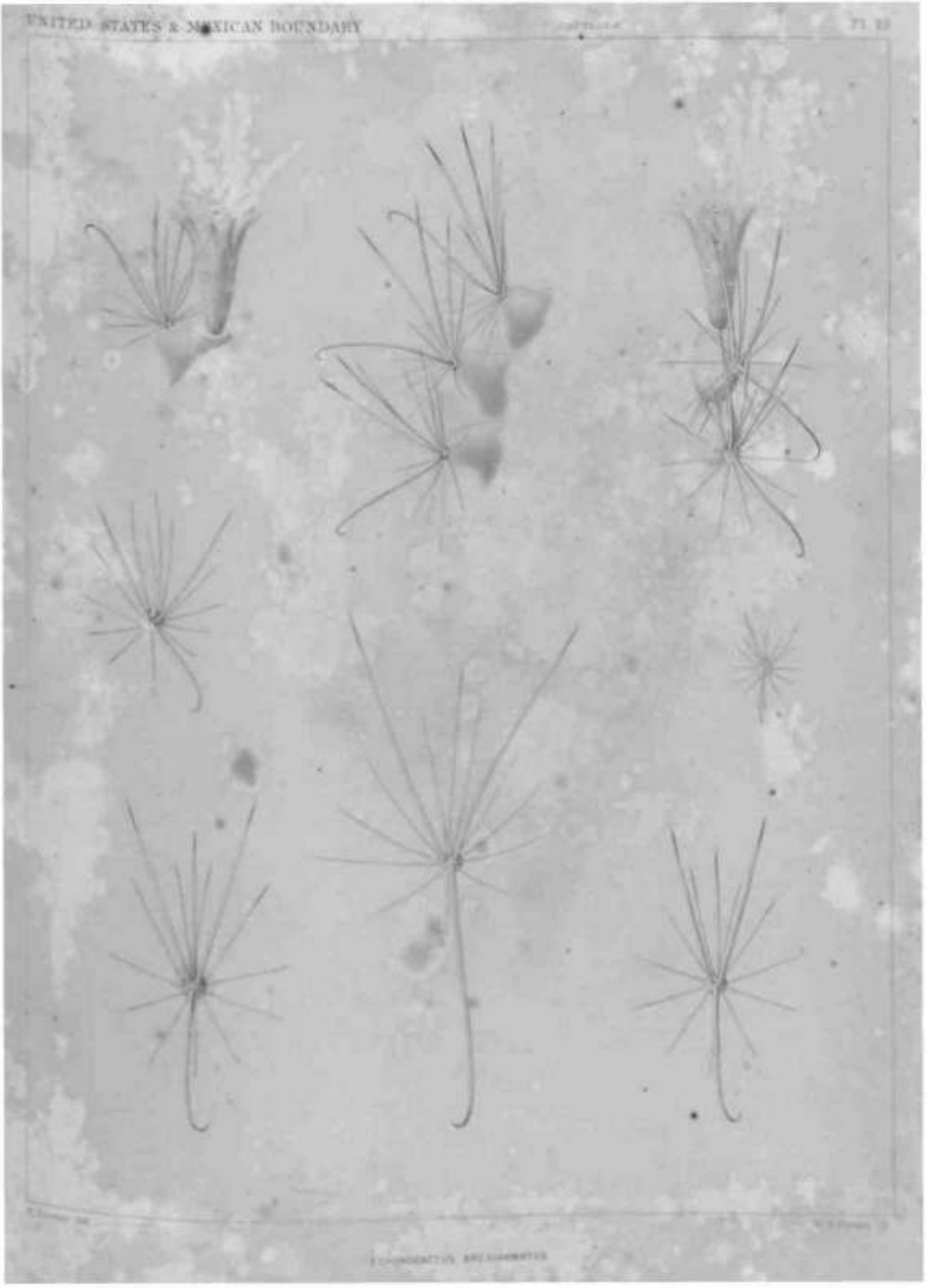
MAMILLARIA MACROMERIS

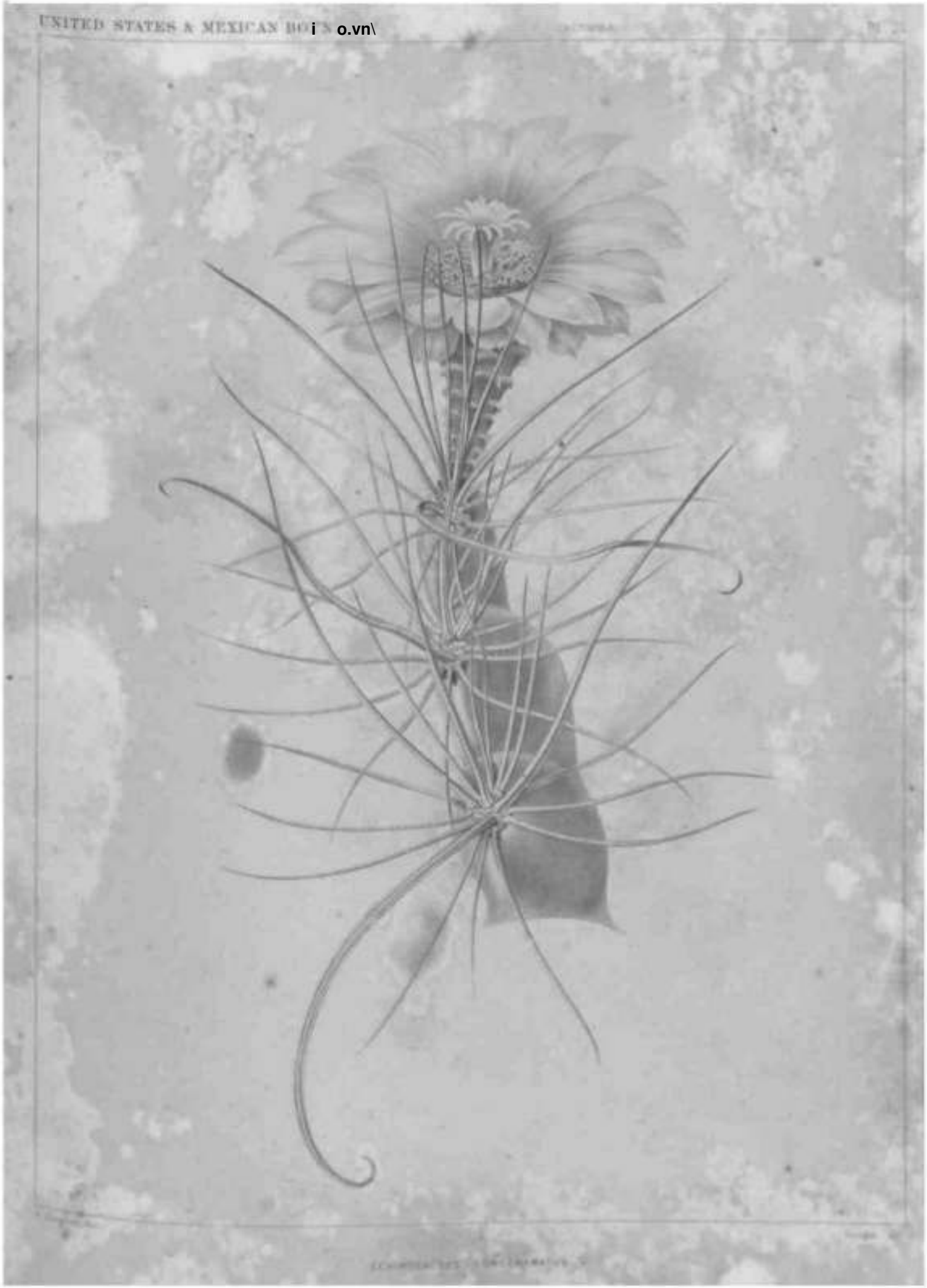


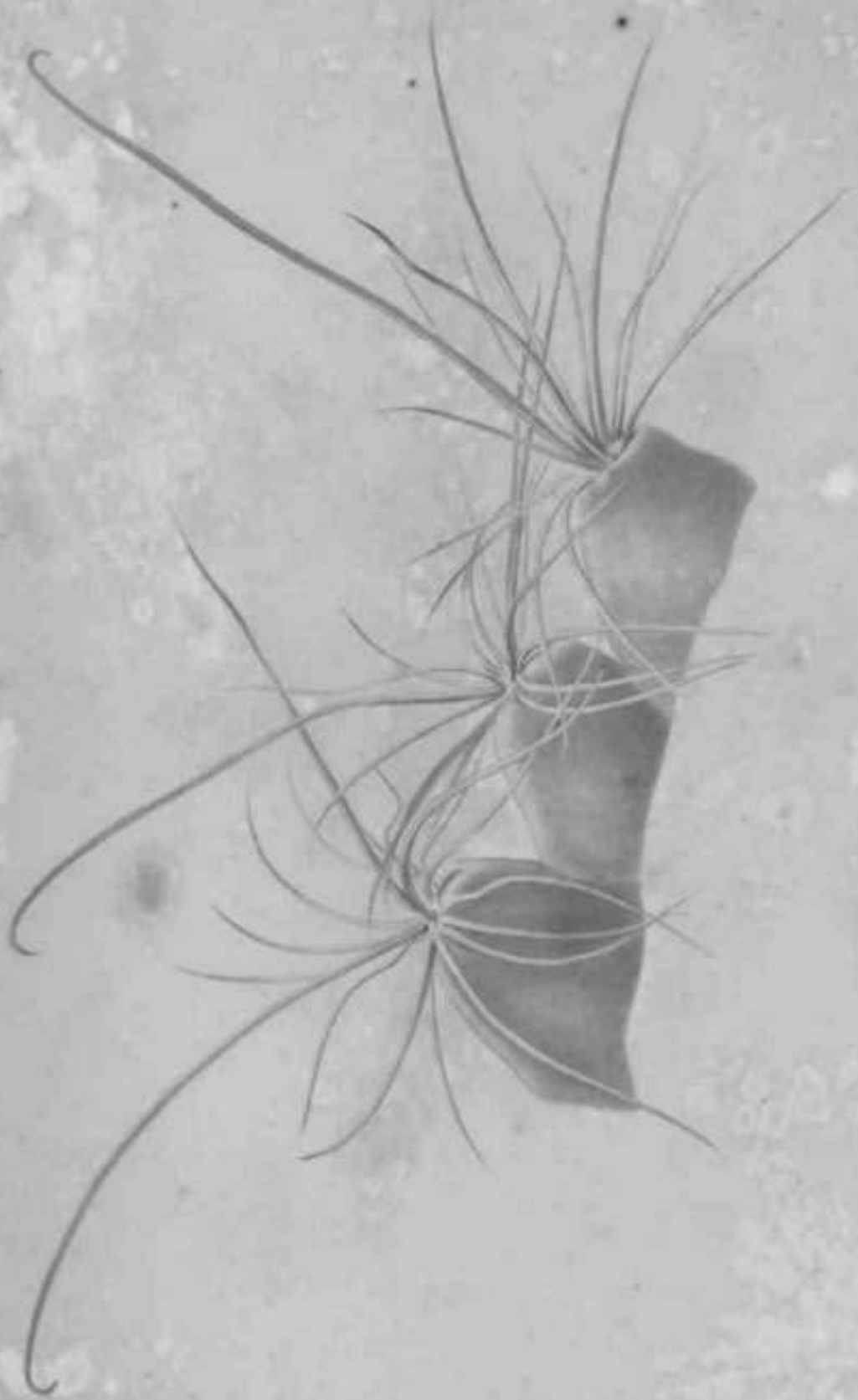


MAMILLARIA FISSURATA









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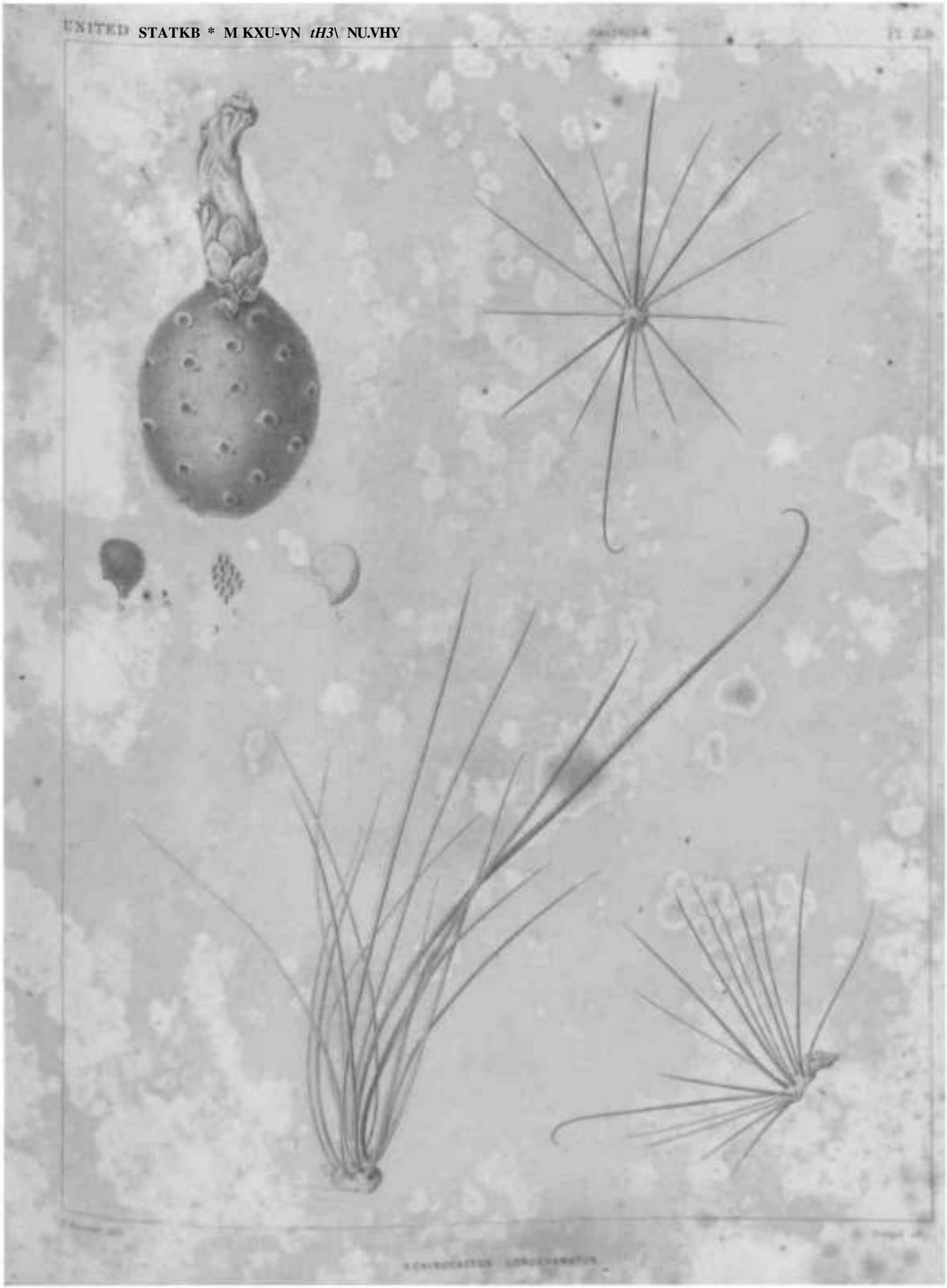
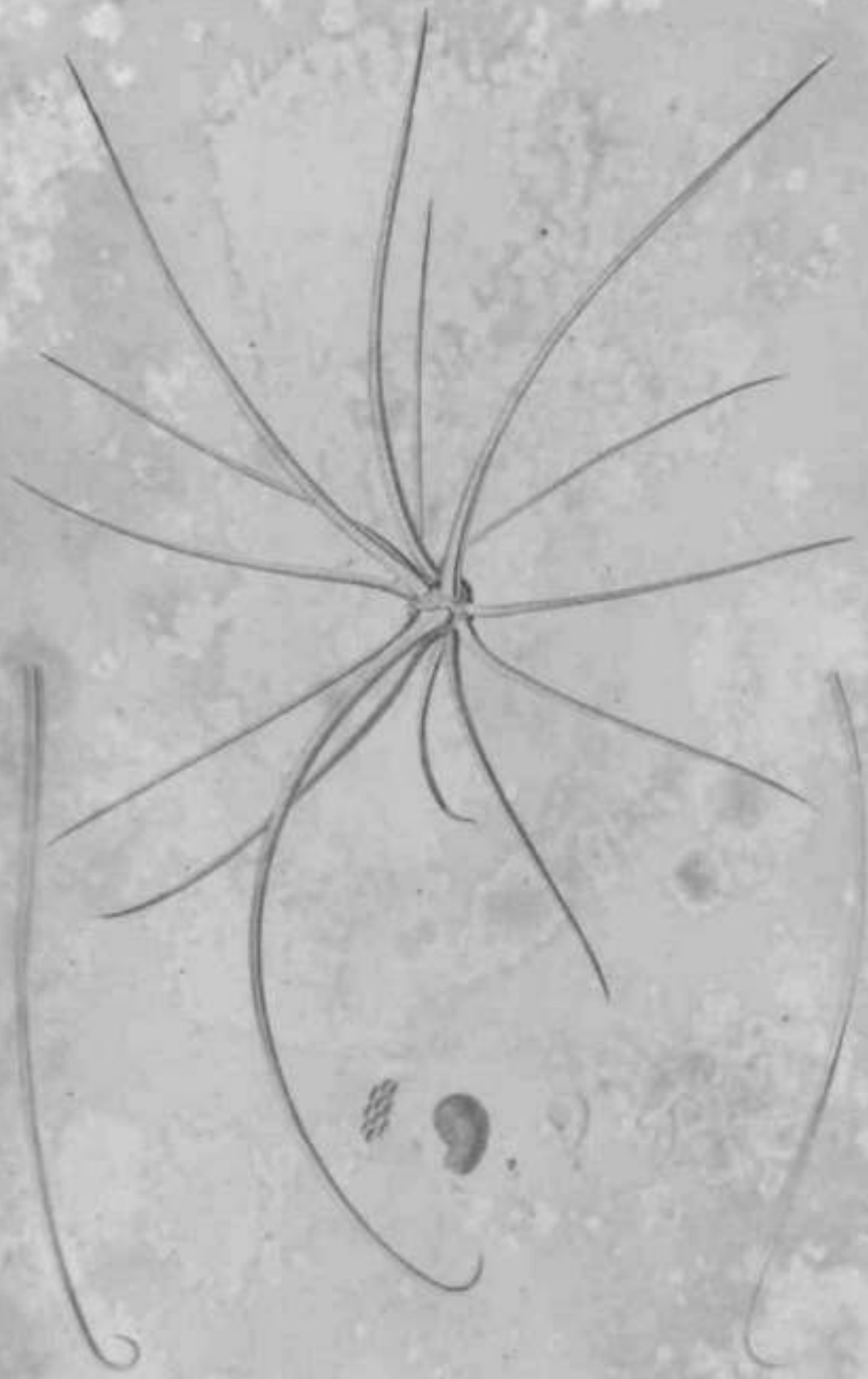
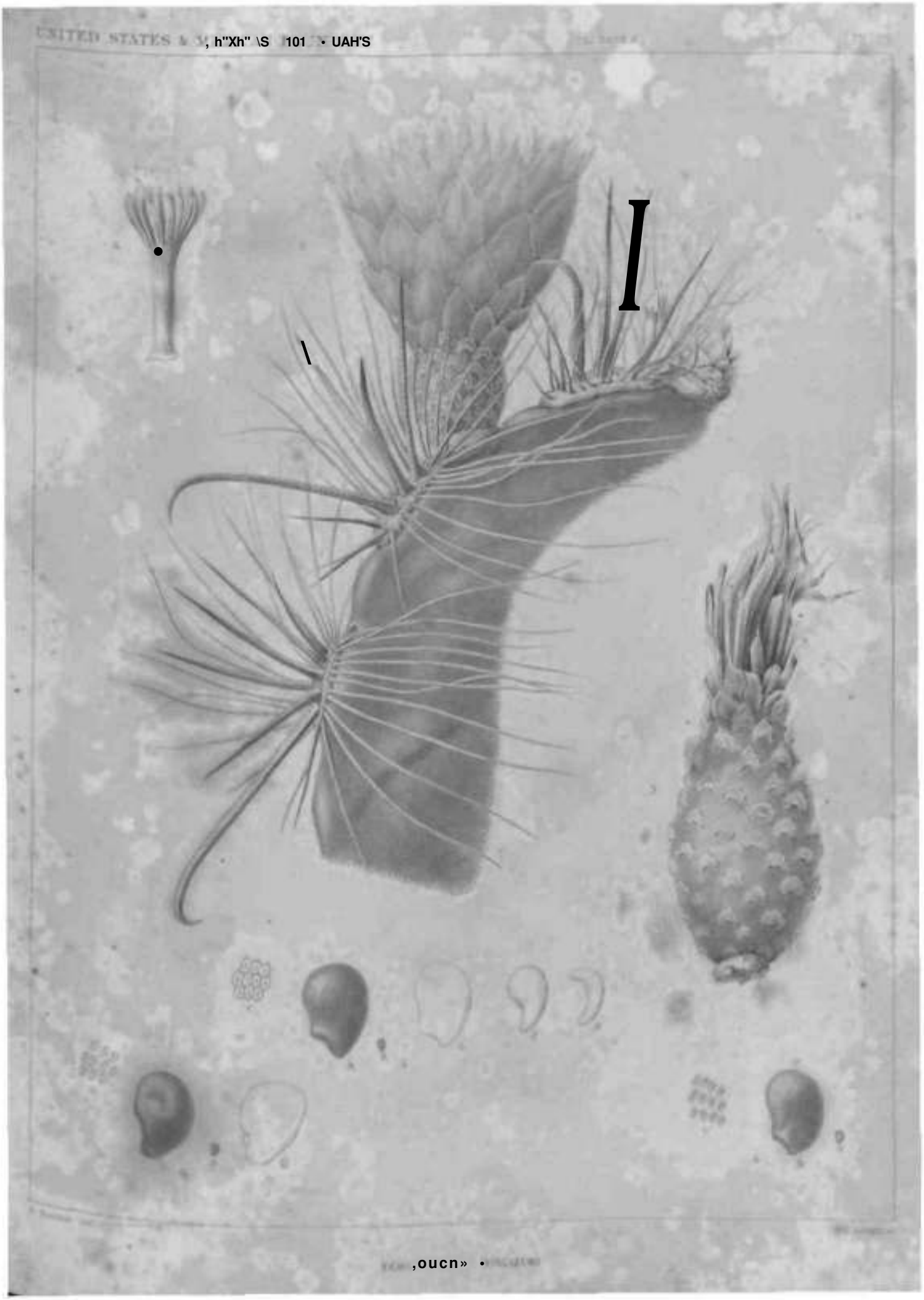
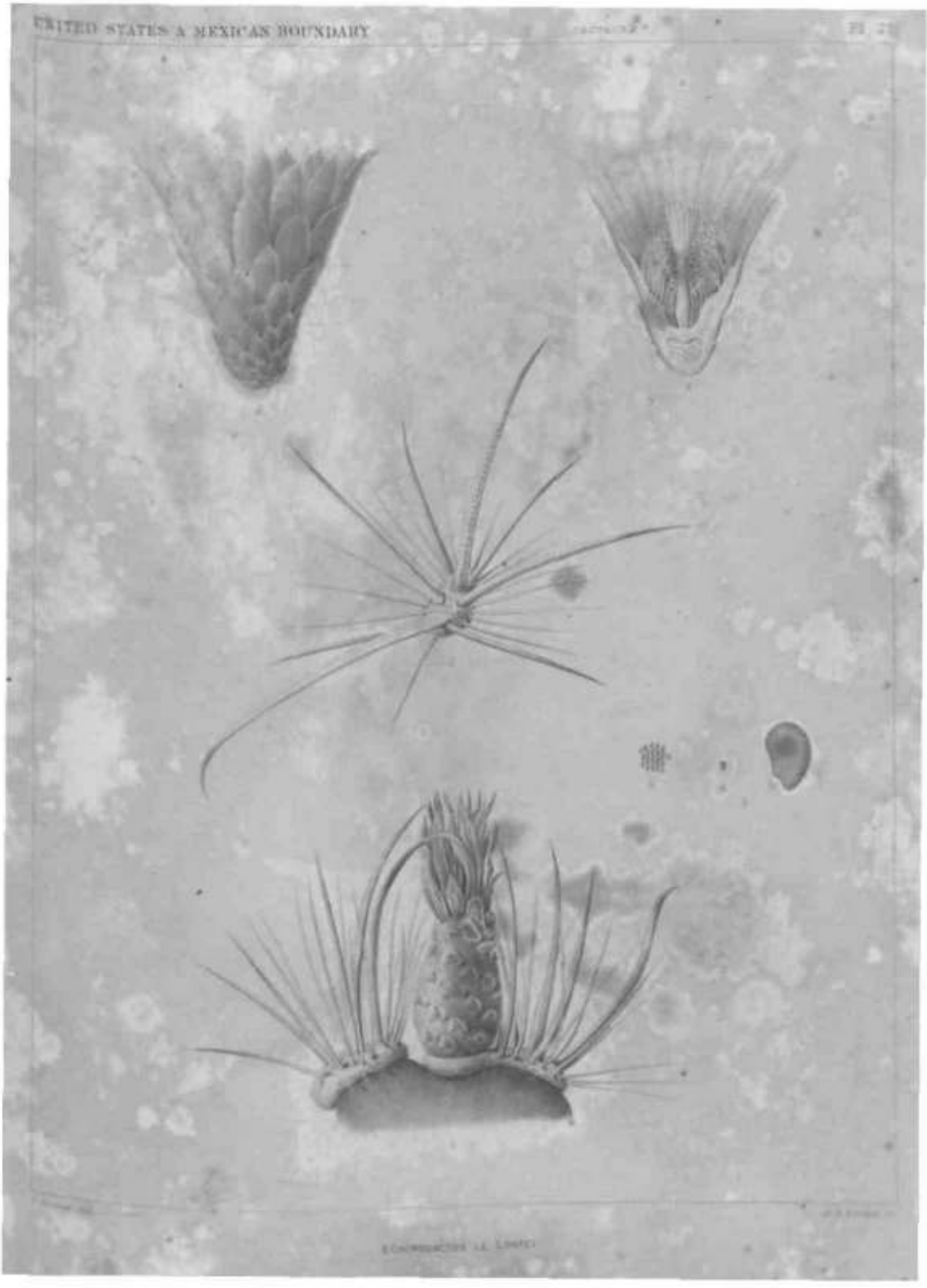
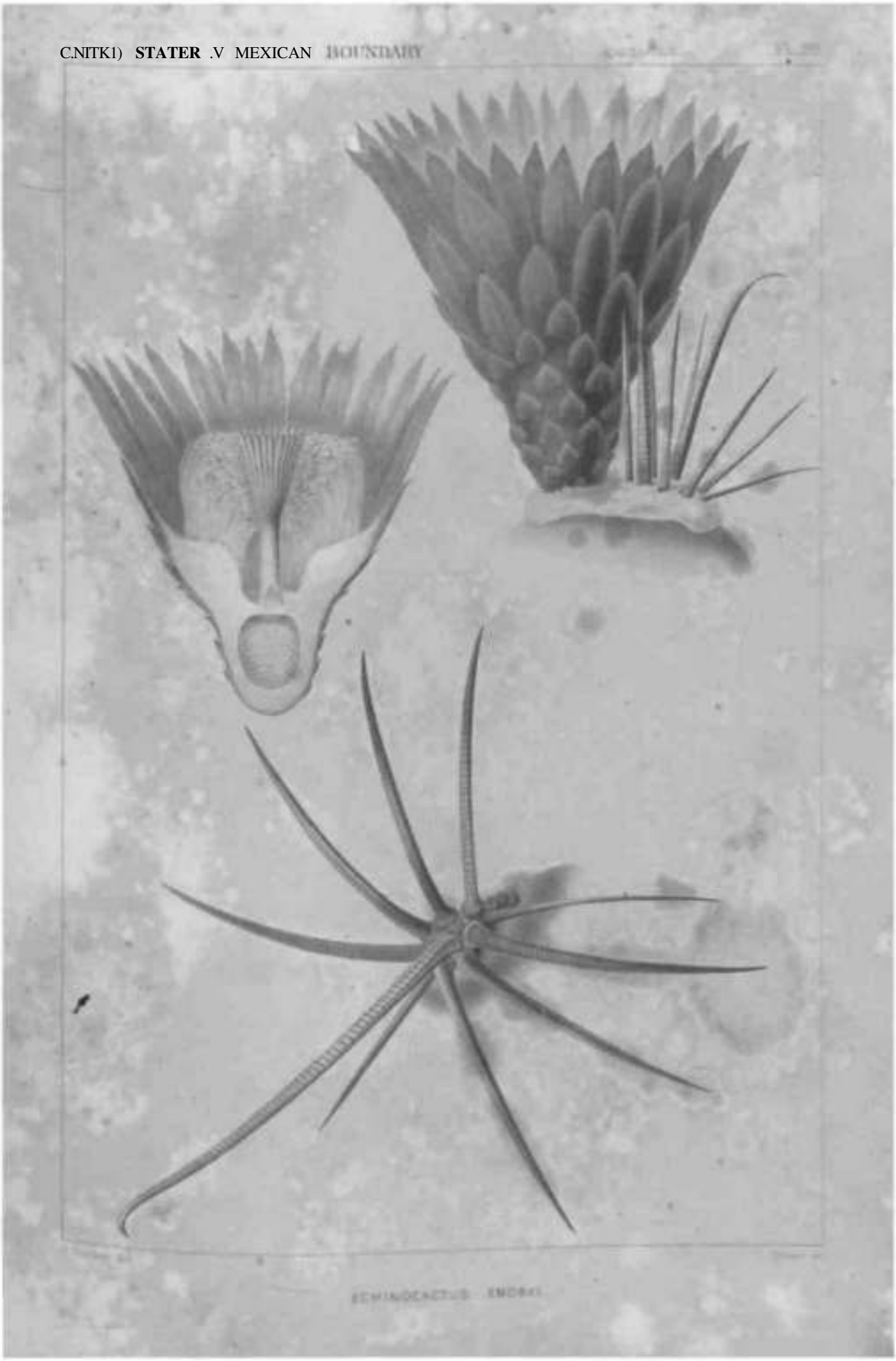




