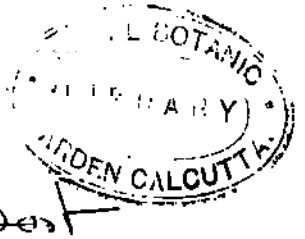


Report

1910-11 upto 1921-22

B2361

on the systematic botanical work only

Report ^-4^e-Director of the Botanical Survey of India for "tfifyear 1910-1L

1. Eastern India.—The Director in his capacity as Superintendent of the Royal Botanic Garden, Calcutta, has continued his work of cataloguing the trees and shrubs cultivated therein. Up to 10,000 numbers have now been checked, leaving over 3,000 still to do. During the rainy season of 1910 Mr. W. W. Sirfith, Curator of the Herbarium, studied in the field the vegetation of the south-east corner of Sikkim in the same way as he had done the north-west corner of that state in the previous year. On this occasion his operations ranged along the Sikkim side of the Cho-La ridge that separates Sikkim from the Chumbi Valley and extended practically fpom Lingtu and Gyi-mo-chi to the TRanka-La. The weather conditions in contrast to what was experienced in* the Llonakh uplands in the previous year were very bad, but in spite of this drawback Mr. Smith collected about 6,000 specimens and first-hand materials for an account of the vegetation of this area that will appear in the Records of the Botanical Survey in due course. The routes followed in 1909 and 1910 are shown in the map illustrating No. 5 of Volume IV of the Records which is just about to be issued. The collection from the Cho-La in addition to conducing to a more accurate knowledge of the vegetation generally of the area has yielded over a dozen species new to science. Towards the end of the year Mr. Burkill, Reporter on Economic Products, in the course of his tours undertaken in that capacity along the Nepal frontier also made collections and recorded observations on the vegetatlon of the area traversed^ by him along the frontier trade route. Mr. H. H. Haines, Conservator of Forests, has during the year issued the frvit of his botanical observations and collections made in the course of his several wars service in Chota-Nagpur in the shape of an excellent Forest Flora of that Division and^of Gangpur and, the Santhal-Parganahs. This forms a valuable contribution to a systematic knowledge of the vegetation of .Bengal.

[m] Although the Botanical Survey ^s a Department was not able during the year to work direct in Burma it has largely benefited, as hitherto, by the practical interest in the vegetation of that ptoWnce displayed by several officers of other departments of Government stationed there. Captain R. W. MacGregor of the Indian Mfedical Service has contributed from the Southern Shan f States a very interesting collection of about 1,600 specimens amongst which are several«novelties. Messrs. A> Rodger, G. S. Cubitt and H. W. A. Watson, all Deputy Conservators of Forests, ha\se sent materials from various parts of Burma. »The first about 400 specimens from the Ruby Mine District, the second over 200 specimens from the Bhamo Division and the third a collection from the neighbourhood of Taunggyi.

2. **Western India.—Mr.** Burns, Economic Botanist to the Bombay Government, has studied the types of vegetation occurring on the sea shore near Bassein and has published his observation. Mr. Burns has also presented the survey with a small but interesting collection of specimens from the Bombay side. He and his assistants have also collected in Kanara, Foona, Thana. Kolaba, Dharwar, Belgaum, 8holapur and Satara, adding altogether over 800 sheets to the local Herbarium. The latter has been greatly enriched by the 'acquirement of the herbarium—numbering over 10,000 sheets—of Mr. Talbot, Conservator of Forests, retired. Mr. G. A. Gammie has published discriptions of the orchids of the genera Sacoolabium, Sarcanthus, Cleisostoma, Fogonia, Spiranthesi Zeuxine and Cheirostylis that occur in the Bombay Presidency. Me. L. J*8edgwick has continued his studies of the mosses of Western India and has published a second list of species found on that side.

3. **Southern India.**—The most imjjortant contribution from this area wartnade by Mr. Alfred Meebold who on his own account made an extensive [1] tour in the latter end of 1910 through the States of Cochin and Travancore. Mr. Meebold has enriched the collections at the Calcutta Botanic Garden by over 2,000 sheets—amongst them rare plants and new species—from the above mentioned states. Mr. C. E. 0. Fischer, Deputy Conservator of Forests, has, as

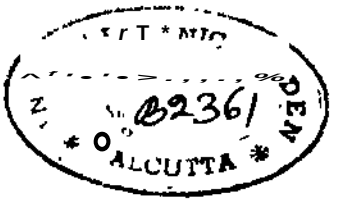
before, contributed largely, over 1,600 specimens having been received from him during the year. Dr. C. A. Barbar, Madras Government Botanist, presented over 800 sheets. During the year Dr. Barber had made a study of the natural order *Loranthacece* while on leave.

4. **North-West India.**—Several more parts of Colonel J. C. B^jaber's descriptive key to the Flora of the Punjab, North-West Frontier Province and Kashmir, have been issued during the year. Collections were made in the United Provinces' Himalayas by Indian collectors working—as during last year—under the care of Mr. N. Gill of the Kumaon Government garden lieutenant S. M. Toppin, R. G. A., has contributed a small collection of Makkand specimens collected by himself.

5. **Publications.—**Of the publications referred to in last year's Report as being in the press, Signor Beccarf s large work on the species of the genus *Damonorops* is about to issue, while Mr. BurkilTs *Notes from a Journey to Nepal* and the first fasciculus of the writer's *Catalogue of the non-herbaceous* ***Phanerogams cultivated in the Royal Botanic Garden, Calcutta,*** **forming** respectively No. 4 of Volume IV and No. 1 of Volume V of the Records of the Botanical Survey have been published. Mr. Smith's account of his tour in the Zemu and Llonakh valleys of Sikkim and descriptions of new species and the writer's second fasciculus of the Garden Catalogue just referred to are about to issue as No. 5 of Volume IV and No. 2 of Volume V respectively. The account of the determinations of prickly pears now wild in India by Mr. I. H. BurkiJl is now in type as No. 6 of Volume IV of the Records, while a third fasciculus of the Garden catalogue is ready for the press. Both Messrs. Burkill and Smith have published several other papers on botanical subjects in non-official periodicals. These are mentioned in the list of published papers appended to this report. The second volume of Mr. Duthie's Flora of the Upper Gangetic Plain including descriptions of species in the natural orders from *Plumb aginaceq* to *Plantaginece* has been issued. Mr. R. J. D. Graham, Economic Botanist, **Central Provinces, has published a *List of wild plants found on \the Nagpur and Telin hheri Farms.***

6. Finance **and Staff.**—From 1st of April 1910 the provinoia^graAts from the Governments of Bengal, Eastern Bengal and Assam, and Burma WLre discontinued and the Survey was placed on a more satisfactory footing. Two Indian assistants for systematic **\vt)A,** a photographer and clerk vere sanctioned while R5,000 were allotted for exploration, travelling allowances and contingencies. Messrs. S* C. Banerji and M. S. Raijjaswami wore appointed assistants on probation for three years from 1st April 1910. Both have worked with commendable assiduity during the year ancj their help is much appreciated. The other members of the staff have also worked well. All the officers of the Survey were in charge of their respective posts throughout the year. The Budget allotment for exploration and contingencies was spent in full; but there was a saving of Rl,195 under travelling allowances. From January 1911 the Department of Economic Products was transferred to the Botanical Survey of India. The Report of the Officiating Reporter on Economic Products dealing with the work of his Department has* been forwarded to Government separately so that no reference is made to it here. A considerable amount of systematic botanical work concerned with India has been done extra-departmentally and a considerable number of papers published in connection with such. The limits of this departmental report do not permit of appropriate re Terence being made to such work here but a more detailed account of botanical rvork generally done in or with reference to India will be presented Inter on to the Board of Scientific Advice.

A. T. GAGE, ***Major, I.M.S.,***
Director, Botanical Survey of India.



*A list of papers containing references to the Botany of India published mostly during 1910*11*

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BEAUVEBD, G. . Contributions à Tetude des Composées asiatiques. II—IV. *{Bull. Soc. Bot. Genhe, 1910, p. 36-51, 99-145, 207—253)*

BENOIST, Jt. • Espfece et locality nouvelles de *Barleria. (Notulce Systematic* i, No. 12, p. 362.)*

BLATTEE, E. J. . The Palms of British India and Ceylon. II—IV. *{Journs Bomb. Nat. Hist. Soc, xx, 1910-11, Nos. 2-4, p. 347—360, 675—705, 981—995 with 16 plates and 1 map.)*

BONATI, Q. . Contribution à Tetude du genre *Pedicularis. {Bull. Soc. Bot. France, hit, 1910, Mem. 18.)*

BBUNNEB, C. . Beiträge zu vergleichenden Anatomie der Tamaricaceen. *{Dissert. Erlangen, 1909, pp. 94.)*

BlJBKILL, I. 5. . Notes on the pollination of flowers in India. Note No. 7. A few observations made in the Central Provinces and Berar. *(Journ. Asiat. Soc. Beng., vi, 1910, No. 3, p. 101—107.)*

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CBAIB, W. G. & HUTCHINSON, J. . *Xylia Kerrii [ffookers Ic Plant., x, 1911, Pi. 2, tab. 2932.)*

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DIELS, L. . *Menispermacea. {Das Pfianzenreich, 1910, Heft 46, pp. 345.)*

DIXON, II. N. . *Merceyopsis,* a new genus of Mosses, with further contributions to the Bryology of India. *{Journ. Bot., xlviii, 1910, No. 576, p\ 297—310 with 2 plates.)*

" " . *Jlyophilopsis,* a new genus of *Pottiacea,* with further contributions to the Bryology of India. *{Journ. Bot., xlix, 1911, No. 581, p. 137—150, with 1 plate.)*

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" " . Contribution à l'etude des Loganiacées asiatiques de Pherbier du Museum de Paris. *{Bull. 8oc. Bot. France, Mi, 1910, Mem. 19, pp. 80.)*

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. *Adinobotrys* and *Padbruggea. {Kew Bull. 1911, p. 193—198.)*

DYKES, W- R. . *Iris himalaica. {Gard. Chron., xlv, 1909, p. 36.)*

FEDDE, P. . *Papaveracea-Hypecoidea* et *Papaveracea-Paptveroidea. {Das Pfianzenreich, 1910, Heft 40, pp. 430.)*

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,, . . Essai d'une classification du genre *Grewia. [Notula Si/stematica, t, 1909, Nos. 4—5, p. 119—132.)*

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GAMBLE, J. S. . . *Oxytenantliera lacei,* in " Decades Kewenses." *(Keio Bb7i., 1910, p. 385 and 1911, p. 192.)*

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HOCHREMINER, B. P. Ci. . Sur un point de nomenclature relatif du genre *(h.'/finij. [Ann Codtervat. et Jard. Bot*, Gen?vr, 1909-10, p. fiO-Xl.)* %

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Report of the Botanical Survey of India for the year 1911-1912.

I. Systematic—*Eastern hidia.—During* the year the Director finished for purposes of publication the first volume of the catalogue of non-herbaceous phanerogams cultivated in the Royal Botanic Garden, Calcutta, bringing the numbers up to a total of 13,437 plants. In the list of identifications there remains a considerable number of blanks to be filled in as opportunities for identification occur. A fair amount of progress has been made in preparing the materials for the second (systematic) volume required to make the work complete. As regards more extended field work, collections were made in the Eastern Himalaya on behalf of the Botanical Survey by Mr. W. R. Jacob of the Forest Department, Mr. R. Lister of Pashok Tea Estate, Mr. W. W. Smith, lately Curator of the Herbarium attached to the Royal Botanic Garden, Calcutta, and by Mr. G. H. Cave, Curator of the Lloyd Botanic Garden, Darjeeling. Messrs. Jacob and Lister collected in Bhutan, the former contributing over 200 and the latter over 100 specimens of interest. Messrs. Smith and Cave's collections were made in Sikkim and the Darjeeling district and supplemented by the collections made by the Lepcha collectors of the Lloyd Botanic Garden they totalled about" 1,400 sheets. Mr. A. Meebold also presented a small collection from the outer hills of the Darjeeling district.

In Assam Mr. I. H. Burkill while officiating during the hot weather of 1911 as Director of the Botanical Survey toured in the Khasia Hills accompanied by Mr. S. C. Banerji of the Botanical Survey Department. Their tour resulted in an accession of nearly 800 sheets. Later on towards the end of 1911 Mr. Burkill was deputed as botanist to accompany the Abor Expedition. Despite the unfavourable conditions, climatic and others, that hampered botanical work on this expedition, Mr. Burkill returned with over 2,000 specimens, which with his notes will serve to add very materially to our knowledge of the vegetation of that little known frontier region.

In Burma the excellent work done by officers of other departments of Government and private individuals has made it less a matter for regret that the Botanical Survey was unable to depute any of its very limited staff to that province. Captain S. M. Toppin, R.G.A., during the year contributed over 100 specimens collected in the early part of 1911 along the Chinese frontier of Burma near Bhamo. The same officer made two botanically important journeys during the year. The first in April and May of 1911 was from Mogaung in the Myitkyina district across the Loipyet Hills to Nanyaseik, thence to Haungpa on the Uru or Uyuchaung river and from there north-westwards till the Chindwin river was reached some thirty miles above Kanti and a little distance south of the Hukong or Hukawng valley, then, down the Chindwin valley to Homalin. The route thus traversed both east and west sides of the watershed between the Irawaddy and Chindwin rivers. The area roughly is between 25° and 26° N. Lat. and 95° to 97° E. Long. About 300 species were collected on this journey. Captain Toppin's second journey made during December 1911 and January and February 1912 was from the confluence of the Mali Hka and N'mai Hka rivers to form the Irawaddy northwards along the region west of the Mali Hka to Patau, thence north-eastwards to the Nam Tamai or upper water of the N'mai Hka, the easterly of the two rivers that join to form the Irawaddy, the area being roughly between 24° and 28° N. Lat. and 97° and 98° E. Long. Captain Toppin's collections from this region are now being worked out. In addition to the collections much valuable information has been furnished by Captain Toppin in his notes. It is intended to publish an account of the botanical results of both his journeys as soon as opportunity permits. From the Southern Shan States Captain R. H. Phillimore, R.E., sent a small but interesting collection. Mr. C. G. Rogers, Conservator of Forests, and **Mr. A. Rodger,** Deputy Conservator of Forests, have also sent interesting collections, **the** fonrfer from Pegu, the latter from the Ruby Mines District. **In** Lower **Burma Mr. A.** Meebold **in** the **spring of 1911 explored part of** the districts **of Mergui and in** the **end of 1911 and** beginning of **1912 collected in the districts**

of Thaton and Salween, travelling beyond Papun in the latter district. From these collections some 2,500 sheets have been contributed by him to the Calcutta Herbarium.

Western India.—Although there is not now so much scope for exploration on the west as on the east of the Indian Empire, there is more than enough opportunity for study of the vegetation from the standpoint of particular orders or genera or species as distinct from the study of the vegetation of any definite geographical area. Both aspects of study, however, are comprehended in Mr. W. H. Talbot's Forest Flora of the Bombay Presidency and Sind, the second volume of which—comprising descriptions and the distribution of species of the orders *Rhizophorece* to *Graminece*—has appeared during the year. Mr. G. A. Gammie has issued a further instalment of his description of the *Orchidacece* of the Bombay Presidencj", comprising the species of the genus *Peristylus.* Mr. B. K. Bhide, Assistant Economic Botanist, Bombay, has published descriptions of new and revised species of Bombay grasses. Mr. W. Burns, Economic Botanist, has described a *Tamarix* association and the vegetation of the sea shore near Bassein. Mr. H. N. Dixon has described two new genera of Mosses from the Bombay Presidency. An account of the western Peninsular Indian Balsams collected by Mr. Meebold and a description of a new species were published by the late Sir J. D. Hooker.

Southern India.—Mr. C. E. C. Fischer, Deputy Conservator of Forests, has as hitherto been the main support of Botanical Survey work in the peninsula. He has contributed over 1,200 specimens collected in various parts of the Madras Presidency such as the Pulney, Anamalai hills and Coimbatore. Mr. Fischer's large and excellently preseived collections will prove of great value when the Flora of the Madras Presidency comes to be written. Dr. C. A. Barber, D.Sc, the Government Botanist, has given as much of his time *to* systematic work as his other engrossing duties permitted. The following is quoted from Dr. Barber's report as Government Botanist for the year 1911-1912 :—

" *Systematic Botany.*—A considerable amount of attention was devoted to this section during the year because of the decision on the part of the Government to have a flora of the Madras Presidency prepared, and numerous reports were forwarded on the subject. There was practically no special touring for the collection of plants, but substantial additions were made to the collections of peppers and *Loranthacece* by the Government Botanist while on other tours and a few local expeditions were made by fieldmen.

" Much progress was made in getting the large accumulation of plants, collected in previous years by the Government Botanist named, although this work was still hampered by lack of staff and the absence of suitable herbarium cases. Some 7,700 sheets were finally written on and added to the special collection of Madras plants. Eighty duplicate sheets were received from the Calcutta Herbarium. A small herbarium of 250 species of plants was given to the Presidency College for teaching purposes and about 50 sheets were distributed to other correspondents. The whole collection of *Dioscoreas* was sent to the Eeporter on Economic Products and named and returned by him. The valuable collection of *Grewias* remained with the Kew authorities throughout the year. An important addition was made to the illustrations of the Madras flora in the form of 513 pen and pencil drawings of plants. On investigation these turned out to be the originals of the plates in Wight's, Beddome's and other authors' published works on the Madras flora. They were received in an extremely dilapidated condition, but every effort is being made to preserve them in a series of specially prepared atlases. About 200 plants were named by the Assistant for various correspondents. The collection of 1,143 sheets of Madras peppers was overhauled by the Government Botanist and numerous dissections and drawings made. The specimens were sorted, arranged and named where possible and notes were drawn up for the information of the writer of the flora. A summary note on this work was prepared and forwarded for filing at Kew. The seed collection was overhauled and it was found necessary to inject a large number on the ground of insufficient naming. About 280 new species were, however, added so that the number at the end of the year was 600."

North West India.—Colonel J. C. Lamber, I.M.S., has issued another part of his key to the flora of the Punjab, North-West Frontier Province and Kashmir. Mr. R. N. Parker, Deputy Conservator of Forests, contributed a small collection of plants from the Hazara district. Lady Douie presented the Calcutta Herbarium with collections made by herself and by Mr. K. S. Imam-ud-din of the Forest Department in Kulu and Pangi respectively.

II. **Economic—**Mr. I. H. Burkill collected famine foods at Madhupur, and spent some little time at Dacca in connection with jute investigations. Mr. D. Hooper made a short trip to the Sunderbuns. Several subordinate members of the staff were sent to various parts of India in connection with the collection of specimens of *Opuntia*, seeds of *Melia Azadirachta* for the Imperial Institute, specimens of Yams for Mr. Burkiirs work on that genus, specimens of *Amorphophallus campanulatus* and for collection of information regarding cattle poisons and drugs. Mr. Burkill has studied in conjunction with Mr. A. S. Finlow, the Fibre Expert to the Government of Bengal, the inheritance of red colour and the regularity of self-fertilisation in the common jute plant, and he has also discovered^ new variety of this species. A translation into English of van Gorkom's account of Cinchona in Java from 1872—1907 has been edited by Mr. Hooper. Over 400 specimens of economic products were sent out to some 26 institutions and individuals within and without India. Of the specimens sent out over 300 were selected for the Field Museum of Natural History, Chicago, by Dr. Millspaugh, the Curator of the Botanical Section of that Museum, on the occasion of his recent visit to India. Seeds constituted the greater number of the other specimens distributed.

Mr. D. Hooper has investigated the chemistry of various vegetable products during the year and has submitted an interesting and detailed account of the various analyses performed by him. An administrative report being scarcely appropriate for the publication of analytical details, only a general account of his results is submitted here. In all he examined 346 substances, of which 34 were exudations, 32 oils and oil-seeds, 91 tans and dyes, 7 fibres, 91 medicinal products, 43 food stuffs and 48 minerals. The following is a short account of the more important of those investigations.

Exudations.--India rubber.—A sample of rubber in approximately half pound balls collected by Mr. Burkill while with the Abor Expedition, proved to have a composition similar to that of *Vicus elastica* rubber. A cake of prepared Ceara *(Manihot Glaziovii* Muell. Arg.) rubber from a plantation at Napha in the Northern Shan States was of fair average composition, showing 74-3 per cent, of caoutchouc and 14-4 per cent, of albumen in the dry rubber. The coagulum obtained by heating the milk of *Euphorbia neriifolia* L. after the milk had beeil preserved for some years in a bottle showed over 87 per cent, of resin and was commercially worthless. A sample of Mulberry *{Morns indica* L.) gum received fiom the Teesta Forest Division in 1909, gave equally poor results.

Resins.—**The resins of** *Calophyllum Inophyllum* L. and *Mesua ferrea* L. were examined and their acid, saponification, and iodine values determined. A sample of brown resin from Kalimpong presented by Dr. G. D. Hope of the Indian Tea Association, gave the characteristics of crude lac with 10-5 per cent, of insoluble impurities. The lac is said to be. found on—amongst other trees—*Albizzia Lebbek* Benth, and a red dye is prepared from it by the Tibetans by boiling the resin in water, while tlic residue 'Laha' is used as an adhesive medium.

Gums.—A few samples of gums were examined on behalf of the Stationary Office. A sample of gum from *Odina Wodier* Roxb. (the "jika" tree) was found to be highly coloured and only partially soluble in water.

Sealing Wax.—Twenty-one specimens were examined on behalf of the Stationery* Department, Calcutta.

Oils and Oil-seeds—Gyvocardia—The oil of fresh seeds of *Gynocardia odorata* R. Br. collected by Mr. Burkill at Kobo on the way to the Abor country, was examined for its acid value. Mr. Hooper states that those values are not much below the acid values of oil from this species as determined in England.

Soy beans.—Two samples of those beans, light brown and black respectively, from Garhwal were found to contain, the light brown 12-55 per cent, and the black 14-67 per cent, of fixed oil, these amounts being below the average contents of Indian cultivated Soy beans.

Chilgoza nuts.—These are the seeds of *Pinus Gerardiana* Wall, and are sold all over Northern India as a food stuff. They have been found to contain about half their weight of an almost neutral oil with slightly drying properties.

Thevetia neriifolia.—Seeds and the oil therefrom were examined on behalf of the Chemical Examiner to the Government of the United Provinces. The composition of the seeds was determined and the characters of the oil.

Prinsepia utilis Royle.—The expressed oil of the seeds of this shrub is used for food and light and occasionally for medicine. In specific gravity, iodine value and melting point of the insoluble fatty acids, the oil was found to resemble cotton seed oil.

Diospyros Embryopteris Pers., *Garcinia Mangos tana* L., *Pistacia vera* L.—The oil contents of seeds of those species and of several samples of mustard were estimated, and the results embodied in an Agricultural Ledger prepared by Mr. Hooper and dealing with Indian vegetable oils.

Dyes and Tans.—Ceriops Candolleana Am.—The statement that the tanning value of the bark of this tree varies with the age of the bark was tested by dividing a 12-foot tree into four parts, the first part representing the older bark" at the base and the last part the youngest bark at the top, and by analysing each portion separately. The tannin figures for each of the parts were respectively 26-2, 24-6, 23-8, 22-s, which would indicate the greater tanning value of the older bark.

Rhizophora mucronata Lam.—A sample of mangrove extract prepared from the bark of this species and forwarded by the Conservator of Forests. Pegu Circle, Burma, had the composition of a good tanning extract.

Fibraurea Trotteri.—" Napoo." A sample of the root of this species which occurs in the forests of Manipur was found to contain 1-89 per cent, of berberine.

Inks.—Various samples of inks and ink powders were reported on for the Stationery Department.

Fibres.—Rhea.—Samples of rhea fibre prepared by a process devised in India, and samples prepared in Germany were compared. In strength and appearance they were equally good while there was very little chemical difference between them.

Phwnix paludosa Roxb.—The leaves of this palm* were found to contain 2*6 per cent, of cellulose. The bark of *Hibiscus tiliaceus* L., [kk] Bhola," yielded 30 per cent, and the bark of *Sterculia villosa* Roxb. 49-S5 per cent, of fibre.

Food Stuffs.—Samples of fresh corms of *Amorphophallus campanulutus* BL " 01," an Araeeous species, cultivated throughout India for its edible conns, were examined and their chemical composition determined. The large pear shaped fruits of the Muli Bamboo, *Melocanna hambusoides* Trin. which species has flowered recently in groat abundance in Assam, are said to be edible. The chemical composition of a sample sent from Sylhot by Messrs. Shaw, Wallace & Co. was determined. The leaves of *Actep/iila excelsa* MuelL which species furnishes the " tea " of the Ahors were examined. The\ contain no alkaloid, but a small quantity of tannin was present and a white crystalline neutral principle. Amongst other food stuffs chemically examined were Salep, the dried tubers of species of orchids, the pith of an unknown bamboo said to be used as food by the Assamese, *Lathyrus satirus L.* [k] Teora/ Soy bean flour and an edible mushroom, *Pleurotus cretaceus,* the last from the Punjab. A sample of **dried** flower **heads of** *Strobilanthes fotios\is* T. Anders, was examined to ascertain if the oleo-resin which they were found to **contain to the extent of 9 per cent, could be put to any commercial use. In addition** to the **oleo-resin the heads afforded 3-18 per cent, of wax and**

0-5 per cent, of sugar, which may explain why they contribute largely to the bee food found in the jungles of the Bombay Presidency.

***Medicinal 'products.*—A sample of the root of *Alhagi camelorum* Fisch.** " Camel thorn " a species reported to possess febrifugal properties, disclosed oir'chemical examination no ground for supposing the species possesses the virtue attributed to it. Belladonna roots cultivated at Jeolikote by the Superintendent of the Kumaon Government Gardens were found on chemical analysis to be of average medicinal quality. A description of the sorts of *Coptis* root procurable in India and a comparative analysis of them have been communicated by Mr. Hooper .to the Pharmaceutical Journal. Preparations of the bark of *Croton Tiglium* L. said to be used by the Abors as an arrow poison were made for a physiological investigation conducted by Major J. W. D. Megaw, I.M.S., of the Calcutta Medical College. Samples of the gummy incrustation on *Gardenia turgida* Roxb. sent by the Deputy Conservator of Forests, Garhwal, were found to contain mannite. The examination of some samples of cultivated ginger root from various parts of India proved great variation in the amount of extract and of oleo-resin. An experiment made in the Kumaon Government Gardens in conjunction with analyses performed by Mr. Hooper demonstrated that young ginger develops more oleo-resin the longer it is allowed to grow. A sample of stigmas and anthers of *Crocus sativus* L.—the stigmas of which constitute the true saffron of commerce,—forwarded by the Revenue Commissioner in Baluchistan, was found to be—as far as the stigmas were concerned—of excellent quality. Samples of Indian blister beetles *Mylabris cichorii* Fabr. obtained from the Medical Store Depots were analysed. The results showed that the drug used in India contains over 1 per cent, of cantharidin, and that one year's storage at least has no deteriorating effect on the vesicant principle. A sample of *Cantharis hirlicornis* from the Murree hills yielded as much as 2·02 per cent, of cantharidin.

III. **Library and Ledger Work.—**During the year over 1,200 books and eight new journals were added to the Library. What are now superfluous numbers of copies of necessary reports and periodicals, and superfluous reports and periodicals will be cut out during the coming year. The distribution of such Ledger files as could not be appropriately retained by the Botanical Survey to the other Scientific Departments of Government concerned, was carried on through the last nine months of the year. At the end of the year 136 files had been transferred to the Geological Survey, 18 to the School of Art, 6 to the Civil Veterinary, 1,813 to the Forest and 158 to the Agricultural Departments respectively. There remained at the end of the year a considerable number of files still to be distributed. Ledgering work will henceforth be confined to the collection and arrangemtat—on modified lines—of information on such subjects of economic and industrial interest that come more appropriately within the now enlarged sphere of the Botanical Survey Department than within that of any of the other Scientific Departments of Government.

IV. **Publications.**—During the year the following numbers of the Records of the Botanical Survey appeared :—

Vol. IV, No. 5.—*The Vegetation of the Zemu and Llonakh valleys of Sikkim,* by W. W. Smith and G. H. Cave.
Some additions to the Flora of the Eastern Himalaya, by W. W. Smith.
Some additions to the Flora of Burma, **by W. W.** Smith.
Three new species of the Compositce from Southern India and a new Justicia from Assam, **by W. W.** Smith.

Vol. IV, No. 6.—*Determinations of the Prickly Pears now wild in India,* by I. H. Burkill.

Vol. V, No. 2.—*Catalogue of the non-herbaceous Phanerogams cultivated in the Royal Botanic Garden, Calcutta, Part I, Numerical List,* **by A. T. Gage.**

Val. V, No. 3.—Ditto (continuation).

Three other numbers are about to issue from the press. The Records at present are in the flourishing but somewhat embarrassing condition of having more material for publication than the rate of issue can overtake. No. 4 of the Agricultural Ledger of 1911-12 was published during the year undei^the **title "** ***Cinchona in Java from 1872 to 1907, being extracts translated font the Scheikundige Bijdragen Tot de Kennis der Java-Kina 1812-1907 by the, late K. W. van Gorkom, arranged with an introduction by D. Hooper.*** **In** addition to the papers published in the Records and Agricultural Ledger officers of the department have published various other botanical papers in non-official publications and in official publications of other departments of Government. These and other papers by officers not officially connected with the department will be more appropriately mentioned in the more comprehensive account of both departmental and extra-departmental research conducted during the year that will later be submitted through the Board of Scientific Advice.

V. **Staff.**—The Director was absent on privilege leave from 21st April to 2nd July 1911, during which time Mr. I. H. Burkill officiated in addition to his substantive duties as Economic Botanist to the Botanical Survey of India. Up to the 31st January 1912 Mr. Burkill was Assistant Reporter on Economic Products officiating as Reporter, and thereafter on the abolition of the Reportership became Economic Botanist to the Botanical Survey which post he held for the remainder of tfce year. Mr. D, Hooper was Curator of the Industrial Section of the Indian Museum throughout the jrear. Messrs. S. C. Bannerji and R. S. Ramaswami, the assistants on probation for Systematic Botany, worked well throughout the year. The clerical staff of the department also gave satisfaction.

VI. **Financial.**—On the Systematic side there was a saving of Rs. 301-9-9 on the travelling allotment of Rs$_f$ 1,500, of Rs. 375-1-6 on the contingencies allotment of Rs. 1,500 and of Rs. 286-1-8 on the allotment of Rs. 2,000. for exploration. On the Economic side there was a saving of Rs. 372-11-0 on the travelling allowance of Rs. 3,700, and of Rs. 55 on the sum of Rs. 2,845 that after reappropriation stood for contingencies. In the Industrial Section of the Indian Museum there was a saving of **Rs. 1,101-7-11** made up of Rs. 858-8-0 on rent of No. 2, **Chowringhee Lane,** Rs. 240 on pay of carpenter and Rs. **2-15-11** on pay of Jemadar.

A. T. GAGE, ***Major, I.M.S.,***
Director, Botaniral Survey of India.

& O. P. LF-NO. * D. & a I.-64-12-460.

: Report of the Botanical Survey of India for the year 19124913.

I. Systematic.—*Eastern India.*—The work of cataloguing the trees and shrubs of the Royal Botanic Garden, Calcutta, has again this year taken up a considerable part of the Director's time. Towards the end of the year many species which were found difficult to determine from comparison with the Sibpur Herbarium material were collected and taken to Kew where they will be worked out. The volume referred to in the opening paragraph of last year's report has been issued and this means an addition of about 3,500 extra plants catalogued. Eastern and Southern India have practically monopolised as regards field work the energies of the Botanical Survey staff. In January and February 1913, the Director toured in the district of Burma and was thus able personally to supplement the excellent work of Forest and other Government officers and private individuals who have been the mainstay of botanical research in this province. The parts explored lie in North Arracan and the Toungoo district of Lower Buraifl. In North Arracan Major Gage explored the district east of Paletwa lying between the Kaladan and Mee Eivers, chiefly in the neighbourhood of Kyaukpauflaung. In Lower Burma he*botanised at Thandaung north-east of Toungoo. As the collections have gone to Europe it is impossible as yet to say much of how they will turn out, but as the idea was that of intensive collection from a limited area rather than extensive collection within a wider field it might be justifiable to predict the existence of interesting if not new species. Some hundreds of sheets were obtained and the weather proved favourable, allowing of their collection and preservation under the best possible conditions. From Burma Mr. J. H. Lace, Conservator of Forests, sent a small but very interesting collection made by Captain Abbey and himself. During the year he has also published a " List of trees, shrubs and principal climbers, etc., recorded from Burma." The list which supplies vernacular names follows the arrangement of the Flora of the British India except that the species are arranged alphabetically under each genus. It should prove a most useful pocket guide to field workers who have already reached the stage of being able to identify families. Mr. D. Hooper, Economic Botanist to the Botanical Survey, has contributed about 600 sheets which he had obtained at various times in the Eastern Himalaya, Bengal, Burma, Assam and Southern India, etc. Mr. C. G. Rogers, Conservator of Forests, Burma, has continued to support botanical work and a small though interesting collection of about 43 sheets has been sent for identification and record. During the year Mr. Lace has contributed some 200 sheets to the Herbarium. Mr. Jacob, who has been deputed from Assam as Forest officer to Bhutan, has sent an excellently preserved set consisting of about 200 sheets from this little known region. A small collection of mosses found at Mungpoo by Miss Warrack during the hot weather and rains of 1912 has also been presented to the Herbarium, and Mr. Cave, Curator of the Lloyd Botanic Garden, Darjeeling, who has done excellent work in helping on the Survey of the Eastern Himalaya, has sent about 500 specimens and a similar number of specimens has been presented by Mr. B. J. Gould, I.C.S., British Trade Agent at Gyantse. The largest donation of the year has been from the Regius Keeper, Royal Botanic Garden, Edinburgh, who has sent over 7,000 specimens which formerly formed part of Wight's Herbarium. These arrived in a good state of preservation and are being mounted and laid in. The collection has been drawn from all parts of India and its value is greater in that it includes a number of "co-types." Our knowledge of the botany of Eastern India has been enriched by the publication in the Kew Bulletin of several new and interesting species. Mr. W. G. Craib and Mr. J. S. Gamble have been the chief contributors to this work. The species described have been collected mostly in Burma and the Shan States, but Siam, the Malay Peninsula and the Eastern Himalaya have also yielded many noteworthy additions. As regards Herbarium work the following collections have been studied :—

(1)^ Mr. Meebold's collections in Mergui, Thaton and Salween in Lower Burma made in 1911-12. Nearly 2,000 specimens were worked out and listed for Mr. Meebold. The main features of this

collection were the conspicuous preponderance of the Malayan element in the floca, the occurrence of well marked endemic forms of typical Malayan species and the scarcity of Upper Burmese plants.

