

THE
BOTANY OF BIHAR AND
ORISSA

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PREFACE TO REPRINTED EDITION

When the Botanical Survey of India was reorganised in 1954, the Government of India decided on the advice of the eminent Botanists of the country that the important Floras of the country which had gone out of print should be reprinted in order to provide immediate facilities of work on Systematic Botany of Phanerogams by students and Botanists of the country. The reprints are now being issued accordingly.

One particular point needs a special mention here. The Government of India, while recognising fully the need for bringing the Floras of the country up-to-date after a thorough revision, cannot overlook the fact that such a work is possible only on an extensive and thorough exploration of the regions already explored or hitherto under-explored and a proper rating of the information thus obtained with the materials in the already published Floras. The present effort is, therefore, the starting point in the greater project of the review of the Floras of our country. It is hoped that these publications would then meet the long-felt requirement of the Botanists of the country.

Owing to the necessity to conform to certain printing stipulations and using the same size of paper for all the reprinted Floras, the paginations in the reprinted volumes differ from that of the original. But the correspondingly corrected index would, it is hoped, enable reference without inconvenience. Some of the printing mistakes in the original Floras have been corrected in this edition.

The present reprinted edition is being published in three volumes. The corrections mentioned in the corrigenda of the original volume have been incorporated in the text of the present edition.

Calcutta, 1961

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Chief Botanist
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THE BOTANY OF BIHAR AND ORISSA

FAM. 114. PIPERACEÆ.

Herbs or shrubs, often climbing, aromatic with minute glands (secretory cells) which very commonly give rise to transparent dots in the leaves. Leaves alternate opposite or whorled, entire, stipules 0 or connate and intrapetiolar or adnate to the petiole. Flowers minute, 1-2-sexual, in axillary or terminal spikes and subtended by peltate bracts. Perianth 0. Stamens 2-6, rarely 1 or 7-8, hypogynous, anthers often jointed on the filaments, dehiscing longitudinally or cells confluent. Ovary 3-4-carpellary, 1-celled, or of 3 or more carpels free or connate below; stigmas sessile, simple or penicillate. Ovules 1 or more, orthotropous. Fruit in the case of syncarpous ovaries baccate or induriscient, of apocarpous ovaries coccous or follicular. Seeds globose, ovoid or oblong; testa thin. Embryo minute, enclosed in a sac of endosperm at one end of the copious floury perisperm; cotyledons minute or obsolete, radicle superior.

Shrubby or herbaceous. Fls. dioecious or rarely 2-sexual.

Anther-cells distinct (or confluent on dehiscence). Stigmas

3-5 more or less connate or confluent 1. *Piper*.

Succulent herbs. Fls. 2-sexual. Anther-cells confluent.

Stigma penicillate 2. *Peperomia*.

1. PIPER, L. Pepper.

Shrubs, rarely herbs, often climbing, with swollen nodes, usually glandular and aromatic. Leaves entire, mostly unequal-sided, stipulate. Flowers very minute dioecious, very rarely 2-sexual, spiked, each in the axil of a peltate bract or bract adnate to and sometimes decurrent on the rhachis, lateral bracteoles sometimes present and forming low ridges on each side of the flower or connate in a semilunar form. Stamens 1-4, rarely more, filaments short, anthers 2-celled, cells often confluent by dehiscence. Ovary 1-celled, style conic beaked or 0, stigmas 2-6. Ovule 1 erect. Fruit baccate. Seed usually globose, testa thin, albumen hard.

A. Bracts orbicular or obovate, peltate with margins free. Fruiting spikes dense, not interrupted:—

1. Stems slender, creeping or rambling, never climbing:—

L. cordate, lower long-petioled, upper often amplexicaul.

Stamens 2-3. Fem. spikes 5-12" 1. *longum*.

2. Stems climbing by adventitious roots, often stout:—

a. Bracts shortly stipitate:—

L. not cordate, with 3 primary nerves converging to apex 2. *peppuloides*.

b. Bracts sessile:—

Midrib with 3-5 rather weak sec. n. not converging to apex. Fruiting spikes under 1.5" conical 3. *chaba*.

Midrib with one sec. n. each side converging to apex. Fruiting spikes red very fleshy cylindrical 1-5" 4. *betle*.

B. Bracts adnate to the rhachis at base and sides. M. and F. spikes very slender in flower. Fruiting spikes interrupted:—

L. coriaceous, often glaucous beneath, glabrous or indumentum beneath microscopic. Ovary immersed in rhachis 5. *nigrum*.

L. membranous, thinly shortly hairy beneath. Ovary sessile with broad base on the pubescent rhachis

6. *attenuatum*.

1. **P. longum**, L. Pipal (the plant), pipramul (the roots), *Th.*; Pipal, *H.*; Pipra-mohr, *Kharw.*; Narjom-red, Ralli-red, *K.*; Ralli, ranuran, *S.*; Long Pepper.

A creeping and rambling aromatic herb with distant alternate lower long-petioled deeply cordate, usually ovate or orbicular, upper more oblong and sessile or amplexicaul leaves. Diccious. Bracts of both sexes stalked peltate with free margins all round. Bracts .05" diam. Bracteoles 0. Male spikes slender, yellow, 1.5—3.5" long. Stamens 2—3. Fem. spikes .5—.75" in flower, up to 1.2" long in fruit, bracts similar to male, but more distant and less stipitate; ovary sunk in and more or less confluent with the thick rhachis, stigmas 3—4 lanceolate spreading papillose. Berries distinct .1" diam.

In damp ground under shade. Champaran to Purneah, frequent! Santal Par., not common! Singbhum, under dense shade! Palamau! Maubhum, *Camp.*! Mayurbhanj, in the mountains! Mals of Puri! Angul! Fl. July—Aug. Fr. Dec.—Jan.

Stems sulcate when dry, usually distinctly puberulous and shoots sometimes pubescent. Normally the leaves are broadly ovate or the lower ones even broader than long and occasionally reniform, but in the Puri specimens most of the leaves are elliptic-oblong 3—5" long, tapering or shortly suddenly acuminate, sometimes all petioled, very closely and minutely dotted rather pale beneath, basal auricles rounded with broad or narrow sinus, principal nerves 3, reaching or nearly reaching and meeting at apex, one (each side) reaching about half way and soon looped and often one shorter additional one near base, nerves and petiole often puberulous, lower petioles 2—3" or often exceeding blade, sometimes all leaves petioled.

Both root and fruit are stimulant and carminative and used for cough. The root is also used in Chota Nagpur for fermenting rice-beer. It is also said to be a valuable alterative tonic and is sometimes used as a spice.

2. **P. peepuloides**, Roxb.

A slender climbing shrub adhering to the trunks of trees by its adventitious roots, with firm pale-coloured, often pustulate, branches. Leaves thin oblong, ovate-lanceolate or oblong-lanceolate, long-acuminate, 4—5.5" long, base not cordate but very oblique and rounded, both sides glabrous, under surface with microscopic white dots; primary nerves, 3 more or less meeting in apex as in *P. longum*, 1 each side reaching about half-way and often 1—2 very weak ones added; transverse tertiaries weak. Petiole .2—4". Male spikes slender leaf-opposed .75—2" on peduncles .1—1.5" with close peltate shortly stoutly pedicelled bracts .025" diam., stamens 2—4 to each bract. Fem. spikes very short .2—.7" on peduncles .1—2", cylindric in fruit with very close berries .08" diam. and remains of the peltate bracts between.

Extreme north of the province. Hills of N. Champaran in damp situations! Fl. Oct.—Dec. Fr. Feb.—March.

Some specimens named *P. peepuloides* at Kew, collected in the Darjeeling District and Khasia Hills, have flexuous fruiting spikes 1—1.5" long, peduncles .3—7" long and berries .14" diam. They seem doubtfully the same species.

3. **P. chaba**, *Hunter*. Syn. *P. officinarum*, *Cas. D.C.*; *Chavica officinarum*, *Miq.*; Chai, *Beng.*; Chab, Chair, *H.*

Stout, shrubby, climbing by means of its adventitious roots, quite glabrous, Leaves sub-coriaceous oblong or lanceolate-oblong or lower

ovate-lanceolate, acute or acuminate, with obliquely cordate or sometimes subequal or attenuate base, pale beneath. Petiole .25—5". Spikes leaf-opposed erect, fleshy, with the peltate bracts sessile. Male spike "about equalling the leaf," stamens 2—3.* Female spike much shorter, ovary immersed in the rhachis, stigmas 3. Fruiting spikes "1—2" long, .5" diam.," broadest at base, obtuse, forming a fleshy cone of innumerable berries each about .08—12" diam.

Only cultivated in India. I have seen no authentic specimens from our area. Fl. July. Fr. Sept.

Stems finely grooved and about 20-ridged, glabrous. Leaf base not cordate (though it is cordate in very young plants), mostly unequal, each side rounded or obtuse or one side subcordate or acute, 2—5", usually no strong basal lateral nerves (an occasional leaf may show one and *Hooker* says base 3—5-nerved!), sec. n. 4—5 mostly alternate, but sometimes one pair opposite, not very strong, not distinctly looping. Male spikes (from *Miquel's* figure) about 1" cylindric on peduncles .5—6". Fem. spikes somewhat conical, compact, .4" in flower, .8—1.2" in fruit on peduncles .3" long.

4. *P. betle*, L. *Pan*, *H.*, *Beng.*; Betle-leaf Pepper.

A climbing shrub with woody roots, glabrous or buds pubescent. Leaves coriaceous from broadly cordate-ovate to obliquely elliptic oblong, 4—7" long by 2—4" broad, acuminate, primary or sub-primary nerves 5—9, usually 7, midrib with 1 sec. nerve both sides. Petiole .3—1.5". Spikes pendulous, bracts orbicular or somewhat obovate, sessile on the hirtellous rhachis. Male spikes 3—6" by .1—12" diam., stamens 2. Female long-peduncled, .7—3.5", ovary immersed in and confluent with the rhachis, apex tomentose, stigmas 4—6 lanceolate. Fruiting spikes stout 1—5", berries .17—25" diam. very numerous, dense fleshy and often confluent into a cylindric fleshy red mass. Peduncle 1—1.5".

Cultivated (in *pan-baris*) in most districts, but especially Purneah and Orissa.

Lowest strong pair of primary nerves (there is usually a weak pair below these) extending two-thirds to three-fourths length of leaf, a strong pair of sub-primary or secondaries reaches to or nearly to the apex, tertiaries numerous scalariform or sometimes more reticulate, base of leaf rarely subcordate, usually oblique and rounded or the lower side only rounded, the other obtuse or subacute.

The leaves form the well-known masticatory with the addition of lime, catechu and betle-palm nuts. To these are often added other aromatic flavouring ingredients. Betle-leaf thus chewed acts as a gentle stimulant and exhilarant. The leaves are also used as a domestic remedy in various ways (*Dutt, Mat. Medica*, p. 245).

De Candolle (*Prod.*, xvi, p. 359) describes a variety "*siriboa*" with the young leaves and petioles pubescent.

5. *P. nigrum*, L. Syn. *P. trioicum*, *Roxb.*; Kali-mirich, Gol-mirich, *H.*, *Beng.*; Chai, Cherwud, *Or.* (the wild plant); Pepper.

A rather stout climber up to 20 ft. high, ridged on the branches. Leaves 5—6" by 2—4" from broadly lanceolate to broadly ovate, on the same plant, acuminate, shining dark green above, often (always?) glaucous or white beneath, lower roundish and nearly equal-sided and slightly cordate; principal lateral nerves 3—4 at or close above the base, lowest weaker short or soon looped or absent, next arcuate

* None of the specimens I have seen show male inflorescence.

for half length of leaf then continued in loops to its apex; above these a strong lateral nerve from far below the middle arcuate to the apex; tertiaries sub-scalariform, not much raised beneath in the cultivated plant; base rounded or oblique with one side acute. Spikes very long slender pendulous, sometimes the female bearing some 2-sexual flowers. fls. mostly dioecious. Bracts adnate to the rhachis at base and sides, sub-oblong but widened upwards, truncate rounded or retuse at apex and with the adnate bracteoles in the female forming a minute cup round the ovary. Male spikes filiform up to 7" long pendulous, bracts each with 3 subsessile anthers. Fem. spike shorter, thicker with ovary immersed in the rhachis, stigmas 3—4 subulate. Herm. fls. have 2 short stamens closely adpressed to the pistil or pistillode. Berry red, sessile globose in interrupted fleshy spikes.

But little cultivated and in the damper hotter parts only, but the following form is wild. FL. May (and at other times?).

Var. **trioicum**, C.D.C. Syn. *P. trioicum*, Roxb.

Stems up to 2" diam., branches firm but with a large pith, mostly pustulate below, leaf-huds minutely pubescent. Leaves 4—6.5", obliquely ovate, long-acuminate, rather coriaceous and somewhat bullate with depressed nerves above, pale or glaucous and microscopically puberulous beneath, base obliquely shallowly cordate, midrib very strong tapering upwards, with a strong lateral nerve each side from a little above the base (sub-primary), a weak one each side below the sub-primary, and a strong sec. n. each side sometimes subopposite, sometimes alternate, intermediate and tertiary venation subparallel, looping and reticulate. Petiole 4—6". Stipular scar prominent.

Wild in the mountains of Mayurbhanj, near streams above 3000 ft.! Fl. Sept.—Oct. (mine were not in flower).

I have little doubt that this is *Roxburgh's* plant which was collected in the same range of mountains further south. *Roxburgh** says "in *trioicum* the leaves have a glaucous appearance, which readily distinguishes it from *nigrum*, which has shining dark green leaves," but *Miquel* says "*trioicum* has leaves less white beneath, also that the leaves are narrower, tending more to the lanceolate form, and are less coriaceous and the amenta triecious."

The cultivated *P. nigrum* is the source of black and white pepper. The berries plucked just before they turn red and dried constitute black pepper. The ripe fruit deprived of the pericarp by maceration in water, then dried in the sun, becomes white pepper. Pepper is used by the Hindus in dyspepsia and very largely in cholera epidemics.

6. *P. attenuatum*, Ham.

Rambling and climbing on trees by its adventitious roots, with soft slender glabrous branches grooved when dry and broadly ovate membranous leaves 4—5.5" with subregular or slightly oblique rounded retuse or cordate base and abruptly acuminate apex, upper surface glabrous, lower thinly shortly hairy especially on the nerves. Primary (and sub-primary) nerves 7, the midrib and 2 subprimary (a little above

* He also describes the bracts as peltate, but does not figure them so. *Wight's* figure is said to be after *Roxburgh*.

the base) reaching the apex but the latter sometimes looped before doing so, outermost nerves shorter and weak, one reaching about half way to apex and looping, tertiaries very slender subparallel. Petiole .7—2". Spikes solitary leaf-opposed very slender, about .05—.08" diam. Males 3—5", bracts adnate cupular, rounded at apex, bracteoles slender, stamens 2—4 exserted. Fem. 2.5—3.5" on slender peduncles .5" long, bracts rather distant rounded truncate with margins decurrent below and with the bracteoles forming a low membranous rim. Ovary sessile glabrous with a broad base and 3—4 short spreading stigmas. Fruiting spikes elongating to 6—9", berries .15" diam. globose, rhachis pubescent.

Mals of Orissa. Fl. Aug.—Sept. New shoots from April onwards through the r.s.

2. PEPEROMIA, Ruiz & Pav.

Herbs, usually succulent with alternate opposite or whorled entire gland-dotted exstipulate leaves. Flowers 2-sexual, minute bracteate, sessile, or sunk in the rhachis of solitary or fascicled spikes. Stamens 2 very short, anther-cells confluent. Ovary 1-celled, stigma lateral or terminal usually penicillate. Ovule 1 erect. Fruit minute, indehiscent. Seed with membranous testa.

Leaves whorled .25—4", elliptic to orbicular or obovate

1. *reflexa*.

Leaves opposite and alternate .5—1", ovate

2. *pellucida*.

1. *P. reflexa*, A. Dietr.

A small tufted herb growing on tree trunks 4—6" high, much branched with firm ridged and grooved branches and elliptic orbicular or somewhat obovate leaves .25—4" long mostly 4 in a whorl, thick and rather fleshy when fresh, coriaceous when dry, margins recurved. Spikes mostly terminal .5—1.25" long on slender peduncles .3—5" long, rhachis pubescent. Bracts peltate, distant, very minute, under .02" diam., the flowers sunk in cavities of the rhachis above them.

Parasnath, Wood, C. B. Clarke! Meghasani, 4000 ft. Fl. April—May.

Stem described as pubescent in *F.B.I.* In my specimens the whole plant is glabrous except the rhachis of the spike which is distinctly pubescent and sometimes the young branches and petioles which are puberulous. Petioles .05—15" long.

2. *P. pellucida*, Kunth.

A very succulent herb becoming membranous when dry 3—10" high with broadly ovate acute 7-nerved leaves .5—1" long and very slender leaf-opposed spikes 1—2" long by .03" diam., glabrous. Peduncle hardly any. Flowers distant sunk in the rhachis, with most minute peltate bracts .007" diam. Fruits .02" diam. globose prettily marked with about 10 vertical ridges and minute transverse very fine raised lines between.

Frequent in plant houses, etc., as a weed, but principally noticed by me in the Terai and Duars outside our area. Fl., Fr. c.s.

Native of South America; now more or less naturalised.

FAM. 115. LAURACEÆ.

Trees, more rarely shrubs, or (*Cassytha*) a parasitic filamentous climber. Leaves alternate, rarely opposite or subverticillate, or (*Cassytha*) 0, entire, frequently clustered at the ends of the branchlets, usually with a characteristic aromatic smell when bruised due to minute glands sometimes visible as translucent dots, exstipulate. Flowers small, greenish or yellowish, regular 1—2-sexual, often clustered or cymose, mostly 3-merous. Tepals usually in 2 series of 3 each, sub-similar, often connate below, more rarely tepals 5 or rudimentary or 0. Stamens in 2—4 3-merous whorls of which one whorl is often reduced to staminodes, hypogynous or perigynous, inner often with 2 large glands at the base; anthers 2- or 4-celled dehiscent introrsely or extrorsely by as many valves, lids finally deciduous. Ovary 3-carpellary, 1-celled with one pendulous anatropous ovule, style terminal, stigma simple, discoid or dilated often 3-lobed. Ovule 1 pendulous anatropous. Fruit baccate, drupaceous or nearly dry, rarely enclosed in or adnate to the perianth tube, but often surrounded at the base by the thickened accrescent receptacle or by the base of the tube and supported on a thickened pedicel. Seed with membranous testa, exalbuminous. Embryo with large plano-convex cotyledons, radicle superior minute.

The Laurels (though this is not well exemplified in our species) have usually a very characteristic method of branching; only one or two of the axillary buds from the crowded terminal leaves develops into a slender green shoot bare of leaves at the base.

I. Not twining nor parasitic:—

A. Inflorescence dense, clustered or umbelliform. All anthers introrse and 4-celled:—

Flower-buds in densely imbricating bracts. Leaves sub-whorled

Flowers in involucrate umbels. Leaves scattered

1. *Actinodaphne*.2. *Litsæa*.

B. Inflorescence laxly cymose or paniced. Innermost whorl of perfect stamens with extrorse anthers:—

1. Anthers 4-celled. Perfect stamens 9:—

a. Tepals persistent. Leaves penninerved:—

Fruiting tepals spreading or reflexed, not hardened.

Fruiting tepals erect, hardened.

3. *Machilus*.4. *Phoebe*.

b. Tepals deciduous, leaves often 3-nerved

5. *Cinnamomum*.

2. Anthers 2-celled:—

Fruit not enclosed by perianth-tube

6. *Beilschmiedia*.

Fruit enclosed by and often adnate to perianth-tube

7. *Cryptocarya*.

II. Twining leafless thread-like parasites

8. *Cassytha*.1. ACTINODAPHNE, *Nees*.

Evergreen trees with subverticillate leaves and small dioecious fls. in axillary or lateral dense bracteate clusters, racemes or umbels, the bracts imbricating and caducous. Calyx-tube short. Tepals 6, deciduous in fruit. St. 6—9. Anths. all introrse and 4-celled. Staminodes 9 in female. Fruit seated on the enlarged cup-shaped perianth tube.

1. *A. angustifolia*, *Nees*. Inc. *A. Hookeri*, *Meissn*; Jharjhampa, Tengeda, Sabalia, Or.

A mod.-sized tree with subverticillate (mostly 6 in a whorl) lanceolate to narrowly oblanceolate leaves, rarely in our area lanceolate-

obovate, 4" by 1" to 10" by 2.5", glaucous beneath and dark shining above, tapering both ends. Petiole .3—5". Fls. mostly from the axils of fallen bud scales between the verticils, inflorescence silkily tomentose. Males clustered or shortly racemose with rhachis not exceeding .3" and silky pedicels .2—2.5". perianth rotate or subcampanulate, tepals ovate to ovate-oblong, .15—2", nearly glabrous inside, st. far exerted with anthers .1" long, filaments .15" pilose. Fem. in clusters or in subsessile simple or slightly branched umbels, tube campanulate .08", tepals spreading ovate-oblong .12" long, staminodes 9 perigynous linear-subulate, innermost 2-glandular as in the male, ovary and style hirsute. Fruit globose or elliptic .25—3" seated on the cupular truncate swollen perianth-tube.

Valleys in good soil, over the whole province in the better forests, but nowhere abundant. Fl. Aug. (or Feb. in the south). Fr. Nov.—May. Evergreen.

Shoots and innovations densely brown villose, buds perulate. Old leaves somewhat brown-villose on the nerves beneath or quite glabrous, sec. n. 7—12 oblique, raised beneath, weak and looping towards margin, tertiary veins very fine, scalariform, margin thickened. Petiole tomentosely-hairy or finely pubescent or glabrescent according to age.

Excepting possibly some specimens with broadly ovate-lanceolate leaves not occurring in our area the northern *A. angustifolia* and the southern *A. Hookeri* are the same species. Mr. Gamble has kindly supplied me with excellent M. and F. flowering specimens of *A. Hookeri* collected by C. E. C. Fischer in Chingleput, and these more closely resemble specimens from northern Bengal than they do some from intermediate localities such as southern Orissa. The two species are widely separated by Meissner in the *Prodromus* since he places (as Hooker says wrongly) *A. Hookeri* in the section *Notholitsæa*. Possibly Meissner's *A. Hookeri*, which he divides into 3 varieties, really includes 3 different species, one of which only belongs to *angustifolia*. Hooker also places the two species far apart on the characters "fem. fl. in sessile or subsessile clusters or umbels" in one section to which he assigns *A. Hookeri*, and "fem. fl. in peduncled umbels or clusters" in the other section to which he assigns *A. angustifolia*. As, however, he says under *A. Hookeri*, "fem. umbelled or subracemose on a short stout peduncle," these sectional characters become immediately vitiated, and the only difference I find is that *angustifolia* has the umbels often compound. The geographical test, Northern India or Deccan species, is also inapplicable from my having collected the plant from Chota Nagpur, Bonai, Puri (with oblanceolate leaves only 5.2 by 1.9" only), Mayurbhanj, and Pallahara State (Cooper!), which connects up the two areas of distribution. The shape of the fruit is given as globose in the *F.B.I.* in the case of *A. angustifolia* and ellipsoid in the case of *A. Hookeri*, but this is not consistent with the other distinctions.

The heartwood is brown but is not used.

2. LITSÆA, Lamk.

Trees, more rarely shrubs, with leaves nearly always scattered and alternate. Flowers several in an umbel surrounded by an involucrel whorl of 4—6 concave sepal-like bracts, umbels pedicelled, usually again umbelled or racemed or fascicled, axillary or from leaf- or bract-scars. Perianth-lobes usually 6, but sometimes very incomplete or absent, tube or hypanthium sometimes greatly enlarged in fruit. Stamens 6—20, filaments of the one or two innermost whorls (if present) 2-glandular.

A. Perianth very incomplete or 0, not (or slightly) enlarged nor cupular in fruit:—

Pedicels clavately thickened in fruit. St. 9—20

1. *sebifera*.

B. Perianth with 4—5 subequal tepals:—

1. Perianth tube only slightly enlarged and somewhat cupular in fruit. Tepals 5—6:—

L. elliptic to oblanceolate-oblong, strongly nerved beneath with raised tertiaries pubescent . . .

2. *polyantha*.

L. lanceolate acuminate with slender nervation . . .

3. *salicifolia*.

2. Perianth much enlarged and cupular in fruit. Tepals 4:—

L. large shining oblong to lanceolate, nervation obscure irregular

4. *nitida*.

- 1.
- L. sebifera**
- ,
- Pers.*
- Chiur,
- Kharw.*
- ; Medh, Menda,
- H.*
- ; Porjo,
- M.*
- ; Baghoari, Jaisanda, Besond,
- Or.*
- ; Baghtal,
- Or.*
- (f. Cooper); Paruhi,
- Bhuia*
- .

Usually a small, sometimes a m.s. tree, aromatic, with leaves very variable in size and shape, but normally ell.-lanceolate and acuminate, pubescent or tomentose on the ovoid leaf-buds and shoots, but glabrescent; sec. n. 6—12 fine oblique reaching nearly to margin, tertiaries very fine and minutely reticulate between. Petiole slender 7—1". Flowers yellowish (from the yellow anthers) with very short pedicels forming capitate umbels supported by 4—6 concave orbicular bracts on slender peduncles 3—8" long which are either racemed, umbellate or corymbose on a common peduncle of variable length which is axillary or from the axils of caducous bracts on the new shoots below the leaves. Inflorescence often appearing nearly simple in fruit from only one ovary developing and pedicels greatly clavately thickened. Hypanthium minute in flower, thickened and disc-like in continuation of the pedicel and 15—19" diam. in fruit, tepals 0 or imperfect. St. 9—20 with long villous filaments. Glands fleshy on villous stipes. Fruit globose black 35—47" diam.

Very widely distributed over the whole province, in valleys and cool aspect of hills. Champaran, up to 4 ft. girth! Gaya! Chota Nagpur, all districts! Sambalpur! Bonai, "a large tree," *Cooper*! Mayurbhanj! Angul! Puri (Mahanadi delta, near the sea)!

Fl. June—July. Fr. Sept.—Nov. Evergreen, new shoots in May.

Bark grey, smooth. In big trees becoming dark grey and slightly rough. Blaze soft yellow-brown and dirty white, with a little chlorophyll in outer layer.

The bark has repute for medicine in several districts. In Sambalpur it is used as a poultice in aching pains of the body. *Mr. Cooper* states that it is used medicinally by the *Bhuia*s and is much valued. The wood is generally said to be durable and not attacked by insects. *Gamble* says wood greyish brown or olive grey, moderately hard, shining, close and even-grained, seasons well, durable, is not attacked by insects and that the bark is used for external application for sprains and bruises. Weight 45—48 lbs.

The following are the principal varieties or forms occurring in the province:—

Var. *α*, *sebifera* proper. L. 2—5.5" elliptic with rounded apex, often somewhat pubescent or thinly fulvous hairy beneath, base acute or rounded, sec. n. 5—8 or more, often irregular and median forked about one-third way from the margin, petioles stouter than in next and with the shoots often permanently pubescent. Puri Division!

Var. *β*, *normalis*. L. 3—6" oblong or lanceolate, obtuse to acuminate, usually tapering both ends, glabrous or sparingly pubescent beneath. Sec. n. rarely forked except near margin.

Ranchi, Mandhum, Hazaribagh, Puri, Cuttack, Bonai, etc.

The commonest form but not apparently the type according to *Sir J. D. Hooker*.

Var. γ , *glabraria*, J. D. H. L. attaining 8", more or less tomentose beneath until the fruit is ripe. Common peduncles attain 1.5" with numerous umbels. Frequent in Singbhum!

Var. δ , *longifolia*. L. up to 11" by 3" lanceolate. Petioles up to 1.4", sec. n. 8—14. Common peduncles .3—6".

Angul! Sambalpur!

2. L. polyantha, Juss. Porjo, Pojo, K., S.; Kukur chita, Beng.; Baglal, Mal. P.; Motwa, Tharu; Barendo, Khond; Bastura, Or. (f. Cooper).

A small tree with brown-pubescent branchlets, strongly-nerved ell- or oblanceo-oblong obtuse or sub-acute leaves 4.5" by 2" to 9" by 4" and tomentose stout-pedicelled umbels clustered along the branchlets and axillary. Fr. ellipsoid or ovoid .25—33" long, seated on the shallow saucer-shaped perianth base which is .12—17" diam.

In valleys, chiefly near streams, throughout the province but nowhere very common. Champaran! Chota Nagpur (ascends to the top of Parasnath)! Gaya ghats, rare! Puri! Angul! Bonai, Cooper! Fl. April—May. Fr. July—Aug. Evergreen. The leaves are renewed in May.

Bark smooth. Blaze somewhat grating, a mixture of brown and white. L. pubescent and glaucous beneath with 7—12 strong sec. n. and raised parallel cross nervules. Umbels 2-several in a cluster sometimes on a very short common peduncle, 5—6-fld. Special peduncle in fem. .12—33" and fruiting pedicels .25—75". Sepals usually 5, linear-oblong, nearly free. St. 9—13, fil. hairy, reduced to 2-glandular staminodes in fem. fl.

The powdered bark is applied to bruises of the body and to fractures in animals. The seeds yield an oil which is used medicinally, Campbell. "Powdered root used for bruises," Cooper. "Wood used for agricultural implements. Wt. 38 lbs.," Gamble.

3. L. salicifolia, Roxb., var. *laurifolia*, J.D.H.

A bushy shrub up to 15 ft. high with numerous suberect shortly finely silky branches, alternate lanceolate or linear-lanceolate leaves 2.5—6" long by .5—1.4" wide, dark green and shining above, glaucous and very minutely fulvous-silky beneath, sec. n. 7—13 distinct and pale (or reddish when dry) oblique, becoming faint and looping towards the margin, tertiaries scalariform, indistinct. Petiole .25—4" clothed like the twigs. M. umbels clustered axillary and from the axils of deciduous bud-scales (whence they sometimes appear racemed), peduncles .2—25", invol.-bracts .15" enclosing 5—4 flowers, tepals linear-oblong .08". St. 6—9. Fem. peduncles often solitary .4", invol. bracts concave orbicular-oblong 4—5, fls. 5 shortly pedicelled, pedicels silky, villose at top, staminodes twice as many as the tepals, elliptic-oblong hairy, inner with 2 glands as in the male. Ovary ovoid glabrous.

Purneah, in low forest! Fl. Dec.—Jan.

Stems attain 3" diam., bark smooth, blaze rather hard, pale-brown. L. green beneath when dry. Involucre-bracts nearly glabrous or silky outside, gland-dotted, 5-nerved from the amplexicaul base, tepals 6—7, outer stamens half as long again as the tepals, filaments pilose, when 6 both series with glands, when 9 the two inner series with quadrate stipitate glands. Fruit (not seen in our specimens) .3" long, purple-black, ellipsoid, seated on the very slightly enlarged sub-cupular perianth tube.

This is united by *Thwaites* with the common Cinnamon (*C. zeylanicum*, *Breyn*), which has leaves 4—7" long, shorter panicles, and flowers .25" long.

The latter is probably also cultivated occasionally in the province, but I have not seen it.

2. *C. tamala*, Fr. Nees. Tejpat, *H.*, *Beng.*; Sisi, *Th.*

A moderate sized tree with leaves usually 4—5" long shining above, mostly oblong. Fls. .2—'25" long. Tepals deciduous in fruit. Stamens and ovary villous.

The leaves are often sold in the Bazars, but it is very rarely cultivated in B. & O. Native of the tropical and subtropical Himalaya and no doubt occurs wild in the forests just north of our boundary.

3. *C. camphora*, F. Nees. The Camphor Tree.

A small tree with dark-grey rough bark on the trunk and branched low down. Buds perulate with branching of the characteristic laurel type. Buds small ovate distinctly perulate. Leaves 2.5—4" long, elliptic-lanceolate or somewhat ovate, acuminate, dark-green above with a whitish or glaucous waxy coating beneath, glands not externally visible, triple-nerved at a considerable distance (.25" or more) from the base, other sec. n. about 2 slender. Petiole long and slender .7" or up to half as long as blade. Flowers very sweet-scented, whitish, .17—'2" diam. in small pseudo-terminal panicles with the branches 1—2" long; yellow glands on the inner stamens very conspicuous. Berry subglobose black.

Occasional in gardens in the damper districts. Fl. March—May. Very slow growing in our area.

The leaves have a pleasant aromatic odour when crushed, but not more camphoraceous in character than many other laurels.

6. BEILSCHMIEDIA, Nees.

Usually evergreen trees with penninerved alt. or opp. leaves and small bisexual fls. solitary and in small lateral panicles on the new shoots. Per. tube short. Stamens sub-perigynous, filaments of innermost series of perfect st. 2-glandular at base with extrorse anthers; anthers 2-celled; staminodes ovoid or cordate. Fruit from globose to very narrowly oblong or obovoid. Perianth quite deciduous in fruit.

Large tree. L. oblong to oblong lanceolate, 3—6" 1. *Roxburghiana*.
Small tree. L. ell.-oblong or narrowly elliptic, 5—9" Var. *Dalzellii*.

1. *B. Roxburghiana*, Nees. Syn. *B. fagifolia*, *Nees*; Katea-ratam, Katea-u:, *K.*

a. Var. *fagifolia*, *Nees* (sp.).

A large dark-foliaged tree attaining 6 ft. girth with rather smooth light bark, linear-oblong or oblong-lanceolate obtuse or slightly acuminate leaves 3—6" by .62—1.75". Flowers in very short panicles .5—'75" long from the leaf-scars and from the axils of caducous scales of the new shoots or from the axils of the new leaves. Fruit narrowly oblong-obovoid purple-black, 1—1.75" long.

Along rivers in Singbhum and Porahat (Deo R., Rangan gara, Saikata gara, etc.), not common! Fl. March—April. Fr. May. Renews leaves April.

Leaves tapering at the base, some slightly obovate and attaining 7" by 2.7"; sec. n. 6—12, intermediate very reticulate and fine, raised both sides. Petiole .33—.75". Panicles villosely-pubescent. Tepals variable in size, .09—.17" long, linear-oblong to oblong-ob lanceolate, pubescent both sides. Perfect stamens in 3—4 series, staminodes white fleshy, sometimes 2-seriate. Testa rather coriaceous.

It is said to be a good timber.

B. fagifolia was united with *B. Roxburghiana* by Brandis (*Forest Trees*), who, however, did not even maintain *fagifolia* as a variety.

β. Var. Dalzellii, Meissn. (sp.).

A small tree (in our area) with green branches, alternate and sub-opposite shining elliptic-oblong to elliptic gland-dotted leaves 5—9" by 1.75—3" narrowed both ends but scarcely acuminate.

Along streams in the Santal Parg.! Fl. and Fr. not seen.

Sec. n. about 7, distant, tertiaries obscure till dry, then they stand out on both sides as fine reticulations as in the last. Buds pubescent.

It greatly resembles *B. assamica*, Meissn., but for its short pubescent buds. *B. assamica* has lanceolate glabrous ones. It may possibly be the type, but that has acuminate leaves. The type has panicles 1—1.5" long and fruits 2" long.

7. CRYPTOCARYA, Br.

Evergreen trees with alternate penninerved (in our species) leaves and small 2-sexual flowers in axillary and subterminal, or on short shoots terminal, panicles. Perianth sub-campanulate with the tube as long as the tepals accrescent and closely investing the fruit of which it becomes a part. Perfect stamens 9, 6 with introrse 2-celled anthers, those of the third series 2-glandular with 2-celled extrorse anthers, 4th series consisting of stipitate staminodes.

1. C. amygdalina, Nees. Dhual, Or.

A moderate sized tree with brown-pubescent twigs, broadly oblong or elliptic strongly nerved leaves 3—5" long and axillary and terminal lax panicles 3—6" long of small tomentose flowers .13" long, articulate at base. Fruit (not seen in our area, in Duars specimens) strongly ribbed when very young, finally smooth ellipsoid .7—.75" long.

Southern Range, Puri, elev. 1500 ft.! Fl. March—April. Fr. May.

Leaves rounded, truncate or with a short cusp, base subacute sometimes unequal, beneath pale and microscopically glandular, midrib strong brown, sec. n. 5—9 strong glabrescent curved at the margin, tertiaries close scalariform. In Duars specimens the leaves are sometimes 7" long and often narrowly elliptic. Petiole .4—.7" subrugose. Panicle-branches 1—3" in flower pubescent or tomentose, whole panicle often enlarged in fruit. Perianth-tube obconic in flower, mouth nearly closed in fruit, tepals ovate-oblong. Third series of stamens on throat of tube each flanked by a fleshy scale, staminodes 3 lanceolate sessile on the fulvous-pubescent throat, filaments of perfect stamens pubescent.

8. CASSYTHA, L.

A filiform leafless parasite attaching itself by means of haustoria to *Sal*, *Carissa* and other bushes, resembling *Cuscuta*, but much greener. Fls. sessile .08" white, with 3 broad ovate imbricating bracts at base, in spikes .5—1.5" long.

1. *C. filiformis*, Linn.

Stems pubescent or glabrous. Spikes pubescent from the axils of scale-leaves. Outer perianth-lobes small orbicular ciliate, inner oblong glabrous valvate. St. 3-seriate. First series petaloid with 2 cells adnate to linear face; second series smaller, similar, dilated below; third series hastate with 2 glands on the very short filament. Staminodes 3 fleshy. Ovary tapering to a minute capitellate stigma. Berry .25—.4" diam. including the white succulent accrescent perianth.

It is noticeable that *Cassytha* and *Cuscuta* are seldom found in the same locality.

Throughout Chota Nagpur, locally abundant esp. near Chorparan in Hazaribagh, chiefly on *Carissa*, *Holarthema*, *Zizyphus* and *Sal!* Puri, common on the fleshy *Euphorbia* and very common in the Khurda scrub jungles! Very common in the Sambalpur range in some of the coppice areas on *Phyllanthus*, *Jamun*, and running through the grass, where it becomes a serious pest! Fl., Fr. most of the year.

FAM. 116. HERNANDIACEÆ.

Trees or shrubs with alternate, often peltately attached and palmately-nerved, simple entire or lobed exstipulate leaves; usually abounding in oil-glands and sometimes also with cystoliths and capitate hairs. Flowers small in axillary or pseudo-terminal cymes or panicles, 2-sexual or monœcious, regular, with 3—many- (rarely 2-) partite perianth with the valvate tepals usually evidently 2-seriate. Stamens as many as and opposite to the outer tepals, 1-seriate, with 2-celled anthers opening by lateral recurved valves, glands or staminodes sometimes present alternating with the stamens. Ovary inferior, 1-celled, with one pendulous anatropous ovule. Fruit sometimes winged, indehiscent.

1. *GYROCARPUS*, Jacq.

Leaves clustered towards the ends of the branches. Flowers 1-sexual, clustered in cymose panicles without bracts. Males very numerous, perianth 4—7-partite, stamens 4—7 with as many alternating clavate glands. Female or hermaphrodite flowers few, tepals 2 accrescent and coriaceous in fruit. Style 0. Fruit a bony nut crowned by the spatulate wing-like tepals. Seed with convolute cotyledons.

1. *G. americanus*, Jacquin. Syn. *G. Jacquini*, Roxb.

A tall tree with brown branches and pubescent or tomentose shoots. Leaves broadly ovate acuminate, with base cordate rounded or shortly cuneate, in young plants deeply lobed, 3—5.5", principal nerves 3 of which lateral usually soon forked, sec. n. 2—3. Petioles 2—5". Flowers white, densely hairy in cymes 2—3" broad and several together from the ends of the twigs on long pubescent peduncles. Fruit globose wrinkled .5—.75", wings striate pubescent 2—3" obtuse or oblanceolate with rounded apex.

Mals of Orissa, very rare (only once seen), *Gamble!* Fl. Jan.—Feb. Fr. April. Decid. Dec.—Jan.

Bark smooth, shining, greenish white.

FAM. 117. PROTEACEÆ.

Trees or shrubs, rarely herbs, with alternate, rarely subopposite or whorled, simple or variously divided, mostly coriaceous, exstipulate leaves. Flowers often showy, 2-sexual, single or paired in the axils of bracts, usually in spikes, racemes, heads or umbels, often irregular. Perianth inferior, segments 4, at first valvately cohering in a cylindric tube gibbous at the base, with free recurved tips. Stamens 4, shorter than and adnate to the tepals on which they often appear inserted, anthers erect, 2-celled, introrse. Hypogynous glands or scales often alternating with the stamens. Ovary 1-celled, often oblique; terminal style with thickened tip; stigma terminal or lateral. Ovules 1 or 2 or many and 2-seriate. Fruit various. Seed exalbuminous, cotyledons often unequal, radicle short inferior or lateral.

A large family, of which over half the species are Australian and none indigenous in our area; only one genus (*Helicia*) is Indian.

1. GREVILLEA, R. Br.

Trees or shrubs with variously shaped, sometimes pinnatifid leaves and regular or zygomorphic flowers paired in the axils of bracts of elongated rarely contracted racemes. Perianth-tube straight or dilated at the base and often recurved under the limb, tepals for a long time connate. Anthers sessile. Ovary stipitate or sessile with 2 collateral laterally affixed amphitropous ovules. Fruit usually follicular. Seeds 1—2 often winged.

1. G. robusta, A. Cunn. The Silver Oak; Silky Oak.

A large handsome tree with fern-like twice-pinnatifid leaves silvery beneath and unilateral racemes of orange flowers with slender pedicels. Follicle 6—75".

Very commonly cultivated. Seeds freely. Fl. March—May. Native of eastern Australia.

FAM. 118. ELÆAGNACEÆ.

Shrubs or trees with numerous silvery or brown scales and alternate or opposite entire exstipulate leaves. Flowers small or mod.-sized, green, white or yellow, in axillary fascicles or cymes, regular, 1—2 sexual, with tubular 2—6-cleft perianth, the lower part sometimes thickened in fruit. Stamens adnate to the perianth-tube and twice as many as the lobes or in the 2-sexual flowers as many as the lobes and opposite to them, perigynous. Ovary free in lower part of tube but closely invested, 1-celled with filiform style and lateral stigma. Ovule 1, basal, erect, anatropous. Fruit indehiscent enclosed in the perianth-tube. Seed ascending with scanty or 0 albumen. Embryo straight axile; cotyledons thick; radicle inferior.

1. ELÆAGNUS, L.

Perianth-tube oblong or globose, constricted above the ovary, limb valvately 4-cleft, deciduous. Stamens 4 on the mouth. Style linear,

included. Fruit a nut consisting of the lower often accrescent part of perianth-tube or hypanthium as well as the developed ovary.

1. *E. latifolia*, L.

A rambling bush with strong straight or reflexed thorns below and mostly elliptic leaves 2—4" beautifully silvery beneath, sec. n. about 5 straight fine. Petiole 1—25". Flowers yellowish-green or greenish-white clustered, only 3" long at first, scaly and pubescent, lengthening by the growth of the portion surrounding the ovary and part above constriction finally deciduous. Fruit 75" oblong-ellipsoid, ribbed.

Mals of Puri! Fl. Nov. Fr. Jan. Evergreen.

FAM. 119. LORANTHACEÆ.

Green parasitic shrubs attaching themselves by means of haustoria to the branches of other woody plants, with opposite or alternate simple entire leaves or leaves reduced to scales and their functions assumed by the often flattened green branches. Flowers from small, regular to brightly coloured and a tendency to zygomorphy, 1—2-sexual, usually bracteate and often 2-bracteolate, in racemes, spikes or fascicles. Hypanthium adnate to the ovary and sometimes growing up as an entire or toothed ring ("calyculus") above it. Perianth sepaloïd or petaloïd of 4—6 tepals free or connate into a tube below, valvate in bud. Stamens as many as the tepals, opposite to and usually adnate to them. Ovary inferior, 1-celled, style short or long, stigma simple. Ovule and placenta not differentiated, completely filling the ovary, with usually 1, rarely 2—3 embryo sacs. Fruit baccate, rarely drupaceous, with a viscid inner layer, by means of which it becomes adherent to the future host.

Calyculus present.* Flowers 2-sexual, often showy
Calyculus 0. Flowers 1-sexual, green or yellowish

1. *Loranthus*.
2. *Viscum*.

1. LORANTHUS, L.

Leaves opposite or alternate, usually broad. Flowers 2-sexual, green or coloured. Hypanthium usually produced into a calyculus which is sometimes reduced to a mere rim. Tepals free or perianth forming a split or entire tube below, lobes reflexed or spreading. Stamens epiphyllous, anthers versatile or cells adnate, parallel.

A. Calyculus broadly tubular. Flowers distinctly racemed:—

Flowers 1" or more. Bracteoles 0

Flowers 5", angled. Bracteoles present . . .

1. *longiflorus*.
2. *globosus*.

B. Calyculus a mere rim. Flowers in tomentose fascicles or very short racemes:—

Leaves under 3" broad, base usually cuneate

Leaves mostly over 3" broad, base cordate

3. *scurrula*.
4. *cordifolius*.

1. *L. longiflorus*, Desr. Banda, H., S.; Sum, K.; Madung, Or.

A woody branch-parasite with glabrous branches and usually broad, but variously shaped, opposite or alternate, sessile or shortly petioled,

* A mere rim in some species.

thickly coriaceous, glabrous leaves mostly about 3—6" long. Flowers showy scarlet and orange or sometimes pink, 1—2" long, in axillary and extra-axillary secund racemes 1—4" long. Hypanthium with calyculus, .1—'15", calyculus distinct broadly tubular usually truncate or only faintly toothed.; Perianth slender tubular split at the back and slightly curved with 5 linear-oblong often green lobes .3—'4" long. Fruit oblong .5" crowned with the calyculus.

The commonest *Loranthus*, found on a large variety of trees and throughout the province. In the Ghichamura Sal forest in Sambalpur nearly every pole was at one time infested with this parasite. Fl., Fr. Nov.—March.

L. mostly elliptic or ovate, obtuse or rounded, base sometimes amplexicaul, midrib often red, with obscure secondary nervation. Racemes and hypanthium pubescent or puberulous. Bract suborbicular .06"; bracteoles 0. Perianth tube somewhat expanded upwards. Anthers linear.

2. *L. globosus*, Roxb.

A glabrous shrub with opposite elliptic-lanceolate acute or sub-acuminate coriaceous leaves 2—4" long, obscurely nerved when green, and greenish-orange flowers about .5" long before the reflexion of the tepals, in 3—7-fld. short racemes .5—'75" long axillary and from the leaf-scars. Perianth-tube oblong 5—6-angled and inflated, with 5—6 linear-spathulate lobes nearly as long as the tube. Fruit globose, yellow (Roxb.).

Manbhūm, Camp! S. P., Chattarjee! Probably also Purneah. Bengal (without locality) *Herb. Kew.* Roxburgh says "common on trees throughout Bengal," but it is only common in the eastern parts, and has been collected by me just east of our area in Jalpaiguri district together with *L. ampullaceus*, Roxb., which Hooker considers a form of the same species. Fl., Fr. h.s. or (*vide* Roxb.) all the year.

Leaves with 5—8 very fine sec. n. easily visible when dry as are the finer tertiaries. Petiole 2—3". Flowers with a broadly ovate bract .06" long and 2 similar rather smaller bracteoles connate with one another about half-way up. Hypanthium with calyculus .15" long, truncate. Ridges sharp extending whole length of the perianth in bud and with triangular projections about middle of the tube. Anthers short oblong truncate, much shorter than free part of filament.

3. *L. scurrula*, L. Huring sum, K.; Banda, H., S.

A tufted shrub with very lenticellate branches, young parts with a brown or hoary stellate or scaly tomentum. Leaves ovate-oblong, ovate or elliptic, opposite or some alternate, young rusty, mature often glabrous, 2—4" by 1—2.5". Base often cuneate and somewhat decurrent on the .3—6"-long petiole. Flowers .5—'7" long before the reflexion of the tepals, fascicled or in short contracted racemes, tomentose, greenish with bright-red filaments. Bracts minute and bracteoles 0. Fruit clavate or pyriform .3".

Perhaps as common as *L. longiflorus*, but usually on low trees and shrubs, esp. common on *Woodfordia* and *Wendlandia*. Plains of Behar, J. D. H.! Chota Nagpur, all districts, common! Santal Parg.! Narsingpur! Fl. Oct.—Jan. Fr. Dec.—Jan. New shoots in Jan.

L. obtuse or subacute with 4—5 faint sec. n. Rhachis of inflorescence mostly under .25". Hypanthium scarcely produced into a calyculus. Perianth tomentose .5" or less, tube curved, inflated, split; lobes linear 4, .12—'17" long, anthers linear .07".

When quite ripe the outer covering of the fruit consisting of an epidermis, a parenchymatous tissue with little chlorophyll and an inner sheath of very minute

cells becomes detached leaving a somewhat 4-gonous clavate body, probably the seed. This has an outer transparent very small-celled layer and an inner thicker tissue very rich in chlorophyll which secretes mucus.

4. **L. cordifolius**, Wall. Ichac' banda, S. (which merely means the parasite of *Woodfordia*).

As Sir J. D. Hooker remarks, this is scarcely more than a variety of *L. scurrula*, differing in its greater size, more rounded and cordate leaves and the more copious white tomentum.

Hazaribagh! Manbhum, Camp.!

I would include this in *L. scurrula*. L. broadly elliptic to ovate, 2—2.5", with rounded or cordate base. Petiole .4—.5".

2. VISCUM, L.

Parasitic shrubs with the leaves opposite or reduced to scales. Flowers 1-sexual, small or minute, solitary or fascicled. Hypanthium solid or hollow in the male, adnate to the ovary in the female, tepals 3—4, green or yellow. Anthers sessile, adnate to the tepals, opening by many pores. Ovary inferior, stigma large pulvinate. Fruit succulent baccate. Embryo in fleshy albumen, solitary or 2 in each seed.

A. Branches leafy:—

Leaves lanceolate or elliptic acute, neither very thick nor venose. Bracts not cuspidate. Fruit oblong, pericarp not dotted

1. *monoicum*.

Leaves mostly broad and obtuse. Lower bracts usually cuspidate. Fruit subglobose, pericarp with lines of raised dots

2. *orientale*.

B. Branches flattened, leafless

3. *articulatum*.

1. **V. monoicum**, Roxb. Vern. Banda (often with the name of the host tree prefixed).

A tufted shrub with slender terete branches compressed at the ends and narrowly elliptic or lanceolate acute leaves, often a little falcate, with 3—5 slender principal nerves. Flowers few at the nodes in groups of 3—1 between a pair of concave ovate bracts .04—'05" long with rounded tips, subsessile, with 1—2 similar pairs of bracts below the floral. Tepals 4. Berry shortly stipitate oblong .25", green polished with few longitudinal white veins.

Manbhum (on *Helicteres*), Camp.! Ranchi, Wood (*Pitorea*); Santal Parganas! Fl. Nov.—Dec. Fr. Jan.

The branchlets may become angled and grooved on drying as in the next, but the leaves are far less opaque and venous.

2. **V. orientale**, Willd. Vern. as in last.

A densely branched shrub with the branches frequently 2—3-cho-tomous or 3—4-nately whorled terete or flattened above, ridged and channelled when dry. Leaves very coriaceous, ovate, ovate-lanceolate obovate or elliptic-oblong, usually rounded or obtuse, base equal or oblique narrowed, subsessile, 3—5-nerved and with many nervules (best seen when dry), 1.5—3" long. Flowers green or yellow, often very numerous (up to 17) at the nodes, in sessile bracteate cymose fascicles, very short branches of fascicle with pairs of bracts all or the lower very

often with a short cusp, ultimate pair of bracts short broad conniving at their base, often rounded, .05—.07" long bearing 2—3 flowers, male and female usually mixed. Berry broadly ovoid or globose but apparently often ellipsoid when young, ripe pericarp with lines of minute raised dots at least when dry.

Frequent on *Zizyphus*, *Croton*, *Erycibe*, and other trees and shrubs. Throughout Chota Nagpur! Angul! Fl., Fr. more or less throughout the year.

Key characters for the separation of this species and the last are very difficult. The branches are sometimes, at any rate, *not* grooved when fresh, the shape of the leaves is variable, the cuspidation of the bracts is not evident in my only specimen with good male and female flowers, the minute warts on the pericarp are not present when young, and it seems that when they are this constitutes the *Viscum verruculosum*, W. & A. The texture of the leaves appears to be the only constant mark of distinction with their many nervules.

The leaves have a matt surface with the edges often slightly crimped. Male fls. .07" long, tepals 3—4 triangular obtuse exceeding the hollow hypanthium, anthers about as broad as long. Female .08" long, tepals rather shorter than the hyp., connate at base triangular-lanceolate. Margins of bracts papillose (as they are in *V. monoicum*).

3. *V. articulatum*, Burm.

A shrub with sap-green striate, often subverticillate, flattened branches contracted at the nodes with leaves reduced to scales. Internodes 1—2" long by .1—.25" broad. Flowers minute, fascicled at the nodes, few or many in connate cupular bracts, 3—4-merous. Fruit subglobose, yellow, smooth.

Common in all districts of Chota Nagpur, ascending to Neterhat (3000 ft.), chiefly on *Diospyros* and *Bassia*! Fl. Dec.—Jan.

FAM. 120. SANTALACEÆ.

Trees, shrubs or herbs, often parasitic on roots (usually hemiparasites only). Leaves alternate or opposite, entire, sometimes scale-like or 0, nerves inconspicuous, stipules 0. Flowers usually inconspicuous, regular, variously arranged, 1—2-sexual. Perianth superior or perigynous, 3—8-toothed, -lobed, or -partite, lobes with often a tuft of hair behind the anthers. Stamens 3—6 often adnate to the lobes, rarely at the base of the perianth opposite to the lobes, anthers 2-celled. Disc perigynous or epigynous. Ovary nearly free or usually adnate to the hypanthium, 1-celled, style usually short, stigma entire or 3—6-lobed. Ovules 2—3, adnate to or pendulous from a central column. Fruit a drupe or nut. Seed globose or ovoid; testa thin or obsolete, albumen copious, fleshy. Embryo usually terete.

Slender herbs. Flowers axillary or spicate
Shrub. Flowers panicled

1. *Thesium*.
2. *Santalum*.

1. THESIUM, L.

Slender herbs, rarely shrubby, "parasitic on roots." Leaves alternate, narrow, decurrent, 1—3-nerved. Flowers minute, greenish or white, solitary, axillary or spicate or in 2-chotomous cymes, 2-sexual. Perianth-tube produced above the ovary with 5, rarely 4, tepals which are hairy

behind the anthers. Stamens inserted at the base of the tepals, included. Ovary quite inferior. Ovules 2—3, pendulous from a basal often flexuous or crumpled column which is free (according to the books consulted) or suspended in a thin-walled parenchyma (in our species) which fills the ovarian cavity. Fruit a drupe or nut, often ribbed. Embryo terete.

1. **T. unicaule**, *Haines (Journ. As. Soc. Beng., xv, 7, p. 316).*

An erect weak pale-green herb about 1 ft. high with very slender glabrous stems and numerous alternate linear-acicular leaves, the lower about 1—1.5" long, upper smaller bearing green sessile 2-bracteate flowers .12" long in their axils. Flowers with their two linear bracts adnate to the base of the leaf in fruit, becoming bottle-shaped.

Among wet grass in valleys. Chota Nagpur elev. 3000 ft. Fl., Fr. April—June. The roots appear to be annual and there is nothing to show that it is parasitic on a cursory examination.

Flowers at first cylindrical with 4 fleshy oblong tepals .02" long with white margins, slightly villous within and with some hairs behind the anthers attaching them to the tepals, which are hardened and incurved in fruit. Ovary sunk in the hypanthium, filled with parenchyma, column a slender flexuous thread bearing at its top 3 microscopic ovules, wall of ovary rapidly hardening in fruit which is a globose drupe venose when dry, the parenchyma becoming converted into white perisperm. Embryo most minute, tapering towards the superior radicle, with 2 very minute cotyledons.

A remarkable species. The fruit develops very rapidly, flowers being only found in the axils of immature leaves, which as they grow carry forward the fruit a short distance from the base and with the spreading bracts appear 3-foliolate. It appears closely allied to *T. himalense*, *Royle*, which *Royle* says "I found on the arid rocky soil near Choupal, to the north of Cheor," and therefore in a very different kind of habitat.

2. SANTALUM, L.

Trees or shrubs with opposite rarely alternate coriaceous leaves and small 2-sexual flowers axillary or in terminal 3-chotomous paniculate cymes. Bracts minute. Hypanthium more or less adnate at the base to the ovary, campanulate, bearing 4, rarely 5, valvate tepals and lined by a fleshy disc terminating in 4 fleshy scales alternating with the tepals. Stamens perigynous on the margin of the disc opposite to the tepals. Ovary at first nearly free, becoming half-inferior in fruit, with elongate style and 2—3-lobed stigma. Ovules 2—3 reflexed on a long acuminate free central column. Fruit with the accrescent hypanthium drupaceous. Seed subglobose, embryo terete slender.

1. **S. album**, L. Chandan, H.; Sandal-wood.

A small glabrous evergreen tree, a hemi-parasite on the roots of a variety of trees. Leaves opposite 1—2.3" long, ovate-lanceolate or elliptic, acute or subacute. Flowers small, at first pale then deep crimson. .18" diam. with rotate ovate tepals. Disc-lobes very thick. Stamens free from the tepals or only loosely adhering dorsally by the tuft of villi which grow up from the perianth at their base. Fruit a fleshy globose shining black drupe annulate at the top with the margin of the hypanthium.

Collected by the Rev. A. Campbell on Parasnath! Introduced by Mr. Mudaliar into Sambalpur a few years ago!* Fl. Sept.—Dec., also March. Fr. March—April, also Nov.

Sandal takes about 2 months to germinate.

FAM. 121. BALANOPHORACEÆ.

Low fleshy leafless or scaly brown, reddish or yellow root parasites (or sometimes saprophytes ?), without stomata. Flowers monœcious or diœcious, small or minute, crowded on spadix-like peduncled globose or elongate heads, peduncles very stout, simple, arising from an amorphous tuberous or branching annual or perennial rootstock. Male perianth of 3—8 valvate tepals or 0, sometimes much larger than the female flower, stamens as many as the tepals and opposite to them, or filaments connate in a solid column with anthers connate or free or anthers sessile in a mass, or in the naked flowers stamens 1—2 only; anthers 2—many-celled, opening by pores, slits or valves or irregularly. Fem. perianth 0 or confluent with the ovary, limb 0 or minutely toothed. Ovary 1—3-celled, styles 1—2 or 0, stigmas simple or capitate, rarely sessile and pulvinate. Ovule 1 in each cell, usually pendulous from the top, atropous or anatropous, naked or with a single integument or reduced to an embryo-sac. Fruit minute, crustaceous or coriaceous, 1-seeded. Seed usually adherent to the pericarp, testa thin or 0, rarely thick, albumen granular and oily, rarely floury. Embryo most minute, undivided.

1. BALANOPHORA, Forst.

Glabrous fleshy herbs with a tuberous rootstock warted with lentils, abounding in a waxy secretion. Peduncles bursting through the rootstock which forms an irregularly or sub-regularly lobed or toothed ring or short sheath at its base. Flowers small or very minute, males comparatively large, monœcious or diœcious, often intermixed with swollen or clavate bodies (function unknown, usually exceeding the ovaries). Male perianth of 2—6 valvate tepals; stamens 2—many, filaments 0 or connate in a column, anthers free or connate. Fem. perianth 0. Ovary ellipsoid, 1-celled, narrowed into a slender style with terminal simple stigma, ovule 1, pendulous. Fruit minute, crustaceous. Seed adhering to the pericarp, albumen oily. Embryo subglobose of 2—3 cells only.

Engler states that the waxy resin in the *Balanophoræ* is so abundant that they burn with great brilliancy.

1. *B. polyandra*, Griff.

Rootstock tuberous, lobed, the peduncles each breaking through a rounded closely lenticellate lobe which becomes cup-shaped and embraces the base of the peduncle with a subregularly lobed sheath.

* Mr. Mudaliar wrote a short article on this subject to the *Ind. Forester* (July, 1917, p. 318).

Peduncles 3—6" high, several, clothed with few large oblong-lanceolate imbricating and sheathing scales. Peduncle monoecious swollen at the end into a clavate head 1—2" long bearing few large male flowers at its base, and densely crowded above these small stipitate knob-shaped protuberances, each surrounded by most minute female flowers. Male perianth 1.5—2" diam. with 4, occasionally 6, tepals, posterior and anterior tepal broadly oblong, lateral smaller, androecium a fleshy mass with numerous confluent anther-cells. Fem. a shortly stipitate fusiform ovary ending in a hair-like style.

On roots of trees. Palamau: Neterhat; elev. 3000 ft. Santal Par.: Mahuagarhi, Gamble! Fl. Sept.—Oct.

In the description of *B. polyandra* in *F.B.I.* the male heads are described as cylindrical and the female heads as ovoid or oblong, from which it appears that the species is sometimes dioecious or at any rate that the peduncles are 1-sexual.

FAM. 122. ULMACEÆ.

Trees, more rarely shrubs, with 2-farious, simple, often unequal-sided leaves, frequently dotted with cystoliths (the cystolith cells sometimes visible when fresh as *translucent* dots). Stipules lateral or intrapetiolar, although not usually amplexicaul often leaving a circular scar or raised line round the branches and stems (as in the Moraceæ). Flowers mostly small, in axillary clusters or cymes, or females sometimes solitary, rarely all 2-sexual, usually polygamous, monoecious or dioecious. Perianth usually 4—5-merous, polyphyllous or gamophyllous. Stamens isomerous to and opposite to the perianth lobes, rarely twice as many (*Holoptelea*), anthers erect in bud, dehiscence lateral. Pistillode usually present in male. Ovary of 2 median carpels, rarely 2-celled; stigmas 2 large, or style 2-fid or 4-fid, branches stigmatic on the inner sides. Ovule 1 pendulous, anatropous or amphitropous. Fruit indehiscent, a nut, drupe or samara. Seed with thin coriaceous testa, albumen 0 or scanty. Embryo straight or curved with flat or folded cotyledons.