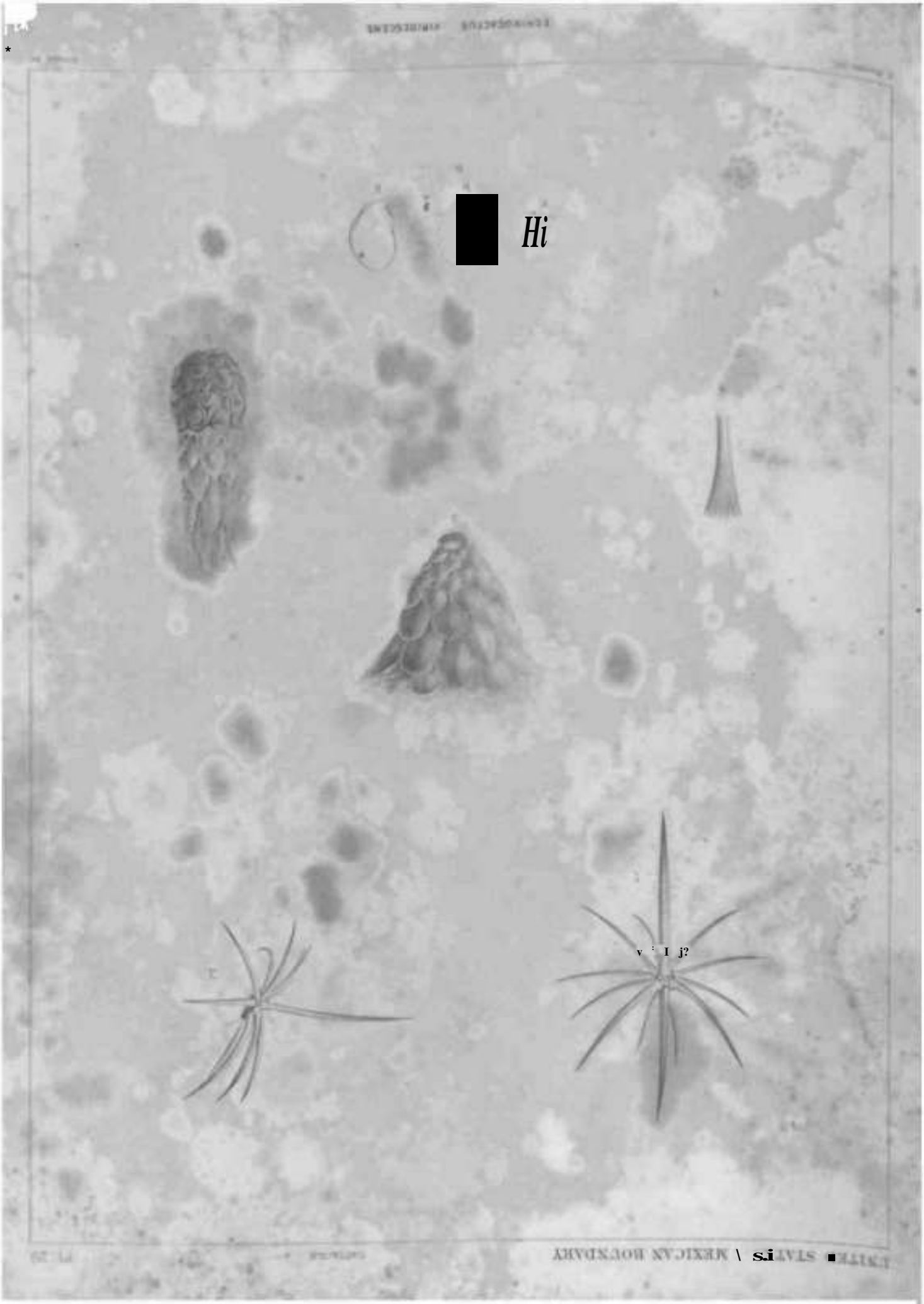
ECHINOCACTUS LONGIHAMATUS

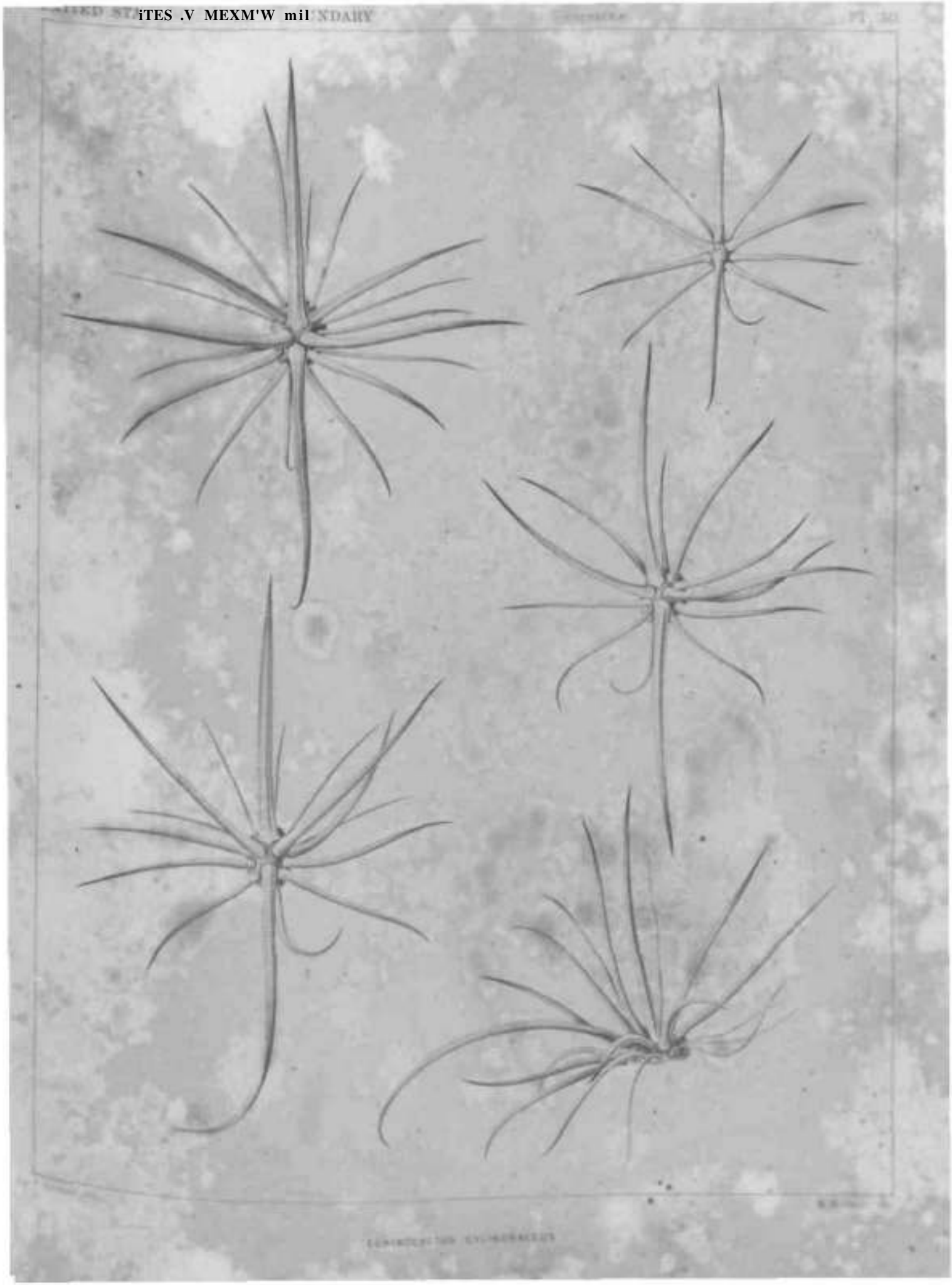


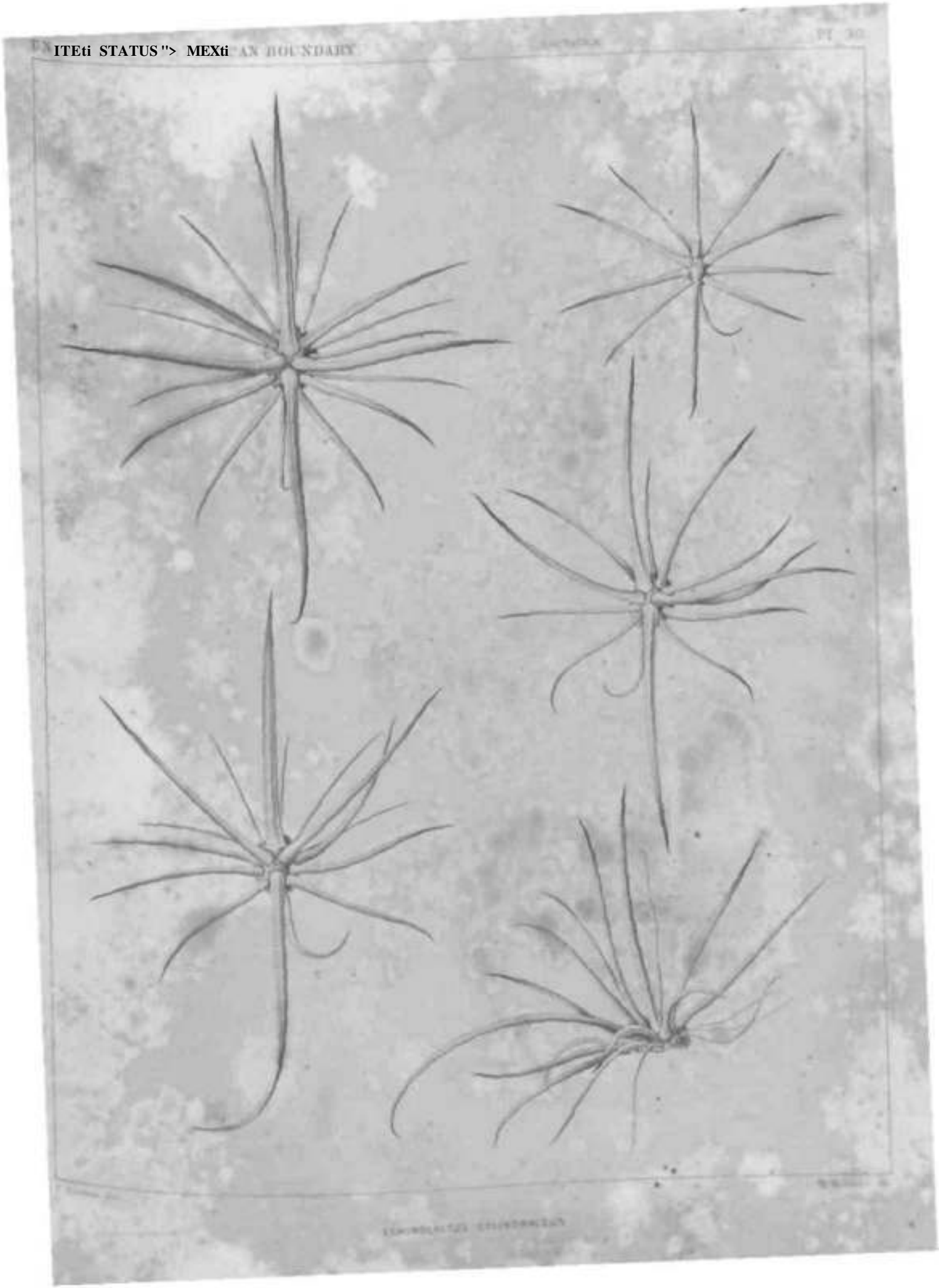


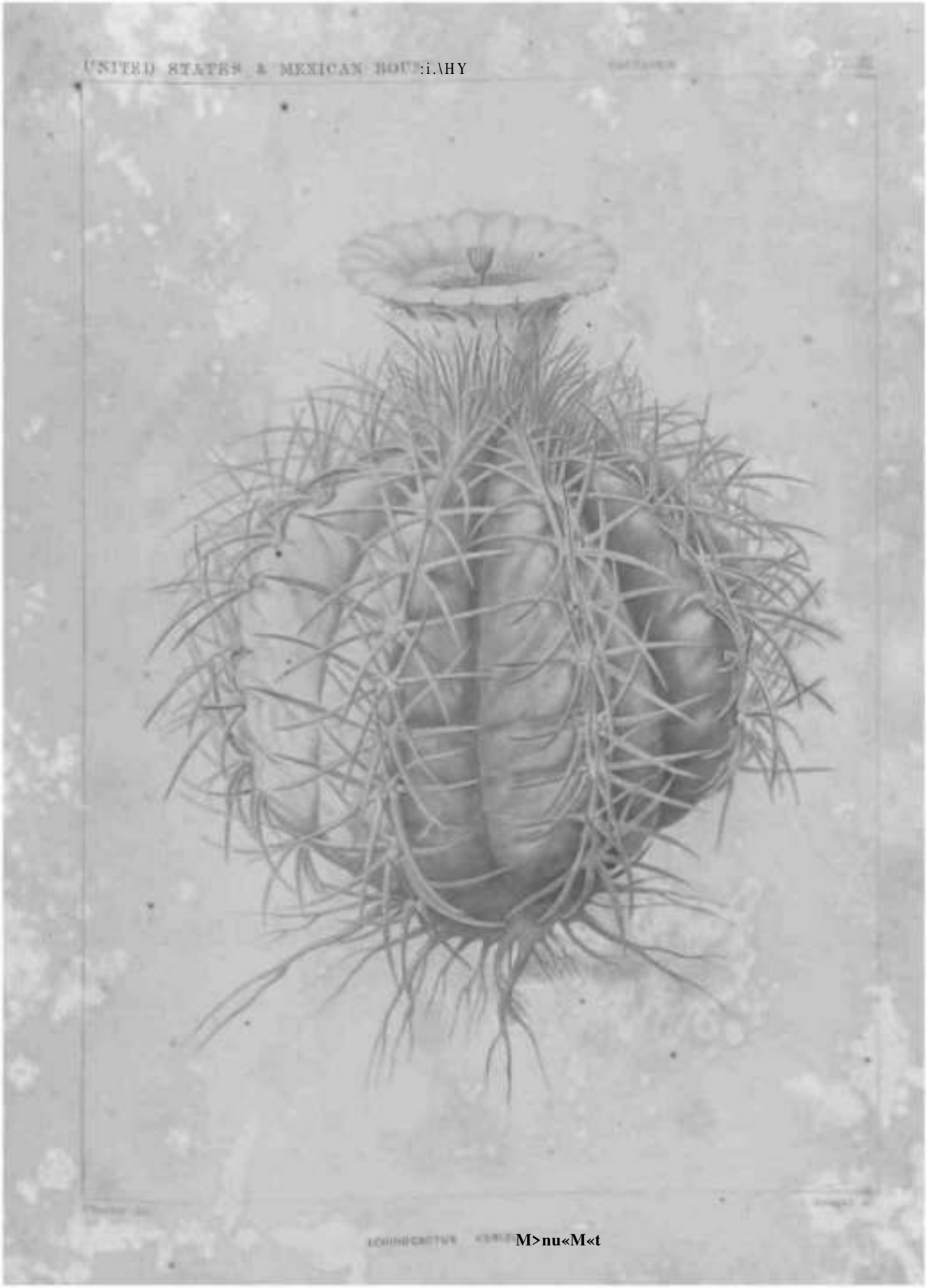


ECHINOCACTUS ENGEL





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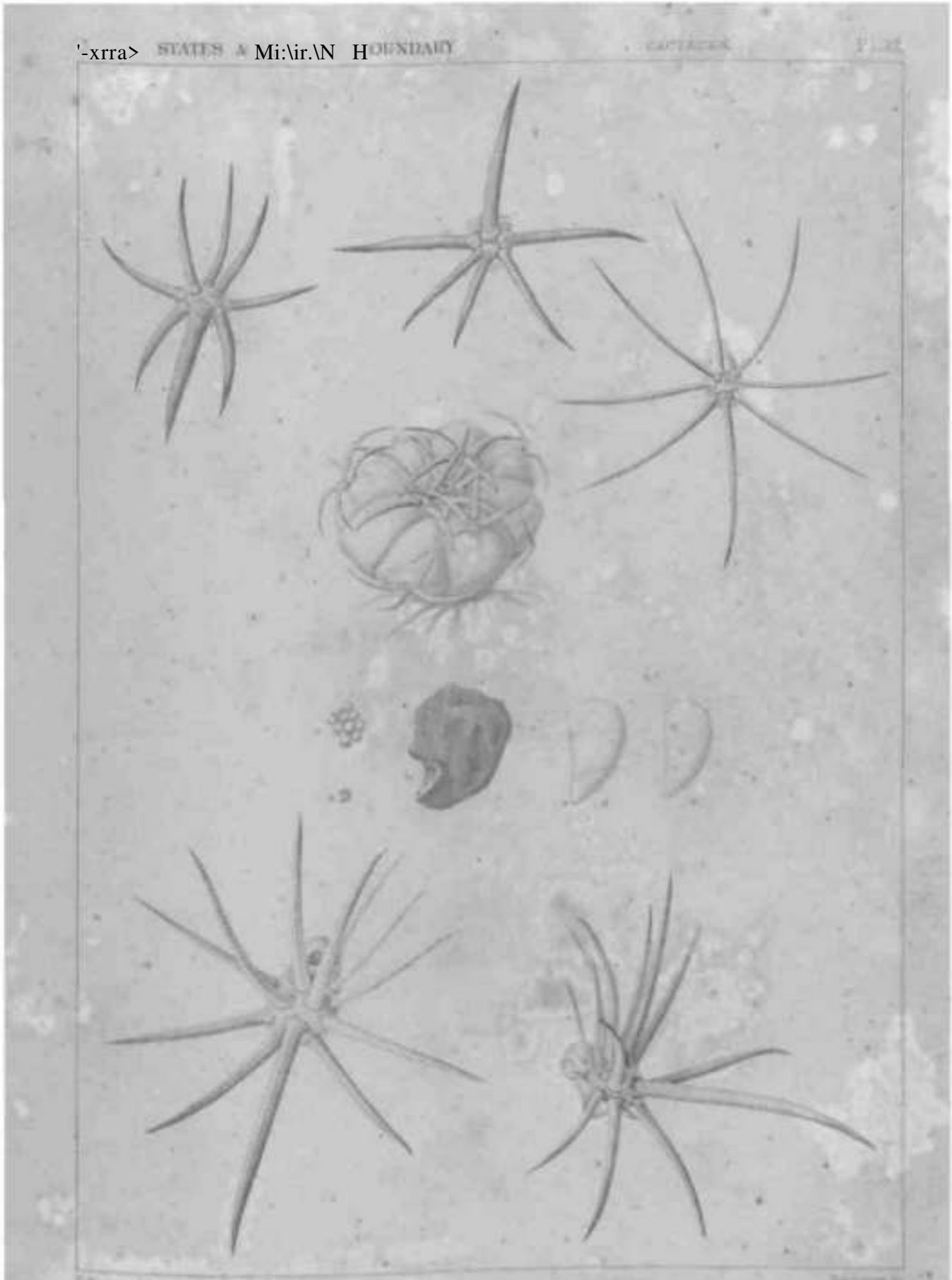
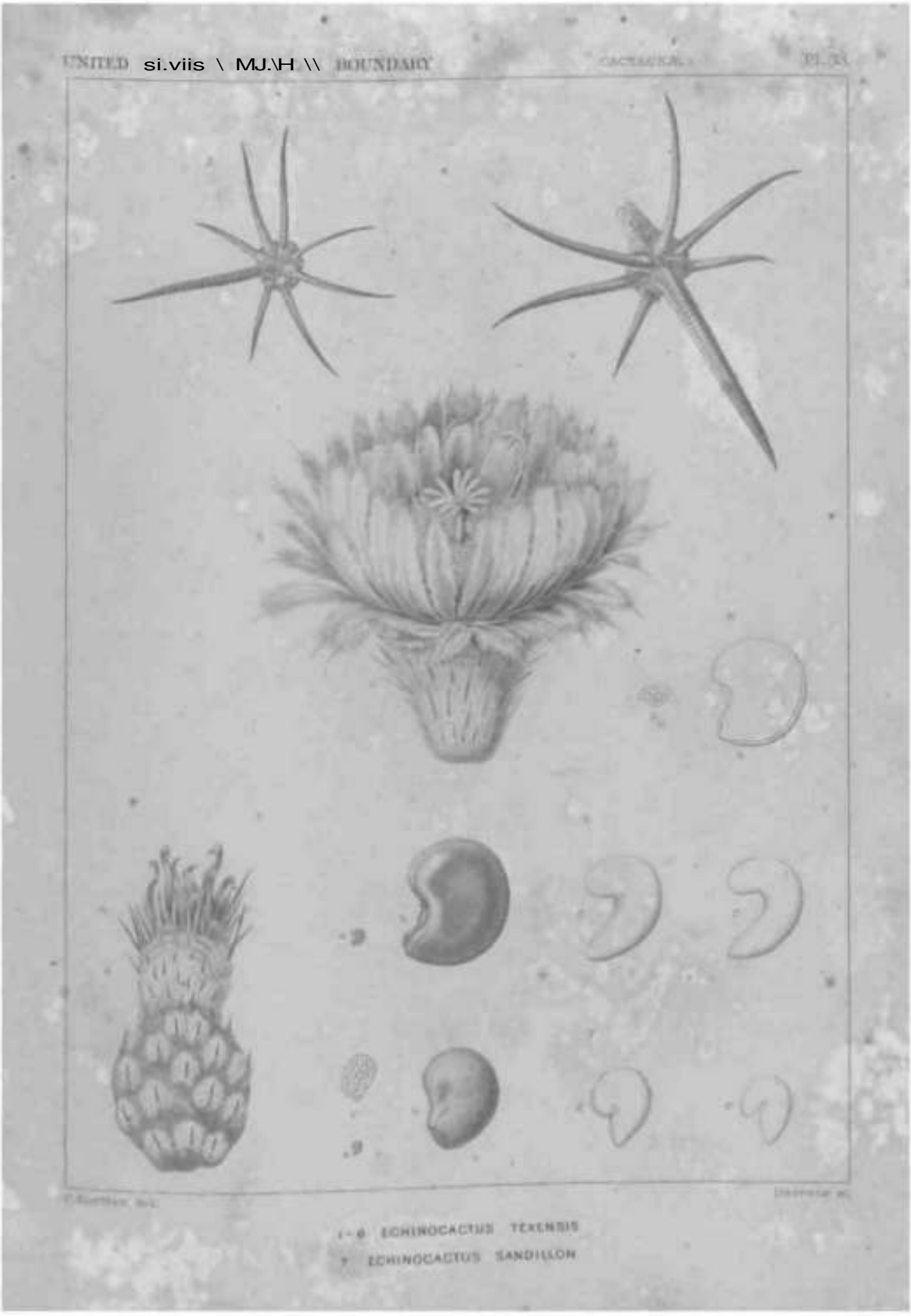