(2) Captain Toppins' Kampti Long Mission collections made in 1911-12. About 800 sheets underwent examination. The families Leguminosae, Eubiaceae and Acanthacese seem to be well represented in the district.

(3) A small collection of plants made by Mr. Meebold at Mungpoo in the beginning of 1912 was worked out and several gaps in the Sikkim Local Herbarium filled.

(4) A collection of 789 specimens made by Mr. I. H. Burkill and Mr, S. C. Banerji in the Khasia and Jaintia Hills in 1911 was worked out and yielded five new records for the locality.

(5) Out of 2,022 specimens of Phanerogams and Ferns collected by Mr. Burkill during the Abor Expedition of 1911-12,1,442 specimens were studied at Sibpur.

(6) A set of 160 sheets sent at various times from various parts of Burma by Messrs. J. H. Lace and C. G. Rogers, contained on examination some interesting additions.

Western India-—Apart from Mr. Hooper's donations mentioned elsewhere, little has been received from Western India, but a revision of the publications of the year shows that botanical work on this side of India is being well supported. Mr. G. A. Gammie has added materially to our knowledge of the orchids of the Bombay Presidency and an excellent revision of the Flora of Aden has been completed by Father E. J. Blatter, S. J., whose " Flora of Aden " is at present in the Press and will appear in parts in the Records of the Botanical Survey of India. The same author continues to publish in the Journal of the Bombay Natural History Society an exhaustive account of the Palms of British India and Ceylon, indigenous and introduced. The work is beautifully illustrated by photographs and drawings which greatly enhance its value.

Southern India.—During the year the Director was able to depute two of the limited Botanical Survey staff to this part of the Peninsula. In February 1013, Mr. Hooper, Economic Botanist, and Mr. Ramaswami, Assistant in the Botanical Survey, toured in the Tinnevelly district collecting and making copious notes on the flora. The expedition resulted in the acquisition of about 700 sheets and of these about 500 have already been studied. So far the most extensively represented natural order in the collection is Leguminosae with 52 species followed by Composite with 32, Convolvulaceae, Acanthaceae, Labiate and Filices with 25 each, Verbenaceae with 18 and Euphorbiacese and Urticaceae with 13 each. The remaining natural orders contain fewer than 10 species each. Mr. C. E. C. Fischer, Deputy Conservator of Forests, has contributed over 600 specimens collected from Coimbatore, Anaimalai and Palni hills. Among the sheets sent were a few which form excellent examples of new species recently described by Mr. W. W. Smith from Southern India. The services of the Reverend St. Munch, S.J.$_f$ and Reverend A. Sauliere, S.J., both of the S. H. College, Shembaganur, have been enlisted and both have ungrudgingly contributed large collections from the Madura district and have done much to help on the Survey in the Southern Peninsula. In all about 700 sheets have come to hand, but the limited staff of the Herbarium has not been able to cope with all the demands for floral analyses and a considerable number of the Madura plants still awaits identification. From what has been accomplished, however, it becomes evident that the typical Deccan Flora is well represented in the districts explored.

North-West India.—Field work in this division of the Peninsula has been chiefly kept up by Captain L. A. Watson and Lieutenant G. G. Everett, both of the 67th Punjabis. The former contributed about 150 sheets of Baluchistan plants and the latter **a** small collection from the same area. As regards systematic work on North-West India plants gathered during the **yoar,** » collection of **about 100** .Sind **specimens** sent by Mr. Hole of the

Forest Research Institute in Dehra Dun supplied several valuable additions and many noteworthy species, not previously recorded, were observed. A *Tephrosia* was thought to be new and was sent to Kew for favour of examination. Kew has since declared it to be new. Mr. H. M. Chibber's collections from Baluchistan were also worked out, but as the specimens were very incomplete the collection was only partially named. Still the list of species will show that it possesses considerable interest. The flora is very different from that of the adjacent Indus plain and the Persian and Arabic element is strongly represented. The collections made last year by Lady Douie and Mr. K. S. Imam-ud-din in Kulu and Pangi have also been studied.

II. Economic.—Mr. Hooper has examined 271 samples of various products during the year and the following notes on the results of his investigations are submitted.

Gums, etc.—Sarcocolla gum is one of the most peculiar natural secretions of plants. Exuding from a shrub identified as *Astragalus fasiculifolius,* Bois., growing in Persia, it is largely exported to Bombay, and is used in medicine and for adulterating opium. It is sweetish to the taste and dissolves for. the most part in alcohol and in water. It is not a true gum, resin or guttd, but consists principally of a glucoside, sarcocollin, which differs in properties from saponin and glycyrrhizin.

Balsamodendron Play fair ii, Hk. f.—This shrub growing on the Somali Coast yields a peculiar soapy gum called " Hotai " which is sent in large quantities to Bombay. It disintegrates in water forming a persistent lather and is used for washing the hair. It contains an acid resin, soluble in ether, and saponin. The occurrence of saponin in a natural exudation is peculiar. Another substance of a similar nature was collected on tour in Karachi. This is called " Dakh " and is brought from the Mekran Coast, Persian Gulf, and is also used by women for washing the hair. It differs from the above in its appearance and composition, but contains a resin and saponin as its principal constituents.

Canarium bengalense, Roxb.—A sample of this resin was presented by Mr. Kemp of the Abor Expeditionary Force. It had the usual properties of a dammar and is used for burning and cementing purposes.

Sealing wax.—Twenty-seven samples of red sealing wax were tested for the Controller of Printing, Stationery and Stamps, Calcutta.

OUs.—Papaw seeds,—The seeds of the ripe fruit of the Papaw *(Carica Papaya,* Linn.) which are usually thrown away as useless were submitted to analysis. The small black seeds have a pungent mustard-like odour and yield an allyl compound when distilled with water. They contain over a quarter of their weight of a yellow fixed oil. The centesimal composition is: water 8-2; oil 26-3; albuminoids 24-3; carbohydrates 15·5; fibre 17·0; ash 8-8.

JLitscea polyantha, Juss.—This is a small evergreen tree met with from the Punjab along the foot of the Himalayas eastwards to Assam. The seeds yield an oil which is used medicinally. A sample of the fruits from Golaghat, Assam, was examined. The cleaned seeds yielded 21-2 and the kernels 33 per cent, of a white crystalline fat; melting at 38-5°. The constants were: acid value 98-9; saponification value 244-8; iodine value 34-4. The fat is of a useful nature, and consists very largely, like that of other Litsaeas, pf lauric acid.

Cotton seed,—The Director-General of Commercial Intelligence has sent for examination samples of refined oil, decorticated cotton seed cake, and hulls. These were found to have a good appearance and to be quite up to the standard in composition of similar products in the European markets.

Soy beans,—Experiments are still being continued in the cultivation of Soy beans in Northern India. The habits of the plants and the character of the seeds are so various that some care has to be exercised in selecting suitable sites for the different varieties. The Superintendent of the Government Gardens, Kumaon, planted Hollybrook Soy beans at Douglas Dale and Ramgarh. Analysis showed that the seeds grown in the first locality gave 18-26 per cent, of oil and those grown at the second locality gave 14-26 per cent.

Also samples of Gun bean grown at Douglas Dale yielded 18-66 per cent, of oil and when grown at Ramgarh yielded 15-74 per cent.

The Director of Land Records and Agriculture, United Provinces, sent samples of the same kind of Soy bean grown in four different villages. They afforded 14-3, 12-2, 12-6 and 11-6 per cent, of oil.

Ochrocarpos siamensis, T. Anders.—Flowers of this tree, called " Tharapu " in Burmese, were received from Mandalay. They are interesting as yielding a perfume resembling violets, and the principle may be extracted by means of oils and fats.

A supply of the seeds of the plant was also received from Mandalay and they were tested with the object of discovering whether they were oleaginous as other seeds of the Guttiferae. Dr. Dymock speaking of *0. longifolius* says, "' The seed exudes a viscid gummy fluid when cut." The seeds of " Tharapu " yielded to ether seven per cent, of a fragraht yellow acid resin. The occurrence of a resin in place of oil in the seeds of Guttiferse is peculiar.

Nephelium Longana, Camb.—The fresh fruit afforded 13 parts of skin, 60 parts of pulp and 27 parts of seeds in 100 parts. The seeds which are a waste product are sweetish and slightly astringent and contain much starch. Chemical analysis showed them to contain: moisture 10-0; oil 3-86; albuminoids 6-25; carbohydrates 73-76; fibre 3-6; ash 2-5. They are not oil seeds, but the composition shows them to have a feeding value equal to that of some cattle foods.

Fibres.—Plectranthus Wightii, Benth.—This plant was sent from Assam, where it is called " Adurantum," as a paper-making material. Samples of the dried plant yielded from 33-6 to 37-16 per cent, of cellulose.

Food stuffs.—Rice.—The Director-General of Commercial Intelligence sent several samples of rice from Burma to ascertain if any difference in the composition accounted for the difference in the price. Samples of rice from Japan and Java with a high valuation were also sent for the same purpose. As the result of a complete analyses of all the specimens there was nothing in the chemical composition to indicate the relative value of the samples, the difference in the price being in the appearance.

Edible roots.—The Director of Agriculture and Industries, Central Provinces, has furnished this office with an interesting series of tuberous roots eaten by the inhabitants. Some of these being supported by botanical specimens were identified and found to be new to Economic Botany, and analyses were made of the more important ones.

The list included the following :—

(1) *Hibiscus* sp. Ban bhendi or Khapsi Kand. (2) *Pycnocycla glauca,* Lindl. Tejraj. (3) *Peucedanum Dhana,* Ham. Kamraj. (4) *P. glaucum,* DC. Bhojraj. (5) *Eulophia* sp. Bansinghara. (6) *Habenaria platyphylla,* Spreng. Chilam chatta.

The tubers were palatable and nutritious. The *Eulophia* and *Habenaria* roots of the orchid family afford salep which is considered a nutritious food among Mahomedans.

Tea.—Ten samples of Shan tea were sent by the Commissioner of Police, Rangoon, for favour of examination and report. The leaves had a uniform moisture, extract and ash content and when minutely examined had the appearance and character of genuine tea leaves.

Vitis lanatn, Roxb.—The fruits of this vine called " Purain" in Kumaon are edible and may be bottled like other fruits. A sample that had been prepared for the Allahabad Exhibition deposited crystals in the bottle after standing a few months. This incrustation was examined and found to consist of acid tartratc of potassium, a salt deposited in grape juice in the manufacture of wine from ordinary grapes.

Fnyaria Vrsca, Linn—The ground root stocks of the wild strawberry plants are used by Kashmiri villagers who cannot afford tea or coffee. The powdered root yielded a somewhat bitter extract containing 9-4 per cent, of tannin.

Drugs.—Atropa Belladonna, Linn.—It was shown last year thai the roots of Belladonna plants grown at the Kumaon Botanical Garden yielded 04 per cent, of alkaloid when one year old and 0*45 when two years old. A sample of roots from three year old plants was received this year and was divided into thin and thick roots. The former yielded 0-4 per cent, of alkaloid and the latter 0-44 per cent, showing that the root does not increase in alkaloidal content after the second year.

The leaves of Belladonna grown in the same gardens were also examined. Leaves from one, two and three year old plants afforded 0-48, 0-49 and 0;49 per cent, of alkaloid respectively. This indicates that leaves from plants of different ages do not show much variation in composition.

Glycyrrhiza glabra, Linn.—A sample *pi* liquorice root grown in Baluchistan was tested for solid aqueous extract. This amounted to 27-75 per cent, which is well above the Pharmacopoeia limit of 20 per cent.

Mineral substances.—Plant ashes.—Several analyses were made during the year of plant ashes having a special reputation for industrial purposes. The ashes of the following plants were tested: *Artemisia vulgaris, Bambusa* sp., *Carica Papaya, Musa sapientum, Phoenix paludosa* **and** *Suaeda maritima.* The ash of the plantain was made a special study, since it has Ions been used in India as an alkaline mordant, by dhobies in place of soap, by doctors as a medicine, as a crude form of table salt and as a manure. It Was therefore considered worthy of enquiry to examine samples of the ash of this plant to discover if they possessed any uniformity of composition and an alkalinity superior to that of other plant ashes. Museum samples were found to have a water soluble extract ranging from 7-94 to 27-51 and insoluble silica from 22-2 to 52-04 per cent. The ash of samples of leaves collected and ignited under supervision were next tested, but these showed striking differences in composition and no single element existed in a constant proportion. The lime, potash and phosphoric acid have a certain value in agriculture and the alkali is useful as a mordant and for detergent purposes, but there is no standard composition.

Tamarix PaMasii, Desv.—Among some specimens received a few years ago from Baluchistan was a sample of salt said to be yielded by a species of Tamarisk. These bushes are known to yield a saccharine exudation like manna, but the exudation of a saline substance is remarkable. The sample of salt had the following composition: volatile matter 7-7, sodium chloride 48-7, sodium sulphate 24-6, calcium chloride 6-9, iron oxide, etc., 5-0, silica and sand 7-1 per cent. It is ta be inferred that this saline substance is an incrustation left on the plant after the subsidence of the flood water which in the regions where Tamarisks grew is highly charged with mineral salts.

III. **Library.**—During the year 50 books were presented to the library and over 300 books and periodicals purchased. The Asiatic Society of Bengal are desirous of publishing a catalogue of scientific literature in the libraries in and around Calcutta, and with a view to supplying material for this purpose the books of the Botanical Survey are being listed with those of the Royal Botanic Garden.

IV. **Publications.**—During the year the following numbers of the Records of the Botanical Survey appeared:—

Vol. IV, No. 7.—*The Alpine and Sub-Alpine Vegetation of South-East Sikkim* by W. W. Smith.

Vol. V, No. 4.—*Catalogue of non-herbaceous Phanerogams cultivated in the Royal Botanic Garden, Calcutta. Part 1 (numerical list)* **by A. T. Gage.**

Vol. VI, No. 1.—*Piperacec B nova e Peninsula Malayana* **by C. de** Candolje.

V. **Staff.—**From 1st April 1912 to 14th March 1913 Major A. T. Gage, I.M.S.! was Director. On the latter date he handed over charge to Mr. C. C. Calder. Mr. I. H. Burkill was Economic Botanist to the Survey from the 1st till 17th April 1912, when he went on combined leave. Thereafter Mr. D. Hooper officiated till 16th October 1912 as Economic Botanist and on Mr. BurkilFs resignation was appointed permanently to the post, charge of which

lie held during the remainder of the year. Up to 14th MarcK Mr. M. S. Ramaswami was Assistant, on which date he was deputed to act as Curator of the Herbarium, his post as Assistant being taken by Mr. P. M. Debbarman. Mr. S. C. Banerji held charge of his post as Assistant throughout the year. My thanks are specially due to Mr. Hooper for his unfailing support and to Messrs. Ramaswami and Banerji for their valuable assistance in the Herbarium. The clerical staff of the Department have worked well.

VI. Financial.—On the Systematic side of the Botanical Survey there were the following savings under their respective heads: under travelling allowance Rs. 179-8-3, under maps, books, plates, etc., Rs. 10-2-0, under miscellaneous Rs. 20-2-11, and under exploration Rs. 55-2-0. The allotments for furniture and post and telegram charges were spent in full.

On the Economic side there was a saving of Rs. 293-3-0 under travelling allowance and of Rs. 18-13-2 under contingencies.

Grants for the Industrial Section were spent in full.

C. C. CALDER, B.Sc, B.Sc. (AGRL), F.L.S.,
Officiating Director, Botanical Survey of India.

ft. G.P. I.-Ko. 4 8. B. 8. A.—29-7-18.

Beport of the Botanical Survey of India for the year 1913-1914.

I. Systematic—*Eastern India.*—During the year an "Alphabetical List of non-herbaceous Phanerogams in cultivation in the open in the Royal Botapic Garden, Calcutta " was compiled and issued by the Director in hiv capacity as Superintendent of the Garden. The list is of the nature of a provisional oindex to the systematic part of the catalogue which is being prepared by Major Gage and will, it is hoped, facilitate exchange of plants, seeds or material for systematic, anatomical, physiological or chemical investigations with other botanical institutions. The Director, during leave, continued his study of the Indian Euphorbiaceae with a view to monographing the family and also worked out and determined several critical species ftfrwarded to him.

„ As regards field work, Messrs. D. Hooper and S. C. Banerji were deputed, the former in October 1913, the.latter in February 1914, to explore botanically, a portion of the Garo hills. The tours resulted in the acquisition of over 800 specimens. These have been studied and several new records for the area were discovered.

Rai Bahadur U. N. Kanjilal, who is engaged in the preparation of descriptive Jists of the Forest trees and shrubs of Assam, presented about 600 sheets of Sisam plants to the Herbarium. These were partly worked out in the Herbarium and determinations given him. The specimens presented form a very valuable addition to our collection of Assam plants. Mr. Cave sent as usual a large cumber of specimens for seed distribution purposes. These were also studied and as aTesult, several gaps in the Sikkim Local Herbarium are being filled. The mosses collected by Mr. Burkill, formerly Economic Botanist to the Botanical Survey, during the Abor Expedition of 1911-12, were determined by Mr. H. N. Dixon whose results have been published in Volume VI, No. 3 of the Records of the Botanical Survey of India. Six species new to science are described besides a few which are noted as indicating interesting extensions of geographical range.

Of other contributions from Eastern India, the outstanding one is a collection received from Mr. J. H. Lace, l§te Chief Conservator of Forests in Burma. Mr. Lace has continued Ms work on the Flora of the^Maymyo Plateau and sent about 400 sheets of plants from that district. These were studisd and found to contain several new species. Our knowledge of the Botany of Burma has further been considerably enriched during the year by the publication both in the Kew Bulletin and in the Records of the Botanical Survey of India oi several species new to science. The chief contributors have been Messrs. J. S. •Gamble, W. G. Craib, W. W. Smith, M. S. Ramaswami and S. C. Banerji. Messrs. Smith and Cave published notes on the himalayan species of *Daphne* and on the East himalayan species of *\Alangium* in the Records of the Botanical Survey of India.

Western India.—Excepting a few specimens received at intervals for identification, nothing in the way of regular collections was received from this part of India. Of the publications connected with the Botany of this side of the peninsula the oustanding one for the year has been the first part of Father Blaster's Flora of Aden forming Volume VII, No. 1 of the Records of the Botanical Survey of India. This number is devoted to a complete history of the botanical exploration of Aden beginning with the year 1809, together with a detailed account of the vegetation in all its aspects. Interesting problems suoh as adaptation, relation of flowers to insects, means of dissemination, etc., are remarkably well discussed with special references to Aden plants. Accurate charts, illustrative of the rainfall and temperature, maps and pho ogrip s accompany the bok, the value of which is thus greatly enhanced. Father Blatter has also published a continuation of his exhaustive account of the Palms of British India and Ceylon, indigenous and introduced„ in the Journal of the Bombay Natural History Society.

Mr. L.*T. Sedgwick has continued his studies of the mosses of Western India and has published in the above journal a third list of mosses found pnthaMide.

Central India.—The work of Mr. R. J. D. Graham, Economic Botanist, Central Provinces, has resulted in the publication of a " List of Grasses and Sedges found on the Nagpur and Telinkheni farms including a few common species from other parts of the provinces." In all about 200 species of Grasses and Sedges are described and the hand book should be of use to workers in those two difficult families. The same author has also contributed an article entitled " Notes of a collecting tour at Ramtek, C. P." to the Journal of the Bombay Natural History Society. The vegetation of the district is briefly discussed and about 200 species enumerated. The third volume of the Flora of the Upper Gqngetic Plain by Mr. J. E. Duthie, is in the press and will shortly appear.

Southern India.—During the year the officiating Director and the officiating Curator of the Herbarium toured in the Travahcore State in August and September 1913. The part explored lies north and to a little extent west of the River Achenkoil which runs through the middle of the State. The weather conditions at the time of exploration were not considered particularly suitable for the collection and preservation of plants, but in spite of this drawback over 2,500 specimens were got in good condition. Time has not permitted of the whole collection being worked out, but so far as it has been studied, it would seem that there is quite an appreciable endemic element and a few new species seem almost assured. So far the most extensively represented family is Leguminosae with 54 species followed by Gramineae with 36, Rubiaceae with 30, Acanthaceee, Labiate and Orchidacese with 21 each and Cyperaceae and Composite with 18 each. The remaining families contain fewer than 15 species each. A botanical survey of the whole state is in contemplation and a full report will, it is hoped, be given on the Flora at some future date.

Mr. M. S. Ramaswami, officiating Curator of the Herbarium, has completed his work on the collection of Tinnevelly plants mentioned in last year's report and has prepared and passed for the press a detailed account of his tour and its botanical results with descriptions of the new species. This work will shortly appear in the Records of the Botanical Survey of India. In all some 470 species are recorded

Mr. C. E. C. Fischer, Deputy Conservator of Forests, Coimbatore, has continued to aid the Botanical Survey as usual. He sent during the year about 200 sheets, mostly Anaimalai plants. These were studied and found to contain many of Beddome's original species not mentioned in the " Flora of British India." Large consignments of Madras plants are being sent for the use of Mr. Gamble in the preparation of the Madras Flora. Mention was made in last year's report of a collection of Madura plants sent by Rev. A. Sauliere, S.J. He has again contributed a few hundreds of specimens from the same region. These were all worked out and the names communicated to him. As a result, Rev. A. Sauliere has published a Hand List of the Phanerogams found on the Pulney hills, seven hundred and sixty-one species in all being recorded. A separate list of the cryptogams collected in the same area was also published by the same author. Mr. Dixon has published in the Records of the Botanical Survey of India a report on the mosses collected by Mr. C. E. C. Fischer and others from South India and Ceylon. Half a dozen new mosses are described for the first time.

A collection of over 500 specimens of Madras Plants collected prior to the year 1910 was presented by Mr. M. S. Ramaswami. This contains several introduced species most of which were formerly unknown to have been present in Southern India. From this contribution many gaps in our South India collection of plants have been filled.

The Herbarium staff has undertaken to name up such plants as are sent from the Travancore forest herbarium. Up to date a fairly large number has been forwarded and though time has not permitted of all being worked up the collections indicate that we shall be able to materially enrich our knowledge of this flora. In connection with the publication of materials for a flora of the state this forest herbarium material will doubtless prove valuable.

Messrs. W. W. Smith and M. S. Ramaswami have described five species new to Science from this part of India. The species described have been collected on the Nilgiri, Travancore and Pulney hills.

North-West India.—Lieutenant Kenneth Mason, R.E., of the Survey of India, forwarded a collection of about 60 sheets consisting of 44 Phanerogamic species collected on the Taghdumbash Pamir—a little known frontier region, at an, elevation of 13,000 to 16,000 ft. On working out, the collection has proved to be a highly interesting one for its size and contains three probably undescribed species besides a few which indicate an interesting extension of geographical range. Mr. M. S. Ramaswami has contributed an interesting report on the collection which has been passed for the press by the Survey of India.

Captain F. £. Koebel of the Frontier force contributed over 200 sheets of Kashmir plants. These were studied and found to contain a large number of species characteristic of alpine and subalpine vegetation. Rosacese, Pnmulaceae and Caryophyllese are especially prominent. These were generously presented to the Calcutta Herbarium and form a very valuable addition to our North-West Himalayan plants.

Mr. N. Gill of the Kumaon Government Gardens sent about 400 sheets of Kumaon plants which, on working out, yielded several new records for the at'ea. *fhe* collection is of further interest in that it contains several European and American introduced species and thereby enriches our knowledge of the alien flora of North-West India. A small collection of Delhi and Simla {Wants was presented by Lady Bourne. These, on examination, proved very, interesting and several Simla plants not mentioned in Collett's " Flora Simlensis " were recorded.

Mention was made in last year's report of the field work done by Captain L. A. Watson and Lieutenant G. G. Everett in Baluchistan. Their collections have now been studied and several additions to the little known vegetation of Baluchistan were recorded. As has been already pointed out by the late Sir J. D. Hooker, the flora appears to be oriental in character with an admixture of Himalayan and Indian Plants. The plants from the lower levels, however, are mainly Arabic and Persian species. Two of the specimens in their collections appear to be probably new. Of the extra-Indian contributions; the following are the principal: about 600 Philippine plants-from the Bureau of Science, Manila; over 500 plants from the Buitenzorg Botanic Garden; nearly 30p Scandinavian plants sent by Mr. B. Gross; about 200 plants from the Singapore Botanic Gardens and about the same number of Siamese plants, from the Royal Botanic Gardens, Kew. Smaller accessions of Cryptogams, mostly from Europe, were also incorporated.

The incorporation of named sheets, though not calling for expert botanical knowledge, requires careful apd reliable work and cannot safely be left to subordinates." It is a problem, for it usurps much of the time of the superior staff. Some 10,560 sheets were actually laid in during the year.

The total number of duplicates distributed was 3,655 sheets consisting mostly of Himalayan, South Indian and Malayan species. They were sent to 37 different botanical institutions throughout the world.

II. **Economic.—**With the retirement of Mr. Hooper the chemical part of the work hitherto undertaken at the Indian Museum ceases. Such work of this nature as still continues to be received is being transferred to other departments competent to deal with it. During the year, the work of collecting fresh material for the courts and of renewing old exhibits which had become the worse for exposure, has progressed. Some exhibits which were no doubt magnificent in the section when it partook of the nature of an " exposition " but which are altogether out of place in the Department as it now exists have been removed and other* will be eliminated as suitably fresh material for exhibit becomes available. New and up to date cases and Bottles for the court are badly needed. The old ones are entirely unsujted for the purposes for which such a display as the section contains, exists. Modern requirements indicate a complete gutting and reconstruction and the *beSt* onbcan do under present circumstances is to collect the useful, remove the useless and gradually by elimination and addition to build up a collectioo

suitable for a court consistent with present day requirements. Besides attending to the numerous Economic questions referred to him and generally making himself acquainted with the work and requirements of his section, the newly appointed Economic Botanist has begun the collection of materials necessary for the compilation of the work on Indian plants of Economic importance urged by the Royal Society some years ago. To be of much y?Jije this work will no doubt take some years to complete, but that it is required is shown by the nature of many of the requests for assistance received. During the year ledgering work has been restricted to such subjects as an Economic Botanist might fairly claim and such as are not attended to by departments which have received the old ledger files.

III. **Library.—**Library work was carried on as usual; the number, of accessions by purchase or exchange being 50. A number of index slipg for the periodicals in the library was prepared and supplied to the Asiatic Society of Bengal which is engaged in preparing a catalogue of scientific literature in libraries in and around Calcutta. The officiating Director and the officiating Curator of the Herbarium are engaged in the preparation of an Index to all species of Indian plants not included in Hooker's Flora of British India. This is intended partly for publication and partly for ,a card catalogue for the immediate use of workers in the Herbarium. The Index has now assumed a big size and contains 882 species. It is proposed to publish these as a single number of the Records of the Botanical Survey of India.

IV. **Publications.**—During the year the following numbers of the Records of the Botanical Survey of India appeared :—

Vol. IV, No. 8.—*A general Index to the whole volume* by M. S. Ramaswami and S. C. Banerji.

Vol. VI, No. 2.—*(1) Two. decads of New Indo-Burmese species* by W. W. Smith, M. S. Ramaswami and S. C. Banerji.

***(2) New Indian Didymocarpi* by W. W. Smith,** M. S. Ramaswami, and S. C. Banerji.

(3) A note on the Himalayan species of Daphne, by W. W. Smith **and** G. H. **Cave-**

Vol. VI, No. 3.—*(1) Report on the mosses 6f the Abor Expedition 1911-12* by H. N. Dixon.

(2) Reports on*the mosses collected* by Mr. C. E. C. Fischer *and .others from South India and Ceylon by H. N. Dixon.

Vol. yi. No. 4.—*(1) Note on the East Himalayan species of Alangiumky* W. W. Smith and G. Bt. Cave.

***(2) Species Novce Plantarum in Herbario Horti. Reg. Calcutta-cognitarum Auctore.* bp W. W. Smith.**

Vol. VIII, No. **1.—*Flora of Aden* by Ethelbert Blatter.**

!A general Index, forming No. 6 (1911-12), to the Agricultural Ledger for, the years **1906—1912, also appeared during the year. An appendix to Volume XI of the Annals of the Royal Botanic Garden, Calcutta, being a supplement to Part I " The species of Calamus " with 83 superb, plates by Dr. Odoardo Beccari was also published.**

V. Staff.—Major A. T. Gage, **I.M.S., Director, was on furlough and combined leave throughout the year, during the whole of which Mr. C. C. Caldtr, B Sc., B.Sc, (Agri.), F.L.S., officiated. Mr. D. Hooper, F.C.S., F.L.S., .was Economic Botanist to the Survey until 1st February 1914, on which date he retired from Government service. Dr. H. G. Carter, M.B., Ch.B.,- *was* appointed to the Department on the 13th December 1913 and remained attached until 1st February 1914 when he succeeded Mr. Hooper as Economic Botanist. From the 1st April 1913, Messrs. M. S. Ramaswami, M.A., and S. C. Banerji, M.A., Systematic Assistants, were confirmed in their appointments**

fiiid admitted to gazetted rank. Mr. Ramaswami, however, continued td officiate as Curator of the, Herbarium throughout the year, Mr. P. M. Debburmaji, B.Sc, acting for him. Mr. S. C. Banerji held charge of his post as Assistant throughout the year. The entire staff gave full satisfaction th"9ughout the year.

VI. **Financial.**—There were the following principal savings under their respective ° heads: under contingencies Rs. 798-11-8, under exploration Rs. 947-12-6, of which sum Rs. 945 were reappropriated to other purposes; under menial charges Rs. 89-8-0, under laboratory charges (in part due to closing of laboratory) Rs. 42-10-9, and under post and telegram charges *yH§*. 398-13. Grants for the Industrial Section were practically spent in full, #s. 16-0-3 only remaining out of a grant of Rs. 2,000. Of a total allotment of Ksf 13,020, Rs. 12,201-9-10 have been spent.

C. C. CALDER, B.Sc, B.Sc. (AGRI.), F.L.S.,
Officiating Director, Botanical Survey of India*

CALCUTTA : PRINTED BI BUPDT. OOVT. PRINTING, INDIA, 8, BA8TIMO8 BTRttl

Reoort of the Botanical Survey of India for 1914-15.

I. Systematic—-Kwfera *India.*—In the Eastern Himalaya collections were made by Mr. 0. C. Calder while officiating as Director and by Mr. G. H. Cave, Curator of the Lloyd Botanic Garden, Darjeeling. Contributions from the same area were also made by Mr. E. A. C. Modder of the Kurseong Forest School and bythelate Mr. H. J. C. Kinghorn of Kalimpong. Mr. "W. W. Smith; formerly Curator of the Herbarium at Calcutta and now of the Royal Botanic Garden, Edinburgh, has continued to interest himself in the Eastern Himalayan Flora and has published accounts of a new variety of *Plumbaginella mkrantha* Spach and a new species of *Sedum (S. Prqege}iànum).*

•From Assam, Rai Upendranath Kanjjlal Bajiadur^of the Forest Department, continued to send collections. ^h? Debburman, Asjjjptant in the Botanical Survey, spent his holidays in collecting in Tipperah and has compiled a list of his collections. ,

- No officer of the Botanical Survey was able to visit Burma during the year and circumstances have reduced the help given so generously during the last few years by officers of other departments of Government and by private persons. A considerable amount of work on material previously collected has been done by Mr. Lace, Mr. S. T. Dunn and others and seventeen new Burmese species have been described during the year.