Flowers clustered, appearing before the leaves. Fr. a samara	1. <i>Holoptelea</i> .
Flowers appearing on the young leafy shoots, axillary. Fr. a drupe:—	
Fls. polygamous, females often solitary. Cotyledons broad	2. <i>Celtis</i> .
Fls. unisexual, all cymose. Cotyledons narrow	3. <i>Trema</i> .

1. HOLOPTELEA, *Planch.*

Trees with the mature leaves mostly entire, penninerved, with scarious caducous stipules. Flowers fascicled at the leaf scars of previous year's shoots and appearing before the new leaves. Perianth campanulate cleft to the base with 4—8 imbricate tepals. Stamens diplostemonous or appearing more numerous from some of the tepals being permanently connate. Ovary compressed, style short 2-fid or 0, branches or stigmatic arms papillose within to the base. Fruit samaroid. Seed flat, exalbuminous. Embryo straight, cotyledons complicate.

1. *H. integrifolia*, *Planch.* Chilbil, *Kharw.*; Charha, Chorora, *S.*; Churla, *Mal-Pah.*; Dauranja, Gharanji, *Or.*

A large or small tree, in some states much resembling a beech. Leaves elliptic or ovate, mature usually entire, 2—4.5" by 1.5—2.75", translucent-punctate when green, with minute raised dots beneath when dry. Flowers green, in very numerous fascicles or abbreviated racemes on the leafless branches. Samara broadly elliptic, 1", notched between the two stigmas, with a long stipes and slender pedicel.

Usually in valleys and on the banks of large rivers in the Central and Southern areas. Santal Par., occasional! Palamau, common! Manbhum and Hazaribagh, scarce! Puri! Angul! Fl. March or April; the flowers only last a few days on any one tree. Fr. end of May when the tree is in full leaf.

Attains 7 ft. girth with smooth light-coloured bark which becomes thick and flaky in very old trees, branches quite white, blaze cream streaked with light brown. Young shoots tomentose. L. usually glabrescent, sometimes somewhat obovate, entire or coarsely crenate or serrate (sometimes even in old trees), often shortly acuminate, base rounded oblique or somewhat cordate, sec. n. 5—7 raised beneath, very reticulate between, 1—2 close to base. Petiole .3—5". Stipules linear, scarcely leaving a scar. M. and F. fls. in the same cluster, 4—8 merous but usually 5—6, tepals linear, pubescent.

Planchon distinguishes 3 varieties by their fruits but does not correlate these with the leaf-forms, of which there are several in our area which require further examination in fruit:—

α. *leiocarpa*, *Planch.*

Branchlets with raised round lenticels, puberulous. L. under 3.5", quickly glabrous (May), base oblique or rounded or a few subcordate. Petiole slender. Samara glabrous, deeply notched. Common.

β. *hebecarpa*, *Planch.?*

Branchlets with few scarcely raised lenticels, glabrous or puberulous. L. mostly up to 5" or 6", rather membranous, glabrous or pubescent beneath (at least up to July), base subcordate or unequal. Petiole .25—3".

The type of var. *hebecarpa* is *Wallich's* 3547 (α), in which the samaras are pubescent but the leaves are glabrous. *Hooker's* specimen from the banks of the Soane has glabrous serrate leaves and pubescent samaras, others have pubescent leaves.

γ. *tomentosa*.

Twigs very pubescent or tomentose, hairs concealing the lenticels. L. coriaceous 3—4", cordate, beneath tomentose with raised nerves, tip rounded or with very short obtuse cusp. Petiole .5—1.75", stout. Samara probably pubescent (not noted).

δ. *fruticosa*.

A shrubby form with very white bark, very tomentose. Probably a form dependent entirely on environment. Palamau hills!

The wood of *H. integrifolia* is not much used. "Wt. 40 lbs." *Gamble*.

2. CELTIS, L.

Trees or shrubs with alternate 2-farious entire or serrate palmately 3-nerved leaves. Flowers small cymose polygamous, male and 2-sexual cymes usually at the base of the shoots; female in the upper axils. Tepals 4—5 imbricate. Stamens isomerous surrounding a woolly torus. Ovary sessile, style with stout plumose simple or lobed arms. Fruit a small drupe with smooth or rugose endocarp. Albumen 0 or scanty. Embryo curved, cotyledons broad flat or bent inward or outward, surrounding the upcurved radicle.

Sec. n. 1—2 as strong as the basal. Drupes solitary or 2-nate 1. *tetrandra*.
 Sec. n. much weaker than the basal. Drupes 2-several on the
 peduncle 2. *cinnamomea*.

1. *C. tetrandra*, Roxb. Chitimiti, Kharw.

A large tree with obliquely ovate or ovate-lanceolate, caudate, sub-entire crenate or serrate rather stiff leaves 1.5—3", glabrous except for tuft of hair in the axils of the sec. nerves, sec. n. 2—3 fine but strong, one each side, nearly reaching the apex. Petiole slender .1—2". Fruiting peduncles simple, nearly always solitary, .3—4", drupe broadly ellipsoid or ovoid, orange when ripe, .25—3" long, glabrous with ovoid ridged otherwise smooth putamen.

Bettiah! Purneah! Along river at Adaye, Palamau, elev. 1500 ft.! Mayurbhanj, 3500 ft.! Fl. Feb. Fr. Oct.—Nov.

Attains 6 ft. girth and more with white or pale bark ringed by the acrescent faint stipular scars, bark on young twigs, brown. Blaze hard, white with brown dots and lines; a chlorophyll layer is present in young bark. Twigs very slender. L. usually serrate above the middle.

2. *C. cinnamomea*, Lindl.

A tree with larger more membranous leaves than the last 2.5—4.7" long, glabrous, shallowly serrate above the middle, basal nerves nearly reaching the apex, sec. n. on midrib short spreading much weaker than the lateral basal, 6—8 mostly joining the midrib and lateral basal. Petiole .2—4" long. Stipules .3". Peduncles .7" with 2 or more ellipsoid drupes .3" long contracted at the apex, pedicels .15", fulvous hairy in flower.

Rocky ravines, Angul! Fr. (young) March—April. Evergreen, renewing leaves in March.

Possibly only a form of the last. The drupes in my specimens are not ripe. The larger leaves may be due to the moist warm locality, but the venation is different.

3. TREMA, Lour.

Usually small trees with the leaves serrate, 3—7-basal-nerved and often oblique. Stipules lateral caducous. Flowers small green, dioecious, 1-sexual or polygamous in axillary cymes. Tepals 4—5, induplicate-valvate or subimbricate. Pistillode in M. 0 or small. Style in herm. or fem. 2-fid or stigmas 2. Drupe small seated on the persistent perianth. Albumen fleshy. Embryo curved or involute, cotyledons narrow, radicle upcurved, incumbent.

L. silky beneath, base oblique, mostly 3-nerved. Twigs adpressed-pubescent. Cymes lax 1. *orientalis*.
 L. tomentose or silky beneath, base oblique, mostly 3-nerved. Twigs with spreading pubescence. Cymes dense var. *amboinensis*.
 L. scabrid beneath, base sub-regular, 5-nerved 2. *politoria*.

1. *T. orientalis*, Bl. Syn. *Celtis orientalis*, L.; Chaur, Th.; Jhavar, S.; Roronga, K.; Rukni, Kharw.; Kokoara, Mal. P.; Kharkas, Or.

A small tree rarely over 35 ft. high in our area, with the trunk ringed with stipular scars. Branchlets with dense silky pubescence.

Leaves ovate-lanceolate or lanceolate caudate 3—6" long, mostly very oblique at the base, more or less white or silvery beneath with fine silky hairs, scabrid or nearly smooth above, serrulate. Dioecious wherever I have seen it. M. cyme usually dense but sometimes lax and branched and up to 1·2" long, tepals narrow oblong concave, torus woolly, pistilode obovoid. Fem. cymes usually lax, tepals flat, stigmas remote, tongue-shaped, papillose. Drupe yellow ·17" long.

Chiefly in the Northern Area, along streams in the forests in the Central Area, rare in the Southern. Purneah, common! Champaran! Santal Parg.! Gaya Ghats, rare! Chota Nagpur, not common, all districts! Puri! Fl. Dec.—Jan. and April—May. Fr. Dec. (perhaps from the May flowering) and probably at other times, or perhaps Fl., Fr. Nov.—May. Evergreen.

Attains 5 ft. girth. Bark smooth white or pale, blaze deep red streaked. Leaf with usually 3 principal nerves, midrib with 2—5 strong oblique sec. n., tertiaries fine scalariform. Petiole ·2—5". Cymes bracteate, M. ·3—7". Fem. about as long but laxer.

Var. **amboinensis**, Syn. *T. amboinensis*, *Blume*.

There are two specimens named *T. amboinensis* in the Calcutta herbarium from our area, one from Manbhum and one from Parasnath, and I have also collected a similar one from Parasnath. They only differ from *T. orientalis* by the denser more spreading pubescence and denser male cymes. Another specimen collected by me in the Saranda Forests can be distinguished from the type by the beautiful whiteness of the leaves beneath (normal *T. orientalis* is silvery green), shaggy pubescence and the nervation often red.

The growth is very fast.

2. ***T. politoria***, *Planch.* Kaksi (from the rough leaves), K.; Gar-Tila, *Kharw.*; Kharkas, *Or.* Also the same vernacular names as for *T. orientalis*.

A small tree attaining about 25 ft. in height with pubescent twigs, stiff oblong or oblong-lanceolate or some ovate-lanceolate leaves 2—3·7" long, scabrid both sides and also hispid on the nerves beneath and with sparse short hairs above, obtuse acute or shortly acuminate, base nearly regular rounded or shallowly cordate, serrulate. Dioecious. M. cymes shorter than or longer than the petioles up to ·5", torus woolly or villous. Fem. cymes laxer with divaricate branches ·4—5".

Often on landslips, near roadside embankments, etc., apparently throughout the province, locally gregarious and short-lived. Champaran, in the hills! Santal Parg., frequent! Chota Nagpur, all districts, esp. along hill roads! Bonai, *Cooper*! Sambalpur! Kalahandi! In this species also there appear to be two flowering seasons, viz. Aug.—Sept. and April—May. Evergreen.

Attains 2—3 ft. girth only. Leaves with 5 basal nerves, midrib with 4—7 sec. n., tertiaries fine, reticulations not raised beneath, dots (due to cystoliths) usually easily visible both sides. Petiole ·1—3". Stipules subulate ·3—4". Cymes bracteate. Tepals oblong to linear, hispid, ciliate and dotted. Drupes much as in *T. orientalis*.

The rough leaves are sometimes used for polishing wood. The fruits are made into an acid jam.

FAM. 123. CANNABINACEÆ.

Shrubs or herbs, sometimes climbing, without milky juice, often secreting aromatic resins. Leaves opposite and alternate palmately nerved or palmately compound, with free persistent stipules. Flowers dioecious. Males in a dichasium or panicle of dichasial cymes passing

into scorpioid cymes, perianth 5-tepalous, tepals imbricate, filaments straight in bud. Pistillode 0. Female flowers in very contracted cymes or heads with large bracts, perianth entire reduced. Ovary 2-carpellary, 1-celled, with 2 large feathery stigmas. Ovule 1, pendulous anatropous. Fruit an achene. Embryo curved or spiral. Albumen present or 0.

1. CANNABIS, *Tournef.* Hemp.

Erect, with the lower leaves usually opposite and upper alternate, palmate, serrate. Male flowers in short pendulous cymose panicles; female crowded with leafy bracts, ultimate convolute, perianth hyaline embracing the ovary or suppressed. Style arms 2, filiform, caducous. Achene compressed, crustaceous. Seed flattened, albumen unilateral fleshy. Embryo curved, cotyledons broad thick subequal, radicle up-curved incumbent.

1. *C. sativa*, *L.* Ganja, Bhang, Charas, Siddhi, *Vern.* (see below).

An annual, smelling, scarcely branched herb of very variable height but usually 3—5 ft. in its feral state, the female plant being generally supposed to grow taller than the male. Leaves 3—8" diam., upper 3—1-foliolate passing into bracts, lower 3—8-foliolate with long petioles. Convolute bracts .08" long with oblique mouth much longer than the ovary and its investing hyaline perianth, accrescent and .2" in fruit.

Frequently growing subgregariously in Singhum! Mayurbhanj! and other districts. Sometimes cultivated in Chora Nagpur and Puri. Native of temperate Asia (*De Candolle*).

Fl., Fr. c.s.

This plant is the source of the true Hemp fibre (as distinct from Sun hemp, Manila hemp, Sisal hemp, etc.) but it is not grown for its fibre in our area. Indeed the fibre is not of value in tropical and subtropical countries, whereas the narcotic resin is but little developed in colder climates. According to *Nadkarni* "*Ganja*" consists of the unfertilised resinous flowering shoots of the female. "*Bhang*" or "*Siddhi*" consists of the dried leaves and fruiting shoots. *Bhang* or *Siddhi* is used in making the intoxicating liquor "*Hashish*" and the narcotic confection "*Majum*." "*Charas*" is the resin which exudes naturally on the leaves, fissures in the stem, and fruits on plants grown in the mountains. *Siddhi*, *Subje* and *Bhang* are synonyms and are used with water as a drink. *Ganja* is used for smoking (usually with tobacco). *Bhang* and *Ganja* are prescribed by native doctors in bowel complaints and as nervous stimulants. (See also *Watt, Dictionary of Economic Products*, and *Dutt, Materia Medica*.) Hemp can only legally be cultivated under licence, but *Bhang* can be collected from the wild plant. The cultivation of *Ganja* necessitates the removal of all the male plants, as the narcotic principle entirely disappears after fertilisation.

To the family Cannabinaceæ belongs also *Humulus lupulus*, the Hop.

Note.—The Euphorbiaceæ, usually placed before the Urticales, have been transferred to a position after the Malvales in view of the frequently dichlamydeous flowers.

The Urticaceæ of the *Genera Plantarum* have been divided into the four families of Ulmaceæ, Cannabinaceæ, Urticaceæ and Moraceæ.

FAM. 124. URTICACEÆ.

Annual or perennial herbs and undershrubs, rarely shrubs or trees, sometimes furnished with stinging hairs, sap watery. Leaves opposite or alternate, often bifarious and 3-basal-nerved, usually with opaque

dots due to cystoliths. Stipules usually membranous, sometimes intrapetiolar. Flowers small greenish 1-sexual, monœcious or diœcious, in open or capitate cymes or cymules axillary or at the axils of fallen leaves, or lateral to and at the base of axillary shoots which may be abbreviated, leafless and spiciform. Perianth 4—5 seldom 2—3-merous, tepals free or united. Stamens in the males as many as the tepals and opposite to them, filaments usually broad and flat at the base, incurved in bud with anthers reversed and later elastically reflexed, anthers 2-celled with broad connective, dorsifixed; pollen spherical. Pistillode usually present. Fem. fl. with usually gamophyllous perianth sometimes accrescent and fleshy in fruit, ovary superior 1-celled, style simple or 0, stigma papillose, plumose or penicillate. Ovule 1, attached at or near the base, erect, orthotropous. Fruit a drupelet or utricle, usually enclosed in and often united to the perianth. Seed with membranous testa and oily albumen. Embryo straight.

I. Hairs (at least those on inflorescence) stinging. Flowers cymose. Leaves alternate:—

A. Female perianth 4-phyllous or deeply 4-lobed:—

Herbs. Style or stigma ovate or linear finally hooked, sometimes appendaged at the base

Suffruticose (in our species). Stigma linear, papillose on one side

B. Female perianth tubular 2—3 toothed

1. *Fleurya*.

2. *Laportea*.

3. *Girardinia*.

II. Hairs not stinging:—

A. Flowers cymose 2—4-merous. Stigma penicillate:—

Herbs. L. opposite. Fem. tepals distinct, unequal

4. *Pilea*.

B. Flowers clustered or very shortly cymose, clusters often spicate. Female perianth tubular:—

1. Stigma filiform or linear. Fruit without a fleshy base:—

a. Stigma not articulate, persistent:—

Trees or shrubs. Flowers-clusters spicate (in our spp.)

5. *Bœhmeria*.

b. Stigma articulate, deciduous. Herbs (in our spp.):—
Stigma filiform. Fl.-clusters axillary. Fl. 4—5-merous

6. *Pouzolzia*.

Stigma linear. Fl.-clusters spicate. Fl. 2—3-merous

7. *Distemon*.

2. Stigma subpeltate, fimbriate. Fruiting perianth in a fleshy cupule:—

Trees or shrubs. Leaves alternate. Fl.-clusters axillary and from leaf scars

8. *Villebrunea*.

1. FLEURYA. *Gaud.*

Nettle-like herbs with stinging hairs. Leaves alternate, toothed, 3-nerved with linear cystoliths. Stipules connate in opposite pairs or 0. Flowers monœcious or diœcious, clustered, clusters in axillary sometimes spiciform cymes which are 1-sexual or androgynous. Male flower 4—5-merous. Fem. fl. perianth cupular 4-lobed or tepals 4 imbricate, equal or unequal, posticous hooded, anticous minute or 0. Ovary oblique with obliquely ovoid or linear finally hooked permanent style with sometimes 2 basal arms. Achene oblique, compressed, exserted, membranous. Seed nearly exalbuminous, cotyledons broad.

1. *F. interrupta*, Gaud. Lal-bichua, *H.*; Bara-kanj, *Uran*.

An erect herb 2—3 ft. high puberulous and with stinging hairs but without bulbous bases on the stems. Leaves ovate acuminate 5—6", coarsely dentate-serrate, glabrous beneath except on the nerves, above thinly hispid with bulbous-based hairs. Petioles longer than the blade. Inflorescence very long and lax, 8—14", its branches and pedicels recurved. Male and female in the same clusters.

Usually near houses and ruins. Ranchi! Khurda! Fl., Fr. Sept.—Oct. Probably annual.

Leaves subcordate, truncate or cuneate at the base. Stipules 2-fid. Fem. fl. oblique on the pedicel. Perianth with unequal tepals, with few erect hairs at the base. Ovary oblique, very fragile. Style upcurved subulate with 2 shorter basal subulate arms which are sometimes absent. Ripe achene exerted compressed with 3 marginal ridges, the middle one sub-alate, faces corrugate.

2. LAPORTEA, Gaud.

Trees, shrubs or herbs with (sometimes very minute) stinging hairs and alternate, entire or toothed palmi-nerved or penni-nerved leaves; stipules free or connate. Flowers mono- or dioecious, in paniculate usually 1-sexual cymes or racemes, upper cymes usually very long and male, flowers and fruit often reflexed. Male: sepals 4—5, sub-valvate, pistillode clavate or subglobose. Fem.: perianth segments 4, subequal or outer small, one sometimes absent, ovary at length oblique, style linear, papillose on one side. Achene oblique, compressed, membranous or fleshy, seated on the perianth, sometimes obliquely stipitate. Seed subexalbuminous, cotyledons broad.

1. *L. crenulata*, Gaud.

A soft-stemmed shrub 3—8 ft. high with white stout branches, large shining elliptic penninerved leaves and greenish flowers in divaricate cymes. Utricle inflated, white.

Deep shady ravines in the Karampoda forest, Singbhum! Fl. Sept.—Oct. Fr. Nov.—Dec. Evergreen.

L. 12" by 4-5" or more, quite entire in our area, minutely pustular and with few scattered hairs. Inflorescence covered with hairs.

The sting of this nettle is most virulent, the effects sometimes lasting for days and producing sleeplessness and fever. It has been noted (*Hook, Him. Journ.*, and by others) that it is worst in the autumn, and indeed I have often found it quite innocuous at some times of the year. This is due to the hairs being deciduous, and that they are especially abundant on the inflorescence. While cutting coupe-lines in November in the Sikkim Tarai, where it is sometimes gregarious, my coolies have been attacked with sneezing, violent catarrh and ultimately vertigo from, apparently, inhaling the numerous minute hairs.

3. GIRARDINIA, Gaud.

Herbs or undershrubs with stout stinging hairs. Leaves alternate palmately 3-nerved, often lobed, stipules intrapetiolar connate, foliaceous. Flowers dioecious or monœcious, clustered, clusters in simple or paniced spikes or heads armed with stinging hairs. Male: sepals 4—5-valvate, stamens inflexed in bud, pistillode globose or cupular. Fem.: perianth tubular, ventricose, 2—3-toothed, at length split on one side. Ovary

straight, stigma subulate, papillose. Achene broad, compressed, seated on the perianth. pericarp rather thick. Seed sub-exalbuminous, cotyledons broad.

1. **G. zeylanica**, *Decaisne*. Syn. *G. heterophylla*, var. *zeylanica*, *F. B. I.*; Nettle.

A coarse herb 4—6 ft. high with numerous long slender stinging bristles. Leaves large lobed and coarsely dentate or serrate, 4—8" long and broad, membranous, with numerous short fine bristles or hairs. Stipules 3—5" long, 2-fid, membranous or somewhat green. Male flowers 4-merous mostly in short axillary spikes, hairy, filaments long persistent. Pistillode globose. Female fls. in dense capitate panicles with fleshy cymose branches and very bristly with stinging hairs. Perianth sometimes with a short free tepal on the split side. Fruit coriaceous, .15" diam., flattened, obliquely ovate, persistent style deflexed.

Not at all common. Ranchi district, 2000 ft. and above, Pitorea, Wood! Ichadar! Fl., Fr. Oct.—Nov. Dies back in the c.s.

4. PILEA, *Lindl.*

Herbs, rarely undershrubs. Leaves opposite, often unequal in the pairs, palmately 3-nerved (subnerved in *P. microphylla*), stipules intrapetiolar. Flowers minute, monœcious or diœcious, in axillary peduncled dichotomously branched cymes with bracts small or 0. Male: sepals 2—4, free or connate in a cup, often gibbous or horned at the back, pistillode conic or oblong. Fem.: tepals 3, rarely 4, very small and unequal, dorsal longest, sometimes gibbous or hooded, staminodes minute, of scales or 0. Ovary straight, stigma sessile penicillate. Achene ovoid or oblong, compressed, embraced by the base of the tepals or not. Seed erect, albumen very scanty, cotyledons broad.

Erect herb with narrowly elliptic leaves 3—6" long

Prostrate herb with very small leaves .1—2"

Similar with leaves up to .5—6"

1. *scripta*.

2. *microphylla*.

var. *portulacoides*.

1. **P. scripta**, *Wedd.*

An erect branched glabrous herb with rather succulent stems, 1—3 ft. high. Leaves sometimes slightly unequal in the pairs or with unequal petioles, narrowly elliptic finely acuminate, 3—6" long, closely acutely but shallowly serrate, lineolate both sides with minute cystoliths, principal nerves 3 meeting in the apex, tertiaries (there are none that can be called secondaries) numerous fine transverse and reticulate. Petioles slender .7—1.5". Stipules acuminate .1", intrapetiolar but their bases connected also by a fine interpetiolar membrane. Male sepals not horned. Achenes (not seen in my specimen) minute bordered with a strong intermarginal ridge, strongly granulate.

Meghasani, Mayurbhanj, elev. 4000 ft.! Fl. r.s. Fr. Oct.

The extreme base of the leaves is usually minutely cordate or notched. Ours appears to be the southern limit of the species, but a closely allied one, *P. trinervia*, occurs in Madras.

2. *P. microphylla*, *Laehm.* Syn. *P. muscosa*, *Lindl.*; The Gunpowder Plant (from the cloud of pollen when shaken).

A prostrate or sometimes suberect small rather succulent herb with numerous patent branches and distichous very small leaves for the most part unequal in each pair, elliptic oblong or obovate, entire, penninerved but nervation very obscure. Petiole very short. Cymes very small, from nearly every axil, usually sessile, androgynous or 1-sexual. Male tepals mucronate. Median tepal of the fruiting flower hooded.

Very common in plant-houses and verandahs, but also naturalised in the damper districts on walls, etc. Native of South America.

A form with very small leaves and a very distinct-looking larger-leaved form are common. *De Candolle* distinguishes the following varieties:—

α. The type with very small leaves 1.5—5 mm. long. Diffuse. Common.

β. *hernarioides*. Stems sometimes short and erect, filiform, little branched, leaves obovate or rotund spatulate 5—10 mm. long, often attenuate into a slender petiole.

γ. *portulacoides*. Stems prostrate with divaricate branches, leaves obovate 10—15 mm. long, attenuate into a distinct petiole. This is, I think, our larger leaved form.

δ. *longifolia*.

5. *BOEHMERIA*, *Jacq.*

Shrubs or small trees with opposite and alternate toothed palmately 3-nerved leaves. Stipules usually free. Flowers in 1-sexual clusters which are arranged in axillary or paniced spikes or racemes, or clusters axillary. Male perianth 3—5-lobed or -partite. Stamens 3—5, pistillode clavate or globose. Fem. perianth tubular, 2—4-toothed, fruiting sometimes angled, winged or swollen. Stigma filiform, persistent. Achene closely invested by the perianth, crustaceous, at length free. Seed albuminous. Cotyledons ovate.

The genus has usually very strong bast fibres. *Boehmeria nivea*, the China Grass, which yields Rhea or Ramie fibre, with beautifully white under-surface to the leaves, is sometimes grown in gardens and has been cultivated in Shahabad, Bhagulpur and Purneah, but more widely in the adjacent northern Bengal districts. It requires a moist warm climate and Purneah would be the most suitable of the northern districts in our area, but probably Cuttack or Puri would be even more suitable, though, I believe, it has not been tried there. The leaves are alternate, ovate, acuminate, dentate. Clusters in axillary paired laxly cymose panicles, the female panicles in the upper axils.

Clusters all spicate in our indigenous species:—

Tree. Leaves alternate elliptic, 3—6"

1. *rugulosa*.

Shrubs. Leaves mostly opposite:—

Leaves linear-lanceolate to lanceolate, 6—15", opposite

2. *macrophylla*.

Leaves elliptic to ovate, 4—8", mostly opposite

3. *platyphylla*.

1. *B. rugulosa*, *Wedd.* Dar, *Nep.*

A small tree with dark rough bark and narrowly elliptic or elliptic-lanceolate leaves 3.5—7" long, acute or somewhat acuminate, closely crenulate, pale beneath with a fine hoary tomentum. Dioecious. M. spikes 2—3.5" long, slender flexuous when mature, pubescent, the clusters each supported by a broadly ovate bract 1" long. Fem. spikes similar, sometimes only .75—1" and stiffly spreading in flower, 3—6" in fruit, perianth hispid-hairy. Achenes elliptic, stipitate.

Sameshwar Hills, on the boundary of Nepal, 2900 ft.! Fl. Sept. Fr. Nov.

Our tree is small and stunted, but I have seen it in Bhotan 40—50 ft. high and 4—5 ft. girth. Blaze pink. Upper surface of leaf glabrous, often rugulose, closely dotted when dry, primary nerves strong, others weak. Petiole .7—1.3". Stipules .15". The clusters are contiguous in young flowers and are covered by the bracts in bud and resemble catkins; they become distant in maturity and the spikes more flexuous.

2. *B. macrophylla*, Don.

A large shrub 6—10 ft. high easily recognised by its long opposite narrowly lanceolate rugulose serrulate leaves 6—15" long, and long drooping axillary spikes with very close clusters of flowers. Monoëcious.

Saranda forests in ravines, rare! Fl. Sept.—Oct. Fr. Feb.

Twigs terete or somewhat angled, strigose. Leaves 1—3" broad, strongly 3-nerved, tapering from the obtuse base, rather pale and strigillose on the nerves beneath, the nervules raised and forming areoles beneath, depressed above. Petiole .75—3" (in the very long leaves). Stipules free, .6", caducous. Spikes axillary drooping, 6—8" or nearly as long as the leaves, rhachis and receptacle hirsute, clusters globose, .25" diam., contiguous in fruit. Fruiting perianth clavate or pyriform, compressed, suddenly constricted at the minute 2—4-toothed mouth, thinly hairy, .07" long, persistent style hooked in fruit.

3. *B. platyphylla*, Don.

A spreading loose shrub 4—10 ft. high with branches strigose or strigillose especially at the nodes, and large broadly elliptic or ell.-ovate leaves 4—8" long by 3—6" broad, opposite or rarely upper sub-alternate, usually unequal in each pair and with unequal petioles 1—6" long, margin crenate-dentate or coarsely serrate, base rounded to cordate, often oblique. Flowers monoëcious (or rarely dioëcious?). Males in usually branched spikes from the lower axils, females minute in close clusters under .2" diam., on simple short or very long spikes from the upper axils, sometimes spikes male below and female above. Fruiting perianth narrowly ellipsoid or slightly obovoid, .03" long, somewhat or scarcely compressed, sometimes unequally angled.

In moist or shady localities, or in ravines in the hills. N. Champaran! Purneah! Singbhum, Palamau, Ranchi, Hazaribagh, either in ravines or on banks at 2500 ft. and upwards! Similar localities in the Southern Area. Angul! Puri! Sambalpur! Fl. r.s. and c.s. Fr. c.s. and h.s. Evergreen.

A variable plant split up by some botanists into a number of species but connected by many gradations. The female spikes have to be compared in similar stages as they are erect and shorter than the leaves when young, often the same being long inclined or drooping with age. I follow *Weddell* in treating the forms as varieties of one species, especially as it seems that the var. *scabrella* (*B. scabrella*, *Caud.*) has been variously interpreted.

Don describes his type (*Urtica platyphylla*, *Ham., M.S.*) as with leaves cordate-ovate acuminate, coarsely serrate and with the branchlets very scabrid both sides, female spikes simple with the clusters distinct, male spikes compound. It was collected in Nepal.

Weddell (*Monograph*, 1856-57), who apparently includes the type under his form *a*, describes this form as with leaves broadly ovate, gradually acuminate with rotund or cordate base and whole margin (even the tip) serrate or crenate-serrate, sparsely hispid above, hispidulous beneath, spikes simple or (esp. the male) simply branched, female equalling or exceeding the leaves, erecto-patent with the clusters pisiform distinct. He quotes *Wall.*, No. 4582 (*a*) from Nepal and this agrees very well with the common *B. & O.* plant usually placed under *scabrella*. Chota Nagpur! Angul!

Var. scabrella, Wedd.

Leaves smaller than in the type, rounded at the base, suddenly shortly caudate, hispid, lower spikes shorter, upper exceeding the leaves, all erect. *Weddell* quotes *Wall.*, No. 4581 (*Goyalpara*), in which the upper spikes are only up to 5.5". I doubt whether this is the *B. scabrella* either of *Cooke* or *Prain*.^{*} It is not the Parasnath plant called *scabrella* by *Clarke*, which appears to me to be only a harsh-leaved state of form α of *Weddell*.

A Purneah plant with soft rhomboid-elliptic leaves 3—5", not or very shortly acuminate, acutely dentate, not markedly rugosely-areolate below (as in the Parasnath plant) and with erect spikes scarcely longer than the petiole seems to come near to this.

6. POUZOLZIA, Gaud.

Herbs, more rarely shrubs, with alternate or opposite 3-nerved usually entire leaves, uppermost sometimes passing into bracts. Stipules usually free. Flowers in 1-sexual or androgynous clusters in the axils of the leaves, clusters never spicate except by the reduction of the leaves at the ends of the branches. Male perianth 4—5, very rarely 3-partite or -lobed, tepals often dorsally gibbous or abruptly inflexed, pistillode clavate or oblong. Fem. perianth tubular with contracted 2—4-toothed mouth, fruiting often angled or winged, stigma filiform articulate on the ovary and deciduous. Achene closely invested by the perianth, usually free within it, crustaceous. Seed with albumen very scanty or 0. Cotyledons ovate.

A. Tepals of male convex or gibbous dorsally, so that the buds are rounded:—

Primary nerves 3. Petioles 1—1". St. 4 or rarely 5

1. *indica*.

Primary nerves 3—5. Petioles 1—4". St. 5

2. *auriculata*.

B. Tepals of male abruptly inflexed about the middle and angled at the flexure so that the buds are truncate:—

Stem with leaves becoming bractiform above so that the flowers become spicate

3. *pentandra*.

Stem not running out into a bracteate spike

4. *hirta*.

1. P. indica, Gaud.

A herb with creeping rootstock and 2—4 ft. long weak stems more or less scabridly hairy. Leaves ovate to ovate-lanceolate or lanceolate, 5—1.3", entire, dotted and appressed hairy beneath, less so and shining above, base rounded, midrib with 1—2 sec. n. only. Petiole 1—2" (attaining 1" in outside specimens). Flowers axillary about 6 in a cluster. Male buds globose and apiculate, very strigose, stamens 5 (—4), tepals convex, oblong, acuminate. Fem. somewhat oblong, fruiting with 4 larger and 2 smaller wings above showing as ridges below. Stigma feathery 17" long.

Singbhum, near streams, not common! Ranchi, *Clarke*! Chota Nagpur (without locality), *Wood*! Sikkim Tarai (and probably Purneah), *Kurz*! There are no specimens in the *Cal. Herb.* from our area except a fragment from *Wood* and the Tarai one. Fl., Fr. Oct.—Jan.

^{*} *Clarke* (in *Journ. Linn. Soc.*, xv, p. 124), when he wrote that *B. scabrella* was quite distinct from *B. platyphylla*, was dealing with a plant he found on a journey from Darjeeling to Tonglu in British Sikkim!

The Singbhum plant has all the leaves alternate and is probably var. *tetraptera*, Wedd. Some varieties have the fruit ridged but not winged and the leaves mostly opposite. In one of Clarke's specimens the achenes are ovoid 8-ribbed, 2 lateral each side sometimes larger. Leaves reduced in size upwards but not bractiform as in *pentandra*.

2. *P. auriculata*, Wight.

Shrubby with erect branched stem, branches virgate, wrinkled (when dry) puberulous or hairy. Leaves alternate, lanceolate elliptic or ovate, acute or gradually acuminate, hispid-puberulous or asperulous above, more or less pubescent or pilose (pubescent-tomentose, Weddell) beneath, margins ciliate, 1-4" long, 3-5-nerved and with a pair of opposite sec. n. about half way up. Petioles long, at least at base, 1-3". Clusters axillary, androgynous, male 5-androus. Fruiting perianth apterous and ribbed or auricled or subalate, 1.5-3 mm. broad, apex 2-dentate.

Singbhum, Clarke! On syenite hills. Rare. Fl. Nov.

L. when young canescent, base acute or obtuse and sometimes rounded.

3. *P. pentandra*, Benn.

Herbaceous or sometimes suffruticose at the base, usually decumbent below, then erect or trailing up to 3 ft. long or more. Leaves linear tapering to linear-lanceolate, or lower ovate or ovate-lanceolate, always opposite below, 1.5-3" long, upper and floral bracts gradually smaller and alternate, sec. n. 0. Petioles short, or 0 in the upper leaves. Flowers very inconspicuous in nearly all the leaf axils, the clusters becoming spicate above from the gradually decreasing size of the leaves. Males 5-merous pedicelled cup-shaped below, the upper part of the tepals membranous and abruptly inflexed in bud so that the cup has a truncate or depressed top and a prominent angle or plait at the flexure. Fem. sessile, most minute in flower, conspicuous in fruit, perianth at first smooth tubular 2-toothed, subsequently tube ridged on one side and the two tepals becoming alate, finally fruiting perianth with a large white concave cordate or emarginate combined wing 1-1.2" long, and a fleshy ridge, enclosing black shining conical achene which is as long as the fleshy ridge.

River banks and wet places. More common than the others. Singbhum! Ranchi ascending to Neterhat 3000 ft.! Palamau! Sambalpur! Fl. Aug.-Oct. Fr. Oct.-Dec.

Stems from a perennial rootstock bearing buds in the autumn, often red, usually with raised puberulous lines decurrent from the leaf bases. Leaves dotted, margin and sometimes the 3 nerves ciliate. Base rounded or cordate. Stipules very small.

4. *P. hirta*, Hassk.

Slender with hairy or nearly glabrescent stems. Leaves, larger 4.5" by 1.1", lanceolate with rounded base, hairy, hispid or glabrescent, old conspicuously marked with small white dots above, usually strongly 3-nerved a little above the base, the three primary nerves extending nearly to the apex, 1-2 weaker nerves on each side below the primary. M. flowers globose truncate, hairy above, with long pedicels 1-1.5", 5-merous, in close clusters.

Parasnath, 3000 ft., *Clarke, Campbell*, etc. Fl. Oct. Also Sikkim Tarai!

Leaves on young plants ovate and 1.6" long only, on mature plants up to 5" acuminate, base sometimes sub-cordate. Petioles .05—1.5" only, hairy. Fruit apterous or 2—3-alate.

7. DISTEMON, *Wedd.*

Herb with alternate, toothed, 3-nerved leaves and minute monœcious flowers clustered in the axils of bracts in axillary and terminal androgynous spikes. Male perianth tubular below with 2—3-fid valvate limb. Fem. perianth ovoid-tubular 2-toothed, closely investing the compressed ovoid ovary. Stigma linear, deciduous. Achene broadly ovoid, acuminate, included in the thickened perianth, pericarp fragile.

1. *D. indicum*, *Wedd.*

An erect slender herb 2—3 ft. high, scarcely branched, puberulous or sparsely hairy. Leaves 2.5—4.5" ovate caudate, coarsely dentate, hairy beneath on the nerves and thinly cobwebby between, hairy above, base shortly cuneate, sec. n. 1—more to each of the 3 principal nerves. Petiole slender 1.2—1.5" long. Stipules .4" lanceolate with a long setaceous tip. Spikes erect 1.2—5" long, sometimes leafy at the base, bracts sub-amplexicaul ovate cordate with cuspidate tips. M. and F. in same axils, about 1 mm. long only. Stamens 2—3 exserted. Achene .1" long, ovoid, beaked.

Ranchi, elev. 3000 ft. under shade in rocky places! Fl., Fr. Aug.—Sept.
Dist. Assam, Burmah, and Java.

8. VILLEBRUNEA, *Gaud.*

Trees or large shrubs with alternate 3—5-palmi-nerved or penni-nerved leaves. Flowers monœcious or dioecious clustered, clusters axillary or from leaf scars sometimes in short lateral cymes or panicles. Bracts minute. Male perianth 4—5-fid with a pistillode. Fem. perianth ovoid narrowed to a minute mouth, somewhat fleshy in fruit. Ovary adnate to the perianth, stigma capitate fimbriate. Fruit consisting of a crustaceous achene free or adnate to the perianth, the base of which is sunk in a fleshy cup which grows up round it (and is said to consist of connate bracteoles).

The achene is described as adnate to the perianth in the *F.B.I.*, but it seems to me to be merely closely invested by it in our species.

1. *V. frutescens*, *Blume.*

A large straggling shrub with hairy twigs. Leaves ovate acuminate or caudate membranous, 3—7" long, dento-serrate except at the rounded or very obtuse base, hispidly hairy above, more softly hairy beneath, sec. n. several and tertiaries very reticulate. Petiole long, often half to three-fourths as long as blade. Stipules subulate awned .4". Flowers male in dense subsessile or sessile female in cymose clusters axillary and from old leaf scars, conspicuous in fruit from the fleshy white cupules from which the ripe perianth and enclosed achene fall. Achene somewhat compressed, minutely pitted.

Near streams. Mals of Puril Mayurbhanj, elev. 4000 ft.! Fl., Fr. April—May. The leaves are very variable in this species and I have only described the form in our area. The Mayurbhanj plant has them more hairy and pale beneath, not so large and with petioles only .5—1.3", but they are not full-grown.

FAM. 125. MORACEÆ.

Tree or shrubs, rarely herbs, nearly always with milky latex. Leaves alternate, very rarely opposite, simple, rarely deeply cut, frequently dotted (due to cystoliths). Stipules deciduous, often sheathing and leaving a permanent annular scar after falling (resembling that of many Magnoliaceæ). Flowers small or minute, green or colourless, dioecious or monoecious, cymose but cymes often dense and becoming capitate, or sometimes spiciform, in some genera crowded on the outside or inside of fleshy receptacles formed of the growth and union of the floral axes; male and female inflorescence sometimes different. Tepals usually 4, seldom 2, 3, 5 or 6, valvate or imbricate, free or connate. Stamens isomerous or reduced in number, when isomerous then opposite the tepals, inflexed or erect in bud, anthers with longitudinal dehiscence. Female perianth often accrescent in fruit. Ovary superior, 2-carpellary, 1-celled. Styles 2 or 1—2-partite, or simple (anterior branch only developed), papillose on the inner side, rarely stigma terminal peltate or tubular. Ovule pendulous from top, amphitropous with micropyle superior, seldom basal and orthotropous. Fruit an achene, or drupe, or sub 2-valvular, often aggregated into large fleshy pseudocarps. Seed albuminous or not. Embryo mostly curved, cotyledons often very unequal, thick flat or one folding round the other.

- I. Stamens inflexed in bud with reversed anthers. Flowers not usually crowded on or inside large fleshy receptacles, recepts sometimes globose and fleshy in fruit. Perianth usually fleshy in fruit:—
 - A. Fem. fl. solitary or 2—3 on a peduncle, style 2-fid. M. fl. capitate or subcapitate:—
 - Spinous shrub. Fem. tepals foliaceous, up to 1" in frt. 1. *Phyllochlamys*.
 - Unarmed shrub or tree. Fem. tepals small enclosing the ovary, fleshy in fruit 2. *Streblus*.
 3. *Morus*.
 - B. M. and Fem. fls. spicate or fem. in ovoid heads. Perianth fleshy in fruit. Style 2-fid 4. *Broussonetia*.
 - C. Fem. fl. in globose heads, sometimes forming a fleshy pseudocarp in fruit. Style simple:—
 - M. fl. spicate. Achenes fleshy, long-stipitate on the globose receptacle in fruit 5. *Plecospermum*.
 - M. and fem. fls. in globose heads. Achenes few, large, sunk in the fleshy pseudocarp in fruit
- II. Stamens straight in bud. Flowers crowded in globose heads or on or inside fleshy receptacles:—
 - A. Fls. in dense globose heads. Achenes many on the fleshy globose receptacle. Male 4-androus 6. *Cudrania*.
 - B. Fls. crowded on the outside of oblong or irregularly globose large receptacles. Male monandrous 7. *Artocarpus*.
 - C. Flowers crowded on the inside of fleshy receptacles, of which the mouth is closed by bracts 8. *Ficus*.

1. PHYLLOCHLAMYS, Bureau.

Thorny trees or shrubs with milky juice. Leaves penninerved. Flowers dioecious, males in short axillary bracteate spikes or heads; female solitary, peduncled. Tepals 3—4 ovate imbricate in the male, lanceolate accrescent and foliaceous in the female. Pistillode dilated at top. Ovary straight in flower, finally very oblique with the 2-partite style lateral. Fruit included in the perianth, obliquely globose or ovoid, pericarp sub-fleshy below, very thin above and finally 2-valved. Seed oblique, testa thin, albumen very scanty. Embryo very large fleshy globose, one cotyledon larger 2-fid enclosing the smaller, radicle upcurved.

1. *P. spinosa*, Bur. Syn. *Trophis spinosa*, Roxb.; Jhumpuri, Or.; Putkuli (Mayurbhanj).

A small tree or shrub with the branchlets often terminating in a sharp thorn, sometimes with a line of pubescence on one side. Leaves rhomboidly elliptic or somewhat obovate acuminate, coarsely irregularly toothed towards the apex, 2—4" long, glabrous, not dotted, base minutely cordate on the petiole, sec. n. 8—10 with many weaker intermediate looped or united into an intramarginal one. Petiole 1" puberulous or pubescent. Stipules lanceolate about as long. Male heads ovoid 15" long, sessile; involucre bracts many imbricate with strong mid-rib and sometimes mucronate. Female sometimes two together with bracts at the base of the short pedicel, fruiting tepals erect and conniving over the fruit, lanceolate acuminate from a cordate base, attaining 1" long. Fruit splitting into 2 valves when quite ripe, obovoid 4" with short style and two very long stigmas persistent on one side.

Ranchi, very rare, ravines on the ghats near Bishanpur! Cuttack! Puri, fairly frequent! Angul, in ravines, rare! Fl., Fr. April—June. Evergreen.

2. STREBLUS, Lour.

Trees or shrubs, the juice sometimes only slightly milky. Leaves scabrid penninerved or sub-3-nerved at the base, stipules small, subulate. Flowers di-, rarely mon-œcious, males in peduncled heads axillary and from the leaf scars, females solitary or 2—4 together axillary, peduncled, bracteate at base. Male tepals 4 connate at base, imbricate, stamens isomerous, pistillode dilated at the top. Fem. tepals free imbricate, embracing the ovary. Ovary straight with central long deeply 2-fid style with very long arms. Ovule pendulous. Fruit with a membranous or thinly coriaceous pericarp enclosed in the fleshy perianth. Seed globose, testa membranous, albumen 0. Embryo globose, one cotyledon very large fleshy, enclosing the small one, radicle upcurved.

1. *S. asper*, Lour. Kakasa (rough), Ote, Ripi chum, Hara-saijang, Sukri-saijang, K.; So: or, Ho.; Sahra, S.; Sihora, Th.; Sara, Or.; Sora, H.

A rigid much-branched shrub or small tree (where not browsed down) with stiff very scabrid rhombic-elliptic or obovate leaves 2—4", very

shortly petioled. Male heads .25—.3" diam. on 1—3-nate peduncles nearly as long, or up to .5", bracts very small ovate under .05" long, outer involucrate; flowers 6—8, perianth about .1" long, tepals connate below, one sometimes smaller than the others, stamens exceeding the perianth. Fem. peduncles .3—.4" with 2—3 bracts .07—.08" long at the top supporting the flower, tepals free but closely wrapping round the ovary .08—.1". Fruit yellow succulent (including the succulent perianth), .15".

Throughout the province but chiefly in the moister districts. Very common in Purneah! Also very common in parts of Angul and Puri, less so in other districts and then near nalas! Fl. March—April. Fr. May—June. Evergreen. Renews leaves in March.

Bark tough, stringy, light grey; blaze with a thin chlorophyll layer, then white, followed by a gradual darkening and a slight exudation of small drops of latex. Leaves usually obscurely toothed, acuminate, scabrid both sides, sec. n. 7—9 of which 1 (each side) close to base and sub-primary, others irregular and looping, reticulate between with nervules raised beneath. Stipules .1". Style below bifurcation about .07", arms .3" long.

A favourite food of goats, which often prevent the tree developing otherwise than as a small, gnarled, intricately branched bush. The wood is very tough. *Gamble* gives the weight as 40—45 lbs. and states that the leaves are used for polishing ivory and wood.

3. MORUS, L. Mulberry.

Trees or shrubs with alternate entire toothed or 3-lobed palminerved leaves and caducous stipules. Flowers spicate, mon- or di-œcious, tepals 4—3 imbricate, those of the female fleshy and swollen in fruit, enclosing the achene and more or less confluent into a syncarp. Pistillode turbinate. Ovary straight with central 2-partite style. Ovule pendulous. Seed subglobose, albumen fleshy. Embryo incurved, cotyledons oblong equal, radicle ascending incumbent.

M. spikes lax, .5—1.5". F. spikes ovoid, styles connate high up 1. *indica*.

M. and F. spikes 1.5—5" long linear dense. Styles bifurcate from near the base 2. *lævigata*.

1. *M. indica*, L. Syn. *M. alba*, var. *cuspidata*, *Bureau* (the Purneah plant so named in the *Calcutta Herbarium*); Siah tut, *H.*; Tut, *Beng.*

A shrub or small tree up to 25 ft. high with ovate or broadly ovate, caudate, sharply serrate, often deeply lobed leaves 2—5" long. Flowers with the young leaves. Male spikes rather lax-flowered broadly cylindrical or ovoid .5—1.5" long, hairy all over, pedicels short, tepals elliptic .08—.1" long, stamens twice as long. Fem. spikes short-ovoid on slender peduncles about half as long, tepals obovate with white margins, styles long, connate below, hairy. Fruit ovoid or subglobose, red, then black.

Common in dry forests and stony places in the Terai and Duars to the east! and in the sub-Himalayan tract west of our area, no doubt therefore occurring within it. *Hamilton* says (in his account of Purneah) "both kinds of *Morus* are here very common." Also cultivated in Bihar, Tirhut and Chota Nagpur! Fl. Oct.—Feb. Fr. April—May. Deciduous for short period in January or February.

Bark light grey. Buds perulate. Leaves scaberulous, pubescent when very young, basal nerves 3 and 3—4 sec. n. on the central one. Petiole 5—1.5". Diccious (where I have seen it). Male peduncles short slender.

Brandis says "a deciduous tree, for silkworms grown as a shrub," but in its truly wild state along stony sub-Himalayan nalas in Mixed Forest I have frequently seen it flowering as a shrub, as, in fact, he himself describes it in his old *Forest Flora*.

2. *M. lævigata*, *Wall.* Kimbu, *Nep.*

A large handsome tree, young shoots hairy or villous. Leaves ovate or broadly ovate, caudate, with base mostly cordate and often oblique, serrulate (in wild examples), 3—7" long. Flowers with the nearly developed leaves; both sexes in long dense narrow more or less pendulous spikes 3—5" long, with very hairy rhachis, pair of tepals in the female facing the edges of the much compressed ovary usually somewhat keeled, inner flat; styles papillose, only connate at the extreme base. Fruit pale-yellow, very small, in long-cylindric syncarps.

Wild in the Sikkim Tarai close to our area, not wild within it. Said to be cultivated in Behar, near the Soane (*Brandis*)*. Cultivated on the Ranchi plateau (differs in some respects, see below)! Fl. Feb.—March. Fr. April—May.

Bark light grey. Twigs lenticellate. Buds perulate. Leaves hairy when young, especially along the nerves, basal nerves 3 and 4—6 sec. n. along the central one, tertiaries distinct, scalariform. Petiole rather stout, 1". Diccious. Peduncles .5", hairy or villous. Male fl. sessile, tepals hairy. Fem. tepals glabrous (*teste Brandis*) or hairy (in my specimens).

The following form is cultivated in Ranchi:—

A large tree differing from the last in the more coarsely serrate leaves with rounded or subcordate base (often oblique) and especially in the shorter suberect female spikes which are only 1.5—2" long and less hairy.

Var. *viridis*, *Bureau*. Syn. *Morus viridis*, *Ham.* (Wall. Cat. 4650)

Leaves rounded at the top. Patna, *Hamilton*! No doubt only cultivated.

4. BROUSSONETIA, *Vent.*

Trees with alternate and sub-opposite hairy simple or deeply lobed serrate leaves and lateral deciduous stipules. Flowers diccious, in solitary axillary capitate or cylindric dense spikes or heads, not connate. Males 4-fid or -lobed, valvate, pistillode minute. Fem. mixed with persistent bracts, perianth ovoid or tubular, 3—4-toothed enclosing the stipitate ovary, style subulate, entire. Ovule pendulous. Fruit (drupels) free on the globose receptacle, fleshy with a fleshy elongated stipes, but with a crustaceous rugose endocarp and excentric style, surrounded by the bracts and unaltered perianth. Albumen scanty or fleshy, cotyledons oblong, equal, radicle ascending, incumbent.

1. *B. papyrifera*, *Vent.* The Paper-mulberry.

A small quick-growing tree with the branches marked with stipular scars, subtomentose branchlets and large obliquely ovate or oblong simply serrate or also (especially when young) deeply palmately 3—5-

* *Hooker* quotes *Brandis* for the Bihar habitat, but there is a specimen of his own collecting at Kew marked "Soane River." Patna is also near the Soane (see var. *viridis*).

lobed soft leaves 3—9" long. Petiole 2—3". Male flowers in cylindric pubescent peduncled spikes 1—3" long. Fem. flowers in tomentose globose heads 3—7" diam., shortly stoutly peduncled, heads over 1" in fruit, red, the individual fruits each with a fleshy red stipes.

Planted in the damper and warmer districts. Fl., Fr. r.s.

The Japanese make paper from the bark of this tree which also yields a textile fibre. It is easily grown both from seed and from cuttings or root division, but I have nowhere seen it planted in the Province except for ornament.

5. PLECOSPERMUM, *Trecul.*

Trees or shrubs with alt. entire penninerved leaves, small lateral stipules and dicecious flowers in lateral 1—3-nate peduncled heads. Male perianth gamophyllous with 4 distinct imbricate lobes, pistillode minute hairy. Fem. flowers connate into a fleshy head with the almost closed very minute projecting mouth of perianth 4—2-toothed. Ovary straight, sunk deep in the head from which projects the long simple filiform style. Ovule pendulous. Achenes few in the fleshy pseudocarp, coriaceous, adnate to the perianth. Albumen 0. Embryo large subglobose with a very large cotyledon embracing a smaller folded one.

1. *P. spinosum*, *Trecul.* Banabanka, *Or.*

A large thorny shrub often climbing by means of its straight or slightly curved thorns, the lower of which attain 2—3", the upper axillary 5". Leaves elliptic or obovate 2—3" long, suddenly contracted to a short rounded tip, more rarely gradually acute, base acute, midrib strong, sec. n. about 6—8 but weak, arching and forming areoles, and when fresh appearing with the branching included nervules as green reticulations on a paler ground. Male heads tomentose 2" diam., flowers nearly sessile with minute bracteoles, perianth-lobes connate about half-way up ovate subobtus. Fem. heads 2—2.5" diam., angular from the small projecting flower apices from which the slender 1.5—2" long flexuous styles protrude, velvety-tomentose, attaining 3—5" in fruit.

Damp jungles. Cuttack to Puri! Frequent. Fl., Fr. March—June. Ever-green.

Sometimes confused with *Cudrania javanensis* (*q.v.*). Branchlets often pubescent. L. with thickened margin. Petiole .25—.35" pubescent. Stipules minute subulate. Peduncles 2—7", pubescent, from the axils of bracts on abbreviated shoots or below the leaves or axillary. Achenes 2".

6. CUDRANIA, *Trecul.*

Trees or shrubs with alternate entire penninerved leaves, small lateral stipules and dicecious flowers in lateral 1—3-nate peduncled globose heads. Male flowers each surrounded by 2—4 bracts more or less adherent to the perianth, tepals 3—5, imbricate, stamens more or less adnate to the tepals, erect in bud, pistillode subulate or 0. Fem. flowers distinct, tepals embracing the ovary. Ovary straight, style simple or 2-partite or with one arm rudimentary. Ovule pendulous. Achenes numerous enclosed in the fleshy pseudocarp formed of the accrescent bracts and perianth, crustaceous, compressed. Testa membranous,

albumen scanty; cotyledons twisted and folded, equal or unequal, embracing the slender upcurved radicle.

1. *C. javanensis*, *Trecul.*

A large scandent shrub in habit and foliage much resembling *Plecosperrum spinosa*, branchlets often densely hairy or pubescent, armed with strong axillary straight or somewhat curved thorns .5—1" long. Leaves elliptic or somewhat obovate 1—3.3" mostly shortly obtusely acuminate or rounded but always mucronate with the excurrent midrib, base acute or subobtuse; sec. n. 6—8 fine but distinct, looping and including fine intermediate nerves and much reticulate nervules, margin slightly thickened. Petiole .3—5". Flowers heads greenish or yellow mostly geminate in the axils, .25—3" diam. Pedicels short tomentose .1—25". Males pubescent, often compressed with (usually 5) large oblong rounded tepals with inflexed tips, pistillode slender. Female head .3" diam. in flower, 1" in fruit, globose.

Near rivers or streams. N. Champatan! Purneah! Fl., Fr. April—May. Evergreen.

The Orissa locality (in *Bengal Plants*) appears to be an error founded on a wrongly named sheet of *Plecosperrum* in the *Cal. Herb.* The following differences easily serve to discriminate the two species in the field even without flowers. The areoles formed by the sec. n. in *Plecosperrum* are occupied by much branched nervules with free endings whereas the nervules are mostly truly and closely reticulate in the *Cudrania*, the leaf tip is usually different (see above), the male tepals are much more conspicuous in *Cudrania*, while the female heads are quite different, being quite globose (not angular) in *Cudrania* with the individual flowers easily separable; the ovary is sunk between the perianth lobes but is not relatively so deep in the head. The achenes are numerous all round the circumference of the larger pseudocarp.

7. ARTOCARPUS, *Forst.*

Trees with alternate coriaceous, often very large, leaves entire or pinnately lobed, or pinnatifid when young and entire when mature, penninerved. Stipules usually leaving an annular scar. Flowers monœcious, densely crowded on globose or variously shaped 1-sexual, usually axillary solitary receptacles, often mixed with peltate bracts. Male perianth 2—4-lobed or -partite, lobes concave, valvate or slightly imbricate, stamen 1 erect in bud, pistillode 0. Fem. perianth tubular, confluent below with the receptacle, mouth minute, ovary straight, style central or lateral, stigma entire rarely 2—3-fid; ovule pendulous. Fruit a large fleshy syncarp covered superficially with the fleshy perianths and the usually apically spinous or otherwise hardened carpels, the lower parts of which are deeply sunk in the syncarp. Seed often very large, exalbuminous, embryo straight or incurved, cotyledons fleshy equal or unequal, radicle very short, superior.

A. Leaves of mature trees undivided. Native or commonly cultivated species:—

1. Syncarp not tubercled (tips of anthocarps flat):—
Branchlets and leaves softly pubescent or tomentose

1. *lakoocha*.

2. Syncarp tubercled:—

Syncarp globose, 3—4" diam. Leaves obovate, scabrid
Syncarp not globose, 12—30" long. L. smooth shining

2. *chaplasha*,
3. *integrifolia*.

B. Leaves of mature trees pinnatifid. Exotic, rarely cult.

4. *incisa*.

1. **A. lakoocha**, Roxb. Daho, Dahu, H., K., S.; Denyo, Barhal Barhar, H.; Madar, Beng.; Jeota, Or. (Lakucha is the Sanskrit name).

A moderate-sized tree with broad dense crown, villosely-tomentose branchlets, large elliptic or ovate, obtuse or shortly acuminate leaves 6—10' long, pubescent or tomentose beneath, entire. Recept. axillary, males sessile from previous year's, females short-peduncled from current year's axils. Male recept. orange-yellow, spongy, ovoid, .75—1", closely covered with the minute peltate bracts, perianths and scarcely exerted stamens, deciduous. Fem. recept. irregularly sub-globose, 3—4" diam. and yellow when ripe with the surface nearly smooth.

Wild in the Champaran forests! also in the Saranda forests of Singbhum! Manbhum, Camp.! Ranchi (Damuda ghats)! Hazaribagh (Parasnath)! and in the Mals of Puri! possibly wild also in Purneah! Frequent in villages throughout the area! Wild but rare in the Orissa States, Cooper. Fl. Dec. and April. Fr. May and Oct.—Nov. Sub-deciduous March.

Bark grey, flaky in small scales, blaze red, immediately followed by drops of white latex. Leaves with 8—13 strong sec. n. nearly reaching the margin, tertiary veins numerous, raised beneath, scalariform and closely reticulate, pubescent. Young leaves sometimes serrate (F. B. I.). Petiole .5—1". Stipules .5", lanceolate villous, caducous but leaving a considerable scar.

The timber is not of much value in our province, as the trunk does not attain any great height as it does in more humid forests. Gamble states that it is highly prized in the Andamans and gives the wt. as 40 lbs. The young male recepts. as well as the fruit are eaten. Hamilton states that the basket makers stain bamboo by equal parts of the bark of this tree and of the "Dangrangga" beaten together with a little lime and water.

2. **A. chaplasha**, Roxb. Latar, Nep.

A magnificent, tall, straight tree occurring in the forests of the Darjeeling district just north of our boundary, but probably not now within it. The leaves of young trees are 1—2 ft. long, elliptic lanceolate and irregularly pinnatifid with a large terminal lobe, of mature trees broad obovate 8—12" with prominent nerves. Bark smooth light coloured, slightly transversely marked from the stipular scars, old slightly cracked. Stipules 1.5" sheathing. Fruits 3—4" diam., globose, tubercled with the flatish hispidulous tips of the anthocarps.

Fr. June.

3. **A. integrifolia**, L. f. Kathal, H.; Kanthar, K., S.; Panus, Or. Jack Fruit (the name Jack said to be derived from the Indian names jaca or tsjaka, vide De Candolle, *Origin of Cultivated Plants*. I can find no record of such a name for this tree in India. The Sanskrit name is Panasa).

A well-known tree with very dense rounded crown, coriaceous elliptic entire (or in young plants sometimes lobed) leaves 4—8" long, of a dark shining green above. Petiole .5—1". Stipules glabrous long sheathing and leaving an annular scar after falling. Male recept. cylindrical 2—6" without bracteoles to the flowers, tepals 2. Fruiting recepts. attaining enormous size, 12—30", tubercled.

Everywhere cultivated, but succeeds best in the moister districts. Native of the Western Ghats. Fl. Dec.—Feb. Fr. r.s.

The recepts are lateral on the trunks and branches, but on special branchlets. The inflorescence is at first enclosed in 2 very large leathery yellowish bract-like stipules belonging to the leaf (often small) on the special branchlet in whose axil the first recept arises together with another lateral bud, the main axis is slightly displaced by the developing recept and the next very reduced internode bears again a pair of large stipules and a younger recept and sometimes a bud; this arrangement is continued and the buds develop according to the luxuriance of the branchlet, on which the small leaves may remain or not; the bud arises alternately to the right and the left of the developing recept.

The wood of the Jack is excellent and is largely used for the large drums (dumung) of the Kols and Santals. The fruit sometimes weighs up to 80 lbs. and is said to be demulcent, nutritious and laxative. It is rather difficult to digest and, in large quantities, produces diarrhœa. The seed is roasted and eaten. The tree readily germinates from seed, which is large (over 1" long) and ellipsoid. The seedling requires shade.