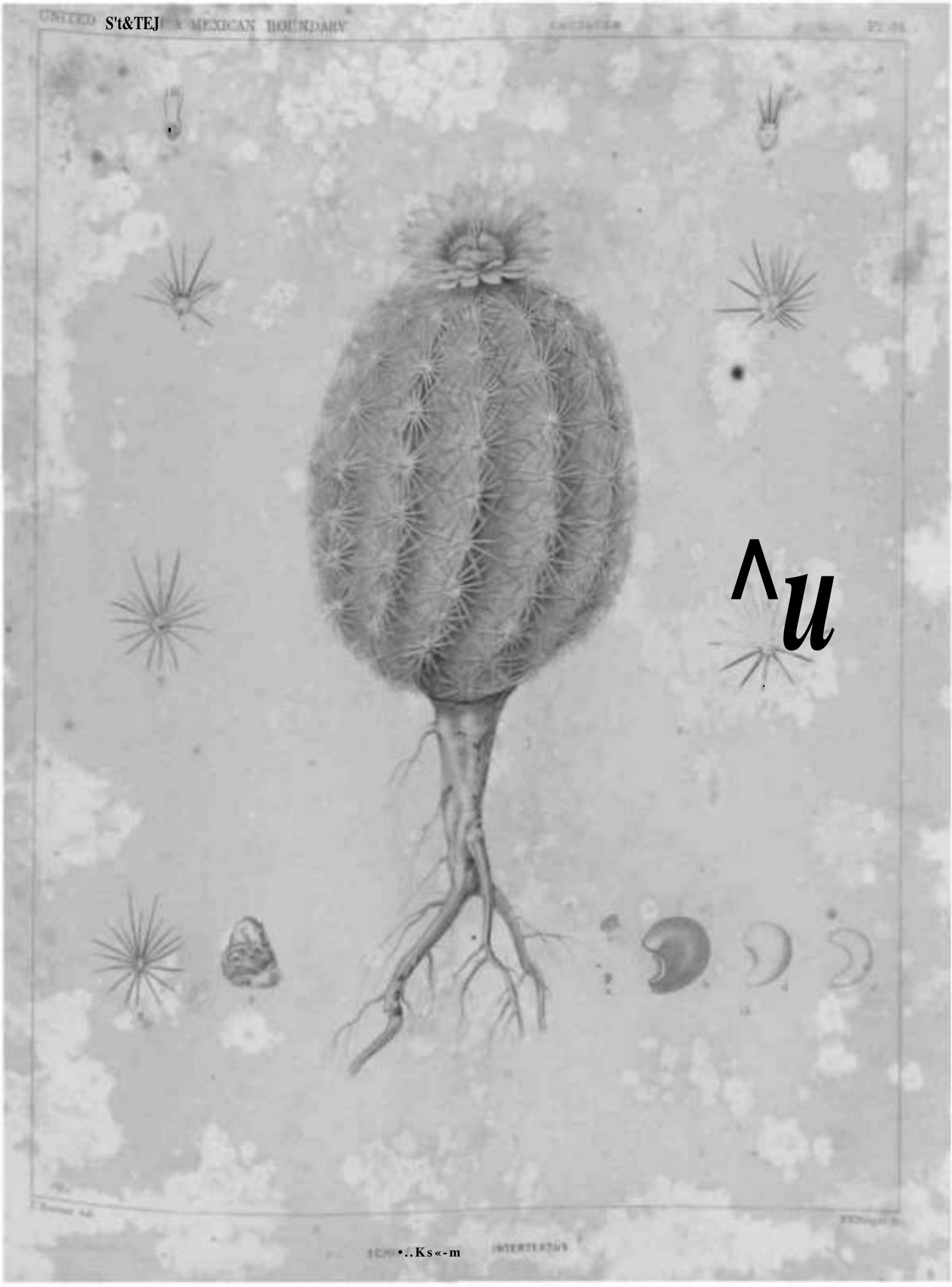
1-5 ECHINOCACTUS HORIZONTHALONIUS

6-7 ECHINOCACTUS PA[illegible]. fln



1–6 ECHINOCACTUS TEXENSIS

7 ECHINOCACTUS SANDILLON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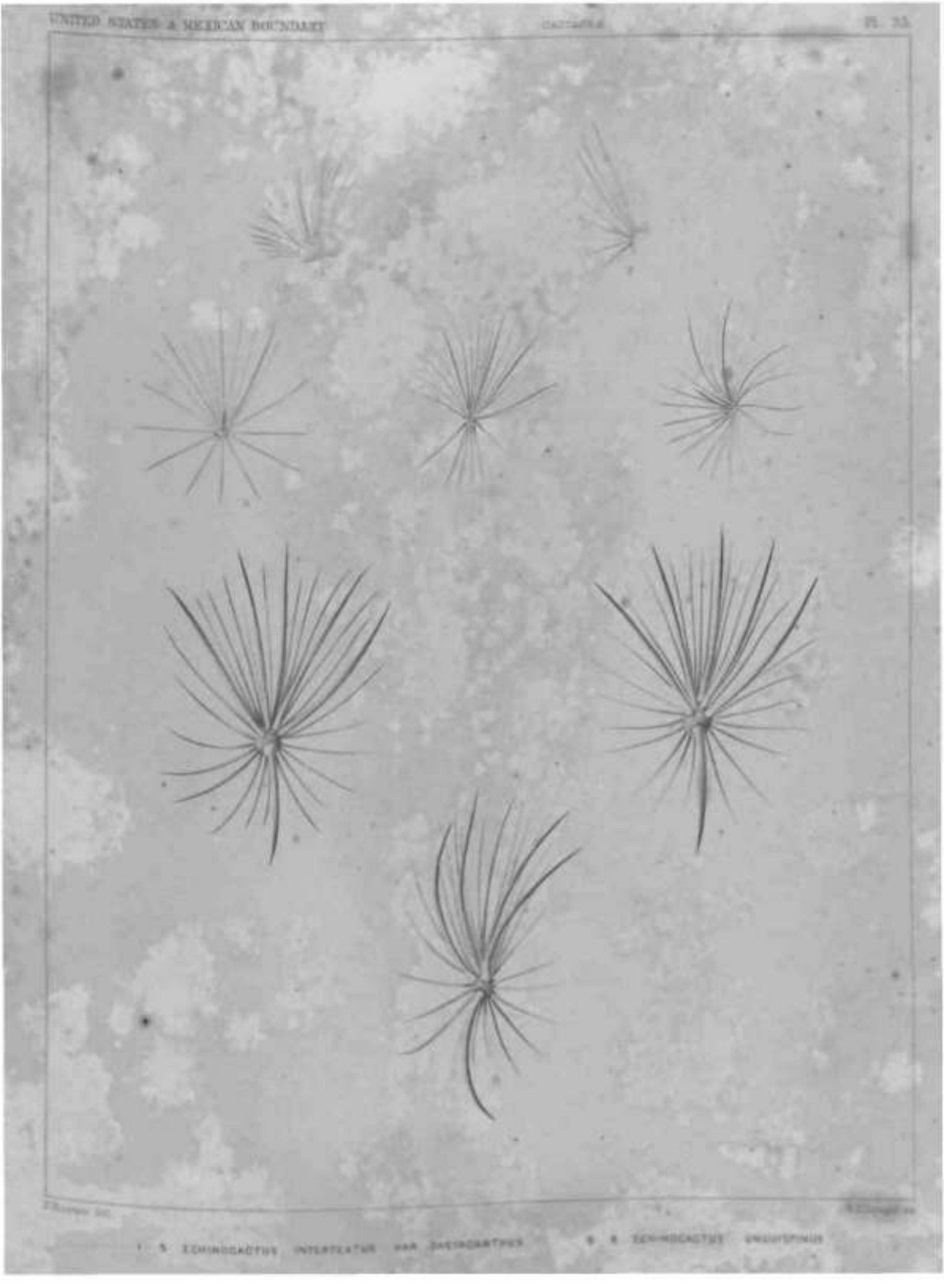
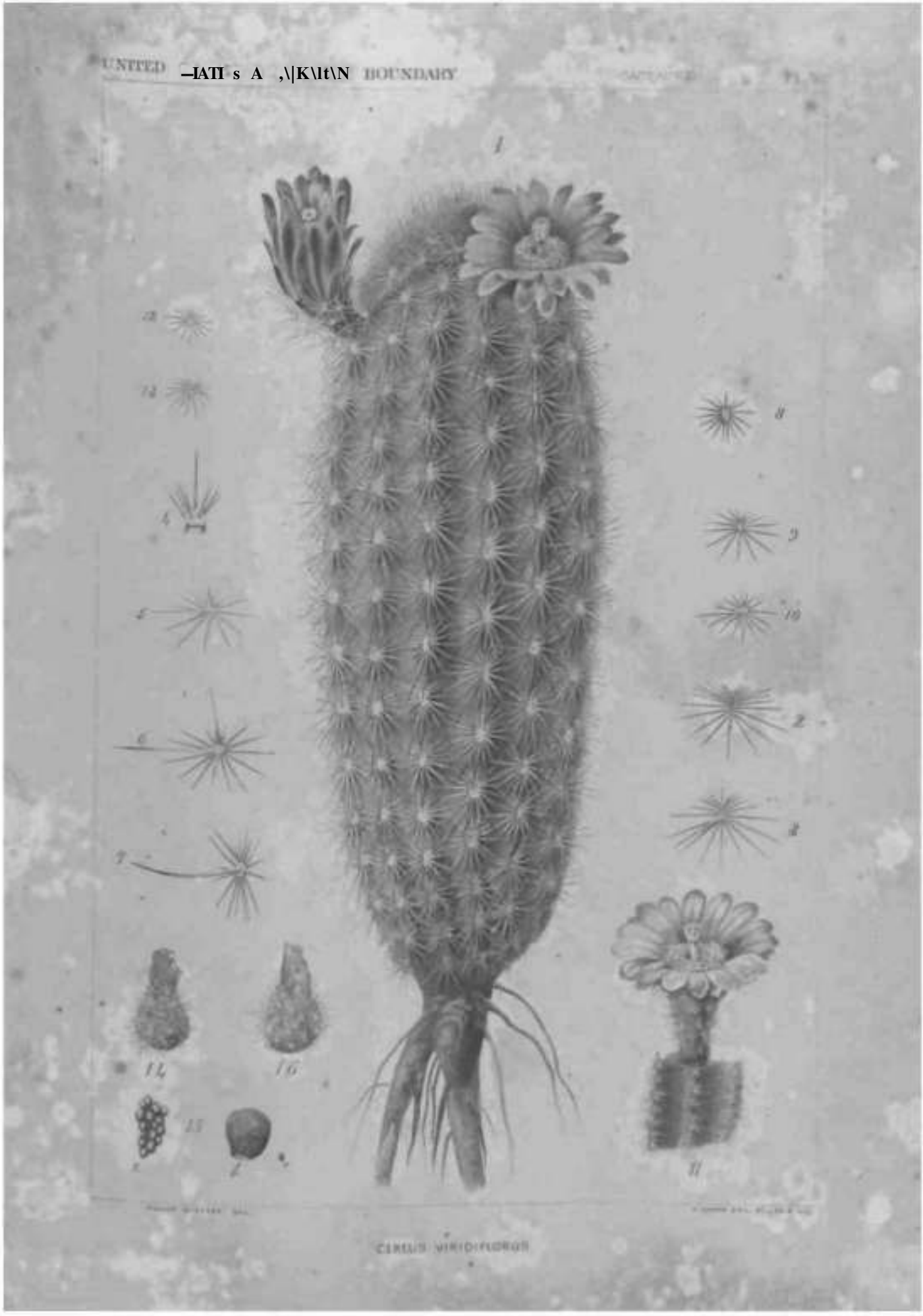


1. 5. ECHINOCACTUS INTERTEXTUS VAR. DASYACANTHUS 6. 8. ECHINOCACTUS ERECTISPINUS



CEREUS VIRIDIFLORUS

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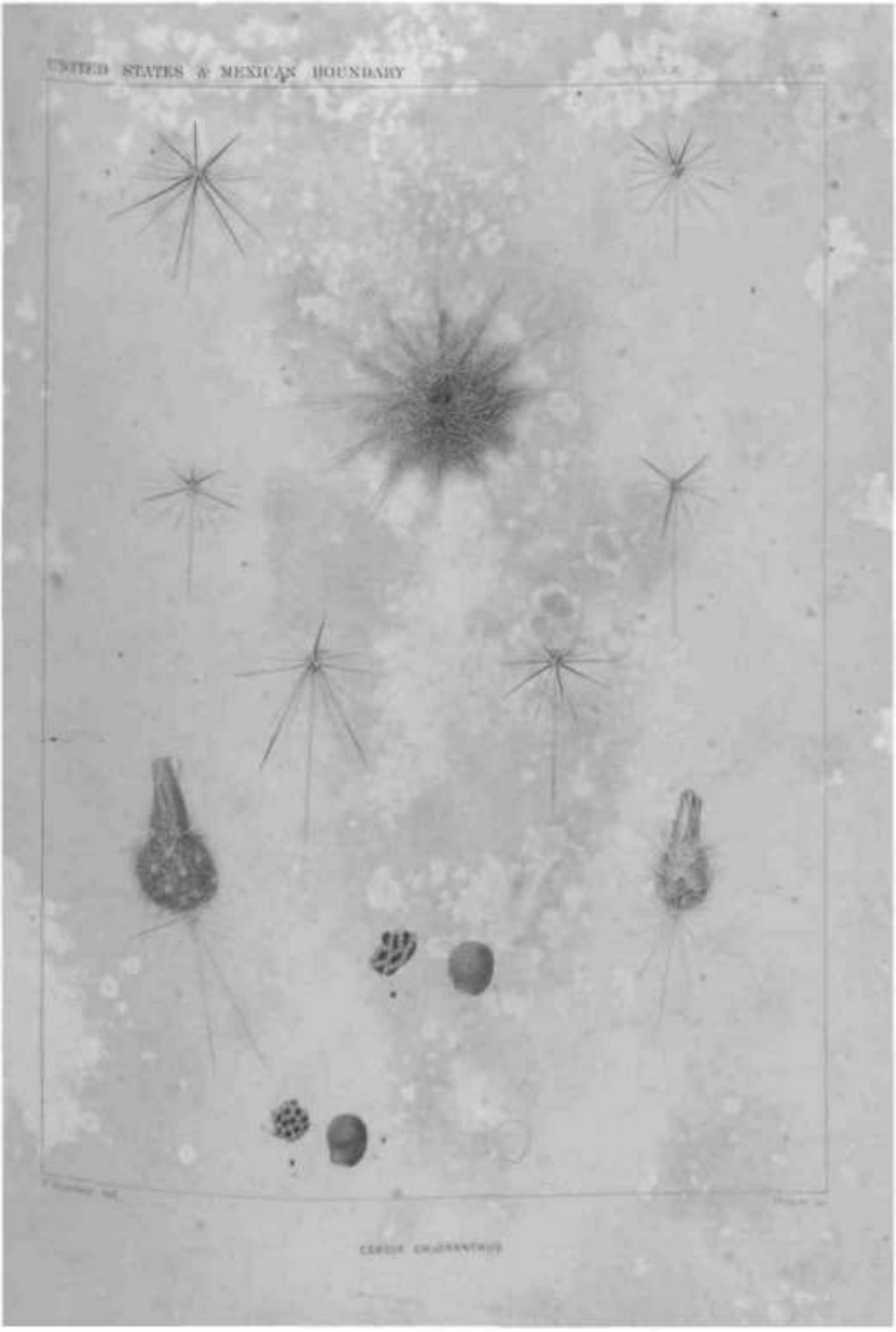
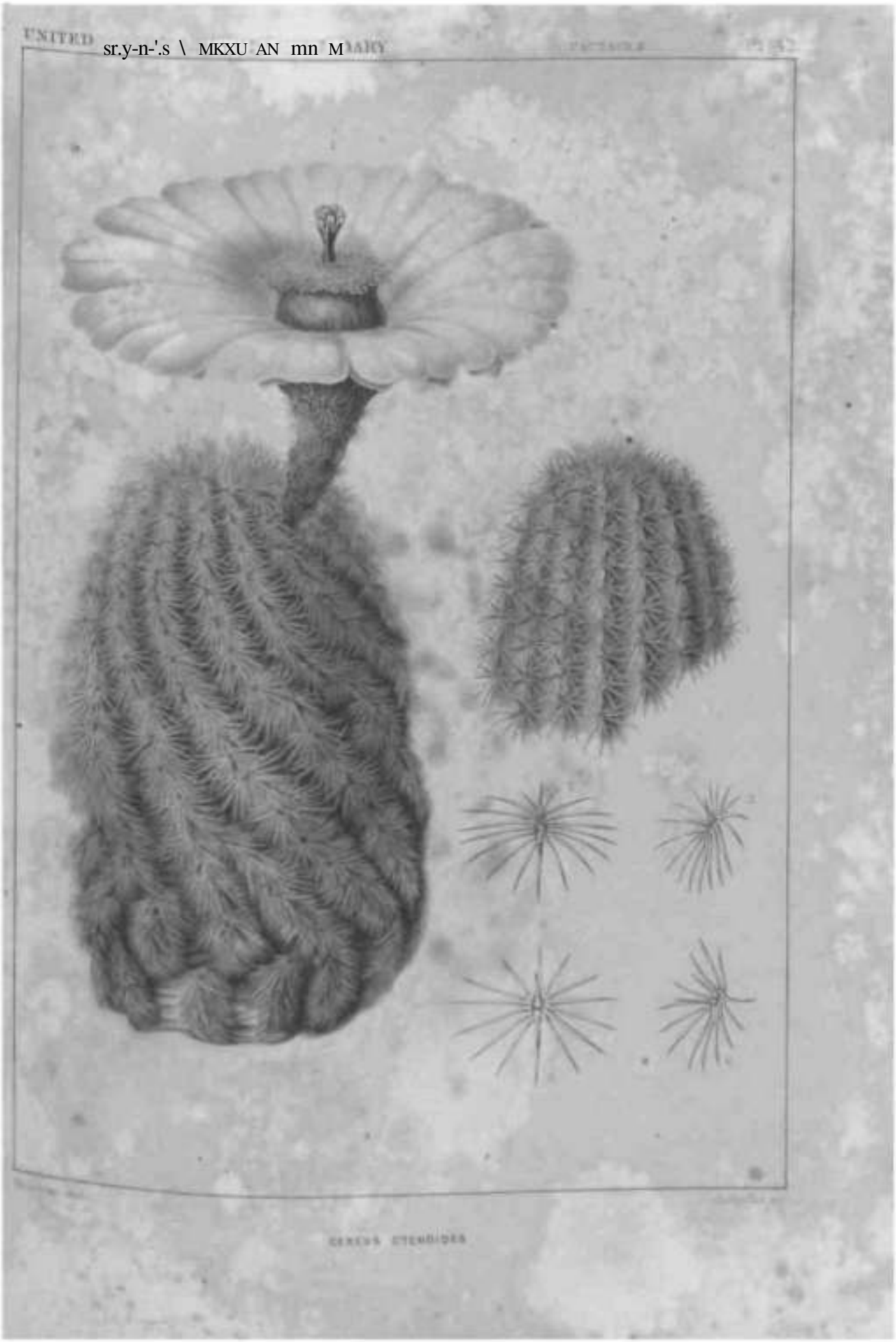
CEREUS CHRYSANTHUS