Western India.—The most important work concerned with this side of India has been the continuation of Father Blatter's Flora of Aden, a further large instalment of which has appeared, and the last part of which is now in the Press. A collection of plants from the Belgaum District was presented by the Forest Botanist.

Northern J»<«a.-The first part of Vol. Ill of Mr. Duthie's Flora of the Upper Gangetic Plain, including descriptions of species in the families from *Wyctaginacece* to *Ceratophyllacece* is ready for issue, and a continuation bringing the work up to the end of *Orchidacea* is in the Press. Interesting papers embodying morphological and biological notes on new and little known west-Himalayan Liverworts have been published by Mr. S. R. Kashyap, one new genus and several new species being described.

Central India.—-The fern and allied flora of Pachmari and its neighbourhood has been studied by Mr. R. J. D. Graham, Economic Botanist, who has published a list of his collection. In all he enumerates 36 species of ferns, 1 *JSquisetum,* 2 *Zycopodiacece* and 2 Seiaginellas.

Southern India.—From the Anamalai Hills nearly 100 sheets have been contributed by Mr. C. E. C. Fisher, Deputy Conservator of Forests. Towards the end of the year Mr. C. C. Calder, Curator of the -Herbarium, was deputed to continue the investigation of the vegetation of Travancore. Considerable progress has been«made in the preparation of the Flora of Madras by Mr. J. S. Gamble, C.I.E., F.R.S., and Mr. 8. T. Dunn, at whose disposal the Madras collection of the Botanical Survey have been placed. Mr. P. F. Fyson has given much attention to the flora of the Presidency and has described during the^ear a considerable number of new species. Daring July and August 1014 Mr., M. 8. Bamaswami, Assistant for Systematic work, explored the VeUgonda hills of the Nellore District and the fiampa country. About 660 species were collected, and most of them- have been determined.

General.—Tf&iher Blatter has continued his erudite work on the Palms of British India and two more instalments have appeared during the year. Dr. Beccari has almost ready for the Press a continuation of his fine work on the LepidocaryesB Palms of Asia. Sir David Prain has published an aooount of some additional species of *Meconopsis* with a key to all the known species, many of which are indigenous to the Himalayas. The writer's studies of the Indian and Malayan *Euphorbiaeece* were interrupted by his recall to India in August of last year, when his manuscripts had to be left behind. Only recently has opportunity occurred of resuming to a limited extent this work, which will take a considerable time to finish.

Industrial Section, Indian Museum.— *Public Gallery.*~During the year progress has heen made in eliminating from the public gallery mere shop window exhibits of the wares of private firms that are of rio educational value and that are out of place in a museum as distinct from a commercial exhibition* A general scheme has been drawn up for the gradual transformation of the gallery into a display of the principal vegetable products of India and their sources arranged on as nearly as possible a natural system of ascent, those products that serve primary necessities such as food, shelter, clothing, medicine coming first and those that foster secondary requirements or luxuries such as dyes or ornaments, coming last. It is intended to arrange the products within each group again on a natural system according as to whether they are yielded by roots or stems or leaves or flowers or fruits or seeds. It is hoped that means will be available hereafter of supplementing the actual specimens where desirable with coloured figures and photographs. As the educational value of a museum depends not so largely on how much is exhibited but on how the exhibits are arranged, care will be taken to avoid attempting to show too iriuch or to overcrowd individual cases.

Many of the old cases are unwieldy and defective in design, so a new type of case has been designed, and five new cases installed. These cases being made of metal sheathed with wood are light yet strong and cause as little obstruction as possible to the view of their contents. Their number will be added to every year.

Two sets of maps, one of India and adjoining countries, the other of the world, and a special form of stand for their proper exhibition have been devised for showing the geographical distribution of products or the plants that afford the products.

The collections generally are in a fair state of preservation but a good deal of purging is still required. About six thousand labels were renewed during the year, but labelling work—which plays an important part in the general effect of a museum—is much handicapped by the lack of a label-printing press, an adjunct which it is hoped will be available in the near future. Over 400 products were added to the collections, over a hundred of which have been placed in the gallery.

Library.—The additions to the Library amounted to 982 volumes.

Publications.—During the year the following numbers of the Records of the Botanical Survey appeared:—

Vol. VI. No. 5. A Botanical Tour in the Tinnevelly Hills by M. S. Ramaswami, pp. 105-172, with map and 2 plates.

Vol. VII. No. 2, Flora of Aden by E. Blatter, pp. 81-336.

Staff.—Mr. 0. C. Calder, B.Sc., B.Sc. (A^ri.), F.L.S., officiated as Director until the 8th September 1914, thereafter Major A. T. Gage, I.M.S., resuming substantive charge. Dr. H. O. Garter, M.B., Ch.B., was Economic Botanist to the Botanical Survey and in executive charge of the Industrial Section of the Indian Museum throughout the year. Mr. M. S. Ramaswami, M.A., B.A., F.L.S., reverted from officiating as Curator of the Herbarium to his substantive post as Assistant in the Botanical Survey on the 9th September 1914. He was on combined leave from 31st October 1914 to 29th April 1915. Mr. Debburman was Assistant on probation for systematic work and Mr. E. F. Vieux was Assistant Curator of the Industrial Section of the Indian Museum throughout the year. All the executive and ministerial officers have shown commendable zeal in carrying put their duties.

Financial.—The toted budget allotment for the year was Rs. 42,500 of which Rs. 2,515 remained unspent at the end of the year.

A. T. GAGE, *Mqjor,I.MJi,*

Director, Botanical Survey of Mia.

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Report of the Botanical Survey of India for 1915-16.

I. Systematic.—*Eastern India.—The* usual collections of high level seeds for distribution to temperate regions of the globe were made by Lepcha collectors in Sikkim under the supervision of Mr. G. H. Cave of tfar Lloyd Botanic Garden, Darjeeling. A prolonged tour through Bhutan was made by Mr. R. E. Cooper, primarily for collecting seed on behalf of a private firm. A general account of the vegetation of the areas traversed by Mr. Cooper has been prepared by him and offered for publication in the Records of the Botanical Survey of India, where it will appear in the future. Professor I. B. Balfour of Edinburgh University and Mr. W. W. Smith formerly of the Royal Botanical Garden, Calcutta, have described several new species of *Primula* from the Eastern Himalaya. From the same region Dr. Stapf has described a new species of *Sarcococca (S. Wallichii)* originally collected nearly a eontury ago by Wallich; M. Raymond Hamet has described two new species of *Sedum,* and Mr. W. G. Craib a new species of *Acacia.*

In Assam Rai TJpendranath Kanjilal Bahadur has continued his explorations and has generously presented many duplicate specimens to the Botanical Survey. His collections have yielded a new species of *Bassia.* At the beginning of the year and again in the autumn Dr. H. G. Carter, Economic Botanist to the Botanical Survey, explored the district of Lakhimpur in the extreme North-East of Assam, paying particular attention to the cultivated plants of the district. The Botanical Surrey is greatly indebted to Mr. L. 0. Clarke, I.G.S* Deputy Commissioner of Dibrugarh, Mr. *W.* C. M. Dundas, C.I.E., Political Officer, Sadiya, and Mr. H. M. Pricbard, I.C.S., Assistant Commissioner, North lakhimpur, for the aid they afforded Dr. Carter in his tours.

Jlr. P. M. Debbarman, Assistant for Systematic work contributed a large collection of specimens from lipperah.

* In Burma Mr. A. Rodger, Forest Research Officer, has materially aided the Botanical Survey by presenting duplicates of his extensive collections. Other collections from Burma have been studied by Professor Balfour and Mr. W. W. Smith of the Edinburgh Royal Botanio Gardens and both they and Messrs. Craib, Dunn and Lace have described a number of new speeies. Mr. C. E. Parkinson of the Forest Department has contributed over 200 specimens from the Andaman [illegible].

In Bengal the late Mr. Ramaswami made a local collection of aquatic plants, studied their oeoology and contributed the results of his observations to the last meeting of the Indian Science Congress. Mr. C. C. Calder has recorded an interesting introduction to Bengal from the West Indies in the form of *fytiveria aUtacea* L., a species of the family *Phytolacoaeeae.* This already shows A tendency to spread with undesirable freedom.

Mr. J. C. Carroll of the Imperial Forest Service contributed a particularly good collection of the characteristic swamp plants of the Sunderbuns, some of which have been forwarded to Professor Percy Groom of the Imperial College of Science for detailed study. In the collection occurred a specimen of *Bruguiera parviflora W.* & A* a speeies which has only onee previously bees reported (by Goodlad in 1796) from the Sunderbans.

Western India.—Mr. H. M. Chibber has published a very useful list of the families and genera* of Bombay plants with derivation of the names. The vegetation of Gujarat has been studied in detail by Messrs. L. J. Bedgwick, I.C.8., and W. T. Saxton of the Indian Educational Service. The results of their researches form the subject of an interesting paper which they havecontrfc buted to the Records of the Botanical Survey and which will be published hereafter.

Northern India.—Collections made on the Taghdumbash Pamir by offioen of the Survey of India formed the subject of a paper contributed by the late Mr. tf. S. Ramaswami of the Botanical Survey Department to the Records

of the Surrey of India. Mr. S. R. Kashyap has continued his studies of the* Liverworts of the Western Himalayas and the Punjab and has described about a dozen new species. Professor Balfour and Mr. W. W. Smith have described several new *Primulas* and M. Raymond Hamet a new species of *Sedum* from: the N. W. Himalayas. The first part of Volume III of Mr. Duthie's Elora of. the Upper Gangetic Plain has been published and the continuation from Gymnosperms to the end of *Orchidacea* has been standing in type for a considerable time waiting the final instalment of manuscript from the author to complete the work.

Central India.—Mx. H. H. Haines of the Imperial Forest Department has published a key to the Forest Flora of ,the Southern Circle of the Central Provinces.

Southern India.—Much activity has been shown in forwarding the study of the vegetation of this area. The most important publication has been part I of the Flora of Madras by Mr. J. S. Gamble, C.I.E., the first 200 pages of which dealing with the natural orders from *Banunculacece* to *Aquifoliacea* have appeared. Mr. P. F. Fyson has published an account in two volumes—one of letter press and another of drawings—of the Flora of the Nilgiri and Pulne$; Hill-tops. Nearly oOO species are described, and there are notes on floral: mechanism and on the economic properties of many of the species. A considerable number of new species has been described by Mr. Gamble, Mr.. Hut chin son and others. Collections made in the Anamalai Hills by Mr. C. E. C. Fischer of the Imperial Forest Department, in Madura by the Hev. Father Van Maldaren, in Travancore by Mr. C. C. Calder and the late Mr. Ramaswamii have been worked out as opportunity offered during the year. The Government Lecturing Botanist, Madras, made systematic collection in the districts of Tinnevelly, Chingleput, Godavari and Vizagapatam. A note on the flora and a: list of the plants of tbe Tinnevelly District were prepared for the Gazetteer of that district, and a list of the plants growing; in and around Taliparamba was* also made out.

General.—The Rev. Father Blatter, 8. J. has published the fifteenth instalment—devoted to the genus *Areqa*—of his work on the Palms of British India and Ceylon. Mr. M. O. F. Iyengar has published his observations on the defoliation of some Madias trees, in which he discusses the various. factors that influence defoliation. The Director has described some photographic methods of registering the sizes of plants, while as scanty opportunities have permitted has continued his study of the Indian and Malayan *Euphorbiacea.* Work has continued by Mr. Calder on the preparation of an Index of Indian, species not included in Hooker's Flora of British India.

In addition to the oontributions of Indian plants mentioned above, important accessions of extra Indian plants have been received from the Royal Botanic Gardens of Eew and Edinburgh, the Botanic Garden Singapore, and the Smithsonian Institute of the United States of America.

II. Economic.—In the Industrial Gallery of the Indian Museum work was conducted on last year's lines, although owing to the impossibility of obtaining suitable glass jars for exhibition purposes, as much progress as was* desirable could not be made. Three new-pattern show cases were acquired! during the year, a label printing press and paper cutting machines were indented for, and arrangements for substituting from the beginning of 1916-17 a printer's and an artist's post for the photographer's were Sanctioned. Hitherto the dried specimens of plants to illustrate the source of products such as timbers have been merely duplicates from the Herbarium of the Koyal Botanic Garden, Calcutta, or from the collection of the late Department of*Economic Products. These duplicates although quite in place in Herbarium cabinets are not ideal for jmMic exhibition, so a special collection has been made from living plants in the Royal Botanic Garden, Calcutta, of specimens for exhibition in suitably designed and well finished frames to replace the present somewhat rousp receptacles.

About a score of exhibits have been added to the gallery contcntg, illustrating the products of such species as *i—Albizzia odaratissima, Alcu rites moluccana, Boehmeria nivea> Coptis Teeta, Cor chorus capwlaris, C. olitorius, Dorema*

Atmnoniacum, Ijfykinus floribunda, Hibiscus cannabinus, Pa paver somniferum, Bicinus communis, Sida rhombifolia, Stereospermum, suaveolens. **Some of the** new cases have been utilised for the display of species that yield edible fruits **such as *Achras sapota, Citrus medica, Eriobotrya japonica, Mangifera indka, Nejphelium Lit-chi, Psidium Ouajava.***

During the year experiments were made in the cultivation of various species of medicinal plants. In the Royal Botanic Garden, Sibpur, several plots of *Hyoscyamus niger* (Henbane) were laid down, and analyses of the dried leaves were kindly made by Mr. G- E. Shaw, the Quinologist to the Government of Bengal. The analyses showed that the samples were of normal alkaloidal contents.

On the Bengal Government Cinchona Plantation at Mungpoo, a consider* able quantity of *Digitalis* was cultivated, the dried leaves of which were also analysed by Mr. Shaw. The chemistry of the glucosidea of *Digitalis* appears to be in a very confused condition, and Mr. Shaw expresses the,opinion that until the question is thoroughly worked out the best method of utilising the leaves ia to keep them perfectly dry till wanted and then to make a fresh infusion, not a tincture, as. alcohol extracts a poisonous glucoside—the digitoxin of the latest authors—as well as the useful one.

On the same plantation the cultivation of Ipecacuanha which was introduced many years ago has been greatly extended during the year, over 30,000 plants having been added to stock. *Atropa Belladonna* and *Podaphyllum Etribdi* have also been introduced, but it is as yet too early to form an opinion as to how these species will thrive in the Eastern Himalaya.

Quantities of the seeds of *Gynocardiaodorata, Sydnooarpus JPightiana* and *laraktogenos Kurzii* have been supplied to Lieut.-Col. Sir Leonard Rogers, C.I.E., I.M.S., to the Bombay Bacteriological Laboratory and to the Bureau of Science, Manila, in connection with the treatment of Leprosy.

Investigations into the botanical sources of the various kinds of Asafoetida are being carried on.

Material for the investigation of the poisonous properties of *Zathyras-tativus* seeds by Sir Stewart Stockman of the Board of Agriculture and fishery and by the Imperial Institute, is being supplied.

Material of the leaves of two Rubiaceous trees, *Mitragyna diversifolia* and *M. parvifolia* has been supplied to Dr. Berger of the Lister Institute, London, for the investigation of the alkaloids of those species.

In connection with an enquiry into the possibility of manufacturing Iodine from sea weed in India, collections were made of marine algae from, the Andamans and the coasts of the Bombay Presidency and of Burma. The plants collected were mostly species of *Sargassum.* The Iodine yield did not cover the cost of transport of the plants from the coast.

The. collection of Edible Fungi continues to increase. Preliminary collections of the various species and varieties of Mulberry occurring in Bengal are being made with a view to assist Dr. Maxwell-Lefroy in his work of improving sericulture.

III. Library-—About the usual increase was made to the Library which is housed in the Industrial Section of the Indian Museum.

IV. Publications.—The concluding part (No. 3) of Vol. VII of the Records of the Botanical Survey appeared shortly after the end of the year. This finishes the Volume which is devoted entirely to the flora of Aden, and forms a work of 418 pages, being the most complete account so far published of the vegetation of the Aden Peninsula. Papers in hand include an account by Dr. H. G. Carter of a collection of plants made by Sir Percy Cox, K.C.SX, K.C.I.E., in the Zor Hills in the Principality of Koweit; an account of a collection made in the Eastern Himalaya by Mr. C. C. Lacaita; an account of the plants of Northern Gujarat by Messrs. Saxton and Sedgwick; en account of his Travancorc collections by Mr. C. C. Caldcr; an account of the vegetation of the Anamalai Hills by Mr. C. E. C. .Fischer; the results of Dr. H. C. Carter's explorations in Lakhimpore, Assam; a sketch of the vegetation of Bhutan by Mr. R. E. Cooper; an account of his Manipur collections by

Mr. A. Meebold; a list of the plants of Arabia by the Eev. Father Blatter, S. J.; and a catalogue of the plants of the Lloyd Botanic Garden, Darjeeling, by Mr. G. H. Care.

V- Staff.—The Director and the Economic Botanist were in charge of their respective posts throughout the year. The Department sustained a severe loss in the untimely death of Mr. M. S. Ramaswami, Senior Assistant for Systematic work, on the 19th March 1916. He was a young man of remarkable gifts, of very pleasing personality and of great enthusiasm for the study of plants in all their aspects, and the cutting short of his life of great promise is much *to* be deplored. Mr. F. M. Debburman, Assistant on probation, was confirmed in the Department on the 31st March 1916.

Dr. Carter, the Economic Botanist, has been assiduous in attention to his duties and the other officers of the Department have all worked well.

VI. **Financial.—**There was a saying of Bs. 1,770-13-0 on the total allotment of Jis. 41,800-0-0 for the department.

A. T. GAGE, ***Major, LM.$.,***
director, Botanical Survey of India,

% 0. P. I.-I D. B. S. L- *8-M6-«(Q

Report of the Botanical Survey of India for 1916-17.

I. *&wt6mB.tic--Ea8ternand Northern India.—A-p&rt* from one or two minor expeditions, no exploration work was undertaken during the year and the staff nave, therefore, been able to devote all their time to the collections of correspondents and accumulated materials awaiting examination. The same officers, as in former yean, chiefly members of the forest Department, have continued to keep us well supplied with material. Rai Upendranath Kan jilal Bahadur visited the Herbarium for several weeks in connection with his' work on the forest Flora of Assam. A considerable mass of his material still awaits examination but we have benefited as formerly by his generosity in giving us many sheets which enhance the value of our collections. Mr. E. 8. Hole crfDehra Dan and Dr. C. A. Barber of Coimbatore have also visited the Herbarium in connection with research work in hand. The usual collections of high level seeds for distribution to temperate regions wore made by Mr. G. H. Gave who also continues work on liis materials for the Lloyd Botanic Garden Catalogue. The results of the examination of Mr. K. E. Cooper's tours in Bhutan are now to some extent to hand in the publication by Professor Bayley Balfour of new species of Primula and Rhododendron. The revision of the Himalayan and Chinese Primulas already in collections, together with Mr. Cooper's new material, has given some forty new species. Of these, fifteen are the result of more critical examination in the light of recently acquired knowledge from the East and West Himalaya; eight are Bhutanese, the outcome of Mr. Cooper's exploration, and the remainder are Western Chinese. Prom the same collector's material Professor Balfour has been able to record two new Bhutanese Rhododendrons and four others of the same genus come in Mr. Ward's material from East Upper Burma. Mr. L H. Buririll, late of the Botanical Survey, has two papers in the Journal of the Asiatic Society of Bengal. One deals with the pollination of flowers in India, the other with the Terai forests between the Ghandak and the Teesta. The results of Mr. C. C.Lacaita's tour, some two or three years ago, in 8ikkim, have been published in the Journal of the Idnnean 8odety where the author records his impressions of the forests of Sikkim with some historical data on earlier exploration of the same region and a list of plants seen or collected.

Mr. A. Rodger, Forest Beeearoh Offioer, Burma, has again materially enriched the local Burmese collections of the Botanical Survey and retentions from collections by Messrs.' Smales, Osmaston, and by Lady Cuffe have also been allowed.

The Flora of Siam and Eastern Burma continues to engage the attention of Mr. W. G. Craib. During the year some eighteen species, not previously represented in his materials for a flora of this area, have been described ia the Kew Bulletin.

Wetto India.*—The results of Meesn. Sedgwiok and Saxton's work on the vegetation of Northern Gujarat, referred to in last year's report, are still in th» Press. The late Mr. Bamaswami'i record and description of a new *Tephrotia* from Bind appeared during the year. Mr. H. M. ChibWs *M . d* familles tad genera of Bombay plants with derivatives continues to appear in the Journal of the Bombay Natural Hirtory Society. Mr. C. 0. Glider has had under examination several species of *Catsia* from this Society's garden in Bombay and has established a good connecting link between two hitherto supposed distinct plants. His observations point to the advisability of a re-examination of the characters hitherto separating some members of the. genus.

Southern InduL- This area continues to attract more botanical attention than most of the other provinces. Mr. J. S. Gamble, C.I.E., continues his work on the Flora of the Presidency but, owing to the loss of Mr. Dunn's co-operation, the whole work devolving on Mr. Gamble's own hands, the issues must in consequence be somewhat delayed. • The method of presentation adopted is that followed in

the corresponding work for Bengal, issued in 1903. The primary object is to facilitate the identification of the species by enabling the collector to ascertain with certainty the genus to which the plant belongs and, this object attained, to limit his attention to those characters of the plant under examination which are necessary to its specific identification.

Mr. P. F. Fyson communicated two papers to the fourth sessions of the Indian Science Congress held at Bangalore in January 1917 ; one dealing with oecological observations on the flora of the Pulney Puars, the other with observations on the struggle for habitat between a true water plant *(Scirpus mucronatus* Linn.) and a moist land plant *(Ammannia rotundifolia* Ham.).

Mr. C. E. C. Fischer has under preparation for publication in the Becords a paper on the Flora of the Anamalais.

Bai Bahadur K. Rangachari presided at the Botanical Section of tlie Indian Science Congress where he communicated a very interesting paper on the Tinnevelly Flora.

On the same occasion Mr. Venkata Rao and MBT Cherian Jacob gave papers on the distribution of plants in Mysore, and on pollination in *Alysicarpus*> respectively, while Mr. T. Ekambaram gave the results of his continued investigations on the structure and mechanism of the bladders of *Tftricularia.* The proximity of Ceylon and the great similarity of its vegetation to that of the southern extremity of the peninsula lends additional interest to Mr. J. 0. Willis[9] paper on the evolution of the flora of the island with reference to the dying out of species.

General.—The Bevd. Father Blatter's treatise on the palms of British India* indigenous* and introduced, deals, since last report was issaed, with groups *Cocoineae* and *Lepidocaryinae.* In all some nineteen species are dealt with, the history, nomenclature, taxonomy and uses being treated in an exhaustive manner. Major A. T. Gage continues, so far as the very limited time at his disposal will admit, preparation of his materials for monographing the family *Euphorbiacea.*

Dr. Stapf has given an historical and taxonomic account of *Cycas Thouarsii* R. Br. and contrasted its characters with those of *Cyoas Btmpkii* Miq. and *Cyca$ cireinalisIAnn,* and has also had *Pandanuipercatu** described and figured in the Botanical Magazine. Mr. Dalimore has contributed an account, of the Asiatic Fines, including some Indian representatives, to the Eew Bulletin. Mr. H. G. Carter's paper on Zor Hills Plants with Notes by Sir Percy Z. Cox, K.C.S.I., K.C.I.E., has been issued as Volume VI, No. 6, of the Becords of the Botanical Survey while Mr. Calder's records of the species of *0xal\8* nofr wild in India is ready for the Press and his account of the vegetation of Travanoore is nearly completed.

II. Economic.—During the year the main subject of economic investigation was with medicinal plants.

The cultivation of *Eyotcyamus muttons* from Egyptian seeds in selected places in Bengal was successful. Samples of leaves thus obtained along with some collected from indigenous plants in Baluchistan have been examined.

The European Henbane *(Eyoscyamus niger)* has not been as successful as was expected. But as seeds of it are easily obtainable in drug shops at Lahore and Amritsar, recommendations for its further experimental culti ration have been made to those likely to take interest in it.

PoiophjfHum Emodi.—Enquiry is being instituted whether it can be obtained in commercial quantity.

Mropa Belladonna has been reported to be available in Kashmir. Our Uttempts to organise commercial supplies have not yet produced much results. Seeds nave been supplied for experimental cultivation in the Khasia Hills.

Seeds of the true Chaulmugra and its substitutes were supplied to Lieutenant-Colonel Sir Leonard Bogen» C.I.E.J.M.S., and to the Bombay Bacteriological Laboratory.

Kelp for iodine has been obtained for the Bengal Chemical and Pharmaceutical Works »nd Dr. B. X. Dutt of the Presidency College, Calcutta. The

outlook of this product does not appear promising but seems deserving of a thorough enquiry. .

Among other medicinal products dealt with may be mentioned *Cannabis, Digitalis, Strychnos, Valeriana, Gaultheria* and *Symplocos racemosa.*

The major portion of the requisition for *Lathy nis sativu** seeds for Sir Stewart Stockman and the Imperial Institute has been met. The balance has boen arranged for.

The enquiry on Hing *(Ferula* sp.) has been at a standstill for want of sufficient materials.

Edible fungi and economic ferns have also received some attention.

Many enquiries about dyes, spices, food products and various industrial products were received and replied to.

III. Industrial Section, Indian Museum.—*PMio Gallery.* -Tho work of the improvement of the Gallery on the line defined in the Annual Report of 1914*15 has been continued and the re-arrangement of specimens in some of the new show cases has been done on the lines therein indicated. For instance, in one of these cases the following eight industrial oils, (1) *Basskt latifolia* (Mahua Seed and Oil), (2) *Brasrica juncea* (Indian Mustard Se?d and Oil), (3) *Cocos nucifera* (Coconut Kernel and Oil), (4) *Calophyllum Inophyh lam* (Pannag Seed and Oil), (5) *Oossypium* sp. (Cotton Seed and Oil), (6) *Zinum usilatissimum* (Linseed Seed and Oil), (7) *Ricinus commwnis* (Castor Seed and Oil) and (8) *Sesamum indicum* (Sesame or Gingelly Seed and Oil) have been exhibited side by side with* the botanical specimens and coloured figures of the plants which yield them. Thirty-one botanical specimens were tftounted and displayed along with timbers exhibited in the Grand Staircase. These were also specially labelled with short descriptions printed in prominent types of the uses of the various parts of thesa timber trees.

As reported last year the difficulty of obtaining exhibition glass jars from Europe still continues and consequently very little could be done towards replacing the old fashioned tin-boxes by glass jars.

During the year over fifty specimens were added to the public collection. Of these the following are of special economic interest and have been displayed in the Public Gallery, the others being put awa^ in the Lockers :—

(1) *Taraktogenos Eurzii* (Truo Chaulmugra of Commerce), seed; (2) *Eydnocarpus venenata* (False Chaulmugra), seed; (3) *Oynocardia odorata* (False Chaulmugra), seed; (4) *Eydnocarpus Wightiana* (False Chaulmugra), seed ; (5) *Syringa Emodi,* bark as medicine; (6) *Rhododendron campanulatum,* twigs as medicine; (7) *Juniper us macropoda,* leaves as medicine; (8) *Sargassum* sp. (Sea weed), ash; (9) *Blumea* sp. (Manipuri Camphor), leaves; (10) *Conor Hum* sp., gum; (11) *Dolichos Lablab,* seed (black variety); (12) *Stizolobium* sp., seed; (13) *Bupleurum falcatum,* fruits (a substitute for Zira); (14). *Latipes sentgrtensis* (Sirkhi grass) seed, used «s an adulterant for Zira; (15) *Bunium Aitchisonii* (Siah Zira), fruits; (16) *Pueraria tulerofa,* tubers (edible); (17) *Anaaardium occidental?* (Cashew-nut," Hijlibadam[f>]), nut and gum; (1*) *Eirneola aunculata,* edible fungi (" apuna rong"); (19) *Premna latifolia,* bark and twigs as dye ; (20) *Marsdenia tinctoria,* dye; (21) *Girardinia hetero-phylla* (Nilgiri Nettle), stems (chopped).

With a view to give a good and brilliant appearance to the show cases it has been found desirable to remove the black polishing of the old show cases and re-polish them with wax. This work is in progress and a few cases of the Gums and Resins Bay have been wax-polished during the year.

Over a thousand labels have been renewed this year. The old labels are being rapidly replaced by new ones printed in the new style in the label printing press obtained for the purpose.

IV. Library-—About the usual increase was made to the Library which is housed in the Industrial Section of the Indian Museum.

V- Publications.—(0 Some plants of the Zor Hills, Eoweit, Arabia, by H. 6. Carter, M.B., Ch.B., issued.

(if) Plants of Northern Gujarat, by L. J. Sedgwick, I.C.S., and W. T. Saxton, M.A., LEA, in the Press.

VI- Staff*—Major A. T. Gage, the permanent Director, was in charge of the Department from 1st April to 27th October 1916, after which he went on privilege leave for 2 months and ip days and since his return has been placed on special duty in connection with the enquiry on the extension of Cinchona Plantation. Dr. H. G. Carter, was the Economic Botanist and in executive charge of the Industrial Section of the Indian Museum throughout the year. During Major Gage's absence he officiated as Director in addition to his own duties and was in administrative charge of the Industrial Section. Mr. P. M. Debbarman devoted his time entirely to the systematic work. Mr. E. F. Vieux, was Assistant Curator of the Industrial Section from 1st April 1916 to 21st January 1937, when he went on combined leave for six months and Mr. Uma Charan Pal acted for him.

All executive and ministerial officers have shown commendable zeal in carrying out their duties.

VII- Financial--There was a saving of Rs. 2,815-14-0 on the total allotment of Rs. 37,600.

H. G. CARTER, M.B., $Ch.B_M$ (Edin.),

Offg. ***Director,***

Botanical Survey of India.

8 0. P. K.-f P. B. 8.1.—5-10-17.

Report of the Botanical Survey of India for 1917-18.

L TOUJS.—The desirability df reducing expenditure on worjc inat can be deferred, combined with the fact that the Economic Botanist was for more than nime months of the year officiating as Superintendent of the Royal Botanic Garden and of Cinchona Cultivation in Bengal in addition to his own duties, cut touring down to a minimum. The only tour was a short one made by Mr. H. G. Carter, the Economic Botanist, in the Ehasia and Jaintia Hills HI the latter half of March 1918. On that tour attention was paid chiefly to economic plants.

IL Systematic WOPk.—*BuUm India.* From Burma considerable collections were contributed by ^fr. A. Rodger, I.F.8., Forest Research Officer. Mr. H. G. Carter is engaged in writing an account of the results of his tours in the Lakhimjfur District of Assam made in 1915. Bai Upendranath Eanjilal Bahadur continues his .work on the Forest Flora of Assam. oMr. F. M. Debbarman of the Botanical Survey has contributed a considerable collection from Northern Tipperah and has enlisted the aid of the Forest Officers in that State in obtaining collections from areas that he could not explore. °

Northern India.-^*An* important and valuable contribution, to tffe knowledge of the Flora of this region is " The Forest Flora of the Punjab ", by Mr. R. N. Parker, I.F.8., that has appeared during the year. Mr. S. R. Eashyap continues his studies of the' Liverworts of the Western Himalaya and the Punjab and has recently added six new species to those already described by him. .Mr. J. 8. Gamble has published a lucidatory note on the Himalayan species of *Skimmia.*

Wettem India.—An account of the vegetation of Northern Gujarat by Messrs. Saxton and Sedgwick has appeared in the Records of the Botanical Survey. The latter has also published notes on the Monsoon Flora at Castle Bock, and apaperon.theCvperaceeeof the Bombay Presidency. The Bev- lather E. Blatter, 8. J., and Professor Hallberg have published contributions towards a flora of Persian Baluchistan and Makran.

Southern India.—Mi. Gamble continues his work on the Flora of the Madras Presidency. An account of the vegetation of the Anaimalai Hills is under preparation by Mr. 0. E. C. Fischer, I.F.S., for publication in the Reoords. The Bevd. Father Blatter has investigated the vegetation of the High Wavy Mountain of Madura District, and has published a preliminary note on its Flora. Mr. p. Tadulingam, Government Lecturing Botanist, Madias, made a general Botanical 8urvey of Vicagapatam, Bellary, Ghingleput, Salem, And Nilgiris Districts. Mr. C. C. Calder, Curator of toe Herbarium of the BoyaPBotanic Garden, Calcutta, continues thei working out of the results of his explorations in Travancore for publication in the Biecords.