4. *A. incisa*, L. f. The Bread-fruit Tree.

Only occasionally cultivated as a curiosity in the Cuttack district. It is a native of the Pacific Islands and requires a hot moist climate without cold in winter.

8. *FICUS*, L. Fig.

Trees or shrubs always with milky juice, often epiphytic when young, sometimes scandent. Leaves usually coriaceous or harsh, very rarely opposite, entire, more rarely toothed or lobed; stipules sheathing the bud and leaving a circular scar after falling. Flowers minute, often mixed with bracteoles, 1-sexual, on the inner surface of a fleshy receptacle the walls of which leave a very narrow mouth which is more or less completely closed by small imbricating bracts. Recept androgynous with the fewer males nearest to the mouth or sometimes 1-sexual. Unfertile female flowers (gall flowers) occupied by the larva or pupa of a hymenopterous insect (belonging to the fam. Chalcididæ) are present in the androgynous or functionally male recepts. Male perianth 2-6-fid or -partite, segments imbricate, stamens 1-2, rarely 3-6, erect in bud. Fern. fl. with perianth similar to the male, or reduced, ovary straight or oblique, style excentric, ovule pendulous. Fruit an achene or fleshy, small, included in the accrescent fleshy syncarp (fig). Albumen scanty, embryo curved, cotyledons equal or unequal.

The pollination of the female flowers is possibly effected by the small insects above alluded to, which escape through the mouth of the receptacle and in so doing brush against the male flowers which are sometimes only in a zone close to the mouth. Where, however (as occurs in some species), males and galls occupy one set of recepts and females and neuters another set, it is not evident how this pollination takes place, as the entry of the insect into the female receptacle would presumably be followed by puncture of the ovaries. It is stated, however, that the short ovipositor of the insect can only reach the ovule of the short-styled stigmaless gall-flower, but not the long-styled and papillose female flower.

It is to be noted that *Cunningham* (*Ann. Cal. Gard. I*, Appendix) from his researches on *Ficus Roxburghii* throws doubt on the whole theory. He does not consider that pollination is necessary for the development of the embryo in figs and does not believe that the gall insects are able to pollinate.

In the following key a stipes means a slender basal prolongation of the receptacle itself and is distinguished from a pedicel. The whorl of 3 bracts usually found at the base of the receptacle is situated at the apex of the pedicel, or, if the fig is sessile, at the base of the receptacle or its stipes (if it has one); sometimes scattered bracts are found on the receptacle.

- I. M., Fem. and Call fls. in the same receptacle. St. 1.
 Trees (or epiphytes becoming trees). Leaves never hispid. Recept. never hispid, always axillary (or from the axils of fallen leaves) and paired or, if clustered (nos. 8 and 8a) under .5" diam., not stipitate (exc. 6) nor on special branches (Nos. 1—14):—
- A. Leaves glabrous (Nos. 1—12):—
1. Lateral nerves, sec. n. and almost as strong intermediate, close (exc. in 4), fine and parallel, recepts always paired:—
 - a. Leaves orbicular or broadly elliptic:—
 - L. 2—3.5", lateral basal nerves spreading parallel to the sec. n., petiole slender, .5—1". Recept. yellow, .6—9" 1. *comosa*.
 - L. 2—3", lateral basal nerves oblique. Petiole .3—5". Recept. purple or white, .4—5" 2. *retusa*.
 - b. Leaves elliptic or oblong:—
 - i. Recept. sessile:—
 - L. tapering both ends, 2—5". Sec. n. 6—10. Recept. .25—35" 2. *retusa* var. *nitida*.
 - L. ell. or oblong, 6—12", sec. n. very close. Recept. .5" 3. *elastica*.
 - ii. Recept. pedicelled:—
 - L. oblong, 5—10", glossy, sec. n. rather distant 7—10 4. *glaberrima*.
 - L. 2.5—5.5", base rounded or obtuse, sec. n. 10—14 5. *glabella*.
 2. Lateral nerves not close and parallel, intermediate not resembling the secondary (see also No. 4):—
 - a. Leaves elliptic or oblong (or some ovate in 7), abruptly acuminate:—
 - i. Recept. always geminate:—
 - L. 5—10", sec. n. 7—11. Recept. stipitate 6. *nervosa*.
 - L. mostly under 6", sec. n. 5—10. Recept. sessile 7. *infectoria*.
 - L. of *infectoria*. Recept. pedicelled, often pubescent var. *Lambertiana*.
 - ii. Recept. mostly clustered, small, bracts broad, often 2-fid:—
 - L. not highly polished, 5—8", nervation of 7 8. *geniculata*.
 - L. highly polished, beautifully venose, 5—8" *tjakela* (p. 872).
 - b. Leaves ovate (also elliptic in 9), often with dots beneath (raised when dry):—
 - i. Leaves obtuse or with short blunt acumen and long petiole:—
 - L. 3.5—5.5", sec. n. 6—12. Recept. with broad base, not wrinkled when dry 9. *tsiela*.
 - ii. Leaves acuminate or caudate:—
 - L. 4—6", gradually acuminate, rarely caudate, rarely cordate, not finely reticulate. Recept. .6—75", wrinkled when dry, with broad sessile base 10. *Rumphii*.
 - L. 4—7", abruptly caudate, cusp .5—1", base cordate, finely reticulate. Recept. depressed-globose, .4—5", subsessile 11. *Arnottiana*.
 - L. 5—7", caudate with cusp, 1—2" long. Recept. black, sessile, .4—6" 12. *religiosa*.
- B. Leaves tomentose or pubescent beneath, at least when young. Recept. usually pubescent, sessile. Aërial roots usually present:—
 Midrib not glandular. Recept. scarlet puberulous, .5—7" 13. *bengalensis*.

- Midrib with an elongated gland at base. Recept
tomentose, .25—.5" . 14. *tomentosa*.
- II. M. and Gall. fls. in separate recepts to the Fem. St. 1—3.
Trees, shrubs or climbers. L. often hispid or scabrous.
Recept usually hispid, 1, 2 or more together, axillary
or in clusters or on special leafless branches, often
large, sometimes bracteate, often stipitate:—
- A. M. fl. with 1 stamen and large pistillode or gall fl.
Recept paired or fascicled, stipitate, hispid:—
- Tree. L. elliptic or ovate acute. Recept .25—.3" . 15. *cuspidifera*.
Large epiphyte. L. broadly rhomboid obtuse, hispid . 16. *parasitica*.
- B. M. fl. without a pistillode or ovary:—
1. Stamen 1:—
- a. Leaves alternate:—
- i. Recept not on special leafless branches:—
Climbing shrub. Recept 1—2 axillary . (22) *scandens*.
Weak shrub. L. heteromorphous. Recept
solitary, hispid . 17. *heterophylla*.
Small tree. Recept paired, hispid . 18. *asperrima*.
- ii. Recept on special, often subradical
branches:—
Small tree with semi-sagittate leaves . 19. *cunia*.
- b. Leaves opposite. Recept mostly on special
branches:—
Small tree. Branches hispid. L. ovate-oblong
or obovate . 20. *hispidula*.
Low spreading shrub in river beds. Branchlets
hirsute. L. lanceolate or oblanceolate . 21. *sæmocarpha*.
2. Stamens 2—3. Leaves alternate:—
- a. Climbing shrub. Recept 1—2 axillary, pedi-
celled . 22. *scandens*.
- b. Erect cultivated shrubs or small trees. Recept.
m.s. to large, solitary or paired, axillary:—
Sub-arboreous L. pale or hoary, usually
tomentose beneath, mostly not lobed. Recept
1" or less, mostly stalked . 22a. *palmata*.
Shrubby. L. deep green, rarely tomentose
beneath, mostly deeply lobed. Recept 1.5",
mostly sessile . 22b. *carica*.
- c. Recept very large (1—2" diam.) on tubercles or
special short branches:—
- i. Erect shrub or branches prostrate . 23. *lanceolata*.
- ii. Small trees:—
L. ovate to elliptic, 4—7.5" . 24. *glomerata*.
L. very broad, 8—18" long by 5—12" broad . 25. *macrophylla*.

1. **F. comosa**, Roxb. Syn. *F. Benjamina*, var. *comosa*, Kurz (there is some doubt, however, whether *F. Benjamina*, L. is not synonymous with *F. retusa*, var. *nitida*. There is no doubt as to Roxburgh's plant. Hence I have taken the name given by him). Pokaha, S.; Panjar, Lakhar, *Th*.

A very handsome, large quite glabrous tree with slender drooping branches, broadly-elliptic or -ovate abruptly acuminate or shortly caudate, with rounded or very obtuse base scarcely 3-nerved, the two lateral basal nerves being hardly stronger than the very numerous close spreading secondaries and spreading more or less parallel to these; secondaries about 12 with their scarcely finer intermediaries all meeting in an intramarginal nerve close to the thickened margin. Recept mostly terminating or towards the ends of the branchlets geminate axillary (but the leaf often suppressed or deciduous), sessile quite globose

or suddenly contracted into the base, '6—'85" diam., one basal bract not sunk in the base (cp. *retusa*), two others almost concealed by the base and often inconspicuous and concolorous with recept.

Champanan, forests of Ramnagar and Bettiah! Santal Parg., in valleys! Valleys in Singbhum and Hazaribagh! Manbhum, *Cal. Herb.*! Angull! Naya-garh! Recept. ripen March—May. Evergreen.

Our plant appears to be *F. Benjamina* var. *comosa*, Kurz, from its large fruit, that of *Benjamina* being described with fruit only '3" (which is the size of the fruit of *retusa*!). On the other hand in var. *comosa* the sepals of all the flowers are said to be "lanceolate-acuminate not spatulate." This is quite different from our specimens in which the bracts are lanceolate, but the tepals are very obtuse sub-spatulate and outermost hooded; the anther is globose, apiculate.

The tree is easily recognised in the forest by its habit and finely nearly horizontally striate nervation of leaves which are 2 by 1" to 3.5 by 2" or sometimes broader in proportion. Petiole slender .5—1", grooved. Stipules .4—'5", linear-oblong acuminate. Recept. up to .9" in length when contracted at base, bright yellow when ripe (sometimes white?).

2. *F. retusa*, L. Syn. *F. benjamina*, Willd. (*Sp. Plant. Ficus* No. 42?). Buti-hesa, Chuman-hesa, K.; Jili, S.; Jir, Beng.

A small or large tree, epiphytic when young on trees or rocks with rather small rotund, obovate, oblanceolate or elliptic leaves always with a cuneate 3-nerved base, lateral basal nerves not or not much stronger than the secondaries but *oblique*, secondaries 6—10 with many nearly as strong intermediate, all meeting in an intramarginal nerve close to the thickened margin. Recept. in axillary pairs sessile divaricate sub-globose '3—'4" rarely '5" diam. when ripe, succulent white or purple.

Champanan! Chota Nagpur, frequent! Gaya ghats! Santal Parg.! Orissa States Cooper! Kalahandi! Ripe recept. have been found Oct.—Nov. and March—May, but there may be two species included here, viz.:—

Var. *retusa*, proper, *F.B.I.*

Leaves 2 by 1" to 3 by 2.5", orbicular to broadly elliptic, rounded obtuse or obtusely acuminate at the apex. Petiole .3—'5", sometimes thinly pubescent. Stipules lanceolate acuminate, .4—'5", sometimes pubescent. Recept. .4—'5", thinly hairy within. Tepals free, oblong or oblanceolate rounded. Ovary long, stipitate above the tepals.

Chota Nagpur to Kalahandi!

Smooth bark on youngest twigs, cracking and falling off leaving them rough. Sometimes closely resembling *F. comosa* but habit different.

Var. *nitida*, *F.B.I.* Syn. *F. nitida*, Thunb.

Leaves lanceolate oblanceolate or narrowly elliptic, tapering both ends, 2" by .8" to 5" by 2.5". Petiole .3—'4" and stipules always (?) glabrous. Recept. .25—'35", sometimes slightly warted. The rest much as in *retusa*. Anther broadly oblong, longer than the filament.

Champanan! Santal Parganas! Fr. March.

3. *F. elastica*, Roxb. The India-rubber Tree.

Epiphytic (but often grown from cuttings and then erect) with large coriaceous oblong or elliptic shining leaves 6—12" long with numerous and very close spreading fine sec. n. and glabrous leaf-scales and stipules 6—8" long (just before unfolding of the new leaf). Recept. sessile, paired at leaf scars, "covered at first by hooded involucre which fall off and leave a basal involucre entire edged cup, when ripe ovate-oblong smooth greenish yellow about '5" long" (*F.B.I.*) or ovoid and greenish-yellow.

Indigenous in the Lower Himalaya not far from our area, but not within it. Frequently cultivated for ornament but of very different appearance from the large indigenous trees, which often start life some 50 ft. above the ground, from which height the aerial roots run down the trunk of the host to the ground and gradually enclose it.

The leaves on fruiting branches are often much smaller than the normal and the leaf-scales and stipules of unhealthy trees often fall off when only 3—4" long. The hooded involucre bracts which are connate and circumscissile above the base are peculiar but not unique; the cup left after the fall is sometimes toothed.

This is the source of the true "india-rubber" which is chiefly obtained by tapping the large aerial roots.

4. *F. glaberrima*, Blume.

A small tree (tall in the Himalaya) with rather scanty latex. Leaves oblong glossy chartaceous 5—10" long, shortly acuminate, with rounded or cuneate 3-nerved base, translucent-dotted when fresh; sec. n. rather distant, 7—10, spreading, raised beneath, looping not far from margin, reticulate between. Petiole 5—15". Recept 25" diam. globose, pedicelled, orange-coloured when ripe, sometimes verrucose when young, basal bracts 3 caducous.

Along streams in the Sameshwar Hills! Fr. Jan.—March.

Bark tough and stringy, pale on the branchlets which and the young leaves beneath are said to be puberulous (*King*). They are glabrous in my specimens. Stipules glabrous 5—75". "Male sepals 4, lanceolate, subsessile. Gall fl. sessile or shortly stoutly pedicelled, perianth 4-cleft. Fem. fl. when ripe with viscid achenes and no perianth," *F.B.I.* The bracts at the base of recept appear to be hooded over the recept when very young but only show as scars at the expanded top of the pedicels in the later stages. Base of recept rarely shortly stipitate above this expanded top of pedicel and in some Sikkim specimens hairy.

5. *F. glabella*, Blume. Putkul, K.

A small or mod.-sized tree with oblong or ovate-oblong suddenly acuminate or caudate not very shining leaves 2.5—3.5" or sometimes up to 5.5" by 2", base rounded or obtuse, sec. n. 10—14 spreading, as strong as the two short lateral basal nerves, very closely and beautifully reticulate between and between the fine loops of the secondaries and the cartilaginous margin, reticulations raised both sides when dry. Petiole 3—75" glabrous. Recept globose or somewhat pyriform pedicelled 25—4" diam., depressed globose, slightly or prominently umbonate (ostiole often however perforate like other figs after escape of the fig wasps), white, pink or blue, often verrucose, usually many, paired from the old leaf axils, some also from current leaf-axils. Basal bracts (at top of pedicel) not sunk in the base, membranous, broadly ovate, or triangular, sometimes deciduous.

Rocky ravines in the mountains. Singbhum! Ranchi and Palamau, Neterhat, 3000 ft.! Recept ripen April—June. Top of Mailagiri Hill, Bonai, *Cooper*!

Cooper's specimen was from a very bushy tree of about 3 ft. girth, with very nodose branchlets, small leaves 1.5—2.5" only and pisiform recepts with caducous bracts. All our specimens have pedicelled recepts and are apparently var. *affinis*. *F.B.I.* Blume describes his *glabella* as with recepts sessile. The pedicels are 1—2" only and slender.

Aerial roots have not been observed. Buds sometimes puberulous. Stipules 1—3".

6. F. nervosa, Roth.

A straight, sometimes large tree, with mouse-coloured tomentose twigs and buds. Leaves sometimes sub-opposite, oblong or oblanceolate, shortly suddenly acuminate or cuspidate, very dark above and shining both sides, attaining 10" by 4" but mostly 5—9", with rounded or cuneate 3-nerved base, the lateral basal nerves very short and not stronger than the secondaries; sec. n. 7—11 depressed in the lamina when fresh so that the leaf appears bullate, looping not far from the margin, closely reticulate between. Petiole 3—1". Recept subglobose 3—5" diam. (25—1", *King*), purple when ripe, on slender stipes thickened upwards, bracts at base of stipes (none at base of recept.) usually 2—3 connate.

Chiefly along nalas. Singbhum! Santal Parganas! Angul! Puri! Nowhere common. Recept ripen March—May. Evergreen, renews leaves March.

Attains 8 ft. girth near Lapangi (Angul). Bark smooth, blaze pale brown, then white, hard. Stipules 5", densely or thinly hairy. Leaves glabrous except some fine hairs along the midrib. Pedicels 3—5". "Male sepals 2 long, spatulate. Gall. fl. with 3, elongate, acuminate sepals. Fem. fl. with 3 lanceolate sepals. Achene ovoid acuminate." *King*.

7. F. infectoria, Roxb. Baswesa, Barsa-hesa, Pepe-hesa, Jojo-hesa, K.; Pakare, S.; Pakar, H., Beng; Kua-jari, Or.

A m.s. or large tree, epiphytic when young, with glabrous, oblong or oblong-ovate, less often ovate, rather abruptly shortly acuminate leaves 3" by 1.2" to 7" by 3.5", usually thinner in texture than preceding, margin often waved, base cuneate, straight rounded or slightly retuse, lateral basal nerves like the secondaries or more oblique, sec. n. variable in number 5—10, looping within the margin, nervules finely reticulate. Recept sessile or stalked, glabrous pubescent or tomentose, 25—3" or sometimes 5—7" sub-globose but without the broad base of *Rumphii* and *tsiela*, whitish or flushed with red, basal bracts free ovate or orbicular spreading, .07".

A common fig. Champaran to Purneah! Sant. Par. All districts of Chota Nagpur, wild and planted! Puri! Orissa States, common, *Cooper*. No doubt in all districts of the province. Recept Dec.—June.

A very variable tree. Bark pale. Buds usually pubescent. Leaves often distinctly pellucid-punctulate, very rarely points raised into small tubercles when dry as in *Rumphii* and *tsiela*, not nearly so closely nerved as in *glabella* and always with much longer petioles than that species. Base seldom subcordate. Sec. n. usually pale and conspicuous above when fresh with evident intramarginal loops. Petioles 1.5—3.5" slender. Stipules under 1" caducous. Tepals 3 or often 4 or 5 linear or lanceolate, filament and anther short and broad.

The following varieties occur in our area:

(α) **infectoria**, proper. Glabrous with recepts sessile.

Roxburgh says that "the bark is brownish ash-colour. L. oblong-cordate, waved, glabrous, 4—6", with few veins. Stipules about 2" long, slender, grooved, with a coloured gland round their apices (I think *petioles* are meant). Fruit sessile, white, size of a pea." This form is rare.

(β) var. **Lambertiana**, *King*. Syn. *F. Lambertiana*, *Miq.*

Pubescent on the pedicels and often recepts. Recept pedicelled.

It is described in the *F.B.I.* as having "coriaceous leaves, base broad rounded emarginate or subcordate, receptacles 3—5" diam., pedicel pubescent 2—3". Under it I include the following forms:—

a. Buds puberulous. L. 3—4", oblong to ovate, not at all cordate, sec. n. 5—8. Recept. 4—5" (in Jan.), glabrous except the base and the stout pedicel. Singbhum!

b. Branchlets and buds pubescent. L. 4—7", base not at all cordate, sec. n. 6—12. Recept. 6—7" (March), base, bracts and 4" pedicel pubescent, and one specimen collected near a stream in Horhap forest with *apical* bracts also pubescent.

Chota Nagpur: Singbhum and Ranchi!

c. Buds silky, slender shoots soon glabrescent. L. much as in last. Recept. *densely tomentose* all over, 6—7" diam., often sessile, bracts rounded, entire or one 2-fid. Recept. with the gall insects escaping in March. Ranchi!

Lac sometimes grows on *F. infectoria* and the Kols say that the fruit is very good to eat.

8. *F. geniculata*, Kurz.

A large tree with grey very lenticellate twigs, large oblong or ovate-oblong shortly suddenly acuminate leaves 5—7" long, not at all punctulate, margin sometimes undulate, base obtuse or rounded with 2 lateral basal nerves and sometimes 2 accessory weak ones added, sec. n. 8—12 translucent spreading looped some distance from margin, other intermediate often conspicuous and nervules very finely reticulate forming minute areoles whitish beneath, nervules slightly raised above. Petioles slender 2—3" often thickened at junction with midrib. Recept. axillary paired and crowding the branchlets and also clustered on raised tubercles at the old leaf scars, sessile or sessile, 2.5—3", depressed-globose, verrucose; basal bracts 3 broad, mostly 2-fid or lobed, with scarious or brown margins.

Wild in the forests of Singbhum (there used to be a tree on the hill in the Tholokabad forest on which the forest rest-house has been erected!). Frequent about Ranchi! Recept. unripe ones seen in Sept., flowering ones with dead galls and not quite nature male-flowers in March. Old leaves shed in February, and the tree is then nearly leafless.

Buds and shoots silky, pubescent or tomentose especially at the nodes, the buds on bursting throw off a number of very long leaf-scales (as well as stipular-coverings) 2—4" long by 3—5" broad, narrowly oblong and translucent and the young leaves are very membranous. Male flower with an oblique or split mouthed gamophyllous perianth and very broad anther. Female irregularly toothed or split. Receptacle with numerous filamentous scales among the flowers.

F. tjakela, Burm. Syn. *F. venosa*, Ait. is recorded in Hamilton's M.S. with the vernacular name of *Nata Pakur*, from Purneah. The true *F. tjakela* is a handsome tree with coriaceous oblong-ovate oval or oblong shortly abruptly acuminate leaves 3—7.5" long with broad rounded or sub-truncate or cordate base beautifully venose and polished when dry. The small recept. only 2" diam. are clustered on nodose tubercles mostly at the scars of fallen leaves. It is a tree of the Deccan and probably *F. geniculata* or a form of *F. infectoria* was the tree referred to.

9. *F. tsiela*, Roxb.

A low or large spreading tree, often epiphytic, without aerial roots, or "sometimes sending down aerial roots like a Banyan," C. G. Rogers. Leaves coriaceous elliptic, or oblong or narrowly ovate, more rarely ovate, 3.5—5.5", distinguished from those of *F. Rumphii* by the very short bluntly acuminate apex or entire absence of acumination, the apex being merely acute or obtuse, also by the larger number of sec. n., 6—12 each side above the basal ones, and not much stronger

than the intermediate, basal nerves usually 3 and 2 weaker ones. Receptis globose or globose-pyriform from a broad base, 4—5" diam., not wrinkled when dry, 1—2 axillary and from leaf-scars, sometimes purple in all stages of development, in other specimens white, often with large but not raised dots.

Frequent in the Central Provinces and likely to occur in Sambalpur and Kalahandi, but the only tree I have met with in Bihar and Orissa was one at Partab, in the south of Puri district! Fr. Jan.—Feb.

Bark smooth, white or greenish, blaze with a thin chlorophyll layer, then pink or red or banded pink and white. When the leaves are ovate they much resemble those of *F. Rumphii*. L. minutely punctulate (as in *F. Rumphii*), dots translucent when fresh, showing as minute tubercles when dry, base rounded, cuneate or oblique, sec. n. less conspicuous than in *F. Rumphii*. Petiole usually half to nearly as long as the blade, often appearing articulate to blade. Innovations and receptis sometimes puberulous or pubescent. Basal bracts very broadly ovate, more or less connate, small and only covering the broad base of recept, unequal, largest .05—.11".

As in other cases the perianth appears variable, male tepals broadly obovate to oblong-lanceolate, gill stalked broadly elliptic or lanceolate with hyaline margins, female broadly ovate or ovate-lanceolate, sessile.

King shows both M. and F. tepals as lanceolate and acute in *tsiela*, oblanceolate and obtuse in *Rumphii*. Roxburgh points out that the stipular scars are not durable in this species. The tree alluded to by Rogers might be *Rumphii*.

10. *F. Rumphii*, Blume. Duranga-hesa, K.

A large or m.s. usually very spreading tree with glabrous or hairy twigs, ovate or broadly ovate leaves 4—6" gradually tapering to the finely acuminate tip and with straight or obtuse or sometimes widely subcordate base (and then again shortly cuneate or obtuse on the petiole) with 3—5 basal nerves and 5—6 sec. n. looping within the cartilaginous margin. Receptis oblong-obovoid or globose with very broad sessile base, glabrous or puberulous, wrinkled when dry, .6—.75" diam., black when ripe, basal bracts m.s. or large, extending one-fifth to one-half diam. of recept, glabrous, pubescent or silky, orbicular, almost hidden by large base of recept.

N. Champaran! Frequent along nalas in the hills of Singbhum, Hazaribagh and other districts of Chota Nagpur! Often in village lands and planted along roadsides where it does well, and is frequently called *Pipal*, than which it is usually a smaller, more spreading and less handsome tree. There appear to be two seasons for ripening the receptis, one in the r.s., the other Dec.—Jan. Ever-green (or some, esp. fruiting branches deciduous), renews leaves March—April.

Bark grey, not pitted as in the *Pipal*. Leaves conspicuously but minutely punctulate, margin often wavy, tertiary nerves meeting at an angle with those from the next secondary nerve or connected by nervules. Petioles 2—3", usually one-third to three-fourths as long as the blade, much stouter and stiffer than in the *Pipal*. Stipules .75—2" glabrous. Receptis often crowded along the branches, geminate, both axillary and from the leaf scars, young verrucose or slightly so.

Blume's description is rather too brief to be sure of this being his tree, but he quotes an excellent description and figure of *Rumphius* which leaves no doubt about it. King would appear to have seen only glabrous specimens. The tree is seldom epiphytic and I have seen it in the form of slender poles in the forest when quite young.

Lac sometimes grows upon it. Said to be a good fodder and the fruit is eaten.

11. *F. Arnottiana*, Miq. Duranga-hesa, K.; Sunum-jo, S. Sometimes also confused with *Pipal*.

A glabrous small tree, or sometimes a shrub, with broadly ovate leaves abruptly acuminate or cuspidate and with a cordate base, usually about 6" by 4—4.5", sometimes 7", the cusp only .5—8", base with 3 strong and 2—4 much weaker nerves and 5—8 strong translucent straw-coloured (when fresh) sec. nerves looped within the cartilaginous margin, tertiaries and nervules very beautifully and closely reticulate (much more so than in *F. Rumphii*), final nervules sunk in the lamina enclosing very small pale areoles. Petiole often nearly as long as the blade, slender. Recept. mostly from the leaf scars depressed globose .4—5" diam. sessile or very shortly pedicelled, at first white and faintly reddish and verrucose, finally purple or nearly black. Bracts thickened pulvinate at base.

Epiphytic on trees or rocks, chiefly on dry rocks or in rocky places. Gaya ghats, frequent! Monghyr Hills, *Cal. Herb. and Wall. Cat.* 4485 c! Karakpur Hills, *Kurz!* Singbhum, Hazaribagh and other districts of Chota Nagpur! Puri! Sambalpur! Ripe recepts found March—June and again (perhaps always var. *courtallensis*) Dec.—Jan. Deciduous about March or April, new leaves bright red, old often turn copper-coloured in Dec.

Stipules 1.3—2" long, membranous, glabrous.

Var. *courtallensis* has ovate leaves mostly 3.5—4" with base only slightly cordate or somewhat cuncate on the petiole. Recept. only .28—3", when ripe verrucose, flushed red, pedicelled, slightly umbonate.

12. *F. religiosa*, L. Asvattha, Sans.; Tepe-hesa, K.; Hesak', S.; Pipar, Pipal, H.; The Pipal Tree.

A very large tree, epiphytic when young, with rotund or broadly ovate, very long caudate, more or less pendulous leaves dark-green and shining above, 5—7" long, the slender tail nearly one-third to half the entire length of the blade, base cordate, with 3 strong principal nerves and 2 or 4 weak ones, margin often waved, undersurface sometimes dotted when dry. Petiole slender, 3—4". Recept. axillary geminate, depressed-globose, glabrous, black when ripe, .4—6" diam., sessile.

In all districts, wild and cultivated, epiphytic on old masonry or on other trees. Fr. r.s. Nearly deciduous in the h.s. in the dryer districts.

Stems often very irregular, peculiarly pitted when old. All parts except bracts quite glabrous. Leaf 5—7-nerved at base, sec. n. 8—10 (excluding the fine acumen), looped within but very close to margin, acumen many-nerved rarely only one-fourth length of whole leaf; stipules 1.75—3" long, linear subulate. Recept-bracts broad rounded, ciliate or pubescent, .15—23" long, sometimes one 2-lobed, hooded over the very young recept which thus appears pubescent.

Branches much looped for fodder and the fruit sometimes eaten.

NOTE.—*Waltich's* 4487 H.B.C. is partly *F. Rumphii* (on right of sheet) with unusually long acumen.

13. *F. bengalensis*, L. Ba: i, Ho.; Bare, M., S.; Barh, Bargat, H.; Bor, Beng.; The Banyan Tree.

A large tree epiphytic when young, sending down roots from the branches which form into accessory trunks. Leaves coriaceous, 4—8" long or attaining 10" by 7.5" in robust specimens, ovate to elliptic with rounded or sub-cordate 3—5-nerved base, old glabrous or slightly

pubescent beneath. Receptis sessile in pairs .5—.75" diam., subglobose scarlet when ripe, puberulous.

Throughout the whole province. Wild in the more humid forests, elsewhere often planted. Receptis may be found all the year round, but appear to ripen twice in the year, viz. April—June and Dec.—Feb. Nearly evergreen or quite so in favourable situations, renews leaves May—June.

Bark grey, blaze pale red, fibrous. New shoots pubescent. Leaves approximate near the ends of the branchlets, young softly pubescent and often reddish, sec. n. above basal 5—8, looping close to margin and united by numerous close tertiaries and reticulate nervules which are not raised. Petiole .75—1.7" long eglandular or mostly with a large, flat, smooth gland beneath near the confluence of the principle nerves. Stipules .75—1" long before falling (leaving a circular scar as in all other figs of our province). Receptis with 2—4, more or less connate, broad, obtuse bracts at the base.

Probably the best shade tree in the province. The timber is not of much value but is sometimes used for *sagar* wheels in Chota Nagpur and for well curbs. Birdlime is prepared from the latex. Useful for elephant fodder. The fruit is eaten in times of scarcity. The tree is easily propagated in the rains by inserting large cuttings (several inches in circumference). Seedlings grown by me were much attacked by a leaf fungus (*Septoria arcuata*),* which caused the fall of the young tender leaves and sometimes proves fatal.

14. *F. tomentosa*, Roxb. Janapa-hesa, K.; Chapakia-bare, S.; Barun, Kharw.

A large or small tree with tomentose or woolly branchlets and frequently with thin aerial roots. Leaves very variable in size, 2—8.5", easily recognised by the more or less persistent tomentum and prominent venation beneath by the cordate base and a curious longitudinal gland with depressed centre (when fresh) situated at the junction of the several principal nerves beneath. Receptis hirsutely white- or grey-tomentose .25—.5" diam. globose sessile.

Rarely epiphytic on trees but generally on dry rocks, often on the most arid hills, sometimes on old buildings, as on the Palamau Fort! Shahabad, Kymur Hills. Throughout Chota Nagpur! Santal Par! Puri! Sambalpur! Receptis appear in the axils of the new leaves in June and remain over a year, the old ones being at the leaf scars. Evergreen, renews leaves in June.

The aerial roots of this species never develop into trunks. L. oblong, ovate or somewhat obovate, acute or obtuse, with a many-nerved base and 5—8 sec. n. above the basal. Petiole .5—2". Stipules .9—1" (in June). Receptis with 3 large orbicular tomentose basal bracts reaching half way up the recept, apical bracts (closing the mouth) minute, glabrous. Anther mucous (it is apiculate in *F. bengalensis*).

15. *F. cuspidifera*, Miq. Syn. *F. gibbosa*, var. *cuspidifera*, F.B.I.

Erect or climbing, epiphytic when young, with brown striate branchlets, elliptic or ovate acute or acuminate leaves 2—5" by 1.25—2.5", stiff, but neither pubescent nor very scabrid, base 3-nerved. Receptis 1—2 axillary, subglobose, .3" diam., minutely scabrid, umbonate contracted into a stipes .2—.25" long with 3 small connate bracts at its base with spreading ovate free portions.

Singbhum! Santal Parg! Fr. Jan.

Buds narrowly lanceolate .3—.4". Leaf slightly scabrid on the nerves beneath and sometimes with scattered minute tubercles beneath, margin slightly thickened,

* Kindly identified by Miss Wakefield.

base rounded or cuneate, lateral basal nerves extending about one-third length of leaf or less, sec. n. 4—6 strong looping with several intermediate and many reticulate rather prominent pale nervules. Petiole 2—4". Tepals linear obtuse or spatulate, shortly closely pubescent or papillose, less so in female, bases attenuate and connate into a short stipes. Pistillode large and sometimes apparently exactly like the gall-ovary.

Both this and the next are united by King with *F. gibbosa*, Blume, probably correctly, but I have found it more convenient to describe the two varieties separately as species. Their general facies in the forest is different. *F. cuspidifera* is often erect with a trunk showing little or no signs of its having been epiphytic.

16. *F. parasitica*, Koen. Syn. *F. gibbosa*, var. *parasitica*, F.B.I.; Kaskasi jhari, Or.

A large epiphyte, with pale branches, rhomboid or subelliptic or ovate-rhomboid, usually oblique leaves up to 8" by 4.5", very hispid and somewhat shining above, pubescent and pale beneath, apex often rounded, base 3-nerved. Recepts mostly paired axillary and from leaf-scars, subglobose, 2—3" diam., umbonate, pubescent hirsute or hispid, contracted into a stipes 2—3" long with 3 small connate bracts at its base as in the last species.

Common on trees, often in the open. Ranchi plateau, common! Singbhum, mostly on the Porabat plateau! Gaya ghats! Hazaribagh (on rocks at Tatijharia)! Palamau, on the ghats! Angul! Fr. Feb.—April.

Buds narrowly lanceolate 2—2.5". Leaf scabrid beneath and less pubescent between the nerves with age, margin thickened, base usually very oblique and obtuse, venation much as in the last species but with more conspicuous loops to the sec. n. and another prominent series of loops between these and the margin. Petiole pubescent 3—4". Male fl. sessile with 5—6 linear acute (not at all spatulate) minutely papillose or puberulous tepals considerably exceeding the short stamen and pistillode or gall-ovary. Filament about equal to anther. In this species I have in several flowers found the male pistillode quite like that of the gall and occupied by an insect.

Probably only one variety, as *F. cuspidifera* is another, of *F. gibbosa*, Blume, a Javanese species. This form (*parasitica*) always appears to be epiphytic and even after the death of the host retains marked evidence of its previous habit. *F. gibbosa* is described by Blume with oblong to oblong-lanceolate or lanceolate leaves acuminate both ends and glabrous, scabrid on the margin, recepts pendulous.

17. *F. heterophylla*, L. f.

An infinitely variable shrub creeping, erect or sarmentose among bushes, twigs brown hairy hispid or with dense spreading pubescence, leaves always more or less hispid or scabrid above, unlobed with cordate or oblique base or very deeply and variously lobed, margins always more or less toothed, receptacles always more or less pyriform and hispid when young, mature sometimes sub-globose 5" diam., mouth broad.

Always in wet or watery places. Purneah! Patna! Angul! Recepts borne from Jan.—May, perhaps also at other times.

The following forms are found:—

a. *scabrella* (*F. scabrella*, Roxb.). L. linear or linear-lanceolate 1.5—3" not lobed, usually rough both sides, petioles 1—2", stems 3—5 ft. high. Purneah!

β. heterophylla proper. L. 1—3" usually ovate, shallowly or deeply pinnatifidly, 3—many lobed on the same plant, very scabrid at least above. Petioles mostly short but up to 1" usually hispid. Stipules oblong-lanceolate .15—.3". Often creeping. Banks of Ganges, Bankipur! Banks of Mahanadi, Angul!

γ. repens (*F. repens*, Willd.). With usually slender erect branches, not creeping. Twigs hairy or hispid. L. elliptic to broadly ovate-oblong and unequal-sided 3—4", in young plants under dense shade 4—6" very membranous, above hispid or scabrid, beneath softly pubescent or glabrescent, sec. n. 5—6 of which one from base which is obtuse or deeply cordate, petiole often 2—3" in young plants or only .4—6" on some branches. Receptis axillary and from leafless axils solitary young ellipsoid apex umbonate with a deep pit, older subglobose or pyriform, ripe .75—1" long. Peduncles .2—3" or long and slender. Perianth of gall flower long, sepals 4 linear .1—1.2" often alternate, pedicel long. M. perianth lobes 3 shorter than in gall. St. 1.

The name *repens* for this variety is unfortunate.

δ. sarmentosa, Haines. Erect or scrambling up to 15 feet high and 8" girth. Twigs with dense spreading pubescence. L. very scabrid 3—5" oblong acute or acuminate with subcordate slightly unequal base, scabrelous beneath, shallowly serrate, sec. n. 6—7 one from base and a brown gland on the mid-rib at their origin. Petiole .5—6" hispid. Stipules oblong-lanceolate caducous .2". N. Purneah!

18. *F. asperrima*, Roxb.

A small tree up to 30 ft. high, somewhat resembling *F. hispida*, but at once distinguishable by the alternate leaves. Twigs hispid. Leaves 3—6" elliptic or ell. oblong acuminate, very scabrid above with minute discs and bristles, softly pubescent beneath, sec. n. 4—5 of which one from the base, tertiary scalariform, strong beneath. Petiole .6—1.5", scabrid. Receptis paired .6—.7" or 1—1.25" diam., globose, outside-tomentose and with close bulbous-based hispid hairs, mouth with numerous erect yellow bracteoles, inner linear, outer broader.

Mals of Orissa! Receptis March—May.

A very distinct species. The leaves are described in the *F.B.I.* as 1—1.5" only; these are probably young. Ripe receptis greenish-yellow, peduncle .3" with scattered small bracts, single axillary and from leaf-scars. M. fl. puberulous below, tepals 3—6 linear-oblanccolate, anther 1. Gall fl. tepals 6, similar. Pedicels and inside of recept villous.

19. *F. cunia*, Ham. Podho, ari, M.; A: i, Ho.; Hor-podo, S.; Kurur, Th.; Bhoka-dumbar, Beng.; Potkuli, Or.

A small or mod.-sized tree with elliptic or oblong-lanceolate, entire or serrate leaves easily recognised by the semi-sagittate base and very short petiole, basal auricle of leaf 3—4-nerved. Receptis in pairs or clusters on long (often several feet) mostly leafless drooping scaly branches often crowded near the root.

Common near streams and on cool, damp slopes of hills. Throughout the province! Fr. most of the year, usually ripe May—June. Evergreen or sometimes leafless in May.

L. 6—15" long, acuminate, often scabrid above, more or less pubescent beneath, sec. n. 9—14. Petiole .2—6". Stipules .75—1", linear-lanceolate puberulous. Receptis globose or pyriform, hispid, red-brown or quite white when ripe, sometimes half buried in the soil, pedicel very short, bracts 3 at top of pedicel. Style of gall fl. very short lateral, of female very long with 2-fid stigma.

Lac is often cultivated on its branches which is sold at 2 as. per seer in Singbhum or about one-quarter the price of Kusum lac. The ripe fruit is eaten.

- 20. *F. hispida*, L. f.** Syn. *F. oppositifolia*, Roxb.; Kota Durga, Th. Kotang, M.; Sosokera, K.; Seta-podo S.; Dumar, Kharw.; Poroh, Mal P.; Thedu, Gond.; Tambol, Balu-dumari, Or.

A small tree 10—30 ft. high. Branches hispid, internodes hollow. Leaves mostly opposite, ovate-oblong or somewhat obovate 4—9", rather scabrid above and hispid beneath. Receptis numerous fascicled on both the trunk and branches, often on leafless drooping branches, also sometimes axillary, globose, closely shortly hairy, umbo prominent.

Along nalas, throughout the province! Common in the damper districts, not common in the dryer. Fr. Jan.—Feb.

Rarely 3 ft. girth, often fruiting as a shrub. Dwarf, slow-grown plants sometimes have the internodes nearly solid. L. toothed, rarely entire, cuspidate, base cordate or rounded mostly 5-nerved, sec. n. 5—7 strong and raised beneath looping close to the margin, tertiaries scalariform raised beneath and reticulate between. Petiole .5—1.5". Receptis 1" diam., yellowish when ripe, base narrowed to a slender or very short stalked with scattered bracts, sometimes also a true pedicel very short with a subverticil of 3 bracts at its apex, hispid. Style hispid-hairy, stigma tubular. Male fl. very few.

Bark yields a fibre. The fruit is eaten.

- 21. *F. sœmocarpa*, Miq.**

A low spreading or straggling bushy shrub 3—4 ft. high with hirsute branchlets. Leaves crowded 4—8" opposite lanceolate or oblanceolate, acuminate both ends, base with 1 lateral nerve each side not stronger than the 8—10 secondaries which are upcurved close to the margin, nerves strigose or pubescent beneath. Petiole .3—8". Receptis 1—2 from the axils of fallen leaves or on short leafless branches globose with contracted stipiform base or ovoid or pyriform 1—1.3" long excluding the .5—7" stipes, hirsute, often 8—10-ribbed or verrucose, with scattered bracts on the stipes extending on to the body of the recept, apex with large-bracted umbo.

Rocky or stony beds and banks of rivers. Bettiah! Fr. practically all the year round.

This shrub somewhat resembles *F. lanceolata* and may be more common than is supposed in the province.

Leaves with lower surface minutely dotted with tubercles. Receptis "yellow-green and warted with yellow when ripe, the ridges terminating in a fleshy cornice," J.D.H. Branchlets bracteate. The top of the stipes usually with 3 deciduous bracts.

- 22. *F. scandens*, Roxb.** Madhur lata, S.

A creeping and climbing shrub with the new shoots rusty and hispid. Leaves ovate or elliptic-ovate acute or obtuse 2" by 1" to 4" by 2.75", mature stiff and harsh, but scarcely scabrid above, glabrous or with sparse short hairs on nerves beneath, base obtuse or subcordate or rounded 3-nerved, sec. n. 2—5 looping close to margin, intermediate 0 or very short, nervules very reticulate sunk and green when fresh, pale and rather obscure when dry. Petiole .3—75". Receptis mostly solitary, axillary, hispid or hispidulous, globose .3—5", or sometimes narrowed into a very short stipes above the .3—4" long pedicel which is 3-bracteate at the apex.

Adhering to trees or rocks by rootlets. Sameshwar Hills! Valleys in Singbhum and on the Porahat plateau! Manbhum, *Campbell!* Parasnath, on the northern side! Sant. Par., rare! Mayurbhanj, 2500 ft. Fr. Jan.—May.

The upper, especially the flowering branches are often spreading and may somewhat resemble young plants of *F. parasitica*, the fruit of which is also similar, but has a longer stipes and shorter pedicel. Indeed there seems considerable alliance between Section 1, *Palæomorphe* of King, which is monandrous and Sect. 6, *Eusyce*, described as 2-androus. *F. scandens* is 1-3-androus (I have found it 2-3-androus and *Roxburgh* draws it as 1-androus). M. and gall recepts in my specimens are larger (4-5") than the female (3" diam.). M. perianth brown, short, irregular in shape, tepals free or nearly so, 4 (always?), anthers 2-3 large with very short filaments. Gall tepals 3-4 lanceolate or linear, glabrous, style subterminal. F. tepals 2-4 linear free. Achene oblong.

22a. *F. palmata*, Forsk. Syn. *F. caricoides*, Roxb. Angjir, Vern.

A small tree with usually well-developed main stem, young branches pubescent or tomentose, glabrescent. Leaves 5-10" long, rather membranous broadly ovate, cordate, mostly simple, rarely lobed two-thirds down, crenate- or dentate-serrate or coarsely serrate, pale, scabrous or hairy above, hairy to villosely tomentose beneath, base with 3 strong and 1-2 weaker nerves, sec. n. 3-6 on mid-rib. Petiole 1-2" long. Recepts peduncled, sub-globose to pyriform, umbonate, 5-1" diam., tomentose or pubescent, yellowish when ripe.

Occasionally cultivated in Northern Area. Bettiah, *Hieronymus!* Patna and Gya, *Ham.!* Shahabad, *Ham.*

Probably a cultivated variety of *F. carica* and often scarcely distinguishable.

22b. *F. carica*, L. Angjir, Vern.; The Fig Tree; Caprifig (the male uncultivated form).

A spreading much branched small tree or shrub, branchlets slightly pubescent or hispid. Leaves coriaceous, nearly all angular, lobed or deeply palmate and segments again sometimes lobed, above deep green somewhat scabrid or hispid, beneath downy or sometimes tomentose or sometimes only scabrid, margin repand dentate. Female recepts more or less pyriform, peduncles very short, male recepts apple-shaped or spheroidal on longer peduncles attaining 1-3". The cultivated fig often, however, appears androgynous.

Rarely cultivated in our area. Patna, *Ham.!*

This is the well-known European fig which De Candolle considers may have been indigenous over the middle and southern part of the Mediterranean basin. *Aitchinson* ("Botany of the Afghan Delimitation Commission," *Trans. Linn. Soc.*, Second Series, iii, p. 109) says that it appears to be indigenous also in the Badghis country and East Persia where he found it in clefts of rocks and escarpments of hill-sides. The leaves in these wild plants are very variable and *F. palmata* is probably only a cultivated descendant. The male fl. in both has about 6 lanceolate segments, gall fl. similar or segments nearly free or free and linear lanceolate as in the female flower.

23. *F. lanceolata*, Ham. Gara-loa, K.; Gui, Kisan; Bambud, Kharw.

A glabrous shrub 3-5 ft. or even up to 10 ft. under shade, usually with prostrate stems or branches and resembling in many respects

F. sœmocarpa. Leaves crowded above, alternate, lanceolate acuminate attaining 8" by 2", entire or distinctly toothed, dotted beneath. Receptes in dense clusters on woody branchlets near the root, red when young with yellow or pale warts, puberulous or glabrous, 1.5–2" diam., top flattened or depressed.

In the rocky beds of streams. Singbhum, chiefly in the Saranda tract! Palamau, ascends to 3000 ft. at Neterhat! Sant. Parg.! Also noted by me from the Sameswar Hills, Champaran, but without examination, and this may have been *F. sœmocarpa*. Fr. May–June.

Easily distinguished from *F. sœmocarpa* by the glabrous twigs and alternate leaves which are broadly linear or linear-lanceolate or lanceolate, but very rarely slightly oblanceolate, sec. n. 6–14 fine spreading short glabrous.

24. *F. glomerata*, Roxb., Loa, K., S.; Dumar, Gular, H., Kharw.; Dumbar, Jagidambar, Beng.; Dimri, Dumri, Or.

A mod.-sized or large tree with ovate, ovate-lanceolate or elliptic dark green leaves 4–7.5" by 1.75–3.25" narrowed to an obtuse or subacute tip and to an obtuse or rounded rarely acute 3-nerved base, paler beneath with microscopic green dots. Receptes 1–2" diam. globose or pyriform pubescent on cauline and rameal branches which are usually short, or sometimes up to 2 ft. long; occasionally axillary receptes are also found.

A common fig. in valleys and on northern slopes, also frequent in villages. Throughout the province. Fr. March–June. Often more or less deciduous Oct.–Nov. Renews leaves Dec.–Jan.

Attains 10 ft. girth in Purneah, with buttressed trunk. Bark grey "rusty-greenish," Roxb., usually marked with the annular stipular scars which (as in many other figs) grow in circumference with the trunk. L. usually glabrous above, often pubescent on the nerves beneath, sec. n. 4–7. Petiole .75–1.75". Stipules ovate-lanceolate, .5–1". Receptes red or reddish, with M., Fem. and Gall flowers in the same recept. M. near the mouth, tepals 3–4 inflated. Perianth of Gall and Fem. toothed. Achene granulate, stigma clavate.

The fruit is largely eaten.

25. *F. macrophylla*, Roxb. Syn. *F. Roxburghii*, Wall.; Kota, M.; Gara-sosokera, Kol.

A handsome low spreading tree with very large broadly ovate or elliptic-ovate cordate-based leaves 8" by 5" to 18" by 12", more or less repand-toothed or coarsely serrate (sometimes entire in cultivated plants) glabrescent above, shortly softly pubescent beneath. Petiole 1–4" stout. Receptes pyriform, 2–2.5" diam. on peduncles 2–3" long clustered on cauline knobs and short lateral leafless branches.

Along streams. Above 1500 ft. in the Saranda Forests and on the Porahat plateau! Kochang, Wood, Gamble! Angul! Sambalpur. rare!

Dark brown. Branchlets hollow or with large pith, young pubescent. L. with 5–7-nerved base, sec. n. 5–7 high up on mid-rib and extending to margin where they enter the teeth, tertiaries mostly scalariform fine but prominent. Stipules 1". Peduncles pubescent bracteate at their apex, base of recept produced into a stipes or not (the stipes is .5" long in some specimens). M. fl. tepals large inflated, stamens 2–3. Gall and fem. with 2–3-lobed perianth. Achene granulate, viscid, style long lateral curved, hairy, stigma tubular.

The fruit is eaten. Leaves said to be a good fodder.

FAM. 126. SALICACEÆ.

Trees or shrubs, nearly always dioecious. Buds perulate. Leaves alternate simple, stipulate. Flowers in close bracteate spikes (catkins), one to each bract, ebracteolate. Perianth 0 or rudimentary; a median scale, scales or glands or a cupular or annular organ (disc or rudimentary perianth) present. Stamens 2 or more with free or connate filaments. Ovary of 2, rarely 3 connate carpels, 1-celled with parietal placentation. Ovules usually many, erect, anatropous on the lower part of the placenta. Fruit capsular, 2—4-valved. Seeds few or many, small, exalbuminous, with thin testa and a basilar pencil of hairs. Embryo straight, cotyledons plano-convex, radicle short inferior.

1. SALIX L. Willow.

Leaves usually narrow. Disc or perianth of 1—2 separate glands or scales. Stamens usually few (up to 10 in our species, which is unusual). Bracts entire.

1. *S. tetrasperma*, Roxb. Nachal, K.; Gada-sigric', S.; Chiur, Kharw.; Bes, H.

A tree or in one form a shrub, with silkily pubescent shoots, lanceolate or oblanceolate to ovate-lanceolate acuminate leaves sparsely hairy or glabrescent and pale glaucous beneath. Catkins terminating the short lateral shoots, 1.5—4" long, pubescent. Disc glands very broad fleshy.

Along rivers and streams, apparently in all districts, but nowhere very common. Champaran, attaining 6 ft. girth in Ramnagar! Purneah! Moughyr! Santal Par.! All districts of Chota Nagpur! Athmalik (Orissa)!

Fl. Oct. usually, sometimes however in Feb. or May and fruits ripen soon after. It is leafless shortly before flowering and flowers at the ends of the new lateral shoots.

There are two distinct forms in our province (see below) agreeing in the large glands, male-glands anterior nearly as long as the ovate to obovate or spatulate, .06" pilose bract and often as broad, sometimes faintly crenate, posterior gland smaller 2-lobed, 2 small lateral side-lobes have also been noted by me in some specimens! Female gland 1, semicircular, and recognisable in fruit. Stamens .15" long, 5—10, often 7, pilose at base. Capsules .17—2" long on slender stipes half as long to nearly as long as themselves. Stigmas 2, entire or 2-lobed.

Var. *α. tetrasperma* proper?

A small tree or shrub with broadly lanceolate or oblong-lanceolate leaves crenate-serrate with rounded base, thinly silky beneath, sec. n. 12—15 fine but distinct and raised beneath.

Santal Parg.! Along streams, sometimes in thick forest.

Var. *β.* (In some respects this agrees better with *S. acmophylla*, Boiss.)

A m.s. or large tree with narrowly lanceolate leaves serrulate or entire with cuneate or rounded base, quickly glabrescent, very white beneath, sec. n. as many or more than in last but obscure and not-raised beneath.

The commoner form.

Baskets are made from the branches.

FAM. 127. CASUARINACEÆ.

Trees or shrubs with cylindric grooved jointed branchlets and leaves reduced to subulate scales connate at base and forming short sheaths at the nodes. Flowers very minute, monœcious.* Males in slender terminal spikes formed of numerous (finally) whorled subulate bracts adnate to the rhachis, each bract subtending a flower consisting of 1—2 median scarious tepals and a pair of (lateral) bracteoles, stamen 1 with short filament and large anther. Fem. in ovoid or globose heads terminating abbreviated lateral branchlets, heads with whorls (members of one whorl alternating with those of next so that the bracts appear spiral, as they do in the *very young* male spikes) of small bracts subtending pairs of very small, finally accrescent, lateral bracteoles. Perianth 0. Ovary of 2 median carpels with an anterior fertile cell and a posterior barren cell or the latter suppressed,† stigmas 2 filiform very long. Ovules in the fertile cell 2, orthotropous, basal or sub-basal. Fruits together forming a cone with the achenes enclosed in the pairs of greatly enlarged coriaceous or woody bracteoles which open when the winged seed is ripe, wing terminal. Testa fused with the wall of the achene, albumen 0. Cotyledons flat equal, radicle very short, superior.

1. CASUARINA, Forst.

(The only genus.)

1. *C. equisetifolia*, Forst. Jamu, Or.; Bilaiti-jhau, Beng.; Beefwood Tree.

A large and handsome tree with drooping branches, very slender sulcate branchlets with whorls of 6—8 scale-like leaves, the internodes .2—3" long on the branchlets, only .1" on main shoots which are tomentose with recurved subulate-setaceous scales .1" long and usually 8 in a whorl. Male spikes usually numerous at the ends of the same branches on which the females are borne lower down, .5—9" long, slender cylindric or slightly fusiform, bracts subulate with pubescent margins. Fem. heads in flowers only .1—1.5" long, ellipsoid, terminating short lateral branchlets below the male branchlets. Fruiting head .5—7.5" long having a general superficial resemblance to that of a coniferous tree.

Often planted but especially on the sandy soils of the Puri coast, where it is rapidly becoming important. Fl. May. Fr. appears to ripen irregularly from June onwards (possibly from flowers of previous year).

Attains 6—7 ft. girth. The branches are dimorphous, those with the longer internodes being deciduous. Male anterior tepal scarious .02" long only, larger than the posterior, slightly hooded over the young anther. Flowering female heads tomentose, bracts subulate externally erect, with a broad horizontal base internally which becomes woody in fruit but the rest of the bract remains unchanged and is scarcely visible in fruit, stigmas exceeding the head, flexuous, bracteoles at first

* Hooker, under *C. equisetifolia* in *F.B.I.* says "diœcious?" Prain in *Bengal Plants*, probably following Roxburgh, says diœcious (without the query), but the trees growing in the Calcutta Gardens are certainly *monœcious*, and I have never seen them otherwise.

† Fide Engler in *Nat. Pflanz. Fam.*

minute in flower, finally .25" long, valvately closed till the seed is ripe and projecting as sharp-edged bosses. Seed with wing .18" long.

The plantation of *Casuarina* at Puri was commenced in 1916 actually on the sea shore. Already however numerous trees along the Orissa coast showed that the locality, which is nearly pure sand, would grow *Casuarina*. At Konarak on rocky soil trees said to have been planted in 1905 showed growth equivalent to 3" girth per annum. Some plants of 3.5 years old were about 25-30 ft. high. Large *Casuarina* occur on the sea face in the Mahanadi delta, but although *Casuarina* is said to be native on the Chittagong coast, there is no evidence that it is native on the Orissa coast and natural reproduction has not been observed. In South India the growth is probably faster and the average age of felling is said to be 10 years. *Gamble* gives the weight as 50-60 lbs. and says that it is hard and difficult to work.

FAM. 128. CERATOPHYLLACEÆ.

Slender submerged water plants with whorled leaves 2—several-times forked, segments filiform denticulate on the outer edges. Flowers minute. Male and female axillary, on the same plant, usually solitary and irregularly scattered, rarely 2 males in one whorl. Perianth (or involucre) of 6-12 narrow subvalvate appendaged (or 2-fid) segments usually pale in the M., green in the Fem. Stamens in the M. 12-30 on the convex receptacle, with very short thick filaments and erect extrorse 2-celled anthers, connective truncate or 2-3-toothed at the top. Ovary in the Fem. of 1 ovoid carpel, 1-celled, with a subulate style stigmatic on one side and a solitary pendulous straight ovule. Fruit a small coriaceous ovoid or ellipsoid somewhat compressed nut terminating in the elongate subulate persistent style, often also with two sub-basal styli-form appendages. Seed with scanty albumen. Embryo with 2 straight cotyledons, the first 2 leaves of the plumule decussate with them, radicle very short inferior.

NOTE.—This family appears to have affinities with the Ranales. There is only one genus.

1. CERATOPHYLLUM. L.

1. *C. demersum*, L.

A water weed superficially like a submerged *Myriophyllum*, collapsing in a tassel when removed from the water, 6" to 3 ft. long, densely leafy. Leaves once or twice bifurcate, .5-1" long, segments .01-.03" broad, showing transverse partitions with a strong magnifying glass, and outer toothed edges. M. fl. in separate axils from the female. Perianth irregularly 10-12-fid, stamens 10-30, anthers large white with white watery pollen. Ovule showing through the translucent ovary. Easily recognised in fruit by the pedicelled ellipsoid, often dotted, nuts .15" long, furnished with one terminal and 2 sub-basal appendages much longer than the nut, some small accessory spines also sometimes present.

Probably common throughout the province (as throughout India) in still waters, but usually only flowering in shallow water. Fl., Fr. apparently most of the year. Several sub-species or varieties (possibly species) exist, but the material from Bengal is excessively meagre and there are no specimens actually collected in our province either at Kew or Calcutta. The plant occurs in Europe.

CLASS.—MONOCOTYLEDONES.

FAM. 129. ALISMACEÆ.

Marsh or water plants supplied with laticiferous vessels, usually with a thickened rhizome. Leaves radical, floating or aërial, palmately nerved or nerves parallel. Flowers regular, 1—2-sexual, mostly verticillate in branched radical inflorescences. Calyx and corolla distinct, each of 3 members or corolla 0. Stamens 6—many, hypogynous or perigynous, anthers erect basifixed, 2-celled, extrorse or (*Butomeæ*) introrse. Carpels 3—6 or more, 1-celled, free, sometimes stipitate, styles and stigma simple. Ovules 1, 2 or many in each carpel, anatropous with 2 integuments. Fruit of achenes or follicles. Seeds small, exalbuminous. Embryo straight or conduplicate.

- | | |
|--|-------------------------|
| I. Ovules solitary, basilar. Fruit of achenes:— | |
| Fls. 2-sexual. St. 6—9. Receptacle flat | 1. <i>Alisma</i> . |
| Fls. polygamous. St. 6. Receptacle flat | 2. <i>Limnophyton</i> . |
| Fls. 1-sexual. St. many. Receptacle elevated | 3. <i>Sagittaria</i> . |
| II. Ovules several on the inner wall. Fr. follicular:— | |
| Stamens 8—12 | 4. <i>Butomopsis</i> . |

1. ALISMA, L.

Scapigerous herbs with lanceolate, cordate or sagittate leaves and delicate white or pink 2-sexual flowers arranged in branched whorls on a pyramidal panicle. Sepals 3 persistent. Petals 3 deciduous. Stamens 6 or 9. Carpels few to many on a small flat receptacle. Ovule solitary, basilar in each carpel. Fruit of coriaceous or hard achenes. Seed erect with membranous testa and horseshoe-shaped embryo.

- | | |
|---|-------------------------|
| I. Leaves always longer than broad, rarely subcordate, 5—7-nerved | 1. <i>plantago</i> . |
| II. Leaves sometimes broader than long, cordate, over 10-nerved:— | |
| Leaves coriaceous, rounded. Style slender persistent | 2. <i>reniforme</i> . |
| Leaves membranous, acutely lobed. Style very short deciduous | 3. <i>aligococcum</i> . |

1. *A. plantago*, L.

A large marsh herb 1—4 feet high with the panicle. Leaves 6—8" erect or spreatling, mostly lanceolate or ovate-lanceolate 5—7-nerved, but varying to linear or subcordate. Flowers 3—4" diam. very delicate, in paniced whorls. Achenes numerous, over 20, membranous, compressed; style slender, deciduous.

Marshes and ponds. Towards the Nepal boundary from Bettiah to Purneah. Fl. c.s. Annual in our area! and never attaining the dimensions of the English plant.

2. *A. reniforme*, Don.

Habit of *A. plantago*, with an annual stem and 13—15-nerved orbicular-ovate leaves 2.5" by 2" to 4.5" long by 6.5" wide (broader than long), with rounded or retuse tip. Flowering stems 12—30",

branches 3—4 or usually 6 in a whorl with bracts up to .5" long in the lowest whorls. Flowers white or pink-purple, .5" diam. Fruiting sepals persistent. Achenes 5—8 turgid, not whorled, .08" long awned with the style, obovoid and dorsally ribbed.

Marshes. Throughout the plains of India according to the *F.B.I.* The nearest locality to our area whence there is record of its collection is the Tarai and it will probably be found in Purneah.

3. *A. oligococcum*, *F. Muell.*

Similar habit or, apparently, sometimes submerged with very flaccid leaves. Leaves 3—6" by 2—3" membranous broadly ovate with cordate base, acute lobes and narrow sinus, 11—17-nerved. Panicle much smaller, 6—9" long and broad, at once recognisable from the large lanceolate bracts of the lower whorls which attain 2—3" long. Fruiting carpels whorled, .08", ridged and muricate.