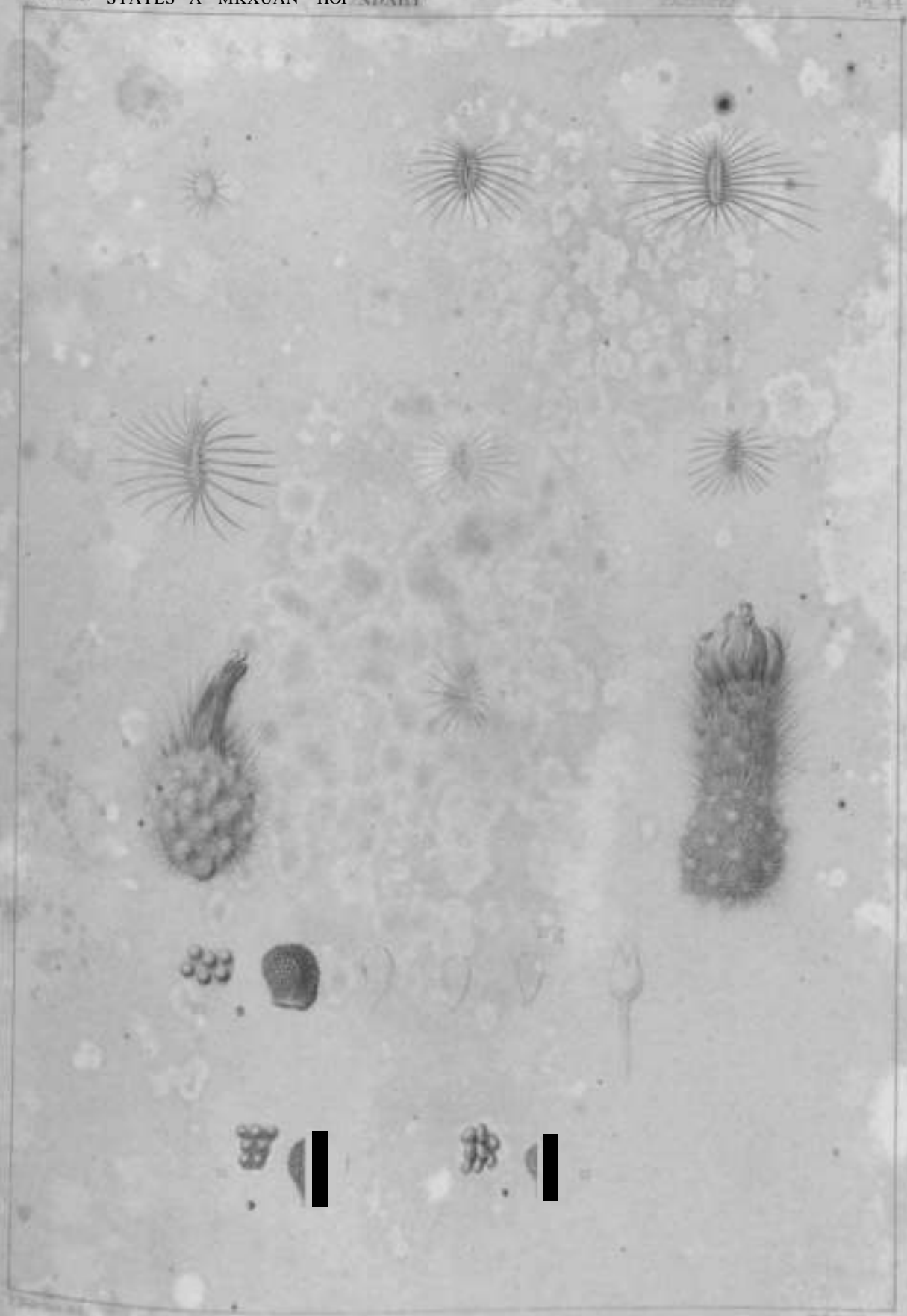


CEREUS CHLORANTHUS

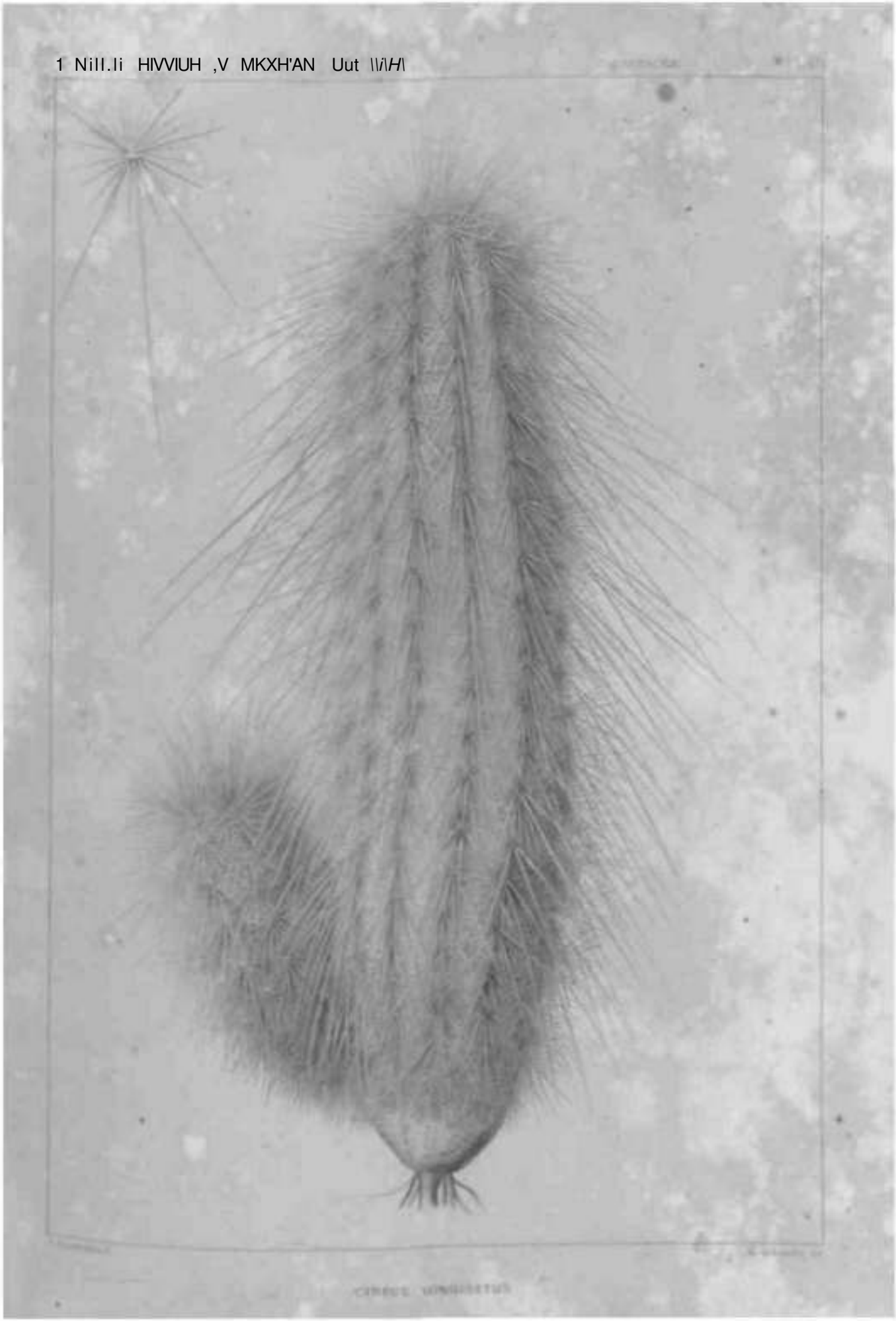
CEREUS BASYACANTHUS



CEREUS CAESPITOSUS



CEREUS CAESPITOSUS



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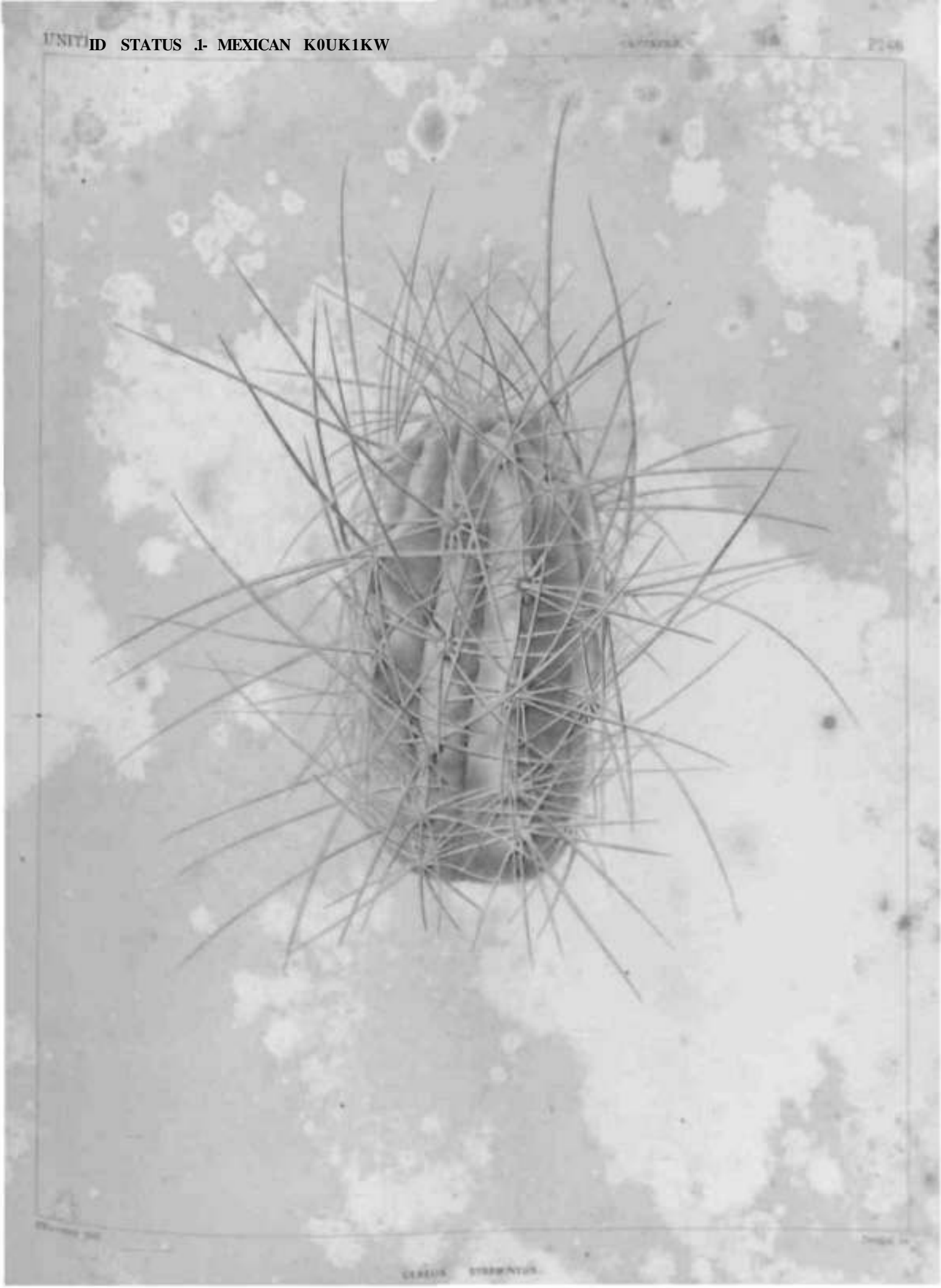
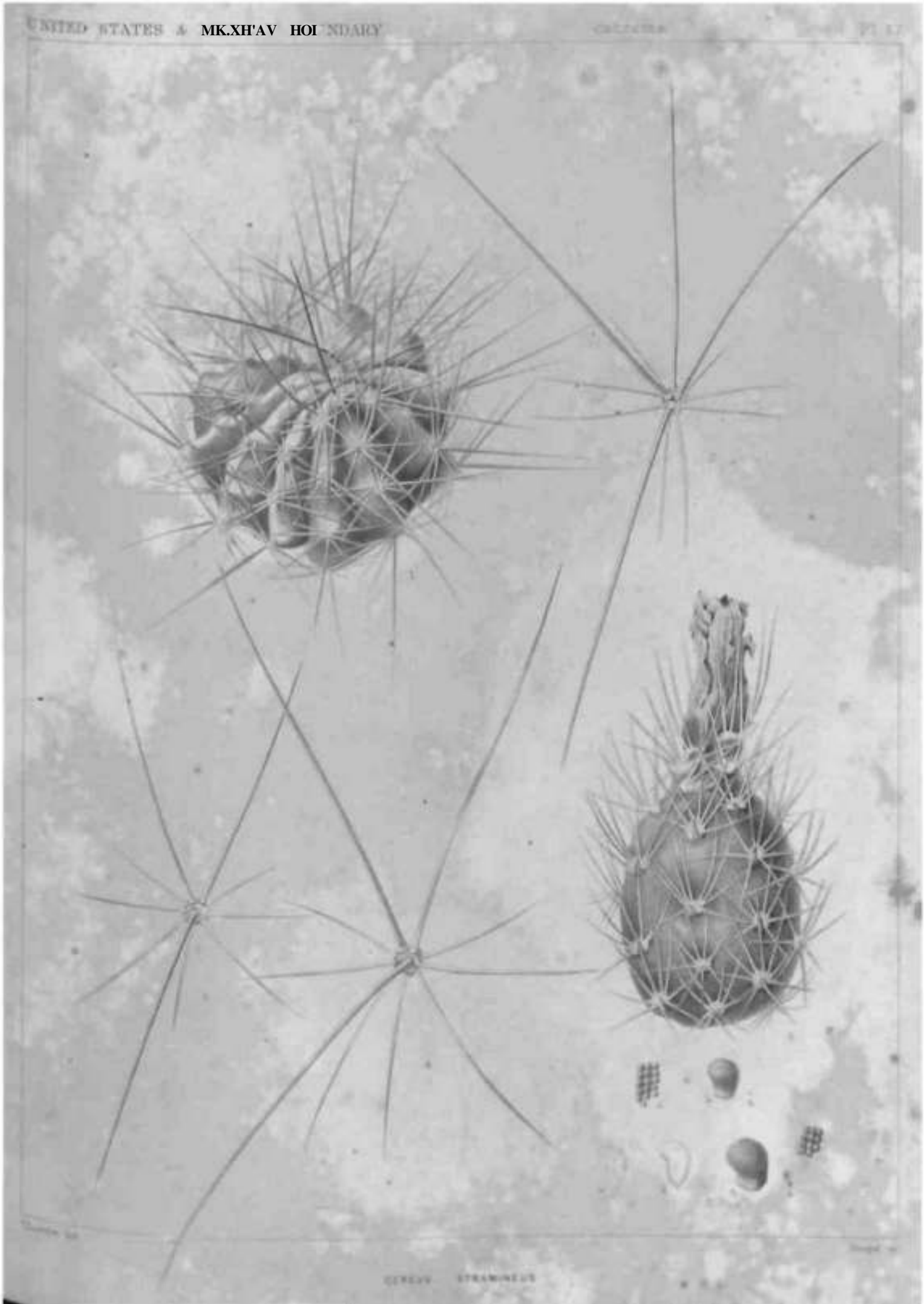
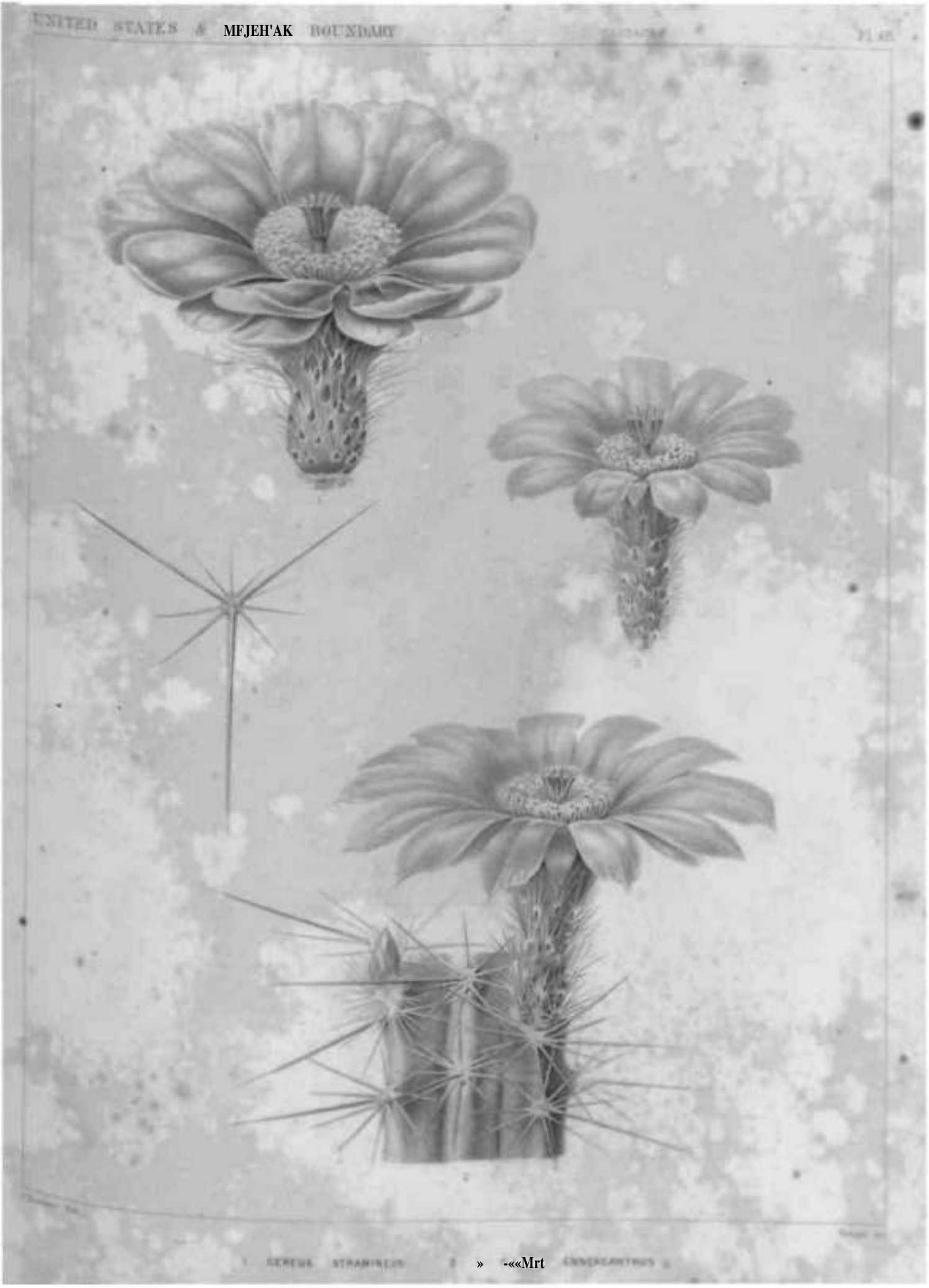
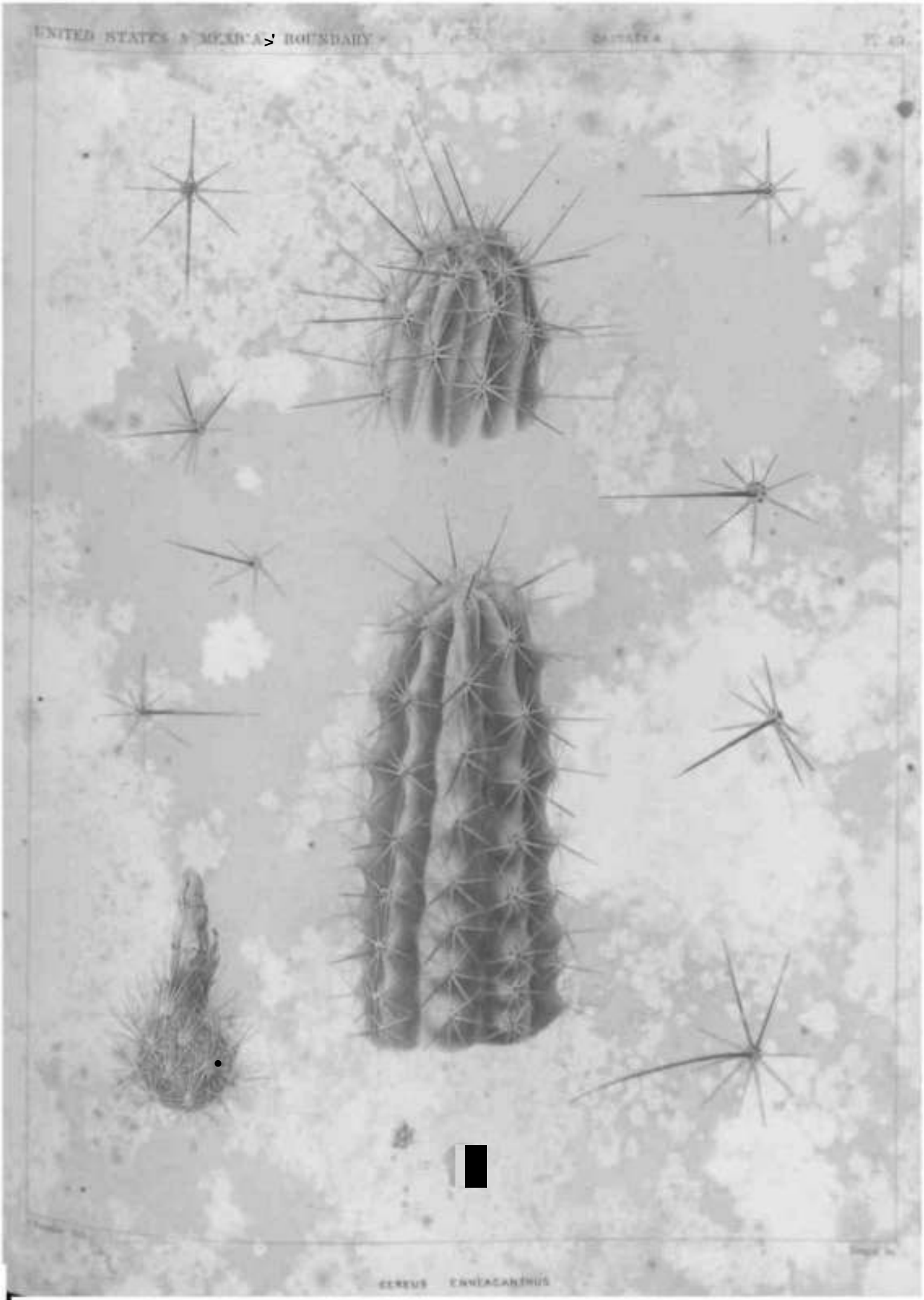
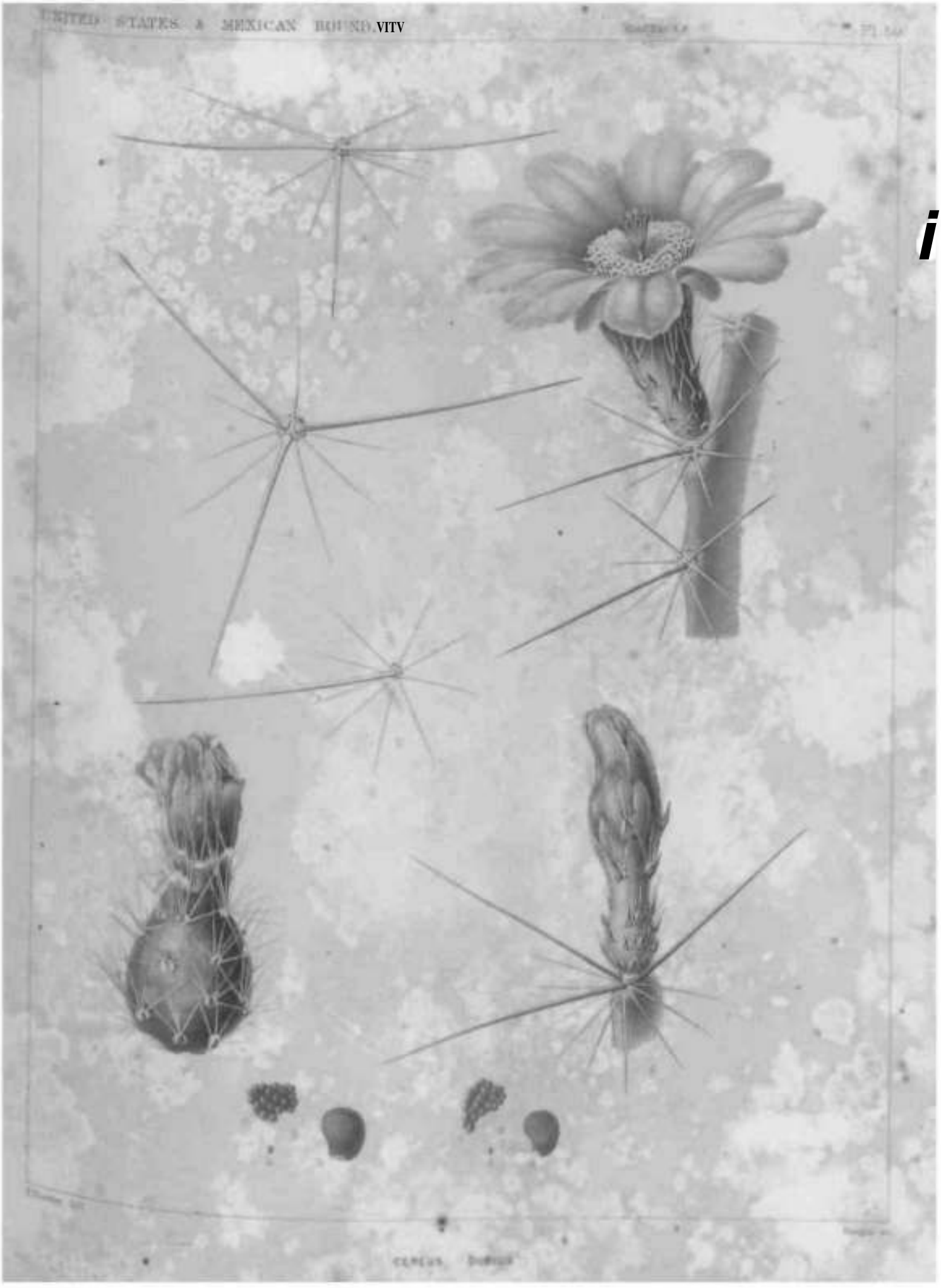