Qpteral.—The Bev. Father Blatter has prepared a list of the Plant* of Arabia with iheir habitats and distribution whioh will ultimately appear in the Records. The twentieth instalment of the sam% author's acoount of the Palm of British India and Ceylon hat appeared. He has also, in ooajunction witfc Professor Hallberg, published a tetitisn of • the Indian •jfcciesof *Botala* and *Ammmmta,* and a papiw on new Indian SCwphulariaee©, wherein *km* new species are described. An account of the •jpaoita.of *QwaKt* now wild in India and a desdiption of a new species of *Vernonia* by Mr. 0.0. Calder and a paper on *Trichodema indicm* and *T. amptexioaule* and descriptions of s new balsam and a iiew orchid by Mr. L. J. Sedgwick are in the press. Mr. P. F. Fyaon of the [illegible] has under preparation a monograph of the species of *JBriooanlon* for the Beoords. Mr. G. B. Pltvardhan of the Agricultural College, Pbona, has recorded his observations on the interchangeability of vegetation and fruft •troctures in *Opwttia eUxtior* and a sport of that species, Signor Beccari's monograph of (he species of Lepidocaryeae Palms other than those of the genera *CaUmm* and *Dam<morop»* is about to be published as a volume of the Annals of the Royal Botanio Garden, Caloatta. Sir David Prain has thrown light on

the obscure genus *Chrozophora* of which he has given an erudite account in the Kew Bulletin. In the same publication Mr. A. W. Hill, Assistant Director of Kevr, has an important paper on the genus *Strychnos* in India and the East, in which twenty-two new species are described, bringing tile known species of this genus in the East up to a total of ninety-two, Mr. J. Hutchinson, Assistant for India at Kew, has published a revision of the genus *Aspidopterys* in which a new species from the Andamans is described. Several new Indian species of various genera have been published in the Kew Bulletin by Messrs. Gamble, Hutchinson, and Stapf.

Routine but very necessary work in the Calcutta Herbarium has been efficiently performed by Messrs. Debbarman and Narayanswami, the two Assistants in the Botanical Survey for systematio work, Mr. Debbarman has written a paper on a teratological condition of *Allium Cepa,* and another on the functions of the pitchers of *Disekidia Rafflesiana.*

III. Economic—As the Botanical Survey has no ground at its disposal available for experimental cultivation on tiny scale, its economic work is restricted mainly to determining the origin of vegetable products, to obtaining supplies of seeds or plants or products for interested parties, to placing buyers and sellers of products in communication with each other, and in general to performing the functions of a bureau of botanical? economic intelligence as regards such vegetable products as are hot dealt with by other departments. During the year the Economic Botanist has done a considerable amount of such work more particularly in connexion with medicinal plants and their products. Limitations of space preclude a full account of such work but the 1 olio wing brief statement indicates its general character.

Information was supplied to enquiries as to whence *Podophyttum Emodi* roots could be obtained. Seeds of *Eyoseyamus muticus* and of *Atropa Belladonna* were obtained and distributed to correspondents who undertook experimental cultivation of those species. Seeds of *Hydnocarpus venenata* and of *Asteriostigma macrocarpa* were obtained on behalf of Lieutenant-Colonel Sir Leonard Rogers, I.M.S., ih connexion with his leprosy investigations. Seeds of *Taraklpgenos Kunii> Oynocardia odorata,* and *Bydnocarpm venenata* were also supplied f o the Bombay Bacteriological Laboratory in connexion with medical research woru\ and seeds of the first species were also sent to the Bureau of Science, Manila. European squills not being available, the bulbs of *Urginea indica* are being utilized to a certain extent as a substitute, and buyers and sellers of those bulbs were placed in communication with ftagh other. Attempts have been* made to collect Male Fern on behalf of the Medical Department. Supplies of officinal . Rhubarb — usually imported *via* Europe —being scarce, the medicinal possibilities of the Eastern Himalayan species *Rheum mobile* and *It. acuminatum* were under investigation, and standardized preparations from the rhizomes of those species were sent to the Professor of Materia Medica in the Medical College, Calcutta, for testing. Material of the roots of *Saxifraga purpurascens,* a native of Sikkim, was collected for experimental testing of its efficiency in the relief of dysentery. Cajeput oil, indistinguishable from the Cajeput oil of commerce, was distilled from the loaves of *Melaleuca Leucadendron,* in cultivation in the Royal Botanic Garden, Calcutta. Suppliers and buyers of *Datura* leaves have been brought together, and supplies of *Lycopodium* spores to private firms were arranged. The cultivation of *Digitalis* and of *Chenopodium ambrosioidei* and *C. antheL minticum* — the latter two the source of an oil Used in the treatment of hook-worm disease — has been started on a fairly extensive scale on the Bengal Cinchona Plantation. Obscure points of nomenclature in the varieties of Indian mustard of considerable practical importance — as lack of clearness in nomenclature has caused no small trouble to American importers — hare been cleared up. Supplies of Lichen material — which before the war used to be exported to Germany — have been arranged for and the investigation of its tinctorial value has been undertaken by Professor 8en of the Civil Engineering College, ~8ibpur. Towards the end o! the year the Imperial Institute was arranging to supply seeds of *Ale«rite$ Fordii* and of *PerUla* odrooufe* — both important sources of drying oils - for experimental cultivation in India. Other specie* of economic interest dealt with during the year included *Ipomoea Turgo,*

L Twrpethwn, Citrulls Coloeynthis% Strychnos Nux-vomica, ***Oentiam Kurroo,*** *Taraxacum officinale,* etc.

IV. Industrial Section, Indian Museum.—As it has been impossible to obtain ei-her glass for new cases or specimen jars, work during the year has been restricted mainly to keeping the existing collections in good order. Almost all the old show-cases have a black finished surface. The experiment was made of scraping the black finish off about a dozen cases so as to expose the natural colour of the wood and wax polishing the latter. The result has been so satisfactory in giving a lighter appearance to the gallery that it is intended to treat the remaining cases in the same way.

Over five thousand labels have been renewed ami almost all the old printed and type-written labels have been replaced by more effective ones printed in the hand psess belonging to the Botanical Sfirvey.

Nearly 120 specimens were added to the collections, some of which were displayed in the public gallery and the others placed in the reference collections.

V_9 Library.—About the usual additions were made.

VI. Publications.—No. 7 of volume VI of the Records was published during the year, being " Plants of Northern Gujarat", by W. T. Saxton, I.E.S., I.A.R.O., and L. J. Sedgwiek, I.G.S. This gives a general description of the vegetation and its (Ecology and a list of the species found in the area.

VII. itaff.—Mr. H. O. Garter, M.B., CLB., officiated as Director m addition to his duties as Economic Botanist up to the 7th January 1918. Thereafter Lieutenaut-Colonel A. T. Gage, I.M.S., resumed charge on his return from special duty. Mr. F. M. Debbarman, B. 8c., was senior assistant for systematic work throughout the year. Mr. V. Narayanswami, B.A., WAS appointed assistant on probation on the 1st May 1017. Both have done good work during the year. Babu TJ. C. Pal, Head Clerk, officiated as Assistant Curator of the Industrial Section of the Indian Museum until the 28th February, thereafter Mr. E. F. Vieux on return from combined leave resuming charge. Babu R. E. Das officiated as Head Clerk up to the same date.

VIII. financial—There was *A* saving of R4,287-10-8 on the total Budget allotment of B40,600, mostly under Salaries Establishment, House Rent, and Travelling Allowance.

A. T. GAGE, LT.-COL., **I.M.S.,**
Director, Botanical Survey of India,
and officer in charge of the
Industrial Section, Indian Museum.

S'JP1—5DBSI-13-8.18. 460.

Report of the .Botanical Survey of India for 1918-19.

I. Touring.—The exigencies of a war-time limited budget restricted touring to a minimum. The Economic Botanist collected in the Ehasia Hills in April 1918 for a short time, giving particular attention to those plants made use of by the indigenous population. In January and February the Director, and from January to April 1919 Mr. F. T. Russell," who had been deputed from the Bengal Cinchona Department, explored the great forests of the northern half of the district of Tavoy in Burma, primarily with a yiew to select sites for starting new, Cinchona plantations there on a large scale. During this tour both officers made considerable collections, which should prove of great scientific inttrest, as the forests of Tenasserim are still very imperfectly known.

. It was impossible with the small-amount of money available also toirrang* for either of the two assistants to go on tour. Messrs. Debburman, B. 8Q.> ana Narayanswami, B. A., however did good service in working out the coUsotions sent in for identification by other departments and by individual officer*

II. Systematic.A&otfero *India.* The scarcity of officers and the exceptionally heavy demands of war work greatly affected the help usually received from officers of the Forest and other Departments interested in • Botany. The most important contribution from this side of India was made by Mr. C G» Rogers, C.I.E., F.L.S., who presented a fine celiection^of specimens made by him in the course of a tour in Tavoy and Mergui districts of Burma*

• *Northern India.—Mr.* G.'O. Allen I.C.S., has published a list of species not hitherto chronicled as occurring in the neighbourhood of Mussoorie. From the Eastern Himalaya collections,have been contributed by Mr. S. ft. Mitra of the Forest Department. During the latter half of the year Mr. H. H. Haines, C.I.E., F.L.S., Conservator of Forests,worked up*in the* Royal Botanic Garden, Calcutta, his Bihar and Orissa collections in preparation for the projected Forest Flora of that province, and presented a fine set of 'duplicates. From the neighbourhood of Ranchi, the Rev. J. Bressers, 8. J., has contributed a considerable collection.

' • *Weitem India.—The* vegetation of the Indian Desert of Western Rajputana has been closely studied by the Rev. E. Blatter 8. J., and Professor • F. Hallberg, who have published an excellent illustrated account of the" flora. Mr.L. J. Sedgwick, I.C.S., F.LS., has continued his investigate iif the Cyperacese of the Bombay Presidency, and has published a study of the Western Indian species of - Zizyphus. Dr. N. Annandafe, Jtfreetor jof the Zoological Survey of India, made an interesting collection of the plants of'the lake basin of Seistan, and valuable .observations «n. the effects of environment and on other (ecological points of interest.

„ *Southern India.-ter.* J.8. Gamble, C.I.E., B.E.8., has continue$tti work on the Flora of the Madras Presidency and in addition has pubfyhed a set of notes on certain of the families and genera that have been under study by him. The Government Lecturing and Systematic Botanist toured in the districts of Salem, North Arcot, Chitoor and the NUgiris, and has prepared detftM *+ criptions and illustrations of some of the common grasses of *itoJ}***s of [illegible] andalistoftheplantflof Jinnevelly. [illegible] contributed largely to the Botanical Survey Col [illegible].

General.-C«pUbk:V.C. Calder, IdUl» CoJwtor *of* ffc* Serbarium, Royal Botanic Garden, Calcutta, .while on taflitdry "^serriw u^ Mesopotamia in the latter half of the year made collections hi that country. ContributkmB were also-received from the Agricultural Department there. *Mr.* J. Hutohjnson, Assistantfor India, Kew has investigated the genera *Taxotrophit, halanottre* Hut* tad *Cordta* and cleared up obscurities in the specific characters and distribution of the species of those genera. A considerable number of new Indian species have been described by various other botanists. Mr. L. J. Sedgwick has published an interesting oeological study of the morphological characters of some Western Indian woody species.

III. Economic—The most important economic work of the year, it regard be held to its possible future results, has been in connexion with Cinchona cultivation. After a prolonged tour on special duty in 1917 to discover areas suitable for the cultivation of Cinchona on an extensive scale, the Director had recommended reserving an area of about 400 square miles in the densely forest-clad northern third of the district of Tavoy in Burma. For the first four months of 1919, Mr. P. T. Russell, Manager of the Bengal Government Cinchona Plantation of Mungpoo, and from the 24th March to the 24th April 1919, Mr. G. E. Shaw B.Sc, F.I.C, F.C.S., Government Quinologist, Bengal, were attached on deputation to the Botanical Survey. The Director and those two officers explored, in more detail than it was possible for the Director to do in 1917, the selected area to discover suitable sites for starting Cinchona planting, and for the erection of a factory. In this work valuable help was given by Mr. G. Innes B/Sc, Executive Engineer, Tavoy, especially in the nytttfr of estimating the water power available for factory purposes. The results of this tour and the recommendations based upofl them form the subject of a special report to Government^ Suffice it to state here that suitable sites were discovered.

The cultivation of medicinal plants other than Cinchona on the Bengal Cinchona Plantations is referred to in the annual report of these, plantations.

The Economic Botanist's work was concerned mostly with the lines of investigation mentioned in last year's report. The investigation by Lieutenant Colonel Sir Leonard Rogers, I.M.S., into the hydnocarpic acid content of seeds of various species of Hydnocarpus was aided by collections of seeds of as many different species as could through the courtesy of officers of the Forest Department be obtained,

IV. Industrial Section, Indian **Museum.—**Owing to the restrictive conditions of the year and the smallness of the staff, work was confined mainly to keeping the existing collections in good order. A vast amount of work requires to be done i/ the public} gallery is to reach the standard demanded by modern ideas of the fnnctions of a Museum, but until an adequate staff is provided little improvement can be expected. Mr. JSeux the Assis^t-Cuiutor^has npde instructive experiments in *the* use of the ftpper acetate process for preferring the green colour of plant exhibits. About 86 specimens were added to the collections.

V. Library.—About the usual additions were made.

VI. Publications.-No, 8 of Volume. VI of the Records of the Botanical Survey was published early in 1919. It consists of an account of " The Species of Oxalis now wild in India " and of "A new Indian Vernonia" by C. C, Calder, Curator of the Herbarium, Royal Botanic Garden, and of papers " On ***Jrichodema indioum* R. Br. and *Trichodema amplexicaule* Auctt." and on** two new Indian species by L. J. Sedgwick, I.C.S. In the Press are the " Flora of Arabia " by the Rev. B. Blatter, S. J., and " Useful Plants of Lakhimpur " by K G . Carter.

VII Staff.-All officers of the department Were in charge of their respective posts throughout the year except that Dr. H. G. Carter, Economic Botanist was on privilege leave from the 16th April to the 14th June 1919 and Mr V. Narayanswami on privilege leave from the 15th to 28th February 1919.

VIII. Financial.—The Budget allotment for the year *plus* a special allotment of Rs. 7,000 for expenditure in connexion with the exploration in Tavoy. was Rs. 16,273-8-0. There was a saving of Rs. 1,558-11-most of which **was saved** on the Tavoy exploration account.

A. T. GAGE, Lt-COL., I.M.S.,
Director, Botanical Survey of India,
and Officer in Charge of the
Industrial Section, Indian Museum.

SGPI—8 6—ED[illegible]—20-8-19.

Report of the Botanical Survey of India for 1919-20.

I. Touring.—With the Economic Botanist absent on leave during the first half of the year and the Director during the second no field work *wm* possible beyond what could be combined with work unconnected with the Survey. Nevertheless material awaiting examination at the herbarium is always more than sufficient to keep the small staff fully engaged. The absence of the valuable incentive and exercise to the faculties of observation in field work is much to be deprecated, but until workers are available in number sufficient to cope with the necessities at head-quarters, field work is likely to be the side to suffer. While on duty as Superintendent of Cinchona Cultivation the writer had opportunity to make collections and to supplement the notes published in Mr. Gamble's list of trees, etc., of the Darjeeling District but beyond this no actual field work was possible. During the current year attempts will be made 'to depute the Systematic Assistants, one at a time, for a limited term of touring work. It is essential that the Systematist should not suffer demoralisation through being narrowed down to work on dried material only.

II. *Systematic-Eastern India.* Most of the collections, either original or duplicate sheets, which Mr. C. G. Rogers, late Chief Conservator of Forests, Burma, had made in different parts of the province were already presented to Sibpur before he terminated his service. There remained with him, however, some 200 specimens of plants, which for various reasons had not been added to the herbarium, and these he kindly made over before leaving the service. The Deputy Director of Agriculture, Insein, Burma, sent a collection of grasses of Agricultural importance for checking and figuring and with a view to publication. Identification of grasses and bamboos in connection with work on paper making in which the Burma Oil Company are interested has also been undertaken. From the neighbourhood of the Chilka Lake Dr. Annandale contributed some 200 specimens. He has under preparation a paper dealing with the biology of the lake and has had the aid of officers of the Survey in the working out of the botanical list which will form a part of the paper. The most important botanical work of the year dealing with Eastern India has been done on plants collected during the Abor Expedition by Mr. I. H. Burkill, late of the Botanical Survey. These plants have been under examination by Mr. Burkill and other experts at home. Some twenty species new to Science have already been described from Aborland. These cover a range of natural families but probably the most important additions are the four new Begonias described by Mr. Dunn. Some of these may turn out to be valuable finds from the horticulturist's point of view. One in particular which has been in cultivation for some years at the Lloyd Botanic Garden maj take a prominent place in Begonia cultivation. Mr. B. S. Hole has addec a new species of Ixora trom the Yamethin district of Burma, while *i* sew Mangrove species *JBruguiera Hainesii* has been described by Mr. C. G Rogers from the tidal forest region of Mergui in the sam< province. Mr. R. E. Cooper's Bhutan collections continue to yield an occa sional new plant. Dr. Staplf has described an Aconite raised from seec supplied by Mr. Cooper.

Northern India.—Mi. G. O. Allen continues' additions tp his list o Mussoorie plants while the distribution and descriptive morphology o the Himalayan liverworts forms the continued study of Professor Kashyaj The Myxophyce© of Lahore is dealt with by Mr. S. L. Gbose and the flor of Persian Baluchistan and Makran by Blatter and Hallberg. Twd nei species *Schefflera bengalensis* and *Rasa Samdersia* have been described froi Northern India.

Western India.—k p%per by Drs. Annandale and Carter on the vegetotio of Seistan appeard in the Journal of the Asiatic Society during the year. Tl introductory part deals jrith the vegetation from the ebological standpoint and tl systematic list contains useful notes on the distribution and local names of tl species mentioned. Rev. E. Blatter, S. J. and Professor Hallberg are publisl ing a flora of the Indian desert of Jodhpur and Jaisalmer in the Jouro; of the Bombay Natural History Society and aits contributing materials for

flora of Baluchistan to the Journal of Indian Botany. The physiological anatomy of the desert plants of Rajputana[1]—the work of Mr. S. A. Sabnis—is appearing in the same Journal. In 1890 Sir David Prain published an account of the plants of the Maldive and Laccadive Islands. Mr. W. B. Hemsley in a paper to the Kew Bulletin now draws a comparison between this flora and "that of the Aldabra group in the mid Indian Ocean. The variation of Bombay Strigas has been studied by Mr. W. Burns. Mr. L. J. Sedgwick has a paper in the Indian Forester on the analyses of some morphological characters of Bombay woody species from an ecological standpoint and has also had under examination the specific values of certain Indian Alysicarpi.

Southern India.—The most important work of the year on this province appears from the hand of Mr. Gamble in the 3rd part of his Flora of the Madras Presidency. The part deals with the flora from Leguininosae-CsesalpinioidesB to Caprifoliacese. ihe new species are appearing in Decades Kewensis in the Kew Bulletin. Some twenty new species, all from Southern India, have been described. The number includes five Oldenlandias and five Memecylons from the Wynaad, Nilgiris or Travancore. An interesting rediscovery of the plants described *bv* Wight as *Heterocarpus glaber* and *H. hirsutus* was made by Professor Fyson while botanising in the Pulneys. The absence of these plants from collections shows how rare they are. Those discovered by Professor Fyson have the flowers blue, not yellow, or orange as mentioned by Wight. He suggests that the orange coloured flowers may belong to the lower slopes the blue coloured to the higher. Professor Fyson with Mr. M. Balasubrahmanyam has also studied the ecological conditions determining the existence of *Spinifix sqarrosus* as a member of the seaside vegetation of Madras.

General.—Mr. 5. H. Haines has described and arranged the much confused Indian species of Carissa. Mr. Gamble has raised the number of known India Mimosas from three to seven with figures and full descriptions of the new species, and a useful key to their determination. For purposes of this work he was supplied with material from the Royal Botanic Garden, Sib pur. Sir David Prain & Mr. Burkill have cleared up in a very exhaustive manner the synonymy and taxonomic position of *Dioscorea saliva* in a paper contributed to the Kew Bulletin. Mr. T. A. Sprague has had the genera Dolichandrone & Markhamia under revision. Indian material of the former genus is now on its way to Kew. Recent work on the Mahoganies of the West Indies seems to throw doubt on the generally accepted belief that the tree now largely grown in India is the true mahogany. Material from the Calcutta gardens may help to settle the point. This is being collected as it becomes available, and will be sent home in due course. A paper of some interest to Indian botanists is a study of the ecology of the tropical rainforest by Mr. R. 0. McLean appearing in one of the issues of the Journal of Ecology. Professor Fyson has published in the Journal of Indian Botany a short resume of a paper on Eriocaulon still to appear in the Records of the Botanical Survey. Mr. L. J. Sedgwick has published his views on the use of the term 'variety' in systematics. He makes the suggestion that nomenclature should be extended to show at a glance the nature of the variety and enumerates some half dozen meanings of the term.

III. Economic—The most important economic work of the year has been the initiation of the scheme for Cinchona Cultivation in Burma. The newly appointed Superintendent of Cinchona Cultivation in that province reached the reserve to start operations in the second week of March 1920. He took with him enough seed to fill nurseries capable of planting up some 100 acres and also a certain number of older Cinchona plants in specially constructed wardian cases. By this means it was hoped to gain earlier experience of how plants beyond the seedling stasje were likely to take to the new conditions. It is too early yet to speak of success for the venture. There have been difficulties with labour and the rainfall experienced has meant an anxious and arduous time but nothing, so far, has happened to disappoint the beltef that Cinchona will eventually be grown with success in the new area. Careful data are being collected relative to climatic and soil conditions. The absence %f leaf mould in the natural forest indicates a heavier rainfall than Cinchona has been accustomed to in Bengal, but this condition is partly set off by the fact that the area is verv well drained. The land does not remain water logged and even a few hour a

after a heavy rainfall the soil regains its workable condition. The present difficulty lies in the bringing of seedlings successfully through the rains. Means to prevent damping off must be devised and nurseries located in sheltered spots where the full force of such cyclonic conditions as have been recently experienced will be less felt.

The cultivation of medical plants other than Cinchona on the Bengal Cinchona Plantations is dealt with in some detail in the Annual Report of these plantations. There has been quite a gratifying success in the cultivation of Digitalis, the Ipecacuanha has seeded well—a factor of some importance for the multiplication of stock—but the cultivation of Chenopodiuni has had to cease on account of the small volatile oil content. A small experimental plot of Belladonna is in cultivation and experiments carried out on behalf of a local chemical firm go to show that Taraxacum can be successfully exploited in the Mungpoo district.

Mr. Green, Manager of the Munsong Plantation, has "been doing very useful pioneer work in the grafting and management of fruit trees suitable for the district. The Economic Botanist's work was concerned mostly with the lines of investigation mentioned in previous reports. Requisitions for seeds of plants of medicinal importance are being received in increasing numbers, information as to methods of cultivation, etc., usually accompanying the requests for seed.

IV. Industrial Section, Indian Museum.—No progress could be made in the much needed improvement of replacing the old exhibition tins by rectangular glass specimen jars as it was found impossible to have those manufactured in India and home supplies were not forthcoming. The work of removing the black polish of the old show cases and repolishing the wood with wax was completed during the year. This work was begun iA 1916-17 with a view to giving a lighter appearance to the gallery. The result is very satisfactory. Some fifty-two specimens were added to the collections during the year. Most of the specimens in the gallery are in a fair state of preservation. Some require renewing and there is great need for a catalogue of the products displayed. Such a catalogue, however, can only be thought of when a staff adequate to the needs of the department is provided.

V. **Library.—**The usual additions of books and periodicals were made.

VI. Publication.—No. 1 of Volume VIII of the Eecords of the Botanical Survey being part 1 of Rev. E. Blatter's Flora Arabica was published in September 1919. In the Press are the "Useful Plants of Lakhimpur" by H. G. Carter the "Flora of the Anaimalai Hills'[1] by C. E. C. Fischer, the "Flora of the Upper Gangetic Plain" Vol. Ill, Part II by Duthie and the second part of Rev. E. Blatter's "Flora Arabica."

VII. Staff.—Lieutenant-Colonel A. T. Gage, I. M. 8., was in administrative charge from 1st April to 11th October 1919, when he went on combined leave. Mr. C. C. Calder, B. Sc, B. Sc. (Agr.), F. L. S., officiated^ Director and Officer-in-Charge from 11th October 1919 till the end of the official year. Mr. H. G. Carter, M. B., Ch. B., was in executive charge excepting for seven months and fourteen days from 13th April to 26th November 1919, when he was on combind leave. Mr. E. F. Vieux was Assistant Curator from 1st April to 14th November 1919, when he went on leave without pay. During Mr. Vieux's absence Babu Uma Charan Pal officiated as Assistant Curator. All officers of the Department have given commendable attention to duty throughout the year.

VIII. Financial.—The Budget allotment for the Botanical Survey was Rs. 49,905. Of this Rs. 42,486-14-3 were spent, leaving a saying of Rs. 7,418-1-9 mostly[1] under salaries and house-rent. The grant for Cinchona work was Rs. 52,158 of which Rs. 1,555-1-6 were saved.

C. C. CALDER,

Offg. Director, Botanical Survey oflndfy, and Officer-ill-Charge of the Industrial Section, Indian Museum.

8GP:-2 DBSI—25-11-20-450.

Report of the Botanical Surrey of India for 1920-21.

I. Systematic—*Emt&rri India and Surma.—In* the forests of the northern third of Tavoy District in Southern Burma, Mr. P. T. Russell, Superintendent of Cinchona Cultivation there, has made excellent collections. The Director tinted the same area early in 1921 and also brought back a collection. The district is botanicaUy rich and these preliminary collections have already yielded raw and interesting species. The distribution of Floras in S. E. Asia as affected to the Burma-Yunnan range of mountains, has been studied by Captain Xingdon Ward. In the Kew Bulletin has been published a paper by the late Major S. M. Toppin, M.C., on the Balsams of the Kachin Hills. In the same journal descriptions of the new species in the collections made by Mr. I. H. Burkill some years ago in the Abor Hills continue to appear. In Notes from the Royal Botanic Garden, Edinburgh, Sir Isaac Balfour and W. W. Smith have published, new species of *Primula, Qmphalogramme, Rhododendron* and other genera from the Eastern Himalaya and Upper Burma.

northern India.—Part II of VoL III of the Flora of The Upper Gangetic Plain, by J. F. Duthie appeared in 1920. It contains the families from *Ooniferae* to *Juncaceae.* This work is now nearly finished, and it is hoped that by another year publication will be completed. Mr. B. N. Parker of the Imperial Forest Service has discovered several Mtherto-undescribed species in the N. *W.* Himalaya. Professor 8. B. Kashyap has published an interesting note on the vegetation forming the floating islands of Bnralsar, a lake in Mandi State. The Balsams of Chitral are referred to in Major Toppin[1]! paper mentioned above.

Western Imiw<-The Bey. Father Blatter and Professor Haflberg Continue to show neat activity on this side of India, their contributions to botanical literature during the year including a paper on new species of various genera found in the Bombay Presidency, studies of the Flora of Jodhpur and Jatalmer, and of the Flora of Baluchistan. The drought resisting plants of the Decoan form the subject of a paper by Mr. R. K. Bhide,

Southern Indi.-T>aiiLg* September and October Mr. V. Narayanswami of the Botanical Survey explored the Rampa country of the Godavery District. His collections, ranging from 600 to 4*500 feet of altitude are beinfcworked out M opportunity allows, and promise interesting results. Collections were also ttBdemiJamanda,Polakot'thePuhi«y and Nilgiri hills and in Eaaugod* tnd Tinnevelly by Mr. K. Rangaohariar Avergal, the Madras Goterwtoeot SyiteinatfeBetaiilst and his assistants. The tame botanist has under fftpantka separate bits of plants for the various district* of the Madras Presidency, to fwffitateoomplatton of district Floras hereafter. Mr. J. 8. Gamble, CXE, haspubMedinoime<jtioBwithth«preparati(m()fhisFlpi»ofMao^afiBA lot of new spedes from Southern India. The *FokooaomU* Maim fotfl^tae subjettof* paper by Mr. Ayyangar.

General.—A large number of [illegible] not concerned [illegible] botany have [illegible] [illegible] of which only a [illegible] be mentioned here. Mr. H. H. [illegible], C.I.E., has cleared up a nomenclatural confu•ion idtfaiBrtO uuuourunf u». w w Hsw Runtnsi 4+mmdwm [illegible] and *WtlMiitn&lkpindut trifolict* tad. 8. lovifoU*. J*.* [illegible] has trablished an account of variation in the fldwen ol JMMMMA sBrtftroifiejws, and Mr. S.H. Prnyag observations on the infloweoenoe anoMlowerB of the gnpe. The nh jaJolodeal anatomr of the plant* of the Indian desert has been Sufied byl&.T.S.8abia«and^itruftareofiome CucurWtooeous tendiOt by Mr. B. D. Sawhney. The ecological aspects of the vegetation of the Upper Gangetic Plain have been investigated by Dr. W. Dudgeon. A case of atrophic abortion of the inflorescence of the Onion has been molded by Mr, p. M, Debbarman.

II. Economic—During the year Cinchona work in Tayoy has been continued under the difficult circumstances inseparable from all pioneer work in trackless tropical forests. So far as nursery work is concerned the results have been excellent, seedlings germinating and growing very well. The real test, however, as to how the young plant* when planted out in the open, will stand the heavy monsoon precipitation that occurs in the- south-western corner of ther reserved area, where operations have been started, has yet to be passed. If the young plants planted in the open at the beginning of the monsoon do not come through it satisfactorily, it does not necessarily follow that the whole reserved area is to be incontinently condemned as unsuitable. It may be found that altering the period of planting out from the beginning of the monsoon to neat its end will enable the young plants to be sufficiently established to withstand the full fury of the following monsoon. On the other hand it may be found necessary to move further inland, or to the southern third of Tavoy District or the northern third of Mergui District, where the rainfall is considerably less than in North Tavoy. Another year's experience will be necessary, before sufficient data can be gathered on which to base a definite opinion as to the future action to be taken.

A large number of enquiries—too numerous to mention here in detail—were dealt with during the year, and many seeds and economic products distributed.

Before he left India, Mr. H. 6. Carter, the Economic Botanist, was engaged in working up a report on the economic plants of the neighbourhood of Shillong. It is hoped that it may be found possible hereafter to publish his report.

III. Industrial Section, Indian Museum.—Work was conducted on the usual lines and requires no special mention. The collections in the public gallery were kept in good order, but until a qualified Curator is available, no development of the "gallery on modern lines of Museum management is possible.

IV. Publications.—During the year the departmental publications have been Part U of Vol. Ill of the Flora of the Upper Gangetic Plain by J. R Duthie, containing the orders from *Coniferae* to *Junoaceae*, and No. 9 of Vol. VI of the Records of the Botanical Survey being Useful Plants of the District of Lakhimpur in Assam by H. G. and D. K. Cuter. A list of the more important extra-departmental publications on Indian Botany that have been published during the year is appended.

V. Staff.—Mr. 0. C. Calder officiated as Director until the 16th January 1021, thereafter Lieutenant-Colonel A. T. Gage, I.M.S., resuming charge. Mr. H. G. Carter was Economic Botanist until the 17th February 1921, thereafter Mr. P. II. Debbarman officiating. Mr. Garter resigned Government Berrice with effect from the 15th March 1920 at the end of the privilege leave granted to him from the 18th February 1921. Messrs. P. M. Debbarman and V. Narayanswatni were Systematic Assistants throughout the year. Babu Uma Charan Pal, Head Clerk, officiated as Assistant Curator of the Industrial 8ection, Indian Museum, up to the 12th September, and from that date Babu Bajoni Kanta Das until the 11th October 1920. Thereafter Mr. Vieux resumed charge. All officere of the department h»ve worked with satisfaction. Messrs. Debbarman and Narayanswami hare as nraal given great assistance in the work of the Herbarium of the Boyal Botanic Garden.

VL Financial.—The total allotment for the department was Us. 1,01,100, of which Rs. 43,440 was for the purely botanical ode of the department and Rs. 57,660 for Cinchona work. The expenditure on the purely botanical side exceeded the allotment by Rs. 5,650-14-1, the excess being due to the revised scales of pay for staff coming into effect during the yea*. Of the Cinchona allotment Rs. 10,000 were surrendered to Government Of the balance only Rs. 32,444-11-11 were expended leaving a saving of B*. 16,105-4-1 prindpaUyonfreight of Cinchona bark and quinine, which were not supplied in the quantities anticipated-

A. T. GAGB, Zti-CM* *IJ1.8..*
Director Boiawietianrvet ofIndia, <md
*0jJU*r4»Ckarg<, Indu$trial Section, Indion Mmtm:*

LIST OF PAPERS.