From the United Provinces to Bengal, probably therefore in our area. Fl. Sept.

2. LIMNOPHYTON, *Miq.*

Characters of *Alisma* but flowers polygamous. Seed with very woody endocarp and with a hole on each side between the endocarp and the exocarp.

1. *L. obtusifolium*, *Miq.*

A dwarf or robust marsh herb with many-nerved reniformly-sagittate to triangular with lanceolately lobed leaves 6—12" by 4—8". Petiole 1—3 ft. long. Flowers numerous, white, .3—5" diam. in whorls on the branches of a large panicle 2—4 ft. long (with the peduncle). Upper whorls mostly male, lower 2-sexual. Achenes in a globose head .5—75" diam., obovoid, turgid with fleshy epicarp wrinkled when dry.

Marshy places, tanks, etc. Bengal, *Griffith* (without locality)! Chiefly in lower Bengal, *Kurz*, etc. and as it extends to the Deccan and Saharapur probably occurring in Orissa. Fl. Feb. Fr. March, July.

The number of flowers or members in a whorl is very variable, only about 5 in weak specimens, crowded in strong ones. Bracts scarious. Pedicels in flower filiform.

3. SAGITTARIA, *L.*

Aquatic herbs, erect in shallow water or with submerged and floating leaves in deep water, often cordate or sagittate. Flowers rather large, 1-sexual or polygamous in paniced or spicate whorls. Sepals 3 herbaceous. Petals 3 deciduous. Stamens 6 or more with filiform compressed filaments. Carpels very many, laterally flattened, crowded on a large globose or oblong receptacle. Style ventral or apical, stigma papillose. Ovule solitary, basilar. Fruit a globose or oblong head of flattened crested or winged achenes. Embryo horse-shoe-shaped.

Leaves usually hastate or sagittate. St. about 24 in M. fl.

Achenes with an entire wing. 1. *sagittifolia*.

Leaves broadly ovate deeply cordate. St. 6—10 in M. fl.

Achenes with a broad toothed wing all round. 2. *guayanensis*.

1. *S. sagittifolia*, L. Arrow-head.

An aquatic with the leaves in deep running water strap-shaped, when floating with lanceolate or elliptic blades and in shallower water emerging and with a hastate or sagittate blade 2—8", usually 4—6" long, usually acute with more or less diverging basal lobes. Petiole very spongy, 3-gonous. Flowers .5—.75" diam., white with usually purple centre, sessile or shortly pedicelled, upper male with longer pedicels, in 3—5 whorls of 3—5 flowers each on a scape 6—more inches long. Achenes in a globose head .6" diam. obliquely obovate, flattened, with broad entire or subcrenate wings.

Purneah! Monghyr, *Kew Herb.*! Sarguja, *Wood!* Fl. c.s.

The plant extends to England where it is common in some parts.

Stoloniferous with the stolons ending in a tuber. Petals .3—.4" long. The stamens are about 24 in the male fl., reduced to staminodes in the female flowers. *Prain.*

2. *S. guayanensis*, H., B., and Kunth. Syn. *S. cordifolia*, *Roxb.*

Leaves apparently always floating (?), broadly ovate, deeply cordate, obtuse or rounded, 1—4" long by 1—3.5" broad, with rounded auricles and obscure radiating nerves. Petiole long or short, often hairy, as are the scapes and pedicels. Flowers white .7" diam., in few close irregular whorls, usually ternate, the 2-sexual 9—12-androus, the upper male more numerous 6—12-androus. Petals obovate cross. Achenes flat, surrounded by a broad prominently toothed wing.

Purneah, *King!* Birbhum, *McLelland!* Ranchi, *Mokim!* Hazaribagh, *Clarke!* Fl. Aug.—Oct.

Roots a dense fibrous tuft, apparently annual. Leaf sheaths very broad, then rather suddenly contracted to the long flexuous petiole. Leaf nerves about 9, distinct when dry, reticulate between. Anthers cordate at base (they are rather sagittate in *sagittifolia*).

4. BUTOMOPSIS, Kunth.

A scapigerous marsh herb somewhat resembling *Alisma* in habit, with elliptic leaves. Flowers in bracteate whorls or a terminal umbel. Sepals 3 persistent. Petals 3 white membranous fugacious. Stamens 8—12 with oblong anthers. Fruit of 4—6 (6—7, *F.B.I.*) erect membranous follicles. Seeds very many, minute, smooth.

1. *B. lanceolata*, Kunth. Syn. *Butomus lanceolatus*, *Roxb.*

Erect 8" to 2 ft. high with erect lanceolate or elliptic 3—7-nerved leaves 2—6" long with very long petioles enclosed by sheaths below. Scape far exceeding the leaves usually with a single terminal whorl of about 5 flowers .75" diam. on very long but unequal pedicels 1—4" long. Sepals oblong-ovate, wrapping round the young fruit. Follicles shortly beaked, .35".

Rather common in wet places, rice-fields, etc. Sikkim tarai, near Purneah! Ranchi! Singbhum! Manbhum! Probably in all districts of the provinces. Fl., Fr. Sept.—Jan.

FAM. 130. NAIADACEÆ.

Aquatic herbs of various habit. Leaves simple, opposite or alternate entire or serrate, submerged or floating, sheathing and sometimes stipulate at the base. Flowers inconspicuous, usually green, 1—2-sexual, in spikes or racemes more rarely axillary solitary or clustered, rarely dicæious, sometimes inflorescence included in a spathe. Perianth 0, or of 3—4 valvate tepals or tubular and almost hyaline. Stamens 1—6, hypogynous in the 2-sexual flowers, solitary or connate in male flowers, anthers 1—2-celled. Carpels 1—6, style long or short, stigma various. Ovule 1 in each cell carpel, rarely (*Aponogeton*) 2 or more, erect or pendulous. Fruit of 1-seeded achenes, drupels or (*Aponogeton*) follicles. Seed exalbuminous, embryo straight or curved, radicular end very large.

The description of the Family excludes the *Juncaginaceæ*, but includes the *Potamogetonæ* and *Aponogetonæ* which are treated as separate families by some botanists.

I. Flowers 2-sexual:—

A. Perianth consisting of 1—4 sepals:—

Sepals 1—3, white or coloured, membranous. St. 6 or more

Sepals 4,* herbaceous, green, anthers 4 sessile

B. Perianth 0. Anthers 2, sessile

II. Flowers 1-sexual or dicæious. Stamen 1:—

Perianth 0. Style long with oblique peltate stigma.

Achenes 2—9

Perianth hyaline. Stigmas 2—4 sessile, slender. Achene one

1. *Aponogeton*.2. *Potamogeton*.3. *Ruppia*.4. *Zannichellia*.5. *Najas*.**1. APONOGETON, L. f.**

Aquatics with tuberous rootstock and submerged or floating leaves longitudinally nerved and with numerous transverse nervules, membranous. Flowers 2-sexual on long scapes bearing solitary or geminate, often unilateral spikes enclosed when young in a conical deciduous sheath. Perianth rarely of 3 segments, usually 2 or only 1, white or coloured, deciduous or (if only one) with persistent broader accrescent base. Stamens usually 6 in two whorls, seldom more in 3—4 whorls, unequal. Carpels usually 3, seldom 4—6, with short or long style and discoid or decurrent stigma. Fruit coriaceous follicular. Ovules 2 basal, or several 2-seriate on the ventral line, anatropous. Seeds erect exalbuminous, embryo straight.

Leaves floating, oblong, 3—5-nerved. Tepals 2 shorter than the 4—8-seeded follicles

1. *monostachyon*.

Leaves submerged, lanceolate to linear-oblong, 3—7-nerved.

Tepals 1—3, white, longer than the 1—2 seeded follicles

2. *crispum*.**1. A. monostachyon, L. f. Ghechu, H.**

Rootstock about 1" by 3—5" diam. stoloniferous. Leaves floating, oblong, more rarely linear-oblong, 2·5—8" by ·75—1·5", acute or obtuse with cuneate rounded or cordate base, 3—5-nerved, petioles sub-3-gonous. Spike solitary on the scape, 1—6" long by ·2" diam. with

* Sepals, or possibly sepal-like appendages to the connective of the anthers.

white, pink or pale-blue flowers. Tepals 2, obovate or suborbicular, .1" long. Stamens 6 with bluish-purple anthers. Carpels 3. Follicles exceeding the tepals, smooth with 4—8 oblong seeds.

Behar, *Hope!* Widely distributed in India and is found both sides of our area, and probably occurs in most of the districts. Fl., Fr. most of the year.

The flowers are very pretty. The rootstock contains much starch and is eaten.

2. *A. crispum*, *Thunb.* Syn. *A. undulatum*, *Roxb.*

Rootstock stoloniferous. Leaves submerged (or floating, *Roxb.*) lanceolate to linear-oblong, 4—6" long, under 1" broad, 3—7-nerved with compressed petioles. Cross nervules very fine and numerous. Scape thickening upwards, spike solitary, 1.5—3.5" long. Flowers crowded white. Tepals up to .3" long, very variable in size (*F.B.I.*). Follicles shorter than the tepals, 3—4, smooth, 1—2-seeded.

Extends from the United Provinces and Central Provinces to Lower Bengal, and therefore almost certainly to be found in our area. Fl. r.s.

The *F. B. I.* states that the leaves are 1—3 ft. long. Some Madras specimens have leaves 14" by 1.1", but these are the largest I have seen. The spikes just raise themselves above the water. Stamens lilac. The rootstock is edible.

2. POTAMOGETON, *L.*

Aquatics with a creeping rootstock, elongate submerged stem and submerged or floating, opposite or alternate, entire more rarely toothed, leaves and intrapetiolar stipules. Flowers greenish, spicate on a lateral peduncle rising above the surface of the water from a membranous spathe or sheath, bracteate, 4-merous throughout. Sepals 4 concave, green, valvate. Anthers sessile on the sepals (or according to some authors the so-called sepals are merely scales developed at the back of the anthers) didymous, with a cell each side of the claw, extrorse. Carpels 4 sessile, 1-celled, 1-ovuled with sub-sessile or decurrent persistent stigma. Ovule inserted in the inner angle, campotropous. Fruit of 4 coriaceous or spongy drupels with reniform seeds.

- | | |
|---|------------------------|
| I. Leaves, at least the upper, floating, oblong or elliptic:— | |
| Floating leaves coriaceous 3—4" long, submerged lanceolate | 1. <i>indicus</i> . |
| Floating leaves .5—1.5" long, submerged linear or filiform | 2. <i>javanicus</i> . |
| II. Leaves all submerged, oblong lanceolate or linear (<i>exc. perfoliatus</i>):— | |
| A. Leaves ovate, cordate, amplexicaul | <i>perfoliatus</i> |
| B. Leaves lanceolate or oblong:— | (p. 889). |
| L. subamplexicaul, 3-nerved, crisped and serrulate | 3. <i>crispus</i> . |
| L. neither amplexicaul nor crisped, 5- or more-nerved | 4. <i>mucronatus</i> . |
| C. Leaves narrowly linear or filiform:— | |
| L. 1—3-nerved. Stipules adnate to leaf-sheath | 5. <i>pectinatus</i> . |
| L. 3—5-nerved. Stipules small, free | 6. <i>pusillus</i> . |

1. *P. indicus*, *Roxb.* Indian Pond-weed.

Stem slender terete, branched. Leaves nearly all floating in shallow water, upper ones only in deep water, elliptic or oblong or elliptic-lanceolate 2.5—4" by 1—1.75", rounded obtuse or acute both ends, rather coriaceous, shining with strong midrib and many more slender parallel nerves mostly proceeding from near the base, petioles 1—4",

stipules free 1—1.5"; submerged leaves lanceolate, undulate, membranous and often elongate (up to 8", *Cooke*), petioles shorter. Spike .7—1.5" long on axillary or leaf-opposed peduncles which raise it just above the water. Flowers densely packed without spaces between the whorls. Sepals (or scales of anther ?) .1" long including the long claw, limb suborbicular concave about .08" diam. Drupels .12" long, obliquely truncate, shortly beaked.

Common in tanks in Chota Nagpur! Shahabad, *J.D.H.*! Probably to be found in all districts of the province but not collected. Fl. Aug.—Jan., perhaps all the year round. Fr. found in April and May, and usually fruits soon after flowering. The plant closely resembles the common English *P. natans*.

Leaves mostly broadly elliptic and obscurely 13—15-nerved from the base; some Behar specimens have, however, lanceolate-elliptic leaves about 3.3" by 1.3".

2. *P. javanicus*, *Hassk.*

Different looking, more slender than the last and with much smaller leaves, ell.-oblong, ovate-oblong or elliptic, acute both ends, or sub-obtuse, 5—7-nerved including the midrib, .5—1.5" long and petiole shorter; stipules .5—1"; submerged leaves linear acuminate or filiform. Spike .3—5" long with flowers smaller than in *P. indicus* and the whorls more distant, peduncle as long or longer than the spike, very slender. Sepals orbicular-obovate. Drupels semi-globose .08" long with stout hooked beak and ribs often toothed or tubercled.

Shahabad, *J.D.H.*! to Sikkim Tarai! Chilka Lake, *Lawson*! Probably also in other parts of the province. Fl., Fr. Dec.—March.

3. *P. crispus*, *L.*

Stems slender, compressed, dichotomously branched with distichous half-amplexicaul close-set oblong to linear acute or obtuse leaves 1—3" or up to 5" long, .1—3" broad with crisped and serrulate margins, 3-nerved. Petiole 0, stipules small obtuse caducous. Spike very small .2—3" long, only 6—8-fl. Peduncles over 1" and exceeding the upper leaves. Flowers very small, sepals .8—1" with the claw. Drupels obliquely ovoid, .1—1.2" (.2" in English specimens), compressed acuminate with straight beak.

Behar, *J.D.H.*! Not uncommon in Chota Nagpur! Fl. Dec.—April.

P. perfoliatus, *L.*, occurs in the United Provinces not far west of our area and will probably be found within it. The leaves are amplexicaul, ovate, cordate, .7—3" upper opposite, 5—9-nerved. Spike dense-fl.

4. *P. mucronatus*, *Presl.*

Leaves all submerged, petioled, elliptic- or oblong-lanceolate or linear-oblong 3—7" by .5—7", acute or cuspidate, with a long point, 5—9- or more-nerved with acute or obtuse base. Petiole one-half or one-third as long as the blade. Stipules 1—1.5", exceeding the petiole. Spike 1—2" of interrupted groups or whorls of flowers, very long peduncled. Sepals suborbicular, very shortly clawed. Drupels half orbicular, shortly beaked.

Chaibassa tank, Singbhum, *Wood (Rec. Surv. Ind.)*.

5. *P. pectinatus*, L.

Stem filiform, copiously distichously branched with filiform very flaccid submerged alternate leaves 1—6" by .1" or much less, opaque with slightly thickened or inrolled margins, 1—3-nerved, sometimes 2" broad and 5-nerved (*F.B.I.*). Sheaths up to 7-nerved. Stipules adnate to the leaf sheath with free points only. Flowers interruptedly whorled on a spike 2—1" with long filiform peduncle. Drupels dimidiate-obovoid, slightly convex ventrally, with strong lateral ridges and when dry sometimes obscurely keeled dorsally, hardly beaked.

Behar, affluents of the Soane, *J.D.H.* Patna, *Wall. Cat.*, 5179 *b*, part! Tirhut and N. Bengal (*vide Beng. Pl.*), but I can find no specimens in the *Cal. Herb.* Fl. Nov.—Jan. It is frequent in ponds and streams as far as the British Isles.

6. *P. pusillus*, L.

Much 2-chotomously branched with very filiform stems. Very like *P. pectinatus* but leaves flat without inrolled margins, filiform, 1—3-nerved. Stipules free. Peduncle long filiform. Flowers and flower-clusters very minute. Drupels turgid obliquely ovoid with a broad dorsal keel.

Patna, *Hamilton*, in *Wall. Cat.*, No. 5180 *b*!

Sub-sp. *flabellatus* with 3—5-nerved leaves .08" broad is recorded in *F.B.I.* and *Bengal Plants*. This is a slip; that part of *Wallich's* No. 5179 *b* which is *flabellatus* is from Nalagola, the other part from Patna is *P. pectinatus* (*P. marinus?* *Hamilton*).

P. pusillus is common in the British Isles and forms "a tangled mass of thread-like stems and dull, olive-green leaves with numerous spikes of brownish flowers which are either submerged or partially rise above the water." *Rev. Johns*.

3. RUPPIA, L.

Slender aquatics growing in brackish water with elongate filiform submerged leaves with stipular sheaths. Flowers minute, 2-sexual, 2—6 together within the leaf-sheath, peduncle usually greatly elongating becoming far exerted and often spirally twisted after flowering. Perianth 0. Anthers 2 sessile, opposite, 2-celled with large kidney-shaped cells soon deciduous from the connective. Carpels 4 with sessile stigma. Ovule 1 pendulous. Achenes long-stipitate, ovoid, obtuse or beaked. Seed uncinatè.

1. *R. rostellata*, Koch. Syn. *R. maritima* sub. sp. *rostrata*, *M. & K.*

Stems very filiform, branched. Leaves 1—3" long, nerves not evident. Fruiting peduncle of very variable length, often attaining several inches, straight. Achenes with very slender stipes attaining 1" in length, spreading divergent, obliquely ovoid acutely beaked.

In brackish water. No specimens have been collected from our area, but it occurs throughout India and has been collected by *Kurz* near Calcutta, so that it will almost certainly be found in Orissa. *R. maritima*, which differs but slightly is frequent in brackish waters in Britain.

4. ZANNICHELLIA, L.

Aquatics growing submerged in fresh or brackish water with a very slender rootstock and filiform stems cymosely branched at the flowering nodes. Leaves narrowly linear or filiform, pseudo-verticillate at the

flowering nodes, with stipular membranous sheaths. Flowers minute, monoecious. Female terminal on an abbreviated shoot enclosed in the stipular leaf-sheath and bearing 2 foliage-leaves below it; one of these bears an axillary male flower, the other a shoot which continues the branching. Male fl. subtended by a spathe (which may be merely the sheath of its leaf; the *F.B.I.* states that both flowers are included in one spathe) and consisting of a solitary stamen with sagittate anther and slightly excurrent connective. Fem. fl. with a hyaline tubular perianth, containing 2—6, rarely more, carpels each with a peltate deflexed large stigma and a pendulous orthotropous ovule. Achenes compressed-sausage-shaped, 2—4, sessile or stipitate, often crenulate spinulose or echinate on the dorsal line and horned with the persistent style. Embryo folded, radicle fold clavate, cotyledonary end tapering slender and twice folded or uncinat.

1. *Z. palustris*, L. The Horned Pond-weed.

A variable aquatic with the characters of the genus. The Indian plant is included in sub-species *pedicellata* Hook. f. (Syn. *Z. pedunculata*, Reichb., and *Z. pedicillata*, Ham.). Male peduncle short, achenes 2—4, subsessile, back crenate or tubercled, style as long as the body of the achene or longer.

Behar, J.D.H. Fl. c.s.

In the Behar plant the flowers are sessile, achenes stipitate, smooth or tubercled dorsally or ventrally or both, style very long.

The plant extends to Britain and it is from British specimens that I have somewhat modified the generic characters given in the *F.B.I.*

5. NAIAS, L.

(Or *Najas*.)

Slender submerged aquatic herbs with a slender creeping root and usually filiform branched stems. Leaves opposite alternate or 3-nately whorled, linear, usually serrulate or sinuate-dentate, base shortly sheathing. Flowers minute, axillary, monoecious or dioecious. Male perianth double, an outer tubular or inflated entire or 4-fid tube and a hyaline inner. Stamen 1, adnate to the inner, central, apiculate or cuspidate, 1- or 4-celled. Fem. perianth 0 or hyaline and adherent to the carpel which is solitary sessile with 2—4 slender stigmas. Ovule 1 basal erect anatropous. Fruit an oblong achene. Seed with thin testa and straight embryo with large hypocotyledonary axis and radicle and well-developed plumule.

The key and greater part of the descriptions have been taken from *Rendle*.

- | | |
|---|-----------------------|
| A. Flowers dioecious. L. 1—15" wide, strongly toothed | 1. <i>major</i> . |
| B. Flowers monoecious. Leaves under 1" wide, teeth very small:— | |
| 1. Fls. of both sexes surrounded by a spathe | 2. <i>indica</i> . |
| 2. Fls. of male only with a spathe. Leaf-sheath truncate or auricled at mouth:— | |
| a. Anthers 1-celled:— | |
| Areoles of testa broader than long (scalariform) | 3. <i>minor</i> . |
| Areoles of testa isodiametric | 4. <i>Kurziana</i> . |
| b. Anthers 4-celled | 5. <i>foveolata</i> . |
| 3. Fls. of both sexes naked | 6. <i>graminea</i> . |

1. *N. major*, All.

A stout species with the leaves '1—15" wide almost pinnatifidly toothed, teeth 4—8 each side triangular. Sheath with rounded entire sides. Flowers dicecious. Anthers 4-celled.

There are no specimens from our area, but it is said to be found everywhere in both fresh and brackish water, and is likely to occur in Orissa.

2. *N. indica*, Cham. Syn. *N. minor* F.B.I. (in part); *N. minor* var. *indica*, A. Br., and *N. tenuis*, A. Br. (The Behar Plant.)

A very slender lax aquatic with filiform stems and filiform or very narrowly linear often setaceous leaves '9—1·3" long with very fine marginal teeth 10—17 each side. Leaf-sheath with rounded auricles or subtruncate or broadly orbicular, minutely toothed. Flowers monœcious, both sexes surrounded by a spathe with a long neck and irregularly toothed mouth, '16—2" long. Seed ellipsoid 2 mm. long, with numerous minute 4—6-gonal areoles in 25—30 longitudinal rows.

Shahabad (moat, Shahganj) J.D.H.!

Typical specimens from Faridpur and Jessore have the teeth evident; the leaves in the Behar plant are very narrow and the teeth sometimes obscure. The teeth are always very fine as compared with the next species.

3. *N. minor*, Allione. Syn. *Caulinia fragilis*, Willd.; *N. dichotoma*, Roxb.

A more graceful plant than *N. indica*, the leafy branches closer and more tufted, much 2-chotomously branched. Leaves recurved, very narrowly linear and attenuate to tip, '4—8" long with the 6—10 teeth each side spreading from a broad base and with a finely spinulose tip. The sheathing stipular bases of the leaves are prominent in this species with rounded often denticulate shoulders or truncate. Seed 2—3 mm. long, obliquely linear-oblong, scarcely areolate but sculptured with 12—18 longitudinal scalariform bands.

Western Bengal, Kurz! Sikkim Tarai, Kurz! Chilka Lake, Annandale! Fl. March. Probably occurs throughout the province.

Male flowers only with a spathe. Anthers 1-celled.

4. *N. kurziana*, Rendle.

A small species with very graceful stem and slender leaves about 15 mm. ('6") long with very numerous close minute teeth. Sheath shortly auricled. Male flower only with spathe. Anther 1-celled. Seed ellipsoid-oblong conspicuously areolate, areoles quadrate in about 16 series.

Purneah, Kurz! Fl. Sept.

5. *N. foveolata*, A. Br.

Stems branched and spreading with linear leaves narrowed and setaceous above '7—1·5" long with 6—20 small subtriangular oblique and very sharp teeth each side. Sheath shortly auricled or with minutely toothed shoulders rather than auricles. Male flower only with spathe, anther 4-locellate. Seed 2·25—2·5 mm. long, areoles distinct in about 20 longitudinal rows, the centre ones subquadrate.

Tanks and streams, abundant. Bengal, Kurz! Bihar, J.D.H.! Fl. Feb.

6. *N. graminea*, Del.

A short grass-like, often gracefully plumose aquatic. Stems up to 2 ft. with densely foliose branchlets. Leaves narrowly linear 7—1" long with numerous (30—50) minute oblique spinules each side. Sheath long-auricled very conspicuous, auricles lanceolate denticulate. Flowers of both sexes naked. Seed narrowly oblong to ellipsoid-oblong 1.75—2.25 mm. long. Areoles subquadrate or polyhedral, small, irregularly disposed or in more or less distinct longitudinal lines.

A very common and widely distributed plant. Ranchi, *Mokim!* Fl. Sept.—Oct.

FAM. 131. HYDROCHARITACEÆ.

Aquatic herbs with simple undivided leaves with 1 to many basal nerves. Flowers minute to showy, monœcious or diœcious, enclosed in a spathe, female solitary. Sepals 3, green or petaloid. Petals membranous or 0. Stamens 3—12, anthers 2-celled. Ovary inferior, placentæ parietal or almost meeting in axis, styles or stigmas 3—12. Ovules anatropous or orthotropous. Fruit membranous or fleshy, rarely dehiscent. Seeds few to many, exalbuminous. Embryo various.

- | | |
|---|--------------------------|
| I. Stem branched leafy. Spathes short sessile:— | |
| Leaves whorled. Perianth double. Ovules anatropous | 1. <i>Hydrilla</i> . |
| Leaves alt. Perianth single. Ovules orthotropous | 2. <i>Lagarosiphon</i> . |
| II. Stemless or with stolons bearing sessile tufts of leaves or with creeping rootstock:— | |
| A. Leaves grass-like without distinct petiole, spathes on long radical very slender peduncles:— | |
| Perianth single. Fls. 1—sexual | 3. <i>Vallisneria</i> . |
| Perianth double. Fls. 1—2—sexual | 4. <i>Blyxa</i> . |
| B. Leaves broad, petioled. Spathes peduncled:— | |
| Tufts of leaves floating. Male spathes 2—3-fld. Ovary not beaked | 5. <i>Hydrocharis</i> . |
| Rooting at the bottom. Leaves submerged and floating. Spathes 1-fld. Ovary beaked | 6. <i>Ottelia</i> . |

1. HYDRILLA, Richard.

Submerged, leafy, diœcious or monœcious, with short whorled leaves or the lower opposite. Male fl. solitary, shortly pedicelled, in a subglobose sessile muricate spathe, sepals 3, ovate or obovate, green; petals 3 oblong or cuneiform; stamens 3, anthers large reniform, opening elastically, pollen large white firm, pistillode small. Fem. fl. 1—2, sessile in a tubular 2-toothed spathe; hypanthium produced into a long filiform neck above the ovary, perianth as in male but the segments narrower; ovary 1-celled, styles 2—3 linear, stigmas fimbriate. Ovules anatropous. Fruit subulate, smooth or muricate. Seeds 2—3 oblong, testa shortly produced each end.

1. *H. verticillata*, Casp.

A weak water-herb having a general appearance of *Elodea canadensis* and, like it, forming large masses suspended beneath the surface. Stems slender branched with linear or shortly-linear, usually

spinulosely-serrulate, leaves .25—4", rarely .5" long, 4—8 in a whorl, spreading with recurved tips.

In tanks and slow-running streams. No doubt in all districts. In the Ganges at Monghyr, *Lockwood!* Behar, *Kew Herb.!* Singbhum! Cuttack, canals! Raneejanj, *Kurz!* Chilka Lake, *Cal. Herb.!* Fl. July—Sept.

L. rarely .5" and narrow-elliptic. M.fl. in whorls sessile at the base of each leaf, escaping from the muricate spathe when mature and swimming on the surface. Fem. above the males if monœcious or in separate terminal branchlets (*Clarke*) and usually solitary in the whorl or opposite. Stigmas pink.

2. LAGAROSIPHON, *Harv.*

Submerged, dicecious, with alternate leaves or sometimes leaves fascicled or subverticillate and lower opposite, serrulate. Male fls. minute, many in an ovoid 2-fid axillary sessile spathe, sepals petaloid, petals rather shorter, anthers 2—3, ovoid, 3 staminodes often present, pistillode 0. Fem. fl. solitary, sessile in a narrow oblong spathe, hypanthium produced into a long filiform beak above the ovary, perianth as in male, staminodes 0. Ovary oblong, styles 3, stout, notched. Ovules many, orthotropous. Fruit ovoid, oblong or linear, many-seeded.

1. *L. alternifolia*, *nov. comb.* Syn. *Valisneria alternifolia*, *Roxb.* *Lagarosiphon Roxburghii*, *Benth.*

A very slender waterweed with distant linear leaves 1" or more (up to 4" long and .15" broad). Male spadix transparent, finally 2-leaved, flowers on a short spadix, perianth reflexed and swimming on the surface when the anthers are ripe. Female with scarious 2-fid spathe wrapping round the lower part of flower, the pinkish perianth of which at the end of the long hypanthium floats on the water.

Many specimens from the old province of Bengal are found in herbaria without more precise locality and it is probably common in our area as it occurs in East Bengal! United Provinces, *Duthiei!* Nepal, *Kew Herb.!* Calcutta! Peninsular, *Wight!* Fl. Aug.—Nov.

Clarke described the male fl. as with a 4-leaved external coloured perianth and a 2-leaved internal one so delicate as to be difficult to see. He also describes the M. fl. (from an unopened spathe) as a simple anther, "a bag containing a few large, white pollen grains." The habit is somewhat that of *Potamogeton crispus*.

3. VALLISNERIA, *L.*

Submerged tufted stemless stoloniferous herb with very long linear leaves. Dicecious. Male fl. very numerous, minute, in spathes projecting from the bases of the leaf-sheaths, spathes very shortly peduncled, sepals 3, petals 0, stamens 1—3, anthers didymous, pistillode 0. Fem. fl. solitary in a tubular spathe terminating a very long filiform spiral peduncle. Perianth as in male, staminodes 3, 2-fid. Ovary narrow, stigmas 3 broad, notched. Ovules many. Fruit linear, included in the spathe, many-seeded.

1. *V. spiralis*, *L.*

Leaves straight from the root, grass-like, flaccid, 3"—1 ft. long according to the depth of the water, longer about .35—5" broad,

wavy, translucent, entire or tips serrulate. Male spathes ovoid 3-lobed, .2—25", breaking off at the base, when the flowers emerge and float on the surface. Fem. spathe with flower .6", floating on the surface when ready for pollination and again withdrawn beneath it by the spirally coiled peduncle to ripen the seed.

Bottoms of tanks and lakes. Behar, in the R. Soane and its affluents, *J.D.H.*! Hazaribagh, Bagodar, *Kew Herb.*! Between Calcutta and Agra, *Jacq.*! No doubt throughout the province, being distributed from the Punjab and United Provinces to Calcutta. Fl. Jan.—May.

4. BLYXA, Thouars.

Habit of *Vallisneria* with linear acute, entire or minutely serrulate leaves. Dioecious or flowers 2-sexual. Male fl. several in a tubular 2-toothed spathe on long or short peduncles from the leaf axils; sepals 3, linear; petals 3, longer; stamens 3—9, 1 or more rudimentary, anthers narrow erect, pistillodes 3 slender. Fem. fl. solitary in its spathe which is peduncled as in the male, hypanthium elongated above ovary, perianth as in male, staminodes 0 or minute. Ovary very slender, beaked with the hypanthium, style very short, stigmas 3 filiform, ovules many. Fruit very slenderly fusiform included in the ventricose ribbed spathe. Seeds many with mucilaginous testa.

A. Flowers dioecious:—

Stamens 8. (6—9). Seeds small, tails short or 0

1. *octandra*.

B. Flowers 2-sexual. Stamens 3:—

L. 6"—4 ft. Capsule 2—3". Seeds with very long tails

2. *echinosperma*.

L. 4—6". Capsule 1—1.5". Seeds with very short tails

3. *oryzatorum*.

1. **B. octandra**, *Planch.* Syn. *Vallisneria octandra*, *Roxb.*; *Blyxa Roxburghii*, *Rich.*

Leaves 8—24" long from the root, tapering to a fine point, minutely serrulate (always?), .5" or less broad. Peduncles raising the flowers a little above the surface. Fls. dioecious. Male spathe open at the top, fls. white mod.-sized, opening in succession, pedicels lengthening when the fls. are ready to expand. Sepals green, lanceolate. Petals linear, recurved, more than twice as long as sepals. Stamens usually 8, unequal, erect, rudimentary carpels 3. Fem. fl. with scape shorter and thicker than in the male, but the elongated hypanthium brings flowers to the surface, petals more filiform. Capsule 2—4" by .17". Seeds tubercled .04" with tails short or 0.

Distributed from the Central Provinces to Eastern Bengal and Khasia Mnts. to Madras and United Provinces, hence it is sure to occur in our area, though I have seen no specimens therefrom. Fl. Sept.

2. **B. echinosperma**, *Hook. f.*

Appears to have a denser tuft of leaves than the last, .4—5" broad, very finely acuminate, more prominent nerves 5. Flowers all perfect, one in each spathe, the peduncle ultimately 1—3 ft. according to the depth of the water. Spathe long linear opening with a slit on one side, produced and tubular above the flower. Hypanthium sometimes 4.5" long, on the top of which the "valvate sepals and long petals with

their tips often spiral. Stamens 3 but only 2 antheriferous" (*Clarke*). Seeds spinescent and together with the slender tails .5" long.

Occurs at Comilla, Bengal, *Clarke*! and is also common in the tanks of West Kanara, *Talbot*! It is probably found in the intermediate area. Fl. Oct.

Talbot says "at the time of flowering the deep water plants become detached from the bottom and float on the surface."

3. *B. oryzetorum*, *Hook. f.*

A short tufted species with leaves 4—6" long only, entire or microscopically serrulate or obscurely crenulate, tips filamentous. Flowers 2-sexual. Petals white linear with yellowish twisted ends. Stamens 3. Capsule 1—1.5" by .17". Seeds sparsely but sharply tubercled .07" long, tails very short or 0.

In rice fields. From United Provinces, *Kew Herb. to Bengal, J.D.H.*! and Khasia Hills, *Clarke*! Ranchi, *Prain*! Fl. Aug.

The Ranchi specimen has spreading rosulate leaves with filiform tips. The scape is described as very short but this would be expected from the habitat.

5. HYDROCHARIS, L.

Floating tufted stoloniferous herbs with orbicular or reniform entire leaves. Dioecious. Male fls. 1—4 in a peduncled 2-leaved spathe, sepals 3 green, petals 3 membranous white. Stamens in 4 whorls of 3 each, the third whorl with sometimes only a one-celled anther, the fourth sometimes staminodial, in addition sometimes a fifth, often incompletely developed, whorl of staminodes, filaments forked, anther-cells basifixed. Centre of flower with 3 spherical glands. Fem. spathe 1-fid., flower long-pedicelled, perianth as in male, with nectaries at base of the petals. Staminodes 6 in pairs. Ovary ovoid, 6-celled, stigmas 6 linear, 2-fid. Fruit ovoid or oblong, fleshy. Seeds many with gelatinous testa full of spiral vessels. Embryo ovoid.

1. *H. asiatica*, *Miquel*. Syn. *H. morsus-ranæ*, *F.B.I.* in part; *H. callulosa*, *Ham*; The Frog-bit.

Very like the *H. morsus-ranæ*. A pretty floating aquatic with cordate or kidney-shaped leaves 1—1.5" not unlike those of some *Limnanthemum*. Fls. about 1" diam., M. only 1—2 in the spathes, antheriferous filaments usually 12 and 3 staminodes, filaments not adnate to those of the superimposed whorls. Petals in both sexes rather crumpled, very delicate.

Frequent in the Jalpaiguri district in still waters! and Rajshaye, *Clarke*! Probably therefore occurs in Purneah. Tirhut, *Prain*, but I have seen no specimen unless the place called Singur is in Tirhut. Fl. c.s.

6. OTTELIA, *Pers.*

Herbs with submerged and floating leaves, submerged usually narrow. Flowers large, solitary, sessile in a tubular 2-fid or toothed spathe and partially exsert from its apcx. Hypanthium elongate. Sepals narrow. Petals larger broad, white or yellow, base with fleshy appendages. Stamens in 3 whorls of which the outer is double, or one or both the inner whorls often failing, anthers erect. Ovary oblong, beaked, nearly

6-celled from the intruded walls, styles 6 linear, 2 fid, ovules many all over the inner surface. Fruit 6-valved, enclosed in the spathe. Seeds many, oblong, testa pulpy.

1. *O. alismoides*, Pers. Syn. *Damasonium indicum*, Willd.

Rooting at the bottom of streams and tanks with flaccid floating and submerged bright green leaves and pretty white flowers with the perianth exerted from a crisped winged spathe, 1.5–2" diam.

Very common in running streams. Purneah! Shahabad, Shahganj-moat, J.D.H. Probably in all districts but flowering in the r.s. and not often collected, also sometimes fl. Sept.—Dec.

Leaves variable in shape, submerged sometimes oblong with tapering base or oblong-lanceolate and about a foot long, floating orbicular- or oblong- and cordate 6–7" diam., on long succulent 2-edged petioles. Spathes on long axillary peduncles tubular with about 6 wavy crisped wings, 1.5" long by .75" diam., sharply 6-toothed or segments obtuse and cuspidate. Stamens 6 in three pairs. Fruit oblong, crowned with the withered perianth, 6-grooved, attaining 2" diam.

FAM. 132. ARACEÆ.

Herbs of very varied size, more rarely shrubby and then usually scandent, very frequently tuberous or rhizomatous with annual shoots, very rarely aquatic, usually quite glabrous and somewhat succulent. Tissues often with latex-tubes or raphides. Leaves usually rather fleshy, simple, lobed or palmately or pedately divided with generally palmate or pedate principal venation and frequently intermediate venation reticulate or of parallel arches; in the tuberous species solitary or few radical and sometimes appearing at a different season to the flowers, in the caulescent species distichous or spiral; membranous sheaths usually present at base of the petiole or peduncle. Flowers small to minute, crowded on a simple fleshy spadix with green or coloured spathe, rarely few (only one female fl. on spadix in the aquatic genus *Pistia*), 2-sexual or usually monœcious with the male and fem. infl. on different parts of the spadix, very rarely dicecious. Spadix often produced beyond the flowers into an "appendix." Perianth 0 or inferior, cupular or of 4–8 segments. Anthers in hermaphrodite fls. 4–8, in monœcious fls. 1—many, often united into synandria and connective usually overtopping the cells. Ovary entire, most rarely lobed, 1—many-celled. Style 0 or various. Ovules 1 or several in each cell, basal, parietal or apical, rarely central; orthotropous or anatropous. Fruits mostly baccate, distinct or confluent. Seeds 1 to many with usually copious albumen (0 in *Pothos*) and axile embryo.

I. Flowers 2-sexual:—

A. Perianth present. Stem often elongate. Raphides 0:—
Scandent. Perianth 6-phyllous. Ovary 3-celled, cells
1-ovuled

Caudex erect. Perianth 2-phyllous. Ovary 2-celled,
cells 1—2-ovuled. Spathe often coloured

B. Perianth 0. Scandent shrubs with abundant
raphides:—

Ovary 2-celled. Ovules 2-seriate. Berries many-
seeded

1. *Pothos*.

Anthurium
(p. 899)

2. *Rhaphidophora*.

- Ovary 2-celled, cells with 2 basilar ovules *Monstera* (p. 900).
- Ovary 1-celled with 1 basilar ovule 3. *Scindapsus*.
- C. Perianth present. Erect prickly marsh herbs. -Ovary 1-celled 4. *Lasia*.
- II. Flowers 1-sexual, monœcious (dioecious in some *Arisæma*).
Perianth 0:—
- A. Terrestrial with large leaves:—
1. Caulescent (a thickened rootstock only in *Zantedeschia*) or scandent, sometimes shrubby. Leaves many. Stamens free or, if synandrous, then fem. fl. with staminodes. Garden plants:—
- a. Female fls. with 3—5 staminodes:—
L. oblong or ovate-oblong, variegated. Stoutly caulescent. Ovary 2—3-celled and -lobed
L. sagittate. Spathe large, pure white (*Arum Lily*)
- Dieffenbachia* (p. 901).
Zantedeschia (p. 902).
- b. Fem. fl. without staminodes (exc. some *Aglaonema*):—
L. often variegated. M. fl. of 2 stamens. Ovary 1-rarely 2-celled, cells with 1 anatropous ovule
Suffruticose. L. sometimes pinnatifid. M. fl. of 2—6 stamens. Ovary 2—more-celled, several-ovuled
- Aglaonema* (p. 901).
Philodendron (p. 901).
2. Tuberosous herbs, rarely caulescent or with thickened rootstocks (some *Alocasia* and *Colocasia*) and then synandrous. Fem. without staminodes. Leaves 1—3 (more in Nos. 9, 10, 12 and 13 or not):—
- a. St. free (anther 4-lobed in 7), loculi usually broader than connective. Leaves pedate. Fls. before leaves (exc. 8):—
- i. Segments of pedatipartite leaf pinnatifid:—
Spadix inappendiculate. Placentation axile
Spadix appendiculate. Placentation basal
5. *Plesmonium*.
6. *Amorphophallus*.
- ii. Leaf segments not pinnatifid. Appendage slender:—
Spathe narrow oblong. Ovary 1-celled, ovules 1—4 basal. Flowers before leaves
Spathe broad or cymbiform. Ovules 2—8.
L. and Fl. coætaneous
7. *Sauromatum*.
8. *Arisæma*.
- b. Stamens free or synandrous. Leaves all simple or hastately or sagittately lobed:—
- i. Stamens free. Leaves hastate. Flowers coætaneous:—
Ovules several, basal and apical
Ovules 1—2 basal
9. *Therophonum*.
10. *Typhonium*.
- ii. Stamens synandrous. L. sagittate or ovate and cordate, usually peltate:—
† Fls. and leaves not coætaneous. Spathe broad, yellow. Bulbiferous stolens developed with the leaves 11. *Remusatia*.
†† Fls. and leaves coætaneous. Stolons, if present, not bulbiferous:—
Ovary with parietal placentæ. Ovules many 12. *Colocasia*.
Ovary with intruded nearly central placentæ
Caladium (p. 907).
Ovary with basilar placentæ. Ovules few-many 13. *Alocasia*.

B. Aquatic herbs, rooting or floating, with linear or lanceolate or small and cuneate-obovate leaves.

Ovaries few:—

Rooting in earth. Ovaries in a single basal whorl. L.
linear or lanceolate

14. *Cryptocoryne*.

Floating. Ovary single basal. L. obovate-cuneate

15. *Pistia*.

1. POTHOS, L.

Herbs or shrubs scandent by means of the adventitious roots. Leaves distichous articulate to the usually winged petiole, simple. Latex tubes and spicule-cells absent. Spadix terminal or axillary, peduncled with small reflexed cymbiform or elongate persistent spathe, sessile or stipitate above the spathe. Tepals 6 with incurved tips. Stamens 6 with flat filaments and ellipsoid anther-cells, extrorse. Ovary 3-celled, stigma small. Ovule 1 in the inner basal angle of each cell, anatropous. Berries 1—3-seeded. Seeds exalbuminous, embryo macropodal.

Leaves 1—4" long. Spadix .17—2" diam. Spathe .17—25"
broad

1. *scandens*.

Leaves 3—6". Spadix .25—5" diam. Spathe .5—7" broad

2. *Cathcartii*.

Pothos aureus, Lind. et André, has been removed to *Scindapsus*.

1. *P. scandens*, L.

Suffruticose, much branched. Leaf-blade elliptic or ovate or oblong, acute or sometimes apiculate, 1—4" long. Petiole (with the wings) .25" by .1" to 2.5" by .6", gradually narrower downwards, upper tips of the wings auricled (in Puri specimens) or obtuse (in Ramnagar specimens). Spathe .17—25" broad, cymbiform, cuspidate, peduncled, and spadix with a pedicel above the spathe which is usually deflexed. Spadix .17—2" diam., ellipsoid or obovoid.

Ramnagar Hills! Puri! Fl. March—April.

There is considerable difference of opinion as to the limitation of the species in this group of *Pothos*. Engler separates *scandens*, *Roxburghii*, *Vriesianus* and *Cathcartii*. *Roxburghii* is separated by the quite globose spadix .3—3.5" diam. Our Ramnagar specimen with very small leaves resembles one specimen placed in *Roxburghii* but it is not in flower. Other specimens placed in *Roxburghii* in *Herb. Kew.* have the form of leaf of *Cathcartii*. Some botanists make the deflection of the pedicel a specific character.

2. *P. Cathcartii*, Schott.

Less widely scandent than the last, but larger in all its parts and leaves acuminate, 3—6" long, oblong, ovate-oblong or sometimes lanceolate, petiole about half as long as the blade, narrowly obtuse (with the wings). Spathe .5—7" broad (up to 1", *F.B.I.*). Spadix .25—3.5" diam. (up to .5" *F.B.I.*). Pedicel erect. Berries scarlet .5—7" long.

Tarai and Duars! and probably therefore in Purneah. Fl. c.s.

See note under *P. scandens*. Hooker includes under *Cathcartii* plants with quite globose spadices and my plant has such a spadix and according to Engler, therefore, should be *P. Roxburghii*. Hooker also states that the pedicel or stipes is sometimes decurved in *Cathcartii*.

Species of *Anthurium*, a large tropical American genus, with usually conspicuous caudex and variously shaped reticulately nervuled leaves and frequently brightly coloured spathes are commonly cultivated in grass greenhouses.

2. RHAPHIDOPHORA, Schott.

Suffruticose climbers clinging by their adventitious roots, with distichous usually large, entire or pinnatifid leaves with many primary nerves and branching secondary nerves; petiole geniculate at the tip. Spathe coriaceous, ovate, acuminate, deciduous. Spadix sessile above the spathe; stout. Flowers crowded 2-sexual, perianth 0, stamens 4—6 with very short flattened filaments and terminal anthers. Ovary obconic, truncate, with small sessile linear stigma. Ovules many parietal. Berries many-seeded and confluent, their tissue loaded with intercellular raphides. Seeds albuminous. Embryo axile.

Parenchyma of the stems and leaves with raphides.

1. *R. decursiva*, Schott.

A stout climbing aroid with stems over 1" diam., large glossy pinnatifid leaves about 1 ft. long with 4—5 segments, or in more luxuriant specimens, up to 2.5 ft. long with 6—12 segments, segments falcate acuminate 3—4-nerved 6—12" long, paler green but not glaucous beneath. Petiole about as long as blade, terete, slightly grooved but neither deeply channelled nor winged. Spathe 5—7" subcylindrically cymbiform, yellow, beaked. Spadix shorter than spathe, narrow oblong. Peduncle 3—6". Stigma raised on the conical top of the ovary.

Mayurbhanj Mnts., above 2500 ft. Fl. Fr. July—Nov.

Closely allied to *Rhaphidophora* and *Scindapsus* is the American genus **Monstera** which includes the often cultivated *Monstera deliciosa*, Liebm. (sometimes called *Philodendron pertusum* by horticulturists). It has very large coriaceous leaves which are not only pinnatifid but curiously perforated with large holes. The very long syncarps are eaten in Mexico.

3. SCINDAPSUS, Schott.

Stout climbing aroids with the characters of *Rhaphidophora* but the one-celled ovary has a single basilar ovule and the seed is exalbuminous.

1. *S. officinalis*, Schott. Dhare-jhapak, S.

A stout epiphytic climber with almost woody stems when old, and large rather fleshy undivided broadly elliptic or ovate leaves 8—10" by 5—6" with dilated or winged petiolar sheaths. Spathe 4—6" green outside, ultimately yellow within terminating in a long acumen, deciduous. Spadix stout, nearly as long and elongating to 6—9" in fruit, with densely packed prismatic truncate ovaries grooved below, the short 4-celled anthers in the grooves.

Frequent on trees and rocks in the damper valleys of Singhbhum! Ranchi (Horchap forest)! Manbhum, Camp! Santal Parg., Kurz! Angul! Narsingpur! Fl. June—July. Usually deciduous in the h.s.

When leafless it is easily recognised by the stout green branchlets with white annular scars and the tissues full of raphides. These are also easily seen in the spathe and ovary. Leaves with rounded or cordate base. Petiole (or sheath?) winged up to 6—7" in length and 1" or more wide, then a very short unwinged portion (petiole proper?). Peduncle shorter than the sheath. Stigma elongate, hemispheric in fruit.

The fruit is applied by the Santals for rheumatism, Camp.

2. *S. aureus* Engl. Syn. *Pothos aurea*, Lind and André, is a very common garden plant with leaves more or less ovate and entire, variegated a golden yellow. Engler does not appear to have seen the inflorescence which should be looked for.

4. LASIA, Lour.

Stout spinous marsh herbs with branched rhizome and long-petioled hastate entire or pedately pinnatifid prickly leaves. Spathe very long, narrow, fleshy, twisted, with convolute base, deciduous. Spadix short, cylindric, flowering downwards. Flowers 2-sexual. Tepals 4—6 obovate with truncate incurved tips. Stamens 4—6 with short flat filaments and parallel extrorse anther-cells. Ovary ovoid 1-celled with stout style and depressed stigma. Ovule 1, pendulous from the top of the cell, anatropous or semi-anatropous. Berries obpyramidal, 6-sided, top warty or muricate. Seed compressed, rugose, exalbuminous. Embryo macropodal.

Vascular bundles of stem and petioles with straight latex-tubes.

1. *L. spinosa*, Thwaites. Syn. *Dracontium spinosum*, L.; *L. heterophylla*, Schott.; Kanta-saru, gola-kanta, K., S.

A very prickly stout herb with thick rhizome and hastate pinnatifid leaves 6—18" long with the lower lobes pedate and base cordate, lobes 1-costate acuminate, nerves prickly. Petiole erect prickly 1—4 ft. long, sheathing towards the base. Peduncle prickly, about as long as the petioles, with a deep purple thick and rather brittle twisted spathe about 1 ft. long. Spadix 1—2" with densely packed flowers with 4 (in the plants examined) pink imbricate perianth lobes hooded over the stamens. Stigma orange, broad, sessile. Heads of fruits oblong 4—6" long and 2" diam., with spongy axis, berries more or less 4-sided, muricate, .75" long. Seed large in a coriaceous testa.

Along muddy streams. Singbhum, frequent! Santal Parg! Sambalpur! Fl., Fr. Dec.—Feb.

The fruit and rhizome are used for sore or swollen throat.

Aglaonema is a genus of succulent or half-shrubby perennials chiefly of tropical India and Malasia with erect or prostrate caudex and ovate or oblong or lanceolate often variegated leaves for which they are often cultivated in grass conservatories, etc. *A. commutatum*, Schott. with spotted leaves is one of the commonest.

Dieffenbachia is mostly a genus of large suffruticose herbs or climbers, inhabitants of tropical America and are often grown in pots from cuttings which very easily strike root. The leaves are usually large oblong or ovate and copiously variegated. Many varieties are in cultivation. *D. seguine*, Schott, var. *variegata*, being the commonest. It is native of West Indies.

Philodendron is a large American genus containing some extremely handsome aroids with large leathery leaves, natives of tropical America. Some are almost tree-like, others climbing; the leaves are often cut or perforated. *Ph. bipinnatifidum*, Schott, has a stem over 6 ft. high and very large 2-pinnatifid leaves. Other species have beautifully coloured spathes.

Zantedeschia æthiopica, *Spreng.* is the name given in *Nat. Pflanz. Fam.* to the well-known Lily-of-the-Nile (*Calla æthiopica*, L. or *Richardia africana*, Kunth) which is really a South African plant. It only grows in cultivation in the cooler parts of the province.

5. PLESMONIUM, *Schott.*

Herbs with bulb-like tubers and 1—few 3-foliolate or -partite and pinnatisect leaves appearing after flowering. Spathe ovate, convolute below, marcescent. Spadix included or exserted, free, bearing female flowers for about one-fourth way up, then densely packed clavate disciform or truncate neuters, the upper half being occupied with male flowers, spadix not produced beyond the flowers.* Male fl. of naked sessile almost quadrate anthers with the cells immersed in the connective and opening at the top by short curved pores. Female fl. of single ovaries slightly sunk in the spadix, with very large capitate stigma. Ovary 2—3-celled. Ovule 1 on the central placenta. Berry oval, 2—3-celled and -seeded. Seeds ellipsoid, exalbuminous.

Unbranched latex tubes occur in the vascular bundles of stem and petiole.

1. **P. margaritifera**, *Schott.* Had, K.

Tuber large depressed hemispherical about 3" diam. Leaf solitary, rarely 2, 1—2 ft. high and 12—18" diam. digitately 3-foliolate, lateral lfts. again 2-partite and then pinnatifid into narrowly lanceolate sometimes forked acuminate segments with strong midrib and oblique sec. n. joined by one or two intra-marginal nerves. Scape 15 in. to 2 ft. high preceding the leaves, brown-streaked and clouded below. Spathe broadly ovoid or deltoid when unfolded (artificially), green and leathery, deep purple at base within and often flushed purple above, obtuse, 3.5—4.5" long. Spadix exserted, 4.5—6" long, erect, with a stipes above the spathe for about .5" long, the females then occupying the next .75—1".

Common. Very common in the open forest land at Purneah, *Burkill* (see below). Singbhum! Ranchi! Manbhum, *Camp!* Fl. May—June. Leaves do not appear until the rains are well set in.

"Had" in Kol merely means *acid*, but the tubers are said to be eaten after much cooking. The neuter flowers are large white and clavate up to .3—35" long in some specimens, or yellow and disciform in others, but the form on the same individual is variable; they are very frequently eaten up by insects.

The Purneah plant is named *Plesmonium Burkillii* by *Engler* and *Kraus*. The leaf is 3-sect. with each segment 12—15" long 2-chotomously branched and cut into linear somewhat tapering lobes 3—5" long. The infrutescence stands taller than the leaves. Berries red. It is difficult to say where it differs from forms of *P. margaritifera* except that the leaf is larger than usual.

6. AMORPHOPHALLUS, *Blume.*

Herbs with bulb-like tubers and 1—few large 3-foliolate or 3-partite and pinnatisect leaves appearing after flowering. Spathe campanulate, infundibular, convolute or open, marcescent. Spadix included or

* I have however an abnormal specimen from Central Provinces in which there is an appendix.

exserted, free, bearing dense male flowers and female flowers without the interposition of neutrals, spadix always produced above the flowers into a large, short or long appendage. M. fl. with 2—4 naked sessile anthers with oblong cells and apical pores. Fem. fl. of globose or obovoid 1—4-celled ovaries with short or long styled and entire or 2—4-lobed stigma. Ovule solitary subbasilar, anatropous. Berries subglobose or obovoid. Seeds exalbuminous. Embryo macropodal.

Unbranched latex tubes occur in the vascular bundles of stem and petiole. Petiole rough with small tubercles. Spathe broad campanulate, open, appendage short sinuous. Peduncle very short 1. *campanulatus*.
Petiole smooth. Spathe with ovate cymbiform limb, appendage short conoid or oblong rounded. Peduncle elongate 2. *bulbifer*.

1. *A. campanulatus*, Blume. Ol, H., K.; Olna, Or.

A very stout herb with the single (rarely two) leaf 1—3 ft. broad, 3-partite with the lateral segments 2-furcate, pinnatifid with oblong lobes or leaflets 4—8" long; petiole 1—3 ft. long mottled dark and light green, very stout, rough with small tubercles. Peduncle much shorter than the spathe, elongating in fruit to 5—6". Spathe with a campanulate tube suddenly widening into an irregular spreading plicate and undulate recurved limb 6—10" broad coloured greenish and purple and often blotched below with white. Spadix very stout. Female portion about 3" long by 2.5" diam. with crowded depressed-globose sessile ovaries, styles 5" long purple. Male inflorescence subturbinate about 3" long by 1—2" diam. with pale-yellow anthers. Appendage dark purple rather shapeless or somewhat conoid, sinuately lobed very large. Fruiting spikes 3—4" long with red obovoid berries .5" long, 2—3 seeded.

Very common, Chota Nagpur! Cuttack! and probably throughout the province but apparently always near villages. Often cultivated and doubtfully indigenous. Bandgaon (Ranchi) Clarke, wild? Fl. April—June. Fr. Nov.

Tuber depressed hemispherical 6—10" diam.
Prain distinguishes a variety *Blumei* (Beng. Pl., p. 1109) with large depressed globose hardly warted tubers and appendage subregularly pyramidal which he states is cultivated only and is known as the Bombay Ol, whereas the type is said to have usually much warted tubers and the appendage irregularly amorphous. He believes this to be wild and cultivated in all the provinces (i.e. as distinguished in Beng. Pl.).

The cultivated tuber is eaten.

2. *A. bulbifer*, Blume. Amla-bela, Beng. (fide Roxburgh).

A somewhat less stout plant than *A. campanulatus*, the leaf usually less broad and the leaflets obovate or lanceolate, it usually bears when mature a large bulbil above the petiole at the forks of the leaf by which it is easily recognised. Petiole as long as in *campanulatus*, green and pink mottled with black, smooth. Peduncle 6—10", mottled. Spathe 3—4" long broadly tubular with ovate (when unrolled) cymbiform obtuse limb open at the top, of a beautiful lively pink or flesh colour deepening to scarlet inside the tube and outside faintly mottled greenish pink. Spadix 3—3.5" long, female portion scarlet .5" long, style very short or 0, 2—4-lobed stigma pink, ovule usually 1 only the other usually abortive. Male inflorescence 1—1.25". Appendix rather stout pale flesh-coloured 1.5—4" long.

A very common forest species in Chota Nagpur! and probably in all districts. Fl. May—July.

The dimensions appear rather variable. *Roxburgh* states that near Calcutta the leaf attains 4 ft. diam. A specimen collected near the Tista River (Darjeeling District) had peduncles 7—8", spathes 7" by 2.3" and spadix 5".

No use appears to be made of the plant.

7. SAUROMATUM, *Schott.*

Tuberous herbs with large solitary (rarely 2) pedatipartite leaves with broad leaflets, appearing after flowering. Spathe shortly peduncled with short cylindrical base with connate margins and very long narrow open finally reflexed limb. Spadix sessile nearly as long as the spathe, male and female inflorescence widely distant, short, dense flowered, with a few large clavate scattered neutrals close above the female, appendage slender not sharply differentiated at its base (as in *Typhonium*). Stamens with compressed connective, cells 2—4 with oval pores. Ovary oblong 1-celled, with 1—4 basal orthotropous ovules, stigma sessile. Berries obpyramidal, 1—2-seeded (1-seeded, *F.B.I.*). Albumen fleshy. Embryo axile, straight, terete.

Vascular bundles with unbranched latex-tubes in stem and petiole.

1. *S. guttatum*, *Schott.*

Tuber flattened-globose or hemispheric 2.5" diam. Leaves occasionally 2, very variable in size, often 2.5 ft. diam. in luxuriant specimens with a petiole 2 ft. long and nearly 1" diam. at its base arising from the centre of the tuber. Peduncle arising from one side of the tuber only 1—2" long in flower, 2—3" long in fruit, green and spotted. Spathe 7—20" long, tubular portion not much differentiated from the limb and often more or less open (at intervals) down to the neuter inflorescence which is soon crowded with dead flies, limb linear-lanceolate, leathery, greenish or yellowish with purple blotches, margins usually purple, waved, apex with a short cusp. Spadix rather slender, ovaries occupying about .5" at base with clavate neutrals just above, then a smooth purple space for 1.5" above which is the male inflor. only .5" long with a smooth grey or purple terete appendix above.

Chota Nagpur jungles, 2000 ft., common!

Central leaflet broadly-elliptic or obovate, rarely narrow-ell. or ell.-oblong, lateral lfts. 2—5 each side not cut quite to the rachis except the last and smallest of the pedate system which is sometimes shortly petioluled and only 3—5" long, others with very broad base and shortly acuminate tip, shining and glabrous both sides, paler beneath, sec. n. translucent very numerous uniting in an intra-marginal one from which again nervules radiate and again unite in a second intramarginal nerve; some of the sec. n. are forked or form a few large areoles by intermediate nerves. Fruiting head 1.5—2.5" diam. subglobose with globose or clavate white receptacle. Berries reddish of more or less hexagonal prisms .4" long, flattened above with a round stigmatic star. Seeds 1—2 (with the remains sometimes of 1—2 other ovules), basal, yellow, pyriform, sub-stipitate.

8. ARISÆMA, *Mart.*

Tuberous herbs with 1—2 leaves 3-sect or pedatisect or pedately compound or with whorled leaflets. Spathe coætantaneous deciduous, convolute at base, with the limb variously shaped often very broad, usually

incurved at the tip. Spadix included or exerted, appendage various, sometimes with a disc-like swelling at base, often excessively long and filiform. Flowers usually dioecious. Fem. fl. densely crowded at the base with sometimes a few neuters above them, ovary 1-celled with short or 0 style and disciform stigma. Ovules 2—8 basilar, orthotropous. Male inflorescence of sessile or stipitate synandria each of 2—5 stamens with cells opening by pores or slits, sometimes neuters above them and neuters sometimes continued on to the appendage. Berries 1—few-seeded. Seeds albuminous with axile embryo.

A very interesting genus of very numerous species, chiefly Himalayan. The appendage sometimes ends in a filiform thread several feet long, trailing on the ground or caught up on other plants. I have found no explanation of this curious development.

Vascular bundles have latex-tubes.

1. *A. tortuosum*, Schott. Dain, Kharw.; Tuya-jondra, S.

About 3 ft. high with a handsome marbled stem and usually 2 leaves with the central leaflet distinct and often shortly petioluled and the 4 lateral on each side pedatisect or pedate with very short petiolule, leaflets lanceolate or oblanceolate and acuminate, centre one 7—9" by 1.5—2" lateral nearly as large or gradually smaller. Spathe 3—5" on a peduncle 2—4 ft. long broadly cymbiform above the open tube, incurved, acuminate, green. Spadix 1- or 2-sexual with yellow slender appendage which is decurved and then again upcurved and exerted, slender and quite smooth.

On the Ranchi plateau and ghats, Horhap forest, etc.! Palamau, Ramandag Forest! Parasnath, Clarke! Fl. May—June, Fr. Nov. Withering away in Dec.