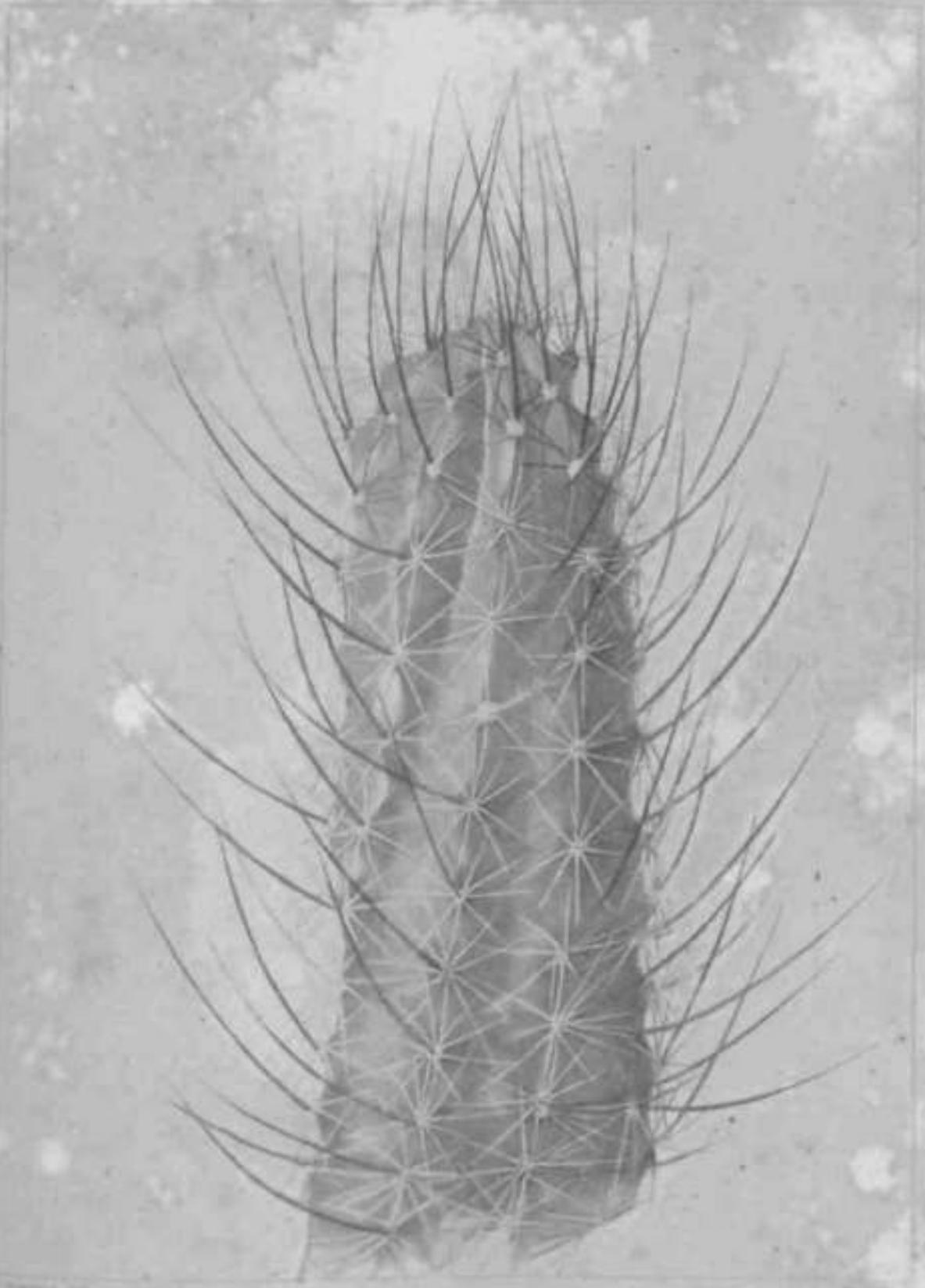




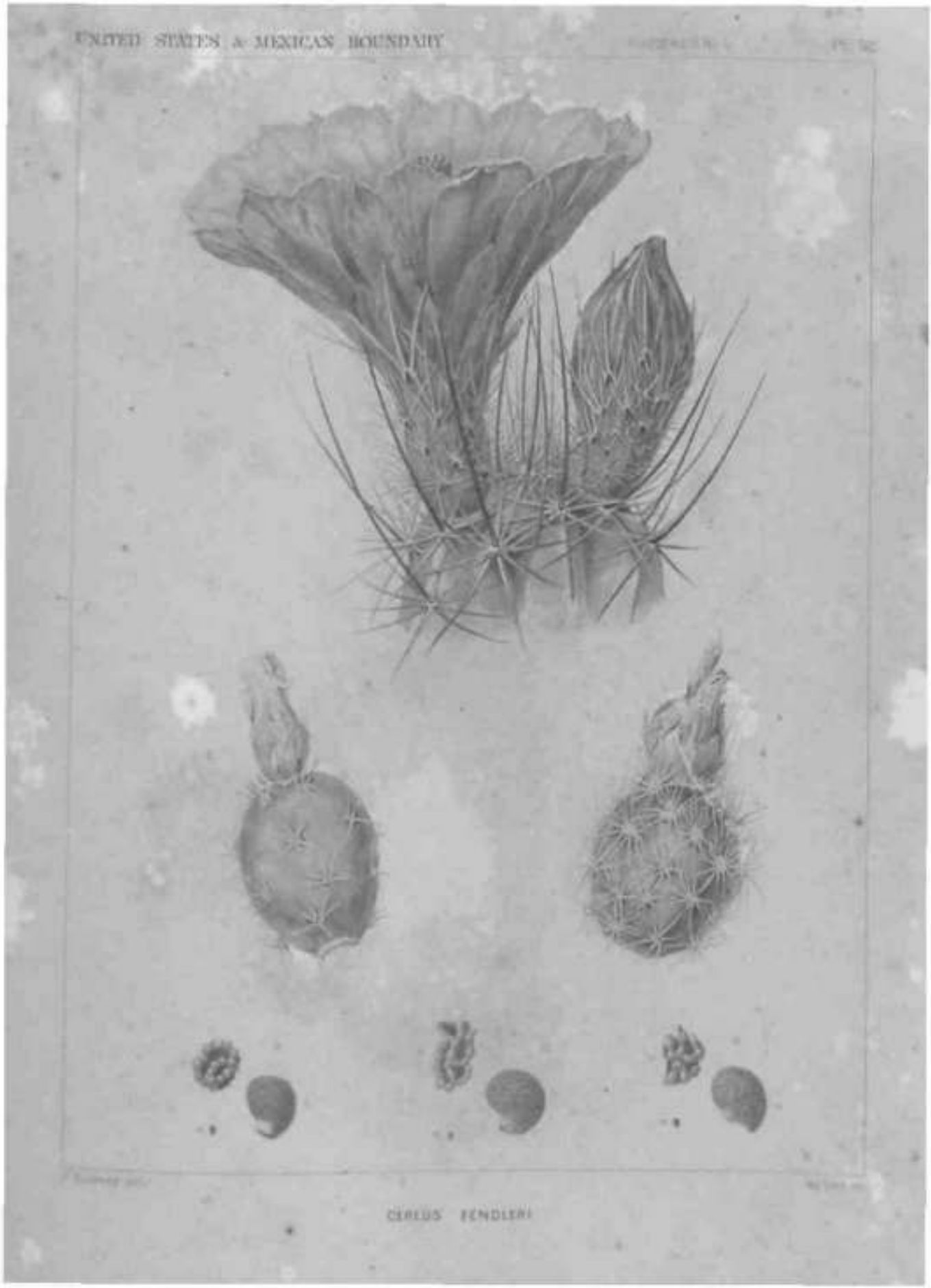
1 CEREUS STRAMINEUS 2 » -««Mrt


CEREUS ENNEACANTHUS



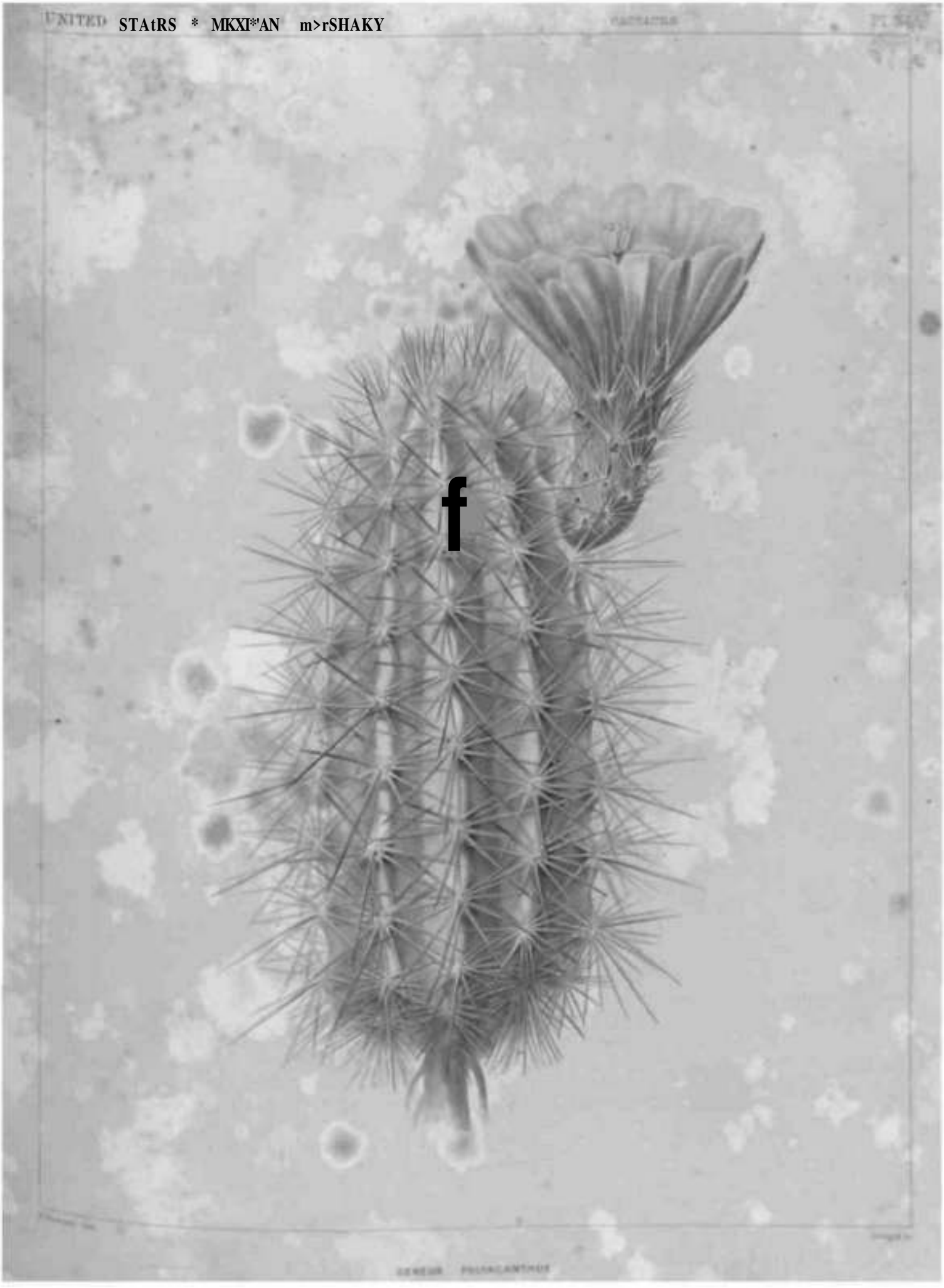


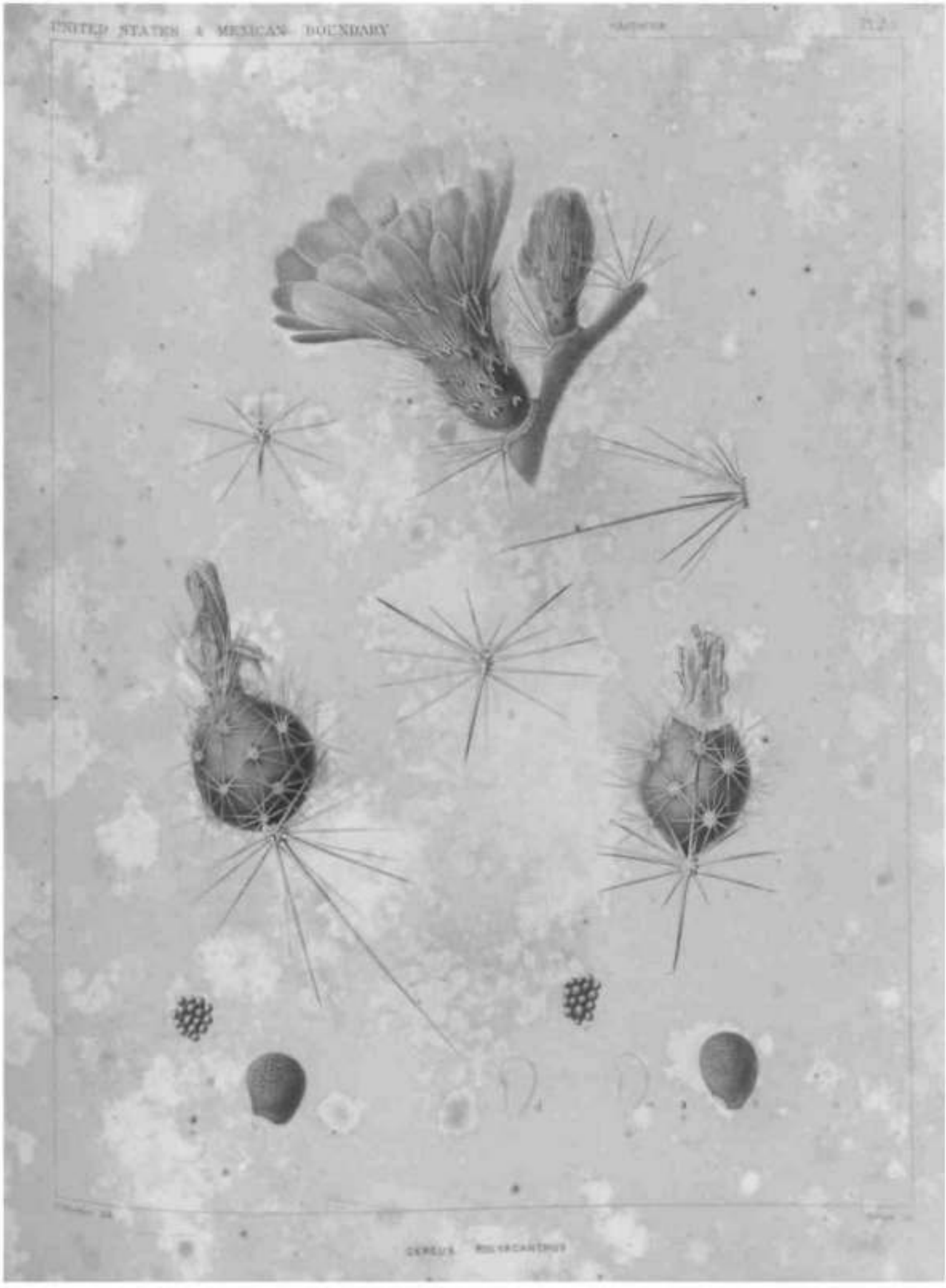
CEREUS TENDLERI



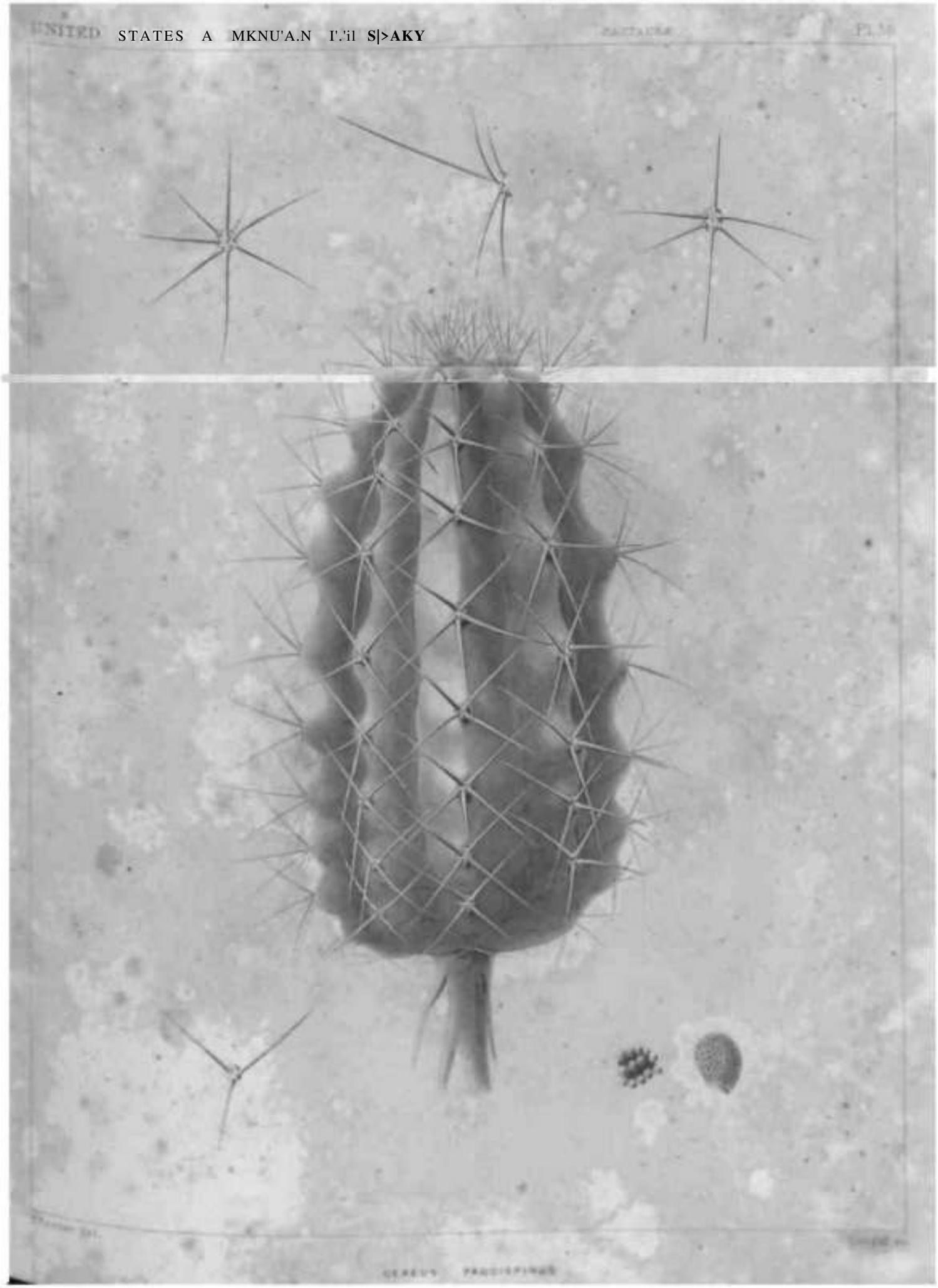
CEREUS FENDLERI

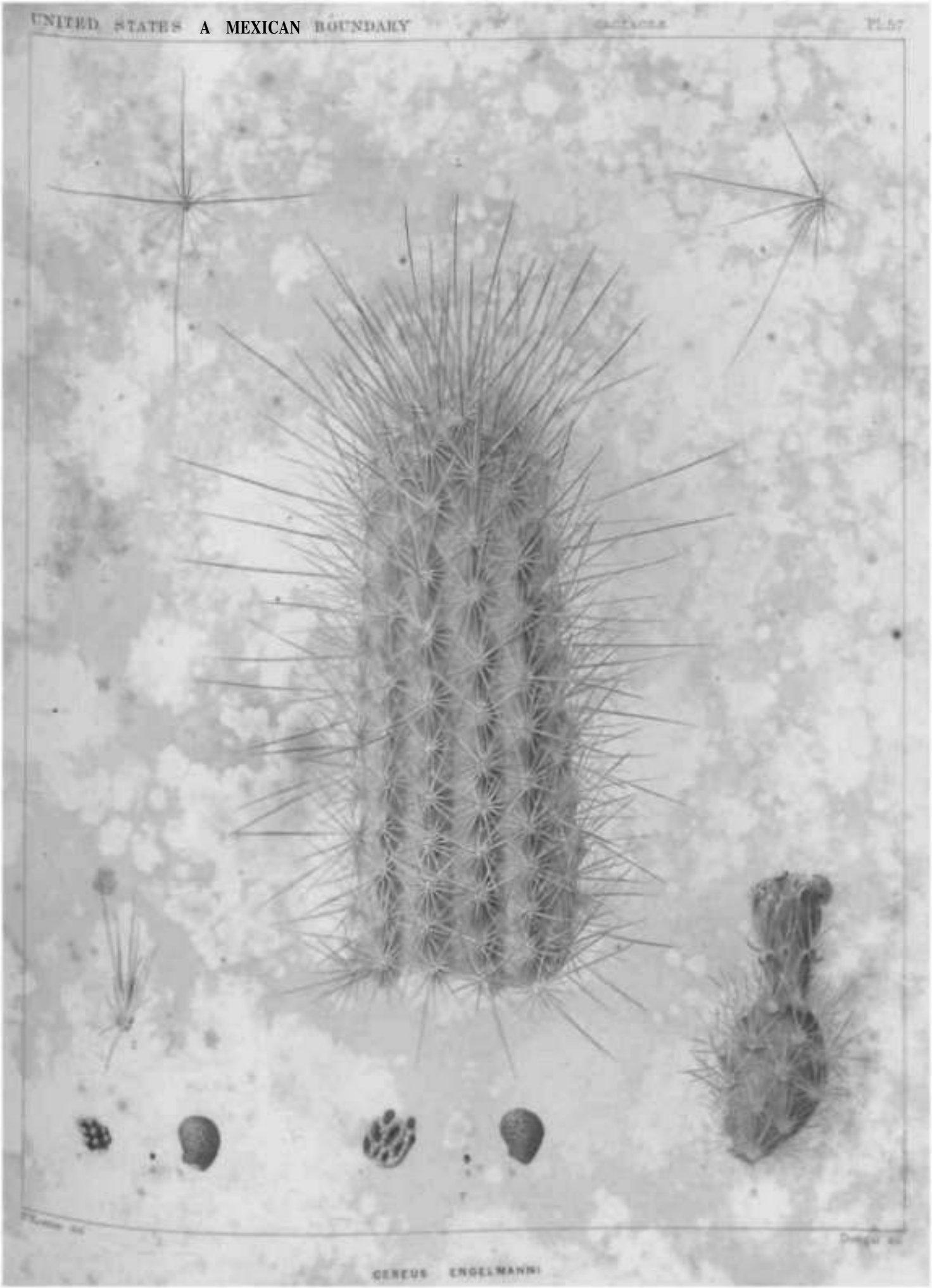
CEREUS TENUIS





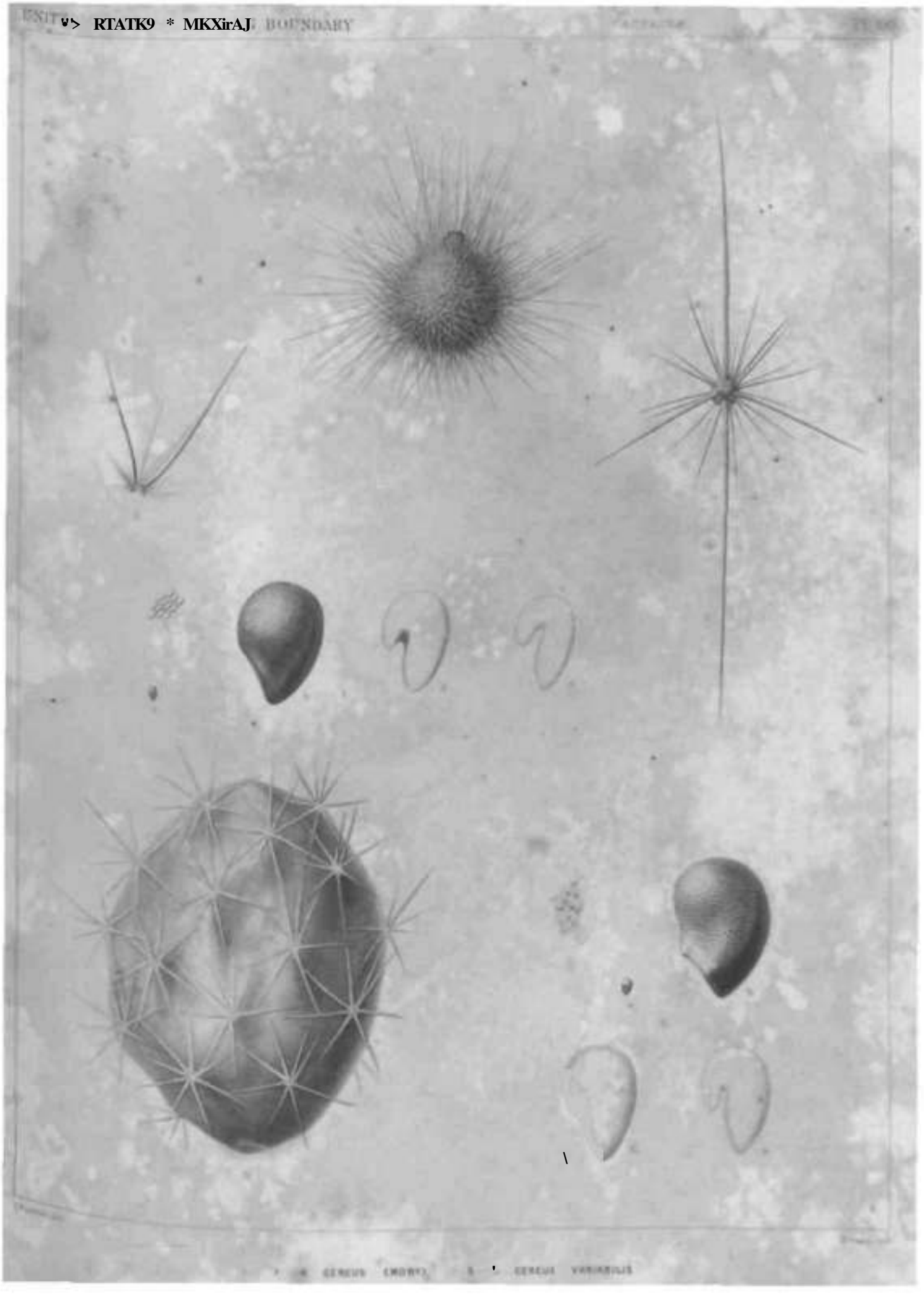
CEREUS POLYACANTHUS

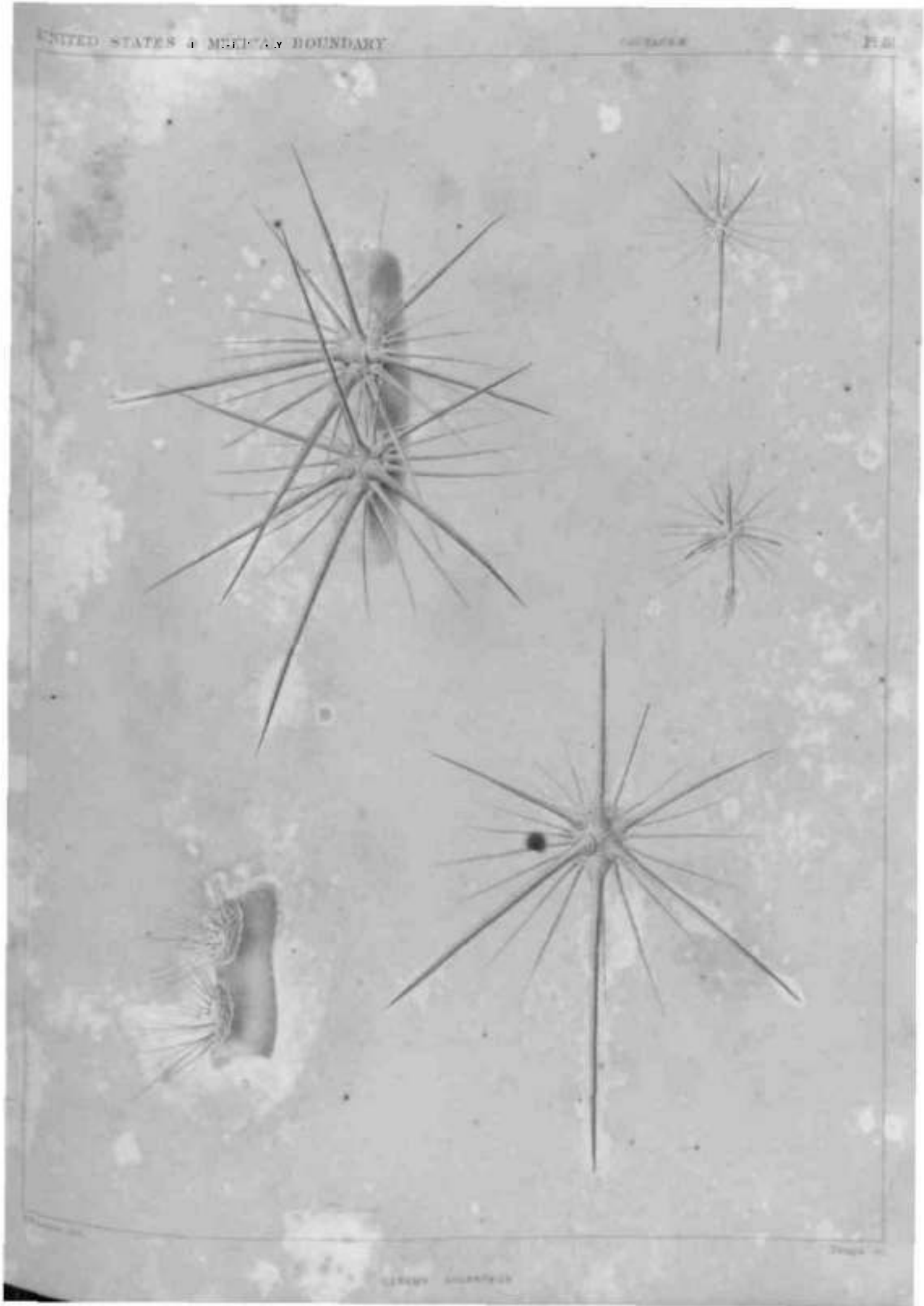


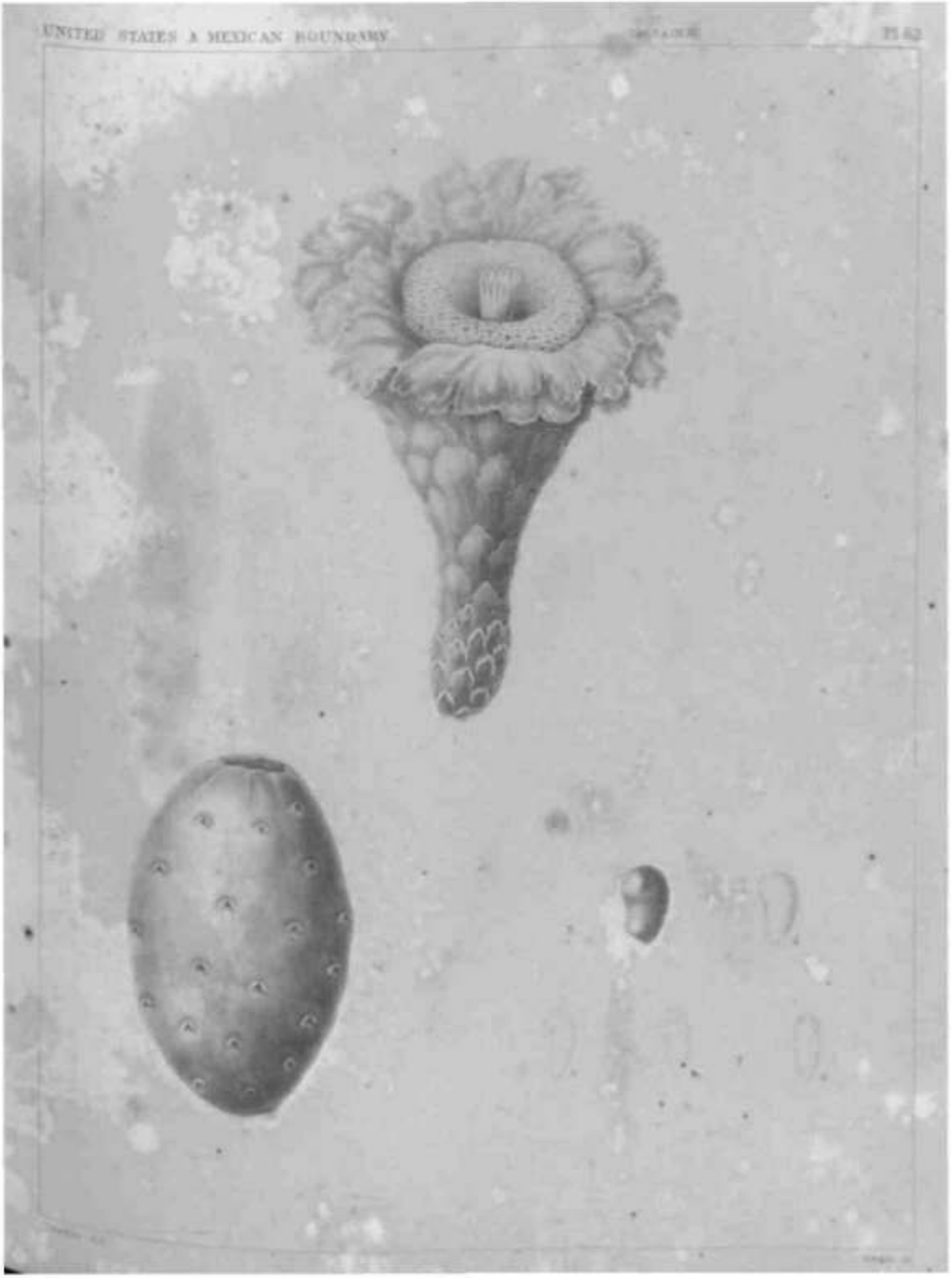


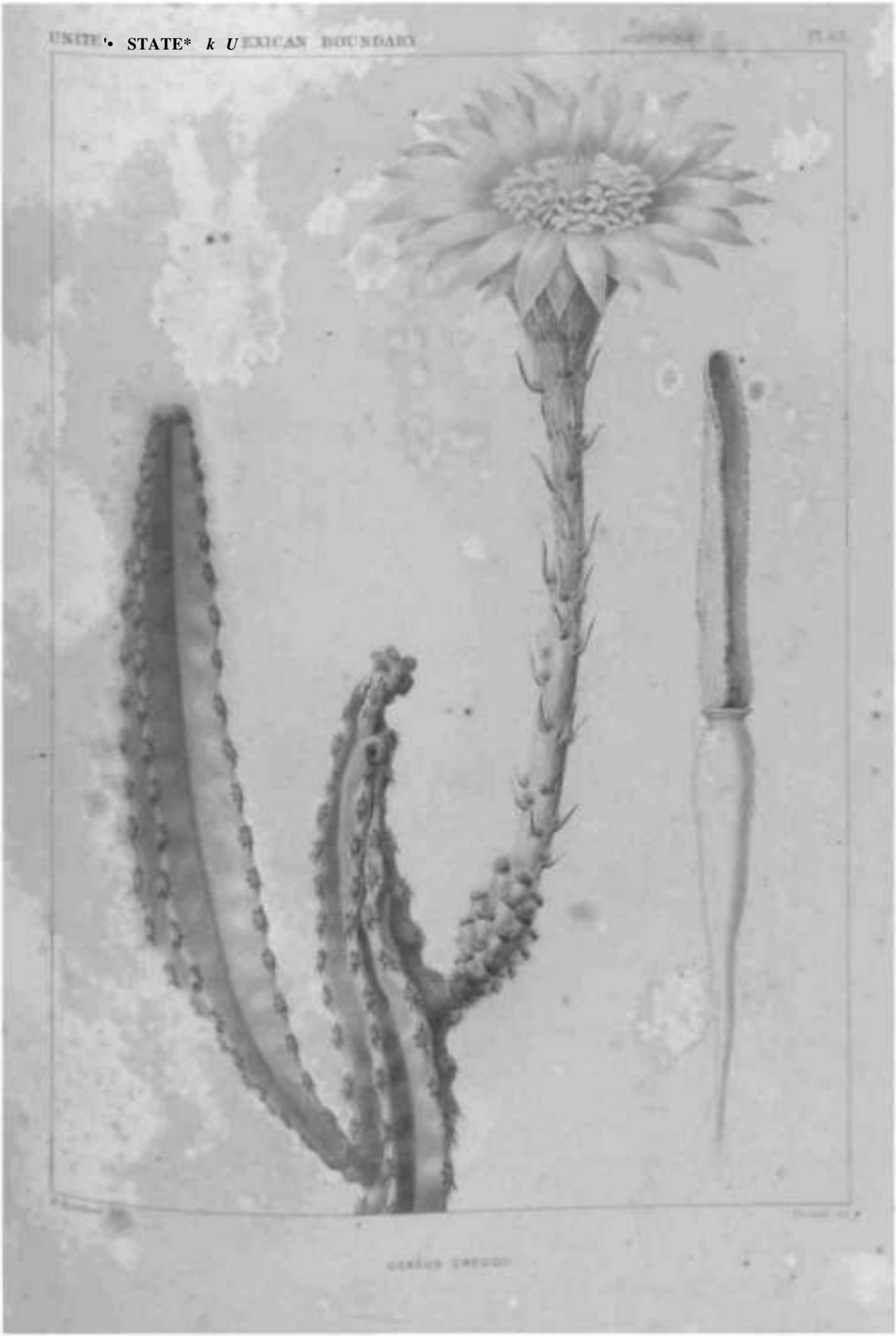
CEREUS ENGELMANNI


UNITED STATES & MEXICAN BOUNDARY
CEREUS BIFLORUS









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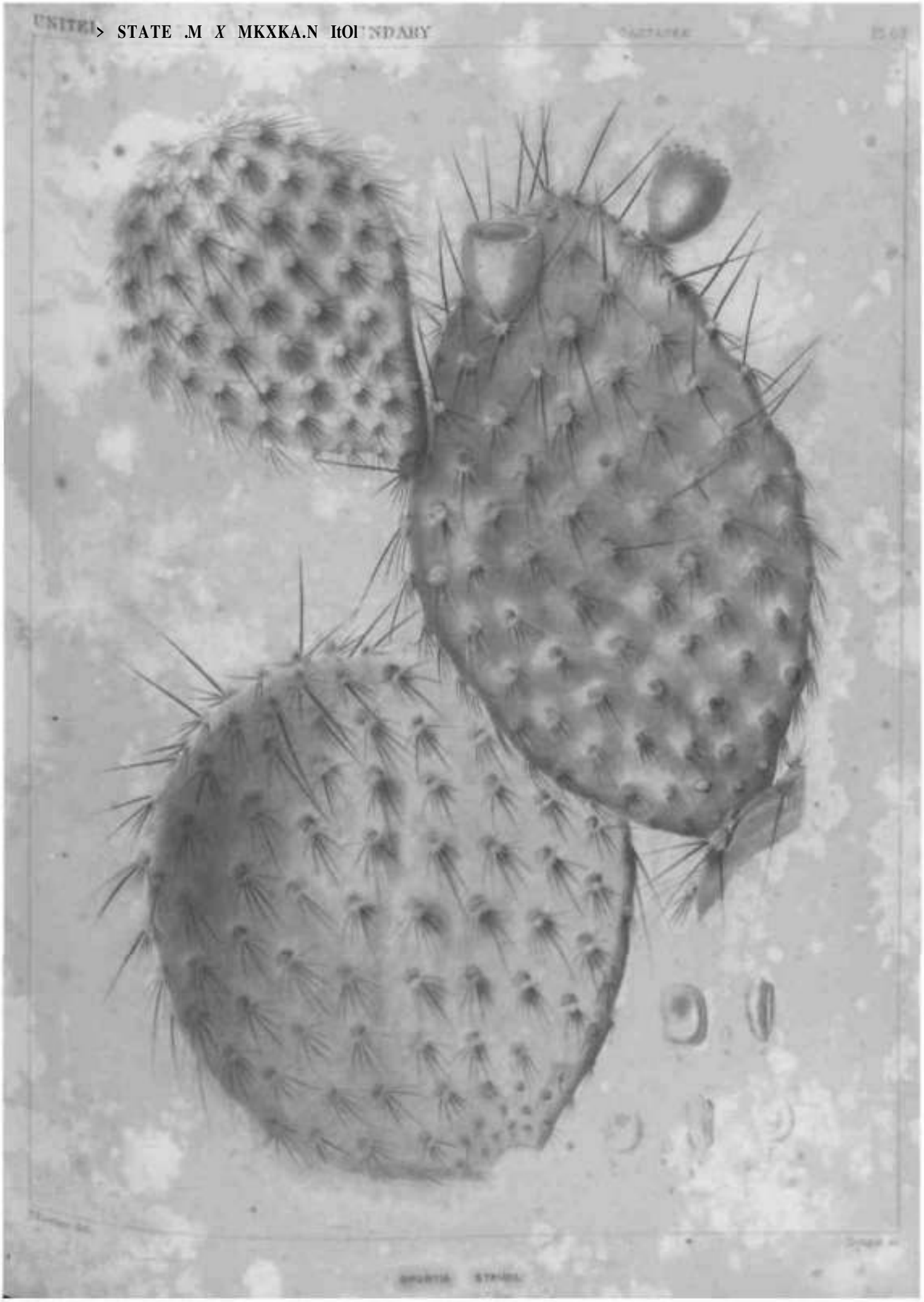
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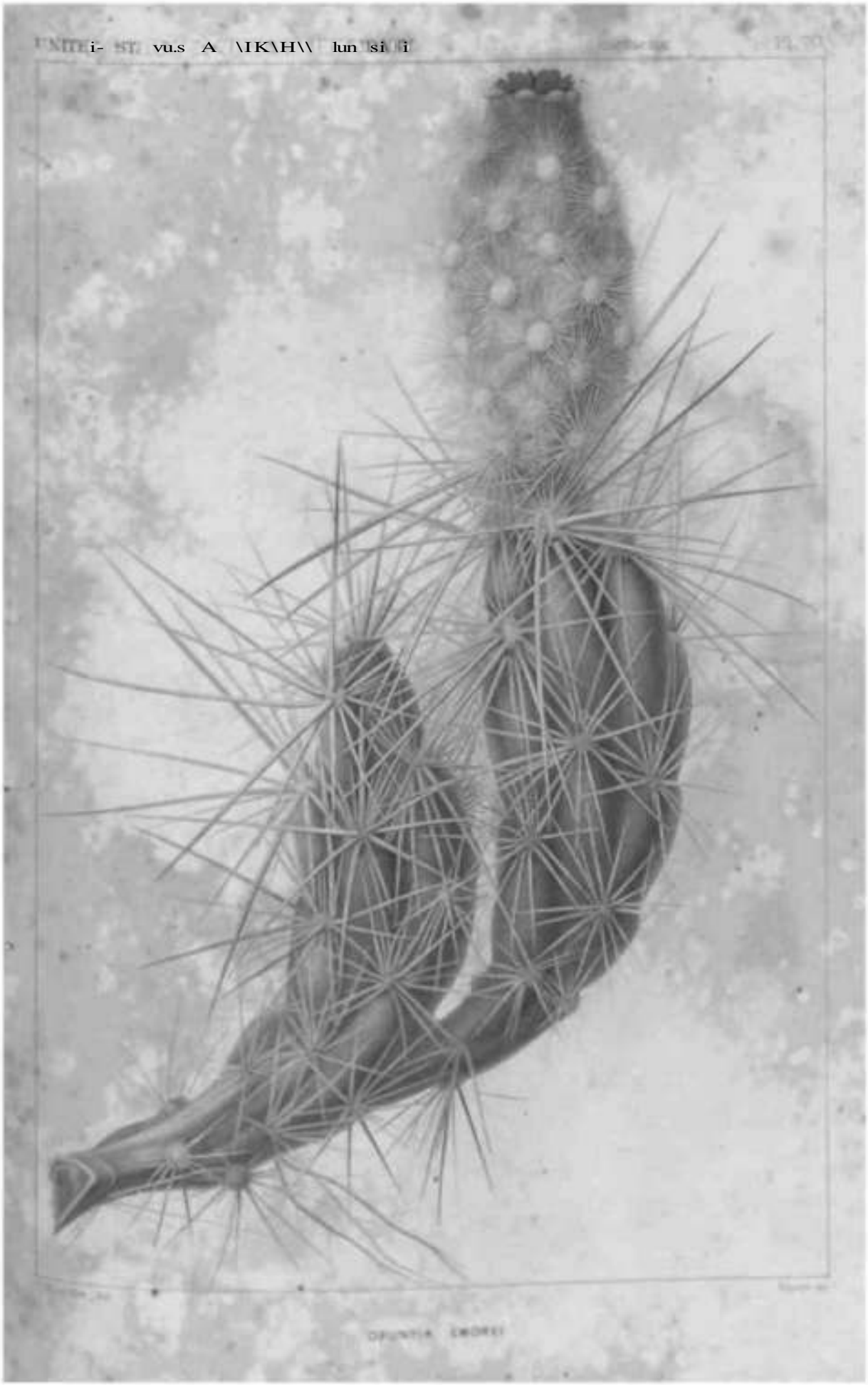
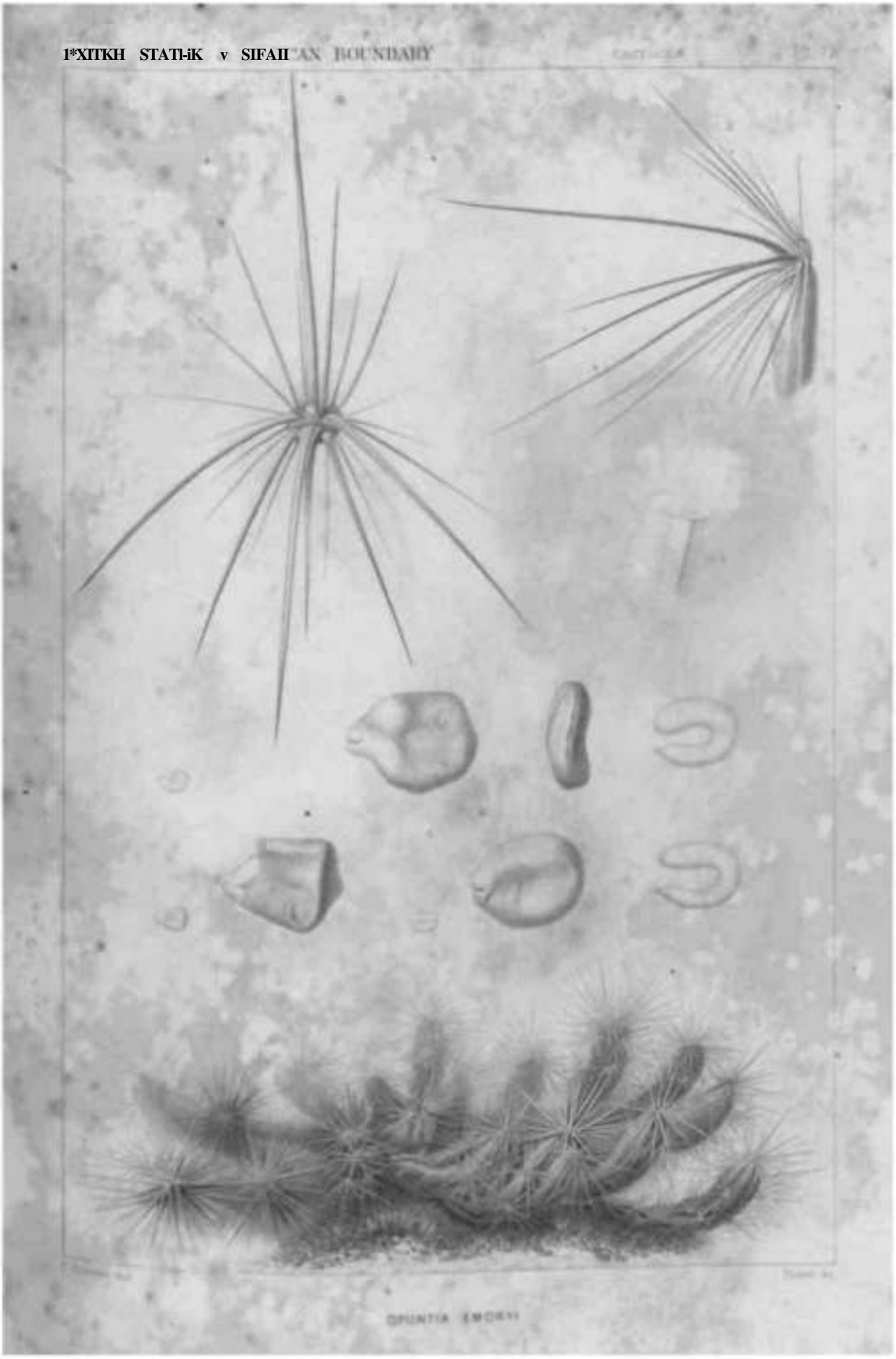
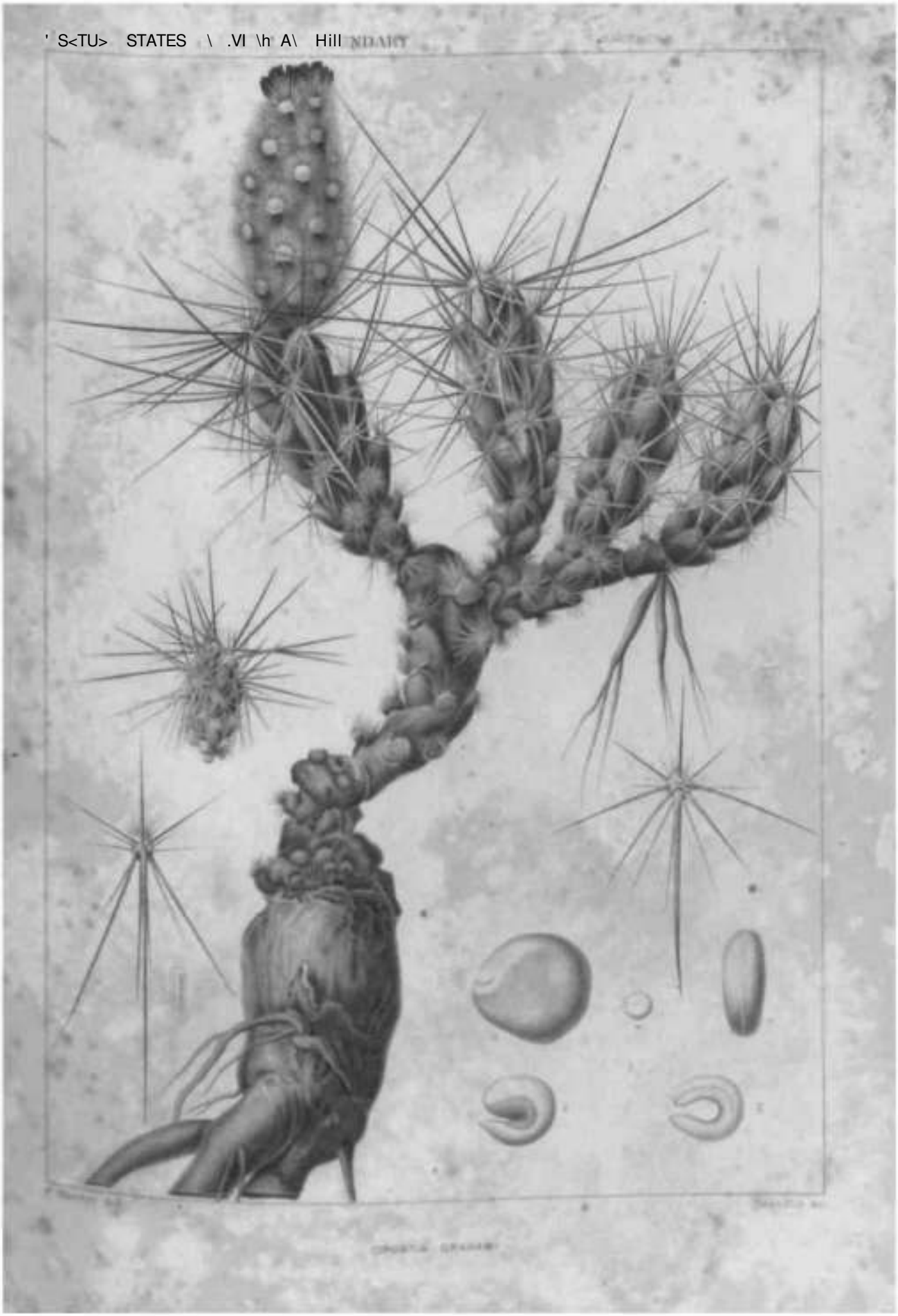
UNITED STATES & MEXICAN BOUNDARY