B&lasubramanyam, M.	Variation in certain cultivated plants. *(Journ. Ind. Bot., i,9$ 10, [1920], p. 325, with 1 pi.)*
Bhide, *U.K.*	Drought resisting plants in the Deccan. *(Journ. Ind. Bot., ii, lSf2, [1921], p. 27, with pi)*
Blatter, E., Hallberg, F., and McCann, C.	Contributions towards a flora of Baluchistan. *(Journ. Ind. Bot., i, 8,1920, p. 263, $i,9$ 10, [1920], p. 344.)*
Blatter, E. and Hallberg, P.	The Flora of the Indian Desert (Jodhpur and Jaisalmer}.. Part VII. *(Journ. Bomb. Nat. Hit. Soc, xxvii, 3, [1920], pp. 606, with 3 pit.)*
Blatter, E., and Hallberg, F.	Species novae Indiae orientals. *(Journ. Tnd. Bot., ii, 1$2, [1921],p.44.)*
Carter, H. G. and D. N.	Useful plants of the District of Lakhimpur in Assam. *(Bee. Bot. Surv. Ind., vi, 9 [1921], pp. 355-420.)*
Dudgeon, "W.	A contribution to the Ecology of the Upper Gangetie Plain, *{Journ. Ind. Bot., i,9 Sf 10, [1920], p. 296, with 2pit.)*
»	Note on heredity. *(Ibid. p. 354.)*
Duthie, J. P.	Flora of the Upper | Gangetie Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts. *(Hi, 2, [1920], pp. 169-283.)*
Fischer, C. E. C.	Notes on Pyrenacantha volubilis Hook, and Scoparia dulcis L. *(Journ. Ind. Bot., ii, 1*2, [1921], p. 67.)*
Fyson, P. P. and Venkataraman, K.	Note on Curvature of cut stems of Bryophyllum calycinom. *(Jour*. Ind. Bot., i, 9 tf 10, [1920]y>. 337, with pi.)*
Haines, H. H.	Note on Sapindus trifoliata L. or S. laurifolia Vahl. *(Kern Bull., 7 [1920], p. 260.)*
”	Note on Amoora spectabilis and A. Wallichi. *(Kew Bull., 7, [1920], p. 238.)*
Holden, B. 8.	
Kashyap, S. B.	Observation on the Anatomy of Teratologic seedlings. *(Ann. Bot., Vol. xxxiv, [1920], p. 321, with ph.)*
Khadflker, T. R.	Note on Hepaticae. *{Journ. Ind. Bot., i, 9 * 10, [1920], p. 365.)*
Mann, H. H.	Description of the inflorescence of Amorphophallus campanulatus Bl. *(Journ. Ind. Bot., ii, 1 $• 9,{192I\,p. 66.)*
Paitbasarathy, M. 0.	Variation in the flower of Jasminum malabaricum Wight. *(Jour*. Linn. -Sec, xh, 302, [1920], p. 165.)*
Peteb, T.	Observations on the Volvooaceae of Madras. *(Journ. Ini. Bot.,i,9$ 10, [19X0],p.330.)*
trayag, S. H.	Saocolobium longifolium and 8. Wightiannm. *(An^Boy. Sot. Gard. Pen*. Cey., tii, Part ii, [1990], p. 79.)*
8Mbnii>T.S.	Some observation .on the infloresceN.ee and flowe» of the grape. *{Agri. Journ. of India, avi, Part I, p. 60,9 pU.).*
Sedgwiok, L. J.	The Physiological Anatomy of the Plant* of the Indua Desert. *(Journ. Ind. Bot., i, 8,9* 10, [1990], pf. 937, 977,1 $9,1991, p. 1.)*
Sinn, 8. A.	
Toppin, 3. M.	A new species of Hogonia from Coorg. *(Ind.Forett, Vol. slvi, 8, [1990], p. 494.)*
Various Authors	Phlomis spectabilis *(Bot. Mag., t. 8870.)* Notes on the Balsams of Chitral and the Kaolia *EB±*
Wanwr,M.P.	*(Kew Bull., 10, 1990, p. 346.)* The Dates of Hortus Malabaricus. *(Journ. Boi., hiii, 696, [1920], p. 991.)* ImBuU^S,
Wright,	Allium sikkimense, *(Bot. fam*, [1990], t. 8858J*

Report of the Botanical Surrey of India for 1921-22.

L Systematic.—Eastern *India and Burma.*—The most important event of the year with regard to the botany of Eastern India is the appearance of Farts I and II of the Botany of Bihar and Orifsa by Mr. H. H. Haines, C.I.E., late of the Imperial Forest Service.' The two parts now published contain the account of 76 families from *BanunodacecB* to *Cornacece.* The work is a valuable addition to the provincial Floras of India. In Bengal Professor Bose has studied the geographical distribution of the species of *Polyporacew^* found in that province and has described several new species. The species of *Dipterocarpus* occurring iQ the Ghittagong District have been studied and form the subject of a paper by Mr. and Mrs. Cowan of the Imperial Forest Service. In Assam Mr. Kanjilal carries on his investigation of the forest vegetation in preparation for the publication of a Forest Flora of that province. In Burma attention continues to be given to the botany of the Cinchona area in Tavoy and collections are 'being steadily accumulated by Mr. P. T. Russell, Superintendent of Cinchona there, as his other duties permit. It is dl the more fortunate that Mr. Russell is taking up this work, as owing to lack of funds it has been impossible to depute any of the Assistants of the Botanical Survey for field work. The latter* however are working up at Head-Quarters as opportunity permits the collections made by Mr. Rufsell and the Director. A considerable number of new orchids have been described by Mr. W. W. Smith, from collections made in Upper Burma and the Burma-China frontier by Mr. 0. Forrest, Captain Kingdon Ward and the late Mr. R. Fairer. New fpecies of *Pkthqirosperrmm* and *Pedicularis* from the same region have been published by Mr. 0. BonatL A new genus of Moss—CAianofoma—founded on material collected many years ago by Parish at Moulmein, has been described pj Mr. H. N. Dizon. During the 1021 Mount Everest Expedition collections were made by Mr. A. F. R. Wollaston which have yielded several new species, that have been described by various botanists.

Northern India.—An interesting illustrated account of the Forest forma* turns and successions of the Sat Tal valley in the Eumaon Himalaya has been published by Mr. L. A. Eenoyer. The Liverworts of the Western Himalaya continue to be investigated by Mr. S. R. Kashyap. The *Astragali* of the Sub-genus *Aegacantha* form the subject of a paper by Mr. R. N. Parker of the Imperial Forest Service and a considerable number of new species from the North-West Himalaya has been published by the same botanist and by Mr. S. T. Dunn. In Nepal collections were made by Dr. S. P. Agharkar and Professor B. S. In*mdar.

Wettern India.—Mi. L. J. Sedgwick, I.C.S., has published several new species of flowering plants from the Bombay side, and a collection of mosses made by him in North Kanara has formed the subject of a paper by Mr. H. N. Dixon. An ecological stufly of Deccan grassland has been made by Messrs. W. Burns and « M. Chakradev. The vegetation of Northern Gujarat has been further investigated by Mr. W. T. Saxton, I.E.S., and his Notes are now in the Press as a number of the Records of the Botanical Survey.

Southern India.—Since last year Part IV of the Flora of the Presidency of Madras by Mr. J. S. Gamble, C.I.E., F.R.S., has appeared, containing the families AiMwsato *Ebenaoea.* Supplementary Note No. IV on the Flora and ... India by the same author have iSSmm IMDS of new specie* from the south of ... Coimbatore has published ... species of grasses ... K. Rangachariyar and C. Tadulingam and a new genus of Moss from the Nilgiris by Mr. H. N. Dixon. Mr. K. Rangachariyar, the Madras Government Systematic Botanist, has published a handbook of some common South Indian Grasses and a second edition of his Manual of Botany. Mr. Jacob, his Assistant, made a collecting tour in the ... Hills. As usual, material was supplied to Mr. Gamble to ... preparation of the Flora of Madras.

General.—Mr. T. S. Sabnis continued his investigation of the physiological anatomy of the plants of th3 Indian Desert and Mr. P. R Fyson his account of the Indian species of *Eriocaulon.* Professor Hallberg has recorded several instances of malformations in various Indian species. A revision of the genus *Canavalia* has been published by Messrs. C. V. Piper and S. T. Dunn. The flowering of *Amndinariafalcatd* is the subject of a paper by Mr. J. S. Gamble. Short general accounts of the Family *Winteraeece* and of the genera of *Fumariacecs* have been published by Mr. J. Hutchinson. Asiatic Sedums have been studied by Mr. R. L. Praeger and a considerable number of new species described. Mr. H. H. Haines has published critical notes on the Indian species of *Carissa* and *Briddia.* The.Indo-Malayan species >of *Jussioea* have been studied by Mr. H. N. Ridley. Messrs. R. N. Parker and'B. L. Gupta continue to publish their useful index to new Indian species of Forest importance. The first instalment of the systematic account of the *Euphorbiacea* of the Malayan Peninsula by the Director of the Botanical Survey has been in the Press for many months now and descriptions of the new species were published during the year in the Records, the species of *Artemisia,* a genus of economic importance as the source of Santonin, were studied at Eew by Mr. C. C. Calder, Curator of the Herbarium of the Royal Botanic Garden, Calcutta, while he was on leave. Mr. P. M. Debbarman, Assistant in the Botanical Survey, contributed five papers on various branohes of Botany to the last meeting of the Indian Science Congress and has published notes on Syncarpy in various species of Indian plants.

II. Economic.—By far the most important work umder this heading is Cinchona Cultivation in Southern Burma. As it would take up too much apace to mention in detail all the work of the year and as detailed monthly reports are submitted to Government, only a general account is given here. The results so far obtained have been instructive, if not so satisfactory as could be desired in every respect. As the site selected early in 1920 for establishing nurseries was found on account of the excessive rainfall and high winds to be unsuitable for planting out .the seedlings in the open, the latter were planted out about 4 miles to the South-East of the Huingye Taung amphitheatre—the site o! the nurseries—on the Southern flank of the most South-Westerly tributary of the Hemze river at an elevation of about 1,700 feet. Planting qut could not be commenced until near the end of May 1921 and was continued throughout June. As a result of the unavoidable lateness in planting out the young plants had not time to consolidate their position in their new quartets before the full fury of the Monsoon burst upon them. As the South-West end of the valley acted as a funnel for the Monsoon current the young plants fared badly. The rainfall CAB be described only as terrific. During June, July and August of 1921 over 240 inohes of rain fell, some of the falls being from 11 to 18 inches in twenty-four houss. More than half the tender young plants succumbed to the ordeal. Those that survived, however, put on excellent growth and up to the time of writing (Jul 1922) a year later are quite healthy and growing well. $he Vacancies were filfed in at the end of the rains of 1921 and planting extensions were continued u weather conditions permitted ifp to May 1922. Of tjbe later plantings from October 1921 to May 1922, those plants planted out up to the end of January 1922 are at the, time of writing quite healthy and putting on good growth, but those planted out later than January 1922 have had to withstand a scarcity of rain during the early months of 1922 followed by a very heavy Monsoon rainfall, and it is ^roDa^leltat a considerable percentage of them will be unable to hold out over the Monsoon.

Although the experience so far gained shows that Cinchona, if planted out at a favourable time of the year can stand up against the enormous rainfall—which is far more than was ever expected—of the present plantation site, Which appears to be the point of impact of the very arrow-head of the Monjtoon, lit i» madvistble to continue to expose young plants to more risks than are ifflavoidAtri». As the rainfall further South in the Tenaaserim Division of Burma is not *niy ocMidcraUy leas in amount but is also less unevenly distributed over the yeai tha a is the oase in the Tavoy District, it would be preferable to select <an6th«r plariatfon site or sites considerably to the South of the present one, sar in Mertn Dis Met, where there are enormous tracts of virgin evergreen hill-forest i«ñti available tather than to continue to take risks that are unavoidable ffintiiQicottU ana in Tavoy District. Proposals for taking action oil these lines ^ be fttbaiitte^ to Government at an earlv <*«>

In addition to Cinchona, the cultivation of Ipecacuanha has also been experimentally started in the Cinchona area. The latest report—received in August 1922—states that the Ipecacuanha plants planted in 1921 have made very fine growth. The climate of Southern Burma being as regards temperature more equable than that of the Eastern Himalaya, Ipecacuanha is likely to flourish in Tenasserim, while it has not to run the risks of being exposed to the direct battering force of exceedingly heavy rain, as it is a small plant and is cultivated in jprotected nurseries. The extremely arduous pioneering work of exploring and opening up under very trying conditions has been carried out throughout the year by Mr. P. T. Russell, the Superintendent, whose energy and zeal have formed an essential facto; in the knowledge so far attained and call for the highest commendation.

At headquarters a large number trf minor economic inquiries—too numerous to mention here—from other Government departments, Botanical .institutions in India and abroad, Universities and private individuals were dealt with.

HI. Industrial Section, Indian Museum.—There was no permanent Curator of this Section during the year and work was consequently restricted to routine lines. Most of the specimens in the public gallery were overhauled and some* thirty new exhibits jadded, and over 3,000 re-labelled.

IV. Publications.—During the year the following parts of the *Records of the Botanical Survey* appeared*:—Vol. VIII, Nos.2 and 3 being the continuation of the *Flora Arabica* by the Rev. Father E. Blatter, S.J.; Vol. IX; No. 1, ***A Survey of the Flora of the Anaimahi Hills* by Mr. C. E. a Fischer, I.F.S.; Vol. IX, No. 2, *Euphorbiacece novcee Peninsula Malayana* by A. T. Gage. A list of** the more important extra-departmental publications concerned with Indian Botany is appended to this report.

V. Purchase of Cinchona Bark and Quinine.^During the year 1,482,980 lbs. of Cinchona bark and 52,910 lbs. of Quinine Sulphate were purchased from Java. Of the bark, 443,572 lbs. were worked up in the Bengal Government Quinine Factory at Mujgpoo and yielded 21,541 lbs. of Quinine Sulphate and 5,976 lbs. of Cinchona Febrifuge, the average Quinine percentage being 5*73. The stock of Quinine Sulphate belonging to the Government of India on tHe 31st March, 1922, amounted to 174,41 If lbs.

VI. Financial.—The total allotment for the year was Rs. 28,88,530 of which Rs. 44,270 were for the Botanical Survey proper and the Industrial Section of the Indian Museum, Rs. 71,000 for Cinchona work in Burma and Rs. 27,73,260 for purchase of bark and quinine. The total expenditure was Rs. 24,43,444, the saving being mostly in the purchase of bark and quinine.

VIL Stall.—Lieutenant-Colonel A. T, Gage, I.M.S., and fa. R T. Ruwell were in charge throughout the. year of their respective pfcsts of Director of the Botanical Survey and Superintendent of Cinchona Cultivation in Burma. There was no permanent Curator of the Industrial Section of the Indian Museum during the year, but Messrs. P. M. Debbaiman and V. Narawrtwami,' Assistants for Systematic work officiated in turn. Mr. E. F. Vieux,' the Assistant Cotttor,' was on leave from the 5th May to 4th October, 1921, the Head Clerk officiating during his absence. From the 26th June 1921 to the end of March 1922 Mr. P. M. Debbarman officiated as Curator of the Herbarium of the Royal Botanic flanten in addition to his own duties. B^th he and Mr. Narayanswami as usual gave great help in Herbarium work in the Royal Botanic Garden. Mr. H: Thomas vas appointed on transferirom tlfe Government of Bengal Cinchona Plantations as Assistant, Superintendent of Cinchona Cultivation in Burma from the 1st December, 1921. All executive and mimsterial officers of the Department have given commendable attention to their duties.

A. T. GAGE, *Ll^CdU I-M.8.,*
Director, Botanical Survey of India.

LIST OF PAPERS.

PARKER, R. N. AND GUPTA, B. L. — New Indian species of Forest importance. (Tie *Indian Forester, xlviii, 5,1922, p. 247+)*

FRABGXB, R. L. — . Some Asiatic Sednms in Edinburgh Herbarium. *(Votet Ray. Bot. Oard. Edin.f xiii, 62, 1921, pp. 67—101, with pis.)*

RAITGA ACHARIAR, E. — . A handbook of some South Indian grasses.

RIDLEY, H. N. — . The Indo-Malayan species of *Jusnaa. {Joum. of BoUmy, lix, 70S, 1921, p. 267.)*

BABNIS, T. S. — . The physiological anatomy of the plants of Indian desert. *(Jow%. ltd. Bot., U, 3,4,5,6, 7,8,9 and 10,1921.)*

SIBGWICK, L. J. — . New Bombay species. *(Jown. Ind. Bot., ii, 4 and 6, 1921% p. 123 with figs.)*

BMITH, W. W. , — . New orchids from Yunan and Northern Burma. *(Xote$ Roy. Bot. Gord. Edin., xiii, 63 and 64,1921, p. 189.)*

VARIOUS AUTHORS , — . Some new Indian species. *(Decades Kewmses,* £«v. *Bvll., 3, 5, 8, 1921, pp. 118, 216, 307.)*

, — .• New speciés'from Mount Everett. *(Kew Bull., 4, f. 149.)*

Report of the Botanical Survey of India jbf 1922-23,

I* Systematic—Eosterrt *Indk m\&* Bwrma.—Apart from the tours- oi the Director undertaken primarily in connection with Cinchona work but taken advantage of for Botanical purposes as well, no touring was possible during the year. Work in the herbarium has therefore been confined to collections already awaiting examination and to identifications of current consignments from outside collectors.

On the systematic side a great variety of study during the year calls (or record. With the development of Botanical Schools in connection, with Indian Universities and Colleges the range of study tends yearly to increase. Practically all the main groups of the vegetable kingdom now have their students and an increasing amount of attention is being given to many groups of plants which for one reason or another We received scant attention in the past. Thus the Algae, the Liverworts and the Fungi now have their taxonomists and a mass of literature °n these as well as on the higher plants is finding issue in new botanical journals and papers.

Mr. Haines' further study of the flora of Bihar and Orissa and the Central Provinces has revealed the existence of the following four species new to science :—*Stereospermum angustifolium, Premna calycina, Leucas kfctorifolk* and *Cumma sulcata*. Full descriptions of these have been published in the Decades Kewensis section of the Kew Bulletin.

h Hoteajrom the Royal Botanic Garden, Edinburgh, are published the ^diagnoses by Prof. Balfour of a large number of Asiatic Rhodo- ^udioBB. Seventy species in all are dealt with including some 29 from ^nat^and the North East Himalaya collected by Messrs Farrer, Kifitfbpi Ward and Cooper, also a large number from China and Tibet collected by Forrest. Mile Camus has described a new genus of the Bambuseae, *Neohoumua*, one species of which under the name *Teino*- JJ^yum DulIooa, Gamble has been known from Bengal eastward in *otth East India and inBurma. It is now reported from French posses- £0*8 in %mth East Asia. Another species belonging to the same genus, «. *tavoyana*, Gamble originally *Bawbwa Heljeri* has been redescribed b~Hi. Gamble in the Kew Bulletin where he gives an account of the ** genus and the effect of its adoption on the nomenclature of certain Piously known Bamboos. An excellent local flora dealing with the Wation of the Andamans from the forest officers' point of view has

appeared in Mr. C. E. Parkinson's latest publication. The keys given furnish the field botanist with a ready means of identifying material as he goes- along and the fuller descriptions in the body of the work supplement the information of the keys which are artificial. From Mr. Parkinson's collection in the islands Mr. Hutchinson has described a new species—*Orphea torulosa*—belonging to the Anonaceae,

In Burma the temporary dis-organisation caused by the transfer of the Cinchona plantations and the heavy work entailed in opening up the new area have prevented Mr. Russell and his assistants from doing as much field botanical work as miglft have been possible under more normal conditions. During a tour to the Mergui area late in thfc year the Officiating Director took occasion to collect and supervise collections. An additional mass of material over that collected in Titvoy is accumulating and will form the basis for future work on the systematic botany of the jungles lying between Mergui and the gulf of Siam.

The Algae of Bengal has been made the special subject of study by Prof. Bruhl and his assistants in the Biological Laboratories, Calcutta. Treatises on Indian bark algae and *Compsopogon* have appeared in the Journal of the Department of Science during the year; several species of bark algae new to science have been described while the distribution in Bengal of numerous previously known forms is being recorded.

The Poiyporaceae of Bengal forms a subject of study for Prof. S.R, Bose; the results of his researches are being issued in the Bulletin of the Carmichael Medical College.

Northern India.—The most important botanical work having a special reference to this area published during the year has been Mr. Osmaston's treatise on the Forest Communities of the Garhwal Himalaya. The work is an oecological study of the tract and the conditions affecting the vegetation. The formations, associations and societies are all described and a series of excellent photographs illustrates the work.

The following new species of plants from Northern India have had their descriptions published:—*Acacia ptwdoebumea,* from Kumaon, Hardwar, etc.; *Indigofera rubro-violacea* from the Chamba 8t$te and Kashmir; *Leptodermis kumaonenns* from Garhwal and *Astragalut oegacanthoide8* from Eumaon.

Mr. W. B. Turrill has a paper on a question of nomenclature in the Cyperaoeae raised in connection with his work on this grouf for the Flora of the Upper Gangetic Plain.

The Liverworts of the North West Himalaya are the special subject of study of Prof. Eashyap and his school at the University of the Punjab. Amongst others Prof. Eashyap has interested himself in plant immigrants. In a paper read at the meeting of tiro Indian Science Congress

he gives an account of foreign species establishing themselves about Lahore.

Daring theyear Prof. Hallberg, late of St. Javier's College, Bombay, made an expedition to the North West to discover the distribution, abundance, times of flowering, etc., of the forms of *Artemisia* found over the area and known to contain santonin. So far as obtaining material rich in santonin was concerned the expedition failed, but a whole crop of questions on the reasons why santonin was not found have been raise4» Quite an appreciable amount of the drug had previously been extracted from the same plant growing in the same area. The reasons why no santonin was obtained on this pccasion are obscure, but the subject is of great economic importance and it deserves to be further investigated. As regards plants from the North West the collections of t^e Botanical Survey are the richer by many thousands of sheets as the result of Prof. Hallberg's tour.

Western India.—Preliminary to a continuation of his work on the physiological anatomy of the plants of the Indian desert Prof. Sabnis is compiling a list of plants of the deserts of Sind. Localities in Sind and the general distribution of the different species found are cited. In 1918 Prof. Saxton and Mr. Sedgwick published in the *Records of tU Botanifidl Survey of India* an account of the plants of Northern Gujarat. Since then many additions have been made and these, with the intention of supplying information supplementary to the main account, have now been published.

In the same publication a further part comprising the families Labiatae to Ceratophyllaceae of Sthelbert Blatter's Flora Aiabica has appeared.

A very handy account of the f ems of Bombay has appeared in Messrs. Blatter and D'Almeida latest publication on this group. The work is illustrated by figures showing the essential morphological details and in maay cases the general appearance of the frond or plant is also given.

A new Indian *gr&us—Urochloa marathensis*—from' the Bombay Presidency has been described by I. T. Renrard in the publication of the VanV'Rijks Herbarium. The new species comes near *U. Helopus* described by Stapf but material is not sufficient to determine it as being identical. In the small amount of material available differences are evident and the author has thought these sufficiently marked to warrant/ tentatively, specific distinction.

Southern India.—lit. Gamble has described the following new species from the Southern part of the peninsula—*Torenia courtaUensis, Didymoearpus Fischeri; Toxocarpus Beddomei, Toxocarpus palghatensisj Legusttum travancoricwn, Brachyitelma Bourneae* and *Brachystdma Rangackarii—wh&Q* Dr. Stapf in Hooker's Icones had fully described and Aguted new.combinations in *Cyrtotoccum-trigonum* and *Capillipidtuvi*

gkntooprit, two new grasses. The most important botanical work dealing with the higher plants and connected with this division at present undet preparation is Mr. Gamble's Flora of the Madras Presidency. Amongst the lower plants a new genus of Moss.—*Beddomiella*^iounded on mate* riäl collected many years ago by Beddome in the Nilgiris has been described by Mr. H. N. Dixon.

General.—Prof. P. F. Fyson has completed his study of the Indian Eriocaulons. His results are published in the Journal of Indian Botany and in the reprint form a handy guide to the student in this rather difficult group of plants.

The Indian Ophioglossums are dealt with by Prof. I. D. D'Almeida of St. Xaviers' College, Bombay. The extreme variability of the individuals comprising the different species has been the cause of much splitting in the genus. Prof. D'Almeida has reviewed the characters which seem to him to merit consideration from the systematist; the group is keyed, re-arranged and described; Indian distributions are dealt with and references made to the various collections on which the work is based.

The Fungi of Ceylon continue to receive the attention of Mr. T. Petch. Additions to the Fungus flora of the island are being published in the Annals of the Royal Botanic Garden, Peradeniya. All additions, no matter to what group belonging, are taken up. As most of the fungi are not endemic in the island but extend their distribution to the Indian Peninsula the work is of much value to students of the fungus flora of India.

A new colonial member of the Isokontae, a group of algae, collected in the inland fresh waters of Ceylon by Prof. F. E. Fritsch, is described by W. B. Crow in the Annals of Botany where the comparative morphology and systematic relationships of the new species are described.

Besides the above many works on systematic botany dealing with groups of plants, some numbers of which extend their distribution to India, have found publication during the year. The genus *Calendula* is dealt with by Hallier, the genus *Ptyssiglottis* by Moore, the Buphorbiaceae-Phyllanthoideae-Phyllantheae by Pax and Hoffman and the Compositae-Hieracium by Zahn, the last two in the Pflanzenxeich. Pfeiffer has a monograph of the Isoetaceae in the Annals of the Missouri Botanical Gardens.

Dr. Church has published an Introduction to the systematy of Indian trees, being notes arranged for students of Indian Botany at Oxford.

Sir J. C. Bose has studied the physiology of the ascent of sap in plants* Prof. Bruhl and his assistants have papers on Vitamines and an interesting and timely account of the new pond pest Eichhornia. Messrs, Dastttr and Saxton have studied the vegetative methods of reproduction

in certain plants and also the oecology of some plant communities in the Savannah formation.

A preliminary note on the life history of *Cedrus Deodam,* with, special reference to fertilisation and the structure of the prothallua has also been given by Mr. Saxton. Papers on the anchoring pads of *Gymnopetalum cochin-chinensis,* floral prolification in *Nymphea rubra* and a note on an artifice of nector sipping birds are some of the results of Mr, Debbarman's observations during the year.

It Economic—The most important item under this heading continues to be Cinchona cultivation. Reference was made in last year's report to proposals for the transference of work to the Mergui District of South Burma. Conditions in the Tavoy area proved impossible and it bebame evident that a new location for Cinchona was inevitable. After very careful preliminary investigation of the soil and climatic conditions in the neighbourhood of Tenasserim, proposals for a fresh start in this district were sanctioned and Mr. Russell, Superintendent of Cinchona Cultivation, with part of his essential establishment moved from Tavoy to fresh quarters situated in the foothills south of the Tenasserim Hevea plantations at Nyaungbinkwjn. As condition! here seemed to provide all the essentials for Cinchona, work was started on a fairly extensive scale but not on such a -scale as would prove ruinous if unforeseen events negatived the area as a source of supply of bark. By the end of the year some 1,500 'kamras' for seelings were in course of construction of which 150 were already carrying their stock awaiting transplanting; a mixed labour force was busy reducing the jungle to order while roads were being pushed through to link up Cinchona camp with the outside world and to get sufficient stores through in anticipation of the time when the rains would put an end to all but the minimum of communication. The original programme provided for a 'break' of 500 acres and cjearing for a considerable part of this had already been done when the need for retrenchment forced a reduction to 250 acres. Sufficient seed lor this minimum only was therefore sown and in far less time than, they take to germinate in the Bengal plantations the seedlings wereipushing their way through and looking the picture of health. It is, of course, much too early yet to claim success, but so far nothing has happened to cause apprehension or to create misgivings as to the ultimate result. Indeed all the evidence up to the present points strongly to the area being well suited for the purposes of a Cinchona reserve. In their early stages the seedlings were thriving so well that it seemed likely that a second transplanting before being put out in permanent sites could be dispensed with. With a large number of seedlings this is what must now happen. Growth has been phenomenal and it has become impossible for lines to be built on a scale large enough and

sufficiently quickly to accommodate all the seedlings. In the process of hardening the seedlings to the sun, methods which have never been deemed possible in Bengal have been successfully proved this year in Burma. The most encouraging feature of the whole scheme is, however, now available from analyses carried out on very young barks grown in the Tavoy area. The writer felt that there was a certain danger of the alkaloid content failing on account of the low elevation at which extensions had to go out. This would have been in accordance with experience gained from elevation tests in Java. No means of proving the point seemed possible until barks sufficiently old for analyses gave us data for Mergui but it was felt that an analyses of Tavoy barks grown on an average at much lower elevations than is the case in Bengal might afford useful evidence of a parallel nature.

If the Tavoy bark analyses now to hand can be taken as an indication of what may be looked for in Mergui, no more promising evidence of future success could be sought. These barks are twice as rich in quinine as Bengal barks of their age and species. When Cinchona trees grown under such adverse climatic conditions as have been experienced in Tavoy give at 2 years of age an alkaloid content of 4% and at one year old between 2% and 3%—percentages attained by Bengal trees at 4 to* 7 years of age—it may be argued that Cinchona planting in South Burma has one factor of prime importance in its favour. Climatic conditions have been almost ideal; the temperature in the hot weather goes a little higher than Cinchona likes, but it is not excessive and light shade planting should easily counter its effects; rainfall possesses none of the terrors it did in Tavoy and the soil seems capable of growing any crop. Under the careful supervision of Mr. Russell and his staff a very successful fresh start has been made.

Ipecacuanha, the only other crop at present experimented with, shows evidence of being much more amenable to ordinary methods of cultivation in Burma than has ever been found to be the case in the more trying climate of Bengal. When last seen in the nurseries the young plants had developed a nice bloom and looked healthy and robust. Seed for the extended cultivation of Ipecacuanha will be made available this year from Mungpoo. Meanwhile experiments on the extraction of the drug from the dried root are being carried out at the Bengal factory, the idea being to place emetine, the finished product, on the market.

HI. Industrial Section, Indian Mūseum.—The appointment of a Curator from the beginning of the year rendered possible the initiation of a scheme for the re-arrangement of this section. A revised plan for the gallery, involving the removal of exhibits which were out of place in a collection devoted to economic plants and their uses, was drawn up and a beginning made to render the gallery less like a home for stray

miscellaneous products having no other fixed place of abode. The bays devoted to foods and medicinal products, the first to be begun, already show considerable improvement. A study of the exhibits one by one is being undertaken by Mr. Bal, the newly appointed Curator, with a view to the preparation of a catalogue of the section. Besides this fresh work, the routine of renewing and overhauling existing exhibit* went on throughout the year.

IV. Publications.—During the year the following parts of the ***Records of the Botanical Survey of India*** **appeared:—Vol. VIII, No. 4** being a continuation of the *Flora Arabica* by the Rev. Father E. Blatter; ***8.* J., Vol. IX, No. 3 being *Additional notes on plants of Northern Gujarat*** by W. T. Saxton, F.L.S., I.E.S. In the Press at present are Mr. I. H. BurkilTs account of the *Botany of the Abor Expedition*. A list of the more important extra departmental publications concerned with Indian Botany is appended to this report.

V. Purchase of Cinchona **Bark and** Quinine.—During the year 777,035 lbs. of bark and 39,682 lbs. of quinine sulphate were received from Java under terms of the Bark and Quinine agreements. Some 404,387 lbs. of Java bark were worked up at the factory at Mungpoo to produce 22,086 lbs. quinine sulphate and 4,892 lbs. Cinchona febrifuge, the average quinine percentage being 5*46. The factory extracted about 92% of the theoretical possible. The stock of quinine sulphate belonging to the Government of India on the 31st March 1923, amounted to 229,575 lbs. By arrangement, as a matter of convenience, large indents of Quinine sulphate on the Bengal Cinchona Department are met on occasion from Imperial stocks at the Museum, an equal quantity being added to the Government of India stocks at Mungpoo from provincial stocks there. During the year 8,215} lbs. Quinine sulphate were issued to Government Departments and to Local bodies in the Punjab. Revenue from this source amounted to Bs. 2,80,565.

VI. Financial.—The total allotment for the pear waB Us. 27,15,000 of which Bs. 53,000 were for the Botanical Survey proper and the Industrial Section of the Indian Museum, Bs. 3,17,000 for Cinchona and Rs. 23,45,000 for purchase of bark and quinine from Java. The total expenditure was Rs. 16,86,208-11-4, the saving of Rs. 10,28,791 being almost entirely due to bark and quinine consignments being below estimates and to plantation work in Tavoy closing down.

VII. Staff.—Lieut.-Colonel A. T. Gage, I.M.S., was Director from 1st April 1922, to 2nd January 1923, when he went on leave preparatory to retirement. • Thereafter the undersigned held the post till the end of the year. Mr. S. N. Bal was appointed to the post of Curator, Industrial Section, Indian Museum, from 1st April 1922, and held the appointment throughout the year. Mr. P. T. Russell continued to hold his post of Superintendent, Cinchona Cultivation, Burma!

until he went on leave for three months from 1st June to 31st August 1922 when Mr. H. Thomas, Assistant Superintendent, acted for him. Mr. Thomas reverted to Bengal to succeed Mr. Green as Manager of Munsong Cinchona Plantation on the latter's retirement towards the end of the year. Maung Sine was appointed Overseer in the Cinchona Plantation, Burma, from the beginning of the year. His knowledge of local conditions and his energy and trustworthyness have proved of much help to Mr. Russell on whom the burden of opening up in Mergui has had to fall. The services of Mr. P. M. Debbarman, Assistant for Systematic Work, were transferred to the Government of Bengal from 3rd January 1923, as Officiating Curator of the Herbarium, Royal Botanic Gardens, which post fell vacant by the transfer of the undersigned to officiate as Director, Botanical Survey of India. The post vacated by Mr. Debbarman remained unfilled in order that effect might be given to retrenchment proposals made by Government. Mr. V. Narayanaswami held his post as Assistant for Systematic Work throughout the year. Messrs. E. F. Vieuz and U. C. Pal were respectively Assistant Curator and Head Clerk throughout the year. Babu Hemendra Chandra Banerji, one of the Upper Division, Clerks, retired from Government service during the year. Babu S. B. Banerji, *A* Lower Division Clerk, was promote^ to the Upper Division and a Lower Division Clerkship thus falling vacant was abolished by order of the Government of India as a result of retrenchment. All executive and ministerial officers of the Department have done their duties with commendable zeal throughout the year.