Tuber depressed globose 2—3" diam. Leaflets usually 9 in our plant, narrowed into sessile or petiolulate base, sec. n. numerous, oblique, uniting in an intramarginal nerve. Peduncle embraced by the leaf sheaths for a considerable distance. When monoecious the stamens occupy the upper two-thirds of the inflorescence without intermediate neuters, synandria stipitate of 3—4 anthers. Fruiting head about 2" long, ovoid with oblong red berries .4" long, each with 3—5 grey subglobose angular seeds .15" diam. with short stout obconic base. Apparently the same plant ascends to 8000 ft. in the Himalayas.

9. THERIOPHONUM, Blume.

Tuberous herbs with cordate or sagittate or hastately 3-lobed leaves. Spathe scarcely constricted, limb ovate-oblong lanceolate or linear. Spadix included, often very slender, female at or a little above the base, ovaries sometimes very few, 1-celled, with sessile rounded stigma. Ovules orthotropous few, erect basal and also pendulous from the apex of the ovary. Neuters above the females or not, and below the males, subulate or filiform. Male inflorescence several times longer than the female with sessile didymous synandria of 2 stamens opening by slits or pores, appendage elongate sometimes very slender smooth at least above, sometimes muricate at the slender base with staminodes or neuters. Berries ovoid.

Latex-tubes occur in vascular bundles of stem and petioles.

1. **T. minutum**, *Engl.* var. **Chattarjeei**, *Haines*; Inc. **T. Zeylanicum**, *Kleinii*, *crenatum* and *Wightii*.

Whole plant about 8–12" high with hastately or sagittately 3-lobed, leaves 3–5" long by 1.5–4" broad, basal lobes lanceolate or ovate-lanceolate. Petioles 4–7" long. Peduncle .5–1". Spathe linear or linear-lanceolate 3" by .5", erect finely acuminate. Spadix 2–2.5", slender. Ovaries in a single whorl at the base, oblong, .08" long with 3–4 minute ovules top and bottom. Male inflorescence .5" long with few filiform neuters at its base .15–2" long, anthers minute didymous, connective with a few minute papillæ at apex. Appendage about 1.5" slender, with a slender stipes which is muricate with staminodes or neuters.

Angul, *Chattarjee!* Fl. Aug.

Two specimens were sent to me by *Mr. B. K. Chattarjee* who stated that it was common. Those botanists who would separate *zeylanicum*, *N. E. Br.*, *Wightii*, *Schott*, etc., would also have to make *this* a *separate species* differing from either of *Engler's* sections (*Eutheriophorum* and *Calyptrocoryne*) but uniting them both, the anther-connective not being at all produced, but the rudimentary flowers being much closer to the male inflorescence than to the female. *Th. Wightii*, *Schott* (regarded by me as merely another variety of one widely variable species) with large spathes and very long appendaged anthers has been collected in Raipur close to our area. *Engler* himself says of this species "verisimiliter etiam hæc species, cujus specimina pauca tantum vidi, cum priore conjugenda erit, si specimina numerosa comparari possunt." Of the species enumerated by *Engler* our plant comes closest to *Th. zeylanicum*, some of which (omitting the anther appendage) exactly match it.

10. **TYPHONIUM**, *Schott*.

Herbs with usually depressed globose tubers and entire sagittate or 3–5-lobed or pedately divided leaves. Spathe appearing with the leaves, with short convolute persistent tube and constricted between the tube and the deciduous ovate-oblong lanceolate or linear limb. Spadix exserted, male and female infl. distant with neuters above the female and sometimes below the male, appendage elongate muricate or smooth. Synandria of 1–2 subsessile anthers, opening by pores or short slits. Ovaries 1-celled formed of one carpel, stigma sessile, placenta basal with 1–2 erect orthotropous ovules. Berries ovoid. Seeds 1–2, globose, albuminous, with axile embryo.

Latex-tubes occur in the vascular bundles of stem and petioles.

Some species of *Typhonium* very closely resemble species of *Therophonium* in general appearance.

1. **T. trilobatum**, *Schott*. Syn. *T. orixense*, *Roxb.*? (see below).

Height 12–20" with a subglobose tuber and hastately 3-lobed or sub-3-partite leaves 5–8" long and as broad with ovate acute lobes. Spathe 3–8" long, green or inside red-purple with broadly ovate open limb narrowed to a long point. Neuter flowers above the female many long filiform and curved, appendage bright red stipitate and muricate, base expanded and intruded. Peduncle 1–4".

Singbhum, in jungles, common! Fl. April–May and Aug.–Sept.

Corm white .7" diam. Leaves with the basal lobes sometimes again lobed or auricled making a double sinus at the base and whole blade sometimes broader

than long, 4" by 5.5" to 8" by 10", lobes broadly ovate. Spathe with objectionable odour, mostly 4.5—6" long (including tube .8—1" long), slenderly acuminate, tip straight or twisted, striate. Neuters white, 7" long, much curved, twisted, clustered at base, anthers of 2—4 whitish cells with rose-coloured pollen (*Clarke*), barren portion above stamens smooth pinkish and club of appendix dark purple. Fruiting spadix 1.5" ovoid.

Clarke says that *T. orixense* is distinct, the neuters have long curling thread-like white terminations while in *trilobatum* they are short, oblong, yellow recurved with hardly visible white points. He says also that the leaves differ in venation and spathes also differ. As he knew both in the field and *Roxburgh* also discriminated them he is probably correct.

11. REMUSATIA, *Schott.*

Herbs with a depressed hemispheric bulb-like tuber and erect shoot: from the side of the tuber or corm develops stolon-like bulbiferous shoots with peculiar small crinite bulbils. Leaves peltate, ovate and cordate, solitary in our species. Spathe with an elongate accrescent tube and a broad erect or refracted yellow deciduous limb. Spadix very short, sessile, male and female inflor. separated by neuters, appendage 0. Male synandria densely packed of 2—3 stamens with oblong cells opening by a pore, flat-topped, mixed with neuters. Fem. inflor. short, ovaries with 2—4 parietal placentæ and almost orthotropous ovules, stigma sessile, disciform. Berries obovoid, small. Seeds albuminous, embryo axile.

Branched latex-tubes occur in stems and petioles.

1. *R. vivipara*, *Schott.*

Corm about 1" diam. Leaf solitary (though on young plants from bulbils a succession of leaves arise the same season), 8" by 5" to 17" by 12", dark smooth shining green, ovate acuminate, not very deeply cordate, sinus not extending half-way to petiole, nerves from mid-rib 4—5 each side and from the basal costæ 2—3. Bulbiferous shoots at first stolon-like, ultimately erect or inclined and bearing clusters of scaly bulbils, scales with hooked awns. Spathe developing before the regular leaf from a broad oblong sheath, tubular portion about 1.3" and broad golden-yellow limb about 2", refracted. Spadix 1—1.5".

Always found by me in pockets of soil among large rocks. Elev. 2000—4000 ft. Singbhum! Ranchi, on the ghats, frequent! Hazaribagh, on Parasnath, *Clarke*! Fl. April. The leaves and bulbiferous shoots develop from the break of the rains and last at least until October.

It can be distinguished from the small rock form of *Colocasia* when without the stolons by the leaves being polished below as well as above, the nervules less clearly defined (when fresh) and the tip acuminate. But when dry the more succulent leaves appear very membranous and the sec. nerves very distinct. Midrib with 3—4 sec. n. each side nearly reaching margin and also a pair of sec. n. from junction of basal nerves which bear about 2 other sec. n. There is no intramarginal nerve but a very fine marginal one almost touching the pronounced hyaline margin.

Caladium is a genus of tropical South American aroids with depressed spherical or hemispherical corms and peltate sagittate radical leaves. Both male and female flowers densely packed. Spadix without appendage, dorsally adnate at the base to the spathe. Differs especially from *Colocasia* by the ovaries, which are slightly adherent by their apices, having deeply intruded placentæ so that the ovary becomes

nearly or quite 2—3-locular with central placentation. The leaves are often most beautifully and delicately variegated especially when they first appear in the hot season and for this reason are favourite verandah plants.

12. COLOCASIA, L.

Shoot from a bulb-like tuber or usually from a subterranean rhizome, more rarely with a rhizome continued into a short erect caudex. Leaves entire, peltately attached to the stout petiole, ovate and cordate or sagittate. Spathe appearing with the leaves with a thick accrescent tubular base above which it is contracted, then with an erect cymbiform limb. Spadix free, shorter than the spathe, stout or slender, male and female inflorescence usually with interposed flat neutrals. Appendix cylindrical subulate or 0. Synandria obpyramidal, of 3—6 stamens with linear cells which open by a short slit. Ovaries ovoid or oblong, 1-celled, with 2—4 parietal placentæ each with numerous orthotropous ovules, stigma flat 3—5-rayed. Berry many-seeded. Seeds with fleshy outer and a ribbed inner coat, albuminous. Embryo axile.

Branched latex-tubes occur in stem and petioles.

No neutrals at base of females, many flat neutrals above. Appendix much shorter than inflorescence, rarely 0. Stigma discoid

1. *antiquorum*.

Few neutrals at base of inflor., very few neutrals between M. and Fem. inflor. Appendix slender, longer than the inflor. Stigma oblong

2. *fallax*.

1. **C. antiquorum**, Schott. Syn. *Arum colocasia*, Willd.; *A. nymphæifolium*, Roxb.; *A. esculentum*, L.; Pichigi, Saru, K.; Kachhu, Beng.

Stem above ground 0, or slightly swollen at the base of the leaf-sheaths, arising from a hard tapering rhizome or in cultivated varieties a tuberous rhizome, suckers or stolons sometimes present. Leaves mostly over 12" (exc. var. *rupicola*), peltate, with triangular sinus cut one-third to half-way to petiole, ovate or subtriangular in outline, with a dull (not polished) surface above, paler or coloured beneath but rarely very glaucous. Spathe peduncled, yellow, mostly over 10" long convolute, never widely open, curved slightly backwards in flower. Spadix much shorter than the spathe, rather slender, appendix much shorter (exc. var. *rupicola*) than the inflorescence. Stigma discoid.

Common, both wild and cultivated. Fl. June—Oct.

The following varieties and probably others occur in our area:—

Var. *α. typica*. According to Engler this has the appendix equal in length to male inflorescence. Widely cultivated! Ranchi, Prain! The next is nearly typical.

Var. *β. esculenta*. Schott. Pichigi saru, K.

Tubers small. Stolons 0. Leaves commonly about 20" by 12.5", the two sides often not quite symmetrical, rather dark green above, beneath paler, scarcely glaucous, tip with very small cusp, sec. n. from mid-rib including one from petiole 6 each side and from the outer side of the basal nerves 3 to each nerve, no secondaries towards the sinus. Petiole as long as blade purplish below. Spathe pale yellow, 11—13" long with green cylindrical tube 2—2.5" long. Spadix 5.5—8.2" long, 4—5" diam. at base; fem. inflor. 1—2" long, fertile ovaries green but with several barren white ones intermixed; above females are flattened rhomboid or

irregularly oblong neuters which often develop a median longitudinal depression or slit. Male inflorescence cylindrical 2—3" long, anthers oblong, with stellately crenate or deeply lobed truncate top, anther-cells 6—8, top flat lobed, lobes as many as the cells, each lobe denticulate and much broader than the cell. Appendage 1.5—2.8", always shorter than the male inflor. ("half the male," Schott).

Cultivated in Chota Nagpur! Fl. Aug.—Oct.

Var. *γ. illustris*, Engler.?

Leaves deep purple beneath. Banks of streams, Saranda Forests! I have no other notes of this variety, nor specimens. According to Engler var. *illustris* has violaceous petiole, blade more oblong-ovate than in type, marked by large purple patches between the primary nerves. I have also a record of a *Colocasia* with violet-black petioles along rivers in Purneah!

Var. *δ. stolonifera*, Haines, near var. *aquatilis*, Hassk (a Javan plant with coloured striate stolons and cataphyllaries).

Stout, stem slightly swollen at base with fleshy rootlets arising from a hard tapering rhizome 4—8" long by .7—1" diam., connected with stem by a neck. Stolons numerous up to 10 ft. in length, .3" diam. with narrowly lanceolate half-patent leaf-sheaths with a long slender terete hooked tip, giving rise to new plants at end only. Leaves sagittate from 13" by 6.5" up to 20" by 10", widest a little below the middle, dark green with shades of darker green above, pale beneath somewhat glaucous, apex with a very small cusp, sec. n. including one from the petiole 5 each side of midrib and those of basal costae 2—4 on outer side, 0 or 1 on inner side. Petiole 2 ft.—2.5 ft. long. Peduncle from sheath of last leaf about half as long as petiole. Spathe bright deep yellow 13" long, tube green 2" long, limb open at top and base for about 2" each end then convolute. Spadix 4.3" by .4" diam. at base. Fem. inflor. green with some white barren ones among them, 1—1.2" long, then flat irregularly oblong neuters .8", male inflor. 2.2", appendage 1.2". Ovules over 40. Anthers oblong, cells 8, top merely crenate (not lobed as in *esculenta*).

Var. *ε. rupicola*, Haines. Syn. *C. affinis*, Schott?; var. *Fontanesii*, Schott?

A very much smaller plant in all its parts. Rhizome globose-oblong scaly .7—1". Leaves oblong-ovate shortly cuspidate, 4—8" long on petioles 2—3-times as long; sec. n. including 2 from the petiole insertion, 4 each side only and basal primaries with 2 each. Spathe 5.5—6" on peduncle 4.5", tubular green portion 1.5", limb yellow. Spadix 4—4.5". Females perfect for .5" then tapering and spadix bearing barren females and rhomboid flat neuters for 1", male inflor. 1" long, anther-tops with 4—6 crenulate lobes. Appendix about 1.5" or rather longer than the male inflor.

Among rocks. Ranchi and Singbhum! Fl. Oct. Only differing from *affinis*, Schott, in the rather shorter appendix. Rajmahal Hills, Kurz! This specimen is called var. *Fontanesii* by Engler, but there are only leaves, and these do not correspond to Schott's description of *Fontanesii*, which moreover was a Ceylon plant!

2. *C. fallax*, Schott.

A very glaucous plant 12—18" high with stolons 12—24" long by .15—.17" diam. freely rooting at the nodes. Leaves ovate or elliptic-ovate obtuse or subacute and with a very small cusp, 7.5—13" by 5—8.25", base rounded with a shallow rounded sinus, beautifully glaucous beneath. Petiole longer than the blade, tapering to the point of attachment where it is very slender. Spathe quite erect, 5—6"; tube green .7—1" rather suddenly contracted to the yellow very finely acuminate limb. Spadix 4.5—5", slender with a few white clavate neuters shortly above the base longer than the ovaries. Fem. inflor. pale yellow .6—8" long, ovary with oblong stigmas, flattened neuters above females very few and only occupying .1—2". Male inflorescence .8" long, anthers oblong, slightly compressed with the flat top crenulate, the crenules corresponding to the 8—9 cells, slit of apical pores

extending to margin. Appendage brown 3", tapering from base upwards, smooth except near base where somewhat rugose with undeveloped neuters.

Singbhum, Ranchi and Palamau on the pats, elev. 3000 ft.! Fl. Aug.

I at first described this as a separate species as it differs from the descriptions of *C. fallax* and also from some of the specimens, but it exactly agrees with a specimen named *fallax* by Mr. N. E. Brown which was grown in the Kew Gardens (origin unknown).

L. with 5--6 nerves each side of midrib including one from the insertion of petiole or very close to it, basal primary nerves sometimes forked and with 3 sec. n. on the outer side of each primary. Sheaths on stolons inconspicuous, scarious, venose, appressed, ovate and shortly cuspidate. Ovaries ovoid, gland-dotted and marked with 3 carpellary lines, walls very thin. Ovules numerous on mucilaginous parietal placentæ.

Engler (in *Pflanzenreich*) describes the style as "*brevi coronata*" but it is distinctly oblong stigmatic in my specimens. Schott (in *Bonplandia*, vii, 28) says "ovaria stylo brevi sed manifesta prædita" but the type (Bir-panee, Terya Ghat, Khasia Hills, H.f.) is in fruit. Some other specimens show when dry, an oblong style (or stigma) often surrounded at base by a small annulus.

13. ALOCASIA, Schott.

Stem usually rhizomatous but sometimes rises a considerable distance above the ground. Leaves usually very large entire, peltately attached or not to the long petiole, more or less ovate and cordate or sagittate. Spathe appearing with the leaves with a thick persistent accrescent tubular base above which it is contracted, then with an erect cymbiform limb. Spadix free somewhat shorter than the spathe with a short female inflorescence without staminodes, above the female inflorescence usually flat neuters and then the male inflorescence of free obpyramidal hexagonal synandria each of 3--5 stamens. Appendage cylindric subulate or 0. Ovaries ovoid, 1-celled, with few to many basilar orthotropous ovules, stigma 2--4-lobed. Fruit enclosed by the accrescent tube of spathe which becomes lacerate, berry almost spherical, red, few-seeded. Seeds albuminous, roundish, with thick smooth testa and axile embryo.

Branched latex-tubes occur in stem and leaves.

I have taken most of the characters of the species from Engler and Roxburgh, the available specimens being few and usually very poor.

- I. Not caulescent. Lowest secondary nerves not uniting with the primaries of the basal lobes:—
 - Spathe about 5", coloured. Spadix nearly as long 1. *montanum*.
- II. Caulescent. Lowest lateral nerves joining the primaries of the basal lobes and almost reaching the apex:—
 - A. Basal lobes semiovate or ovate, rounded:—
 1. Basal lobes free to the base or nearly so:—
 - Terminal lobe broader than long. Spathe 6--10" cymbiform. Appendix longer than inflorescence 2. *macrorrhiza*.
 - Terminal lobe ovate-triangular longer than broad. Spathe narrowly cymbiform 8--12" with disagreeable smell, appendix longer than inflorescence 3. *indica*.
 2. Basal lobes more or less connate at base:—
 - Spathe cymbiform, fragrant, 5--8" long *odora*
 - B. Basal lobes triangular subobtuse or subacute, connate at base. Spathe 3--4" 4. *fornicata*. (p. 911).

1. *A. montana*, Schott. Syn. *Arum montanum*, Roxb.

Caudex a short cylindrical tuber up to 2" diam. Leaves somewhat coriaceous broadly cordate-ovate, polished, 6—8" long and nearly 6" broad, shortly apiculate at the obtuse apex, basal lobes only about one-fourth as long as the broadly ovate terminal lobe with an almost circular sinus between, secondary nerves 3 on each side almost from the base, 4—5 sec. n. higher up ascending within the margin and uniting in an intra-marginal nerve. Petiole stout 8—10". Peduncles several, about 8" long. Spathe cucullate, coloured (Roxb., yellow?) with oblong tube 1—1.2" and limb nearly 4", acute. Spadix nearly as long, neuter inflorescence rather suddenly thickened at the base, conoid, acute towards the apex and 2—2.5" long.

Found by Roxburgh in the mountains of the Northern Circars and very likely occurring in the mountains of Puri and Mayurbhanj.

The root is said to be used to poison tigers. Roxb.

2. *A. macrorrhiza*, Schott. Syn. *A. odora*, C. Koch; *Arum odorum*, Roxb.

The largest of our terrestrial aroids, forming a considerable aerial stem often 4 ft. high (attains a much greater size in some provinces) and 2—4" diam. more or less clothed with aerial roots. Leaves broadly ovate sagittate repand, 2—4 ft. long and 1.5—3 ft. broad, deeply cordate, with the basal lobes shortly connate or for about one-tenth of their length and sinus narrow. Spathe 6—10" long with the tube about half as long as the coriaceous hooded cymbiform cuspidate pale-green limb. Spadix nearly as long as spathe and appendage nearly as long as the flowering part, sinuously sulcate. Ovary incompletely 4-celled.

Often seen near pools and rubbish heaps in the moister districts close to the villages but not indigenous. Fl. c.s. Fr. h.s.

The flowers are said to be fragrant.

Engler maintains the distinctness of *odora* and *macrorrhiza* in which case our plant is probably *odora*. In addition to the key characters (see above) which are based on his own but are unsatisfactory (as he states that specimens of *odora* may be found with basal lobes little or scarcely connate), the following appear to be the points of difference and are mainly in relative size:—

A. macrorrhiza.

Caudex 6—15 ft. high and up to 8—12" diam. L. up to 2 ft. and as broad, end lobe triangular ovate acute with 9—12 lateral nerves each side, the lower digitately spreading. Petiole and costæ sometimes coloured. Peduncles 5—8" long. Tube of spathe oblong 2.5—3.3" long, limb 4.7—6.5" long by 2—2.5" broad in middle. Fertile male inflor. 2—2.5" long, sterile appendix conoid obtuse or subacute sulcate 2—2.5" long.

Native of Ceylon.

A. odora.

Caudex only 2—3 ft. high and up to 2—3.5" diam. L. 20"—3 ft. long by 15—30" broad, end lobe broadly ovate, acuminate, with 6—10 lateral nerves each side; basal lobes semi-ovate rounded at tip. Peduncles 5—9.5" long. Tube of spathe

oblong-ovoid or ovoid 1.3—1.7" long, limb 4—5.5" long, 1.7—2.1" broad. Fertile male inflor. 1.25" long. Sterile appendix narrowly conoid 1.25—1.5" long, thickened at base and .4" broad, attenuate upwards.

Native of tropical Himalaya, Silhet and Khasia Hills.

3. *A. indica*, Schott. Manna, Man-kandu, *H.*; Man-guri, Man-kachu, *Beng.*

A robust herb with caudex attaining 3—6 ft. and 4—8" diam. Leaves 2—3 ft. long bright green, triangular-sagittate slightly repand, end lobe triangular acute (*Roxburgh* says rounded with a bent-down dagger-shaped point), with strongly marked whitish midrib and 6—8 strong pale sec. n. each side spreading at an angle of 60—70° from the midrib and slightly ascending towards the margin; basal lobes ovate with rather a narrow sinus between and sometimes shortly confluent, their primary nerves forming an acute or nearly a right angle with each other. Petiole as long as or longer than the leaves, round and tapering upwards, sometimes transversely clouded. Peduncles several (always paired, *Roxb.*) 4—8" long. Spathes with slight, rather offensive smell, 8—12" long of a pale greenish-yellow inside and out, tube oblong-ovoid 1.5—2" long (marked inside with irregular reddish lines, *Engler*), limb 6—9" long by 2—2.4" broad, narrowly oblong with a small subulate cusp. Fem. inflor. yellow, narrowly ovoid, about 1" long; fertile male inflor. white 1.5—2" long, appendix conoid rugulose 4—5" long and .3—4" broad. Pistil obovoid about .2" long with sessile 3—4-lobed stigma. Berry red .3—4" diam.

Occasionally cultivated near native houses. Purneah! Chota Nagpur, *Wood!* Some varieties cultivated as ornamental plants! Fl. April—May.

Numerous fibres from the rootstock end in small tubers and the caudex is usually furnished with adventitious roots.

The stems and small tubers referred to above are eaten.

There are several varieties. *Man-guri* has the petiole darker coloured. In the garden variety *variegata* the petiole has irregular violet lines and the blade is glaucous beneath with pallid nerves, deep green above. Young plants resemble those of *A. odora*.

4. *A. fornicata*, Schott.

A rather large aroid with stout erect caudex 6" to 2 ft. high above ground. Leaves polished ovate sagittate 12—15" (whole length, only 8—10" from insertion of petiole to apex) by 6" to 18" by 10" or even larger, basal lobes about half as long as terminal lobe or less, connate for one-tenth (in Orissa specimens) to one-third (in Chota Nagpur specimens) their length. Petiole 18" to 3 ft. long. Spathe about 3.5" only with tubular green base about 1" only in flower and a whitish-green or greenish-yellow oblong cuspidate limb 2.5". Spadix about equalling the spathe with the appendage about as long as the inflorescence. Synandrium with flat crenulate top and several cells opening by pores above. Ovules 3—5 basal, style short stout, stigma capitate 3—4-lobed. Fruiting peduncle 6—10" somewhat clavate upwards.

Not common. Always under shade and usually along muddy streams. Chota Nagpur (chiefly Singbhum Forests)! Puri forests! No specimens from our area in *Herb. Cal.* Fl. June—July. Fr. Sept.

Basal primary nerves almost at right angles, sec. n. to midrib 5—8 each side slightly raised above and about 4 on upper side only of each basal nerve, tertiaries

rather faint uniting in an intermediate nerve. Petiole and peduncle sometimes with black markings. Fruiting spadix 1", inside accrescent spathe base 1.75—2.5" long. Berries .15" diam. globose obovate crowned with the short style, with one erect seed and 3—4 abortive ovules.

14. CRYPTOCORYNE, Fisch.

Aquatic or marsh herbs with creeping rootstock and stem short or 0. Leaves simple, narrow or broad, sometimes almost grass-like. Tube of the spathe subterranean or submerged and almost completely closed against the entry of the water by ingrowths or partial septa, limb often narrow, projecting above the water by means of which pollinating insects have access.* Spadix very slender with its tip adhering to the septum in the spathe. Fem. infl. a single whorl of connate 1-celled ovaries with a few pistillodes or neuters. Male infl. cylindric with 2-celled anthers, cells with conical perforate tips and vermiform pollen. Ovary with short recurved styles and many erect orthotropous ovules. Fruit of coriaceous connate 2-valved many-seeded carpels. Seeds oblong, albuminous with axile embryo.

- A. Tube of spathe above the inflorescence long and slender:—
 Spathe reticulate inside opposite the male inflorescence 1. *retrospiralis*.
 B. Tube of spathe above inflorescence 0 or split:—
 Spathe transversely lamellate or rugose within. Peduncle 0 2. *spiralis*.
 Spathe smooth within. Peduncle 1" in fruit 3. *unilocularis*.

1. *C. retrospiralis*, Fisch.

An interesting little plant with creeping rootstock, stout fleshy roots and radiating grass-like leaves 3—4" by .2—25" or up to 12" by .75", acute or acuminate, often crisped or waved, costa distinct and 1—2 side-nerves not parallel. Spathe 3—4" or more or less nearly equalling the leaves, sub-sessile, lower tube (including the inflor.) about .3" rather wider than the upper tube (above the spadix), which is slender and 2—4-times as long as the closely twisted blade. Ovaries 5—6, 3—more-ovuled, stigmas broadly elliptic or orbicular. Fruit shortly peduncled ovoid, not twice as long as broad.

Rivers and gravelly or sandy nalas in the forests or open, submerged or flowering when dry. The shorter spathes apparently occur when not submerged. Chota Nagpur, frequent! Probably in all districts. No specimens in *Cal. Herb.* from our area. Fl., Fr. c.s.

L. linear, or linear-lanceolate, narrowed into a slender petiole or subsessile, sheathing. Spathe grey streaked and mottled with purple, the walls of the tube surrounding the male inflor. reticulate with transparent pits between the reticulations, the septum is recurved over tip but not entirely blocking the tube.

2. *C. spiralis*, Fisch. Syn. *Ambrosinia spiralis*, Roxb.

Similar in habit to *C. retrospiralis*, with vertical or horizontal rootstock and no stem. Leaves linear or more often rather linear-lanceolate and .3—4" wide but occasionally up to .6—8" wide, more distinctly

* According to Engler. But very frequently the plants flower after the drying up of the water. The transverse partition is referred to as a septum in *F.B.I.* but it is perforated.

petioled above the sheath. Lower tube of spathe (*i.e.* the part surrounding inflorescence) obconic about .75" long, tube above the spathe hardly any, blade up to .3" broad and open below, closed and twisted upwards and transversely rugose within, usually 2—3" long only, but said to attain 4" or more, dark purple especially inside, margin sometimes denticulate. Peduncle hardly any.

It is said to occur in all the provinces according to *Bengal Plants* but the material shows no specimens from our area, although the general distribution (from Bombay to Lower Bengal) makes it very probable that it occurs.

3. *C. unilocularis*, Wight. Syn. *C. Roxburghii*, Schott; *Ambrosinia unilocularis*, Roxb.

Habit of the last two, with linear lanceolate leaves, attaining 9—18" by 1". Peduncle distinct, clavate upwards. Spathe gibbous opposite the inflorescence, twisted immediately above, the septum at base of the twist, whole length said to attain the length of the leaves (*Roxb.*), purplish outside, inside deeper purple and beautifully dark spotted. Carpels 4—5.

Singbhum? (see below).

Although *Engler* says "*Herb. Kew*" in his monograph opposite the locality for this species there is no specimen at Kew and little is known of the species except from *Roxburgh's* drawing (of which *Wight's* is a copy). *Engler* describes the pistil as 4-gynous but *Roxburgh* figures it as with 5 stigmas and says ovary 1-celled.

A specimen of *Cryptocoryne* collected by me may possibly be this but it had only one flowering spathe, the rest in fruit and this belated flowering spathe was perhaps not fully developed: Rootstock stout about 4" beneath the soil. L. with the sheaths about 4" long then spreading flat on the ground for 5—7" (in *Roxburgh's* drawing they are erect), breadth about .25", fleshy, entire or waved or with small teeth. Spathe twisted almost immediately above the inflor. and limb streaked with purple, 1.5" long. Spadix .3". Ovaries 5—6 combined into an oblong 5—6-celled ovary about 2" long in which the numerous ovules are almost axile, neck ending in 5—6 oblong processes (stigmas?), inside which are (and adhering partly to axis) 5—6 small stipitate papillose bodies (stigmas or rudimentary flowers?). Spathe limb smooth inside. Fruit ellipsoid-oblong ovoid-oblong .6" long, 5-celled with numerous seeds on a peduncle over 1" long.

It is possibly *C. Roxburghii*, Schott with narrower leaves and shorter spathes than usual but the material is insufficient.

Singbhum in river beds! Fl. Jan.

15. PISTIA, L.

A floating stemless but stoloniferous gregarious tufted aquatic with sessile obovate-cuneate leaves in a rosette. Spathe very small, tubular below, open above, its short peduncle partly sheathed. Spadix adnate to back of the tube of the spathe, free above, bearing at the base a relatively large ovoid 1-celled ovary with conical style and discoid stigma. Male inflorescence of few sessile connate stamens beneath the apex of the spadix, with a ring of minute confluent neuters below them. Anther-cells opening by vertical slits. Ovary with many subbasal and parietal or orthotropous ovules. Fruit membranous, few-seeded. Seeds albuminous, integuments strongly thickened towards the micropyle and forming a cap. Embryo ovate or cuneiform, minute, apical.

The seeds float and the first leaves of the seedling are roundish and lie flat on the water.

1. *P. stratiotes*, L.

Gregarious and resembling small floating cabbages with the obovate leaves 1—3" long, rounded or retuse, nerves flabellate, raised beneath, pubescent. Spathe pale yellow or white, .5" long, obliquely campanulate, contracted near the middle.

In most districts! Probably throughout the province but prefers the still backwaters of rivers especially in districts with a warm winter.

Fl. h.s. Fr. c.s.

FAM. 133. LEMNACEÆ.

Small or minute floating gregarious aquatics. Shoot (*frond*) not differentiated into stem and leaf, sometimes also rootless and subglobose, usually explanate and distinctly dorsi-ventral; sometimes also, from the direction and branching of the weak vascular system, a basal and apical portion is distinguishable. The branches grow from the upper (dorsal) side of the frond, but are at an early period enclosed in a pocket by the growth of the parent shoot and become lateral, they may be soon detached and become independent plants. Flowers most minute, monœcious, consisting of 1—2 naked stamens in the male and naked 1-celled ovary in the female, both male and female sometimes enclosed in a common minute membranous spathe. Stamens with 1—2-celled anthers. Ovary with short style and truncate or funnel-shaped stigma. Ovules 1—7. Fruit a bottle-shaped utricle. Seeds 1 or more with coriaceous testa, with or without albumen. Embryo axile cylindric.

Fronde flat with 1 or more rootlets. Fls. sunk in marginal clefts.

Anths. 2-celled

Fronde very minute, subglobose, rootless. Fls. dorsal. Anths.

1-celled, sessile

1. *Lemna*.

2. *Wolffia*.

1. LEMNA, L. Duck-weed.

Fronde explanate with one or more very fine roots. M. and Fem. fls. in marginal clefts enclosed together in a small transitory spathe. Male of 2 stamens (or a pair of 1-stamened flowers?) maturing one after the other, with 2-celled (4-locellate when young) anthers and slender filament, anthers dehiscing by transverse slits, pollen muricate. Ovule orthotropous or half-anatropous.

Note.—Engler separates from *Lemna* the genus *Spirodela*, Schleid. This is distinguished by the daughter-shoot of the frond bearing at its base a small lobe which is considered to be a basal leaf. *Spirodela* has also several roots whereas *Lemna* develops only one to each frond (or frond branch). In *Spirodela* is included *L. polyrrhiza* and *L. oligorrhiza*.

1. Root 1:—

a. Frond entire, branches obovoid, soon detached:—

Frond asymmetric nearly flat both surfaces

Frond orbicular or obovoid opaque, tumid beneath

b. Frond with serrate tip. Branches hastate persistent

2. Roots more than one (*Spirodela*, vide supra):—

Frond herbaceous, broadly obovate to orbicular 7-nerved.

Frond membranous shining ovate or oblong 3—5-nerved.

1. *paucicostata*.

2. *gibba*.

3. *irisulca*.

4. *polyrrhiza*.

5. *oligorhiza*.

Herbaria contain very few specimens of *Lemna* from our area, nor have I found time to collect them. In view of the wide-spread nature of these aquatics, however, it is probable that all the following, the descriptions of which I have to a great extent borrowed from *Sir J. D. Hooker*, will be found.

1. *L. paucicostata*, Hegelm.

Fronde asymmetric, obovate or obovate-oblong, nearly flat on both surfaces, entire. Root 1, with acute root-cap. Ovule solitary.

Apparently throughout India, extending from Moradabad to Ceylon and Khasia. Santal Pargannahs, in stagnant waters, common, *Kurz*! Probably in all districts.

2. *L. gibba*, L.

Fronde symmetric, orbicular or obovoid, tumid beneath, entire, opaque, epidermis with flexuous walls, cells beneath very large. Root 1, root-sheath elongate, cylindric, root-cap acute. Stamens 2. Ovules 2—7. Utricle circumsciss. Seeds erect, anatropous.

Still waters throughout India, *J.D.H.*

3. *L. trisulca*, L. Ivy-leaved Duckweed.

A very distinct species from the lanceolate or oblanceolate daughter fronds being hastately attached and their remaining attached towards the middle or base of the parent shoot and in their turn often bearing 1—2 lateral younger fronds; the shoots or daughter-fronds ultimately develop a slender very tapering base, are often somewhat hastate and are more or less serrate at the tip; nerves 1 towards the base and three towards the apex. Root 1, with acute cap. Ovule solitary.

Bengal, *Roxb.* and *Kurz*! Not specifically recorded from our area but I think I have seen it and it is likely to occur.

4. *L. polyrrhiza*, L. Syn. *Spirodela polyrrhiza*, Schleid.

Fronde large orbicular or orbicular-obovate and up to 3" long, herbaceous flat or nearly so, 7-nerved towards apex and 1 towards base, usually purplish beneath. Roots several. Spathe 2-lipped. Stamens 2. Ovules 1—2.

A common species, probably throughout the province. Bengal, *Griffith*, *Kurz*, and others without definite locality!

5. *L. oligorrhiza*, Kurz. Syn. *Spirodela oligorrhiza*, Hegelm.

Fronde elliptic-oblong, membranous, 15—2" long, 3—5-nerved, purple beneath, collected in circinate groups. Roots 2—5 very long. Spathe 2-lipped, stamens 2. Style long. Ovule 1.

Bengal, frequent, *Kurz*!

2. WOLFFIA, Horhel.

The smallest known flowering plants consisting of minute oblong or subglobose rootless fronds flattened above, proliferous. Flowers without spathe, bursting through the upper surface. Male a sessile or subsessile 1-celled (2-locellate when young) anther, transversely dehiscent at top, pollen smooth. Female a globose ovary with short style and depressed stigma. Ovule 1 erect orthotropous. Utricle spherical indehiscent. Seed oblique, albumen fleshy scanty.

1. *W. arrhiza*; *Wimm.*

Fronde subglobose or more cylindrical.

Very common in Bengal, *Roxb.*, *Kurtz.* and others. Probably throughout India.

FAM. 134. TYPHACEÆ.

(Excluding Sparganiacæ.)

Aquatic or marsh herbs with creeping rhizome clothed with distichous scales and with erect distichous spongy linear leaves placed face to face (not equitant as in *Iris*). Flowers minute densely crowded in cylindrical superposed spikes, the upper spike male the lower female. Fls. often intermixed with slender clavate bracteoles or simple or branched hairs. Perianth 0 (the slender hairs in the female are sometimes regarded as a perianth). Male fl. with 2—5, usually 2—3 or rarely only 1 stamen, filaments usually connate, tip of connective thickened. Fem. fl. seated on a slender elongate axis thickly covered with persistent hairs, in a few species in the axil of a membranous spatulate bract. Carpel 1 minute stipitate and narrowed into a capillary persistent style with a clavate or filiform stigma. Ovule 1, pendulous from the top of the carpel. Sterile female flowers occur on a yet longer axis or stipes with a clavate pistillode. Fruit becoming detached with the hairy stipes, very minute with a membranous pericarp, indehiscent or dehiscent by a lid on germination. Seed sometimes adnate to the wall, with very thin perisperm and fleshy endosperm. Embryo axile.

1. TYPHA, *L.* Reed-Mace; Cat's-tail.

Characters of the Family.

L. 3-gonous above the sheath, pollen 4-globate

1. *elephantina.*

L. semi-terete above the sheath. Pollen globose

2. *angustata.*

1. *T. elephantina*, *Roxb.* Hugla, *Vern.*; Greater Indian Reed-mace; Elephant-grass.

A gigantic gregarious marsh plant 6—12 ft. high with erect grass-like equitant leaves 4—6 ft. long, 7—1.5" broad, somewhat convex dorsally and concave ventrally, becoming narrower keeled and trigonous towards the sheath. Flowering stem embraced at the base by the leaf-sheaths, straight, glossy, spongy within the top forming the rachis of the female and male spikes. Lower female spike 6—10" long by 3—1" diam., finally brown, a deciduous foliaceous spathe embraces the whole inflorescence when young. Male spike 2—3" above the female 8—12" long, pale coloured with a basal spathe and 2—3 smaller upper ones, all deciduous, anthers 1—5, 1" long with 4-globate pollen. Bracts between the flowers very numerous, filiform 2—3-cleft. Fem. fl. with lanceolate stigma, mixed with clavate pistillodes and bracteoles with fasciated tips longer than the inner (perianth?) hairs.

Marshes,heels and river backwaters. Distributed from the United Provinces to Duars and Purneah! Probably in several other districts but not specifically noted. Fl. July—Aug.

It is used for stuffing elephant gaddis.

2. *T. angustata*, *Chaub. Hugla, Vern.*; Lesser Indian Reed-mace.

Similar in habit to the last and often up to 8 ft. high or somewhat more, usually 5—6 ft. Leaves up to 8 ft. long, 3—9" wide, narrower above the sheath but lower parts of the leaves plano- or concavo-convex; plano-convex upwards, acute, often longer than the flowering stem. Female spike pale-brown 3—5" wide in flower, up to 7" or 9" in fruit, sometimes 2 superposed with an interval but in that case there is no interval between the upper female and the male spike. Bracteoles of female subspathulate equalling the linear stigmas, both longer than the (perianth?) hairs, mixed with clavate-tipped pistillodes. Pollen simple.

More frequent than the last and perhaps in most districts but not collected nor always discriminated. Shahabad, *Cal. Herb!* Fl. May—June.

A yellow cake is made from the flowers (pollen?) called "boor" and is much eaten according to *Stocks*.

FAM. 135. PANDANACEÆ.

Trees or nearly stemless, stems when elongate with aerial or stilt-roots, simple or 2—3-chotomously branched, annulate, cylindric. Leaves long and narrow, tufted at the ends of the branches and spirally 3-farious, rigidly coriaceous, keeled with keel and margins spinulosely toothed, rarely unarmed. Flowers dioecious, small, without intermixed bracts or bracteoles, crowded on simple or branched spikes (spadices) which are terminal and in the axils of the upper spathaceous leaves. Perianth 0. Male fl. with numerous stamens (but where sessile and without pistillode the limits of an individual flower are not discernible), filaments free or connate, anthers erect, basifixed. Fem. fl. with small or 0 staminodes; ovary of one to a variable number of carpels with corresponding number of cells; stigmas distinct, sub-sessile, papillose. Ovules solitary and suberect or many and parietal. Fruit of 1—several-celled woody or fleshy drupes angled by pressure with the neighbouring drupes, the whole forming a large globose ovoid or clavate syncarp. Seeds minute, testa striated, albumen hard fleshy. Embryo minute.

1. PANDANUS, L. f. Screw-pine.

Stems not climbing. Staminodes in fem. fl. 0. Carpels 1-ovulate. Seed large.

Arboreous or shrubby. Inflorescence sweet-smelling. Ovary several-celled

1. *tectorius*
(*fascicularis*).
2. *fœtidus*.

Shrubby. Inflorescence fœtid. Ovary 1-celled

1. *P. tectorius*, *Sol.* Syn. *P. fascicularis*, *Lamk.*; *P. odoratissimus*, *Roxb.*; *Keora*, *H.*; *Kiya*, *Or.*; *Kewa-kanta*, *Beng.*

A bushy shrub or growing into a tree with stem 10—12 ft. high with many thick terete aerial and stilt roots. Leaves closely spirally 3-fariously imbricate, erect then drooping, 3—5 ft. long, abruptly caudate.

Spathes white. Male inflorescence very sweet-scented, branched with a spathe at each branch, flowers pedicelled with the stamens spicately arranged on the floral axis (connate filaments?). Female spikes stout unbranched subtended by 3-fariously arranged white spathes. Ovaries of 4—9 connate carpels, 6—20 on a spadix, in fruit trigonous obpyramidal woody 1.5—2" long, with flat tubercled tops each tubercle crowned by a withered stigma; the whole syncarp ellipsoid drooping 4—10" long and 4—8" diam. deep orange-coloured on peduncles 5—6" long.

Wild in the deltaic swamps of the Mahanadi, Balasore and Cuttack, where it forms a tree! Also common and semi-wild in other parts of the Orissa coast and will grow on sand. Sometimes cultivated in other parts (e.g. Ranchi, near the lake). Fl. r.s. Fr. May—June.

Roxburgh states that it is the white spathes of the inflorescence which yields the powerful fragrance so noticeable when this plant is in flower. The shrubby form is often used for hedges in Orissa as in the *Casuarina* plantation at Puri.

2. *P. foetidus*, Roxb. Kcor-kanta, kiya-kanta, *Vern.*

A much branched bush 5—6 ft. high. Leaves 2—4 ft. acuminate spinose toothed as in the last. Male inflorescence in the axils of white or pale yellow spathes as in *P. odoratissimus* but the smell foetid and very disagreeable. Fls. without an elongate torus, covering the rhachis of the spike so that it is impossible to define the boundaries of each, anthers long linear with very short filaments conical at the base. Female spike with very numerous flowers each of a single carpel. Drupes crowded angular obpyramidal, 1-celled, each with a smaller pyramidal crown and an apical prickle (the modified stigma), the whole syncarp very compact and red when ripe, 3—4" long.

In village shrubberies and hedges, occasional in Purneah, Santal Parganahs and Chota Nagpur! Fl. c.s. Fr. May—June.

FAM. 136. CYCLANTHACEÆ.

Perennial herbs or small unarmed palm-like shrubs with distichous or spiral petioled flabellate leaves, usually deeply 2—4-fid or -partite, plicate. Flowers monœcious, both sexes densely whorled or spirally arranged on a simple cylindrical or oblong spadix, which is enveloped when young by 2—6 spathes inserted on the top of the peduncle. Male perianth 0 or with a many-toothed mouth and obliquely stipitate, stamens 6 to many, filaments connate at the base and confluent with the fleshy perianth, anthers adnate, pollen ellipsoid, smooth, pistillode 0. Fem. perianth 0 or of 4 short distinct or connate tepals, sometimes not distinguishable from the neighbouring flowers, frequently accrescent and hardened in fruit, staminodes often 4. Ovary free or immersed in the tissue of the spadix, depressed-quadrate, truncate or 4-lobed at the apex, 1-locular. Style 0 or pyramidal, stigma solitary or 4. Ovules many anatropous, on parietal placentæ or pendulous from the apex of the cells. Fruits forming a fleshy syncarp with berries distinct or confluent containing many small albuminous seeds on fleshy swollen placentæ. Embryo minute axile straight or curved, sub-basal.

1. CARLUDOVICA, Ruiz & Pav.

1. *C. palmata*, R. & P.

A small palm-like plant with very short stem but the leaves on long erect petioles attaining 4—6 ft. in height, blade mostly 4-partite with each segment cut into linear acute lobes. Spadix 1—2 ft. in height crowded with flowers, 4 males stipitate round each female which is immersed in the spathe. Male perianth many-toothed. Female with filamentous staminodes which give a curious fibrillose appearance to the spadix, stigmas 4-sessile radiating, finally swollen. Ovules very many on 4 placentæ.

Often cultivated in grass green-houses and usually mistaken for a palm. Native of South and Central America.

FAM. 137. PALMACEÆ.

Trees or shrubs, usually with a terminal unbranched crown of large leaves, sometimes widely scandent, without aerial roots. Leaves alternate sometimes distichous, plaited, first ones simple, mature palmate or pinnately divided, rarely simple; petiole sheathing. Flowers mostly small in simple or copiously branched inflorescences (spadices) sheathed at the base and often at the base of the branches by spathes, sessile or sunk in the surface of the rhachis, monoecious or dioecious, the males and females nearly always differing in form. Inflorescence rarely terminal and ending the life of the tree (monocarpic). Perianth usually dry or coriaceous, in 2—3-merous whorls, usually free, imbricate or valvate. Stamens 3 or 6 rarely more, anthers versatile, rarely basifixed. Ovary superior, apocarpous, of 3 1-celled carpels, or syncarpous and 1—3-celled, stigmas usually sessile. Ovules 1—2 in each carpel, large, sessile, or with short thick funicle or adnate to the cell wall, anatropous. Fruit various, apocarpic or syncarpic, indehiscent. Seeds erect or laterally attached, raphe usually branching all over the testa; albumen horny or bony, sometimes ruminant. Embryo small, in a small cavity near the surface of the albumen.

I. Leaves in a terminal crown, stem never climbing. Fruit not scaly (1—9):—

A. Leaves pinnately divided:—

1. L. 2-pinnate. Stamens many. Ovary 3-celled 1. *Caryota*.

2. L. 1-pinnate or -pinnatisect. St. 3—9:—

a. Ovary syncarpous, stigmas 3. Spadices androgynous:—

Spadices infrafoliar. Ovary 1-celled 2. *Areca*.

Spadices interfoliar. Ovary 3-celled 3. *Cocos*.

b. Ovary of 3 free carpels:—

Flowers dioecious. Lowest leaflets often thorns. Fruit of drupes. Terrestrial 4. *Phoenix*.

Spadices androgynous. Fem. in a terminal head. Fruits in a large syncarp. Æstuarial, stemless 5. *Nipa*.

B. Leaves flabelliform or palmately divided:—

1. Flowers 2-sexual:—

a. Ovary 3-lobed. Very large palms 6. *Corypha*.

b. Ovary of 3 free carpels sometimes cohering in the styles:—

Carpels 3-gonous. Style filiform 7. *Licuala*.

Carpels globose. Styles 3. 8. *Livistona*.

2. Flowers dioecious. Fem. very large: -
 M. fl. sunk in cavities of the large cylindric branches
 of the spadix 9. *Borassus*.
- II. Leaves scattered. Stem often scandent. Fruit covered with
 closely imbricating scales:—
 Spathes tubular at least below. Fem. fl. sessile on the spike . 10. *Calamus*.
 Spathes at first enclosing the inner ones, then open, outermost
 deciduous. Fem. fl. with a bracteate stipes 11. *Dæmonorops*.
 Many palms occasionally cultivated in gardens are omitted.

1. CARYOTA, L.

Erect, sometimes tall, palms with very large 2-pinnate or 2-pinnatisect leaves and obliquely dimidiately flabelliform, or cuneiform leaflets, petiolules or bases swollen at their insertion. "Flowering from the upper leaf-sheaths and successively downwards," alternately male and female or androgynous. Spathes 3—5, incompletely tubular. Spadices interfoliar, shortly peduncled, much fastigiately branched; branches slender, pendulous. Fls. monœcious solitary and male, or 3-nate with the intermediate female. Sepals 3 rounded, imbricate. Male petals 3 linear-oblong, valvate, stamens numerous, filaments short, anthers long. Fem. fl. subglobose, petals 3 rounded, valvate, ovary 3-celled, stigma 3-lobed. Ovules erect. Fruit globose, 1—2-seeded, stigma terminal. Seeds erect, albumen ruminant. Embryo dorsal.

Trunk solitary, tall. Spadix 8—10 ft. St. 40—50 1. *urens*.
 Trunks several (soboliferous), low. Spadix 4—5 ft. Stamens
 about 15—25 2. *mitis*.

1. *C. urens*, L. Mari, H.; Salapo, Or.; Indian Sago Palm.

A rather stout but very beautiful palm 30—50 ft. high with trunk slightly ringed. Easily recognised by its immense 2-pinnate leaves 15—20 ft. long with leaflets shaped somewhat like those of the Maiden-hair fern but 4—8" long and præmorsely jagged, oblique with the upper margin produced and caudate.

Deep ravines in the Saitha forest, now unfortunately nearly extinct (once frequent near Tuia)! Fairly common in some parts of the Mals of Orissa (e.g. the Tamna forest)! Sometimes planted. Fl. April—Aug.

L. 10—12 ft. broad, petiole very stout and old sheaths reticulate. Spathes 1·5 ft. Spadix 8—10 ft. long, the branches all reaching nearly the same level (corymbose but drooping). Flowers a female between two males. Males 5" long or more, cylindric in bud and about three times as long as broad, stamens about 40—45. Fruit globose 75" diam., acrid.

The fibre of the leaf-sheaths is used. The pith yields a good sago which fact has largely caused the destruction of the tree. The inflorescence is tapped for toddy.

2. *C. mitis*, Lour.

Only found in gardens in our area with soboliferous stems 12—25 ft. high. L. and inflorescence smaller. M. fl. 25" long, st. 15—25. Fruit 5" diam.

2. ARECA, L.

Slender, often tall palms with annulate stems and a crown of pinnate leaves. Spadices infraxillary (from axils of fallen leaves), branched. Male fl. 1—2-nate, many towards the ends of the branches, minute, sepals

small, petals obliquely lanceolate, valvate. Stamens 3 or 6, anthers basifixed, erect. Fem. fl. much larger, few at the base of the branches of the spadix, sepals and petals orbicular, imbricate, accrescent, ovary 1-celled, stigmas 3 sessile. Ovule basal erect. Fruit a coriaceous drupe with a single seed with truncate base and ruminant albumen. Embryo basilar.

1. **A. catechu**, L. Gua, S., Beng.; Supari, H.; The Areca or Betel-nut Palm.

A very graceful palm with a slender trunk 40—70 ft. high but only 6" more or less in diam., very straight and uniform. Leaves 4—6 ft. with numerous leaflets 1—2 ft. long, upper imperfectly separated. Spathe glabrous, compressed. Spadix much branched, rhachis stout compressed, branches with filiform tips bearing more or less distichous minute male flowers with 6 stamens. Fem. solitary at the base and axils of the branches, sepals 3" ovate, obtuse; petals subsimilar, staminodes 6, connate. Fruit ovoid 1.5—2", smooth, orange or scarlet.

Everywhere cultivated in the open village lands, succeeding best in the moister districts.

Yields the Betel nut.

3. **COCOS**, L.

Unarmed palms with (in our species) tall trunk and pinnate or pinnatisect leaves with narrow leaflets. Flowers monœcious on simply paniced erect, at length drooping interfoliar spadices, the branches bearing scattered fem. flowers, often between two males towards their bases and males above. Spathes 2 or more, lower short, upper fusiform or clavate. M. fl. unsymmetric, sepals small, valvate, petals oblong acute, valvate, stamens 6, anthers linear, erect, pistillode minute or 0. Fem. fl. usually much larger, ovoid, perianth greatly accrescent; sepals imbricate, petals convolute with imbricate tips. Ovary 3-celled, cells with short style and recurved stigmas. Ovule 1 in each cell, sub-basilar. Fruit large, ovoid, terete or trigonous, 1-seeded, with thick fibrous pericarp and bony or stony endocarp with 3 basal pores (the remains of the 3 cells). Seed adhering to the endocarp, albumen solid or hollow. Embryo opposite one pore.

A genus of some 30 species, several of which are now introduced into gardens but only the following is at present important in our area.

1. **C. nucifera**, L. Nariyal, narikel (the tree or ripe fruit), dab (the immature fruit), Vern. The Coco- or cocoa- nut (also in commerce, cokernut).

A beautiful palm 60—90 ft. high with straight or sinuous stems and a crown of feathery leaves 8—20 ft. long with numerous close equidistant linear or linear-lanceolate leaflets 2—3 ft. long. Spadix divided into numerous drooping spikes bearing fem. with a few herm. fl. near the base, the upper portion being densely covered with male flowers. Fruit obtusely 3-quetrous, 10—15" long. The endocarp and contained seed is the well-known cocoanut.

In villages, esp. near the houses in most districts but only occasional in the dryer ones, increasing in numbers in the damper districts and becoming abundant near the sea in Orissa. Fl. h.s. and beginning of r.s. and ripening nearly a year afterwards.

Coir is obtained from the fibrous pericarp and every part is used. A "dab" after slicing off the apex yields a most refreshing cool drink in the hot season.

4. PHOENIX, L.

Tall or very short palms with the stems clothed for a considerable time with the bases of the fallen leaves. Leaves pinnate with linear, lanceolate or ensiform leaflets which usually lie in different planes and are frequently fascicled, lowest often spinescent. Flowers dioecious, yellowish, coriaceous, in branched erect or ultimately drooping branched interfoliar spadices. Calyx cupular 3-toothed. Male petals 3, obliquely ovate, valvate, stamens usually 6 (3—9) with subulate filaments and erect dorsifixed anthers, pistillode minute or 0. Fem. fl. globose, calyx accrescent, petals rounded, imbricate, staminodes 6 or a 6-toothed cup, carpels 3 free, stigmas sessile, uncinat. Ovule erect. Fruit an oblong drupe with fleshy pericarp. Seed with very hard or cartilaginous grooved testa and equable or subruminate albumen. Embryo dorsal or sub-basilar.

A. Leaflets more or less fascicled and in different planes:—

- | | |
|--|------------------------|
| 1. Trees attaining 40 ft.:—
Lfts. 6—18" by .75—1". Fr. 1—1.3" | 1. <i>sylvestris</i> . |
| 2. Shrubs, or trunk under 20 ft.:—
Stems 6—12 ft. covered with the spiral leaf-bases. Lfts.
not very rigid, base not thickened nor decurrent | 2. <i>humilis</i> . |
| Stem 15—20 ft. and much stouter than type with rela-
tively small tessellated leaf-bases | var. <i>robusta</i> . |
| Stem very stout, bulbous and tessellated, under 2 ft.
Lfts. very rigid with swollen and decurrent bases | 3. <i>acaulis</i> . |

B. Leaflets not fascicled, 2-farious:—

- | | |
|---|----------------------|
| Stem stout soboliferous 6—20 ft. Æstuarial | 4. <i>paludosa</i> . |
| Stem short slender, not soboliferous. Rupicolar | 5. <i>rupicola</i> . |

The descriptions are mainly after *Brandis*.

Phoenix dactylifera, L., the true Arabian and Persian Date, is a tree allied to *P. sylvestris*. It is cultivated in Sind and the Punjab but only specimens are occasionally grown in our area, where it does not thrive.

1. *P. sylvestris*, Roxb. Khajuri, H.; Indian Date Palm.

A tall palm, often 40 ft. high, with the trunk densely covered with the bases of the fallen petioles. Leaves greyish-green, 7—12 ft. long, leaflets 6—18" by .75—1", the lowest converted into long spines 4" long, much fascicled with the fascicles up to 3" apart and lying in different planes. Spathe thick, almost woody. Male inflorescence white, scented, compact, on a short peduncle. Fruiting peduncle finally drooping 2—2.5 ft. long, terminating in large bunches of spikes bearing orange to reddish-brown drupes 1—1.2" long. Flesh sweet but very scanty. Stone .7—1.25" long, nearly half as broad as long.

Frequent in open lands in Tirhut, Gaya, the northern and eastern parts of Hazaribagh and towards the Orissa coast, occasional in other parts of the province. Fl. h.s. Fr. May—June, also seen in fruit Sept.—Oct.

The leaves are used for mats and baskets. It is frequently tapped for the

preparation of *toddy*, the cuts are successively made in the lower but growing part of the crown and greatly disfigure the tree.

2. *P. humilis*, Royle. Khajur, *H.*; Kita, *K.*; Polot, *Th.*

Stem very rarely 12 ft. usually 4–6 ft. at time of flowering, attains 9" diam., densely covered with the stumps of the fallen petioles, often developing root-suckers when the primary stem has been burnt or injured. Leaves 4–8 ft. Leaflets pliable, 10–20" long, 3–5" wide, fascicled, not lying in one plane, base not thickened nor decurrent on the rhachis which is 1" broad at the base, spines up to 3" long. Fruiting peduncle 2–4 ft., compressed, 5" broad. Fruit 5" long, orange to black.

Common on the dryer ground and ridges in the "bhabar" and hills of N. Champaran! Chiefly on ridges of white clay schist in Singbhum! Fl. March–April. Fr. May–June.

The spadix frequently exceeds the leaves in fruit.

The uses are the same as of *P. acaulis* and I am not quite sure that the distinguishing characters between the two species always hold good.

Var. *robusta*, Beccari. Syn. *P. robusta*, *Hook. f.*

Hooker describes this as follows:—Trunk 15–20 ft. as thick as a man's body closely clothed and appearing tessellated from the sheaths of the fallen leaves. L. about 3 ft. long, lfts. fascicled 4-farious, strict, strongly conduplicate, fruiting peduncle 2 ft. Trunk with the appearance of a *Cycas*.

Parasnath, 4000 ft., *J.D.H.*, etc.

3. *P. acaulis*, Buch.-Ham. Vern. names as for *P. humilis*, also Pind Khajur, *H.*

Stem thick and ovoid, not more than a foot high and as broad as high, covered with the persistent leaf bases. Leaves 2–6 ft. long with stiff fascicled leaflets 10–20" long, 3–7" wide, not in one plane, lowest reduced to strong spines 2–6" long, base of lfts. thickened and decurrent on the rhachis. Spadix 6–10" long in flower, elongating to 1–3 ft. in fruit, suberect. Drupe 5–6" long, red finally black.

A common plant in Chota Nagpur, especially on poor clay soils in open grassy forest! Fl. April. Fr. May–June.

The fruits are much eaten by pea-fowl. The leaves are used for thatching, mats, etc. A sago is prepared from the interior of the stem.

4. *P. paludosa*, Roxb. Hital, *Or.*

Soboliferous with stems 6–20 ft. high and 3–8" diam. covered to a great extent by the dark fibrous network of the sheaths and long pointed petiole-bases but lower parts bare, annulate. Leaves 3–10 ft. long, lfts. 2-farious in one plane, not fascicled, flaccid except the lowest spinescent ones, longer 12–18", tips filiform. Spathe much as in *P. sylvestris*, scurfy outside. Spadix with numerous spreading branches, up to 3 ft. long. Stamens 6, short. Female with 6 scale-like staminodes. Drupe 5" long, shining black when ripe, pulp a dirty looking soft greenish-black of an intolerable taste (*Roxb.*). Seed cartilaginous, embryo at the base.

Sub-gregarious in the mud of the Mahanadi delta. Balasore! Cuttack! Very common and often forming thickets. Fl. March–April. (? It was in young fruit in May.)

5. *P. rupicola*, *T. And.* is a handsome small palm dark green leaves up to 40 ft. long with a marked spiral twist and curved rhachis and the leaflets about 18" in a more or less vertical plane. Fruit shining yellow. It grows on rocks near the rivers of the Sikkim and Bhotan Hills and Duars and is sometimes cultivated for ornament.

5. NIPA, *Wurmb.*

A gregarious palm with branched rootstock but no aerial stem. Leaves pinnatisect with lanceolate plicate leaflets. Spathes many. Spadix terminal, branched erect in flower, drooping in fruit. Fls. monœcious, males in catkin-like lateral branches of the spadix, female in a globose terminal head, perianth glutinous. M. fl. minute mixed with setaceous bracteoles; sepals linear, with broad truncate inflexed tips, imbricate. Stamens 3, filaments cuncate, anthers linear basifixed. Fem. fl. larger with 6 rudimentary displaced sepals, staminodes 0. Carpels 3, tips free each with an oblique stigmatic line. Ovules 3, erect. Fruits forming a large globose syncarp of many obovoid angular 1-celled, 1-seeded carpels with pyramidal tips and sometimes infra-apical stigmas, pericarp fleshy and fibrous, endocarp spongy and floury. Seed erect, grooved on one side, testa coriaceous viscid within and adherent to the endocarp, albumen equable. Embryo basilar, obconic.

1. *N. fruticans*, *Wurmb.*

Stem underground sometimes thick. Crown of leaves dense. Leaves 12—18 ft. long, evenly pinnatisect, leaflets linear or linear-lanceolate with very characteristic bifurcate soft spines or scales scattered along the midrib beneath with their common base adnate to it and each fork subulate 2—3" or more long. Fruits roughly, often unequally, 3—4-sided and compressed and with a variable number of subsidiary flutings and rounded ridges, 3—4" long by 2.5—3.5" wide.

This common Sunderbans palm has not been reported from our area, but I mention it here as I have picked up its fruits on the Orissa coast and it may possibly occur in the Mahanadi delta.