OPUNTIA EMORYI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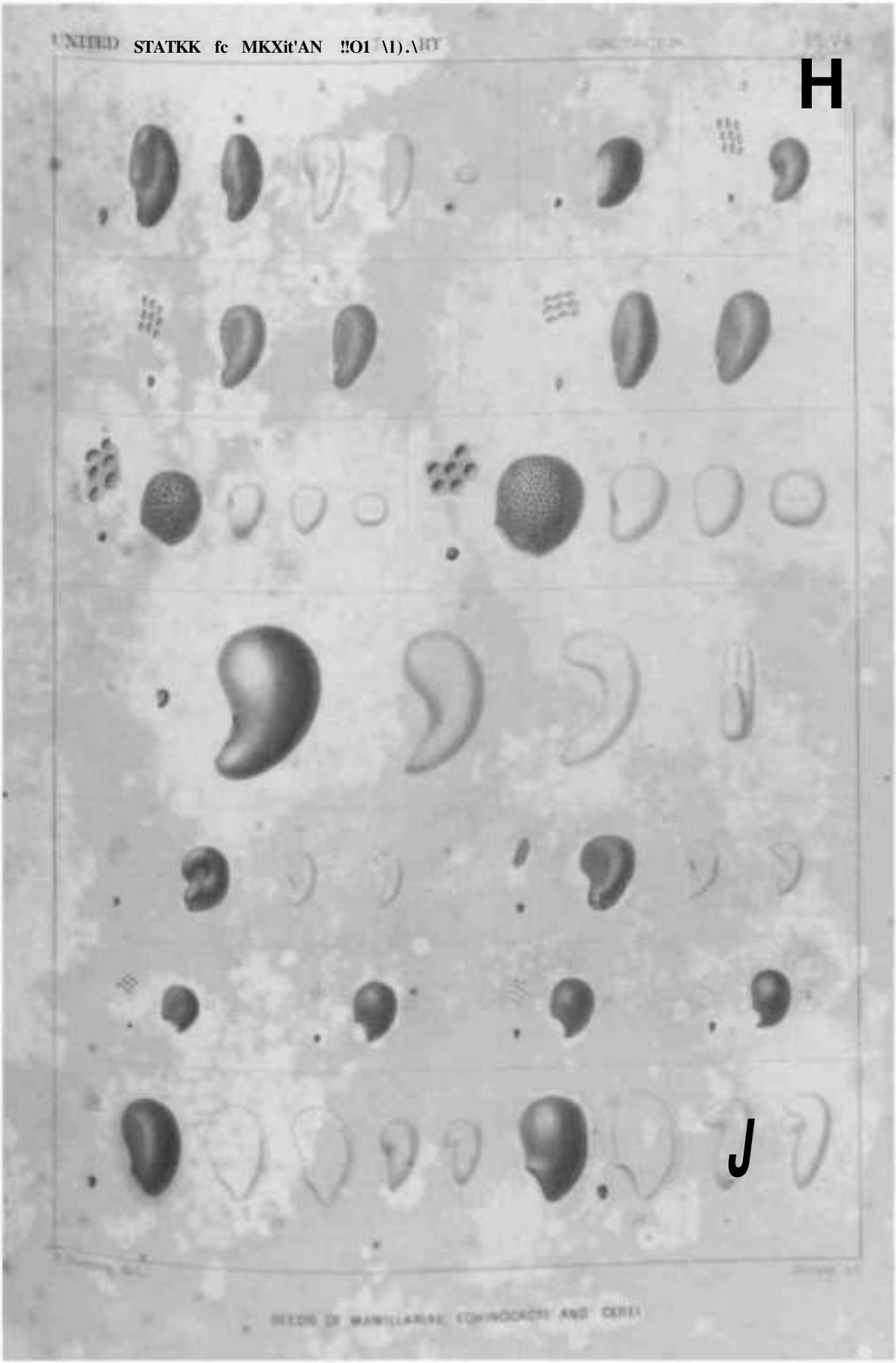
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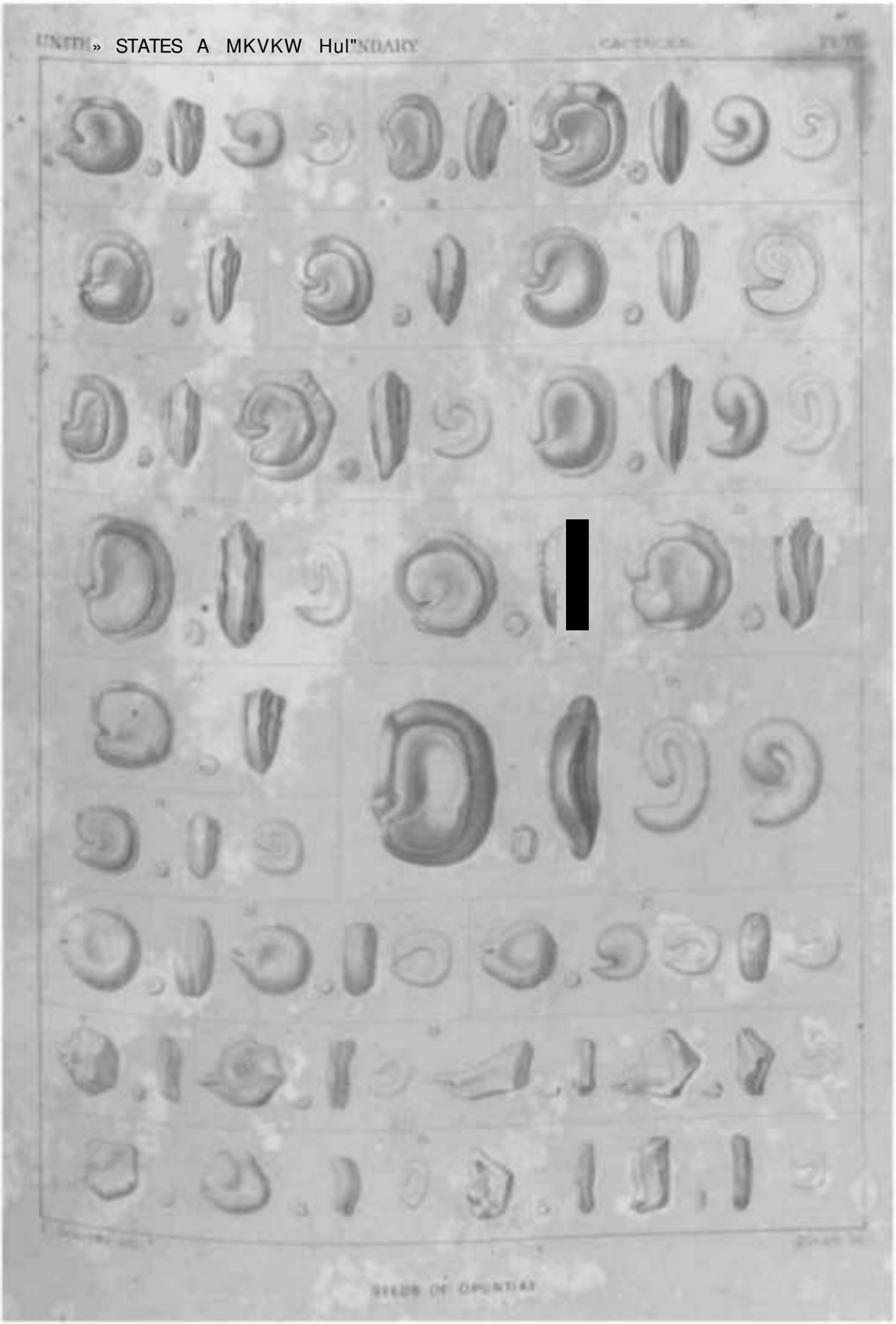
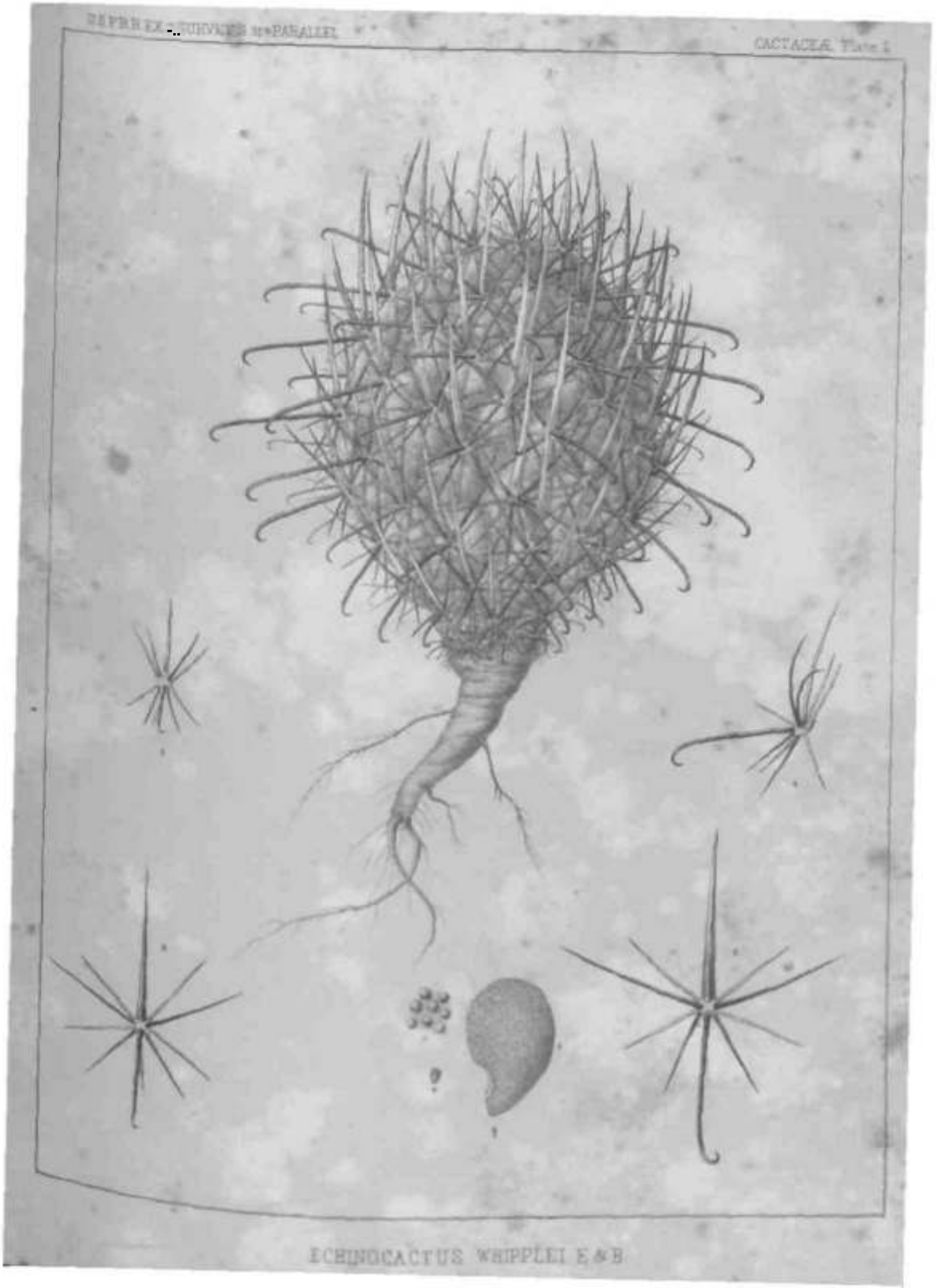


SEEDS OF OPUNTIAE



ECHINOCACTUS WHIPPLEI E & B

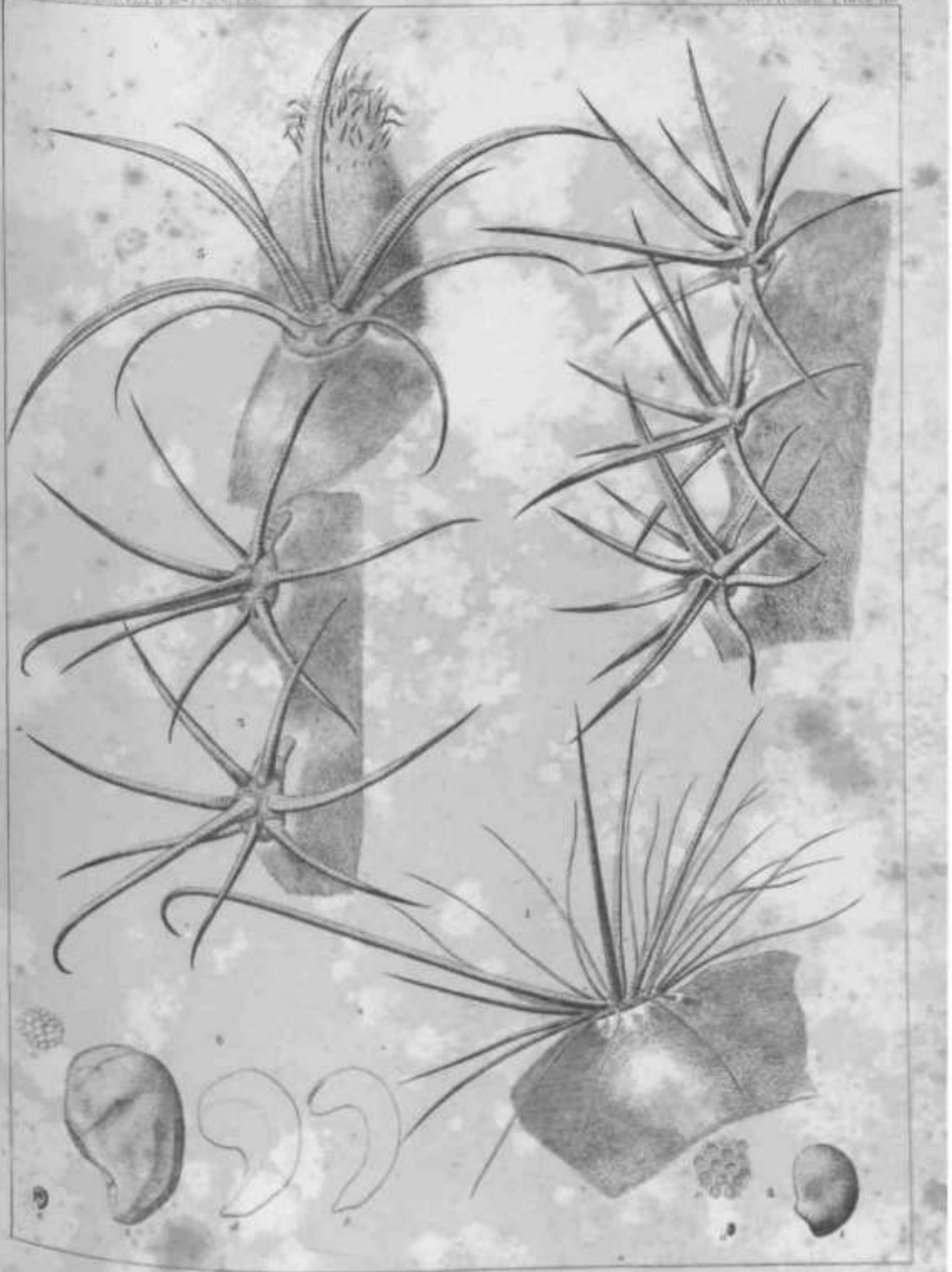
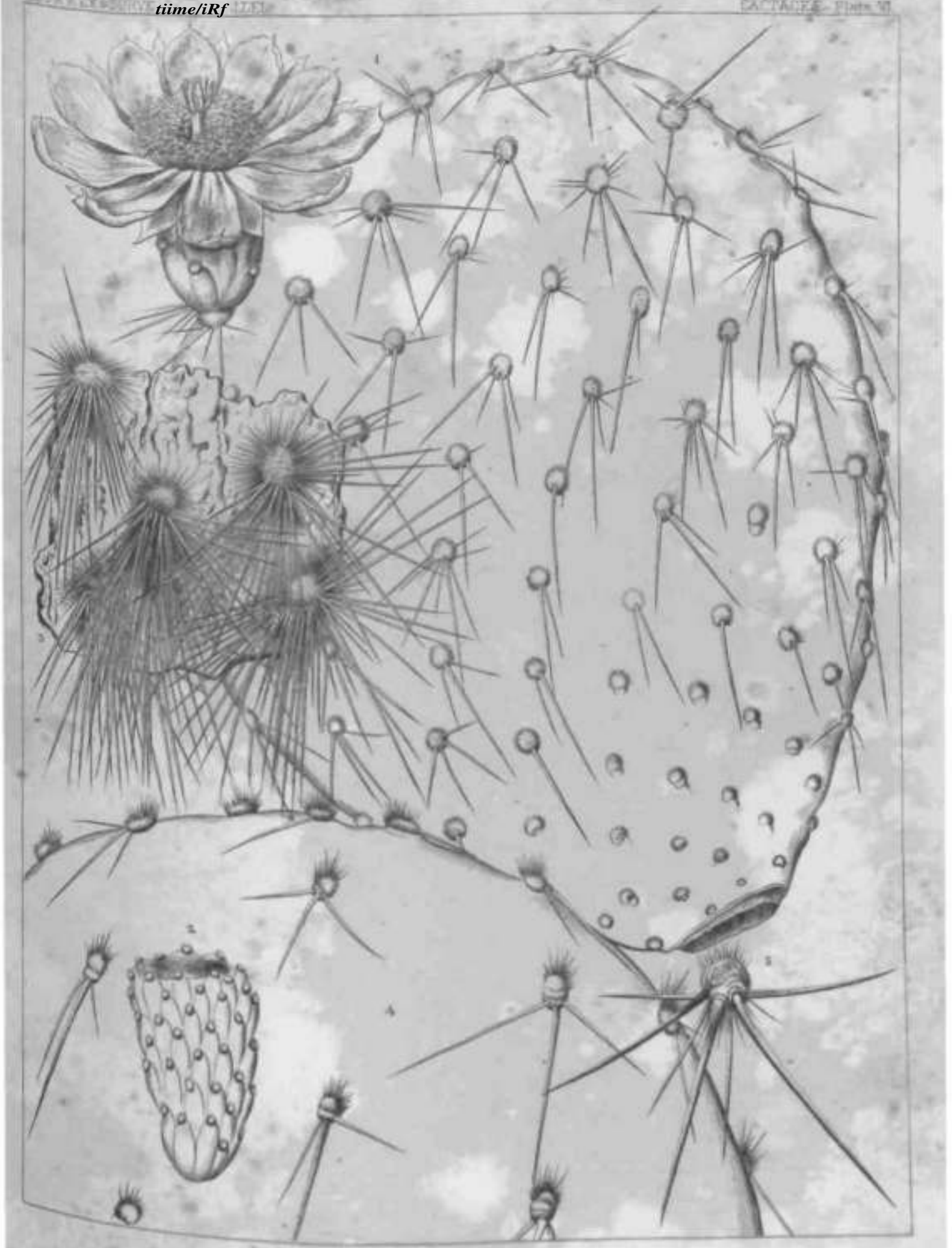


Fig. 1. ECHINOCACTUS WISLIZENI. Fig. 2. E. ENGELMANNII. Fig. 3. E. POLYCEPHALUS. Fig. 4.

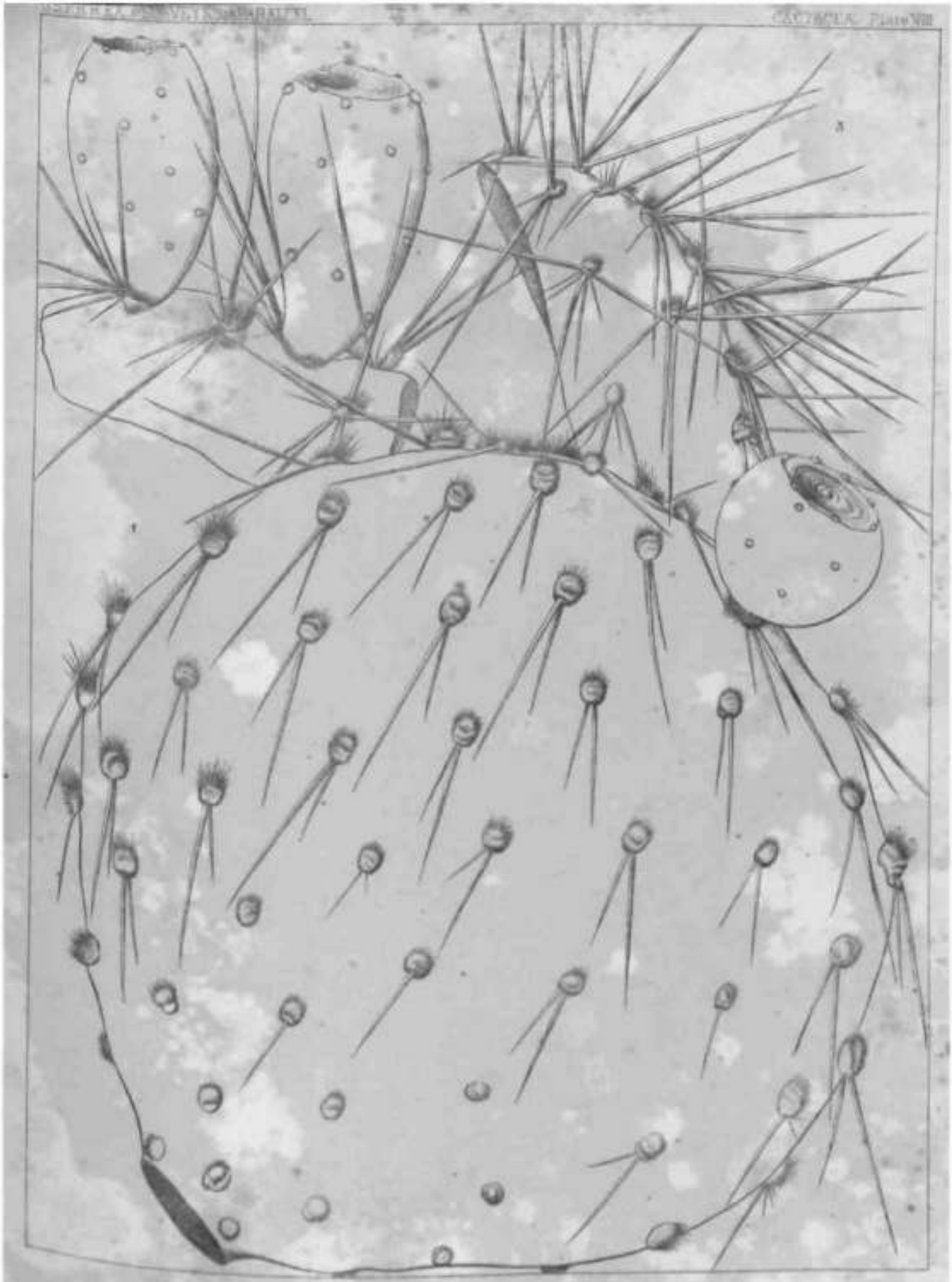
1-3 CEREUS PHŒNICEUS. R. 4-6 CEREUS QUADRICOSTATUS. L. 7-9 CEREUS TRIANGULARIS. F.
A. C. PHŒNICEUS. B. C. REGELIANUS. C. C. TRIANGULARIS.

1. CEREUS MICRANTHUS HAB. 2–3 C. CONACANTHUS HAB. 4–5. C. EXPERIMENT. var. VARIEGATUS
6–11. var. CHICO ACUMINATUS



1-3. OPUNTIA CHLOROTICA. E.&B. 4-6 O. PROCUMBENS. E.&B.