C. C. CALDER,

Offg. Director, Botanical Sumy of India.

LIST OF PAPERS.

ttlDLEY, H. N. . . The distribution of plants. *(Ann. Bot.,r xxxvii, 145, p. 1.)*

SAXTON, W. T. . . Mixed formation in time.—A new concept in 0 ecology. *(Journ. Ind. Bot., Hi, 1922, p. 30.)*

„ „ . . Some observations and suggestions regarding Nyctinasty. *(Journ. Ind. Bot., Hi, 5,1923, p. 127.)*

SPBAGUE, T. A. . . Notes on Theaceae II. *(Jaurn. Bot., lxi$_h$ 723,1923, p. 82.)*

TUMLL, W. B. . . Notes on Cyperaceae. *(Kew BuU. 3$_t$ 1922, p. 122.)*

VILLANI, A. . . . Sulla classificazione delle Crocifere. *(Am* di Bot., xvi, fan i, 1923, p. 71.)*

CALCUTTA : FBIOTID IX SUPDT. OOVT. PWMTIMO, IHDIA, 8, HASTINGS STREET.

Report of the Botanical Survey of India for 1923-24.

I. Systematic—toerw *India and Burma—The* financial stringency which has been influencing the development of the Department for some years has again made it imperative for the year's work to be confined to headquarters. No purely botanical tours could be indulged in although opportunity was taken during tours connected with other work to add to the collections atheadquartersi

By much the most important botanical results for the year concerning this Division must be considered Mr. I. H. Bur&U's ' Flora of the Abor Expedition' which has just appeared as Vol. X of the Records of the Botanical Survey of India. For a work of this description, one which might well be taken as a sample for future work of the same nature, something more than a mere passing reference seems necessary. Mr. Burkill accompanied the Abor Expeditionary force during the months of November to March 1911-12 into a field where the observations and collections made prove to be of the highest scientific value. The area seems to be a particularly suitable one for the study of questions concerning the ecology and geographical distribution of plants. Abor land forms the meeting point of several very distinct types of flora all of which are carefully analysed by the author and a flood of light is now thrown on the origin of the Flora, its history and relationships. ' The work divides itself into 8 parts as follows:—(1) Introductory and a general view of the outer Abor Hills and of the plain just under the hills in which are described the lines of work taken, the nature of the country, the climate, the soils, the occurrence or non-occurrence of certain genera of high geographical importance and the effects of man on the Flora. The biology of the flora of Abor land forms part 2 in which are described the various ecological formations chief amongst which is the *Skingheng* formation. A list of the higher plants, their zones, altitudes, distribution and a comparative analyses of altitudes in the Sikkim Himalaya are given in part 3, while parts 4, 5 and 6 deal with wider aspects of distribution. Part 7 deals with the genesis of the flora and the work ends, Fart 8, with a complete enumeration of the species found, their localities, elevation, etc. A map of the country and a series of. interesting photographs illustrate the volume.

Professor W. W. Smith and Mr. G. Forest have descriptions of the following further new or interesting species belonging to the area in

Notes from the Royal Botanic Garden, Edinburgh.—*Primula Valentiniana* Handmzt. *Primula brachystoma* W. W. Sm., *Primula calliantha* Franch, *Primula DicUeam* Watt. *Primula lacerata* W. W. Sm.

A new fungus *Trametes cincta* is described by Prof. S. R. Bose in the Bulletin de la Societe Mycologique de France. A collection of *Mycetozoa* from Northern India has been worked out and published in the Journal of Botany by Mr. G. Lister. Comparatively few *Mycetozoa* seems to have been collected previously and the present series is said to be specially valuable in extending our knowledge of the distribution of species. Prof. S. R. Eashyap, the authority on Indian Liverworts, has a short paper in the Journal of the Indian Botanical Society on *Monoselenium tenerum*, a liverwort described by Griffith 80 years ago and not found again till it turned up in a collection made in 1920. An interesting account from the ecological standpoint is given of a part of the riverine tract of Burma by Messrs. Dudley Stamp & Leslie Lord in the Journal of Ecology. The authors limit their analyses to those plants or group of plants which characterise the different formations, a method which while giving only a partial picture of the whole, eliminates the disadvantages attaching to long lists of plant names while yet making it possible for the average reader unacquainted with the area to reconstruct the main scene. In concluding the authors refer to a difficulty experienced by most workers in this field of knowledge and not avoided by them, namely the present day complexity of nomenclature when dealing with ecological questions.

Northern India.—In the Indian Forester Mr. H. G. Champion has discussed the influence of the hand of man on the distribution of forest types in the Eumaon Himalaya. The main divisions are made from the Forest officer's point of view, forest species of economic importance being allowed to characterise the divisions. The main conclusions aimed at are that population and its effects cause certain species naturally belonging to certain areas to be driven to contiguous and less favourable areas and that the balance is shifted from the more mesophytic to the more xerophytic type of vegetation. The same author has another paper of ecological interest where he deals with the interaction between *Pinus longifolia* and its habitat in the Eumaon hills.

The succession of epiphytes in the *Quercus incana* forest at Landour has been studied by Prof. W. Dudgeon. The various stages in the succession are distinguished and described. A noteworthy and surprising result is reached in the relative abundance of the lower orders of plants among the epiphytes of this region. An examination of the forests of the Eastern Himalaya would almost certainly

shift the balance in favour of an increased proportion of the higher plants appearing amongst the epiphyte flora.

Reference was made in the last year's report to the question of Santonin yield from *Artimisia* in the North West. Since then the subject has been further investigated. Prof. Hallburg has returned from leave in Europe[1] and is now engaged in furthering the original enquiry. Another investigator has also been in the field. Material is being sent from the North West to Calcutta where it is being successfully extracted in a small way.

Western India.—k& in several other provinces the chief work in Western India has been of an ecological nature. In the Journal of Ecology Prof. W. T. Saxton has discussed the phases of vegetation under monsoon conditions in a tract of low lying country near Ahmedabad with a well marked and fairly regular summer monsoon. The procession of plant communities in relation to the stage of the monsoon and consequent humidity of the area is clearly brought out. Eight Synusia or aggregations of plants belonging to the same life-form and making similar demands upon a similar habitat, are distinguished. The ecological interest of the paper lies chiefly in that the observations relate to an area in which for no great length of time during a year are the plant communities allowed to make their demands on constant climatic or edaphic conditions. It would be interesting if the results obtained from Prof. Saxton's observations could be compared with those from an area giving fairly constant edaphic conditions of a humid nature. As Prof. Saxton has now left India the subject is suggested for other botanists interested and with opportunities for working in the same field.

Southern India.—Another part, being the 5th, of Mr. J. S. Gamble's Flora of Madras has appeared during the year. This brings the revision down to the middle of the family Scrophulariaceae. The work is likely to remain for many years a standard one for students of systematic botany' belonging to this province. In the Decades Kewensis section of the Kew Bulletin Mr. Gamble has described the following new species.—*StrobHanthes Lawsom, Strobilanlhes urceolaris, Andrographis Lawsoni, Lepidagathis Barberi—a*\\ from Peninsular India. In the Journal of the Indian Botanical Society Mr. P. M. Debbarman of the Botanical Survey has a critical note on *Crotalaria madwensis* W. and *Crotalaria candicans* W. & A. These plants originally believed to be specifically distinct were first combined by Baker ^n 1876 and most subsequent authors follow Baker in keeping them together. Mr. Gamble in his new Flora has, however, reinstated C. *candicans* as a good species. Mr. Debbarman while inclined to think that the two species are inseparable, realises that minute examination in the field

is necessary to clear up the point. Mr. Debbarman deals in the same Journal with an instance of staminody and multiplication of petals in *Cadaba trifoliala* W. & A. another S. Indian species. The vegetation of Lalitpur in Central India has been studied by Miss Mabel Hartog who distinguishes and enumerates the constituent elements of some six formations.

General— Besides a large increase in the attention paid to ecological problems concerning the higher plants there is evidence of an increased interest in all the lower groups. The fresh-water Plankton Algae from Ceylon, a group hitherto neglected, have been studied by Dr. W. B. Crow. The character of the material and the limitation of the investigation to certain classes of organisms of the phytoplankton, preclude any account of the Plankton as an association. The author deals with the material from a systematic point of view. Four new species are met with. Thirty-six have not been recorded previously from Ceylon though a large number of them are not uncommon in the tropics. The geographical range of each species is cited and further evidence obtained of the cosmopolitan nature of this group of plants. During the year a paper on the Indian Charophyta by Mr. J. Groves was read before the general meeting of the Iinnean Society. The paper included descriptions with figures of two new species *Nitella Wattii* and *N. mirabilis.* An appeal is made for investigation of the group in the field and a promise given of ample results to any student of Indian botany who cares to take it up.

The methods of attachment of certain Algae has been studied by Prof. Iyengar while Prof. Kashyap continues his work on Indian Liverworts. A new species of the group *Fysonia tenera* has been described from Madras. Students of the fungus flora of India include Mr. Mitra, Prof. Bose and Mr. Petch of Ceylon all of whom have published results of their investigations during the year.

In the Botanical Gazette Dr. A. Arber has discussed the morphology and development of the leaves of certain Gramineae while in another paper she deals with the leaf-tip tendrils of certain Monocotyledons. Part of the material for this investigation was sent from the Royal Botanic Gardens, Calcutta.

The most important general work concerning the higher plants and a work likely to be a constant source of reference in the bookshelf of every systematist is Mr. J. Hutchinson's Contributions towards a classification of Flowering Plants. The work has been undertaken with the object of preparing a phylogenetic system of classification of natural families and genera and Mr. Hutchinson intends in due course to publish the full results of his studies as a separate work. The utility of such a work appearing in English cannot be overestimated,

II. Economic—As regards work of immediate economic import* ance Cinchona cultivation claims a precedence that it is now likely to maintain. The Burma scheme must still be considered as in an experimental stage, but there is a growing volume of evidence that at no distant date it may emerge as a well established and flourishing industry. There have been times of misgiving but no industry in a new sphere can remain entirely exempt from its initial difficulties. In the Bengal plantations, during their early history, the appearance of a certain disease gave rise to all kinds of pessimistic prognostications, yet these plantations, outliving their era of misfortune, emerged to a state that belied all that had been predicted for them, and it can now be said of the Burma scheme that nothing short of an accident or a misfortune that cannot be foreseen will prevent its successful development.

Last year experience had still been confined to plants in the nursery where a luxuriance of growth spoke well for their future but the real test was to come when they reached the open. The present report can now speak of how the young plants behave when they **have** passed the nurseryman's hands. As early experience might mean a saving in time .and expenditure afterwards it was decided to get a stock* of older plants from the abandoned Tavoy area and also to ship several wardian cases full of plants from the Bengal plantations, the idea being to immediately get a stock of plants under observation in the open, in conditions exactly similar to those that the oncoming seedlings in Mergui would have to meet. The Bengal shipment did not prove the success that was hoped for, the long sea journey with several transhipments proving too much for the plants but the Tavoy lot, which weie taken down by Mr. Russell personally and had expert attention throughout, stood the much shorter journey well and in the event were to prove of very great experimental value. They were immediately put out to permanent situations in a site exactly similar to what Mergui reared plants will get. At first they hung back as if objecting to the change but signs were not long in coming that the fresh conditions had been found congenial. Line by line the plants picked up; there was scarcely a casualty and in a few months time the experiment gave results a year ahead of what could have been looked for had it been carried out with local stock. It **was** evident that very large nursery plants could be transplanted with every success, at least at this time of year. An experiment with a different object in view therefore suggested itself. If plants much larger than would normally be called upon to withstand a transp'anting would succeed what about seedlings put out to permanent situation before they had reached what had hitherto been considered transplanting age ? Could nursery existence on these new conditions be shortened ? It was not

advisable to gamble with any large stock but the results obtained showed without any remaining doubt that the gamble was worth while. As in the case of the Tavoy plants there was an immediate check and it is possible that a prolonged period of drought would have brought the experiment to an end, but in this new area rainfall is much more evenly distributed than it is on any of the Indian plantations, a factor of very great importance during the early existence of plants in the open. Bain came and the tiny seedlings went ahead. Thereafter nothing would stop them. They now constitute the Mergui " None such ", an area of young Cinchona ahead even of the much older plants from Tavoy. It is at once evident that nursery existence for Cinchona in Mergui can be shortened. Whether this is. the best stage for transplanting or not remains for further experiment but it is already proved that Cinchona can go out to the open at a stage viewed as impossible in the Bengal plantations and in practice not attempted in Java. While experiments in the open were giving these encouraging results the main bulk of seedlings still in the nurseries were writing their own plain lesson to anyone qualified to read. A comparison between them and young plants in the open at once showed the advantage of early permanent situation. At the same time nursery seedlings had exceeded expectations. They were already getting inconveniently large for handling and they would be much larger ere the land was ready to take them. Several *Kamras* were therefore cut back to within a few inches of the ground, treatment which killed a number of plants under the conditions in which it was carried out. Although the results of cutting bark do not belong to the year under review it is at the date of writing known that seedlings can be cut back under conditions different from those in which it was first tried. Unless the beds be well soaked before the operation bleeding to death may ensue, but if the precaution of watering be taken the mortality is reduced to a degree that makes the operation a success. This is a result of considerable importance in view of the likelihood of seedling development getting ahead of land preparation.

So far the above experiments relate to *C. Ledgmana* only. *Cinchona sucdrubra* has also been sown but in this species the results are far behind Ledger. They cannot be called a failure and it is quite possible that further experiment may prove succirubra a success. In the writer's opinion a hybrid in cultivation on the Bengal plantations may well take the place of succirubra in Burma and already seed of this hybrid has been collected for trial. It thrives very well at low elevations in Bengal, a* point in its favour for trial in Burma.

When seedlings were cut back opportunity was taken to have the very young bark analysed; the results obtained agreed generally with those got from young Tavoy barks referred to in last year's report.

The year's experiences of Cinchona in Burma merely go to confirm the optimism expressed earlier. There are still dangers ahead and disease to the plant is always the danger that suggests itself when plantations of any kind are attempted in untried areas. A defoliating catterpillar was found troublesome towards the end of the year but its effects were never really serious and it disappeared when the rains came. More recently there have been some signs of canker though again not as yet to a degree to cause misgivings. So far, *Helopeltis*, the great scourge of Cinchona in Bengal, is absent from Mergui. A constant watch for disease is being maintained. Given a continuance of freedom from attacks by insect and fungoid pests Cinchona Cultivation in Burma should now present no difficulties that expert plantation management cannot cope with.

Ipecacuanha.—This is at present the only other plant under experiment in Mergui where it is obviously much more at home than it ever can be in the Bengal plantations. Nursery lines of the plant are looking well and though a certain amount of rhizome is already formed and might be extracted there has been no cropping. The present policy confines itself to multiplication of stock. The experimental cultivation of Ipecacuanha in the shade of bamboo jungle may give results enabling us to dispense with the cost of erection of nursery lines and preparation of beds. As under such conditions there would inevitably be a certain mortality, the experiment cannot be attempted on any scale until stocks are sufficiently large.

III. Industrial Section* Indian Museum.—Some 127 specimens most of which were food substances and medicinal drugs, were added to the collections during the year. Numbers were collected by the Curator and others purchased in the local markets. The most welcome addition is a collection of pieserved fruits donated by the Agri-Horticultural Society after the exhibition in the Eden Gardens in December. The Cinchona exhibit has been renewed and the usual work of overhauling existing exhibits carried out, some two thousand old labels having been renewed. The scheme of rearrangement of the gallery on the lines of the revised plan is progressing and the preparation of a catalogue of the medicinal bays is well under way. Experiments on the preservation of specimens in liquids have been carried out.

The number of enquiries received and replied to regarding economic and medicinal plants from private individuals, firms and Government Departments both in India and elsewhere are too numerous to mention in detail. Amongst others enquiries relate to the following:— ***Gymnema sylvestre, Podophyllum Etnodi, Astragalus fascicularis, Carum copticum, Ferula sp. Saussurea Lappa, Atropa Belladonna, Hyoscyamus***

sp. Denis elliptica, Myristica fragrans, Canarium bengalense, C. resiniferum and C. strictum.

IV. Publications.—Vol. X, No. 1 of the Records of the Botanical Survey, being Mr. I. H. Burkill's Flora of the Abor expedition, has appeared and is under distribution. No. 2 has gone to the Press with orders for printing. Sevefal papers by members of the staff and outside contributors are awaiting the issue of No. 2 before going into print.

V. Cinchona Bark and Quinine.—During the year 608, 103 lbs. of bark and 39,682 lbs. of quinine sulphate were received from Java under terms of the Bark and Quinine Agreements. The Quinine Agreement between the Secretary of State and the Dutch Combine dated the 8th April 1921 which came into operation from the beginning of that year, expired with the close of the calendar year 1923. Under the terms of this agreement the total quantity of quinine sulphate received is 60,000 kilos, equivalent to 132,276 lbs.

The arrangement by which the Bengal Factory took all the Government of India bark coming forward has now been modified by allowing the Madras Factory to extract half the deliveries. The new arrangement allows of the Madras factory being kept in commission while at the same time the pressure on the Bengal factory is relieved.

Some 430,604 lbs. of bark were worked up at the Bengal Government's factory at Mungpoo to produce 24,956|- lbs. of quinine sulphate and 4,983 lbs. of cinchona febrifuge. The total stock of quinine sulphate on the 31st March 1924 amounted to 282,986 lbs. of which 131,418 lbs. were in the Indian Museum in 3,806 original cases and 151,568 lbs. at Mungpoo.

During the year a bark shed for storage of Government of India' bark had to be erected at Mungpoo as the storage capacity of the factory already existing was found insufficient for the provincial and imperial stocks together.

Distribution of Quinine.—During the year 10,328 lbs. of quinine sulphate were issued against 8,215*75 lbs. during the previous year to Government Departments and to local bodies in the Punjab. The quantity of cinchona febrifuge issued was 351 lbs. All large indents are met from stocks in the Indian Museum by the issue of original cases and small indents from stocks manufactured from the Government of India bark at Mungpoo. An exchange supply of 2,075 lbs. in original cases was issued from the Indian Museum on behalf of the Government of Bengal, an equal quantity being added to the Imperial stock at Mungpoo from the Provincial stock there.

***Revenue by the sale of Quinine.*—The total revenue during** the year was Rs. 2,77,896 against Rs. 2,80,565 during the previous

year. The decrease is due to the fall in the price of quinine. Of the total revenue *(viz.* Rs. 2,77,896) Rs. 40,574 were by cash sales to local bodies, etc., and Rs. 2,37,322 by credit to Government Departments in the Punjab. The revenue does not include Rs. 46,298 being proceeds from the sale of 5,722f lbs. of cinchona febrifuge by the Government of Bengal as the same was deducted from the cost of extraction of quinine paid to the Local Government.

Area oj Supply.—The Punjab is the only province which is, at present, supplied with quinine from Imperial stocks. The question of the final allotment of the area of supply to the Governments of India, Bengal and Madras as recommended by the Cinchona Conference held at Delhi on the 11th December 1923 is still under the consideration of the Government of India.

VI. Financial.—The total budget allotment for the year was Rs. 18,06,970 of which Rs. 45,200 were for the Botanical Survey proper and the Industrial Section, Indian Museum, and Rs 17,61,770 for cinchona including Rs 15,75,000 for the purchase of bark and quinine from Java. The total expenditure was Rs 16,82,115 leaving a saving of Rs. 1,24,855. The saving was chiefly under purchase of bark, freight charges and cost of extraction of quinine. The expenses of the new bark shed amounting to Rs. 3,500 and the cost of recruitment of labour for Burma, Rs. 14,000, were met by reappropriation from the budget grant under cost of extraction of quinine.

VII. Staff.-In the absence of Lieut.-Col. A. T. Gage, C.I.E., I.M.S., the undersigned held charge as Director. Mr. P. T. Russell, Mr. Braybon and Mr. Maung Sine all held their'respective posts in Burma while at headquarters Mr. Bal was Curator, Mr. Vieux, Assistant Curator and Mr. Narayanswami, Assistant for systematic work. Under orders of Government the second post of systematic Assistant remains vacant. Amongst ministerial officers Babu U. C. Pal was head clerk and in both the Botanical and Cinchona sections of the Survey his praiseworthy efforts in dealing with much additional work concerned with the distribution of quinine deserve special mention. Babu R. E. Das was cashier except for a period of leave when his duties were performed by Babu H. S. Ghose. All executive and ministerial officers have done their duties with commendable zeal.

C. C. CALDER,

Offg. Director, Botanical Survey of India.

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Report of the Botanical Survey of India for 1925-26.

I. Systematic.

General—During the period under review the Systematic Assistant has been officiating as Curator of the Herbarium at the Royal Botanic Gardens and the second Systematic Assistant's post has been vacant, so that Systematic work has again been confined to head quarters. Some thousands of specimens have been identified for correspondents and considerable additions have been made to the Herbarium. The Curator of the Industrial Section of the Indian Museum made an extensive tour in Assam and Eastern Bengal and collected medicinal and economic plants required for the Museum, otherwise no field exploration work has been undertaken. It is to be, regretted that this important function of the Botanical Survey should have been neglected and it is hoped that staff and funds will permit of a certain amount of field work being undertaken next year.

The desire of Indian Botanists to know more about the morphology, physiology and anatomy of indigenous plants especially of cryptogams has led to the publication of numerous articles, the most important of which are cited under the respective geographical subdivisions. There have also been two important publications on ecology, one relating to Burma, the other to Tehri Gharwal.

Among botanical publications of general interest the following maybe mentioned :—

Mr. Hutchinson's " The Families of Flowering Plants" which is the outcome of his contributions towards a phylogenetic classification of flowering plants is a work of exceptional labour and care. It has an elaborate key and a list of families with constant characters which is helpful, especially, in the identification of material in the field. This list might perhaps be extended.

" The Flora of the Malayan Peninsula " in three volumes by Mr. H. N. Ridley carries to a conclusion the work of the late Sir George King and Mr. J. S. Gamble and fulfils a long-felt want. If the author had quoted King's numbers the rearrangement of the Malayan species in the Calcutta Herbarium would have been facilitated.

Miss Ida Colthurst has written a popular account of the Principal Indian Trees.

The following papers are also worthy of mention (1)" The Growth of the Cotton Plant in India " by R. S. Inamdar, S,B. Singh and T. D.

Pande, (2) " The Distribution of the Magnoliaceae" by R. D'O. Good, (3) the " Anatomy and the Morphology of the Flower of Euphorbia " by Dr. Julia Haber, and (4) the " Morphological Study of Monocotyledons " by Dr. Agnes Arber, all in the Annals of Botany. An interesting essay on the question of" species " by Mr. W. B. Turrill and Mr. T. A. Sprague's paper on the classification of Dicotyledons in the Journal of Botany are valuable to systematists. Dr. Ralph Holt Cheney has written an illuminating monograph on the economic species of *Caffea.*

It is also of interest to note that the Eew authorities announce the inclusion in the 7th Supplement of the Index Eewensis of references for the Wallichian species in Donn's General System (1831-37).

By the death of Mr. J. S. Gamble on the 16th October 1925, India has lost a devoted Botanist. His " Manual of Indian Timbers " is a standard work and his contributions to botanical literature made him known to Botanists throughout India. His "list of the Darjeeling Plants" (1895), his " Monograph on the Bambus© " (1896) and his " Flora of Madras," the sixth part of which appeared before his death, were his chief contributions to Indian botanical literature. His valuable Herbarium has, since his death, been presented to Eew.

Eastern India and Burma.—Attention is directed to " The Vegetation of Burma from an Ecological Stand Point" by Professor L. Dudley Stamp, Professor of Geology and Geography in the University of Ran* goon which appeared just before this report went to the press. Professor Dudley Stamp's new book will appeal not only to the Botanist and Forester but to all who are interested economically or otherwise in the vegetation of the country and his classification presents a very clear picture of the main types of vegetation characteristic of this region. A special feature of the book is its copious photographs, maps and sketches. The aerial photographs of the Delta Forests suggest that this method might be very usefully employed for the preparation of stock maps of forest vegetation on a large scale. Professor Stamp acknowledges his indebtedness to Forest Department Working Plans. These, though published, are not available to the general public and contain valuable information which would, in many cases, merely require correlating and expanding to complete general surveys of the vegetation of a great part of India itself and it is hoped that the lead given by Professor Stamp may be followed elsewhere.

During the year, the Department has been indebted to Mr. G. E. Parkinson of the Burma Forest Service for a regular supply of botanical specimens.

The collections of Colonel Gage and Mr. Russell from Tavoft worked out by Mr. Narayanaswamy, have yielded several new species which will be described indue-course*. . . . .

Mr. Parker has described two new species from Tavoy, *viz, Pkctrtmia tavoyana* and *Lasianthus longipeduncuhtus* and Mr. Fisher another from the same area, *viz. Elaocarpus quadratus.*

During the year the first part of the Flora of Bihar and Orissa by Mr. Haines was published which completes this valuable work.

The revision of Gamble's list of the Darjeeling Plants by A. M. and J. M. Cowan has been completed and is being published by the Government of Bengal under the title," The Trees of Northern Bengal." Over 400 species from the Darjeeling District have been added.

During 1925, the mosses of the Mount Everest Expedition were described by Professor Dixon in the Journal of Botany and the Lichens of the same region were described by Mr. Robt. Paulson in the same journal. Of the 31 species of lichens enumerated only two are new species.

Professor Briihl and his assistants are continuing their work on the fresh water Algse of Bengal and have published two papers, one on the subaerial Algae of Burkuda Island in the Chilka Lake of the Ganjam District and another paper on the Algal Flora of the Maidan tanks in Calcutta.

Southern India.—Mi. J. S. Gamble until his death was engaged on the 7th part of his Flora of Madras. This part was published during this year and brings the revision down to the Euphorbiacese.

In the Eew Bulletin Mr. Gamble described the following fifteen new species of Lauracee all from Southern India :—*Cryptocarya anamalayana, C. Beddomi, C. Bourdilloni, C. Lawsoni, Cinnammum riparium, C. travancoricum, Actinodaphne Bournecw, A. Bourdilloni, A. Lammi, A. Tadulingcmi, LUsea mysorensis, L. insignis, L. Bourdilloni, L.* fracon-*corica* and *Neolitsea Fischeri.*

From the same region he has described a new genus *Pseudoglochidion* and the following new species of the Euphorbiacese :—*Pseudoghchidion anamalayana, Glochidion Bourdilloni, Phylhnthus Narayanatwumi, EmbUca Fischeri, Reidia Beddmei, R. Gageana, R. megacarpa* and *R. stipulacea.*

Mr. Fischer, formerly of the Indian Forest Service, has described two new species *viz. Caralluma stalagmifera* from Vandular and *Fieus Auglc.di* from the Pulney Hills. From additional material collected in the Madras Presidency he has been able to publish a full description of the little known species, *Euphorbia caducifolia,* Haines. The Department is indebted to him for contributing specimens to the Herbarium to replace those lost at sea during the war. . A new species of *Pavonia,* from Coimbatore *P. Coxii* i§ also described in the same journal by Messrs. C. Tadu* lingam and H. C. Jacob.

The Gryptogamic Flora has received the attention of Profeetox J. F. D. Almeida and Mr. M. 0. P. Ayengar. The fonnet in the Journal *pi* the Indian Botanical Society haapubliaheeU detailed account of the

ferns of the High Wavy mountain in the Madras District recording one new species *Davallia Hallbergii.* The latter, who has been for some years engaged in the study of the marine and fresh water algse has described in the same journal a new species *Hydrodictyon indicum* from Madras.

Western India.—From this part of India the following papers were published:—(1) The Cause of Cotton Wilt in India by S. L. Ajrekar, (2) The Morphology of the Rice Plant and of the Rice Inflorescence by B. Mundkar, (3) The Course of the Vascular bundles in *Achyranthes aspera* by R. H. Dastur and (4) The Abnormal Sporophylls of Cycas circinalis by Professor S. R. Kashyap. Two new species of Ranunculus *viz. R. Munroanus* and *R. palifolius* from Kashmir are described by Mr. S. T. Dunn in the Kew Bulletin. In the Journal of the Indian Botanical Society a new moss *Trematodon brevicalyx* Dizon from Lahoreis described in detail by L. N. Mathur of Lahore.

Northern India.—The Ecology of Tehri Garhwal, an elaborate and instructive paper by Professor W. Dudgeon and L. A. Kenoyer in the Journal of the Indian Botanical Society justified its claim to be a critical study of the ecological factors determining the vegetation of the area and the value of the paper is enhanced by numerous, illustrations.

Mr. R. N. Parker of the Forest Research Institute has published notes on the genus *Sonneratia* wherein he attempts to clear up the confusion regarding the proper determination of the Indian species of this genus. He lays emphasis upon the shape of the fruits rather than the presence or absence of petals as the distinguishing factor in determining the species. Further notes are published by him on a hybrid *Terminalia arjuna* X *tomentosa,* with general remarks on tree hybrids.

Mr. B. B. Osmaston has described a new species of Smilax *viz. S. erecta* from Garhwal in the Kew Bulletin.

In the Journal of the Indian Botanical Society R. K. Saksena and L. N. Mathur have recorded an *Ophioglossum,* viz. *0. fibrosum* Schum. from the Indo-gangetic plain and have appended notes on conflicting points raised when comparing their specimens with that described by D'Almeida.

H» Economic.

Although it is still too early to regard the Cinchona area in Mergui as other than experimental, the evidence of a further year's working goes to prove, that on certain aspects at all events, Cinchona is capable of withstanding fairly well the severe droughts and sudden downpours to which this area is subjected. These appear to be fairly frequent in occurrence and are 'a source of grave anxiety to the planter. Everything went well during the earlier part of the year, and plants of all species made vigorous growth. In August and September

however heavy torrential rain fell, the downpour lasting for 22 days ard exceeding any rainfall previously recorded. The rain was accompanied by strong monsoon winds. The heavy winds caused havoc among plants not securely anchored to the soil and water logging of the soil consequent to heavy rain increased the mortality and a repetition of the experience in Tavoy was apprehended. On receipt of this alarming information Mr. Calder hastened to the Plantation in November and witnessed the damage which had been done.

Messrs. Calder and Russell agreed that instead of risking complete failure by having the whole area in one place, it should be divided. With this object in view Mr. Calder approached the Government of India with the suggestion that another area removed from the boisterous monsoon conditions should be looked for in Upper Burma. With the sanction of the Government of India Mr. Russell was deputed to find another suitable site for chinchona cultivation. After a careful search over a wide area, occupying three months, Mr. Russell reported the discovery of a suitable site in Mogok in the Katha District. This site he considered most favourable, enjoying climatic and soil conditions exactly similar to those in the Bengal plantations. The question whether the area selected should be taken up is under consideration.

By the end of the year although there were still vacancies in the Mergui Plantations, many of these had been filled and the aspect of the plantation was not altogether unfavourable.

During the year there was less appearance of canker disease in the plantations and this at no time appeared formidable. The trouble was minimised by improved drainage systems, shallow planting and by leaving belts of natural jungle across the main direction of the storms to protect the plants from the high winds.

With regard to labour, although the health of the labour force was better than might have been expected, difficulties were again experienced owing to shortage. Recruitment of some 200 coolies towards the end of the year temporarily removed this difficulty.

Cultivation of Medicinal Plants.—Ipecacuanha cultivation is also still in the experimental stage. The plants are healthy and are growing well but the root is not yet ready for the factory.

IH Industrial Section, Indian Museum.

Some 750 specimens were registered during the year and 504 were deposited in the gallery. Most of the specimens were food materials, others were timbers, fibres, medicinal plants, oils, dyes and gums. These collections were made principally by the Curator during his tour in East Bengal and Assam. Of the new exhibits the most noteworthy are 191 varieties of cultivated rice, a number of specimens

o' silk cocoons and cloths, edible fruits from Manipur and the Naga ' Hills and baskets and mats made of different species of *Cakntvx* ▷y the different hill tribes.

The whole of the exhibit in connection with the manufacture of Quinine has been replaced by fresh material.

The re-arrangement of the gallery in accordance with the new scheme, which was reported in the Annual Keport of 1922-23 has been undertaken during the year with considerable improvement in effect ami educational value.

The overhauling of specimens was continued and over four thousand old labels were renewed and a new show-case has been added.

Experiments, on the preservation of fresh specimens in liquids \ri1h a view to retaining the natural colours, gave satisfactory results in tlio case of green fruits and leaves.

Information regarding the sources of supply, etc., of numerous economic products were given to a large number of correspondents, and exhibits were supplied to universities and colleges in the United States, Canada, Straits Settlements and elsewhere.