6. CORYPHA, *L.*

Tall stout monocarpic palms with very large flabellately multifid leaves with spinous petiole and very large terminal paniculate spadix with many tubular spathes. Flowers small, 2-sexual. Calyx cupular 3-fid. Petals 3, connate below in a stipes, ovate, acute, imbricate or subvalvate. Stamens 6, filaments subulate, anthers dorsifixed. Ovary 3-lobed, 3-celled; style short, subulate. Fruit of 1—3 globose fleshy drupes with basilar styles. Seed erect, globose or oblong with equable albumen. Embryo spiral.

1. *C. umbraculifera*, *L.* Tali, *Beng.* The Talipat palm.

A magnificent palm attaining 80 ft. high and 2.5 ft. diam., the young trunk covered with the large sheaths and petiole bases, subsequently annulate. L. 8—16 ft. diam. cleft nearly to the middle into linear segments and with a petiole 5—10 ft. long. At flowering time the top of the tree is a huge pyramidal yellow panicle 10—20 ft. in height. After fruiting it dies.

Only occasionally cultivated; chiefly in Orissa.

2. *C. elata*, Roxb. Bajur, Beng. is nearly as tall with spirally ridged trunk and more slender petiole 6—12 ft. long. Panicle much smaller ovoid. Occasionally planted.

7. LICUALA, Thunb.

Short rarely tall-stemmed palms with more or less orbicular or flabellate plicate deeply partite or palmately divided leaves and usually spinose petioles. Spadices interfoliar, sheathed by tubular coriaceous persistent spathes. Flowers usually small, scattered, 2-sexual. Bracts and bracteoles obscure or 0. Calyx cupular or tubular, lobed. Corolla tubular at base, lobes coriaceous, valvate. Stamens 6 with cordate anthers, filaments compressed subulate, united into a tube at base, sometimes adnate to corolla-tube. Ovary of 3 free or nearly free truncate 1-ovuled 3-gonous carpels, styles filiform. Ovules erect. Drupes small with style terminal. Seed erect, globose, free, often hollowed on ventral face, albumen equable. Embryo dorsal.

1. *L. peltata*, Roxb. Thai, Kol; Kurud, Beng.

Stems erect 2—5 ft., rarely 10 ft., with very large erect, palmately compound orbicular leaves 3—5 ft. diam., segments narrowly ob-cuneate, about 20, 4—10" wide at the top, 3—5-lobed with the lobes again 2-lobed, retuse, or emarginate. Spadix erect 4—8 ft. long with simple drooping racemes 8—18" long of subsessile white and green flowers, turning brown with age. Fruit ellipsoid, orange-coloured, .5" long.

In muddy streams or swamps with moving water in the forests of Saranda, Chota Nagpur! Similar localities in the Mals of Orissa (Sulia reserve, Aran forest, etc.)! Fls. Dec.—April. Fr. March—May.

Young leaves with a deciduous rufous tomentum, lobes of median leaflets blunt, of lateral acuminate, strongly plicate. Petiole flat above keeled below, with 2 rows of short recurved black prickles. Racemes (or spikes) woolly or tomentose, about 5—8 only, spathes 12" with 3—4 sharp teeth. Calyx obconic 3—5" long, toothed or shallowly lobed. Cor.-tube scarcely longer with spreading or reflexed acutely triangular downy lobes .25—3" long. Carpels 3-gonous appressed united above in the style.

Leaves used for mats, etc. Elephants feed on the lower parts of the stems.

8. LIVISTONA, Br.

Tall palms with annulate trunk and large orbicular, flabellately plicate leaves split to the middle into 2-fid narrow lobes, petiole long with spinose margins. Spadices interfoliar, long peduncled, erect, fruiting pendulous, loosely paniced. Spathes many, tubular, sheathing. Flowers minute 2-sexual, sepals 3 rounded, imbricate. Corolla valvately 3-lobed, coriaceous. Stamens 6, filaments subulate, united in a ring, anthers cordate. Ovary of 3 nearly free globose carpels, styles short free or coherent, stigmas minute. Ovules basilar, erect. Drupes 1—3, globose oblong or ellipsoid with subterminal style. Seed erect, ventral face hollowed, albumen equable. Embryo dorsal.

1. *L. chinensis*, Br. is often cultivated in gardens and attains 25 ft. but in its young state often grown in tubs. Leaves reniform with the segments deeply 2-fid, long acuminate and pendulous. Drupe olive-coloured.

Other species of *Livistona* are also occasionally cultivated.

9. BORASSUS, L.

Trunk stout. Leaves fan-shaped. Flowers dioecious. Spadices very large, simply branched, spathes open. Male fls. small, mixed with scaly bracteoles, secund in two series in small cymules or capitate spikelets and protruding one by one from the cavities between the large broad closely imbricating bracts of the stout cylindrical branches of the spadix. Sepals 3, narrowly cuneate, tip inflexed, truncate, imbricate, petals shorter, obovate spatulate, imbricate, dry; stamens 6, anthers sessile large oblong, pistillode of 3 bristles. Female fl. larger, globose, scattered singly on the branches of a sparingly branched spadix. Perianth fleshy, much accrescent, sepals reniform, petals smaller, convolute, staminodes 6—9, ovary globose, sub-trigonal entire, or 3—4-partite, 3—4-celled, stigmas 3, sessile recurved. Ovules basilar, erect. Fruit a large subglobose drupe with 1—3 fibrous pyrenes; pericarp thinly fleshy, stigmas terminal. Seeds oblong, top 3-lobed; testa adherent to the pyrene, albumen equable, hollow. Embryo subapical.

1. **B. flabellifer**, L. Tal, tar, tali, tala, tadi, *Vern.*; The Palmyra or Toddy (*tadi*) palm.

A very large palm 70—100 ft. in height and 2 ft. diam. near the ground, often swollen near the middle, when young covered with the dry leaves and bases of the petioles, old naked and marked with the sheath scars. Leaves 3—5 ft. diam. with 60—80 linear-lanceolate (not drooping) segments, folded along the midrib. Petiole 2—4 ft. long semiterete, edges spinosely serrate. Branches of male spadix clustered, about 12" long and 1" diam. including the closely imbricate broad truncate bracts, the flowers seated on the inner upper side of the cavities, petals spreading 1" long. Fem. fl. 1" diam. Fruit 6" diam.

In nearly all districts, cultivated. In Chota Nagpur it chiefly occupies a zone or belt skirting the Gangetic plain from the Sonc to the Ganges at Sahérganj. It is, however, common on the Palamau and Hazaribagh plateau within this zone esp. on gneissic rocks and occurring naturalised in the scrub jungles. In Gaya it is very common. Fl. March—May. Fr. August or the following March—May. Native of Africa.

It is largely tapped for "toddy," the sugary juice from which it is prepared exuding from the cut spadices and which is often used in place of yeast for making bread in camp. The leaves are used for fans. Portions of the fruit and seeds are eaten and there are very numerous other uses for parts of the tree.

10. CALAMUS, L. Cane.

Usually slender palms, rarely erect, armed with long spines or recurved prickles and usually scandent, very frequently climbing by the aid of long flagella copiously supplied with recurved prickles, which may be a continuation of the leaf-rhachis or an appendage to the leaf-sheath or a continuation of the spadix or its spathes. Leaves not confined to a terminal crown, pinnate or pinnatisect, midribs often armed. Spadices interfoliar, compound, elongate, with tubular or open persistent spathes passing into bracts and bracteoles (spathels and spathellules). Flowers small polygamo-dioecious, in usually distichous often scorpioid spikelets, solitary or 2-nate in the spathellules. Male

calyx cupular 3-toothed, petals 3 acute, coriaceous, valvate, stamens 6, filaments short, anthers dorsifixed. Fem. calyx as in the male, slightly accrescent, corolla tubular below, 3-fid, valvate; staminodes forming a cup. Ovary incompletely 3-celled, clothed with retrorse scales, style with 3 stigmas. Ovules basilar, erect. Fruit with thin pericarp clothed with retrorse closely imbricating polished scales, style terminal. Seed smooth or pitted, albumen equable or ruminant. Embryo ventral or basal.

- A. Rhachis flagelliferous, leaf-sheaths not flagelliferous:—
 Lfts. inequidistant, broad. Fruiting per. pedicelliform 1. *latifolius*.
 B. Rhachis not flagelliferous, leaf-sheaths some flagelliferous:—
 1. Spathe elongate persistently tubular:—
 Lfts. fasciated. Fruiting per. not pedicelliform 2. *viminialis*.
 Lfts. equidistant, slender. Fruiting per. pedicelliform 3. *tenuis*.
 2. Primary spathes at first tubular, soon split open:—
 Leaflets narrow equidistant. Frt. per. not pedicelliform 4. *guruba*.

1. **C. latifolius**, Roxb. Var. *marmoratus*, Beccari; Gauri-bet, Or.

A stout widely scandent cane armed with numerous often sub-verticillate close reflexed, or young patent, horizontally flattened, lanceolate prickles over 1" long and numerous very short triangular ones. Leaves very long with the rhachis produced into a long flagellum armed with recurved prickles, leaflets very inequidistant, mostly geminate with both members of the pair on the same side of the rhachis, oblong-lanceolate about 10" by 1.5", or sometimes 20" by 4", ending in a bristly acumen and margins with distant setiform erect prickles. Sheath with a marbled appearance. Inflorescence with spreading distichous somewhat zigzag branches with the internodes sheathed with tubular-obconic spathes with oblique cuspidate densely ciliate mouth, joints of male with recurved or nearly straight spikes 1.5—7" long with closely imbricate orbicular distichous bracts bearing a flower and distinctly 2-lobed cupular bracteole in their axils. Principal spathes shaped like those on the branches, sometimes split at apex, armed with broad short and rather longer spines. Fruiting calyx pedicelliform. Fruit subglobose, nearly 1", pale.

Along streams in the mountains of the mals of Orissa! Fl. Dec.—Jan.

Young parts rusty tomentose. Leaflets not setose on the nerves, sometimes flabellately clustered, petiole pulvinate below on the sheath with sharp narrow spines. M. fl. .2" long, calyx .1" long.

The cane is said not to be as good as the *Kanta-bet* but superior to the *Pani-bet*.

2. **C. viminialis**, Willd. Var. *fasciculatus*, Becc.; Pani-bet, Or.; Bent, K., S.

Often sub-erect and tufted, ultimately climbing in favourable situations, rather stout, armed with slender straight, not flattened, very sharp reflexed spines, .5—1.5" long on the rhachis and petiole and also flat ones on the stem (leaf-sheaths). Leaf-rhachis not produced into a flagellum but a flagellum arises laterally on the leaf-sheaths. Leaflets many inequidistant, often 2—4 close one above the other, then a wide interval, linear-lanceolate, 6—12" by .5—1" ending in a bristle, margins and costæ beneath with setiform prickles. Inflorescence very long with the main rhachis ending in a flagellum, internodes long each covered by a long

tubular spathe with oblique acuminate mouth, surface with scattered reflexed small prickles. Main branches of spadix 7—15" bearing in male many slightly decurved sec. branches 3—6" long with short scorpioid distichous spikes, lower 3" long with very small ovate acute bracts each with a cupular bracteole and flower. Sepals free ovate .06" long, petals oblong acute .1" long, many-nerved. Spathes on the branches tubular with an acuminate tip, mouth glabrous or slightly minutely ciliate. Fruiting calyx explanate. Fruit subglobose, 3" (—5", F.B.I.), pale.

Purneah! Damp ravines in Singbhum, occasional! Puri, very common! Fl. Sept.—Oct. Fr. April—May.

Young parts with a white powdery tomentum. Setæ on the leaflets erectopate. Spines on the flagellæ scattered hooked. Female spikes 2—3" long with oblique truncate close bracts .08" long. Bracteole of M. with short obtuse lateral lobes, of female larger more acute. Albumen equable.

The cane is used for baskets, etc., but is considered inferior.

3. *C. tenuis*, Roxb.

A very slender cane with feathery pari-pinnatisect leaves and numerous close equidistant linear-ensiform 3-costate leaflets, the 3 costæ with slender sparse bristles above, mid-rib only sparingly spinulose beneath. Leaf-sheaths with very slender flagellæ, compressed and unarmed or nearly unarmed in their basal portion, terete and armed upwards with scattered solitary or somewhat confluent claws. Rhachis of inflorescence very long and flagelliferous, bearing partial decomposed inflorescences at intervals, spathes elongate tubular, lower with a short limb and scattered recurved spines, partial spathes unarmed and scurfy when young, spathels densely crowded cymbiform. Male fls. quite exerted from the involucre and corolla with an unusually long tube. Fem. fl. exert accompanied by a well-developed neuter.

Along our northern boundary. Bettiah, *Hieronymus*! Purneah! Fl. r.s.

The canes are 4—75" diam. when sheathed, only about the size of a quill when stripped. Leaves very like those of *guruba*, with 20—30 lfts. each side, 8—12" long by 3—5", the setæ on the costæ however far more slender, often .25" long, only their base thickened. Fls. distinctly 3—4-seriate. Fruit .5" diam., mucronate, seated on the pedicelliform perianth, scales pale with a shallow median channel.

4. *C. guruba*, Ham. Kanta-bet, Or.

A large climber with stems (covered with the leaf sheaths) often glaucous, densely armed with flattened spines of various lengths, longer ones .7", shortest conical. Leaves 3—5 ft. long, shorter with 30—40 close equidistant dark-green linear leaflets each side 6—12" by .5—7", smaller upwards, setose on the 3 or 2 lateral costæ beneath, on the central one only above, margins setose, petiole and rhachis armed with long recurved and short conical spines beneath and on the margins, not flagelliferous, but many of the leaf-sheaths flagelliferous, spines sometimes geminate (not 3—5-clawed as in the somewhat similar-looking *Dæmonorops*). Inflorescence with numerous distant spathes and much paniced branches on a very slender rhachis ending in a long flagellum. Spathes at first tubular throughout and enclosing the panicles, splitting open above and .7" broad contracted to the tubular base and persistent, brown and shining. Partial panicles (from the axil of each spathe)

pyramidal or thyrsiform, 6—9" long. Lower branches 2—3" or longer and again branched, very slender with closely appressed tubular spathes with truncate mouth shortly acuminate on one side, ultimate m. spikes (spikelets) very numerous, erect, 5—3", with adnate minutely cuspidate spathels and very shallow or flat minutely 2- (laterally) lobed spathellules. Calyx tubular .05" long with short ovate teeth, corolla 1", petals connate one-third up, acute, filaments adnate below. Bracts on the female spikes with more prominent cusps. Spathellules flat. Fruit globose .3", scales yellowish-green with brown and scarious margins.

Purneah! Along streams in the hills, Mals of Orissa! Fl. March—April. Fr. Dec.

Leaves very like those of *tenuis* (q. v.) Lfts. about 35 each side, margins usually smooth or very slightly bristly-spinulose. The flagellum is prickly armed throughout (cp. *tenuis*).

Canes used for ropes, etc.

11. DÆMONOROPS, Blume.

Closely allied to *Calamus* (and included as a section of that genus in *Genera Plantarum and Nat. Pflanz. Fam.*), but spathes not tubular, large, at first closed and outer completely enclosing the inner and panicle, deciduous. Inflorescence more compact and the rhachis never elongate or produced into a flagellum. Fem. flower with a bracteolate pedicel. Leaf rhachis produced into a long flagellum.

1. **D. Jenkinsianus**, Mart. Bet, bent, Vern.; Cheka-bet (in the Duars).

A large climbing cane with large pinnate leaves about 6 ft. long, ending in a long armed flagellum with 3—5-fid claws. Leaflets 2 ft. by .6—75" equidistant linear, finely acuminate, 3 costæ sparsely setose above with very long bristles, central only beneath, margins setulose, petiole and rhachis at first furfuraceous with many hooked spines or claws beneath and on margin. Outer spathe densely armed on the back with acicular and flat often compound spines, over 1" broad, 2-keeled with inflexed margins and a long spinescent beak, inner unarmed. Spadices subaxillary with short stout prickly peduncle. Male spadix thyrsiform, dense, flowers deeply grooved. Fruit .7" (F.B.I., only .4" in my specimen, perhaps not mature), marked with characteristic longitudinal grooves passing through the centre of the scales which have scarious margins and broad scarious tips.

One of the commonest canes in the evergreen swamps of the Duars and Tarai! and probably extending into Purneah. Fl. h.s. Fr. Dec.—Jan.

FAM. 138. CYPERACEÆ.

Mostly perennial, grass-like herbs with sympodial rootstock, rarely annual. Stems rarely with knots at the nodes,* usually 3-quetrous and with the uppermost internode below the inflorescence usually very long. Leaves 0 or elongate and grass-like, often 3-farious,* with closed, very

* Compare Gramineæ.

rarely open sheaths and ligule* insignificant or 0. Flowers 1—2-sexual, much reduced, solitary in the axils of close imbricating bracts (*glumes*) forming "spikelets," spikelets often forming an inflorescence of a higher order. Bracteoles 0. Perianth of 6 scales or bristles or of an indefinite number of hairs or 0 (in *Cariceæ* female flower with a *utricle*† enclosing the ovary). Stamens 3 (apparently the outer whorl of a typical Monocotyledonous flower), anthers linear, basifixed and apex entire.* Ovary superior, syncarpous, 2—3-carpellary, 1-celled, style short or slender with 2—3 stigmatic branches.‡ Stigmas not feathery. Ovule 1 basal erect anatropous. Fruit dry 1-seeded (nut), seed usually free from pericarp. Embryo small basal median enclosed by the floury albumen.

Mostly plants of damp places or marshes.

- I. Two-sexual flower-bearing glumes in a spikelet always at least one usually many above the 2—3 lowest empty glumes. Nut neither bony nor enclosed in a utricle:—
- A. Fl. glumes all distichous (apparently few lowest in *Courtoisia* sometimes spiral). Bristles always 0:—
1. Glumes many. Rhachilla of spikelet persistent:—
 - a. Stigmas 3, nut more or less 3-gonous 1. *Cyperus*.
 - b. Stigmas 2, nut not at all 3-gonous:—
 - Nut laterally compressed 2. *Pycreus*.
 - Nut dorsally compressed 3. *Juncellus*.
 2. Glumes often few. Rhachilla of spikelet deciduous leaving a disc above the empty glumes:—
 - a. Stigmas 2. Spikelets always in capitate spikes. Gl. 4—5 only. Nut compressed 4. *Kyllinga*.
 - b. Stigmas 3. Spikelets capitate or spicate:—
 - Bisexual glumes 1—12, not winged 5. *Mariscus*.
 - Bisexual glumes 1—3 only, prominently winged 6. *Courtoisia*.
- B. Flowering glumes many spirally arranged or sometimes lower only sub-distichous. Bristles often present:—
1. Style base swollen over a button-like apiculus of the nut, a constriction between the apiculus and nut:—
 - a. Leaves 0. Bristles nearly always present 7. *Eleocharis*.
 - b. Leaves usually present at base of stem. Bristles 0:—
 - Style persistent flat and hairy, or if deciduous not leaving a prominent button on the nut. L. glabrous 8. *Fimbristylis*.
 - Style linear glabrous, deciduous and leaving a button on the nut. L. or their sheaths with fine hairs 9. *Bulbostylis*.
 2. Style-base passing gradually into the nut (sometimes deciduous a little above the base leaving a small apiculus). Bristles or scales often present:—
 - Bristles, linear or filiform or 0 10. *Scirpus*.
 - Bristles cut into numerous capillary segments 11. *Eriophorum*.
 - Bristles 6, inner 3 with expanded sub-petaloid tips 12. *Fuirena*.
 - Bristles 2, scale-like elliptic and enclosing the nut 13. *Liphocarpha*.
- C. Fl. glumes few, only the next above the 3 or 4 empty 2-sexual, rarely also a second 2-sexual. Lower glumes distichous, uppermost spiral:—
- Nut beaked by the persistent dilated style base 14. *Rhynchospora*.

* Compare *Gramineæ*.

† For the morphology of the "utricle" see *Carex*.

‡ Referred to shortly as stigmas, the shaft or haft only being called the style.

- II. Two-sexual flowers 0. Spikes or spikelets 1—2-sexual:—
 Spkts. with 1 fem. fl. and 1 or more male or entirely 1-sexual.
 Nut bony usually polished, not enclosed in a utricle 15. *Scleria*.
 Spkts. all reduced to 1 flower, in the axils of spicate glume-
 like bracts, upper bracts in a spike with male flowers and
 the lower female or lower spikes entirely female, uppermost
 entirely male. Nut enclosed in a utricle 16. *Carex*.

1. CYPERUS, L.

Annual or with perennial rhizomes. Leaves mostly towards the base of the erect stems, rarely reduced to sheaths, bracts under the inflorescence usually resemble ordinary foliage leaves. Spikelets more or less laterally compressed, with many glumes, in heads or spikes which are arranged in simple or compound umbels or sometimes reduced to a single head or spike. Rhachilla persistent (exc. in *aristatus*), sometimes winged (see note below). Glumes distichous, at least the lower deciduous in fruit, 2 lowest empty, next above several or many 2-sexual (very rarely reduced to 1 or 2 flowering and then the lower glume not enclosing the upper), all subequal, upper-most 1—3 male or empty. Hypogynous bristles 0. Stamens 3—1, with linear or oblong often apiculate anthers. Style branches ("stigmas") 3, base not tumid nor articulate on the nut which is usually equally 3-gonous and 3-sided (a few species have unsymmetrical or slightly compressed or quite globose nuts).

Cyperus as defined above excludes *Pycneus*. *Juncellus* and *Mariscus* as in the *Flora of British India* and as I understand is being done in the *Flora of the Upper Gangetic Plain*.

Much use has been made in the *F.B.I.* of the wings of the rhachilla, and it seems to me that the distinction of narrow and broad wings (in itself a purely relative distinction difficult to work without a suite of specimens) widely separates some closely allied species. The rhachilla may be winged in various ways, either the wings are the very thin continuous margins of the compressed rhachilla and lie in the same plane as that of the rhachilla, or the wings are at right angles to this plane and discontinuous, but form no part of the glumes or, thirdly, the wings appear to be the detached bases of the glumes themselves and can therefore only be seen after these fall. Cooke (wrongly as I think) states as a universal rule that the wings form part of the glumes.

Of other characters I am a bit doubtful of the value of the length of the bracts but that of the glumes appears to be a very good character and to vary within singularly narrow limits.

- α. Stigmas 3, minute or tapering, nut unsymmetrical and angles corky. Tank flowers:—
 Style long with minute stigmas. Infl. capitate 1. *cephalotes*.
 Style short slightly compressed and widening upwards, stigmas as long, somewhat tapering. Infl. sub-capitate 2. *platystylis*.
- β. Stigmas 3 filiform. Nut symmetrically 3-sided (exc. sometimes in *flavidus* and *difformis* and exceptionally in others):—
 I. Slender or caespitose annuals (sometimes perennial in *haspan*). Glumes small in all (under .07" except No. 11). Spp. 1—11:—
 A. Spikelets clustered (*i.e.* not spicate). Spp. 1—8:—
 1. Glumes very short, as broad as long. Spkts. in dense globose heads, hds. umbelled. Nut sub-equally 3-gonous:—
 Gl. .025" long, obovate, truncate. Nut .02" 3. *difformis*.

2. Glumes slightly longer than broad, .02—04" long. Spikelets numerous digitate. Nuts sub-globose:—
Rhizome 0. Nut globose or sub-compressed, obscurely 3-sided. St. 1 4. *flavidus*.
Rhizome slender. Nut globosely-obovoid, 3-sided. St. 2—3 5. *haspan*.
3. Glumes somewhat longer than broad, .02—05". Nuts symmetrically 3-gonous:—
H. 2—8". Gl. .04—05" mucronulate. Nut obpyramidal .02" 6. *amabilis*.
H. 2—6". Spkts. chestnut-colored. Gl. .04—05" with awnlet about $\frac{1}{4}$ th blade. Nut linear-oblong .03" 7. *castaneus*.
H. 1—3". Spkts. ferruginous. Gl. .03—04" with awnlet recurved, $\frac{1}{2}$ to as long as blade. Nut narrowly obovoid .02" 8. *cuspidatus*.
- B. Spikelets spicate rather than clustered but rhachis short (long in *iria*). Spp. 9—11:—
1. Spikelets very short (.2—4" long only) in contracted spikes resembling heads, rhachis on fall of spkts. marked with spiral disciform scars:—
Gl. .05—06" long with recurved awnlets as long as blade 9. *aristatus*.
2. Spikelets elongate, not deciduous nor leaving closely scarred rhachis:—
Gl. very short and broad, .04—05" truncate. Spikes long 10. *iria*.
Gl. .13—15" acute or mucronate. Spikes short 11. *compressus*.
- II. Perennials with thick rootstocks or thick or slender rhizomes. Glumes mostly over .07" (exc. in some Nos. 24—28). Spp. 12—end:—
- A. Spikelets clustered, not spicate. Spp. 12—15:—
1. Spikelets in simple heads or reduced to a single spkt.:—
- a. Spkts. much compressed, white or cinnamonous:—
Spkts. .4—1" long. Median gl. .15—17". Nut .06—08" 12. *niveus*.
Spkts. .2" long, rarely .3—5" in a dense head like a *Kyllinga*. Gl. .05—08". Nut .03" 13. *leucocephalus*.
- b. Spkts. not much compressed. Gl. .18". Sand plants 14. *arenarius*.
2. Spkts. 3—9 in a cluster, clusters in compound umbels:—
Gl. .06—07" long. Style very short. Nut broadly ell. 15. *diffusus*.
- B. Spikelets distinctly spicate. Spikes in simple or compound umbels. Spp. 16—end:—
1. Rhachilla with usually 2 wings at each internode parallel to median plane of flower, free from glume or 0. Robust herbs. Spp. 16—28:—
- a. Nut oblong or narrowly ellipsoid. Inflorescence usually more or less feathery with spikelets of unequal length and slender rhachilla, not conspicuously shorter than the glabrous spikes (open to exceptions but *cp.* next section). Spp. 16—23:—
- i. L. long (often as long as stem). Bracts long. Wings of rhachilla narrow and hyaline (usually). Gl. often loosely imbricate:—
† Gl. .07—1":—
Spkts. .7—1" long, nodding or spreading

- on the lax spike. Gl. distant, truncate, reddish
 Spkts. erect, at least in fruit. Gl. mucronulate
 Spikes more densely fascicled, usually grey
 †† Gl. .18" long, loosely imbricate as in *distantis*
- ii. L. few or short (up to 6") or 0. Bracts short. Wings of rhachilla variable in breadth. Gl. closely imbricate:—
 Stem almost 3-winged at top. Spkts. terete. Gl. .08" with incurved margins all round when dry. Wings very narrow
 Stem 3-gonous. Gl. .1". Wings broader. Bracts rarely half the length of the umbel
 Stem obscurely 3-gonous at top, sometimes obscurely septate when dry. Wings as in 20. Bracts $\frac{1}{2}$ to as long as umbel. Spkts. reddish
 Stems terete, septate or articulate when dry. Bracts very short, almost scale-like
- b. Erect cultivated shrubs or small trees. Recept. m.s. to large, solitary or paired, axillary:—
 Sub-arboreous L. pale or hoary, usually tomentose beneath, mostly not lobed. Recept. 1" or less, mostly stalked
 Shrubby. L. deep green, rarely tomentose beneath, mostly deeply lobed. Recept. 1.5", mostly sessile
- iii. L. usually short (4--8") or 0 rarely 16". Bracts very long and overtopping the compound umbel. Wings of rhachilla very strong embracing the ovary and nut:—
 Gl. .12" rounded at back. Nut half as long, oblong, style shorter than nut
- b. Nut broadly ellipsoid or obovoid. Spikelets of nearly equal length usually stiffly spreading in fruit, in almost cylindric spikes with spreading branches at their base. Rhachilla compressed:—
- i. Rhachis of spike or glumes more or less scabrous or pubescent:—
 Gl. .05--.07", glabrous. Spkts. .15--.3"
 Gl. .06--.09" hispid on top of keel. Spkts. .7"
 Gl. .1" glabrous. Spkts. .6--1.2"
- ii. Rhachis of spikes and glumes glabrous:—
 Gls. ovate. Spkts. ovate or oblong or if linear .1" broad
 Gl. .09--.1". Rhachilla wings narrow or 0
 Gl. .05--.06". Rhachilla wings broad. Spkts. spreading
 As in 27 but spkts. denser, erecto-patent, dull-coloured
 Gls. linear ovate. Spkts. linear
16. *distantis*.
 17. *nutans*.
 var. *cleusinoides*.
 18. *Thomsoni*.
 19. *malaccensis*.
 20. *tegetiformis*.
 21. *corymbosus*.
 22. *articulatus*.
 22a. *palmata*.
 22b. *Carica*.
 23. *tegetum*.
 24. *pilosus*.
 25. *babakensis*.
 26. *procerus*, var. *lasiorrhachis*.
 26. *procerus*.
 27. *exaltatus*.
 28. *radiatus*.
 28a. *digitatus*.
2. Rhachilla with wings only apparent after fall of the glumes which have broad margins decurrent on the rhachilla (either adnate to the wings or

- wings being bases of the glumes):—
 Base of stem slender. Infl. lax 29. *rotundus*.
 Base of stem woody. Rays of umbel very slender 30. *tuberosus*.
 Base of stems slender. Inflorescence subcapitate 31. *polystachyus*.

1. *C. cephalotes*, Vahl.

Stems and roots slender. Leaves 2—5, about two-thirds as long as the stem. Spikelets many in a single dense compound head .4—75" diam. often with broad bracts above the 3 (—5) foliaceous ones. Spikelets .25—5" long by .12" broad, rigid, often bent, with stout persistent angular, hardly winged rhachilla. Glumes closely imbricate, cymbiform, green with red or brown, .1" long. Nerves exc. midrib obscure. Style with minute stigmas. Nut ovoid, unequally trigonous (*i.e.* somewhat plano-convex), passing gradually into the linear style, stipitate below, corky.

Floating in tanks with slender stolons (*Clarke*). No specimens from within our area but it extends from Bogra in Bengal to Madras and therefore almost certainly occurs in Orissa. Fl. May.

Stems 4—16". L. about .17" broad. Bracts up to 4—8" long. St. 3—2, filaments broad, anthers large, linear-oblong. Nut .08" long (or half glume, *Clarke*).

Clarke remarks that in those Cyperaceæ which float in tanks which do not dry up a corky thickening of the cells, especially towards the lower angles of the nut, enables them to float and vegetate among the rotting surface vegetation of the tank.

2. *C. platystylis*, Br.

Usually robust with stems and leaves up to 2 ft. long, stoloniferous. Inflorescence compound, but heads often very short-peduncled, so that they often appear as one, 1—10" diam. Spikelets bright brown, umbellately or digitately clustered, .2—5" long. Glumes (lower) .1" long, broadly ovate or ovate-oblong concave, scarcely cymbiform (cymbiform, *Clarke*), the back with three green rather distant nerves, sides thinner nerveless but streaked with red, apex minutely mucronate. Nut dorsally compressed and subplano-convex but keeled and with lateral ridges so that it is 3-gonous, the ridges yellow and corky.

A tank-floater (*Clarke*). On banks of the Ganges (not apparently floating). Kurz. Bhagalpur (Nathpur), *Ham.* Santal Parganahs, Kurz! Also Rajshaye and Lower Gangetic Plain so probably over the whole of the North-Eastern districts. Fl., Fr. May—Feb.

Stolons covered with ovate striate brown scales. Stems flattened below, 3-gonous upwards, .5—7" thick at base, up to 42" long and subsolitary (*Clarke*) or clustered (*Kurz's* specimen). L. up to .3—5" wide with scabrous cutting edges. Bracts 2—18", leaf-like. Rhachilla with strong transverse ledges but not deeply excavate after fall of glumes. Fil. ligulate; anths. linear-oblong with a small red mucro. Style about half nut, flattened; stigmas nearly as long as style.

3. *C. difformis*, L.

Tufted, annual, 6—20" high, well marked by its acutely triquetrous weak stems and congested globose grey heads of linear-oblong spikelets .17—3" long with very numerous minute glumes only .025" long, broader than long (when unfolded), obovate and truncate. The heads are .3—5" diam. usually several to many in irregular umbels with bracts 2—10" (usually 2—6") long, sharply keeled. Nut broadly

ellipsoid, subequally trigonous, very pale brown or straw-coloured, nearly as long as the glume.

In wet ground, sand of river-beds, etc., frequent. Sikkim Tarai, King! Bhagalpur, *Ham.*! Monghyr, *Ham.*! Singbhum, common! Hazaribagh, *C.B.C.*! Chota Nagpur, *Wood.*! Throughout India, *C.B.C.*, and almost certainly throughout our area. Fl., Fr. Aug.—Jan.

L. usually somewhat shorter than the stem, .1—2" broad, several-nerved, flaccid. Umbel often appearing lateral from the longest bract being erect. Rhachilla with pale centre and grey wings between the ledges. Glumes with green centre and red or brown sides, when dry with almost white centre tips and margins. Nut .02", surface neither striate nor punctate (even under high magn.).

4. *C. flavidus*, Retz.

An annual caespitose sedge or stems subsolitary, 2—12" high with the yellow or brown inflorescence usually occupying over half its height and very compound, 2—9" diam. Spikelets very numerous .2—3" rarely elongating to .5" long (after fall of lower glumes), linear. Glumes minute .02—04" long, ovate-oblong (when unfolded), with rounded not keeled back triangular in shape and more opaque than the more hyaline sides, apex rounded, midrib and nerves very obscure and no mucro. Stamens 1, more rarely 2. Nut practically globose or very obscurely 3-sided, white and minutely verrucose (under high mag.) when quite ripe .01—015" long, with a minute stipes.

Very common in rice-fields. Monghyr, *Ham.*! Western Bengal, "common everywhere in rice-fields, wet place etc.," *Kurz.*! Ranchi, *Clarke.*! Hazaribagh, *Clarke.*! Manbhum, *Clarke.*! Puri, *Walsh.*! No doubt in all districts. Fl., Fr. April—Dec. Apparently always annual. "Lives about 3 months," *Clarke.*

Very closely allied to *haspan* and sometimes mixed with it. L. 0 or flaccid and overtopping the stem, .1" broad. Bracts similar. In fruit the white nuts are visible between the opened glumes. They are plano-convex according to *Clarke* "with plane face to rhachilla," 3-gonous according to *Cooke*, but in the many specimens I have observed they are as described above and the plant comes very near to some *junceus* and *Pycnus*. Rhachilla slender blotched with red.

5. *C. haspan*, L.

A tufted herb with many equal stems 3—15" high or stems scattered on the horizontal rather slender creeping rhizome. Inflorescence simple or a compound umbel with numerous unequal rays up to 2.5" long and bearing 3—8 stellately spreading rather slender linear-lanceolate grey or reddish spikelets .2—4" long by .04—05" broad. Glumes .04—06" long, ovate-oblong (unfolded), not or slightly keeled and obscurely nerved, obtuse or sometimes minutely mucronate. Stamens 2—3. Nut .015—02" long, globosely obovoid, trigonous, smooth or minutely verrucose (under high magn.). Style slightly longer than nut.

Kisanganj (Purneah)! Behar, *J.D.H.*! Monghyr, *Ham.*! Jamalpur, *Cal. Herb.*! These are the only specimens seen from our area, but *Clarke* states that it is abundant throughout India in rice-fields. Fl., Fr. May—Sept. Perennial but often flowering on fibrous roots the first year.

Stems variable, sometimes stout, 3-gonous or sub-3-angulate above. L. sometimes 0, 12—17" wide with inflated sheaths. *Clarke* says that the umbel may be thin and straggling (as in our specimens) or dense with innumerable spikes, bracts short or long. Anthers linear-oblong, often with bristly tip.

6. C. amabilis, Vahl.

An elegant small sedge with cæspitose stems 2—8" high terminating in a compound (rarely simple in very small specimens) usually decomposed umbel of many clusters of yellow and brown linear spikelets .2—5" long or sometimes (after fall of some of the glumes) up to .7" or 1" long, .04—06" wide. Glumes close numerous, laxer and more spreading in fruit, .04" long only, lower rarely .05", narrowly cymbiform, minutely mucronate. Nut very small, 3-quetrous, obpyramidal, pale yellow (ripe?) when fresh, brown when dry, scarcely .02" long.

Very common in rice-fields, etc. Behar, Kurz! Chota Nagpur, all districts, plains and plateaux! Fl., Fr. April—Dec.

Leaves one-third to half as long as stems, finely acuminate, .06" broad, quite glabrous. Rays of umbel 1—4" long. Spikelets usually brown down the centre and golden on the edges. Rhachilla with brown midrib and thin scarcely winged margins, concave but not excavate between the ridges. Glumes 3—5-nerved on the back, mucro variable (according to Clarke, always very small, straight, and usually pointed in specimens seen by me). Anther small oblong. Style somewhat shorter than the ripe nut, stigmas nearly as long as style, very slender. Nut (under high magn.) has lines of minute raised dots.

7. C. castaneus, Willd.

A pretty little cæspitose sedge 2—6" high with chestnut-coloured linear spikelets .2—35" long (or after fall of lower glumes up to .7" long) in mostly simple (a few compound in larger specimens) umbellate heads. Glumes 15—30 (15—70, Clarke) minute, linear-oblong (when folded), scarcely cymbiform, obtuse, brown, with the green keel excurrent as an erecto-patent or recurved awnlet about one-fourth as long as the glume. Nut .03" linear-oblong, with parallel sides, 3-quetrous, dark red. Style much shorter than the nut.

Singbhum, in moist fields! Hazaribagh (Giridih and Parasnath), Clarke! Fl., Fr. Sept.—Dec.

Roots of very delicate fibres. Leaves filiform, several in the cluster, mostly shorter than the stems. Bracts with a broad base gradually filiform upwards, mostly twice the diameter of the head or in compound umbels sometimes exceeding the few rays, which may attain nearly 2" in length. Stamen usually 1 (sometimes 2) with small oblong anthers. Style-branches short. Glume .04—05" long without the awnlet, slightly 2-lobed, the sides ending in rounded shoulders broader than the 3-nerved keel. Nut very closely minutely punctate (under high magn.), three-fourths as long as glume.

8. C. cuspidatus, H. B. and K.

A very small sedge often only 1" high, rarely 4", much resembling the last but usually a ferruginous-brown rather than chestnut coloured (though Clarke says that the colour in both is somewhat variable), best distinguished by the somewhat longer awnlet and especially by the nut being obovoid .02" long only. The close simple (very rarely compound) heads of spikelets often form a continuous sub-globose mass over-topped by the few filiform bracts. Glume (with the excurrent awn) .05", awn recurved about half to three-fourths as long as the retuse conduplicate blade which is only nerved in the keel. Nut oblong-obovoid.

In drying up rice fields and sometimes associated with the last. Purneah, Kurz! Monghyr, Ham! Singbhum! Hazaribagh, Clarke! Manbhum (Barakhar), Cal.

Herb.! Barkūda (Chilka Lake), N. & C. Fl., Fr. Sept.—Nov. Annual. *Clarke* says that it is distributed throughout India.

L. shorter than the stems, very slender. Bracts sometimes .3" long. Glume same shape as in *castanous*, blade only .03—.04", awn sometimes (e.g. in the Monghyr specimen) as long as the 2-lobed blade. Nut .02" long, under high magn. minutely punctulate in close longitudinal lines, chestnut-coloured.

9. *C. aristatus*, *Rottb.*

A small sedge with the habit of a *Kyllinga*, very well marked by reason of the small dense heads of spikelets .2—.4" long with the brown glumes furnished with recurved awnlets as long as the blade, length of glume together with the awn .05—.06".* Nut oblong or narrowly oblong-obovoid 3-quetrous, brown, .02—.027" long, minutely mucronate with the style-base.

Ranchi, *Clarke*! Hazaribagh, *Clarke*! Fl., Fr. Oct.—Nov.

Stems tufted, 3-quetrous or sub-3-ulate. L. usually shorter, .05—.08" broad. Rays of umbel, if present, few, .2—.7" long or heads all clustered and sessile, globose or oblong, .25—.4" long, the rhachis on fall of the closely packed spikelets marked with prominent spiral disciform scars. Bracts 2—5 slender, tapering, up to 2" long. Glumes with the blade sometimes shorter than the awn, keeled, ovate-oblong, nerved to the margin. Stamen 1. Style slender, a little shorter than the nut and capillary stigmas a little shorter than the style.

10. *C. iria*, *L.*

Rhizome 0. Stems tufted clustered 4"—2 ft. high, 3-quetrous. Spikelets in simple or compound spikes or sub-racemose on the branches of a decomposed inflorescence, main branches of inflorescence umbellate with compressed peduncles 0—5" long much swollen at their base. Glumes very broad and truncate, flowering 5—20, .04—.05" long conduplicate keeled but when opened out rather broader than long with broad scarious nerveless sides, scarcely imbricate in fruit and nut sometimes slightly exceeding the glume, black, 3-quetrous, microscopically punctulate, style much shorter than nut.

Common in rice-fields. Bhagalpur, *Ham.*! Patna, *Wall.* (No. 3360)! Monghyr, *Ham.*! Singbhum! Manbhum, *Camp.*! Khurda, *Walsh.*! No doubt in every district. Fl., Fr. Aug.—Jan.

Luxuriant plants attain 3 ft. in height. Very distinct in the short broad glumes not longer than the black nuts and scarcely imbricate in fruit but very variable (like most of the genus which grow in more or less drying-up swamps) in size. Leaves shorter or as long as stems. Bracts under inflorescence attain in large plants 12" by .2", 2 or 3 always exceeding the inflorescence. Inflor. varies from 2" to 20" in diam., with a cluster of sessile spikes and several long branches again carrying umbels of spikes or compound racemes, subtended as are the partial spikes by filiform bracts, and setaceous bracts or glumes are frequent at the base of the spkts. Spkts. variable in length, the spikes sometimes ending in an elongated spikelet. Glumes 7—9-nerved on and close to keel (3—5-nerved on back, *C.B.C.*), keel sometimes scabrid. Rhachilla broad flattened but not winged. Nut oblong-obvoid.

11. *C. compressus*, *L.*

Rhizome 0. Stems clustered erect and diffuse 6—15" long (up to 30", *Clarke*) and whole plant a somewhat grey- or silvery-green. Spikelets large, much compressed, 4—6" long elongating to 1.2" after fall

* *Cooke* says that the glume is $\frac{1}{4}$ " long. Possibly a mistake for $\frac{1}{2}$ " or else the east and west plants are different forms.

of lower glumes, .08—.15" broad, 3—many in a simple terminal head or short spike, or heads also umbelled on rays 1—3" long. Glumes cymbiform, .13—.15" long, ovate when unfolded, with keel produced into a short cusp or mucro or in some glumes scarcely excurrent, but tips very acute, lateral nerves 3—5, broad margins white scarious. Nut obovoid ellipsoid 3-quetrous .05" long with rather concave faces, shining brown or black.

Sandy bank of Ganges, Kurz! Throughout Chota Nagpur, common! Puri, Walsh! Chilka Lake, Hooper! Fl., Fr. July—Dec. Annual.

Leaves usually numerous and rather shorter than the inflorescence, bracts overtopping the inflor. by 1—3", .1—12" broad. Spikelets in *forma pectiniformis* (Kurz, Western Bengal and Bihar) 1" long and with very excurrent keel, always linear when mature. Rhachilla said not to be winged (Clarke), but it has sometimes a distinct dotted wing or margin, which does not extend beyond the prominent ledges; internodes of rhachilla long.

12. *C. niveus*, Retz.

A small pretty sedge, tufted from the stems arising very close together on the sympodial horizontal rhizome, about 4" high when first coming into flower, often 15" in grass. Leaves rather numerous narrow with filiform tips, shorter than the stems. Spikelets white or pale, 4—9 together in a terminal head supported by linear or filiform bracts .7—2" long, much compressed, ovate-lanceolate to oblong .4—1" long by .15" wide with many (20—40) boat-shaped obtuse glumes, the midrib scarcely produced into a mucro, other nerves strong about 6 each side. Nut prominently 3-quetrous somewhat obovoid, .06—.08" long with short base of style at top, style about as long as glume.

Most conspicuous after jungle-fires in savannahs. Purneah! Singbhum! Ranchi! Hazaribagh (Parasnath, from base to top in grassy places), Kurz! Fl. Feb.—June.

Stems thickened at the base, 1-seriate, with strongly nerved sheaths below. Median glumes .15—.17", upper and lower somewhat shorter. Stamens 3.

13. *C. leucocephalus*, Retz.

A small sedge with the habit of the last but very much resembling a *Kyllinga* with one dense globose white head of spikelets .2" long or less (in large form as up to .5" by .2", Clarke). Glumes rather more variable in size than usual .05—.08" long, oblong-lanceolate, whitish or cinnamomeous with hyaline margins, subobtuse. Stamen 1. Nut .03" long, oblong-ellipsoid 3-gonous, apiculate (as in last), black with pale reticulations.

Monghyr, Wall. (Cat. 3445C)! Manbhum, Campbell! In sandy places under shrubs, Manbhum (Barakar), Kurz! Fl., Fr. May.

Wallich's specimen is only 3" high. Rhizome very short woody with close stems thickened at the base. L. shorter than the stem, filiform, .05—.06" wide. Heads with 8—50 compressed spikelets each with 12—20 glumes or sometimes only 8—10. Glumes keeled, obscurely 3-nerved. Stigmas 3 about as long as style.

On one sheet *C. leucocephalus* is mixed with *Kyllinga brevifolia* and the similarity is remarkable.

14. *C. arenarius*, Retz.

An interesting little sedge with a wiry creeping rootstock often deep down in the sand, with vertical branches. Leaves wiry or terete

and fleshy, often recurved, 4—10" with rather inflated strongly striate sheaths at base. Stems 4—12" with an erect bract looking like a continuation of it except for the sheath at its dilated base. Spikelets pale, finally brown, in single terminal globose heads .5—7" diam., each spkt. ovoid or elliptic-oblong .27—'3" long, 9—16-fld. Glumes not much compressed, elliptic-concave scarcely keeled, rounded at tip but midrib sometimes ending in a mucro. Anthers 3, tip red but not crested. Ovary oblong, style short, stigmas 3 longer than style. Nut (*vide F.B.I.*) unequally trigonous concavo-convex, dusky black one-third length of glume.

On sand-dunes on the coast from Chandpur! to Puri! Fl. Feb.—May—June.

Branches with their sheaths obconic above narrowing to the rhizome. *Clarke* describes the glumes as boat-shaped and strongly 3-nerved* and rounded. In my specimens the lowest empty glumes are about 7-nerved and mucous, the fl. glumes 11-nerved and often mucronate, .18" long. Style .07". Filaments very long, flattened.

The plant acts as a sand-binder.

15. *C. diffusus*, *Vahl.*

Rather robust with short rhizome and with broad leaves and bracts .3—6" wide, flat and green-nerved. Umbel usually decomposed 4—12" diam. Spikelets 3—9 together digitate, .3—5" long and .06—'08" wide. Glumes cymbiform, broadly ovate (when unfolded) cuspidate, .05" long or with the cusp .06—'07" long, rather distant in fruit. Nut broadly ellipsoid and 3-quetrous, about two-thirds as long as glume.

Clarke says throughout India except the dry west. The specimens are chiefly confined to the very moist belt from the Sikkim Tarai to S. India and eastwards. It may occur in Purneah and on our eastern fringe.

16. *C. distans*, *L. f.*

A robust (depauperated specimens may be very small) rather leafy sedge 1—3 ft. high with relatively very large decomposed umbellate panicles often 1 ft. across of loosely spicate linear spikelets .5—7", decreasing to the top of spike with very slender wavy rhachilla, semi-patent and distinct in flower, patent in fruit. Glumes very narrow erect, appressed to rhachilla and only slightly or not overlapping one another, .07—'08" long, truncate or very obtuse, white-margined above. Rhachilla after fall of some of the glumes up to .75" long, with narrow alternating hyaline ultimately caducous wings. Nut grey to dusky black oblong or narrowly ellipsoid .05—'07" long.

Monghyr, *Ham.* (*Wall.*, No. 3366 E)! Singbhum! Fl., Fr. r.s.

Stems often .5" diam. at base, stoloniferous (*vide Clarke*) with stolons up to 2" long by .06" wide, clothed with dark-brown elliptic acute scales. L. often as long as stem, .25—35" broad. Umbels sometimes reduced to a single head 2.5" diam., rays in robust plants sometimes 2 ft. long. Bracts like the leaves, up to 8, exceeding the head, with broad base. Spkts. red, with filiform bracts often at their base. Fl.-glumes slightly obovate when unfolded, sometimes retuse, red-striate or midrib 3-nerved green. St. 3. Ovary linear, stigmas 3 about as long as style which is shorter than nut.

* I have since examined *Clarke's* specimen (also collected at Puri). The glumes are rather opaque but are many-nerved. I fail to see 3 especially strong ones.

17. C. nutans, Vahl.

A robust rather leafy sedge 2—4 ft. high from a stout woody root-stock. Leaves 20—30" long by about 3—45" wide, narrowed both ends. Spikelets grey-brown in a large decomposed umbel on the ultimate branches of which they are spirally spiked, 2—35" long, sub-erect, not distinct but forming more or less of a thyrse, usually subtended by a bract or glume with a long awn. Glumes 6—12 (in my specimens. *Clarke* records many more, up to 20, and then of course the length of spkt. would be greater), linear or oblong .08—.1" long obtuse but midrib produced into a short aristula, nerves 2—3 each side of midrib, sides scarious. Rhachilla not very distinctly winged. Nut oblong or oblong-oblancheolar, 3-quetrous, .06" long, very pale (perhaps not ripe) or brown or dusky black (*Clarke*), with a small apiculus or mucro after fall of the style which is only $\frac{1}{2}$ — $\frac{3}{4}$ length of nut with 3 very slender stigmas about as long as nut.

Often near streams in the jungles. Monghyr, *Cal. Herb.*! Rajmahal Hills, *Kurz!* Ranchi, elev. 3000 ft.! Singhbhum, elev. 2000 ft.! Manbhum, *Wood!* Fl. Fr. Aug.—Oct.

Stems often .6" diam. at base, not stoloniferous (?), often several stems together. L. often as long as stem up to .45" broad, many-nerved. Rays of umbel usually more erect than in *distans*, 2—12" long. Bracts like the leaves and similar to those of *distans*, those of partial umbels narrower, and frequently filiform or awned bracts supporting the spikes, lowest empty glume frequently bract-like with filiform tip. Two lowest glumes very small linear-lanceolate. Stamens 2—3.

Var. **eleusinoides.** Syn. *Perus eleusinoides, Kunth* (and in *F.B.I.*).

This seems to be a mere form of *nutans* with more fascicled denser shorter spikes and with denser umbels. *Clarke* appears to distinguish it by the densely spicate spikelets being 20—40 fld. (but many of the specimens have no more fls. than has *nutans*), colour always grey not reddish, but narrowly ellipsoid often curved. *Kunth*, however, describes the spikelets as "8—10-floris dense obsitis, squamis ovato-ellipticis, sub-apice mucronulatis, carinato-navicularibus," and the nut as obovate-oblong, fuscous, etc., in fact almost exactly as in *nutans*. The type (*Wall. No. 3346b*) is a robust plant with several stems from a short rhizome, clothed with leaf-bases. Primary rays of umbel 2—4", each bearing a very close umbel of grey spikes 6—8" long.

Ranchi, *Clarke!* Hazaribagh, *Clarke!* Monghyr, *Wall.!*

18. C. Thomsoni, Boeck.

This is another plant of the *distans* group which has been found in the Sikkim Tarai close to Purneah, and hence is probably in our area.

Rhizome short woody and with general habit of *nutans*. Inflorescence grey shining rather feathery from the close large spikelets having elongated internodes to the rhachilla. The glumes are thus loosely imbricate as in *distans*, but .18" long, with 7—9 very close dorsal nerves. Nuts oblong or ellipsoid, only a little over half as long as glume or less, black, top acutely pyramidal.

19. C. malaccensis, Lam.

Habit rather various. Rhizome creeping woody and with long stolons under .2" diam. clothed with broad lax dark chestnut scales 1" long. Stems robust, up to 3 ft. sharply 3-quetrous. Umbels large spreading 7—8" across lax, or rather dense and only 2—3", simple compound or

congested with very long involucre bracts. Spikelets almost terete, glumes up to 14, oblong when unfolded with rounded back and margins incurved all round when dry, .07—.09" long. Nut very narrowly oblong, $\frac{1}{2}$ ths length of glume, 3-gonous, ultimately black.

Brackish mud banks, *Clarke*. Sandy tracts, *Walsh*. Puri, *Walsh*!

Stems with concave faces above. L. usually few, erect, ensiform, clothing base of stem with their sheaths, uppermost 2—6" long. Spikes of 4—10 spikelets 3—7" long linear. Glumes about 11-nerved, with narrow rather coriaceous margins, not keeled, apex rounded; only $\frac{1}{4}$ " long according to F.B.I., but some specimens named by *Clarke* have them nearly 1", so that this is probably a mistake.

Prairie says "stem terete," but *Lamarck* distinctly states that his *malaccensis* is 3-quetrous and it is often 3-winged at the top. *Walsh's* specimen (named by *Clarke*) is not very characteristic, moreover, the rhachilla is distinctly winged. It is, I think, *tegetiformis*, though *malaccensis* very likely occurs in Cuttack and Puri.

20. *C. tegetiformis*, Roxb.

A robust sedge 1.5—5 ft. high with 3-gonous stems or 3-quetrous at the top not or obscurely septate and long stolons. Leaves hardly any. Bracts short, rarely half the length of the umbel, the rays of which attain 3—5". Spikelets in short spikes or corymbs, 4—16 together, linear, compressed, .5—1" long, glumes closely imbricate, 1" long, back with 6—7-nerved keel or rounded and striate with brown and faintly 5—9-nerved ovate-oblong (when unfolded). Rhachilla with linear hyaline wings embracing the ovary. Anthers linear, minutely apiculate or mucicous (*Cooke*). Style .03—.04". Nut .05" oblong, 3-gonous, black. Style .03—.04" with stigmas .05—.08".

Gaya, *Nusker*! Puri? (see remarks under *malaccensis*). Fl. Oct.

There is only one specimen from our area (Gaya) which has been named in the *Cal. Herb.* and that appears to me doubtful and is possibly *C. corymbosus*. The bracts slightly exceed the umbel and the erect spikelets are very young. Glumes .11" long, back with 5 slender nerves, anthers 3 minutely apiculate, wings of rhachilla very obscure, nut undeveloped. Most of the specimens named by *Clarke* are from Lower Bengal and Eastern Bengal. I suspect that the length of the involucre bracts is not a good character, especially in inflorescences of different stages of growth.

21. *C. corymbosus*, Roth.

A robust sedge 2—3 ft. high, stems when dry often more or less septate, obscurely 3-gonous at the top, terete below and attaining .3" diam. Leaves on the flowering stems 0 or with a short blade reaching 5" long terminating a loose sheath, on the young shoots two to three upper sheaths sometimes bearing linear-lanceolate short blades. Bracts $\frac{1}{2}$ — $\frac{3}{4}$ length of the umbel or slightly overtopping it, margins often recurved when dry and scabrid. Umbels with very unequal erect or sub-erect rays, longest rarely 4" long. Spikelets .25—1" long light brown or reddish 4—12 together in short often compound spikes subtended by lanceolate and setaceous bracts. Glumes erect, ovate-oblong (unfolded), .1—1.2" long, mucicous, rounded on the back with a closely 3-nerved centre flanked by brown striæ or finely 10-nerved, margins scarious. Wings of rhachilla usually distinct, oblong (in *Wallich's* no. 3351 nearly .02" broad). Nut .06" long, narrowly obovoid, 3-gonous, apiculate.

Monghyr, *Ham.*! Singbhum! Hazaribagh, *Clarke*! Fl., Fr. Oct.—Nov.

I have seen no ripe nuts, and suspect that some specimens ascribed to this species are young states of others and that there is no specific difference between this and *tegetiformis*. Rhizome creeping, clothed with dark brown scales and hardening into rhizomes. The new shoots are said to arise on these at some distance from one another as also in the case of *tegetiformis*, whereas in *C. tegetum* there are said to be no stolons and thus the lateral shoots arise from the base of the older ones. Herbarium material is insufficient to check these characters. Anthers 3, mucicous and brownish yellow according to *Cooke*, minutely apiculate in specimens (some named by *Clarke*) dissected by myself. Style .04—07", stigmas .08—12".

22. *C. articulatus*, L.

A very stout sedge with terete septate stems 3—6 ft. high up to .8" diam. at base and stout stolons clothed with ovate-lanceolate striate dark coloured scales .7" long. Umbels large, with rays up to 2—6" long, grey, feathery with dense linear spikelets .5—1.5" long, 5—15 together in close spikes, at first straw-coloured. Bracts very short, only .3—7" long, ovate, concave. Glumes imbricate even in fruit, ovate, obtuse, obscurely 3—5-nerved on the back, .08—09" long. Rhachilla very slender wavy with oblong or elliptic scarious wings in the sinuses. Nut oblong-ellipsoid, 3-gonous, acute each end, black, shining, .05".

Extending from Bengal to Ceylon, in tanks, etc. No specimens from within our area, though it will probably be found in Cuttack and Puri.

The septa or articulations are well marked when dry.

23. *C. tegetum*, Roxb.

A robust rush-like sedge 1.5—4 ft. high with solid green shining stems obtusely 3-angled (trigonous or triquetrous, *Clarke*) above, rising from a creeping woody rhizome .3" diam. New shoots ascending close to base of previous ones (*vide Clarke*, but see below; cp. nos. 25 and 26). Leaves sheathing the stem below for about one-third up or less, blades narrow short or fairly long. Spikelets .7—1.2" long, brown or red, linear in peduncled spikes which are umbelled or corymbose on the branches of compound umbels 4—12" diam. which are supported by long bracts. Glumes narrowly oblong (oblong when unfolded), .08—12" long, loosely imbricate especially in fruit, back rounded finely about 10-nerved coloured, margins broad scarious, tip rounded quite mucicous. Nut linear-oblong very slightly obovoid, .06", brown or grey embraced on each side by the prominent lanceolate or ovate wings of the rhachilla which separate by a clean cut when ripe.

Chiefly on river banks. Tarai, *Clarke*! Shahabad, *J.D.H.*! Gaya, *Kurz*! Santal Parg.! Ranchi, *Clarke*! Singhbhum, common! Hazaribagh, *Clarke*! Manbhum, *Wood*! Probably throughout the whole province. Fl., Fr. Aug. (but usually from Oct.—Jan.).

Rhizome stout and in some of my specimens culms quite 1" apart. Sheaths much inflated when old.

Leaves above the sheath 0 or 3—9" long. Inflor. with long foliaceous bracts often one and a half times its length, about .2—3" wide, margins scaberulous, midrib strong. Branches of umbel 1—10" long suddenly contracted at the corymbs of spikes, branches and peduncles of spikes with short lanceolate finely or setaceous acuminate bracts as well as a short truncate sheath at their base. Glumes sometimes only .06" long in flower. Wings of rhachilla about .04—05" long, as long as ovary and usually green in flower, ultimately red or brown. St. 3. Style rather persistent about .04", leaving no base on falling, stigmas 3 long and slender, often .12" long.

This is a good species for observing that the wings of the rhachilla form no part of the glumes (as stated to be the case by *Cooke*); the glume very clearly embraces the wings and can be moved over the wings.

It is said to be employed in Calcutta for the manufacture of mats.

24. C. pilosus, Vahl.

Height 2—3 ft. with stems 3-quetrous above, glabrous below but rhachides of inflorescence closely hispidulous-pubescent. Spikelets (at least when mature) spreading at right angles to rhachis, 3-seriate in loose elongate spikes which are usually in compound umbels, pale brown, lanceolar in outline .15—·3" or rarely up to .5" long but those on a spike usually constant, the lowest empty glume converted into a setaceous bract of variable length, sometimes exceeding the whole spikelet, other empty glume short hyaline rounded. Fl.-glumes 7—20, .05—·07" long broadly ovate (when unfolded) and nearly as broad, rounded or truncate but with a minute mucro from keel. St. 3, anthers mucous. Nut ellipsoid acutely 3-gonous, .04" long black, style shorter than nut, stigmas 3.

Common in rice-fields. Ranchil Manbhum, Ball! Hazaribagh, C.B.C.1 Throughout India according to F.B.I. and probably throughout our province. Fl. Sept.—Oct.

Stems often robust and .4" diam. at base. Stolons very slender with distant nodes and scales .25—·3" long, ultimate rhizome wiry. L. often $\frac{1}{2}$ ths as long as stem, .2—·3" wide. Bracts like the leaves usually far overtopping the umbel .2—·3" broad with minutely hispidulous margins. Umbel variable, sometimes a foot across with rays 9" long, at other times reduced to a single head of spikes. Gl. up to .08" in some Ceylon specimens, back rather rounded slightly keeled, striate with red, nerves about 3 each side of keel rather obscure, margin broad white nerveless. Rhachilla compressed with translucent centre, not winged.

A very distinct species from the *nutans* and *tegetum* group, easily recognised by the dense divaricate spikelets, subequal in long cylindrical spikes and small mucronulate glumes with broad scarious margins.

Juncellus serotinus (not found in our area) is so like this as to be indistinguishable, and the two have been collected together at Dharmasala (3500 ft.). The genera are probably entirely artificial.

25. C. babakensis, Steud.

This resembles a dense-flowered large-spikeletted form of *pilosus* of which species I would prefer to consider it a variety. *Clarke* describes it as follows: Umbel of few (3—6) rays, lowest ray much longer than the others, erect, stout, secondary umbels condensed into oblong or square dense rigid compound spikes 2" by 1.5", rhachis of spikes scarcely scabrous, never pilose (I would call them hirtellous, as in some *pilosus*), spikelets more robust than in *pilosus*, .7 by .12—·17", 14—40-fld., red brown, rhachilla stout, .03" wide, compressed glumes boat-shaped hispid-scabrous at the top of keel, nut hardly $\frac{1}{2}$ glume.