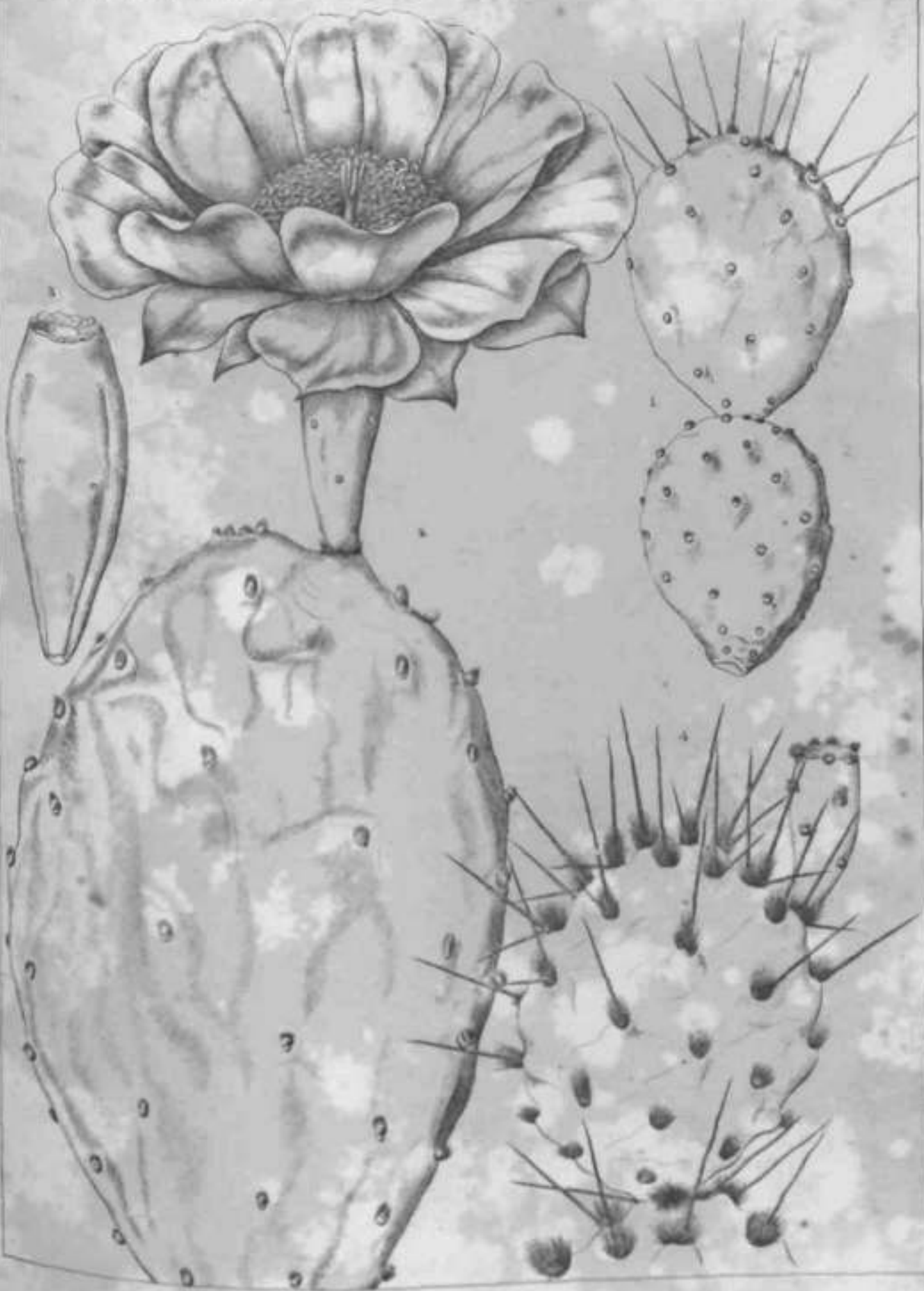
1-4 OPUNTIA OCCIDENTALIS, E.&B. 5-8 O. ANGUSTATA, E.&B.



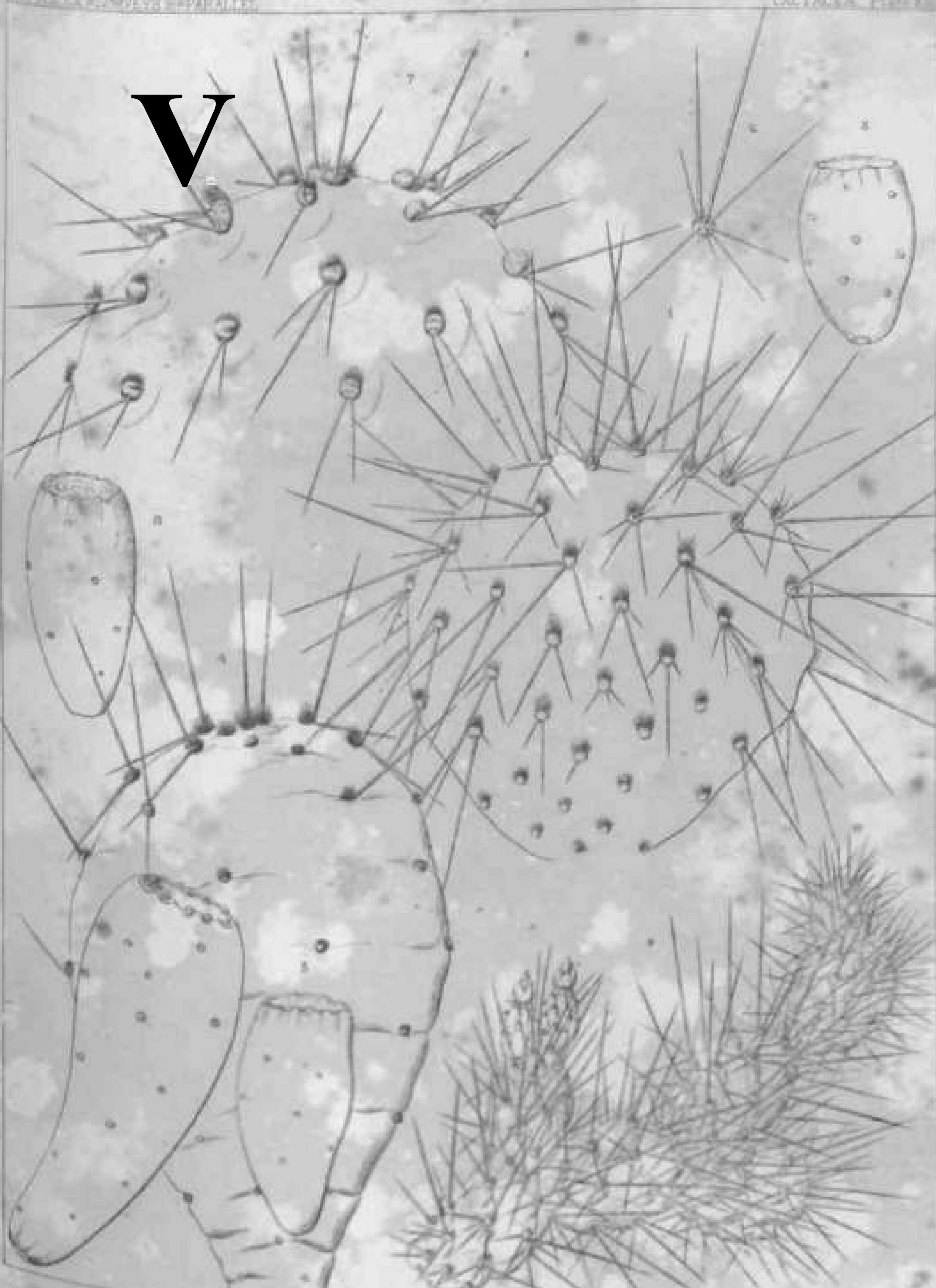
3. OPUNTIA ENGELMANNI var. CYCLODES Eng. 4. OPUNTIA FORTISPINA Eng.

1–3 OPUNTIA CAMANCHICA. 1 & 3 OPUNTIA MOHAVENSIS. 1 & 3

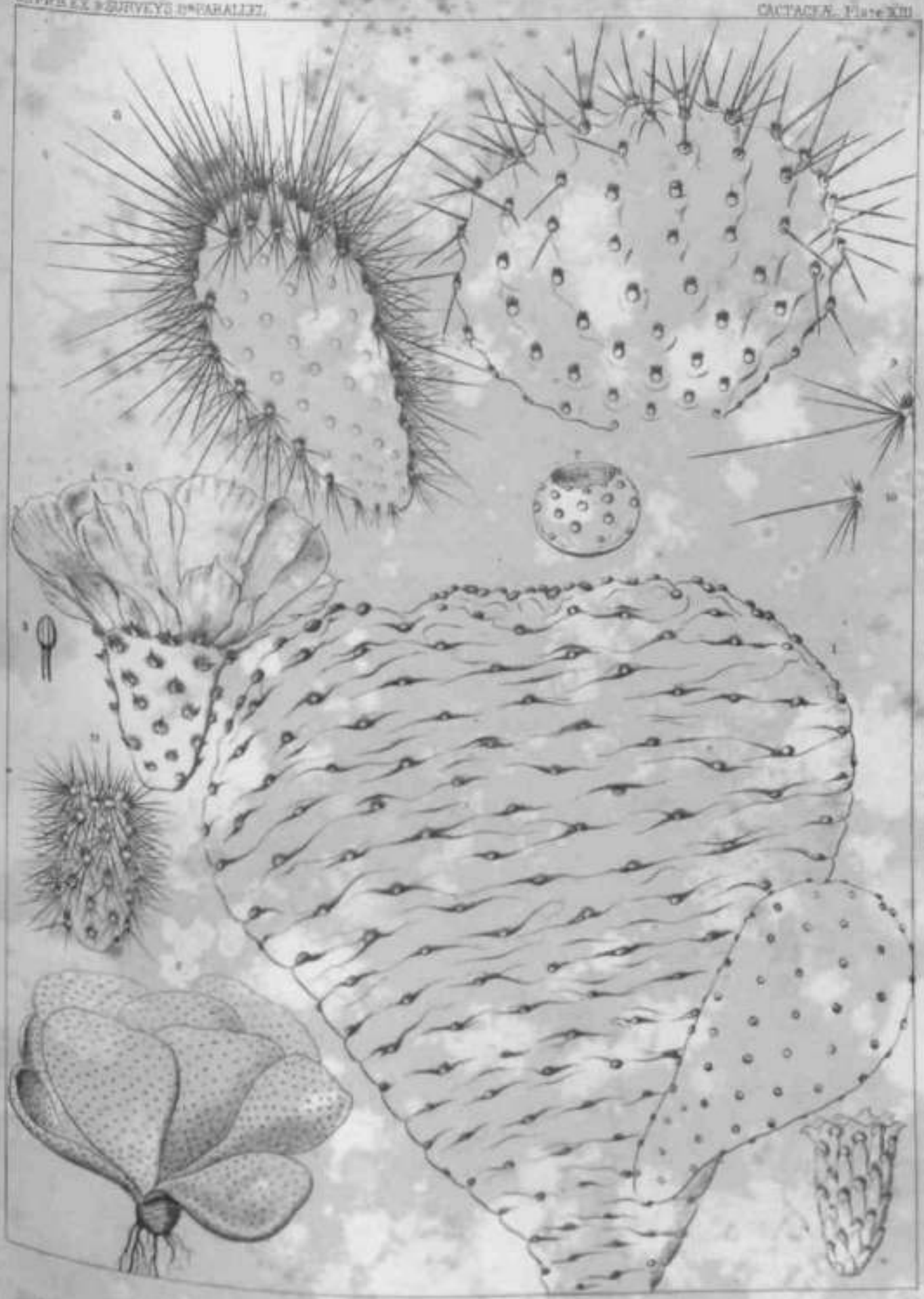
1-2 OPUNTIA VULGARIS, Mill. 3-4 OP. RAFINESQUII E.



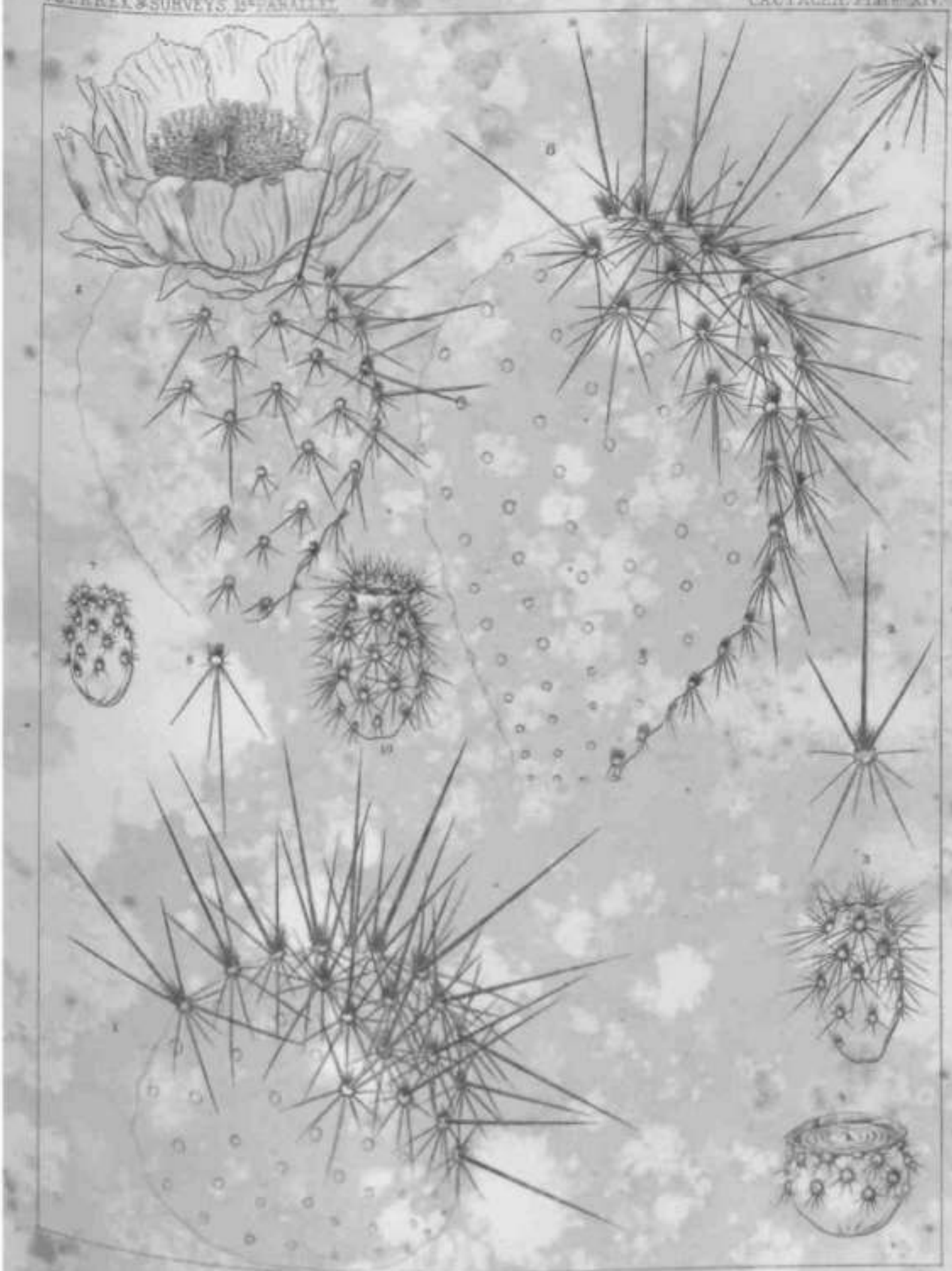
1. OPUNTIA RAFINESQUII, var. E. 2. 3. OP. RAFINESQUII, var. E.



1-2. OPUNTIA CYMOCHILA, E & B. 3-4 OPUNTIA STENOCHILA, E & B. 5-7 OPUNTIA FUSIFORMIS E & B.
8. OPUNTIA BRACHYARTHRA, E & B.

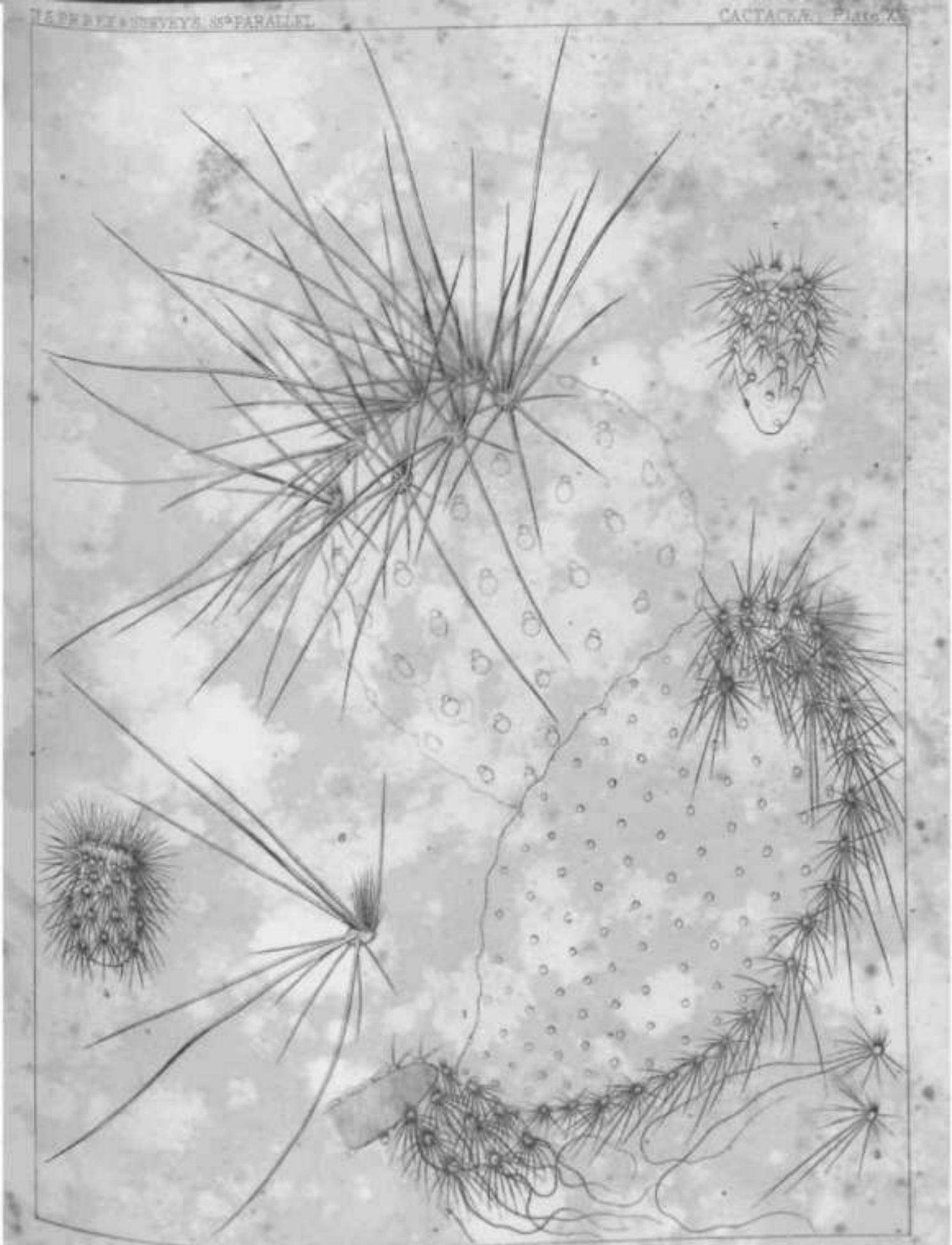


1-5 OPUNTIA RAFINESQUII. Engelm. 6-7 OPUNTIA SPHAEROCARPA. Engelm.
8-9 OPUNTIA ERINACEA. Engelm.



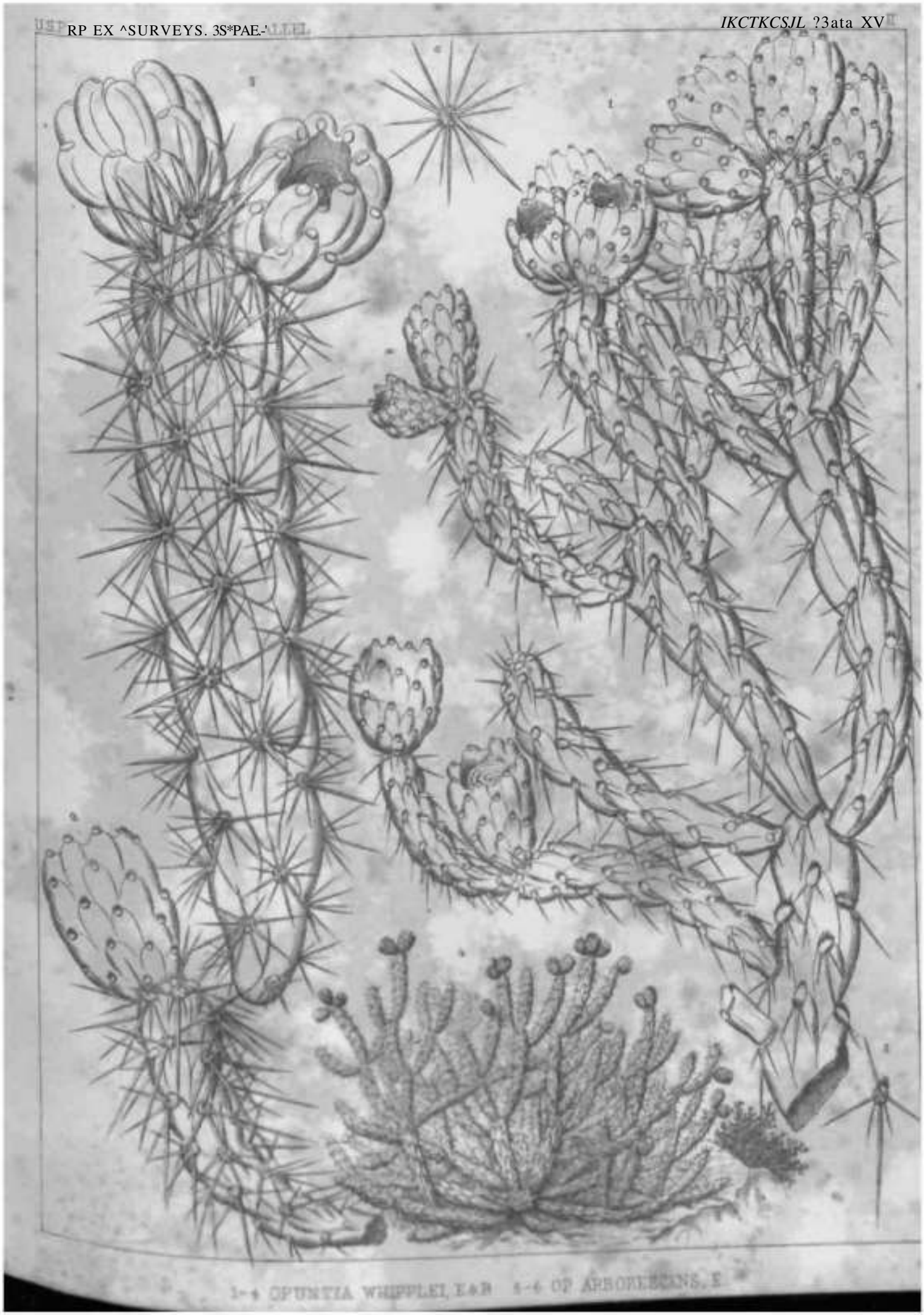
OPUNTIA MISSOURIENSIS DC.

1-3. var. RUFISPINA. 4. var. PLATYCARPA. 5-7. var. MICRODASYS. 8-10. var. ALBISPINA.

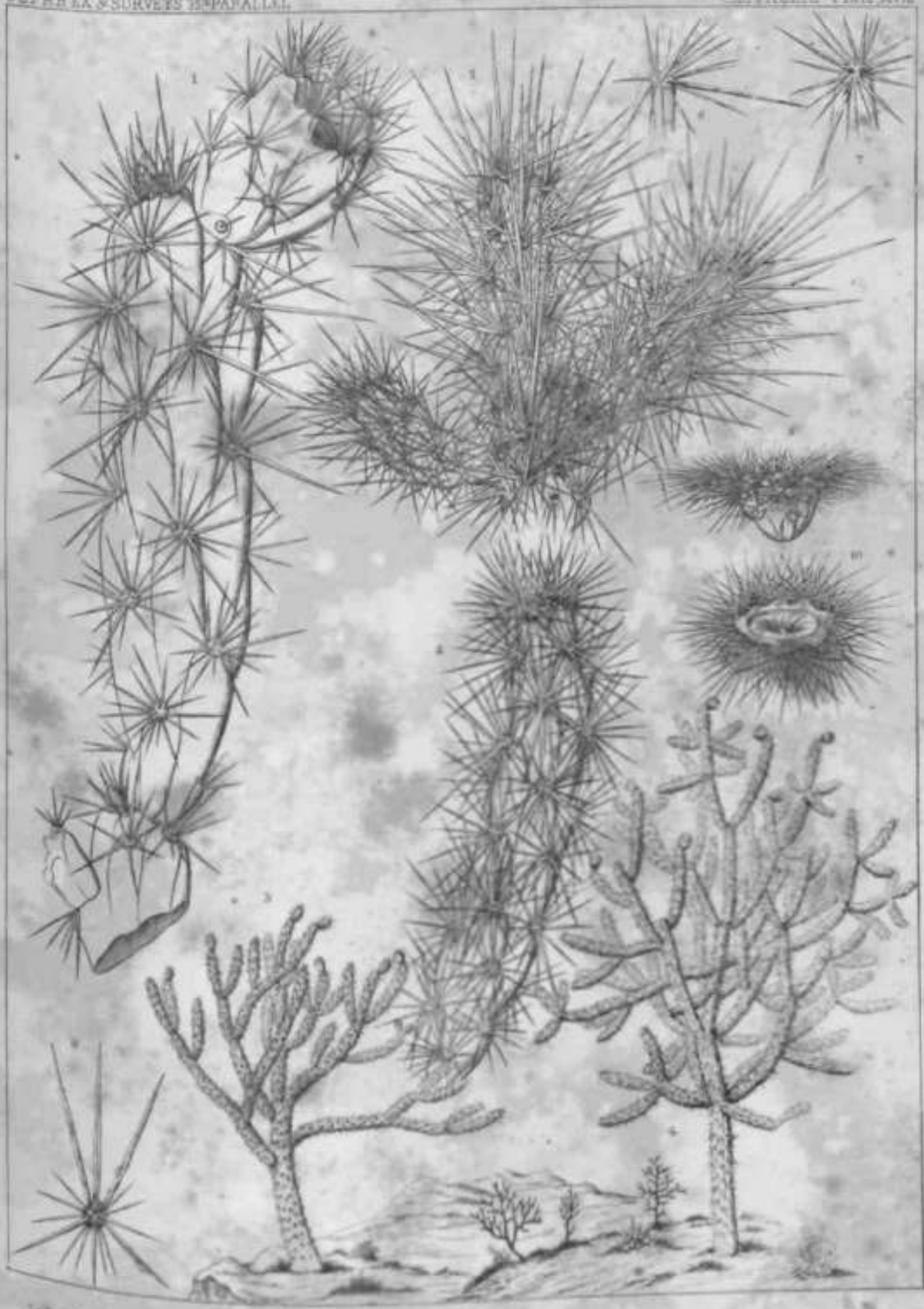


1-4. OPUNTIA MISSOURIENSIS. DC. var. TRICHOPHORA *I* & B.
5-6 OPUNTIA HYSTRICINA I & B

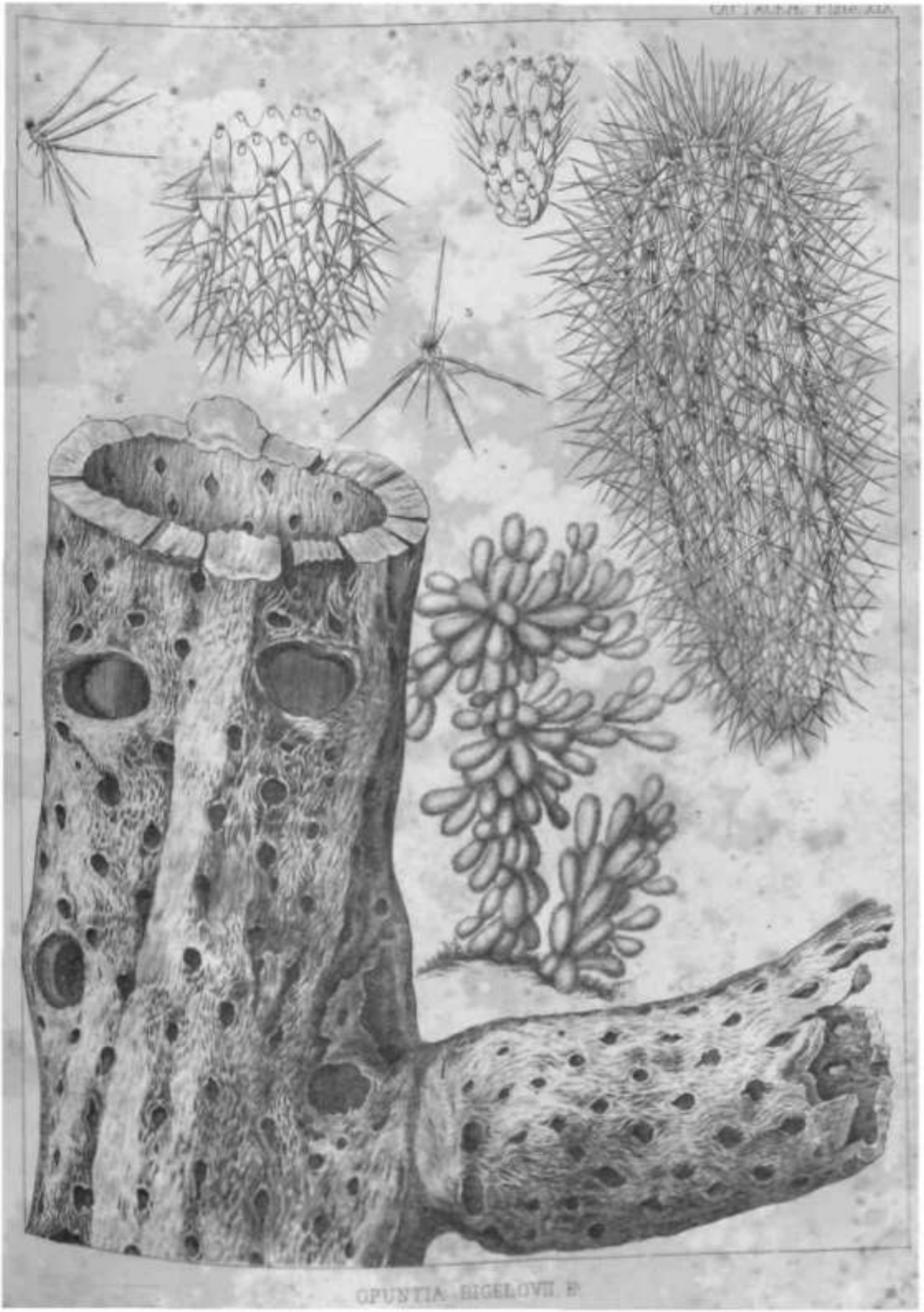
OPUNTIA DAVISII S. & B.