The catalogue for medicinal plants and their products reported^! the Annual Report of 1924-25 has now been completed.,

IV. Publications.

The following works have been published and distributed:—

(i) Records of the Botanical Survey of India, Vol. IX., No. 4 Freshwater Algae from India by Nellie Carter, (ii) Records of the Botanical Survey of India, Vol. XI., No. I (1) list of Species and Genera of Indian Phanerogams not included in Sir J. D. Hooker's Flora of British India by C. C. Calder, V. Narayanaswami and M. S. Ramaswami (2) Loranthacerc of Southern India and their host plants by C. E. C. Fisher.

V. Cinchona bark and Quinine.

During the year 491.549*7 lbs. of bark were received from Java of which 248,697*8 lbs. were sent to the Bengal Government Factory at Mungpoo and 242,851*3 lbs. to the Madras Government Factory at Naduvattam.

Manufacture of Quinine—At Mungpoo Factory 626,137 lbs. of bark were worked yielding 38,036 lbs. of Quinine Sulphate and 9,769 lbs. of Cinchona Febrifuge. At Naduvattam Factory the whole of the bark received viz. 242,851*9 lbs. was worked yielding 7,556 lbs. of Quinine Sulphate and about 2,400 lbs. of Cinchona Febrifuge.

Stocks of Quinine.—"She total stock in hand on the 31st March 1926, amounted to 334,732-138 lbs. of which 110,386*670 lbs. were held at the Indian Museum in 3,329 original cases, 211,201*031 lbs. at Mungpooand 13,144-437 lbs. at Naduvattam.

The stock at the Indian Museum is entirely Java Quinine contained in original cases. These cases are of two kinds : (1) war time Quinine received in 1919 under Agreement with the Association of Quinine Manufacturers in Allied Countries and packed in cases each containing 25 lbs. of Quinine Sulphate in 4 unsoldered tins and (2) Quinine Sulphate received under Agreement with the Dutch Combine (1921-23) contained in cases of 20 Kilos or 44'092 lbs. of Quinine Sulphate in 4 hermetically sealed tins. The 25 lbs. cases on account of the containers being insufficiently packed have shown shortages in weight due to the loss of water of crystal ii nation. The loss, however, does not affect the medicinal value of the drug but, as indent era claimed compensation for shortages, it was decided by the Government of India in 1924, to stop the issue of the war-, time packed (25 lbs.) cases until such time as it*can be utilised in the preparation of special products.

Areas ofdistribution.—-The allotment of areas has been geographical, the whole of Southern India including Indian States therein receive supplies from the Madras Cinchona Department; Bengal, Bihar and Orissa and Assam including Indian States receive supplies from the Bengal Cinchona Department and the rest of Northern India including Indian States therein are supplied from the Government of India stock.

Issue of Quinine.—During the year 13,999*152 lbs. of Quinine Sulphate were issued against 12,159 lbs. during the previous year. The increase is due mainly to larger consumption of Quinine in the Punjab including the Indian States within it. During the year the Punjab alone took 11,565 lbs. against 9,731 lbs. in the previous year or an increase of 1,834 lbs.

Cinchona Febrifuge.—The demand for Cinchona Febrifuge was persistently high on account of its relative cheapness. Owing to the limited outturn of this drug, which is in the nature ol a bye-product in the manuiacture of Quinine, it was decided by the Quinine Conference held in December 1925, that Cinchona Febrifuge should be issued t > provinces in proportion to their Qu'nine consumption in the previous year. It has now been arranged to give effect to this decision during the ensuing year. During the year under review 9,770 lbs. of Cinchona Febrifuge were manufactured at Mungpoo from the Java bark, of which 9,658 lbs. were sold by the Government of Bengal. The tctal stock of Febrifuge on the 31st March 1926, amounted to 8,297 lbs. of which 4,079 lbs. were held at Mungpoo and 4,218 lbs. at Naduvattam. No departmental distribution is undertaken by the Government of India for the reasons explained in last year's report and the Bengal Jail Department continue

to issue this drug as well as other minor products to all areas in ths Northern India.

Revenue by the Sale of Quinine.—The total revenue during 1925-26 amounted to Rs. 3,90,715 against Rs. 3,16,953 for the previous year. Of the total revenue Rs. 91,354 were by cash sales to local bodies and Indian States and Rs. 2,99,361 by credit sales to Government Departments. The revenue does not include the sale proceeds of Cinchona Febrifuge belonging to the Government of India which are in the first instance credited to the Government of Bengal and ultimately deducted from the cost of extraction of Quinine payable to this Government. As Bengal sold over 9,000 lbs. of India Febrifuge a further credit of the order ofRs. 81,000 will be due to the Government of India. Full details will be given when materials for the exchange account are available.

VL Financial.

The original budget allotment for the year was Rs. 7,07,000 from which Rs. 1,74,000 was surrendered reducing it to Rs. 5,33,000. The surrendered amount was distributed as follows:—(1) Pay of Systematic Assistant Rs. 5,000, (2) Purchase of Cinchona bark Rs. 1,20,000 and (3) Extraction charges Rs. 49,000. Of the nefct allotment, Rs. 49,880 were for the Botanical Survey proper and the Industrial Section, Indian Museum, and the balance Rs. 4,83,120 was for the Cinchona Department. This last figure included Rs. 2,85,000 (as reduced by the surrender of Rs. 1,20,000) for the purchase of Java bark and freight charges thereon. The expenditure in the Botanical Survey proper was Rs. 50,057 showing an excess of Rs. 177 after re-appropriation of Rs. 100 from Cinchona. Under Cinchona the expenditure was Rs. 4,49,180 showing a saving of Rs. 33,940. The saving falls chiefly under purchase of bark and extraction charges.

VIL Stall.

Mr. C. C. Calder held charge as Director throughout the year. In the Botanical Survey proper Mr. S. N. Bal was Curator of the Industrial Section, Indian Museum, and Mr. V. Narayanaswami was Assistant for Systematic Work and officiated as Curator of the Herbarium Royal Botanic Garden, Sibpur, throughout the year in addition to his own duties. Babu U. C. Pal was Assistant Curator except from 3rd October 1925 to 20th February 1926, when he was on leave. During his absence Babu R. K. Das, Head Clerk, acted as Assistant Curator and Babu E. N. Banerjee acted as Head Clerk.

In the Cinchona Department Mr. P. T. Russell and Mr. A. Braybon jheli charge as Superintendent and. Assistant Superintendent, Cinchona

Cultivation, Burma, respectively throughout the year. Maun: Sine was Overseer in the Cinchona Plantation, Burma. All the executive and ministerial officer's of the Department discharged their duties with commendable zeal.

J. M. COWAN;
Qffg. Director, Botanical Survey of India,

Report

of the

Botanical Survey of India

for

1934-35

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Report of the Botanical Survey of India for 1934-35.

I. General.—Botanical Survey work proper consists more of outdoor or field investigations and less of work indoors. Briefly stated, field work covers the study of plants in nature throughout India and Burma, with the object, firstly, of appraising the entire vegetable wealth of India and secondly of increasing our knowledge of those plants, in all possible aspects and finally making such a knoweldge available for the benefit of the people of the country which maintains the Survey. It includes among others (1) the collection, classification, naming and preservation of plant specimens and plant products in a dry state in a herbarium and a museum to serve not only as standards for future reference but also as an assemblage of the entire vegetable resources of the land in one easily accessible central spot and (2) collecting and acclimatising living plants in a botanic garden for the purpose of their multiplication and distribution when found useful to man. Ever since the organisation of the Survey in 1890, its activities have been directed towards floristic work mainly, as the extent of unexplored regions was great, but now and then problems of economic importance have also been successfully tackled as a reference to previous reports would disclose. But for some years past, the Survey had been passing through critical times both in finances and man power, which have conduced to the apparent inactivity in its own sphere of work. The year under review has been no exception and consequently attention has been directed to work near at hand, namely in the Herbarium, Royal Botanic Gardens, and in the Museum, the results of which have to large extent compensated for the absence of work in the field. The Curator of the Industrial Section made a very short tour in Dacca and Mymensingh and collected a few specimens, which were added to the Economic Herbarium attached to the Museum.

A feature that keeps the Survey alive is the constant flow of specimens into the herbarium sent by officers more fortunately placed than those of the Survey, who, in return for the present of specimens made by them, are supplied with lists of identifications and economic information. Apart from departmental work,

extensively according to Dr. Bor, *Quercus incava* Roxb., *Quercus .polystachya* Wall., *I'opulus ciliata* Wall., *Salix longiflora* Anderss., *Hahcnaria uiceolata* CL, and *Cypripedium Fairieanum* Lindl. Of these *Q. incana* Roxb., occurs widely in the North-West Himalayas from Bushar to the borders of Western Nepal. It has also been collected from China Hills and the Shan States of Upper Burma. Its presence in the Aka hills, a locality almost midway between the two original centres of distribution, bridges the apparent discontinuity that had existed so long in its occurrence almost throughout the entire length of the Himalayas and as far as Burma. The occurrence of yet another Oak, *Quercus poiystachya* Wall., till now recorded from Manipur and eastwards across Shan Hills as far as Tavoy in lower Burma, leads one to the inference of the existence of an Indo-Burmese Flora running from the Himalayas across the Naga, Kachin and Shan Hills up to lower Burma. Such discoveries of valuable plants, even by casual workers, should draw our attention to the fact that our knowledge of several parts of India is far from perfect.

The herbarium collections were enriched during the year by consignments of plants received in exchange from Washington, Canton and Singapore. Some 6,000 sheets have been put into the general collections.

2,354 sheets of the Herbarium material belonging to *Denis, Burwanniaceae, Avicennia* and *Gossypium* were on loan to Drs. Quisumbing of Manila, Pulle of Utrecht, Moldenke of Manila and Mr. TTutohinson of Indore respectively, in connection with research work on their hands.

Messrs. Parkinson, Kanjilal and Das of the Forest department had several groups of plants placed at their disposal in the herbarium in connection with their floristic work. Dr. Sahni of Lucknow has revised the sheets of *Marattia.*

163 sheets of *Evoirulus* were received back from Holland and the Madras sheets of the Sibpur Herbarium which were on loan to Kew in connection with the preparation of the Flora of Madras by Gamble and Fischer were also received back from Kew.

General information on all kinds of subjects, botanical and economic, was supplied to a wide range of correspondents. Notes on the genera Psilotum, Isoetes, Imperata, Andropogon and on the species, *Cymbopogon Martini, Andropogon versicolor, A. Schcenanthus, Cassia renigera, Cassia auriculata, Brunfehia latifolia* and *Asclepias,* forming the materials relating to economic problems, were furnished.

The Curator of the Herbarium, Koyal Botanic Gardens, accompanied by one of the herbarium assistants botanised on the Paresnath and the Tundi Hills of the Hazaribagh district of Bihar and Orissa and brought in a fair collection of plants. Another of the herbarium assistants, Haripodo Naskar, visited portions of Northern Bengal and secured a good collection of plants also.

Mr. V. Narayanaswami of the Survey department has completed a preliminary revision of the nomenclature of the Indian grasses, the most important group of economic plants, which not only consists of all the valuable cereals of India, namely, wheat, rice, oats, millets and maize, but also a large number of useful indigenous fodders, essential oil-yielding plants, sugar cane, raw materials for use in the manufacture of paper and bamboos, whose utility in the economy of India is too well known. In the preparation of this paper, much help was derived from the late Dr. Stapf's work on the grasses of Tropical Africa, the late Rev. Father Blatter's Revision of the Gramineae in Cooke's Flora of Bombay, Haine's Botany of Bihar and Orissa, Merrill's Enumeration of Philippine plants and from the herbarium sheets of the order at Sibpur. The shears have been rather very freoly plied in this family and a number of Genera and species have been drastically split up and remodelled so as to fit in with the modern conceptions of the generic and specific limits, keeping always in mind that the earlier published name was the valid one to be retained for the species. These changes were already anticipated by Hooker in the Flora of British India, which was published in 1894. In that monumental work only 152 genera and 882 species were recognised as occurring in India, but under the new arrangement, there are 196 genera and 948 species which includes several new species described after 1894. *Andropogon,* almost the biggest genus of grasses in India, containing nearly 75 species according to Hooker, is now only about one-twentieth of its original shape, because most of the species placed therein have now been distributed to smaller genera like *Schizachyrium, Diectomis, Hypogynium, Andropogon, Amphilophis, Capillipedinni, Sorghum, Vetiveria, Chrysopogon, Dichanthium, Heteropogon, Cymbopogon* and *Eulaliopsis.* Similarly it is the case with *Paspalum, Panicum, Axonopui, Pennisetum, Pollinia, Erianthus, Uchcemum* and *Rottboellia.* He has also completed the revision of the nomenclature of Indian Flowering Plants, a work commented upon in the last report as having been started by him. The work is voluminous covering nearly 80 pages of closely typed matter and includes all the families of Indian plants, which it is hoped to be taken up for the records of the Botanical

Survey of India, when the latter is free. It is a work that should prove very valuable to oue and all who may have something to do with the plants of India. These two papers along with those on *Glycosniis, Dendrobium* and *Cassia nodosa* and *japonica* were read by him before the Calcutta Session of the Indian Science Congress held in January 1935. He has also contributed to the same congress an interesting paper on the nature and the importance of a Herbarium.

Mr. Biswas, the Curator of the Herbarium, Botanic Gardens, Bengal, published four papers in Current Science and a fifth in the " Transactions of the Mining and the Geological Institute of India ". The first of them is on " Some foreign weeds and their distribution in India and Burma ". He discusses the wild [illegible] extensive areas of such noxious exotics like *E.upatorium odoratum, Crotan s.parsiflorus, Lantana camara, Eichhornia speciosa (crassipes), Ageratum conyzoides, Mikania scandens, Argemone Mexicana, Siloeda.. maritima* and *Opuhtia Dillenii.* These weeds are only a very small fraction of the numerous exotiqs that have come to stay in India, not only to the detriment of the indigenous flora but also to the detriment of man. They have been spreading with undesirable freedom, destroying on their onward march extensive areas of valuable arable land and unless they are nipped in the bud they will prove certainly, in no very distant date, a serious source of loss to the agriculturist in the first instance and to the Government in the long run. The Oxalis and the Spergula pests in the potato fields of Ootacamund and the surrounding country on the Nilgiris, the menase of *Eupatorium adenatphorvm* to the Ooty hunt, the water-hyacinth *(Eichhornia crassipes)* curse hanging on large areas in Eastern Bengal and Assam, Burma and South India, the intolerable nuisance of the Khaki weed, *Alternanthera echinnta,* to the pedestrians and the sportsman in Madras, Salem, Coimbatore, Mysore and elsewhere in South India are some of the weed problems that have been engaging most vitally the attention of the public and the Government alike at the present moment. Other papers by the same author are " Progress of Algological studies in India ", " Observations on the systematic position of Ficus Krishnae growing at the Royal Botanic Gardens, Sibpur ", " Observations on some plant abnormalities in Bengal " and " The vegetation of Tundi and the neighbouring areas of the Hazaribagh district ".

III. Systematic—Regional.—Interest in South Indian Flora is continued and Mr. C. E. C. Fischer of the Kew Herbarium has published in Part III of his " New or little known plants from

South India ", the following new species for the Madras province. They are *Sonerila tinnevelliensis, Ari&mma convolutum, Ccelachne Meeboldii, Tripogon pungcns, Impatiens Aliciae, I. coelotropis, I* platyadena, I. dendricola, I. andamanica, Sonerila nematadensis,. Oxytenanthera nigro-ciliata* var. *Hoheiiackeri.* But the most important contribution to the systematic botany of Madras is the publication of the penultimate part (No. X) of Gamble's Flora of Madras by C. E. C. Fischer, dealing with the difficult family of Gramineae. With this part, the systematic portion of the Flora of Madras is finished and with the final part (Part XI) which is reported to be already in the press, the Flora of Madras will be completed. The last part will contain the introduction, addenda and corrigenda and the index. This work was started by Gamble in 1914 under the authority of the Secretary of State for India in. Council. Gamble, who had long been connected with the preparation of the " Materials for a Flora of the Malayan Peninsula " in collaboration with Sir George King, was finally chosen to undertake the compilation of this flora, on the termination of the Malayan work. The idea of the compilation of a Flora of Madras originated as early as 1909 and a series of correspondence passed between Lt.-Col. A. T. Gage, the then Director of the Botanical Survey of India, and Dr. C. A. Barber, then, the Government Botanist,. Madras, who was also for some years, one of the *liaison* officers of the Botanical Survey, on the desirability of starting the compilation of a Flora for Madras -with imperfect materials and when there were still several parts of Madras to be explored and collected and on the, choice of the author suited to the task. Notwithstanding, Gamble, who was entrusted with the work, wrote to the head of Survey and impressed upon him the urgent need for the collection and forwardal to him of specimens, whenever possible, from the Agency Tracts of Ganjani and Vizagapatam districts, including Jeypore and the zamindari forests of those districts, the coastal ranges, especially the Mahendragiri Hills on the East Coast, parts of ceded districts during particular seasons, Wynad and the Higher ranges of Coorg, Mysore, Hyderabad, the Highway mountains of Madura district and portions of Travancore, especially central Travancore lying between Peermade and Shencottah, which were considered by him unexplored then.

Consignments of Madras sheets of the Sibpur Herbarium were forwarded to him from time to time. Some 2,300 sheets belonging to families of Portulacaceae to Connaraceae were unfortunately lost in the sea during the war and the Madras sheets of Sibpur up to Bubiaceae were not consulted by Gamble as they reached him after

he had finished with those families with the mterials available at Sew. Collections of plants, made in the Rampa Agency and in the Central Travancore, while the work was in progress, were made available to him, and these have been helpful in establishing new records for those areas. Gamble completed the first seven parts between 1914 and 1925, but his unfortunate death in 1925 deprived him of the opportunity to see to the end of the work. However, it has been ably continued by Mr. C. E. C. Fischer, late of the Forest Department in Madras, who has now published the penultimate part. Fischer has not departed from Gamble's plan of treatment of the work and since the last part is still pending publication, it is too premature to review the work as a whole. The publication is a valuable contribution to a province which initiated the study of Indian plants as early as the seventeenth century and sent out eminent votaries of the Science like Eoxburgh and Griffith to distant parts of India for creating other centres of botanical research. Citation of localities like Konkan, Deccan, Carnatic and the Corromandal coast under distribution are rather vague terms which require clear definition in the introduction. These«were the broad geographico-botanical divisions which Hooker and Thompson used in their works as early as the fifties of the last century. The notes on this part of the Flora, which Mr. Fischer has published in the Kew Bulletin should assist in clearing up certain doubtful points in the nomenclature of the Madras grasses.

Additional parts, numbers 23 to 25 of the " Revision of Cooke's Flora of Bombay " by Blatter and McCann, dealing with the Cyperaceae of Bombay have appeared in the pages of the Journal of the Bombay Natural History Society. Further instalments of the popular illustrated account of " Some beautiful Indian trees of India " by Blatter and Millard, containing the descriptions of *Jacaranda mimosaefolia, Solatium macranthum,* and *Bauhinia variegata* £ *pvrjnirea* were also published in the same journal.

The interest in the " Flora of Waziristan " is evidenced by the publication of Part III of that Flora dealing with *Caisalpiniaceae* to *Lentihulariaceae* by Blatter and Fernandez in the same journal. In this connection, it is my most regretable duty to record the sad death of the senior author, Rev. E. Blatter, S.J., on #5th May 1934. India has lost an eminent systematic botanist in him, who, by his enthusiasm and keen interest in the study of Indian plants, has contributed materially to the knowledge of Indian Plants from 1903 up to the date of his death. The ' Records of the Botanical Survey of India' is much indebted to him for his works on the " Flora of Aden " and on " Flora Arabica ".

Ferns of Waziristan have been published by J. F. R. D' Almeida who in collaboration with Blatter has shown some interest to the Flora of this part of the North-West Frontier of India.

Mr. Mukat Behari Raizada of the Dehra Dun Herbarium had a paper in the * Indian Forester ', Vol. LX, on " The new or little known plants from Eumaon ", based upon the collections of Mr. A. E. Osmaston from Eumaon. In this article he records the existence in Eumaon of nine species of plants, namely, *Clematis smilacifolia* Wall., *Sinomenium acutum* Rehder. & Wilson, *Citrus hystriv* D.C., *Natsiatum herpeticum* Ham., *Flemingia involucrata,* Bth., *Musscena frondosa* L., *Echinanthus attenuatus Nees. Phlogacanthus Lambertii Sp. Nov., Loranihus odoratus* Wall., *Vis cum osmastoni Sp. Nov.,* which had escaped so long the notice of such eminent workers in Eumaon as Sir Edward Strachey and Winterbottom (1846-49), Duthie (1880), Major E. Madden (1848) and Osmaston (1927), who have all carefully gone over Eumaon and its flora rather minutely and published their results in their respective floras. Of these nine species, *Sinomenium acutum* Rehder. & Wilson, of the Menispermacepe, is an interesting occurrence of a Chinese plant, which had not so long been reported, outside China and Japan. *Phlogacanthus Lambertii* and *Viscum osmastoni* are two new species described for the area. This report of several fresh records for an area, long considered overworked, is an interesting illustration to prove that no area is an exhausted field for botanical discoveries.

Ecology, a subject of far-reaching importance and application in the agronomy of India and in the study of Indian plants, was in no way a neglected one. It goes hand in hand with that of floristic survey and each is so inextricably mixed up with the other that to separate one from the other would resemble the separation of the salt from the sauce. Mr. E. L. Aggarwal's paper tin the " Soil Flora in Deodar Forests and its importance " is an ecological paper dealing with the soil Flora in Deodar Forests and its relationship to the growth of tree crops. The author is struck by the wonderful occurrence of the same type of soil or surface coyer of plants whereyer Deodar Forests exist from Kulu, through Seraj and lower Bushar,'to Hazara and concludes that a soil which contains most of the above species would certainly be most suitable for the introduction of Deodar. Frequency and the altitudinal range of the indicators are surer guides in the policy of regeneration of forests than mere stray occurrence of one or two species only. The nature or the habit of the soil flora should also be taken into account before launching upon regeneration work of tree crops.

"Works of such ecological nature are the desiderata in the right direction at the present moment and deserves greater application and encouragement than hitherto.

Mr. E. 0. Shebbeare, Conservator of Forests, Bengal, records the distribution of Conifers that occur naturally in Sikkim, namely *Abies densa, Taunts baccata, Tsuga Brunoniana, Pinus excelsa, Larix Grijfithii, Picea spinulosa* and *Juniperus pseudosabina,* and discusses the causes underlying them. The cultivated conifers are also listed in the paper. *Cupressus Cashmeriana,* a conifer of dubious status is also discussed in a note by Sir Arthur Hill, who has reserved his final opinion pending the results of the cultivation in Eew of the suspected species.

To the Botany of Assam, a most useful service has been rendered by the publication of the First Part of Volume I of the " Flora of Assam " by the late Rai Bahadur IT. N. Eanjilal and Messrs. P. C. Eanjilal and A. Das, dealing with Ranuncukceae to Elseocarpaceae. This work is being published under the authority of the Government of Assam and it is hoped that the other volumes also will soon follow. According to the note on page iii by Mr. Das, this Flora of Assam strictly excludes the herbaceous plants of Assam and treats mostly about the plants of forest importance, namely, trees, shrubs and large climbers. But the title of the work appears to be rather inappropriate and should have been " Forest Flora of Assam ". The authors have not defined the limits of the flora and no map is appended for the help of the reader. At the beginning of the introduction, a short note is given about the collectors in Assam and about the beginnings of this flora.' As the joint author has not said anything about the labours and the achievements of the Botanical Survey of India in connection with the Flora of Assam, a few words on those points are essential.

Botanical work in Assam starts with Buchanan Hamilton, who in 1806, collected plant specimens from Goalpara while engaged on the Statistical Survey of Bengal. Nathaniel Wallich was the next botanist who in 1821 collected in Sylhet. In 1835 Wallich, accompanied by Griffith and McClelland, again visited Cherapuftji, Myrung, the Ehasya Hills, Gauhatti and Sadiya in quest of the tea plant. Griffith stayed behind and his botanical work in Ehasya, Bhotan and the Mishmi mountains are described in Griffith's posthumous papers. J. W. Masters, under the garden employ, was deputed by Wallich in 1837 to work on the Naga Hills, whose flora he published in 1847. In 1860 Hooker and Thompson visited portions of the Sylhet and the Ehasya Hills. Simons, Jenkins and

Peal come next who between 1850 and 1357, supervised and assisted the Indian collectors of the Botanical Garden in their districts, besides" furnishing the collections of their own. *Coptis Teeta* of the Mishmi Hills was first forwarded by Jenkins to Wallich and it was later on collected by Gammie and Burkill independently from the Mishmis. J. L. Lister, under Sir George King, worked on the Daphla Hills in 1874, who was followed subsequently by S. Kurz (1876) and G. Gallatly (1878), and G. Mann, the first Conservator of Forests of Assam (1883) who have all explored the Brahmaputra plains and the Khasia and the Jaintia Hills respectively. C. B. Clarke's endeavours between 1863 and 1886 were partly on the plains of Assam and partly on the Hills. Thereafter we pass on to the continuous botanical activities of the Botanical Survey of India under the successive directorships of Sir George King, Sir David Prain and Lt.-Col. A. T. Gage, who have each personally and by European and Indian agencies carried out an unbroken chain of botanical explorations from 1890 to 1914. During this period Sir George Watt and Mr. I. H. Burkill of the Department of the Eeporter on Economic products to the Government of India had also very materially enriched the collections of the Survey from places like the Manipur State and the Abor Hills, lying south and north of the Lakhimpur district of Assam. Botanical explorations in Assam and Burma were the main work of the Survey for nearly two decades from the beginning. The late Eai Bahadur U. N. Kanjilal came up on the scene in 1914, who bridged up several lacunae in the collections of the early veterans from 1914 onwards. The Botanical Survey thoroughly explored the entire province of Assam from one end to the other and accumulated a wonderful collection of Assam plants at Sibpur. But for this excellent collection and the help rendered by the Officers of the Survey, namely Ramaswami, Debbarman and Narayanaswami in identifying the Assam collections to the authors of this flora from 1912 onwards, it would not have been possible for the authors to have issued the work so soon as this. On the whole the book supplies a long-felt desideratum for the flora of the province of Assam.

•Floras have so far come out or are in progress of issue for Madras, Bombay, portions of the Punjab, the upper Gangetic Plain (incomplete), Kumaon, Gorakhpur, Bihar and Orissa, Bengal (old), Assam and Burma (very old and imperfect). There are still several parts of India, either unexplored or imperfectly explored for which no flora so far exists. These parts are (1) Mysore (partly included in Gamble's Madras Flora), (2) Hyderabad, (3) Central Provinces and Berar, (4) Central India, (5) Rajputana, (6) The

Punjab as a whole, (7) Kashmir, (8) Nepal, (9) Sikkiin and Bhutan* and (10) Burma.

Mandragora Shebbearei, C. E. C. Fischer and *Caret montir Everestii,* Kukenthal are two new species for Tibet that have been described in the Kew Bulletin.

The collections of that intrepid explorer and collector,. Capt. Kingdom Ward, from Assam and Upper Burma, have been, the source of the most important contribution to our knowledge of *Agapetes* by Mr. H. K. Airy-shaw, in the Kew Bulletin. With the fuller materials of this genus placed at his disposal, he had been able not only to clear up many doubtful points concerning certain species of the genus already published by C. B. Clarke in the Flora of British India., but also to describe several new species. The new species, that have come to light, are: —

A. jnthiflora (Upper Burma), *A. Sikkimensis* (Sikkiin) new vars. *typiea* Airy-shaw, var. *psevdo-veriicillata* Airy-shaw, var. *maciosepah* Airy-shaw, var. *acvminata* Airy-shaw, and var. *parvifiora*$_9$ (Kurz.) Airy-shaw of *A. setigera* Wall.—all froMi Khasia—*A. neriifolia* (King, et Prain.) Airy-shaw, *A. pseudo-Grijjiihii* Airy-shaw (Upper Burma), *A. hyalo-cheiles* Airy-shaw (E.. Bhutan), *A. adenobotrys* Airy-shaw (Upper Burma), .4. *KanjHali* A. Das (Assam), *A. spissa* Airy-shaw (Assam), *A. brachypoda* Airy-shaw (Upper Burma), and *A. pen sill is* Airy-shaw (Upper Burma).

A fuller description of *Agapetes linearifolia,* Clarke, a rare species collected hundred years ago by Griffith, has been possible now from Kingdom Ward's fuller materials.

An account of a botanical tour made by Mr. C. E. Parkinson to the Mulayit peak in lower Burma has been presented by him to the pages of the Indian Forester. Mulayit peak is one of the three highest peaks in the chain of Hills known as the Tenasserim Tomas which form a continuation of the Shan Plateau and of Martaban, rising to a height of about S,000 feet. A sketch of the vegetation of the Tenasserim Hill tops with an enumeration of the species collected therein is appended to the paper.

Of general systematic interest to India are the papers, (1) a key to the species of *Deutzia,* sect, mesodeutsia by Airy-shaw, (2) *Firmiana* and *Erythropsis* by H. K'. Ridley, (3) An account of the genus *Meconopsis* by G. Taylor and (4) A critical revision of certain Taxonomic groups of the Malvales by H. L. Edlin in the New Phytologist. In (1) above, *Devtzia Hookeriana* (C. K. Schneider)

Airy-shaw and *D. staurothrù* Airy-shaw are two new Indian species closely related to *D. corymbosa.*

The two genera of Sterculiaceae—*Firmmna,* Mars, and *Erythropsis,* Lindl.—along with *Scaphiuni, Pterygota,* and *Vterocymhium,* though separated by Eobert Brown were united together under *Sterculia* by Bentham and Hooker in the ' Genera Plantarum ' and by Masters in the ' Flora of British India '. Most of these genera have been separated by later botanists. *Firmiana* and *Erythropsis* are considered very distinct from each other, of which *Firmiana* does not occur in India, but the following belong to *Erythropsis* viz.: —

Erythropsis colorata (Roxb.) Burk. *(Sterculia colorata* Roxb.), *E. fulgens* (Mast.) Ridl. *(S. fulgens* Mast.), and *E. pall ens* Ridl. nov. *(Sterculia pattens* Wall, et Voight. nomen.).

The discovery by Sprague and Fischer of Dr. W. "Watson's ' Combination of Indian Grasses' published in 1882 in Atkinson's " Gazeteer of the North Western Provinces of India ", accompanied by the corresponding number under *Andropogon* in Steudel's ' Synopsis Plantarum Glumacearum' has led to a joint note by them in the Kew Bulletin, styled " The validation of new combinations by indirect citation of synonyms concerned ". These combinations were long overlooked and were omitted from the Kew Index so long. Ignorant of Watson's earlier combinations, authors made their own combinations which are now reduced as synonyms in the light of these earlier names. Watson's combinations like *Cymhopogon Martini* Wats, (the rusha or the geranium grass), *Cymhopogon flexuosus* (Steud.) Wats., and *Apocopis himalayensis* (Steud.) Wats., have now superseded *Cymhopogon Martini* Stapf., *Cymhopogon flexuosus* Stapf., and *Apocopis Royleanus* Nees., respectively.

Hutchinson's " The families of flowering plants ", Part II, treating about the classification of Monocotyledons of the world has been published. The phylogeny of the monocotyledons proposed and discussed in this book are on a par with his work on the Dicotyledons and it is out of place to discuss the merits or otherwise of the work here. Suffice it to say that it is a valuable contribution to the taxonomy of Monocotyledons.

Of the wide range of subjects covered by the scientific productions of the Indian Universities and Colleges and the Agricultural Departments in India in the realm of Indian Botany, Fungi, Pteridophyta, Cytology, Physiology, Morphology and Anatomy, the

Reproductive Organs and Agricultural Botany have all been dealt with. Anything more than a passing reference to some of them is out of question, but it is gratifying to realise the rapid advances that are being made in the study of such branches of Botany that are impossible for the Official Survey to take up. A certain ' Fusaria ' by A. Mitra, ' The Root-system of embryo-sac and the pollen-grain in Cassia tora ' by R. M. Datta, ' Origin of leafy sporophytes in Ferns ' by G. P. Mazumdar, ' A preliminary note on the study of Azolla pinnata ' by. S. R. Sud, ' A contribution to the anatomy, morphology and cytology of the flower of *Digera arvensis* ' by A. C. Joshi, ' A contribution to the life-history of *Vallisneria spirdlis* ' and ' The vascular anatomy of the flowers of four Nyctaginaceae ' are some of the botanical papers that were published in the Journal of Indian Botanical Society.

" The classification of the rices of Bihar and Orissa " by Eashi Ram and Sarvayya Chetty, " The chromosome numbers in the genus Saccharum " by T. S. N. Singh, and " A Haploid plant in Rice " by K. Ramiah are some of the results obtained in the branch of agricultural botany and plant genetics. ' Physiological investigations on water-hyacinth (Eichhornia crassipes) with notes on some other aquatic weeds ' by Parija is a contribution to the subject of weeds and their eradication. In this paper the author discusses on experimental basis, the life-history of this pernicious weed and suggests certain remedies for its eradication, which are no more than the prevention of seed-formation at the proper time and removal of the weed by mechanical means. Chemical measures have proved a failure for the purpose.