Bhagalpur (near northern boundary), Ham.1 Fl., Fr. Sept.

Spikelets sometimes only .25—·55" long (in some specimens named by *Clarke*), rhachilla deeply excavated. Glumes .06—·09" long, mucronulate or minutely cuspidate, same shape as in *pilosus*. Nut elliptic-obovoid black, .04—·05" long.

26. C. procerus, Rottb.

A yet stouter form of *pilosus* with larger spikelets and glumes, glabrous even on the rhachides (except in var. *lasiorrhachis*) and with relatively much smaller nuts. Secondary umbels loosely corymbed of 1—5 spikes. Spikelets shining remote .6—1.2" long, by .12" reddish, 20—46-fld. Glumes .09—·12" long, with narrow scarious margins. Nut .04" long, black, ellipsoid-obovoid, 3-quetrous.

Monghyr, *Griff.* (but specimen very young)! Hazaribagh, *Clarke!* Puri, *Walsh!*
See also variety. Fl., Fr. Sept.—Nov.

Stolons elongate, clothed with long acuminate scales, bulbiferous (*Cooke*). L. very long, often exceeding the stems, .25—5" broad, thickly coriaceous or spongy. Primary rays of umbel 3—7, stout, 1—4" long. Rhachis of spikes rather stout, angular. Bracts 2—5, sometimes up to 15" long. St. 3, anthers oblong, mucinous. Rhachilla sub-4-gonal, compressed, with the scars margined not winged.

Var. *lasiorrhachis*, *Clarke*.

Axis of spikes scabrous-pilose.

Ranchi, *Clarke!* Hazaribagh, *Clarke!* elev. 2000 ft.

The spkts. are only about .6" long but the glumes are .1". Bracts with filiform tips.

According to *Wight*, *C. procerus* is common in rice-field in Madras, grows to be a great height and is used for making mats.

27. *C. exaltatus*, *Retz.*

A very robust and handsome sedge 3—6 ft. high with obtusely 3-gonous stems, narrow leaves occasionally longer than the stems and compound umbels terminating in very numerous cylindrical spikes, many of which are 2" long or more and .15—.4" broad. Spikelets numerous but distinct, usually spreading at right angles from the rhachis .1—3" long or .5" after fall of some glumes, often brightly coloured. Glumes .05—.06" long, very similar to those of *radiatus*, very acute to minutely aristate. Anthers oblong, not crested. Nut pale ellipsoid .025" long, 3-gonous. Style .03", stigmas as long.

Santal Parg., *Kurz!* Ranchi (Tamar) Wood! Manbhum, *Clarke!* Fl., Fr. Sept.—Nov.

Perhaps not specifically different from *C. radiatus* but different in appearance from the spikelets being distinct especially in the form (*dives*, *Clarke*) with spreading spikelets to which all our specimens belong. Bracts of umbel foliaceous, up to 2 ft. long, .2—3" broad with very broad base. Spkts. with a lanceolate-setaceous bract at their base. Wings very narrow, sometimes appearing continuous on the straight rhachilla and not very conspicuous.

28. *C. radiatus*, *Vahl.*

A stout sedge 1—3 ft. high leafy below, with leaves often two-thirds as long as stem, .3" broad. Umbel simple or compound with digitate very dense scarcely peduncled cylindrical spikes 1" by .3". Spikelets densely erecto-patent .1—2" long, dull-coloured (neither yellow nor red), with very small closely imbricate broad-ovate keeled obtuse glumes .05" long without or .06" long including the excurrent mucro or awnlet, back narrowly and finely 3—5-nerved with broad membranous margins. Anthers oblong, not crested. Nut ovoid or ellipsoid, .025", 3-gonous, or 2-gonous with back rounded rather than angled. Style hardly any, stigmas 3, very short (perhaps not properly developed in specimen examined).

Santal Parganahs, *Kurz!* Fl., Fr. May.

28a. *C. digitatus*, *Roxb.*

A tall robust handsome sedge 1.5—4.5 ft. high with stout rhizome. Stem 3-gonous and up to .2" diam. at the top. Leaves often as long as the stem .5—7" broad. Umbel very compound and 6—20" diam.

with the bracts usually far exceeding the umbel and 3—5" broad. Spkts. .35—.75" long by .05" broad in cylindric corymbose spikes 1—3" long with an angled or winged rhachis. Gl. .12" long, linear with scarious sides and slightly apiculate. Wings on rhachilla narrowly linear, deciduous. St. usually 1 often persistent until the wings fall. Nut grey .05—.06" long, 3-quetrous, very concave towards rhachilla.

Sarjuga, C. B. Clarke! Bhagalpur, Ham.! Fl. Aug.—Nov.

Whole plant glabrous. Easily distinguishable from *C. exaltatus* by the long, much narrower linear spikelets. It is, I believe, a fairly common sedge not often collected.

29. *C. rotundus*, L. Batha-bijir, M.; Rotesila, Ho.; Mutha, Beng.

A small or slender sedge with 3-quetrous stems 4"—2 ft. high arising from small hard corms or tubers or bearing tubers on its slender wiry stolons. Leaves rather numerous, mostly radical and generally shorter than the stem, 1—12" broad, ending in a filiform tip. Spikelets light brown shortly spicate on the branches of irregular compound umbels, about 3—8 spikelets in the spike, lanceolate-linear .25—.75" or sometimes 1" (1.5" Cooke) long. Glumes linear-oblong, lower .12—.16" long, upper somewhat shorter, rounded but midrib mucronulate. Wings on the rhachilla narrow hyaline continuous with the hyaline margins of the glumes till ripe. Foliaceous bracts at base of inflorescence nearly always 3.

A common weed and growing even on gravel paths in gardens. All districts (probably) though only collected from Singbhum and Palamau inside our area but from many places on the borders. Fl., Fr. July—Dec.

Whole plant glabrous and somewhat glaucous. Primary rays of umbel 3—5", sometimes 8" long and frequently compound. Spkts. occasionally 1" long. Glumes 3—7-nerved on back, rather obscurely. Nut .06" long, obovoid trigonous.

The tubers have a pleasant fragrance and are about .5" diam., ovoid, black or dark brown outside, white within. They are said to be tonic and also useful in fever, diarrhoea, dysentery and dyspepsia. Cattle eat the leaves.

30. *C. tuberosus*, Rottb.

Very like *C. rotundus* and, as Clarke says, the difference is perhaps not specific. The woody base of the stems is the best character. It has more slender rays and spikelets and the glumes in fruit are not closely imbricate. The median glumes are about 1—1.5", edges produced down into the strongly winged rhachilla.

Chilka Lake, Hooper! Fl. Aug.—Jan.

The stems in Hooper's specimen are 2.5 ft. high, rays of umbel 1—2".

31. *C. polystachyus*, Rottb. Syn. *C. subcapitatus*, Clarke.

This also seems nothing more than a variety of *C. rotundus*. Stems and leaves long and slender, stem at base oblique nodosely thickened then abruptly contracted into a long slender rhizome. The inflorescence is contracted into a close subcapitate umbel with rays 0—5" long and appears lateral from the lowest strongest bract being erect and as though a continuation of the stem. Glumes 1" long, ferruginous-brown.

Puri, Burkill!

2. PYCREUS, Beauv.

Very closely allied to *Cyperus* and probably only artificially separated by the two carpels instead of three, the stigmas being two and the nut laterally compressed. The spikelets in all our species have a great superficial resemblance to those of *Eragrostis* among grasses.

- A. Nut with longitudinally oblong epidermal cells:—
 Nut not distinctly transversely lineolate. Spkts. under .1" broad. Infl. not rayed. Root aromatic
 1. *stramineus*.
 Nut with transverse wavy lines. Spkts. .15" broad. Inflor. usually rayed (sometimes reduced to a single head)
 2. *latespicatus*.
- B. Epidermal cells of nut subquadrate hexagonal, sometimes appearing dotted:—
 1. Stems clothed to far above the base with sheaths or leaves. Spkts. .5—1" by .1—17"
 3. *sanguinolentus*.
 2. Stems with leaves only at the base:—
 a. Small tufted annuals. Nut ellipsoid or obovoid:—
 Gl. .04—05" long. St. usually 1
 4. *pumilus*.
 Gl. .08—09" long. St. 2
 5. *globosus*.
 b. Small tufted perennials:—
 Spkts. .5—75" long. Nut oblong symmetric
 6. *odoratus*.
 Spkts. .6—8" long. Nut asymmetric
 7. *sulcinus*.

1. *P. stramineus*, C. B. Clarke. Syn. *Cyperus stramineus*, Nees.

A slender plant very closely allied to *P. odoratus*, Beauv, but with high with long compressed straw-coloured spikelets .3" elongating to 1" or 1.2", under .1" broad, about 5—12 only in a spike or head, the lower glumes seriatim deciduous leaving a prominently areolate rhachilla in the concavities of which the smooth 2-convex nuts often persist after the glumes fall. Glumes (lower) .08" long, mucronate. Spike sometimes with one or two bracts on the rhachis overtopping it.

Throughout the moister parts of India, Clarke. The only locality in our area whence I have seen specimens is Jamalpur (Monghyr)! Prain says Orissa (Beng. Pl.). Fl. Sept.—Nov.

2. *P. latespicatus*, C. B. C. Syn. *Cyperus latespicatus*, Boeck.

Usually larger than last 6—16" high, spikes more umbellate. Spikelets similar but much broader, .1—15" broad, often chestnut-coloured, often shiny. Rhachilla deeply excavated. Lower glumes .1" long. Nut black or blackish-grey, .03" long obovoid, beautifully rugulose with transverse wavy lines.

Very common. N. Bengal, Kurz! Sarguja, 2500 ft., Clarke! Singhum! Ranchi, Clarke! Hazaribagh, Clarke, Anders., etc.! Sambalpur, Griff.! Fl., Fr. Oct.—Nov.

Usually annual, Clarke. L. about half length of stem or 0, .1—15" wide. Glumes ovate-cymbiform, keeled, obtuse, sides scarious and nerveless. Filaments often persistent after glume drops. Under the microscope the epidermis appears composed of longitudinally linear or oblong cells ending in raised lines.

3. *P. sanguinolentus*, Nees. Syn. *Cyperus sanguinolentus*, Vahl.

A tufted rather coarse very leafy sedge 7—8", or more slender and up to 16" high, with creeping rhizome. Leaves rarely 0, usually shorter than or as long as the stem, .1" wide. Heads or spikes in a short simple umbel or only one. Spikelets linear or oblong-lanceolate clustered (in a head) or shortly spicate, red or reddish, .5—1" long by about .1—17"

broad, rhachilla not as deeply excavated as in *stramineus*. Glumes rather loosely imbricate .06" or usually .08—1" long, ovate cymbiform, obtuse, nerved on the back. Nut white or brown, .04" long smooth, hardly half length of glume, outer cells all subquadrate hexagonal.

Udeypur, *Prain's Collector!* Santal Parg., *Kurz!* Fl. Aug.—Feb.

Stem decumbent at the base, often clothed one-third its length with leaf-sheaths, the leaves thus some distance from the base of the stem. Bracts 3—5 foliaceous, up to 5" long. Spikelets 6—24-fld. Nut in the Udeypur specimen is almost orbicular but not symmetrical, much compressed. The stems are clothed with short lateral branches each terminating in a head.

4. *P. pumilus*, Turrill, (not of F.B.I.). Syn. *P. nitens*, Nees; *Cyperus pumilus*, L.

Short and tufted 1—6" or laxer and 10" high. Spikelets pale or somewhat silvery small, clustered or shortly spicate, the head (or spike) solitary or in a simple umbel with a central sessile cluster and 2—6 rays 2—3" long or less. Glumes very small, .04—05" long, or .06" with the cusp, boat-shaped or narrowly oblong mucronate or cuspidate from the excurrent keel. Stamen usually 1 only. Nut somewhat obovoid, brown or grey, .02" long.

Monghyr, *Ham., Clarke!* Santal Parg., common, *Kurz, Gamble!* Ranchi, *Clarke*, common, etc.! Hazaribagh, *Clarke!* Probably throughout the province, Fl. Sept.—Nov., May. Annual.

L. shorter or as long as the stem, .05—1" broad, weak, 1-nerved, acute. Heads of spkts. .25—1" diam. Bracts 3—4 foliaceous up to 4" long. Spkts. .17—6" long, 20—50-fld., rhachilla slender, persistent. Glumes sometimes 2-fld or -lobed with rounded lobes and with green keel, 3—5-nerved and with rounded hyaline nerveless sides. Stigmas about as long as style. Nut (under high magn.) with longitudinal lines of small isodiametric cells raised in the centre.

It appears to be very closely allied to *Cyperus flavidus*, Retz.

5. *P. globosus*, Reichb. Syn. *P. capillaris*, Nees; *Cyperus globosus*, All.

A very slender annual with tufted stems up to 16" high and very slender almost filiform erect leaves and bracts. Inflorescence often compound with several short rays and a central sessile subglobose spike bearing pale brown to deep brown linear much-compressed spkts. at right angles to the rhachis. Umbels sometimes reduced to a single head. Gl. .08—09". Nut ellipsoid apiculate chestnut-brown to black .03".

Ranchi, *Wood!* Hazaribagh, *Clarke!* Also in the Upper Gangetic Plain and extending eastwards so that it probably occurs in all our Northern Tract. Fl. Oct.—Jan., also May (in Tarai). Annual.

Stems 3-gonous. L. 4—12" weak. Rays of umbel usually very short but attaining 2.5". Bracts 4—8". Spkts. variable in length, .3—5" by .1" or in some Khasia specimens 1.3" long by .12". Glumes ovate-oblong or ovate-obtuse, closely imbricate. Rhachilla stout 4-gonous. Stamens 2. Stigmas as long as style.

Var. *stricta*, *Clarke*. Spkts. narrower straw-coloured or yellow less compressed frequently short only 6—12-fld., sometimes curved or twisted, gl. closely packed but loosely imbricated. Chota Nagpur, *Clarke*.

6. *P. odoratus*, Beauv. Syn. *P. polystachyus*, Beauv.; *Cyperus odoratus*, L.

A very small tufted sedge only 2" high but often attaining 15" with very close capitate spikes of radiating spikelets, the umbel simple

rayed or contracted into one head. Spikelets linear many-flowered .5—'.75" long by .07—.09", compressed reddish-brown. Glumes .08—.1", closely imbricate, minutely mucronate. Nut oblong, sub-truncate and apiculate.

Puri, *Atkinson!* Fl. May. Perennial.

Stems somewhat thickened at base, 3-gonous. L. overtopping the stem when very short, shorter than the stem when this is elongate, .12—.17" broad. Rays of umbel 2—7, .1—2" long, each terminated by usually ternate spikes of 4—8 spikelets. Bracts 3—6, spreading, 4—16" long. St. usually 2. Stigmas as long as the style.

Cooke points out that the name *odoratus* has priority over *polystachyus*. I find no record of the plant being odorous.

7. *P. sulcinux*, C. B. C.

A slender plant very closely allied to *P. odoratus*, *Beauv.* but with laxer more compound inflorescence and relatively shorter bracts and the nut is unsymmetric, enlarged or gibbous towards the base, broadly furrowed on each face. Glumes more remote. *Clarke* says that the narrow edge of the nut is much flattened against the rhachilla.

Siliguri and Sikkim Tarai! and probably therefore Purneah. Fl. Sept.—Oct. and May.

Spikelets linear .3—.8" or more after fall of lower glumes.

3. JUNCELLUS, *Griseb.*

As in *Cyperus* but nut plano-convex, more or less compressed ventrally, the plane face flat against the rhachilla and stigmas 2. Rhachilla (as in *Pycneus* never winged) persistent. Stamens 3—2 anterior.

Perhaps even more artificial than *Pycneus*, some species, e.g. *J. serotinus*, being indistinguishable from species of *Cyperus* (in this case *C. pilosus*) except in the compressed not equilaterally trigonous nut.

1. *J. pygmæus*, *Clarke*. Syn. *Cyperus pygmæus*, *Rotth.*

A very tufted small herb 1—4" (rarely attaining 10") with dense compound heads .25—.75" diam. of linear, often curved or twisted spikelets .2—.3" long, greenish-white or finally pale brown. Nut plano-convex, $\frac{1}{3}$ — $\frac{1}{2}$ glume.

Purneah (up to 8" with hds. .6—.7" diam.)! Behar (hds. .4" diam.), *J.D.H.*! Sandy bank of Ganges, *Wall.*! "Moist shady soil near tanks in Bengal," *Wall.*! Fl. May—Jan.

Leaves long flaccid. Bracts 3—6". Stamens 2—1, anthers small linear mucous.

4. KYLLINGA, *Rotth.*

Stem leafy below only, terminated by 1—3 sessile capitate ovoid or cylindrical dense spikes subtended by leaf-like bracts. Spikelets small compressed of 4—5, rarely more, distichous glumes, rhachilla disarticulating above the two very small lowest glumes. Gl. iii 2-sexual, iv male or empty or rarely 2-sexual, a fifth and occasionally one or two other rudimentary glumes sometimes present. Stamens in fl. glumes 1—3, anterior, anthers mucous or nearly so. Nut laterally compressed, style linear continuous with nut, with 2 linear stigmas.

- A. Rhizome very short, stems close, thickened at base:—
 Hds. ovoid, 3-nate, centre one .25—3". Gl. iii .06—08" 1. *triceps*.
 Hds. cylindric, if 3-nate then lateral very small, centre one
 .3—6" long. Gl. iii .08" long 2. *cylindrica*.
- B. Rhizome creeping, slender, with the stems at intervals:—
 Hds. ovoid, rarely 3-nate. Gl. iii not crested. 3. *brevifolia*.
 As in *brevifolia*, but gl. iii with a crest on the keel 4. *monocephala*.

1. *K. triceps*, Rottb.

A small plant 3—9" high, stems thickened at base and tufted on a short thick rootstock. Leaves from one-half to as long as stems, .12—17" wide. Heads usually 3-nate, rarely fewer or 4—5, ovoid or cylindric-ovoid, pale, centre one about .25" long, lateral smaller. Gl. iii ovate, .06—08" long, with smooth green slightly excurrent keel, sides 3—4-striate.

Widely distributed from Moradabad to Madras and therefore probably throughout our area. Behar, Hope! Hazaribagh, C.B.C.! Ganjam, Fischer! Fl. July—March.

Bracts under the heads 3—4 unequal, up to 2—3" long. Spikelets about .1" long, straw-coloured. St. usually 2. Nut two-thirds as long as glume, pale brown, ellipsoid, obtuse.

Clarke says that the fertile glume is striate, but I find specimens named by him very strongly nerved just as in *cylindrica* from which it is often scarcely separable.

2. *K. cylindrica*, Nees.

Usually more slender than the last, stems 4—12" not much thickened into the short rootstock. Well-named from the shape of the heads which are .3—6" long by about .17" broad, sometimes ternate but then the lateral very small. Gl. iii ovate, .08—1" long, keel green scarcely excurrent, sides strongly nerved.

Parasnath, Anders.! Fl. Sept.

L. as in *triceps*, but usually shorter than the stems. Bracts 2—several, usually 2—3. Spkts. .1—17" long, straw-coloured. Nut as in *triceps* (finally black, C.B.C.).

3. *K. brevifolia*, Rottb.

Height usually 6—20", several stems erect from a slender creeping rhizome clothed with large brown imbricating scales. Leaves few erect 1—3" or sometimes exceeding the stem (Clarke), .07—17" broad, glabrous or scabrid, especially at the tips. Heads usually solitary .25—3" long, subtended by 3—4 foliaceous bracts 1—4" long. Glumes green or brownish, lowest 2 very minute, iii 2-sexual ovate with green mucronate keel and scarious sides with 4—6 lateral nerves each side (2 very close to midrib). Nut ellipsoid compressed yellowish or yellow brown, gl. iv, .12", male or empty.

Singhuhum! Hazaribagh, Clarke! Throughout India, Clarke! Fl. May—Oct.

Rhizome under .1" diam. Bracts often hispid on the margins. Heads sometimes 3. Fl. glume scabrous on lower part of keel, less so or smooth above. St. 3 or 2. Nut $\frac{1}{2}$ to $\frac{3}{4}$ as long as glume, ellipsoid obtuse, style $\frac{1}{2}$ as long as nut. Minute red glands are frequent especially on the sheaths, but Clarke states that the fl. glume is always eglandular.

4. *K. monocephala*, Rottb.

Very similar in appearance to *brevifolia* and with the same creeping rhizome and scattered stems. Tips of leaves also sometimes scabrid.

as in *brevifolia* and minute red glands frequent in both. It differs however in the upper part of the keel of the fruiting glume being furnished with a wing or crest with scattered small red glands.

Wide-spread from the United Provinces to Bengal and therefore almost certainly within our area. Fl. July—March.

It is often mixed on same sheets as *brevifolia* and does not appear to me to be more than a variety of that species.

5. MARISCUS, Vahl.

Usually perennial herbs with grass-like leaves and bracts. Spikelets laterally compressed or quite terete with the glumes 2-seriate (distichous) or slightly spiral, lowest 2 always empty, smaller than the others, usually persistent or separately deciduous after the rest of the spkt. has fallen, next 1—2 glumes also sometimes empty, occasionally only 1—3 glumes flowering and 2-sexual but more often more and up to 12. Rhachilla disarticulate above the two lowest glumes leaving a small knob or disc with sometimes an annular ridge on the top. Stamens 3 (in all plants seen by me). Nut usually oblong and somewhat wider upwards more rarely ovoid or obovoid, sometimes slightly curved and asymmetric. Stigmas 3 slender.

Mariscus is united with *Cyperus* by some botanists. It seems to me usually amply distinct and (as in the case of *M. dilutus*) to make a transition to the *Rhynchosporæ*. The only species likely to give rise to confusion in our area are *Cyperus aristatus* and *M. squarrosus*, but in this case it seems that the *Cyperus* is nearer *Mariscus*.

I. Umbels contracted into a single ovoid dense head:—

Spkts. bearing 2—6 nuts

1. *Dregeanus*.

II. Umbels not contracted into dense heads:—

A. Spikelets short in linear cylindric or oblong spikes:—

1. Umbels simple:—

a. Spikes cylindric narrow sessile or peduncled. Spkts. bearing 1—2 (very rarely 3) nuts:—

Stolons slender. Fruiting spkts. suberect slender acuminate 2"

2. *tenuifolius*.

Stolons 0. Fruiting spkts. divaricate subfusiform 15"

3. *Sieberianus*.

b. Spikes short subquadrate. Spkts. bearing 4 or more nuts:—

Spkts. divaricate. Glumes aristate

4. *squarrosus*.

2. Umbels compound. Robust herbs with broad leaves:—

Spikes cylindric or ovoid. Spkts. with 3—6 nuts. Glumes obtuse

5. *albescens*.

B. Spikelets linear in globose spikes or heads. Heads in compound or decomposed umbels

6. *compactus*.

1. *M. Dregeanus*, Kunth.

A caespitose sedge 1·2 ft. high without stolons and the spikelets congested into a single terminal head 3—6" long and broad, each spikelet ovoid to linear 2—3" long bearing 2—6 nuts. Glumes above the two persistent lowest 12—15" many-striate. Nuts linear black 3-quetrous 08" (oblong or somewhat obovoid, *Clarke*).

Messrs. Narayanswami and *Carter* refer to a *Mariscus* sp. nov. allied to *M. Dregeanus* but to which they give no name. They state that it differs in having

nuts in all the spikelets, which are usually compressed and longer than those of *Dregeanus*. The fl. glumes are boat-shaped and not ovate.

Island of Barkuda in the Chilka Lake, rare (*Memoirs As. Soc. Beng.*). I have not seen it.

Base of stem in *M. Dregeanus* oblong thickened by the turgid membranous coloured sheaths.

2. *M. tenuifolius*, Schrad.

A very slender plant with very slender stolons, base covered with fibrous sheaths. Leaves slender or filiform (in the Monghyr specimen) and bracts similar. Spikes cylindrical 3—1" long solitary on the rays which are 0—1" long in a simple contracted umbel supported by bracts 3—6" long. Spikelets 2" slender acuminate dusky-green, ultimately suberect, with 2 small glumes .02—03" long at the base and usually 2 nut-bearing glumes.

Monghyr, Wall.

Clarke throws doubt on this having come from Monghyr.

3. *M. Sieberianus*, Nees. Syn. *Cyperus umbellatus*, Miq.

Rather slender grass-like sedge 18—30" high with several stems uniseriate on a short creeping rhizome covered with the remains of old leaf-sheaths. Spikelets closely spirally arranged in cylindrical pedunculate spikes 7—2½" long (including the peduncle) in a simple terminal umbel with 3—5 larger lower foliaceous bracts and 2—5 more slender or setaceous bracts, the lower ones far exceeding the umbel, the narrower ones slightly so. Spikelets erecto-patent in flower linear-subulate .13" long, in fruit spreading at right angles to the rhachis, semifusiform, .15" long, deciduous, leaving the bract-like lower glume and the other small empty glume on the annular scar or these separately deciduous. Fruiting spkt. after falling consists of 2 subequal glumes, outer lanceolate-oblong mucicous many-nerved, inner cymbiform with curved keel prolonged into an awn and with broad hyaline sides. Nut brown .08", curved-oblong, 3-quetrous. Style ¾ths nut, stigmas longer.

Usually found on somewhat high ground but in the rains. Frequent. Purneah! Singbhum! Hazaribagh (on Parasnath) J.D.H.! It is very common eastwards of our area. Fl., Fr. Aug.—Sept.

Leaves often as long as or exceeding stem, .12—17" broad. Rays of umbel or spikes simple (but see variety), straight, peduncle sometimes longer than spike in fruit. Spkts. in flower usually (typically) with only 4 glumes: i small lanceolate-acuminate or setaceous bract-like .05" or less, ii empty half-convolute, truncate .06", base amplexicaul, iii .12" (or whole length of spkt.), very convolute, linear-oblong (when unrolled), iv present in a very small hyaline state and embracing the young 2-sexual flower. It has a short incurved very acute or mucronate tip, st. 3. In Clarke's variety *evolutior* there are more flowering glumes and the spikelets bear 2—4 nuts. In var. *subcomposita* the spikes are often digitate on the rays. Neither of these varieties have been seen in our area.

4. *M. squarrosus*, C. B. Clarke.

This is a small plant closely resembling *Cyperus aristatus* Rottb., and as it extends from Bengal to Ceylon is very likely to be found in Orissa. The stems are not winged as in the *Cyperus*, spikelets about 2" and glumes .05—07", the awn less recurved than in *C. aristatus*. The nuts are linear .04" long which is nearly twice the length of those of the *Cyperus*. This latter, however, in the button-shaped scars after fall of the spikelets is practically a *Mariscus* but the lowest glumes are not persistent below the articulation.

5. M. albescens, Gaud.

A stout species 1—3 ft. high with long leaves often as long as stem, up to .35" broad. Spikes 1—1.5" long, in a dense corymb (compound umbel) with numerous spreading oblong hardly compressed close spikelets .2—25" long. Glumes about 8, flowering about .1" long, slightly concave, 9-nerved, obtuse. Rhachis after fall of the spkts. stout angled, with the 1—2 persistent lanceolate basal glumes below the prominent scars of the articulate rhachilla. Nuts 3—6 to a spikelet, short, broad, ovoid.

Barkuda, Chilka Lake. "Between rocks in water near the edge of ponds. Plants 3 ft. high. Fl. mainly June—Oct., but also in April when the rocks are quite dry." *Narayanvami* and *Carter* (*Memoirs As. Soc.*, vii, 4).

Leaves transversely lineolate, *Clarke*.

6. M. compactus, nov. comb. Syn. *Cyperus compactus, Retz.* (Obs. v, 10); *M. microcephalus, Presl.*; *Cyperus dilutus, Vahl* (1805—06).

Rhizome short stout covered with old remains of sheaths and short leaves and bearing two or three stems 8"—3 ft. high, their bases clothed with very characteristic large oblong-celled spongy leaf-sheaths. Easily recognised by the numerous straight subulate spikelets aggregated into brown globose heads (contracted spikes) .5—75" diam., the heads on the rays of compound umbels 2—12" diam. Glumes imbricate much convolute, often 3—4 lowest empty so that when, as is sometimes the case, there are only two or three 2-sexual glumes this might be taken for a *Schænus* or *Cladium*. In other cases however there are as many as 14 fruiting glumes. Nuts narrowly oblong slightly wider upwards (narrowly obovoid, *Clarke*), .7" long, 3-angled, usually slightly curved on one side, tip beaked with the base of the style. Rhachilla slender with narrow hyaline persistent wings.

In rice-fields, common. Purneah and western Bengal, *Kurz!* Ranchi, *Clarke!* Singbhum! Also in Upper Gangetic Plain and eastern and lower Bengal, so that it probably occurs in all districts. Fl., Fr. Aug.—Nov.

L. nearly or as long as stem. Bracts usually about 3, very long and about .2" broad, others shorter, with large-celled tissue at their base like the leaves. Peduncles of heads with a bract at base as well as a tubular sheath, rhachis attaining about .2" long in fruit and covered with the lowest pairs of glumes after fall of the spkts. and their very prominent knob-like bases. Spkts. not compressed and the convolute glumes slightly spirally arranged, lowest 2 empty small .03". lii about .06—08" also often empty, ovate-lanceolate, about 5-nerved, iv usually flowering convolute .12—15" linear-oblong obtuse, closely 3—4-nerved along centre and remainder scarious coriaceous. iv and v similar, the rest either male or tabescent or up to 14 altogether flowering. Ovary minute, style three times as long passing gradually into ovary, stigmas long. St. 3, anths. apiculate. Rhachilla with long internodes so that each glume only embraces about half the following.

Cyperus compactus, Retz. (1779—91) is given as a synonym by *Kunth* and is the oldest name. *Retz*'s plant came from China but our plant also extends into China. It is described as having terete culms, but the rest of the description agrees fairly well.

6. COURTOISIA, Nees.

Herbs with erect simple stems and grass-like leaves only near the base. Spikelets compressed in umbelled globose spikes, very often with the lowest glumes in a different plane from the succeeding ones and

occasionally with abortive rudimentary spikelets in their axils, usually 2 lowest empty, 1—3 succeeding 2-sexual and nut-bearing and always winged on the keel, uppermost sterile. Rhachilla disarticulating above the empty glumes. Stamens 3 with oblong anthers. Style short persistent with 3 long stigmas. Nut 3-gonous acute.

1. *C. cyperoides*, Nees.

Stems 1·5—2 ft. high, clustered, 3-quetrous. Leaves very long, flaccid, under ·25" broad. Inflorescence corymbiform with several long unequal rays 1—4·5" long, and a central sessile head, the longer rays often compound, ultimately bearing many globose or sub-globose heads ·3—·5" diam. consisting of numerous short congested spikes bearing many scarious bracts and few-fl. spikelets. Spikelets mostly with a lower empty cymbiform bract ·12" long and a narrower mucous bract ·06" long at their base, often resembling glumes but in other cases in a different plane and bearing rudimentary spkts. in their axils. Flowering glumes 2, rarely more, usually only 1 nut-bearing boat-shaped with prominently winged keels and broad sides, ·15—·18" long, subequal or one rather longer and with a more prominent cusp. Nut narrowly fusiform beaked, 3-quetrous, ·12" long, embraced by the glumes.

N. Bengal (Purneah?), Kurz! Ranchi, Gamble! Hazaribagh, T. Anders! Singbhum, chiefly in rice-fields, frequent! Fl., Fr. Oct.—Feb. Annual.

7. *ELEOCHARIS*, R. Br.

Stems simple erect, non-flowering stems sometimes leaf-like, but of same form as the flowering. Leaves reduced to a few cylindric usually membranous sheaths at the base of the stems, usually truncate, sometimes with a small tooth or minute blade. Inflorescence a single (rarely more) terminal spikelet supported by a short bract which occasionally bears a flower and never exceeds the spikelet. Glumes several to many, imbricate on all sides, obtuse. Lowest flower perfect nut-bearing, several succeeding glumes usually nut-bearing, upper tabescent. Bristles 8—5, rarely fewer (often small or 0 in *atropurpurea*). Stamens 3—1, anterior: anthers linear-oblong, not crested. Style-base dilated and apparently articulate (usually sharply constricted between nut and the style base), but persistent. Nut more or less obovoid plano-convex when stigmas are 2, or 3-gonous when stigmas are 3 on the linear style.

I. Stems 1—3 ft. high, ·15—·25" diam. Spkts. scarcely wider than the stem. Gl. ·2—3" long. Stigmas 2 or 3:—

Stems septate. Nut not distinctly striate

Stems not septate. Nut cancellate*

1. *plantaginea*.

2. *fistulosa*.

II. Stems slender, mostly under 12" high under ·1" diam. Spkts. wider than stem. Gl. under ·2" (rarely more in 3):—

A. Stigmas 2. Nut biconvex:—

1. Nut (with style base) ·06—·08", style base large conical:—

Stems 4—20". Gl. ·18—·2"

3. *palustris*.

* Outer cells subquadrate in vertical series, their walls causing the nut to be vertically and horizontally striate.

2. Nut .03", style-base very small depressed or disciform:—

Stems 2—14". Spkts. .12—5". Bristles brown .

4. *capitata*.

Stems 2—7". Spkt. .1—25". Bristles shining white

5. *atropurpurea*.

B. Stigmas 3. Nut 3-quetrous or 3-gonous:—

Stems 1—2", angled. Spkt. .05—15"

6. *chaetaria*.

Stems 8—12", fluted. Spkts. .2—3"

7. *congesta*.

1. *E. plantaginea*, R. Br.

A rush-like caespitose sedge 1—3 ft. high with terete tough stems .17—2" diam. distantly obscurely septate when dry terminated by single brownish spikelets .7—1.2" long and about same diameter as the stem, embraced at the base by a very short rounded scarious margined bract appearing as a continuation of the stem. Glumes closely imbricate, .2—3" long broadly oblong to somewhat ovate or obovate, tip always rounded and with a thin scarious margin, back closely striate and sometimes with a faint keel. Bristles 7—8 about as long as the nut (excluding the pyramidal style-base), retrorsely hispid. Nut light brown polished smooth about one-third as long as glume, biconvex or obscurely 3-gonous according as the stigmas are 2 or 3, tipped with the persistent conical articulate base of the style which is two-thirds to three-fourths as long as the nut. Style very long.

Monghyr, *Ham.*! Hazaribagh, *Clarke*! Gregarious in shallow tanks from the Sikkim Tarai to Raipur (in the Central Provinces outside our S. W. district)! also in Bengal proper, so that it will probably be found in other districts within our area. Fl., Fr. Oct.—Dec.

Stolons long .12—17" diam. Sheaths at base of stems 2—8" long, thin and torn. Rhachilla after fall of glumes stout with deep depressions and marked ledges (on which the nut rested).

2. *E. fistulosa*, Schultes.

Habit of the last but stems triquetrous at the top and not transversely septate when dry, spikelets about the same size but more acute and the tips of the glumes less closely appressed, nut distinctly longitudinally striate and more minutely transversely striate from the superficial transversely-oblong cells being arranged in vertical series.

Same situations as *E. plantaginea* and sometimes growing intimately associated with it so that with one hand one may collect several culms of both species. Jalpaiguri, probably therefore Purneah! Jumalpur (Monghyr Dist.), *Kew Herb.*! Ranchi, *Clarke*! Fl., Fr. Oct.—Dec.

The sheaths and the shape of the glumes are much the same as in *E. plantaginea* but the rhachilla is somewhat slighter, less deeply excavate and often with membranous appendages (remains of the glumes?) after fall of the glumes.

3. *E. palustris*, Br.

A rather slender caespitose sedge with creeping rhizome black or dark brown. Stems 4—20" high up to .12" diam. (rarely .1" in our area) terminated by an ellipsoid or cylindric dense-fid. yellow or brownish spikelet wider than the stem .3—1" long and .15—2" broad. Glumes much imbricate long, boat-shaped with green keel and hyaline or coloured margins, lanceolate when unfolded, .18—22" long, obtuse. Nut including the large style-base .06—08" long, biconvex, obovoid rounded

and very broad, style-base nearly half as long as nut ovoid or broadly conical.

Shahabad, *Ramajad Lal*! Also in Lower Bengal, so that it will probably be found in the intermediate plains districts. Fl., Fr. Dec.—March.

Stems with loose often red leaf-sheaths below, the uppermost sometimes produced on one side into a triangular point otherwise truncate. Stem with a terminal small glume-like bract supporting the spikelet oblong green with broad scarious margins. Bristles 6 as long as or exceeding the nut, retrorsely scabrous (sometimes reduced in both number and length, *Clarke*). *Clarke* speaks of the nut being much narrowed at the top, sometimes to a very short beak; it is rounded at the top in specimens seen by me. Outer cells obscure, rarely reticulate.

The plant is cosmopolitan and is common in the British Islands where the nut is usually striate.

4. *E. capitata*, *Br.*

Perhaps not specifically distinct from *E. atropurpurea* but stouter and attains 14"; small specimens are only separated by *Clarke* from the bristles being brown or ferruginous instead of white. The glumes also appear to be less folded but merely concave and broadly elliptic or ell.-oblong. The spikelets are said to attain '5". Nut deep brown or black as in *atropurpurea*.

Near rivulets, *Kurz*! Hot springs of Saruchkund, Plains of Bihar, *Kew Herb.*! Hazaribagh, *Anders.*! Manbhūm, *Ball*! Singbhum, *Clarke*! Fl., Fr. Sept.—Dec.

5. *E. atropurpurea*, *Kunth*. Syn. *Scirpus capitatus*.

A small weak cæspitose sedge 2—7" high. Stems slender terminating in a single small ovoid or sub-cylindric spikelet '1—'25" long. Glumes '05—'06" long at base of spikelet, broadly-oblong obtuse or rounded at tip, membranous, folded, 3-nerved. Bristles about 6 as long as nut, glistening white. Nut brown (black, *Clarke*), polished microscopically striate obovoid, biconvex, '03" long, crowned with the disciform style-base. Style 2-fid.

In dried up pools, etc. Purneah, *Ham.*! Monghyr, *Griff.*! Western Bengal and Bihar (Manbhūm), *Kurz*! Hazaribagh, *Anders.*, *Clarke*! Singbhum! Fl., Fr. April—Dec. Annual.

6. *E. chætaria*, *Roem. & Sch.*

A very small tufted sedge 1—2" high, occasionally up to 6", sometimes with a short filiform rhizome. Stems slender, angled, terminated by a short ovoid or ellipsoid few-fid. spikelet '05—'15" long. Glumes, lower sub-distichous '1" long, boat-shaped with broad coloured and scarious sides, upper spiral smaller. Nut '05" long, distinctly 3-quetrous, rounded between the prominent angles and distinctly punctulate in vertical lines (cancellate, outer cells in each face in 6—10 series, sometimes perforated, *Clarke*).

In half-wet swamps and rice-fields. Sikkim Tarai (near Purneah), *King*, *Kurz.*! Ranchi, *Clarke*! Singbhum! Probably in many other districts. Fl., Fr. Sept.—Dec. Probably annual.

Uppermost stem-sheath often with 1 or sometimes 2 scarious elliptic blades '04—'05" long. Spikelets with few glumes, only 1—4 developing nuts. Stigmas 3. Angles of nut often slightly produced at its shoulder, style-base short conical. The nut apart from the style base and thick receptacular base is cylindricoglobose.

7. *E. congesta*, Don.

A caespitose sedge 8—12" high with slender nearly terete 8—10-fluted or -striate stems and a terminal many-glumed ovoid or conical spikelet .2—'3" long frequently with subsidiary branches from the axil of the bract which may bear a smaller spikelet. Glumes .08" ell.-oblong concave, not keeled, hyaline in centre and with often coloured margins or a coloured band between the centre and margins, midrib very fine. Stigmas 3 longer than the short style. Nut straw-coloured .05" without or .06" with the narrow-conical style-base, obovoid or pyriform obscurely 3-angled. Bristles rather stout a little longer than nut, retrorsely scabrous.

In the hills of Chota Nagpur, over 2000 ft. Ranchi, Clarke! Sirguja, Clarke! Tributary States of Chota Nagpur (without precise loc.), Prain's Collector! Fl. Fr. Oct.—Dec.

Lower sheaths often reddish, uppermost with a short subulate or lanceolate appendage. Branches of inflorescence when present shorter or longer than the spikelet with a sheath round their base. There is a short neck between the nut proper and the style-base (which latter Clarke describes as bulbiform!), and the species appears almost inseparable from *E. subvivipara*, Boech, except by habit. The latter has very slender flexile stems and small heads.

8. FIMBRISTYLIS, Vahl.

Usually tufted sedges with short woody rootstock or fibrous roots, not stoloniferous. Leaves usually near base of stem, rarely 0. Spikelets 1—many clustered or discrete, umbellate when numerous, many flowered with all the glumes imbricate or in a few lower distichous. Lowest 1—2 rarely 3 glumes empty, several succeeding with 2-sexual flowers, upper tabescent. Stamens 3—1, anterior. Bristles 0. Style usually more or less pubescent or hairy, its base dilated and constricted below the dilatation, deciduous altogether or persistent, stigmas 3—2. Nut usually obovoid, often with a foot or gynophore (much dilated in *F. podocarpa*).

The glumes in this genus are much more variable in size than in *Cyperus*.

The length of the spikelets in the following key is the length before the fall of the lower glumes; the spikelet continues to elongate after the fall of the lower glumes, though the glumaceous part often remains fairly uniform in length.

- I. Stigmas 3, nut usually 3-gonous, rarely compressed. Style sometimes glabrous:—
 - A. All glumes spirally imbricate. Spkts. mostly small:—
 1. Spikelets discrete (not sessile in clusters), many, in compound umbels:—

Spkts. subglobose under .1". Gl. .04—'05" ..	1. <i>miliacea</i> .
Spkts. ellipsoid acute, over .1". Gl. .06" .	2. <i>quinquangularis</i> .
Spkts. lanceolate .17—'25". Gl. .08—'1". Stems flat above	3. <i>complanata</i> .
Spkts. ellipsoid .2—'3". Gl. .1—'16". Rhizome stout .	4. <i>Thomsoni</i> .
 2. Spkts. sessile in clusters, clusters umbelled:—

Spkts. .15—'25". Gl. .15—'16". Rhizome stout. L. 2—5"	5. <i>junciformis</i> .
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 - B. Lower glumes distichous or sub-distichous. Spkts. discrete or solitary, usually large:—
 1. Umbels compound. Spkts. 3". Umbels with short hairy bracts

6. <i>fusca</i> .

 2. Spkts. one only or few in the umbel:—

Spkts. 5—9 in the umbel, .15—'3". Gl. .06—'08"	7. <i>tenera</i> .
Spkts. solitary (rarely 2—3) on the stem, 3—5"	8. <i>monostachya</i> .

- II. Stigmas 2, nut narrow or biconvex. Style much compressed, nearly always hairy above or below. Glumes imbricate spiral:—
- A. Spkts. one only or few (rarely up to 6) in the umbel, mostly large:—
1. Spkts. only one on the stem. Stem obscurely 4-angular, leafless or nearly so:—
Spkts. .25—4". Nut linear-oblong 9. *tetragona*.
Spkts. .2—35". Nut sub-globose, transversely fluted 10. *acuminata*.
 2. Spkts. 1—3 (rarely 6). Stem not 4-angular. Leafy:—
Spkts. ovoid .3—7". Nut stipitate 11. *schœnoides*.
Spkts. linear-oblong .5—7", usually 1—2 sessile and 1 ray 12. *subbispicata*.
- B. Spkts. many (1 only in *diphylla* var. sometimes few in *ferruginea*) umbelled, usually small:—
1. Glumes discrete (sub-clustered in *spathacea*):—
 - a. Glumes with awn as long as the blade (exc. sometimes *æstivalis*). Small very tufted often pubescent herbs:—
 - i. Spkts. subglobose or oblong, awns squarrose:—
Nut linear cylindric 13. *dipsacea*.
Nut orbicular-obovoid. Style-base with pendulous hairs 14. *squarrosa*.
 - ii. Spkts. narrow, awns not squarrose. Style minutely hairy at the base 15. *æstivalis*.
 - b. Glumes mucicous or keel only very slightly excurrent (awned in the lowest glumes of *æstivalis*):—
 - i. Hairy or pubescent all over. Lower gl. awned 15. *æstivalis*.
 - ii. Mostly glabrous (L. sometimes hairy in *ferruginea*, sheaths and bracts sometimes hairy in *diphylla*):—
† Nut with large gynophore, minutely many- striate 16. *podocarpa*.
†† Nut with very minute or 0 gynophore:—
† Leaves long (often as long as stem):—
Spkts. not angled by the prominent keel of the glumes 17. *diphylla*.
Spkts. angled by the prominent keels of the glumes 18. *dichotoma*.
†† Leaves very short compared with the stems:—
Spkts. ovoid .2—4". Gl. .12", hoaty above, Nut pale 19. *ferruginea*.
Spkts. often congested, cylindric .1—15". Gl. .06", rounded. Nut black 20. *spathacea*.
 2. Spkts. sessile in clusters:—
 - a. Heads solitary on the stems. Spkts. .2", ovoid or lanceolar 21. *argentea*.
 - b. Clusters umbelled:—
L. long, not silky. Spkts. narrowly linear .4—6" 22. *Hookeriana*.
L. short, silvery silky. Spkts. ellipsoid-oblong 23. *sericea*.

1. *F. miliacea*, Vahl.

Cæspitose, usually 1—2.5 ft. high. Stems angled or almost winged above embraced at base by the large leaf-sheaths. Leaves usually well developed and frequently as long as stem, .07—2" broad, many-nerved.

Branches of umbel often strongly 3-quetrous and scabrid. Spikelets very many in decompound umbels 1—6" diam., sub-globose, .08" long, usually one central sessile and 2—5 lateral with slender pedicels on the final branches of the umbel. Glumes .04—'05" long, ovate-cymbiform, keel scarcely excurrent or submucronate. Nut obovoid 3-gonous, .02—'025" long, minutely transversely striate (with transversely elongate cells) and often minutely verrucose, pale straw-coloured. Style about equal to nut with pyramidal base, scantily pubescent near the 3 stigmas.

Rice-fields, etc., common. Chota Nagpur, Wood! Singbhum! Hazaribagh, Clarke! Probably in all districts. Fl., Fr. r.s. and c.s.

Clarke says hardly separable from *quinquangularis*, but it appears to me very distinct. The rhachilla is nearly or quite naked after the fall of the glumes or the scales are very inconspicuous; one empty narrowly lanceolate glume-like bract is, however, sometimes persistent at the base. The glumes have a pale midrib and a dark brown streak each side of it and lighter brown sides almost exactly as in *quinquangularis*.

2. *F. quinquangularis*, Kunth.

Cæspitose with many angular stems usually 1—2 ft. high, sometimes flattened at the base, rarely leafless. Leaves usually half to as long as stem, many-nerved, .05—'07" broad, rarely leafless. Spikelets very numerous, small, ellipsoid or oblong-lanceolate, more or less pointed .1—'2" long on capillary pedicels in rather compact decompound umbels 1—6" diam. Gl. .06" long, ovately cymbiform with keel slightly produced into a mucro. Nut globosely obovoid .02" long minutely cancellate with very short but transversely elongate cells and verrucose when old, very minutely apiculate after fall of the style. Style not conspicuously flattened, a little longer than nut, only pubescent near the 3 stigmas which are nearly as long.

Common in rice-fields. Santal Parg., Kurz! Ranchil! Singbhum! Manbhum, Clarke! Hazaribagh, Clarke! also on Parasnath 3000 ft.! Fl., Fr. Oct.—Jan.

As in most *Fimbristylis* scales are left on the rhachilla after the fall of the glumes, the morphology of which is not clear to me. They are very marked in this species, are brown and lanceolate and .02" long. They appear to form no part of the glumes but are rather in the nature of bracteoles.

3. *F. complanata*, Link.

Stems 8"—2 ft. flattened above. Leaves numerous often 4—8" long, .12—'22" broad, almost premorse. Umbels large usually very compound 2—4" diam. with brown lanceolar angled spikelets .17—'25" elongating to .3" after fall of lower glumes. Bracts broad very obtuse like the leaves, always much shorter than the umbel, .5—1.5" by .1". Glumes .08—'1" with the 3-nerved keel of lower glumes excurrent as a fine point. Nut .02" long white obovoid obtuse tubercled.

Several times collected in Bengal without specific locality and also in the United Provinces and the Peninsula. It probably therefore occurs in our Area although I have seen no specimens certainly collected there. Clarke states that it occurs throughout India. Fl., Fr. May—Sept.

4. *F. Thomsonii*, Boeck.

Stems 8"—2 ft. obscurely angular or compressed above, base often densely clothed with leaf bases on a thickened stock. Leaves short

2—4" or up to 12", obtuse, .1" broad. Spikelets large .2—3" long (or .4", *Clarke*), ellipsoid or oblong-lanceolar, discrete in compound and decomposed umbels, angled, with an empty aristate glume or bract at the base .15" long, the awn hispid. Lowest flowering glume also shortly awned and slightly hispid on keel. Other fl. glumes .1—1.6" long, cymbiform with keel very shortly excurrent. St. 3. Ovary linear with very large pyramidal style base, style (with base) .06—0.7" glabrous (or nearly so), arms nearly as long, minutely pubescent. Nut pyriform-obovoid, obtusely 3-gonous, .04—0.6" long, obscurely, transversely lineolate, verrucose.

Hazaribagh (on Parasnath, 4200 ft.) *Clarke*! Fl., Fr. April.

I doubt whether this is anything more than *F. junciformis* with discrete spikelets though the style-base is much broader than I have seen it in that species. The Hazaribagh specimen (named by *Clarke*) has the thick stock, leaves and bracts much as I have described under *junciformis*.

5. *F. junciformis*, *Kunth*.

Stems 8—18" obscurely angular or somewhat compressed, usually densely leafy at the base and arising from a stout thick rootstock sometimes .5" diam. Leaves usually short 2—5" long (or sometimes two-thirds as long as stems, *Clarke*), .05—1.2" broad, obtuse, margins incurved or not. Spikelets .15—2.5" long, always some clustered, terminal ones sometimes solitary, in compound and decomposed umbels 1—3" diam. (umbels usually longer than broad). Glumes usually with an empty aristate glume or bract at the base and clusters also supported by an aristate bract. Lowest fl. glumes often with excurrent keel, other fl. glumes .15—1.6" long, cymbiform, chestnut-brown with narrow scarious margins, keel very shortly or not excurrent. St. 3 with linear apiculate anthers. Ovary with pyramidal style base, style .07—1" long glabrous (or nearly so), stigmas $\frac{3}{4}$ ths as long or more, minutely pubescent. Nut obovoid, 3-gonous, .04" long, minutely verrucose.

Monghyr, *Ham.*! Chota Nagpur, chiefly on the plateaux. Sandy places, Manbhum, *Kurz*. Dry grassy places in Ranchi! Palamau! Chota Nagpur, *Wood* (without district)! Fl., Fr. May—Sept. Perennial.

Rootstock woody, clothed by the brown dilated bases of the leaf-sheaths.

L. usually with minutely hispidulous margins at base. Umbels with one to three principal bracts .5—1" long with broad amplexicaul many-nerved dry sheaths and frequently scabrid blade. Branches of umbel much striate and often compressed.

The plant is well named, the brown tufted spikelets reminding one much of a *Juncus*. It is usually burnt annually by jungle fires and shoots up after these have passed over the ground.

6. *F. fusca*, *Benth*.

Rootstock stout. Stems tall slender 8—18" with a tuft of leaves 2—6" long, .06" broad, at the base. Spikelets discrete brown oblong .3" in rather lax mostly compound umbels 1—2.5" diam. with usually hairy short bracts .3—7" long. Glumes .17—2" long, lower 3 empty and 2—6 nut-bearing distichous or nearly so, upper 3—6 male or sterile 3—few-ranked, narrow-lanceolate, few-nerved, keeled, all shortly awned or mucronate, margins pale. Stigmas 3. Nut obovoid pale .04" long minutely verrucose.

Manbhum (Barakar) in sandy thickets, Kurz! Fl. May.

7. F. tenera, Roem. & Sch. Var. verrucænum, Clarke (in Kew Herb.).

A slender rather flexuous-stemmed plant 8—12" high. Stems tufted 4—5-angular under the sparse irregular umbel. Spikelets all distinct, linear-lanceolate, 15—3" long light-brown, 7—9 only in the umbel. Glumes 06—08" long, ovate acuminate with 3-nerved slightly excurrent keel, glandular-puberulous in the type, glabrate in our plant. Stigmas 3. Nut not compressed, with 2 ridges stronger than the third, broadly obovoid, yellow-brown, verrucose.

Ranchi, 2000 ft., Clarke! Fl., Fr. Oct.

L. about half as long as stem, very narrow, flat, glabrous. Umbel subcompound with 2—3 bristle-like bracts up to 1" long. Rhachilla after fall of glumes with much raised margins to the scars. Glumes somewhat cymbiform. Style longer than nut, glabrous, deciduous with the pyramidal style-base.

This is apparently the same as the published variety *oxylepis*, Clarke (Steud. sp.).

8. F. monostachya, Hassk.

Cæspitose with a dense tuft of fibrous roots and stems thickened at base 3—10" high compressed and striate, microscopically hispidulous above on one edge. Leaves several at base of stems almost filiform, 1—6" long, semi-terete, back round, upper surface depressed, base slightly narrowed to the sheath and the edges with a few microscopic hairs. Spikelet solitary (rarely 2—3, Clarke) terminal 3—4" long, ovoid or conical, subtended at the base by 1—3 boat-shaped awned bracts (empty glumes of some) 14—25" long with pale scarious sides, awn sometimes longer than the blade, broad, hispid or muricate. Flowering glumes lower distichous, about 5—6 fruit-bearing 2" long, then 5—6 functionally male, the rest male or tabescent, broadly ovate with rounded back, sides converging to a hard tip. St. 3, 3" long, with much flattened filaments 2" long. Style flattened stout 3-winged below where it forms a narrowly conical base, pubescent up to the 3 stigmas. Nut obovoid or globose above the attenuate base, 08" long, 3-sided, angle-ridges extending down the base, straw-coloured, minutely verrucose.

Monghyr Hills, Kurz! Nathpur, Ham! Singbhum! Manbhum, Camp! Ganjam, Fischer (probably therefore Puri)! Fl., Fr. r.s.

Leaf-sheaths narrow, tip rounded opposite to the blade, covered like the leaves with small red dots. Blade usually recurved, upper surface concave, the epidermal cells very distinct, globose and apparently containing air, lower surface with about 3 delicate nerves each side of mid-rib and rows of numerous minute red dots. Rhachilla after removal of glumes with very prominent red-dotted wings (base of glumes?). Style (with base) finally deciduous, about 12" long, stigmas filiform one-third to nearly as long.

9. F. tetragona, Br.

Cæspitose, often robust, with stems 4—24" high obscurely 4-angular each terminated by a single large conic dense-fld. spikelet 25—4" long. Glumes very many on the larger heads closely imbricate with rounded backs, broadly oblong or ovate at base, 12—14" long or only 1" in small heads, with a dark lanceolate 3-nerved centre, paler sides each with about 3 delicate nerves, and hyaline margins, tip rounded.

Stigmas 2. Nut linear-oblong, very slightly compressed, but with a slight ridge or nerve along each side, and closely cancellate (cells in about 9 longitudinal series each side of the nut), about .08" long, excluding the flattened style-base, straw-coloured. Style persistent.

Wet places, margins of tanks, etc. Near Purneah (in Sikkim Tarai) along stagnant waters, *Kurz!* Ranchi, 2000 ft., *Clarke!* Singbhum, *Clarke!* Hazaribagh, *Clarke, Anders.!* Fl., Fr. Sept.—Dec.

Stem nearly leafless, uppermost sheath mucronate or produced into a short blade up to 1" or 1.5" long with scarious margin. Spikelet with 2—3 lowest glumes (bracts) empty, longer than the flowering but much shorter than the spikelet, ovate. Rhachilla with minute points after fall of the glumes.

10. *F. acuminata*, *Vahl.*

Smaller and more slender than *tetragona*, 3—9" high, like an *Eleocharis* in general appearance with single terminal ovoid-lanceolar spikelets 2—3.5" long. Median glumes about .17" long, oblong-lanceolate scarious, somewhat concave, keeled upwards and keel slightly excurrent. Nut white globosely ovoid, zoned with about 6 transverse flutings, .06" long.

Throughout India, *F.B.I.* From Kumaon to the Sikkim Tarai, *Clarke!* and Bengal, *Griff* (without precise locality)! Probably therefore in our Northern Area. Fl., Fr. Oct.

Stem leafless. Uppermost sheath produced on one side 0—5".

11. *F. schcenoides*, *Vahl.*

Cæspitose with stems thickened below, 4—12" high, striate, slender above and often flexuose when bearing more than one spikelet. Spikelets 1—3 (on the same plant), distant, ovoid or conical, .3—7" long, dense-flowered with all the glumes spiral, supported at the base or not by a rigid lanceolate bract .1—1" long with a rigid green excurrent keel or broad awn. Glumes lower flowering suborbicular concave .15" long, keeled above and somewhat mucronate, many-striate. Nut suborbicular-obovate with a short stipes .07" long with, .05" long without, the stipes, biconvex, very finely minutely brown-striate and microscopically dotted (smooth white rarely discoloured brownish, *Clarke*).

Purneah, *Kurz!* Manbhum (Barakar), *Clarke!* Hazaribagh, 2000 ft., *Clarke!* Orissa, *Walsh!* Throughout India, *Clarke*, and probably throughout our area. Fl., Fr. Aug.—Oct.

Rhizome 0 or very short. Leaves filiform, $\frac{1}{3}$ — $\frac{1}{2}$ as long as stem, incurved edges minutely scabrous, superficial cells very distinct. Glumes seriatim deciduous, rhachilla clothed with small scales (bases of glumes?) after their fall or (*vide Clarke*) leaving the rhachilla minutely hairy by the ragged edges of the areoles. Style long flattened, villous.

12. *F. sub-bispicata*, *Nees & Meyen.*

Cæspitose, rigid, 6—15" high with leaves shorter than the stem .04" broad in middle, obtuse. Spikelets large linear-oblong .5—7" long before fall of glumes, 1—3 rarely 6, usually 1—2 sessile and 1 ray, subtended by 1—2 short bracts. Rhachilla after fall of lower glumes reaching 1" with very spiral scars. Glumes oblong scarious, median

about .2" slightly keeled and mucronate above. Nut obovoid or pyriform, smooth, .06" long, microscopically striate with dots.

Puri, Atkinson! Fl., Fr. May.

13. *F. dipsacea*, Benth.

A little plant growing in dense tufts 2—4" high and 3—5" broad with slender or filiform stems and capillary leaves often as long as the stem. Spikelets very numerous, single and in dense umbels with 2—3 filiform bracts often overtopping umbel and up to .6" long, subglobose or oblong .1—2" long, echinate with the awns of the glumes. Glumes very narrow, hyaline with green keel excurrent into a squarrose awn as long as the blade, .06—08" long with the awn. Nut .025—03" long linear cylindric glabrous or with capitate hairs mostly curved. Stigmas 2 as long as the style.

Purneah! Santal Parganas, Kurz! Sandy bank of Ganges, *Kew Herb.* Fl., Fr. May.

Clarke states that the young pistil is frequently ornamented with clavate glands which usually disappear in fruit, but in one of Wight's specimens are developed into ovoid processes nearly as wide as the nut. These glands or capitate hairs are multicellular with the walls of the cells irregularly thickened, the stalks are 1-cellular.

14. *F. squarrosa*, Vahl.

A little tufted plant similar to *F. dipsacea* superficially. Spikelets all oblong .15—25" long in umbels often 2—4" diam. with bracts usually short, sometimes as long as the umbel. Glumes flat broadly oblong pale fuscous with keel produced into a long squarrose awn equal to or exceeding the blade, .07—09" with the awn. Nut compressed orbicular-obovoid, smooth, pale yellow. Style base swollen with remarkable pendulous villi all round sometimes $\frac{3}{4}$ ths as long as nut. Stigmas 2.

From the United Provinces to Lower Bengal! Patna, Wall! Dalaganj (Purneah), J.D.H.! Santal Parganas, Kurz! Fl., Fr. Jan.—May.

Glabrous or pubescent. Stems 2—8", striate. L. about $\frac{1}{2}$ to $\frac{3}{4}$ ths stem.

15. *F. æstivalis*, Vahl.

A small grass-like tufted and gregarious herb 2—8" high with very slender erect angular stems and filiform leaves clothed, as well as the sheaths, with small spreading white hairs. Spikelets very small, .06—08" long in compound and decomposed umbels with very unequal rays .2—1.5" long supported by filiform bracts, the lowest of which usually overtops the umbel and is like the leaves. Glumes .05—07" long few scarious hispidulous cymbiform with green keel excurrent as an erect awnlet (as long as the blade in the lowest glumes only). St. 1. Nut ellipsoid-subglobose or somewhat obovoid 2-convex smooth, slightly margincd, very obscurely reticulate, .02—03" long. Style nearly as long as nut prominently bulbous and minutely hairy on the base and with minute unequal scattered hairs upwards, stigmas short recurved puberulous.

Gregarious in wet places. Patna, Ham! Ranchi and Palamau on the pats, elev. 3000 ft.! Fl. May. Annual.

Clarke says of the nut that the outermost cells are quadrate-hexagonal, arranged in 12—16 vertical rows on each face, but far less prominent than in *F. dichotoma*.

16. *F. podocarpa*, Nees (in part).