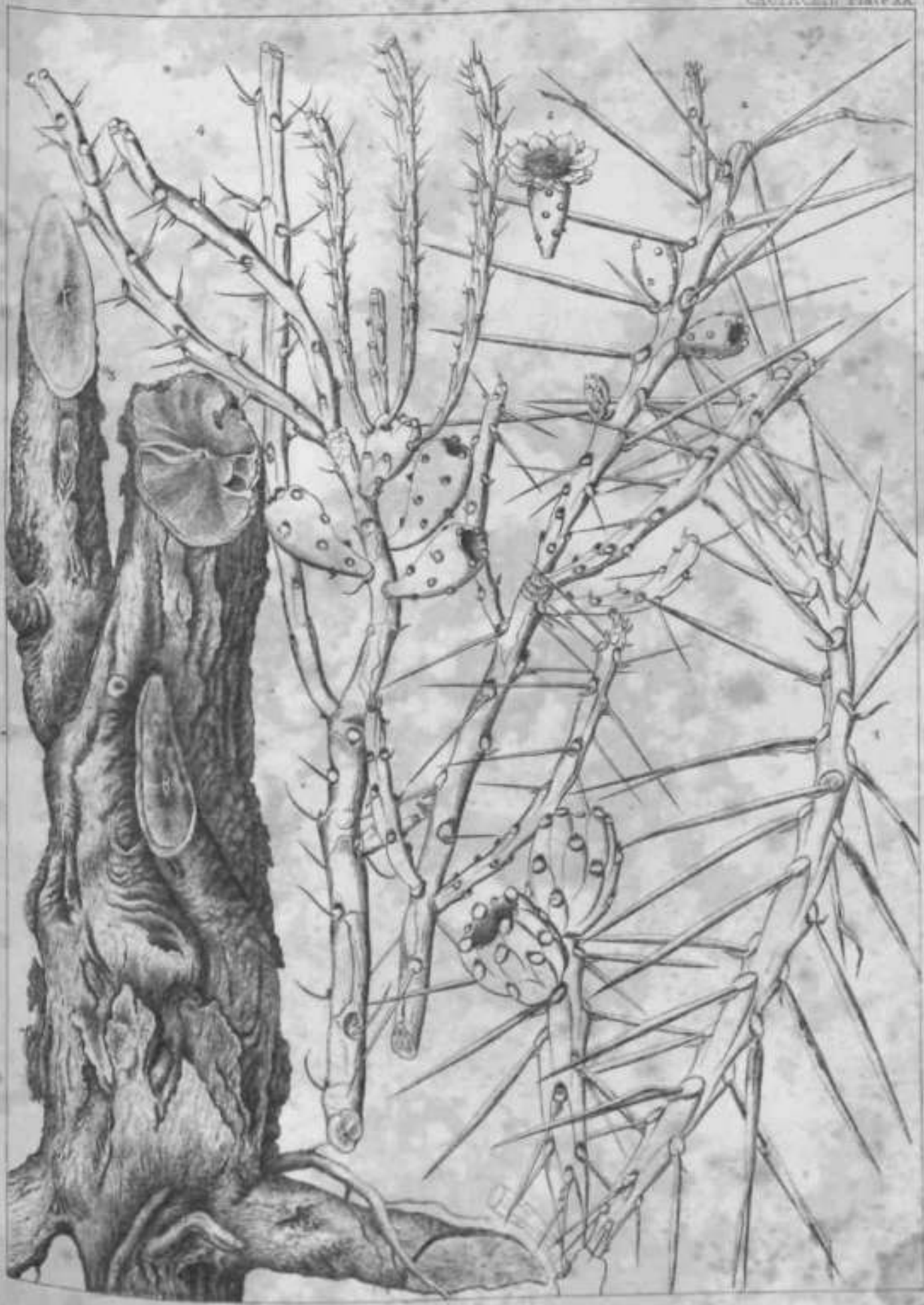
1-4 OPUNTIA WHIPPLEI, E&B 5-6 OP ARBORESCENS, E



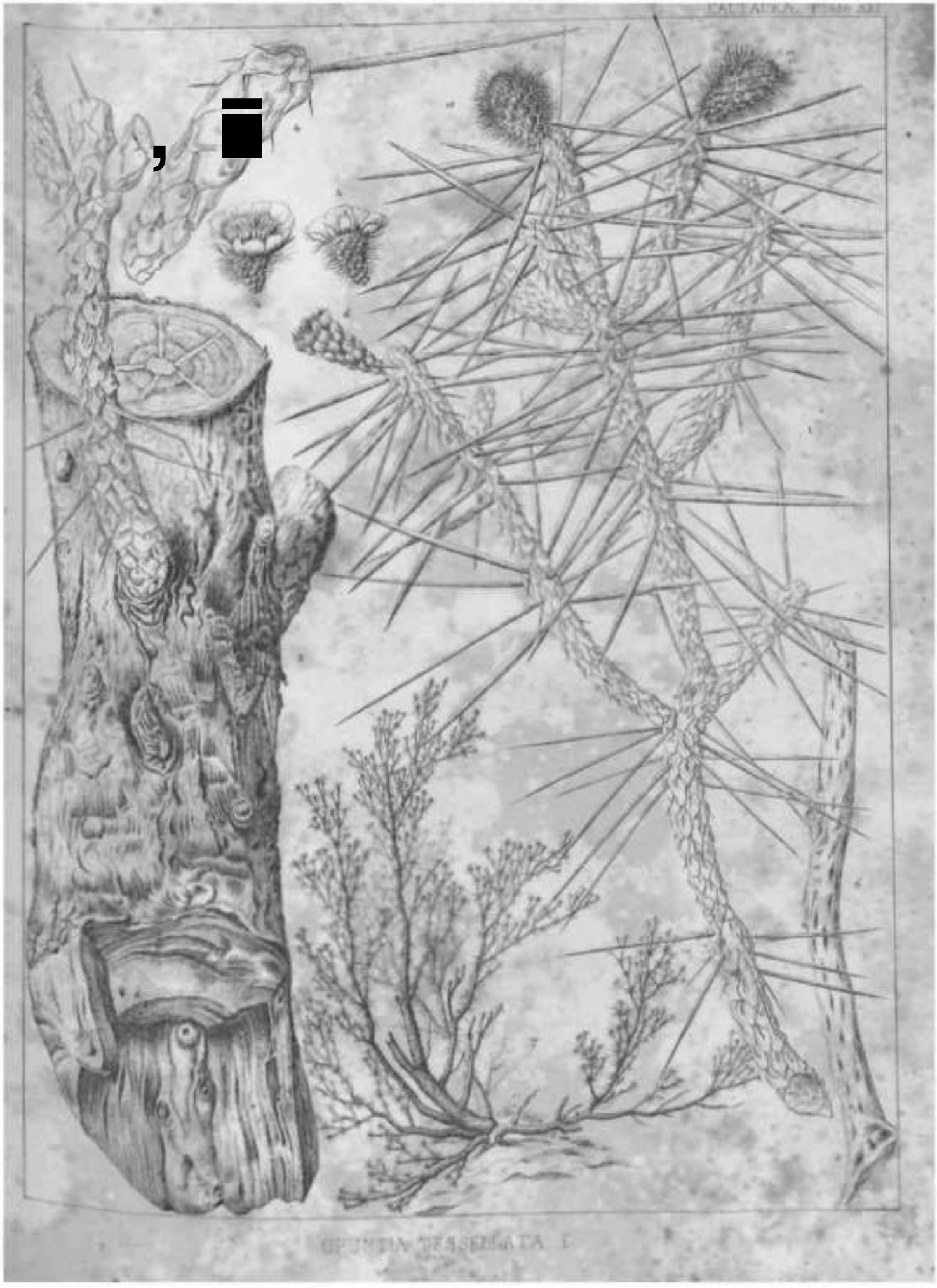
1-2 OPUNTIA ACANTHOCARPA. E. & B. 4 OP. ARBUSCULA, E. 5-10. OP. ECHINOCARPA E. & B.

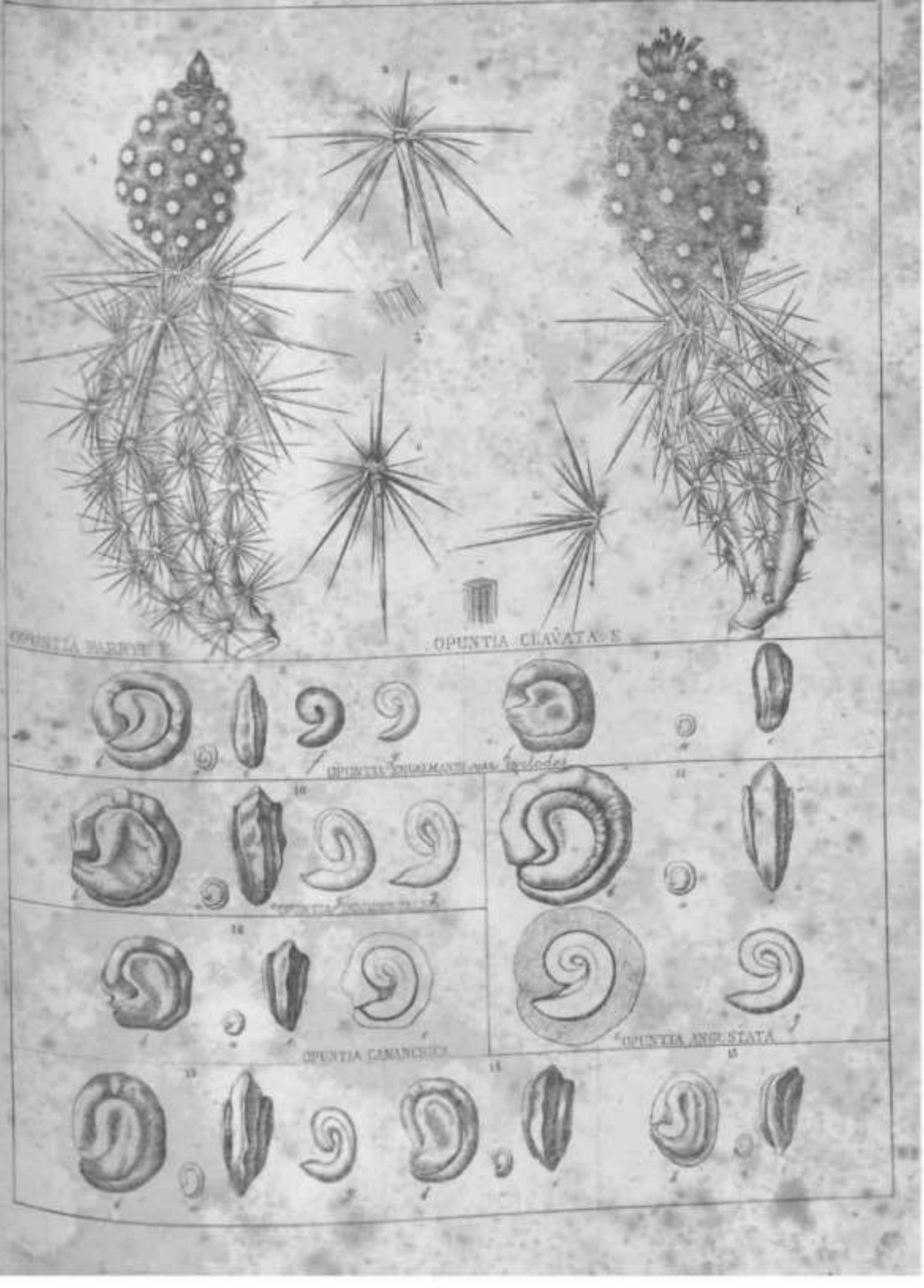


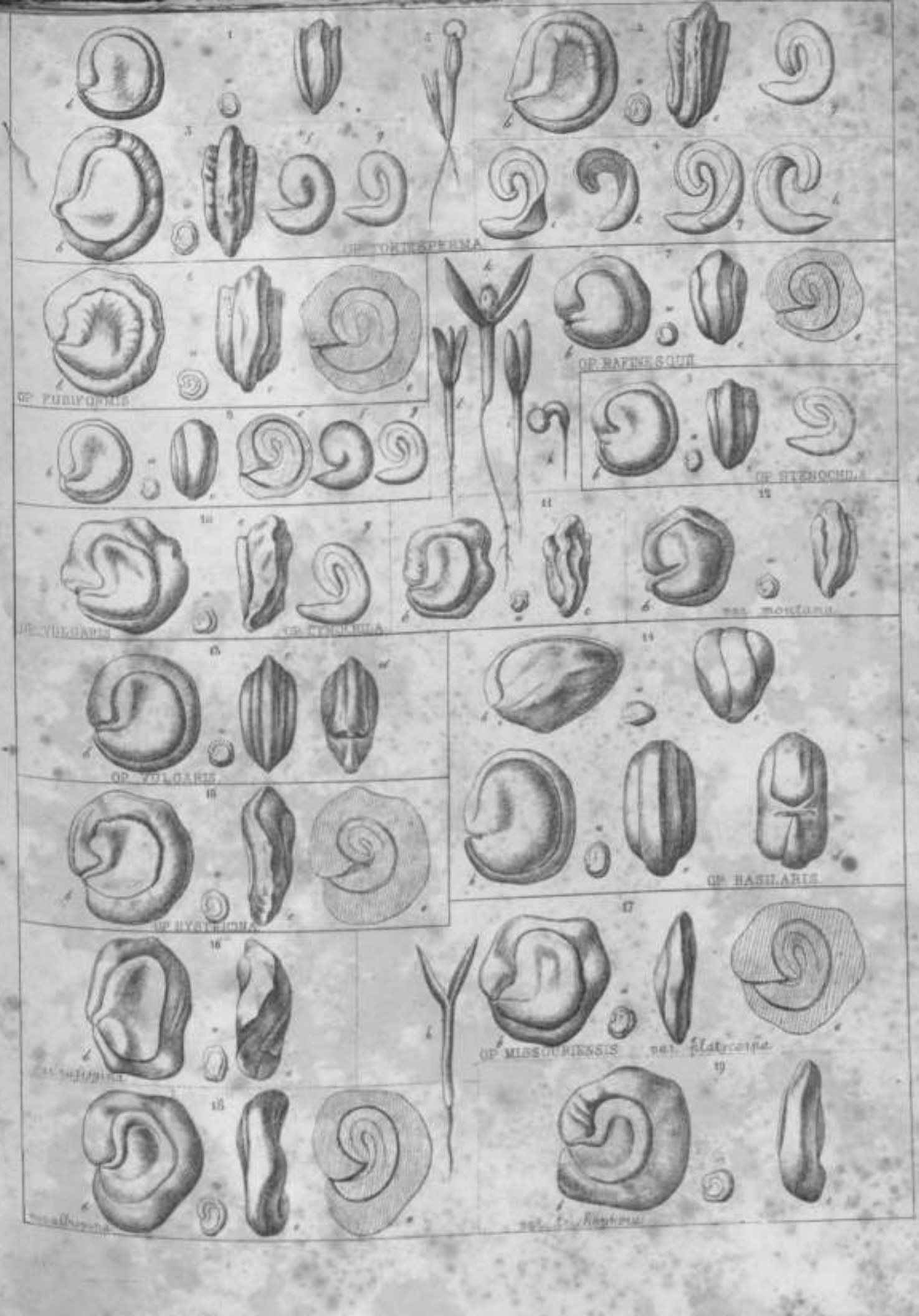
OPUNTIA BIGELOVII P.

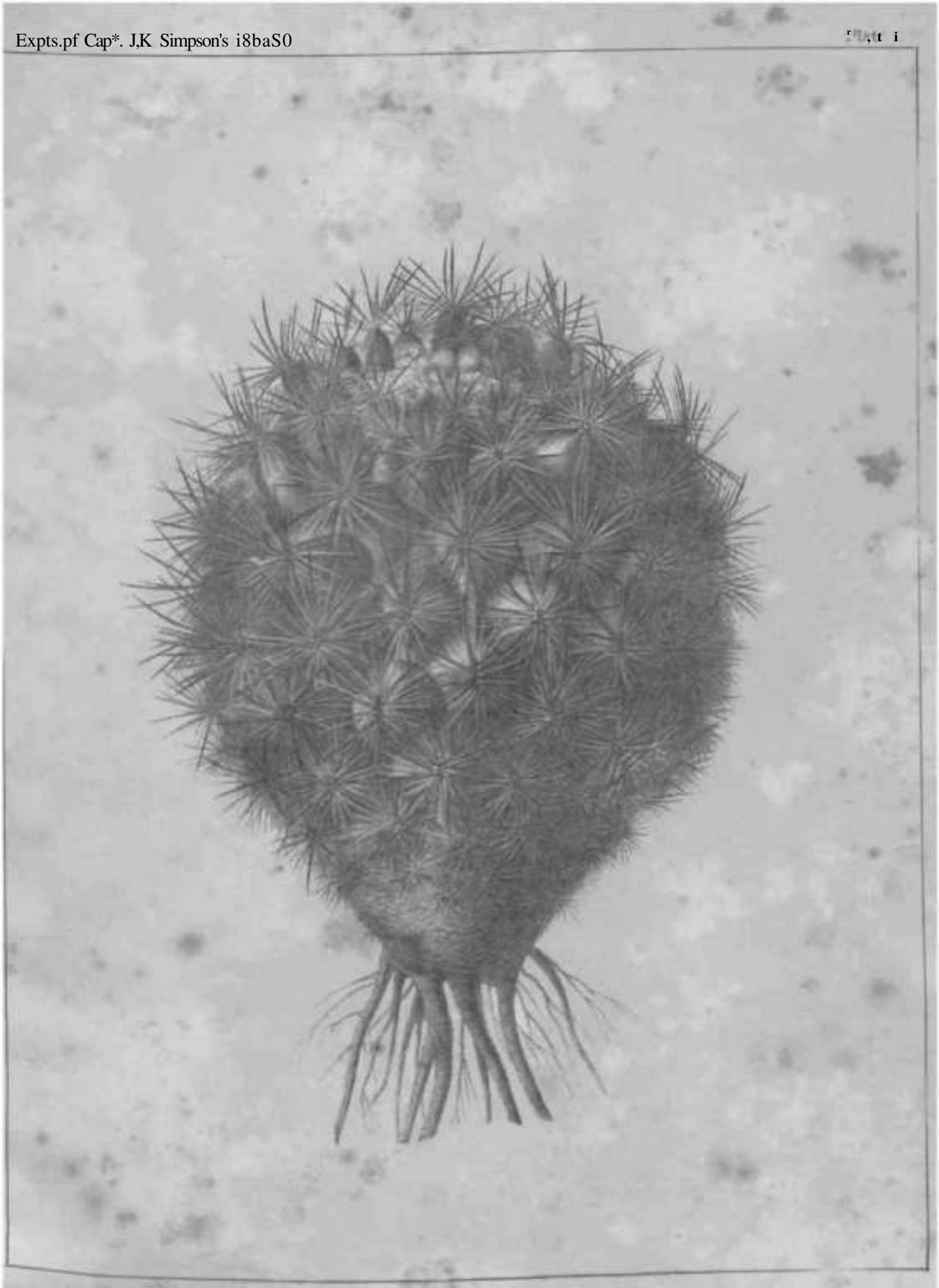


1. OPUNTIA VAGINATA. E. — 2-3. OPUNTIA FRUTESCENS. E.




OPUNTIA CLAVATA
OPUNTIA ANGUSTATA
OPUNTIA CAMANCHICA

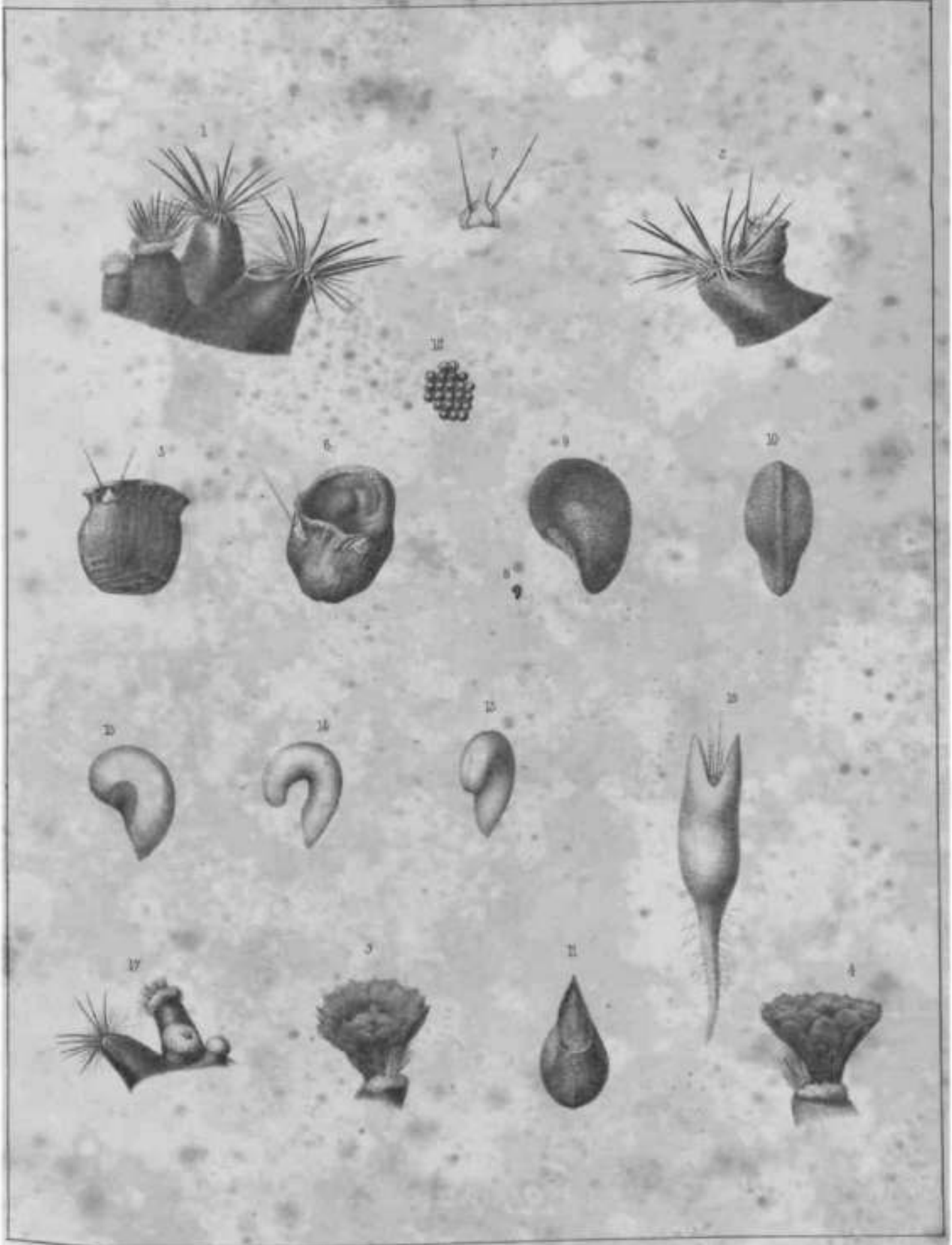

OP. TORTISPERMA
OP. RAFINESQUII
OP. PUSILIFORMIS
OP. STENOCHILA
OP. VULGARIS
OP. VULGARIS
OP. BASILARIS
OP. HYSTRICINA
OP. MISSOURIENSIS var. Platycarpa



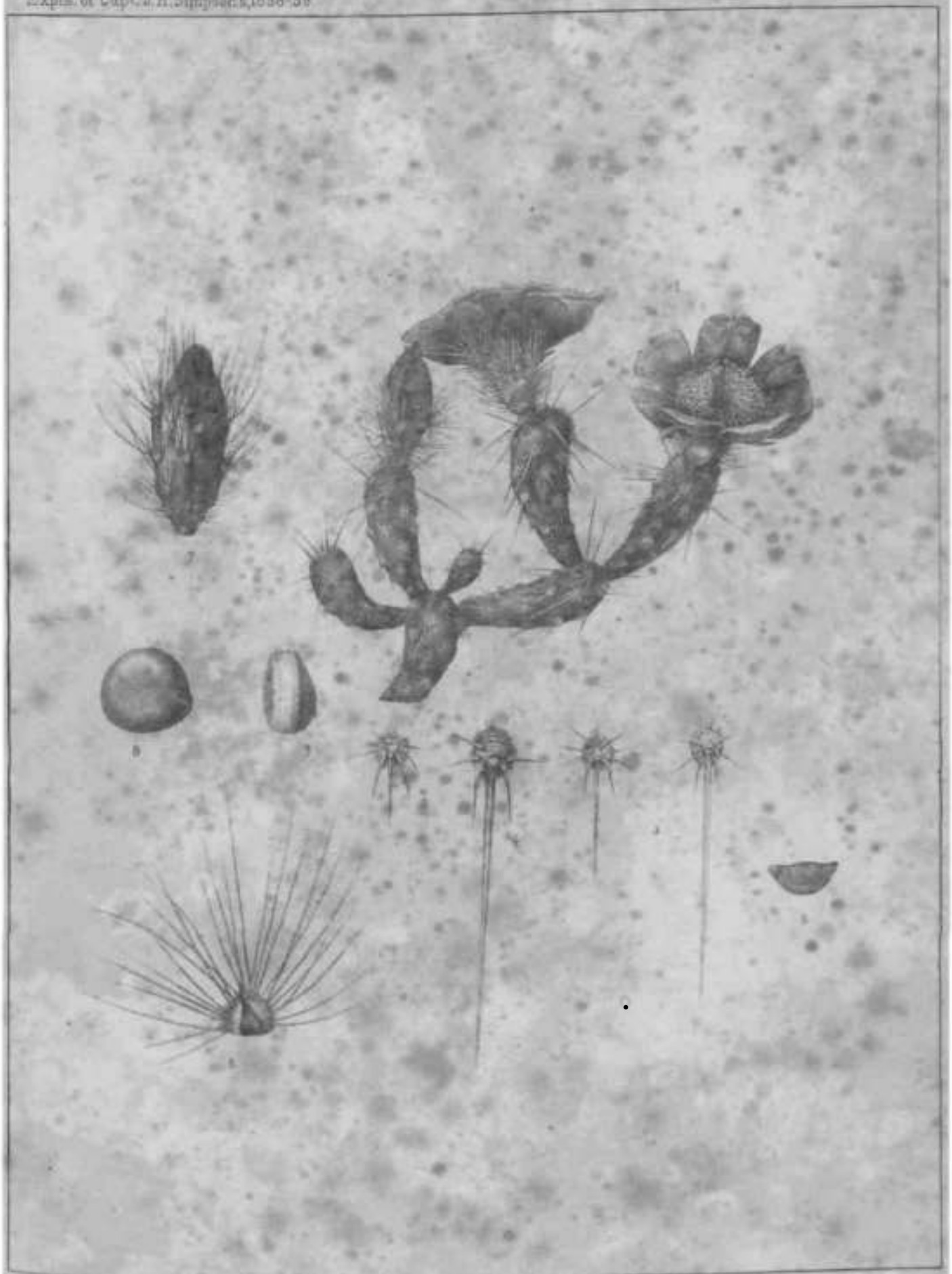
ECHIWOCACTUS SIMPSONI ENGELM.

Expls. ofCitpi J.H Sim,-sens If

Plate II



iCHIWOCAC ' 1MP50NI EWr.



OPUNTIA PULCHELLA. ENGELM.