Mention may be made here that the materials for the systematic portion of this report have been given to me by Mr. Y. Narayanaswami, the Systematic Assistant of the Botanical Survey of India, working in the Herbarium at the Royal Botanic Gardens, Sibpur.

IV. Industrial Section.—During the year under report about 350 specimens were exhibited in the Public Gallery at the Indian Museum after registration. Drugs and the pharmaceutical preparations made from them, that were kindly presented by Messrs. Bengal Chemical and Pharmaceutical Works, Limited., deserve special mention and have been very attractively exhibited in a Central Case showing serially the various processes through which the raw materials pass through before they are finished products. These include, among others, the following: —

Holarrhena antidysenterica, Hydiastis, Strychnos Nux-vomica, Hyoscyamus, Scilla, Strophanthus, Psychotria Ipecacuanha, Atropa Belladona, Ephedra vulgaris, Aconites.

The Curator undertook a very short tour in the Mymensingh and Dacca Districts for the collection of a number of medicinal plants. He also procured samples of basketry work, jute textiles and other miscellaneous cottage industries of Mymensingh and took this opportunity of collecting botanical specimens for the Economic Herbarium attached to the Industrial Section of the Indian Museum.

As usual a number of herbarium specimens exhibited in the Gallery and in the Timber exhibit in the Staircase were replaced by coloured drawings of the plants, giving a much better effect to the exhibits.

Numerous correspondents in India and abroad were furnished with information on the sources of supply of economic plants. Identifications of botanical specimens were also carried out as usual for several, the most important among them being the Excise Department, the Customs House and the Co-operative Societies.

There had been a considerable increase in the number of enquiries by commercial firms and the public in India, regarding the sources of the supply of raw materials and finished products relating to economic plants, which were all satisfactorily dealt with. A special feature deserving mention is the large number of students of the local colleges and the University who visited the Gallery lor their studies of the economic products and who were attended to.

Mounted specimens of wild rice including *Oryza sativa, L.* var. *plena,* Prain, collected from Bombay, Bengal, Madras, Central Provinces, United Provinces, Nepal borders, Assam and Burma, were supplied to the Kew Herbarium at their request.

Information on materials of the following was supplied to various applicants in different parts of the world:—

Cwtalaria juncea Linn., *Crotalaria return* **Linn.,** ***Sesbania aculeata*** **Pers.,** *Punica Granatnm* L., *Artemisia inaritima* L., *Raphanvs sativa* L., *Cocos nucifera* **L.,** *Mimusops* ***hexandra*** **Roxb.,** *Brovssonetia papyri fern* **Vent.,** ***Cymbopogon Martinii*** **Stapf.,** *Vinca rosea* L., *Tamarù dioica* **Eoxb.,** ***Tamarix arliculata*** **Yahl.,** *Aeschynomene* ***aspera*** **L.,** ***Denis elliptica*** **Benth.,** *Carum copticum* **Benth.,** ***Saussurea lappa*** **Clarke,** ***Taxus baccata*** **Linn.,** ***Andropogon muricatus*** **Retz.,** ***Corypha umbraculifera*** **Linn.,** *Metroxylon sp.,* ***Smilax sp.,*** ***Aconitum*** *heterophyllum* **Wall.,** ***Clematis Gowriana*** **Roxb.,** ***Crocus sativus*** **L.f** ***Strychnos Nvx-vomica*** **Linn.,** ***Acacia Catechu*** **Willd.,** ***Desmodium gyrans*** **D. C,** ***Alhagi mauro-rum*** **Desv.,** ***Eriodendron anfractuosum*** **D. C,** ***Cannabis sativa*** **Linn.,** ***Papaver somniferum*** **Linn.,** ***Ferula asa-foetida*** **Boiss.,** ***Aleurites Fordii*** **and** ***A. montana.***

V. Financial (Botanical Survey proper).—The original Budget allotment for the year was Bs. 41,900 for the Botanical Survey proper including the Industrial Section, Indian Museum and a sum of JRs. 137 was appropriated, bringing the Budget figure to Its. 41,763. A surrender of Us. 547 was made from the allotment. The actual expenditure was Bs. 41,026. The saving under this head was Bs. 190 being distributed under several items.

VI. Staff.—Mr. C. C. Calder held charge throughout the year as Director and Mr. S. N. Bal was the Curator, Industrial Section, Indian Museum, during the year under report.

Mr. V. Narayanaswami was the Systematic Assistant throughout the year excepting for 27 days on leave from 9th April to 5th May, 1934.

Mr. S. B. Banerjee was the Head Clerk till the 21st September 1934 and during his absence on leave, Mr. T. C. Mukherjee, Senior Upper Division Clerk, acted as the Head Clerk till the end of the year under report.

During the year Mr. M. N. Mukherjee, Upper Division Clerk, retired on superannuation after rendering over 25 years' meritorious service in the department.

All the members of the staff and clerical establishment have worked quite satisfactorily.

S. N. BAL,

Curator,

Industrial Section, Indian Museum.

CINCHONA AND QUININE.

Burma Plantations.—Operations were restricted to maintenance of the existing blocks in good condition. The plantations had a comparatively dry year, rainfall being 18 inches short of the previous year's total. But through judicious stimulation of a green crop the effects of drought were minimised and cinchona did not suffer to any extent. The result of an interesting experiment is reported by the Superintendent—namely, that trees originally with fi to 9 stems which had been thinned to *2* or 3 stems at the beginning of the year showed a very rapid growth compared to trees left unthinned.

The harvest of bark obtained during the year was 64,421) lbs. The Ipecacuanha beds continue to flourish and furnished 498 lbs., dry roots now stored at the Indian Museum. Of the shade trees planted for the protection of young cinchona, rubber is doing well and seems to have already attracted the notice of the Government of Burma.

MungpOO Factory.—No bark was received at the factory during the year*under report but of the existing stock of bark 101,615 lbs. were extracted yielding 3,224 lbs. of Quinine Sulphate and 1,679 lbs. (including material in process) of cinchona febrifuge. There is now a total of 12,309 lbs. febrifuge at the factory all in unground condition and kept up a reserve against the day when the stock of Madras febrifuge will give out. All Quinine Sulphate extracted was in crude form as there are still large stocks of the purified product made in past years. In the process of extraction Burma bark and the purchased Java bark is blended in such proportion as would lead to economy in expenditure.

Besides this 38,166 lbs. net crude Quinine Sulphate was recrystalised to yield 35,039 lbs. Trade Quinine of B. P. Standard and 204 lbs. ordinary Quinine Sulphate. The experience ot the last two years have led to valuable results, the quinine now produced being equal in colour to most brands on the market and better than most in chemical purity. The low bulk density which seems to be such a desirable characteristic in the Trade can also be produced if suitable plant could be put up for the purpose.

Indian Museum: Calcutta.—At the Museum, besides the usual distribution to Provincial Governments, arrangements have also been made for the production of quinine reinforced Cinchona febrifuge tablets for supply to the Director, Public Health, Assam. A total of 1,000 lbs. was supplied during the year under review.

A uole-worthy transaction was the supply of 8,000 lbs. Quinine Sulphate powder and 2,000 lbs. tablets to the Government of Ceylon during the epidemic outbreak of malaria.

Total sales were as follows:—

	lbs.
Sulphate	**29,942**
Quinine Sulphate Tablets	**2,342**
Cinchona febrifuge	**1,926**
Reinforced C. F. Tablets	**1,100**

The total revenue realised from sales Wing Us. 0,08,781-5-0.

Stocks.—In the course of the year the total stock of Quinine Sulphate diminished from 207,657 lbs. to 235,800 lbs. The stocks of bark changed from 022,817 lbs. to 585,131 lbs. and of Cinchona febrifuge from 21,147 lbs. to 19,087 lbs. Details are given in the following stock accounts.

Stock Accounts.

Quinine Sulphate.

Dr.	lbs.	Cr.	lbs.
To stock on 1st April 1934	267,657	By sales and other issues	77,351
To manufacture and returns	45,360	By stock on 1st April 1935-	
		At Indian Museum	62,292
		At Mungpoo	172,962
		At Naduvattam	612
	313,217		313,217

Cinchona febrifuge.

To stock on 1st April 1034	21,147	By sales and other issues	2,718
To manufacture	1,258	By stock on 1st April 1935-	
		At Mungpoo	12,369
		In Calcutta	7,318
	22,405		22,405

Bark.

To stock on 1st April 1934	622,317	By issue, for extraction	101,615
To quantity harvested during the year	04,480	By stock on 1st April 1985—	
		At Mungpoo	498,773
		At Mergui	80,358
	686,746		686,746

S. C. SEN,

Botanical Survey of India.

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Report

of the

Botanical Survey of India

for

1935-36

CALCUTTA
GOVERNMENT OF INDIA PRESS
1937

Report of the Botanical Survey of India fpi 1935-36.

I. Systematic—The officers of the Survey have had little opportunity for outdoor exploration since the advent of retrenchment. But, as has previously been the case, a large number of workers outside the Survey belonging to Universities, the Forest, 'Agricultural, and other Departments of Government availed themselves of the expert services of the officers at headquarters.

There has been a considerable increase in the number of specimens identified for various correspondents and workers, some 3,500 specimens having been named. That intrepid and veteran explorer, Capt. Kingdon Ward, His Excellency Sir John Anderson, Mr. N. L. Bor of the Forest Department, Assam, and Mrs. Townend are a few among* those whose collections have come in for identification. Capt. Kingdon Ward and Mr. N. L. Bor collected in the Naga Hills, while His Excellency made a collection during his visit to Bhutan. A large number of specimens, however, are from Mrs. Townend who has been a very enthusiastic collector in the Sikkim Himalayas. All the above localities, judging from the collections, should yield very interesting facts of distribution, gome new species, and not a few first records.

Besides the above, the Locust Research Entomologist, Karachi, Mr. 0. E. Parkinson of the Forest Institute, Dehra Dun, Mr. Purkayastha, Forest Department, Assam, Mr. B. N. Tandom of the Allahabad University and several others had their specimens identified by the Department. A considerable number of sheets were received in exchange and presentation from the Lignan University, Canton, the Botanical Garden, 'Asia Mediae, Taschkent and the Singapore Gardens.

Some 421 sheets were on loan this year, comprising the genera *PsMotum, Plewrospermum, Aganoma, Ta&ocarput, Geniintoma, Monotropa,* and others, to Messrs. C. E. Parkinson, C. Norman of the British Museum of Natural History, T. Tsing of the Sun Tat sen University, Dr. S. P. Agharkar of the Calcutta University, and others. About 754 specimens, which were on loan, were received back from various workers, including 7. B. Hutchinson, Dr. H. N. Moldenke of the New Tork Botanic Garden, The Forest

Botanist, Federated Malay States, and others, with necessary notes incorporated on the sheets.

Plants going out on exchange or presentation include 200 local species to Formosa, 30 specimens of *Phoenix* to America, and a collection of flower buds in special preserving fluid to Sweden. The National Herbarium, Manila and other institutions throughout the world also benefited.

General information on all kinds of subjects, botanical and economic, was supplied to a wida range of correspondents. Among, others, information was given regarding *Medioago sativa,* Sabai grass, *Gleichenia* and *Sohioea* species,. Citrus,, *Piper chabba, Taraktogenot Kurzii* and *Hydnocarpus Wightiana, Ptychotria Ipecacuanha* and Fibre plants. Correct and up-to-date information regarding the herbarium was furnished to Dr. Verdoorn for incorporation in- the next annual issue of " Chronica Botanica ".

Mr. Biswas, Curator of the Herbarium, botanised about Darjeeling up to Phalute *vid* Sandekphu and brought to tha herbarium about 500 valuable specimens and a good many " Alpine " seeds; *

'Among foreign visitors' who worked[1] in tie* herbarium, mention should be made of Prof. Tanaka who made a< prolonged study: of material and literature regarding Citrus. The Curator of tile Herbarium has published a few papers, namely, "Jute and 'Allied? Fibres"; "Our Garden Sanseveriaa", "Calcutta Kite* Works and Organic Growth ", and " Note? on the Systematic Position of Sansevieria growing in India- with special- reference to *S. LaunntiiWmBm".* :

The year under review is of special importance as several important resolutions, suggestions, and tentative proposals specially affecting iromenclature and taxonomy have emanated from tie Sixth' International Botanical Congress field' at Amsterdam. TE« proposed compilation of a new phytography representing the collections in tire larger Herbaria of the world and tfce scheme to pBoto* graph type specimens of all plants should go far in removing certain handwrkpB<und»r which all worJcen, specially numograpiiists, have been labouring*. An International Dictionary of Botanical Terminology (though restricted to Phanerogam*), translated and explained' in Eoglisn,. Frvnoh, and Germany wirafli, no: doubt; prove of value m tile standardisation of descriptions. *Qw£* a work' is contemplated. It was ata) held to be highly: desirable that the Linnean type- speoimenft at the Linnean Society and at tfie BritisW Museum^ stould[5] be photographed^ time making- copies availaBle for

distribution to workers in other herbaria. 'A number of modifications proposed in the international rules of nomenclature have, been accepted by the Congress.

Fart 10 of the Flora of the Madras Presidency completes the. Florà proper. The final part will contain addenda, indices, etc.. Mr. Fischer has contributed further notes on Part X, which are calculated to clear many doubtful points. The South Indian grasses, 132 genera, are included in this part, Stapf's generic names being mainly adopted. Several genera of the Flora of British India, like *Panicum, Paspahm, Pollinia, AnthMria, Andropogan,* etc., have been split up into smaller genera after Stapf.

Several new species and new combinations resulted from Prof. Barnes' collections in South India, worked out by Mr. Fischer. Amongst these is *Impatient anaimudica* C. E. O« Fischer, sp. nov., Travancore, Anaimudi Ridge, 8,000 ft., £. Barnes, allied to 7. *trarvancorica* Bedd. *Arum overturn* L. and *Lagenandra toxicaria* Dak., formerly united under the latter name, have had to be separated again as the result of new material furnished by Prof. Barnes. Two species are recognised, *Lagenandra ovata* Thw. and *Lagenandra toxicaria* Dalz.—both from Travancore. The vegetative parts of the two species are very similar, but all the parts are larger in *L. cvata.* A new Sonerila, *S. nemdkadensis* C. E. G. Fisher, from Barnes' Travancore collection, is also recorded.

Collections made by Capt. Kingdon Ward and Mrs. N. E. Parry in Assam have resulted in the following new species, combinations and first recordsi—*Verwma Talaumifolia* Hook. f. et T., yar. *hirsutior* C. E. C. Fischer, Garo Hills, Mrs. N. E. Parry; *Veronica cana* Wall., Delei Valley, 6,000 ft., F. Kingdon Ward; •*Veronica capitata* BentH., Delei Valley, 11,000 ft., F. Kingdon Ward; *Pinguicula alpina* L., Delei Valley, 10,000 to 11,000 ft., F. Kingdon Ward; *Aetchynanthus deleienns* C. E. C. Fischer, sp. nov., Delei Valley, F. Kingdon Ward; *Aeschynanthus linearifalia* C. E. C. Fischer, sp. nov., Delei Valley, F. Kingdon Ward; *EUhottzia Thomfstmi* Hook., Garo Hills, 100 ft., Mrs. N. 13. Parry; *Celtis tinensis* Pers., Delei Valley, 2,000 ft., F. Kingdon Ward; *Lloydia Forrettii* Diels., Delei Valley, 12,000—13,000 ft., F. Kingdon Ward.

Mr. C. E. 0. Fischer Has continued his contribution to the" (Flora of Burma based on the collections of C. E. Parkinson', Kingdon Ward, C. W. D. Kermode, and others, of which tibia

following are new species:—*Goniothalamm burmanicu** C. E. C Fischer, sp. nov. *(Anonacece),* North *Tonugoo* District,, G. E. Parkinson; *Scolopia Kermodei C.* E. C. Fischer, sp. nov. *(Flavourtiacece),* Basin District, C. W. D. Kermode; *Adhatoda oreophila* C. E. Fischer, Comb. nov. var. *magna* 0. E. 0. Fischer, var. nov. *(Acanthacea),* Haymyo Plateau, Gokteik, C. E. Parkinson.

The first part of Volume I of the Flora of Assam has appeared. This is the result of the work of several authors, all Forest Service men. Although it suffers from some of the disadvantages that may be expected of work that has been done in the field and away from herbaria and libraries, it is welcomed as providing the first concise account of part of the Flora of the province. The volume is introduced by on ecological sketch, by a geological account, and Vy a note on the dimatological factors influencing the vegetation. It is bound to serve as a useful work of reference and as a handy companion to all interested in the Flora of this part of India. Especially will it aid the Forest Officer and botanist.

The revision of the Flora of the Bombay Presidency (started 'by the late Father Blatter) is being continued in the pages of the Journal of the Bombay Natural History Society by Dr. 0. licCann. The *CyperacecB* is being continued. In the same journal some "beautiful Indian trees with coloured illustrations by the late E. Blattér and S. Millard, popular descriptions of *TecameUa undulata, Kydia oalycina*$_f$ *Amherstia nobilis, Dillenia indica,* and *Kleinhovia hospita* have appeared.

Volume VIII, No. 6, of the Records of the Botanical Survey brings to completion the Flora Avabica by the late Father Blátter. "Biis volume containB the familiw tinetacea to Grámme* and lias a general index.

In fiie Journal of the Indian Botanical Society (XIV, So. 3, pp. 257-263) 8. C- Dixit records some species of Chara and "Nitella, chiefly from the Deccan, round about Poona, and Eathiawar, of which one is a new species. In a paper published in ihe Journal of the Indian Botanical Society (XIV,, No. 4, pp. 339-348) Mr. Mukat Behari Baizada has described a number of recently introduced or otherwise imperfectly known plants from ihe Tipper Gangetic Plain. This list may form a sort of supplement to Duthie's Flora of the Upper Gangetic Plain. II has been observed here that some plants indigenous to tropical America are becoming established and naturalised in the region of the Upper Gangetic Main to an amazing extent. The discovery is in conformity with observations made in the neighbourhood at

Calcutta several years ago. He has also contributed a paper, " The Genus Psilotum in India ", Indian Forester, LXI, No. 10, p. 654, presenting an account of the genus and the distribution of one of the two species known under it. *P. triquatrum* alone ocours in India.

Mr.' D. B. Mukerjee has contributed notes on a collection of plants from Mahendragiri in the Eastern Ghats, Agency area. Sixty species were collected at 500 ft. above sea level. A preponderance of South Indian Hill Flora over other hill floras was observed. .The altitude is said to have its effect on the colour of the floral leaves, epidermal growth, etc. Dr. N. L. Bor made large collections in the botanically little known Balipara Frontier Tract and has given an account of the Conifers growing in this area together with brief notes on climate and geology, Mr. C. E. Parkinson has given an account of some Indian and Burmese Dillenias (Indian Forester, LXI, No. 7, pp. 447-458). E. G, Baker records a small bushy leguminous plant with yellow flowers from, the Salween Gorge, Tibet, collected by Capt. Eingdon Ward. It is allied to *Sophora, Caragane,* and *Aitragahs,* but differs in certain characteristics.

It is made into a new genus under the name *Sdwèenia Wardii* Baker.

• *Hedysarum oitrinum* from S. 13. Tibet with racemes, of pale; lemon coloured flowers and pods with 3-4 flat glabrous articulations is a new species. *Hedytarum citrinum* sp. nov., S. E. Tibet, 13,500 ft., F. Ludlow and Sherriff. Two new species of *Styracece* belonging to a new genus, *Huodendron,* are also reported from Tibet in the Journal of the Arnold Arboretum, XYI, p. 341: (1935). *Huodendron tebeticum* Alfred Rehder, Genus n.ov. sp, aov., extreme S. E. Tibet, Coll. C. E. Parkinson. *Huodendron bùmstatnm* Alfred Rehder, sp. nov., Upper Burma to West of Yunan, Coll. C. E. Parkinson. G. F. Eingdon Ward Has given ft very interesting account of his 12th expedition in Asia in quest of plants and their seeds.' He explored S. E. Tibet, namely, the Salween-Irrawady Divide, Shugdan Gompa, Dri Valley, Delei Valley, and part of the Mishmis. He has also contributed to the Journal of the Linnean Society, London, a sketch of the geography and botany of Tibet, being materials for a flora of that country. In the course of the paper he observes that recent botanical exploration has shown that the affinity of the Eastern Himalayan Flora lies almost entirely with Western China across the Tibetan river gorge country. It does not lie with the southern ranges except in a minor degree, although the mountain ranges appea*

to be continuous in this direction. Both alpine flora and temperate forest extend east and west in continuous belts. Definite zonal vegetation according to altitude exists here beginning with temperate rain forest and ending with alpine flowers and dwarf shrubs in the higher zones. It is evident that the Flora of Tibet becomes progressive, richer, and more varied as one travels southeastwards into the river gorge country, where many types of plant associations are met with. The river gorge country is one of the botanical treasure houses of the world.

Another paper giving a pointer to a modern trend in classification is given in the pages of the Journal of Botany (No. 873, Vol. 73, page 241) by Kingdon Ward, regarding Rhododendron seeds. Considered from an evolutionary standpoint it can be inferred that seeds are amongst the most stable parts of flowering plants. They do not easily change in response to a changed environment. The author supposes that a study of the seeds may give valuable data in determining the line of descent and so in recognising relationships. Applying the above principle to the classification of Rhododendrons he proposes an amendment to Bayley Balfour's system of classification of Rhododendrons, where seed characters receive greater attention than hitherto.

Mr. Bharadwaja has reported the occurrence of *Isoetes coTomandelina* L. from near Benares where it is said to be extensively spread over a radius of 10 miles. No more than passing mention can be made in this report regarding the ever-increasing number of papers on a wide range of botanical subjects that have emanated from Indian Universities, Colleges, and Institutes. All branches of botany now have their students in this country and the class of work is high.

Mr. P. Maheswari has contributed a paper on the progress of work in India on the embryology of angiosperms wherein he stresses the value to taxonomic classification of a study of the embryology, the wood anatomy, and vascular supply to the floral organs.

Of special importance is the contributions of J. F. Caius in the Journal of the Bombay Natural History Society on the medicinal and poisonous palms of India, followed up by the medicinal and poisonous grasses of India and the medicinal and poisonous ferns.

Mr. J. D. Snowien has given an outline of the classification of cultivated Sorghums. This work was undertaken as a revision consequent on further collections from Africa and Asia, at Kew

After Stàpf's revision of the cultivated Sorghums òf Tropical[1]. Africa. The present outline which gives new species, varieties, etc., is a preliminary to a complete revision of the Sorghums.

II. Industrial Section, Indian Museum.—During the year under report the Public Gallery has been enriched by the addition of $56 specimens, which consist mostly of medicinal plant products collected from East Bengal and South India.

The Curator undertook a long tour in the Madias Presidency and Travancore during the year, which resulted in collection of valuable specimens of medicinal plants and their products, fibres and their products, products of cottage industry, food materials, spices, and other miscellaneous articles. He also took this opportunity of collecting herbarium specimens for the Economic Herbarium attached to the Industrial Section, Indian Museum, which has also been enriched by the addition of about 50 sheets.

As usual, **a** number of herbarium specimens, exhibited in the Gallery, were replaced by coloured drawings of the plants, giving much better effect to the exhibits..

During the year a number of students of some of the Colleges of Calcutta and the Post-Graduate students of the University of Calcutta visited the Gallery with a view to study the exhibits.

Numerous correspondents in India and abroad were furnished with information on the sources of supply of the Economic Plants and in various cases the plants were identified for them. The number of enquiries by commercial firms and the general public in India regarding the sources of supply of raw materials and finished products considerably increased and they were all satisfactorily dealt with. Further supply of botanical specimens of wild rice from various parts of India was continued for the Kew Herbarium at their request. Authentic specimens of roots of *^conitvm hetenphyllum* were supplied to Prof. W. Bae Sherriffs of Southampton for research studies.

The work of general overhauling of the Gallery was continued,, resulting in improvements in various directions.

Information on materials of the following waff supplied to various correspondents both in India and abroad:—

Acacia arabica **Willd.;** ***Aconitum heterophylhim*** **Wall.;** ***'Aconitum*** **sp.;** ***AUtonia scholaris*** **Br.;** ***Amomum arpmaticum*** **Boxb.;** ***Areca Catechu*** **L.;** ***'Arenga saccharifer**'*** **Labill.;** ***Atropa Belladonna*** **L.;** ***Bambusa*** **sp.;** ***Berberti arittata*** **DC;** ***Bahmeria nivea*** **Hook & Am.;** ***Brattica campettrit*** **L.;** ***Bratnca sp.;***

Broussonetia papyrifera **Vent.;** ***Butea jrondota*** **Boxb.;** ***Carica Papaya*** **L.;** ***Carum Carui*** **L.; Com'a sp.;** ***Cinchona*** **sp.;** ***Citrullus Colocynihit*** **Schrad.; Cttrut Aimmtuitm L.j** ***Curcuma aramatica*** **SaUisb.;** ***Datura fastuosa*** **L.;** ***Dendrocalamus ttrictu**** **Wees.; /fern's** ***elliptica*** **Benth.;** ***Embelia Ribei*** **Burm.;** ***Gardenia lucida*** **Boxb.;** ***Holarrhena antidytenterwa*** **Wall.;** ***Hibucus Sabdariffa*** **L.;** ***Hydrocotyle asiatica*** **L.;** ***Indigo/era indica*** **Lamk.;** ***Mangifera indica*** **L.;** ***Nicotiana Tobacum*** **L.;** ***Ocimum Badlicum*** L.; tfrj/za *coarctata* Boxb.; Oryza *latifolia* Desv.; C%«a *a£ft?a **L. var. plena Prain;** ***Oxytenanthera*** **sp.;** ***Papaver somniferum*** **L.;** ***PerUla ocimoide**** **L.;** ***PicrorMza Kurrooa*** **Benth.; Piper Ifctfe L.;** ***Plantage Psyllitm*** **L.;** ***Podophyllum Emodi*** **Wall.;** ***Psychotria Ipecacuanha*** **Stokes;** ***Sacckarum ciliare*** **Anders.; &att**wea** ***Lappa*** **Clarke;** ***Scopalia*** **sp.;** ***Sesamum indicum*** **DC.;** ***Swertia Chirata*** **Ham.;** ***Terminalia Chebula*** **Retz.;** ***Thevetia nereifolia*** **Juss.;** ***Tinospara cordifolia*** **Miers.;** ***Tritioum vulgare*** **Vill.;** ***Urginea Scilla*** Steinh.; Fata-'ow TTaZZicAti' DO.

HI. Cinchona **and** Quinine.—Ifarma *Plantation*,*—In the plantation rainfall was normal and there was no damage to Cinchona. No extension was allowed, but the existing blocks were maintained in good condition. Analysis at the Mungpoo Factory shows that age has enriched the Burma bark in quinirie content and it compares now very favourably with Munsong bark. During the year under review the harvest of bark was 81,772 lbs., the corresponding figure for 1934-35 being 64,429 lbs. Bark sent to the Mungpoo Factory for extraction was 75,569 lbs. and the stock lying at the plantation at the end of the year was 92,511 lbs.

The shade trees are doing well. The accumulated Ipecacuanha; roots are sent to Calcutta and stored at the Indian Museum. Revenue realised from the sale of these roots during the year under review ws Bs. 1,760.

Mungpoo Factory.—The recrystallisation 'of crude quinine to Trade Quinine of B. P. Standard went on as before and the total produce was 17,230 lbs. Its growing popularity is evidenced from its continued sale.

During the year bark received at the Factory from the Burma Plantation for extraction was 76,569 libs. The total bark treated was 73,078 lbs. (Java 23,341 lbs. and Burma 49,737 lbs.), yielding 2,820 lbs. Quinine Sulphate and 1,379 lbs. Cinchona Febrifuge.

Since the supply of Cinchona Febrifuge from the Presidency Jail, Alipore, to the 'Government of India area was stopped under orders from the Government of Bengal, indents from the India

area are being complied with from the Government of India stock of Cinchona Febrifuge at Mungpoo.

Indian Muteum.—The most notable event of the year was the Government of India's decision to make a free distribution of 46,000 lbs. quinine to the various provinces and minor administrations except Bengal, in pursuance of their policy of liquidating the surplus stocks. This distribution was made from the stock at the Indian Museum. Owing to the loss of the water of crystallisation the Java Quinine became short weight 'but over-strength and this quinine was used in making the distribution. An invoice weight of 49,451 lbs. quinine was issued to the various provinces with the result that the total stock of quinine reached an amount of 157,870 lbs. at the end of the year, leaving an excess of only 7,870 lbs. over the reserve. This small quantity would inevitably prove inadequate to meet India's normal annual distributions.

Three kinds of tabkts, *viz.*, Quinina Sulphate Tablets, Quinine Reinforced Cinchona Tablets, and Cinchona Febrifuge Tablets, are being prepared for supply to Assam and Upper India. These supplies are made direct from the Indian Museum. The supply to Assam increased from 1,000 lbs. in 1934-35 to 1,764 lbs. in 1935-36, and the Punjab began to indent for Cinchona Febrifuge Tablets towards the close of the year.

Besides the free distribution of 49,451 lbs. of quinine, the total net sales of all kinds of drug during the year were as follow:—

	Lbs.
Qaimne 8ilphste of all forms.	.90,146
Quinine Sulphate Tablets.	.1,222
Quinine Reinforced Cinchona Tablets	1,764
Cinchona Febrifuge Tablets	166
Cinchona Febrifuge Powder.	.4,633

The total revenue realised during 1935-36 was Bs. 5,53,3544.

The following stock accounts will reveal the position ^of the different kinds of drugs:—

Quinme Sulphate.

Dr.	Lbs.		Cr. Lbs.
1b Stock on 1st April 1086	286,866	fly Sales- and other issues	100,896
„ Manufacture and ivturns	22,900	„ Stock on 1st April 1036-	
		At Indian Museum	9,716
		At Mungpoo	147,643
		Atttadnttttoa	612
	288,766		2S8,76Ï

Quinine Sulphate TabUU.

Dr.	Lbs.		Or. Lbs.
To Stock on 1st April 1936 . . .	899	By Sales and other issues .	1,226
„ Manufacture . .	1,194	M stock on 1st April 1936-	
		At Indian Museum .	868
	2,093		2,093

Quinine Reinforced Cinchona TabUU.

To Stock on 1st April .1936 . . .	319	By Sales	1,764
„ Manufacture . .	1,484	„ stock on 1st April 1936—	
		At Iddian Museum .	89
	1,803		1,803

Cinchona Febrifuge TabUU.

To Stock on 1st April 1936 . . .	M	By Sales	166
„ Manufacture . .	383	M stock on 1st April 1936-	
		At Indian Museum . ,	228
	383		383

Cinchona Febrifuge.

To Stock on 1st April 1936 . . .	19,687	By Sales and other issues .	6,250
„ Manufacture . and retunis . . .	1,800	„ stock on 1st April 1936-	
		At Indian Museum .	1,768
		At Mungpoo . .	13,469
	21,487		21,487

Bath.

To Stock on 1st April 1936 . . .	686,231	By Issue for extraction .	73,078
„ Quantity harvested during the year .	81,722	„ stock on 1st April 1936—	
		At Mungpoo . .	601,364
		AtMergui . . .	92,611
	666,963		666,963

IV. Financial.—The total budget allotment for the year was Us. 1,53,000, of which Rs. 41,800 was for Botanical Survey proper **and** Bs. 1,11,200 was for Cinchona. The whple grant was spent,

leaving a small saving of about Us. 2,000 mainly due to modification by audit of the flat rate of extraction of quinine from bark.

V. Staff.—The writer held charge throughout the year as Director, except from 31st May, 1935, to 29th November, 1935, while on leave out of India. During his absence the post of the Director, Botanical Survey of India, was kept in abeyance. Mr. S. C. Sen, Quinologist to the Government of Bengal, who was then the Officiating Superintendent, Cinchona Cultivation in Bengal, discharged the Cinchona duties of the Director. Mr. S. N. Bal performed the duties of the Director at Indian Museum and was placed in immediate charge of the Quinine Stock at Museum under the general supervision of Mr. Sen. Mr. K. P. Biswas, Curator of the Herbarium, Royal Botanic Gardens, Sibpur, who was then officiating as the Superintendent, Eoyal Botanic Gardens, discharged the Director's duties at Sibpur. Mr. S. N. Bal was Curator of the Industrial Section, Indian Museum.

Mr. V. Narayanaswami, Systematic Assistant, acted as Curator of the Herbarium, Royal Botanic Gardens, Sibpur, under the Government of Bengal from 31st May to 29th November, 1935, and Mr. %. D. Srinivasan, a retrenched officer of this Department, worked in Mr. Narayanaswami's place from 13th August to 29th November, 1935.

Mr. T. C. Mukharjee acted as Head Clerk up to 13th May, 1935, when Mr. A. Banerjee was appointed to officiate in the post. Mr. S. B. Banerji, the Head Clerk, retired from Government service from 1st February, 1936.

On the Cinchona Plantation Mr. G. H. Fothergill acted as Superintendent throughout the year during Mr. P. T. Russell's leave preparatory to retirement. Mr. Mg. Sine was Overseer throughout the year except for a period of three months when Chandra Lai officiated in his place.

All the members of the staff worked well during the year.

C. C. CALDER,

Director,

Botanical Survey of India.

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