Cæspitose, about 1 ft. high, with striate or angled somewhat flexuous slender glabrous stems (exc. on some of the leaf-sheaths). Leaves as long as or shorter than the stems, .07" wide, ciliate or hispid on margins, sheaths often hairy. Umbels lax with few (sometimes only 3) spikelets, when compound branches with only 1—3 spikelets. Bracts hairy at base and scabrid on the edges above, one often exceeding the umbel, others shorter. Spikelets brown .15—'.3", mostly supported by a setaceous bract about as long or much shorter with scattered hairs (as on the secondary bracts of the umbel). Glumes concave-ovate or cymbiform, .1—'.12" long, keeled throughout, very shortly acutely excurrent or minutely cuspidate, lateral nerves 5—7 obscure. Fil. much flattened (arising from base of the foot) .12" long. Nut biconvex, nearly orbicular above the large obconic swollen usually toothed foot, .07—'.08" with the foot, .05" without, rounder than in *diphylla*, polished pale yellow or white, strongly margined, about 13-striate with the fine striæ composed of minute raised dots. Style flat, .06" long gently tapering, shortly ciliate above the base, stigmas 2 much shorter.

Singbhum! Manbhum, *Clarke!* Fl., Fr. June—Nov.

17. *F. diphylla*, Vahl.

Tufted or stems rather distant on the short rhizome, 1"—2 ft. high striate angled or rarely compressed and sometimes hairy under the umbel which is sometimes reduced to 1 spikelet or simple or compound. Leaves long, sheaths and bracts often densely hairy. Spikelets .2—'.25" before fall of glumes ovoid-oblong terete not angled above with the prominent keels of the glumes (as in *dichotoma*), up to .5" after fall of lower glumes. Glumes glabrous (*Clarke*) or thinly pubescent towards tip .08—'.1" ovate, concave, green-keeled and mucronulate, the sides brown or reddish, dry. Nut biconvex straw-coloured, almost glistening or iridescent white, with a very small foot, .04—'.05" long obscurely 5-ridged on each face and trabeculate, sometimes longitudinally striate, especially when unripe.

Throughout India (*Clarke*). Ranchi and Palamau, elev. 2000—3000 ft.! Singbhum and Hazaribagh, *Clarke!* Manbhum, *Clarke!* Ganjam, *Fischer!* and probably therefore Orissa. Fl., Fr. May—Oct.

Var. *a. annua*, Clarke (Roem. & Sch., sp.).

A very minute form 1—3" high bearing single or up to 3 spikelets. Hazaribagh, *Clarke!* Rajmahal Hills, *Kurz!* Fl. Oct.

(*Clarke* named the Rajmahal specimen first *dichotoma*, then *trispicata*, *Steud.*)

Var. *β. pluristriata*, Clarke. Syn. *F. pilosa* of most authors, not of *Vahl.*

A slender herb with a nearly horizontal rhizome .15" diam. and angled stems about 2 ft. high. Leaves few 6—10" very slender with inflexed margins, back very villose or long-pubescent, less so on upper surface, sheaths villose. Lowest bract of infl. .04" broad, villous like the leaves but usually shorter than inflorescence,

erect, other bracts shorter 2—3. Branches of umbel few, very unequal, 0—2.5" long bearing about 3 spikelets only and secondary bracts, sometimes again branched, sec. and tertiary bracts with acicular pubescent tips. Spikelets brown terete .15—2" long (in fl.). Gl. .09—15" chaffy brown ovate green-keeled in upper half and mucronate, keel 1-nerved shortly sparsely hairy above at least on some glumes. St. 3. Style very flat with close spreading pubescence especially below the stigmas, .08" long, stigmas nearly as long slender but easily breaking. Nut .05" pyriform with a very small foot, white, marked with about 13 longitudinal rows of minute white dots.

Ranchi! Palamau! Elev. 2500 ft. Fl., Fr. May.

In the multi-striate nut this comes close to *podocarpa* of which I should rather consider it a variety than of *diphylla*.

18. *F. dichotoma*, Vahl.

A very small tufted sedge rarely attaining 10" in height, often only 2—3" with flattened striate stems terminated by compound or decomposed umbels of narrowly ovoid spikelets .1—1.5" long elongating after fall of lower glumes to .3". Glumes closely spirally imbricate .05—06" long, boat-shaped with strong keel excurrent into a mucro. Nut .025", biconvex straw-coloured, 5—9-striately ridged on each face and closely beautifully cancellate, base not produced. Style flat villose above, twice length of nut, stigmas somewhat tapering over half as long as style. On fall of style-base the nut has a minute apiculus.

Chiefly in rice-fields, common. Chota Nagpur, Wood (without precise locality)! Manbhum, Camp! Hazaribagh, T. Anders! Midnapur (near Singbhum), Abdul Huk! Banks of Ganges (probably Sant. Parg.), Kurz! Barkuda (Chilka Lake), "on the sandy foreshore," N. & C. Fl., Fr. c.s. and Kurz's specimen in his.

L. often as long as stem usually shorter .03—07" wide, superficial cells very distinct (as in most of preceding). Umbels 1—4" diam. with 1—2 bracts nearly as long. Glumes with the prominent keels green 1—3-nerved. In some specimens the top of stem and lowest glumes are minutely pubescent.

19. *F. ferruginea*, Vahl. Syn. *F. trispicata*, Steud.

Stems 8—30" caespitose rather stout. Leaves very short or hardly any, sometimes 4—6" with the taller stems, glabrous or hairy. Umbel usually of few (5—10) spikelets, sometimes reduced to 1 or 3, sometimes compound with 20 spikelets. Bracts shorter than umbel. Spikelets ovoid .2—4". Glumes .12" ovate or broadly ovate and somewhat keeled upwards, nearly flat, apiculate, brown, with hoary upper half, due to a minute pubescence. Nut white or pale yellow .06" orbicular-obovoid, minutely stipitate and apiculate, not at all ridged as in *diphylla* but very closely microscopically multi-striate with dots. Style longer than nut flat, hairy below the stigmas.

Throughout India, Clarke. Bengal, Masters (without locality)! Common about Calcutta, Cal. Herb! Probably therefore in Orissa. Fl., Fr. May—Oct.

20. *F. spathacea*, Roth.

A tufted very rigid plant 4—12" high with stems swollen below and very numerous short leaves .7—5" long by .06" wide. Spikelets often congested (but distinct, not usually clustered) .1—1.5" long before fall of glumes, in compound umbels .5—1" long. Glumes .06" brown with white or hyaline rounded tips and upper margins, keeled, mucous often notched. Nut dull black obovoid with minute styler scar but not apiculate, smooth or somewhat tubercled.

Puri, *Atkinson!* Chilka Lake, *Hooper!* Fl., Fr. May—Aug.

L. with incurved margins, obtuse, only .7—1.5" in the Puri plant. Umbel (*vide Clarke*) 2" diam. in well-developed examples, in less developed examples the spkts. are nearly or quite clustered, sometimes virtually in a single head. Bracts short .4" rigid, with rather scabrid keel, partial bracts shorter, cuspidate. Stamens usually 2. Style somewhat shorter than nut, often glabrous.

21. *F. argentea*, *Vahl.*

A small caespitose species with the habit of *squarrosa*, with many filiform leaves usually shorter than the stem, glabrous except for a few small points along the margin, surface cells prominent, back striate. Spikelets pale brown clustered in single heads, .2" long before fall of the lower glumes then elongating to .4", rachilla after fall clothed with small cups from the height of the margins of the scars which are apparently the bases of the fallen glumes. Glumes lanceolate to ovate .05—.06" acute, with prominent 3-nerved keel. Nut pale .02" obovoid smooth or with faint transverse wavy lines slightly margined, stylar scar rather large.

Western Bengal and Bihar, *Kurz!* This is the only record but there are specimens from Central India, the Peninsula and Lower Bengal so that it is probably distributed through our area. *Kurz* says "in dried up rice-fields, frequent." Fl., Fr. Dec.—Jan.

22. *F. Hookeriana*, *Boeck.*

A tufted annual 4—10" high with compressed stems and narrow flat leaves often as long as the stem. Of very different appearance from any of the preceding from the narrowly linear acute spikelets .4—.6" long clustered and solitary on the erecto-patent branches of umbels often 4—6" diam. Spikelets 4—6 in a cluster, .1" or less broad. Median glumes about .15" long, narrowly lanceolate very acute, rusty green, keeled, brown scarious on the sides. Stigmas 2. Nut .03" long obovoid biconvex obtuse or truncate, very shortly stipitate, light brown, slenderly longitudinally 12—15-striate on each face from the regularly superimposed transversely oblong outer cells, and shoulders of nut subtuberculate by small scales or papillæ.

Ranchi, 2000 ft. *Clarke!* Fl., Fr. Nov.

23. *F. sericea*, *Br.*

A very distinct species in its thick elongated rhizomes .3" diam. with the closely imbricating brown leaf-bases and beautifully silvery-silky closely imbricating leaves .5—2" long, .1—.14" wide. Sheaths at base of stem silky. Stems 3—6". Spikelets .2—.3" long capitate 2—6 in a cluster and clusters mostly umbelled with short silky-hairy acuminate bracts. Glumes .08—.14" long, keeled, mucronate silky. Nut obovoid smooth pale biconvex.

Puri, *Atkinson!* Margins of freshwater lakes. Fl., Fr. Jan.—May.

9. BULBOSTYLIS, *Kunth.*

Annuals with fibrous roots and slender stems leafy only near the base. Leaves very narrow and sheaths generally finely hairy. Spikelets

congested or umbelled, rarely umbel reduced to one spkt. Glumes imbricate on all sides 2—1 lowest empty, many succeeding 2-sexual, uppermost tabescent. Bristles 0. Stamens 3—1, usually 2. Style as long as nut, linear, glabrous, with very small bulbiform base and leaving a minute button on the nut after falling; stigmas 3. Nut obovoid obtuse 3-gonous, smooth, scarcely stipitate.

The button on the nut is ultimately deciduous and is sometimes so small as to be scarcely distinguishable from the apiculus in some *Fimbristylis*. The usually finely hairy sheaths and 3 stigmas then usually serve to distinguish the genus from *Fimbristylis*.

- | | |
|--|----------------------------|
| I. Spikelets in dense terminal (or pseudo-lateral) clusters:— | |
| Very slender. Leaf-sheaths only hairy. Hds. not harsh | 1. <i> barbata</i> . |
| Rigid with curled leaves, mostly pubescent all over. Hds. almost prickly | 2. <i> subspinescens</i> . |
| II. Spikelets discrete, umbelled or rarely umbels reduced to a single spikelet. Leaf-sheaths hairy | 3. <i> capillaris</i> . |

1. **B. barbata**, *Kunth*. Syn. *Scirpus barbatus*, *Rottb.*

A tufted small grass-like herb 1—10" high with very slender striate stems and capillary leaves as long as or shorter than the stems, sheaths very slenderly pilose especially in the throat. Spikelets linear, angled, .07—27" long in dense clusters at the top of the stem, sometimes appearing lateral from the longest bract being erect and about twice as long as the head. Glumes .07" long, cymbiform, keel of lower glumes excurrent as a very short awnlet, sides rusty-brown or dotted, keel and margins sometimes very minutely hirtellous. Nut obpyramidal or obovoid, .025" long, pale brown or yellow with the small bulbiform apiculus not larger than the foot, most minutely transversely striate or punctulate.

Common. Puneah, *Cal. Herb.*! Monghyr Hills, *Kurz*! Sant. Parg., *Gamble*! Ranchi (on Ichadagh, 3000 ft.)! Manbhurn, *Camp.*! Singbhum! Puri, *Walsh*! Barkuda (Chilka Lake), *N. & C. Fl.*, Fr. July—Dec.

Scarcely distinguishable from some *Fimbristylis*, which have the button on the nut nearly as large. Leaves usually 2—4" only. *Clarke* says "glumes scarcely acute," but all our specimens show some at least of the glumes with excurrent keel. Gl. triangular-ovate when unfolded. Rhachilla zigzag or spiral, narrowly winged between the angles. St. 3—1.

2. **B. subspinescens**, *Clarke*.

Cæspitose, closely pubescent all over or stems glabrate, 1—4" high often curved. Leaves about $\frac{1}{3}$ to $\frac{1}{2}$ length of stem, numerous, curved acicular, striate, pubescent with very broad striate sheath. Spikelets .15—25" long in a dense almost prickly terminal head about 3" diam., pointed bracts about as long. Glumes .12—14" long with brown (when dry) somewhat rounded keel scarcely excurrent and scarious sides, finely pubescent. St. 1 (—3?). Style slender about .05", stigmas nearly as long. Nut pale brown (*Clarke*; I have only seen unripe ones).

Sands on the Puri coast, *Clarke*, *Athinson*, *Walsh*, etc.!

3. **B. capillaris**, *Kunth*.

A very slender tufted sedge 3—10" high with capillary leaves $\frac{1}{2}$ to $\frac{3}{4}$ as long as the striate stems. Sheaths with very slender hairs, at

least in their throats. Spikelets '1—'25" long, solitary or umbelled or umbels compound, rays rarely more than '7" long, bracts almost glumaceous awned or with filiform tips, rarely '2" long. Glumes '07" long broadly ovate cymbiform with acute keel scarcely or not excurrent or lower sometimes with a minute awnlet; keel 3-nerved, sides nerveless. Nutlet '025" long and nearly as broad, obovoid triquetrous slate-coloured when ripe, very closely minutely dotted (pale transversely undulate, *Clarke*. Probably unripe. The dots are sometimes in somewhat undulating transverse lines), surface shining between the dots.

Western Bengal and Behar, *Kurz*! *Parasnath, Cal. Herb.*! Fl., Fr. Sept.

10. SCIRPUS, L. (in part).

Small or large sedges, all glabrous, or inflorescence slightly hairy. Spikelets 1—many in a simple or compound inflorescence, usually many-flowered with all the glumes spirally imbricated, rarely lower subdistichous, 1—2 lowest glumes empty, uppermost tabescent. Bristles present or absent (sometimes broad in *littoralis* and *isolepis*). Stamens 1—3, anterior. Anthers linear or linear-oblong. Style with a linear or conic base continuous with the nut, not enlarged over a bulbous swelling (as in *Eleocharis*, *Fimbristylis* and *Bulbostylis*). Stigmas 2 or 3. Nut plano-convex, biconvex or trigonous, sessile or nearly so, sometimes apiculate.

I. Spkts. 1—many, sessile in simple clusters (1—2 rays sometimes added in *supinus*):—

A. Small herbs with small spkts. under '25". Gl. '02—'1" long. Bristles 0:—

1. Style very short:—

Spkt. 1 only '07—'15" long. Gl. not awned. Stig. 2

Spkts. 1—few, '1—'2" Gl. long-awned. Stigmas 3

2. Style long. Spkts. several. Gl. mucronate. Stig. 3

B. Spkts. over '25". Glumes over '1" long:—

1. Bristles 0. Stem terete. Heads near base:—

Stems septate when dry. Spkts. '3—'5"

2. Bristles 3—6. Stems 3-quetrous:—

Heads lateral. L. very small or 0. Spkts. '25—'5"

Hds. terminal. L. long. Spkts. '3—'8"

II. Spikelets many stalked or umbelled. Robust sedges. Bristles usually present:—

A. Umbels often sub-capitate or simple, never decomposed:—

Gl. '25". Bristles 6—3 scabrid

Gl. '15". Bristles plumose or long-pubescent

B. Very robust, with decomposed umbels 5—8" broad. Gl.

'12—'14". Bristles smooth or scabrid

1. *isolepis*.

2. *squarrosus*.

3. *supinus*.

4. *articulatus*.

5. *mucronatus*.

6. *maritimus*, var.

6. *maritimus*.

7. *littoralis*.

8. *grossus*.

1. *S. isolepis*, Boeck. Syn. *Hemicarpha isolepis*, Nees.

A very small tufted annual with setaceous stems '5—'4" high only, bearing a single spikelet '07—'15" long below the top, almost at right angles to the stem (and short erect bract). Leaves 1—2, '25—'1" long, filiform. Glumes minute '02—'03" obovate rhomboid obtuse, minutely mucronulate with the excurrent keel. Bristles 0 but a thin hyaline obovate irregular scale (rarely 2), as long as the nut, is sometimes obliquely laterally placed between the nut and glume (*Clarke* in

F.B.I.) St. 1, lateral. Nut a little shorter than the glume, biconvex, narrowly obovoid, beautifully white reticulate with the areoles black. Style less than $\frac{1}{4}$ nut, stigmas short recurved. Bristles 0.

Ranchi, *Clarke!* Plains of Bihar, *J.D.H.!* Monghyr! Fl., Fr. Nov.

2. *S. squarrosus*, L.

A small sedge 1.5—10" high. Leaves 1—2 short, on the inflated many-nerved sheaths. Spikelets densely softly bristly from the tails of the glumes, usually 1—4 (up to 10, *Clarke*), clustered almost at right angles on the stem, 1—2" long or elongating to 4" after fall of lower glumes. Bracts 3—2" long, erect (when the spikelets appear lateral) or not, a second shorter bract often present. Glumes oblong square shouldered then suddenly contracted to an awn or tail longer than the blade, .03" long without the tail which is slightly recurved. Bristles 0. St. 2—1, very short. Style minute with 3 recurved stigmas. Nut .02", narrowly obovoid, trigonous, brown to black, very minutely black punctulate much as in the last.

Monghyr, *Ham.!* Singbhum sands of the Karo River! Hazaribagh, *Clarke!* Manbhum (Barakar), *Clarke!* Fl., Fr. Sept.—Jan.

3. *S. supinus*, L.

A leafless or nearly leafless sedge 2—18" high (usually 4—8") with slender terete stems sheathed at the base and terete brownish spikelets 1.2—2" long in lateral clusters, occasionally with a stalked cluster (ray) added. Glumes .08—1" long, cymbiform, keel narrow ending in a minute usually black or dark coloured acute mucro, lateral nerves 0. Bristles 0. Nut .04—0.45" long, more or less 3-sided but one face usually broader than the other two and the angle between the two smaller faces sometimes rounded, faces transversely undulate-lineolate, apex minutely apiculate.

Rice-fields and rivulets. Ranchi, *Gamble!* Singbhum, common! Hazaribagh, common! Probably in all districts.

Short leaves, usually under 1" are sometimes present. Head of spikelets sometimes placed about the middle of the stem (some botanists treat the stem above the head as the lowest *bract*) but usually higher. Spkts. usually 15—20-fl. Gl. with linear green keel and brown-scarious sides. St. 3. Stigmas 3.

Var. *uninodis*, *Clarke*. The heads are sub-umbellate, i.e. having 1—3 rays rarely 1" long in addition to the sessile head.

Hazaribagh, *Clarke*.

4. *S. articulatus*, L.

A caespitose sedge with terete fistular (appearing quite flat when dried for the herbarium) stems 1—2 ft. high, septate when dry and then .2—4" diam., spongy, leafless (barren stems may sometimes be taken for leaves). Spikelets brown .2—5" long in a single dense lateral head usually within one to a few inches of the base. Glumes .15—2" long membranous not keeled or only slightly keeled, ovate, acute entire. Nut obovoid 3-quetrous, .07" long, with transverse wavy striæ, top pyramidal.

Marshy ground, sides of tanks. Singbhum! Manbhum, *Clarke!* Also probably Sambalpur (I have collected it in Raipur). Fl., Fr. Dec.—Jan.

Root fibrous. Sheaths short rather loose with very oblique tip but no blade, margins of tip scarious. St. usually 3. Style with the stigmas .1" long. The stem above the spikelets may be a bract as in many other species.

5. *S. mucronatus*, L.

General habit of *S. articulatus* but the stems 3-quetrous or 3-winged and spikelets .25—5" long in a cluster near the top, the stem (or bract) beyond the inflorescence .5—3" long. Bristles 5—6 unequal, retrorsely hispid. Nut obovoid unequally trigonous shining black scarcely transversely wavy.

Monghyr, *Ham.!* Ranchi, elev. 2000 ft. *Clarke!* Singbhum 2000 ft., *Clarke!* Fl., Fr. Oct.—Nov.

Usually with a short rhizome. Glumes .1—2" broadly ovate, keeled and many-nerved slightly mucronate, margins sometimes minutely scabrous. Nut with two smaller faces sometimes giving place to a single curved face, minutely apiculate, .05—06" long.

6. *S. maritimus*, L. var. *affinis*, Roth (sp.).

A robust or slender sedge 1.5—6 ft. high with 3-quetrous leafy stems. Leaves grass-like often as long as stems .15—2" wide (in small specimens, doubtless much wider in taller plants). Spikelets large, .3—8" long, ovoid, in a dense terminal (the basal bract not appearing like a continuation of the stem) cluster of 2—5 supported by a foliaceous bract often 4—10" long. Glumes .25" long, nearly flat with strong excurrent midrib produced into an awn, puberulous, margins membranous, sometimes sub-fimbriate. Bristles 4, as long as nut. Nut .09" long, compressed, sub-convex, smooth most minutely uniformly dotted, finally black. Stigmas 2.

¹Banks of the Ganges, *Kurz.* Fl., Fr. Feb.—April.

²The type which occurs in the United Provinces and extends to E. Bengal may also occur, it has a simple or compound umbel, 6—3 bristles and 3-fid style. *Clarke* says there are intermediate forms.

Rhizome creeping woody with nodes dilated into tubers.

7. *S. littoralis*, Schrad.

A tall rather stout sedge 2—5 ft. high with stems mostly 3-gonous upwards, terete below. Leaves short or 0. Spikelets large, sometimes almost clustered but usually distinct from one another on short pedicels, sometimes inflor. compound with unequal compressed sub-erect rays 1—2" long, lateral, about 1" below the 3-quetrous top of the stem (or bract), with several scarious bracts at the base. Glumes somewhat concave, .15" long, elliptic-oblong, red brown with scarious margins, rounded notched or subentire but midrib excurrent as a short cusp or awn, lateral nerves obscure. Bristles 4—5, .05" long, pubescent or plumose upwards. St. 3—2 longer than the bristles; anther shortly appendaged (red-crested, *Clarke*). Nut obovoid, compressed, apiculate, brown, .06—07" smooth (faintly marked with the minute longitudinally elongated cells under high power).

¹In shallow waters of the Chilka Lake! Fl., Fr. Dec.—Jan.

Rhizome hardly any, sometimes slender stolons are present (*Clarke*). L. 1—2" or sometimes 4" long and green (*Clarke*). The young spikelets are often deep

purple, the old ones light brown, when full grown they are 3—6" long, or more after fall of the lower glumes. Pedicels flattened, scabrous. Edge of glumes often sparsely puberulous. Style about 1" and stigmas longer.

8. *S. grossus*, L. f. Syn. *S. kysoor*, Roxb.; *S. maximus*, Roxb.? Kesor, Kesari, Beng., H.

A very large sedge 4—6 ft. with the roots or stolons frequently bearing black tubers. Stems sharply 3-quetrous or 3-winged. Leaves almost as long as the stem, spongy, up to 1" broad. Involucral bracts 3 foliaceous up to 18" long. Spikelets brown ovoid 15—3" long in large decompound panicles 5—8" long and broad. Glumes brown scarious 12—14" long nearly muticous or with a short cusp or awn up to 05" long (var. *kysoor*) proceeding from the back below the apex, broadly obovate-oblong, concave, midrib below cusp distinct or obscure otherwise nerveless. Bristles usually 6, sometimes fewer, exceeding the nut. Nut 07" long including the marked apiculus, elliptic-obovoid, 3-gonous, brown, without markings.

In tanks, etc., usually in a foot or more of water. Northern Bengal, Kurz! Ranchi! also at Raipur in the C.P. and Bengal and probably in Sambalpur and other districts. Fl., Fr. Sept.—Dec.

Wings of stem, edges of leaves and involucral bracts sometimes minutely scabrous (soft and smooth in my C.P. specimen). L. keeled, somewhat translucent when fresh. Branches of panicle angled, scabrid. Rays, pedicels and glumes sometimes minutely pubescent. Anthers 3, 1" long linear, minutely apiculate. Bristles, I believe, always occur in our plant but they are rather late in development and are small in the flower (possibly Roxburgh's *S. maximus* in a distinct species?), barbs on the bristles not always found. Ovary linear with a very large style base. Style 03—04", stigmas 3, longer than the style.

Used for making coarse matting in Dinajpur (Bengal). The small tubers are eaten.

11. ERIOPHORUM, L. Cotton-grass.

Glabrous or nearly so with leaves only near the base. Spikelets few or many with all glumes spirally imbricate. Bristles 6 divided nearly to the base into numerous capillary segments which become greatly elongated in fruit so that the inflorescence becomes cottony. Stamens 3—1, anterior. Style slender, glabrous, deciduous, stigmas 3. Nut sessile, 3-gonous, smooth, narrowed at the apex.

1. *E. comosum*, Wall.

A tufted wiry sedge with swollen bases to the stems, somewhat resembling "Bhabar grass" in general appearance (with which it has sometimes been confused) the leaves being long and very narrow and often overtopping the stem, edges scabrid, leaf-sheaths not woolly as in the "Bhabar grass," but upper parts like the stems sometimes very thinly pilose. Flowering stems 4—30" slender, tough, bearing compound or decompound irregular umbels of brown narrowly ellipsoid spikelets 2—3" long which are soon overtopped by the cotton-like tufts of the hypogynous "bristles." Nut linear, 3-gonous, beaked, smooth, 1" (Clarke says brown-black, mine are pale).

It extends from Kumaon to Chittagong, but chiefly in low hilly tracts, and Griffith's specimen from Bengal is from cliffs. It probably occurs (and I think I have seen it there but can find no specimen) in the Ramnagar Hills of Champaran. Fl., Fr. Sept.—Nov.

12. FUIRENA, *Rottb.*

Mostly hairy sedges leafy to above the middle or to the top. Leaves grass-like. Spikelets clustered, many-flowered, uppermost glumes tabescent. Glumes spirally imbricate all round, strongly aristate, hairy in upper half. Hypogynous bristles 6, 2-seriate (referred to as sepals and petals respectively) or reduced or 0, sepals bristle-like, petals often with slender claw and broadly expanded top. Stamens 3 or 2. Style long, glabrous, deciduous (above the base), stigmas 3 long. Nut small, 3-quetrous, more or less pedicelled, usually narrowed at top.

Annual. Petals large quadrate with slender claw

1. *glomerata*.

Perennial. Petals oblong-obovate sessile

2. *umbellata*.

1. *F. glomerata*, *Lam.*

An erect tufted sedge usually about 1 ft. high leafy to the top with the stems or leaf-sheaths patently hairy. Leaves 2—5" usually densely hairy. Spikelets greenish subcapitate, heads 1—3 (rarely up to 10) axillary and terminal. Glumes about .06" long (without the awn) orbicular obovate hairy with a green hairy dorsal awn nearly as long as the blade. Petals large quadrate with slender claw, .05" long, persistent. Nut rather shorter than the petals, brown, equally 3-quetrous, elliptic obovoid with a small linear apiculus (style-base).

In rice-fields, common. Bihar, *J.D.H.*! Ranchi, *Gamble*! Singbhum! Manbhum, *Ball*! Giridih (Hazaribagh), *Prain*! Sambalpur! Probably in all districts. Fl., Fr. Oct.—Jan. Annual.

Leaves often .2" broad, linear, acute or tapering from base to apex, sheaths rather inflated. Bracts exactly like the leaves, not much overlapping the clusters. Spikelets .25—3" before the fall of the glumes, ultimately often .45" with rather stout rhachilla marked with regular areoles with acute edges. Glumes with 3 distinct nerves converging to the awn. Petals often apiculate, blade longer than claw.

2. *F. umbellata*, *Rottb.*

Very similar to *F. glomerata* in general appearance, but it has a long creeping rhizome, usually more compound umbels and is particularly distinguished by the shape of the "bristles" or petals which are oblong-obovate sub-sessile, 3-nerved, truncate or very obtuse at the top and sometimes with a fine apiculus or mucro.

There are no specimens from our area, but as it occurs in the Sikkim Tarai, Central Provinces, Madras and Eastern Bengal, it most probably occurs. *Clarke* says "throughout India except the drier North-west." Fl., Fr. Sept.—Dec.

13. LIPOCARPHA, *Br.*

Glabrous sedges leafy only near the base, bearing a single head of few (usually 1—6) spikelets with very many 2-sexual flowers. Glumes imbricate on all sides. Perianth or bristles represented by 2 hyaline elliptic median scales (apparently connate bristles). Stamens 3—1, anterior, with small linear-oblong mucicous anthers. Style small, glabrous, stigmas 2 or 3, scarcely exsert. Nut small oblong ovoid or obovoid, plano-convex or 3-gonous, smooth, minutely punctulate, closely invested by the hyaline scales.

Scales much longer than the nut. Style $\frac{1}{2}$ — $\frac{3}{4}$ nut .
Scales about as long as the nut. Style under $\frac{1}{2}$ nut

1. *argentea*.
2. *sphacelata*.

1. *L. argentea*, Br.

Rhizome hardly any. Stems usually 10—20" obscurely 3-gonous. Heads of 1—8 pale shining, or sometimes fuscous, broadly ovoid spikelets .15—.25" long supported by a usually spreading or reflexed bract 1.5—3" long and a shorter one. Glumes .1" long, .05" broad above, spatulate-oblong with triangular tip, nearly flat, keel sometimes slightly excurrent, sides hyaline with about 2 delicate nerves and brown marks. Scales narrowly lanceolate .08" long entirely enclosing the nut, separable into longitudinal shreds. Nut .04—.05" long, brown, narrowly oblong obovate-oblong, plano-convex or 2-convex, very minutely closely dotted.

Frequent along stagnant waters in the Sikkim Tarai, Kurz! Hazaribagh, Clarke! Barkuda (Chilka Lake), at the side of a footpath, N. & C. Fl., Fr. Oct.

The leaves are usually shorter than the stem, about .08—1" broad, apparently somewhat concave, many-striate.

2. *L. sphacelata*, Kunth.

Habit and height of *L. argentea*. Spikelets 1—8, dark purple or purple-spotted, rarely pale, ovoid, .15—.2" (before fall of the glumes) attaining .4". Glumes .07" long, .04" wide at the top, cuneate-obovate (shape much as in last) with broadly triangular suddenly acute tip, about 2-nerved each side of slender midrib. Scales .06", oblong, acute, hyaline, 6-nerved (or striate, perhaps the boundaries of the individual bristles). Nut brown, .05—.06", i.e. nearly as long as the scales. Style very short (only about reaching the top of scale).

Western Bengal and Behar, Kurz! Hazaribagh, Anders., etc. Manbhum, Clarke! Fl., Fr. Oct.—Dec.

After fall of the lower glumes the stout rachilla (as in the last) is closely covered with trapezoidal areoles with a depressed button-shaped scar inside each.

14. RHYNCHOSPORA, Vahl.

Habit rather various. Leaves long, narrow. Spikelets often clustered in heads or panicles. Glumes usually 7—8, lower more or less distichous, 3 lowest or sometimes more empty, next one or sometimes 2 usually longer containing a perfect nut-bearing flower, uppermost male or sterile thinner in texture and rounder on the back than the perfect. Bristles present or not. Stamens 3—1, anterior. Style long linear glabrous, stigmas 2, style base dilated. Nut oblong or ovoid, compressed, beaked by the persistent style-base.

I. Spikelets in a single terminal head

1. *Wallichiana*.

II. Spikelets paniced:—

Spikelets discrete in paniced corymbs, .2—3" long

2. *aurea*.

Spikelets .15—.2" long mostly in clusters, clusters loosely corymbed

3. *Hookeri*.

1. *R. Wallichiana*, Kunth.

Tufted with stems 4—24" trigonous, striate. Leaves several, about half as long as stem, minutely scabrous, sometimes hairy. Spikelets

20—50 in the head which is .5—.7" diam. with 3—8 bracts 1—3" long. Glumes 6—7, 3—4 lowest empty, ovate, next one longer with a perfect flower. Bristles 6—4 or rudimentary or 0. Nut obovoid minutely scabrous on shoulders, with narrow conic beak one-fourth to one-third the length of nut. Stigmas short.

Throughout India, common, *Clarke*. Sikkim Tarai, *Clarke!* and also Central Provinces! but no specimens actually from within our area. Fl., Fr. Oct.

2. *R. aurea*, *Vahl*.

A stout herb 2—3 ft. high, smooth or scabrous upwards with leaves 1—2 ft. long by .5—1" broad, the whole length of stem. Spikelets numerous brown lanceolar acuminate .2—.3" long in several (3—5) corymbs on a panicle often 1 foot long. Glumes about 7, lowest 3—4 ovate smaller, next one with perfect flower. Bristles 6, as long as nut, sometimes unequal or deficient. Nut obovoid truncate with beak as long. Stigmas 2 short.

North Bengal, *Kurz* (possibly *Purneah!*) Common throughout India, *Clarke*.

3. *R. Hookeri*, *Boeckl*.

Less robust than *aurea* and with a very lax inflorescence of distant clusters of ovoid acuminate spikelets .15—.2" long, clusters with 1—5 spikelets. Nut obovoid chestnut-coloured, smooth, suddenly narrowed into a very small cylindrical neck, beak linear as long as the nut greenish straw coloured (in *R. aurea* the beak is nearly as broad as the nut at base).

Nathpur, *Ham!* (There are two Nathpurs, one in Bhagalpur, the other in Dinajpur to the east of *Purneah*, the one within, the other close to our area.) Fl., Fr. Aug.—Sept.

15. SCLERIA, *Berg*.

Annual or with rhizomes. Stems leafy 3-sided. Leaves grass-like, 3-nerved often with cutting scabrid edges, base sheathing. Spikelets in an elongate compound panicle with the partial panicles in the axils of leaves which become bractiform upwards, panicle sometimes narrow or reduced nearly to a spike. Flowers all unisexual, male and female in the same spikelet or more usually in distinct spikelets in the same cluster or branch. Bisexual spikelet with one female flower below and a few males above, female spikelet similar but upper male portion reduced to a small rudiment or 0 (when the female fl. appears terminal). Glumes several, 2—4 empty in the female spkt. below the fruit-bearing "female glume"; fem. glume amplexicaul but margins not united round the pistil, male spikelets with 2—3 empty glumes at base and often several anther-bearing, stamens 3—1, anthers linear often mucronate. Nut bony and usually shining, style linear, deciduous, stigmas 3 long. There is usually a short gynophore under the nut dilated into a saucer or disc which is often 3-lobed.

The *Sclerias* are usually easily recognisable from the inflorescence and large ellipsoid or sub-globose white nuts, but the inflorescence of the *cruciata-plebeja* group of *Carex* is very similar to the *elata* group of *Scleria*.

The following series advance in general from the more slender with simple spicate inflorescences to the more robust with compound inflorescences and pyramidal partial panicles.

- I. Bi-sexual spikelets many, with sometimes a male spkt. close beneath:—
- A. Inflorescence a simple spike with spkts. in distant clusters. Nut verrucose. Annual 1. *pergracilis*.
- B. Inflor. with a few simple branches. Perennial:—
Nut smooth 2. *lithosperma*.
Nut transversely wrinkled var. *Roxburghii*.
- II. Bi-sexual spikelets 0 or few:—
- A. Annuals with fibrous roots:—
Panicle branches mostly simple. Disc 3-lobed. Nut with close much raised reticulations 3. *tessellata*.
Partial panicles dense, compound. Disc truncate. Nut quite smooth 4. *annularis*.
- B. Perennials with horizontal nodose rhizomes and pyramidal partial inflorescences. Leaves mostly caudate-setaceous:—
Stems 2—3 ft. Disc-lobes lanceolate thin brown 5. *hebecarpa*.
Stems up to 4—5 ft. by 3". Disc-lobes short obtuse 6. *elata*.

1. *S. pergracilis*, Kunth.

A very slender sedge 10—20" high with the inflorescence unbranched, consisting of clusters of spikelets in an interrupted very narrow spike 2—6" long, clusters 3—7" apart, their bracts 2" or less long. Bisexual spikelets many, terminal, 16" long, with sometimes a male spkt. beneath. Fem. glume cymbiform, ovate-lanceolate, .08" long, mucronate. Nut white, subglobose-ovoid above the short 3-quetrous gynophore, verrucose, obtusely 3-gonous, .04" diam.

Western Bengal and Behar, *Kurz!* Hazaribagh, *Kurz!* Hazaribagh, *Anders.* (but *Clarke* says doubtfully collected there)!

Lower sheaths often a little pubescent. L. 4—10" long up to .12" wide. Clusters usually of 2—5 spkts. M. glumes above the female brownish, not keeled.

Trimen says that the leaves are lemon-scented and used to drive away mosquitoes.

2. *S. lithosperma*, Sw.

Usually slender 1.5—3 ft. high, the inflorescence with few slender distant simple branches or in robust specimens sometimes again branched but sec. branches weak. Spikelets in small clusters on the branches and near the end of the main axis, many 2-sexual, lower bracts often long and setaceous. Fem. glume .15" long, ovate cymbiform, cuspidate. Nut .1" long, .08" diam. very broadly ellipsoid, trigonous with trigonous gynophore, perfectly smooth and white in the type. In var. *Roxburghii*, *Thwaites*, the nut is rather larger with pyramidal subacute apex, transversely wrinkled and with minute ferruginous glands.

Santal Parg., *Wall!* Chota Nagpur. Hazaribagh, *Clarke!* Singbhum, *Clarke!* Western Bengal and Behar, *Kurz!* the variety on Parasnath! Fl., Fr. Oct.

Rhizome elongate, horizontal, woody. Stems not tufted. Leaf-sheaths usually hairy. L. 6—12" long, up to .2" wide. Panicle reaching 1 ft. in large specimens, thin and straggling.

In var. *Roxburghii*, *Thwaites*, the partial panicles are said to be much more rigid and subpyramidal and the clusters of spikelets more numerous and dense. The Parasnath specimen, however, is very thin with secondary panicles simple spicate.

3. *S. tessellata*, Willd.

Stems 1—2 ft. high, rather slender, hairy or glabrate. L. linear acuminate but not setaceous at tip 4—10" long by .1—2", margins scabrid. Panicle narrow, glabrous, main branches remote in the axils of leaves or leaf-like bracts only 1—2" long on peduncles 0—4" long. Spikelets clustered in the axils of rigidly acuminate keeled bracts averaging about .5" long with margins and keel scabrid. Bisexual spkts. few or 0. Fem. spkts. ferruginous green .18" long, glabrous, in same clusters as male spkts. Nut broadly ellipsoid-ovoid, .1" long, .09" diam., white, with close much raised reticulations especially when unripe, at last often nearly smooth, seated on a 3-lobed disc with lobes triangular or lanceolate.

Western Bengal and Behar, *Kurz!*

Rhizome hardly any, roots fibrous. L. with white hairs or glabrate (*Clarke*, all glabrous in our specimens), sheaths conspicuously winged or not. Fem. glume broadly ovate-cymbiform cuspidate. Anthers with a large apiculus.

4. *S. annularis*, Kunth.

Externally very like *S. tessellata*, Willd., with triquetrous stems 1—2 ft. high and 3-winged sheaths scabrid on the angles with reflexed papillæ, and hairy on the margins near the mouth. Spikelets in the partial inflorescences more dense than in *tessellata* but with similar rigid bracts with scabrid keels. Spikelets similar but the female disc with truncate margin instead of lanceolate lobes and the nut perfectly smooth white, broadly oblong or somewhat obovoid.

This which has been found by me in the rocky hills of Bilaspur so like those of the not distant Sambalpur and Palamau, and has also been found by *Griffith* in Bengal, is almost certain to occur in Chota Nagpur or Sambalpur. Fl., Fr. Oct.

Roots fibrous, dark red. *Clarke.*

5. *S. hebecarpa*, Nees.

Stems 2—3 ft. high from a woody horizontal rhizome, 3-quetrous. Sheaths, or some of them, usually distinctly 3-winged, slightly hairy or villous. Leaves 1 ft. long, up to .35" broad, long-acuminate or caudate, more or less hairy on back, margins scabrous. Panicle thin but terminal portion usually pyramidal, branches triquetrous or subulate with long acicular bracts. Fem. glume about .1" long, broadly ovate scarcely keeled, midrib produced into a mucro, disc-margin with lanceolate acute thin brown lobes .04" long. (In the Manbhum specimens named by *Clarke* from our area the disc is thick with truncate margin but the nut has fallen and perhaps the lobes also.) Nut when young minutely velvety, .1—.12" long, subglobose or ellipsoid, obscurely trigonous, narrowed at apex, straw-coloured or brown, "nearly always obscurely reticulated, margins of reticulations microscopically brown-hispid, or finally glabrate almost shining," *Clarke.*

Rajmahal Hills, *Kurz!* Ranchi, *Clarke!* Manbhum, *Clarke!* (The Manbhum specimen is very like *S. annularis*, but is named by *Clarke.*) Fl., Fr. Sept.—Nov.

Var. *pubescens*, *Steud.* (sp.). Leaves often softly villous beneath. Rachis of panicles very hairy. Spkts. sometimes hairy.

Chota Nagpur, Hazaribagh, *Clarke.*

6. *S. elata*, Thw.

A much more robust herb than any of the preceding, often 4—5 ft. high, with stout rhizome (nodose as in *hebecarpa*) and polished stems often 3" wide. Leaves 12—20" long, spreading 3-fariously, 3—6" wide, their sheaths 3-winged. Panicle including the lower axillary partial panicles about 1 ft. long, partial and terminal panicles rigid pyramidal, 2—4" long, rather dense but spikelets scarcely clustered, rachides acutely angled or winged pubescent or scabrid. Spikelets solitary or 2 together in the axils of narrow lanceolate-setaceous bracts usually longer than themselves, branches of the partial panicles in the axils of similar but longer bracts and partial panicles in the axils of foliage leaves below. Fem. fruiting glume very broadly ovate, 14" long, midrib strong excurrent as a mucro, disc-lobes very short sub-orbicular. Nut broadly or globosely ovoid from a broad base, 9—15" long, white, reticulate, reticulations (especially the transverse parts) raised with minute ferruginous hairs, ultimately glabrate, tip smooth glabrous.

Frequent in shady places and in the forests of Chota Nagpur! Mayurbhanj, elev. 3000 ft. Fl., Fr. March—June.

In its young state before the panicle opens it looks, apart from the 3-farious leaves, very like a grass. Stems often straw-coloured with darker nodes. L. deep green with 3 prominent nerves especially the two lateral, tip caudate setaceous, margins scabrid, cutting. Tip of the sheaths (opposite to the blades) rounded with short dense brown hairs (deciduous with age), and this character carried up into the bracts of the inflorescence, especially on the inside of the spikelets, where it becomes more pronounced, is a good recognition mark. Fem. spkt. usually in the same axil as a male, 15—17" long before fruiting (excluding the 3 very long pubescent stigmas), glumes 4, two uppermost sub-equal carinate. Male spikelet smaller on a pedicel above the female, glumes up to 6 or 8, lowest 2 empty, keeled mucronate, lowest 8", others about 12" long, ovate-lanceolate.

16. CAREX, L.

Rhizomatous, nearly smooth, grass-like herbs but stem often 3-quetrous and bearing leaves near the base only (upper leaves, if any, bearing parts of the inflorescence in their axils and being regarded as bracts). Inflorescence of simple, or more usually, paniced spikes which are female in their lower part and male in their upper part, or wholly 1-sexual. Flowers 1-sexual each solitary in the axil of a bract or "glume." Glumes usually numerous and imbricate all round the axis of the spike (these glumes are not considered homologous with the glumes of other Cyperaceæ but are probably bracts subtending a very reduced spikelet).* Female with an upper proper glume wrapping round and concealing the ovary, its margins entirely connate and forming the "utricle" which is more or less bottle-shaped, mouth of its neck or beak often shortly 2-fid. Stigmas 2 or 3 exerted from the neck. Male flower with 2—3 stamens without utricle or perianth. Nut compressed or 3-gonous, included in the utricle.

* Sometimes a slender rudimentary racheola occurs in the perigynium or utricle at the base of the ovary as in the allied genus *Kobresia* in which the utricle is split down one side. Both *Carex* and *Kobresia* are more abundant in temperate regions.

I. Stigmas 3. Nut 3-sided or not flattened:—

A. Spikes all 2-sexual, female flowers below, male above:—

1. Panicle elongate of distant axillary more or less pyramidal panicles with numerous very short spikes:—

a. Glumes .06—12" ferruginous or brownish. Spikes not congested

Utricle ellipsoid strongly ribbed suddenly contracted into a beak $\frac{1}{3}$ — $\frac{2}{3}$ utricle. Gl. much shorter than utricle

Utricle small narrow-ellipsoid or ovoid, definitely nerved glabrous. Beak as long as utricle. Gl. small ovate as long as utricle (without beak)

Utricle narrow-ellipsoid acutely 3-gonous, strongly many-nerved, hairy fuscous-brown, beak scarcely $\frac{1}{2}$ utricle

b. Glumes straw-coloured, spikes congested:—

Fem. gl. .1—12" with distinct aristula. Utricle ellipsoid .15" with beak $\frac{1}{2}$ — $\frac{2}{3}$ body

2. Spikes only 1—5 on the few distant branches of the panicle:—

Spikes ovoid .25—3" long, congested at top of stem

Spikes linear 1—3", all distant

B. Spikes 1-sexual, lower wholly female, terminal $\frac{1}{2}$ —3 male1. *cruciata*.*a. *cruciata*. β . *filicina*. γ . *plebeia*.2. *stramentitia*.3. *rhizomatosa*.4. *speciosa*.5. *Wallichiana*.

II. Stigmas 2. Nut much flattened:—

Lower spikes female drooping. Terminal wholly male

6. *phacota*.1. *C. cruciata*, *Wahl.* Inc. *C. plebeia*, *Clarke*, *C. filicina*, *Nees*.

Stems many 2—3.5 ft. high sub-cæspitose from a stout branched horizontal rhizome which is covered with fibrous sheaths, 3-quetrous, smooth, attaining nearly 1" diam. Leaves many long, often overtopping the stems, upper passing into bracts, .1—2.5" broad, ending in long setaceous scabrid tips, margins more or less scabrid, nerves usually two stronger than others as seen from above, about 5 subequal each side of midrib as seen from below, sheaths glabrous, lowest on stem sometimes without blades lanceolate cuspidate. Panicle about a foot long consisting of a number of axillary more or less pyramidal partial panicles 1.5—2.5" long and terminating in an oblong or pyramidal panicle. Partial panicles with lateral branched spikes below, simple spikes above and terminating in an elongated spike, all spikes short with female glumes below spreading in fruit and a terminal cylindric male portion, ultimate lateral spikes .25—5" long. Peduncle glabrous, rhachis and rhachides of spikes angled pubescent or hispid. Glumes brown ovate to lanceolate concave with strong midrib more or less excurrent as a mucro or awnlet, .06—12" long with the awnlet. Utricle ovate acuminate or turbinate always beaked, the beak from one-quarter to as long as the rest of the utricle, more or less strongly ribbed closely clinging to the 3-quetrous nut, .08—15" long (the difference in length mainly due to the variable beak), brown dotted.

A very common plant on banks and in shady places, probably throughout the province. Fl., Fr. Sept.—Jan.

A large number of species has been made of what I include under this. I briefly indicate their limits as drawn up by *Clarke* for the *F.B.I.*, but they seem to me to pass into one another in all directions and their separation to be quite useless and artificial:

* As explained below, the above varieties are considered species in the *F.B.I.*

α. *cruciata*, *Wahl.* (sp.).

Utricle ellipsoid trigonous strongly ribbed suddenly contracted into a beak one-third to two-thirds the utricle. Glumes much shorter than utricle, ovate, minutely mucronate or not.

Singbhum, *Clarke!* Hazaribagh, *Clarke!* and also apparently specimens collected by myself belong here.

Clarke calls his specimens var. *nagpurensis* and he further describes this variety as having "secondary panicles (my partial panicles) with suberect branches scarcely pyramidal, sometimes very slender, ripe utricle scarcely inflated fuscous-green often with black or red dots in upper half, beak subconic at base $\frac{1}{2}$ — $\frac{2}{3}$ utricle." Utricles from glabrous to intensely scabrous."

The habit of the plants so named is different, one being with very thin (like *plebeia*) and the other with hispid-pubescent dense panicles. Spikes each with an acicular bract as long as itself $\frac{2}{3}$ — $\frac{4}{5}$ " long. Utricle in one specimen grey or hoary. Beak of utricle one-third to one-half as long as the whole length.

β. *filicina*, *Nees* (sp.).

Spikes small, often very many on slender branches, not congested, female glumes not (or scarcely) mucronate, utricle small narrow-ellipsoid or ovoid definitely nerved glabrous, beak linear about as long as utricle.

Parasnath, 3000 ft., *Clarke.*

The actual specimen so named has glumes $\cdot 06$ — $\cdot 07$ " long, mucronate! Utricle twice as long, $\cdot 14$ " including the long beak which is scabrous or hispid and strongly ribbed.

γ. *plebeia*, *Clarke* (sp.).

Leaves narrow, partial panicles pyramidal slender, spikes brown, fcm. gl. ovate acute scarcely mucronate, utricle narrow ellipsoid acutely trigonous strongly many-nerved hairy fuscous-brown, beak scarcely one-fourth length of utricle.

Chota Nagpur, alt. 1500—2000 ft. throughout the province!

A Ranchi specimen named by *Clarke* has glumes $\cdot 05$ — $\cdot 06$ " long with minute *fine aristula*. The lateral spikes are $\cdot 2$ — $\cdot 3$ " long only supported by filiform bracts as long, and in their axils is a remarkable semi-globose ribbed tubercle not commented on by *Clarke* but which also occurs in other specimens of my own as well as in specimens of *cruciata*! Utricle $\cdot 08$ — $\cdot 12$ " sharply beaked and ribbed, often hispid, beak nearly as long as the rest of the utricle or $\cdot 04$ ". In general it seems to me that *plebeia* can be distinguished from *cruciata* var. *nagpurensis* by the much more delicate partial panicles with spreading glumes. *Kükenthal* (in *Pflanzenreich*) reduces *plebeia* to *continua* and includes *condensata* in *cruciata*. He might have gone much further in such reductions.

2. *C. stramentitia*, *Boott.*

Rhizome with fibrous sheaths. Stems and leaves 1—3 ft. Leaves up to $\cdot 5$ — $\cdot 7$ " wide, usually two of the side nerves stronger than the others above. Panicle of several pyramidal partial panicles as in the last, but straw-coloured and spikes congested. Fem. glumes $\cdot 1$ — $\cdot 12$ " long with a very distinct hispid aristula on most, sometimes as long as the blade. Utricle ellipsoid beaked 3-gonous many- (15—20-) nerved or -ribbed, $\cdot 15$ " long with the beak half to two-thirds as long as the rest.

* By utricle *Clarke* apparently means the utricle *without* its beak.

Ramnagar to Sikkim Tarai in the Northern Area, King, etc.! Manbhumi, Campbell! Parasnath, 4000 ft., Clarke! Fl., Fr. April.

This species which is included in the *F.B.I.* between *cruciata* and *plebeia* is very distinct looking. The spikes are very dense. Clarke says "near *indica* but the characteristic setaceous bracteoles are wanting." It has, however, frequently setaceous bracts at the base of the spikes as long as the spikes as in the last species.

3. *C. rhizomatosa*, Steud.

A leafy sedge about 1 ft. high from a stout woody nodose horizontal rootstock which is densely covered with the fibrous bases of old leaf sheaths. Leaves on barren shoots 6—8" flat keeled about 2" broad, glabrous except for the scabrid margins, those on flowering stems 1—2" only. Fl. stems sub-terete with long erect distant flowering solitary or 2-nate branches its whole length, each in the axil of a leaf or bract. Lower branches 2—3" long, upper shorter, bearing at the ends 1—5 short dense ovoid greenish or brown spikes .25—3" long, congested at the top of the stem. Fem. glumes about 4—8 at base of spikes, .1—1.2" long, lanceolate, green with scarious sides and an excurrent awn about one-quarter to one-third as long as the blade. Male glumes above the females .17", stamens 3—6. Utricle in flower ovoid with shortly tapering neck, in fruit 3-gonous broadly ellipsoid scabrous-hairy, fuscous-brown, obscurely 8—15-nerved, with 2-fid beak scarcely half as long as the rest.

Wet ground, most evident after the jungle fires. Pats of Ranchi and Palamau! Fl. May—June.

Lower bracts leaf-like as long as the peduncle, upper rather exceeding it.

4. *C. speciosa*, Kunth.

Stems slender few 8" to 2 ft. high from a woody rhizome covered with fibrous sheaths, often overtopped by the long leaves which are from .12—1.75" wide. Spikes pale few (3—1) and very remote on the stem, linear 1—3" long, lower long- upper usually short-peduncled, female glumes below, male above. Fem. gl. ovate-oblong with triangular very acute tips, .1" long, midrib not very prominent, side nerves many. Utricle .15—1.7", ellipsoid (ovoid pyramidal, Clarke) triquetrous, many-striate, slightly puberulous on the corners, acuminate, scarcely beaked. "Nut oblong-obovoid, two-thirds utricule, black, style short, base scarcely dilated," Clarke.

Rajmahal Hills, Cal. Herb.! Western Bengal and Behar (Parasnath), Kurz! Fl., Fr. Aug.—Sept.

5. *C. Wallichiana*, Prescott.

Erect, variable in height, 6—30", stoloniferous with strongly 3-quetrous stems smooth or scabrous above and covered with split often purple sheaths at the base. Leaves overtopping the stem, flat, .1—2" wide with a rigid filiform tip. Spikes 5—6, lower 2—3 distant female .7—1.5" long by .15—2.2" broad, cylindric dense-flowered, shortly or, finally, long-peduncled. Upper 2—3 spikes male linear .7—1.5" long, close with lanceolate acuminate-aristate glumes pale-fuscous with green 3-costate back. Utricle exceeding the glumes ovoid-ellipsoid, dense-pubescent, turgidly 3-gonous, nerved, .13—1.4" long without the short

abrupt 2-fid beak which is divided nearly to the base into 2 lanceolate prickly teeth. Nut closely included elliptic 3-gonous stipitate. Stigmas 3.

Dumraon (Shahabad), *Ramyad Lal!* Fl., Fr. Feb.—April. It is frequent in the Upper Gangetic Plain and extends to Sikkim.

6. *C. phacota*, Spreng.

Rather a handsome sedge about 2 ft. high with cæspitose 3-quetrous stems from a short woody rhizome and with brown sheaths at their base. Leaves glaucous, often as long as stem or exceeding it and attaining 3 ft., 25—3" wide. Inflorescence consisting of several long drooping female spikes towards the top of the stems 2—3" long in the axils of foliaceous bracts and a terminal erect brownish male spike. Fem. usually 4—5 on slender peduncles 12—25" long, linear-cylindric, 25" diam., glumes oblong with an excurrent green linear 3-nerved centre, hispid above and white often brown-dotted sides, length including the excurrent cusp 12". Utricle much medianly compressed exceeding the glume in length and breadth, ovoid, or ell.-rhomboid, 12—14" long, margined, faces hoary (brown in the herbarium) with close white papillæ, scarcely beaked. Stigmas 2.

In marshy places under shade, 2000 ft. Singbhum! Fl., Fr. March—June (also collected by me in the Central Provinces, both localities being an extension of its distribution over that given in the *F.B.I.*).

The papillæ or glands on the utricule turn red and come off on boiling.

FAM. 139. GRAMINEÆ.

Annual or perennial herbs* (grasses) or suffruticose or with very large woody culms (bamboos). Stems or culms terete, hollow or solid between the transverse septa (knots or nodes), often swollen above the septum externally but inside the sheaths (culm nodes)* and sheath often with an annular swelling at the base which may become shrunk or discoloured with age (sheath nodes)*. Leaves distichous; sheath open or its margins overlapping, more rarely closed to the top; a membranous scarious hard or hairy appendage (ligule) usually at junction within of sheath and blade, sometimes ligule obsolete. Flowers usually 2-sexual but often some 1-sexual and in a few genera diœcious, always much reduced, solitary in the axils of close imbricating sessile green or scarious or coriaceous bracts (glumes).† Glumes distichous and alternate on a minute axis "rhachilla"; each separate system of glumes with the rhachilla is called a "spikelet." Spikelets spicate or racemed or variously paniced. Lower 2 glumes ‡ (rarely only 1 or more than 2)

* The word "node" is usually sufficiently intelligible when referring to hairiness or other character and is then used without qualification.

† The glumes are distinguished by some authors into *glumes*, i.e. the lower empty ones and *florets*, *valves* or *flowering glumes*. The outer involucrel glumes however often more resemble the first flowering than the flowering do one another and the morphology is the same. These same authors call the palca a *valvule*.

‡ The glumes are numbered consecutively from below upwards thus, i, ii, iii, etc., but if there are reasons to believe that any are suppressed the numbering is

normally empty, others usually flowering or at least with a bracteole (palea) normally opposed to the glume (but without any visible internode between) which is nerveless or often 2- rarely more-nerved or -keeled, never awned, sometimes absent or reduced. Empty or rudimentary glumes may also sometimes occur above the flowering. Within the palea and usually embraced by it the 2-sexual flower consists typically of (a) 0—3, usually 2, minute fleshy turgid scales—"lodicules"*—which are probably a rudimentary perianth (*Hackel* however considers them to be bracteoles), they are said to function by their turgescence in forcing open the glume and its palea (and they shrivel up and disappear after the anthers are empty); (b) stamens 1—6, usually 3, with versatile anthers usually emarginate both ends; (c) ovary 1-celled with 2 more or less free styles and plumose stigmas. Ovule anatropous. Embryo often large at the base of the seed but towards one side; plumule with several leaf-rudiments, cotyledon converted into the "scutellum" which remains in the seed to absorb the copious albumen.

In the arrangement of the Gramineæ I have begun with the Bambuseæ which show several primitive characters, the possession of the normal 2 whorls of stamens, the transition from bracts to glumes, etc., and have ended up with the highly modified and evolved Maydeæ.

In many respects I have been largely guided by Stapf in *Fl. Trop. Africa*.

KEY I. TO GROUPS (and the genera of uni-generic tribes).†

- I. Tall stout woody grasses (Bamboos), stems hollow, very rarely sub-solid between the nodes. Stamens 6 (in our spp.). Empty gls. 2—more scarcely differentiated from the basal bracts of spkt. and usually increasing in size to the flowering. Fl. gls. 1—several. Palea usually large. Lodicules often 3. Gen. 1—4
- II. Herbaceous, rarely suffruticose with hollow or solid culms. Empty glumes 2—1 (rarely 0), not passing into basal bracts. Stamens 3—1 (exc. *Oryzæ* 3—6). Lodicules 2 or 0. Gen. 5—end:—
- A. Spkts. not articulate on their pedicels or on the rhachis joints. (Exc. in some *Eragrostæ* and *Agrostæ*, and then spkts. with 3 glumes only and rhachilla articulate or many glumes. See also *Zoysiæ*.) (To p. 984):—
1. Fl. glumes 1—many, all 2-sexual or uppermost imperfect. Rhachilla usually articulate above gls. i and ii and often at base of other glumes, sometimes produced beyond the last glume. Gl. iv rarely crustaceous in fruit (*Cœlachne*). Gen. 5—29
- a. Very large grasses (Reeds). Spkts. pedicelled in large decomposed panicles. Rhachilla jointed. Fl. gls. 3—8, narrow, 3-nerved. Gen. 5—7
1. **Bambuseæ.**
- POACEÆ.
2. **Arundinææ.**

in accordance with their supposed position, e.g. if from comparison with allied species it is believed that gl. i is suppressed the lowest glume is numbered ii and so on.

* Where the number of the lodicules is not given it is assumed to be two. More than 2 are only found in the Bambuseæ.

† Groups ending in *-astræ* are sub-tribes.

(For another large Reed-like grass see *Thy-sanolæna*.)

- b.* Moderate-sized or small grasses. Panicles not decomposed or if so then fl. gls. either broad or only 1--2. Gen. 8--29:—
- i. Spkts. 2--more fld. or if 1-fld. then gls. 5-nerved:—
- † Spkts. not clustered nor spicate or if spicate (few *Eragrostæ*) then gls. many similar broad:—
- Fl. gls. 3--7-nerved or nerveless, gls. i and ii not much shorter than the spkt. Awn geniculate or 0. Gen. 8, 9
3. *Avenæ.*
- Fl. gls. 3-nerved, usually many, awnless, entire or toothed. Gl. i and ii much shorter than the spkt. Gen. 10--12
4. *Eragrostæ.*
- †† Spkts. very minute 3--5-fld. in globose clusters on an elongate simple rhachis and subtended by imperfect spkts. Genus 13. *Elytrophorus.*
- ††† Spkts. large sessile 1--more-nate in the notches of a simple rhachis. Flg. gls. 5--9-nerved. Gen. 14, 15
5. *Hordeæ.*
- ii. Spikelets 1-fld. or if more than 1-fld. then upper fls. imperfect or spkts. in digitate spikes or minute 1--3 fld. and sunk in a simple rhachis (*Oropetium*) or (*Sporobolus*) 1--2-fld. and gl. iii 1-nerved:—
- † Spkts. 1--more-fld. 2-seriate and secund on the spiciform branches of a slender panicle or on a simple spike (clustered in *Gracileæ*). Fl. gls. all or the lower only 2-sexual. Rhachilla produced or not. Gen. 16--24
6. *Chloridæ.*
- †† Spkts. 1-fld. (rarely 2-fld. in *Sporobolus*) paniced. Gl. 3 only (rarely 4 in *Sporobolus* and then rhachilla jointed at base and gl. iv not hardening as in *Panicææ*). (Spkts. jointed on their pedicels in *Garnotia* and *Polypogon* and *Sporobolus*). Gen. 25--29
7. *Agrostæ.*
2. Glumes normally 4 or i and ii obsolete, iii imperfect or male. Flg. glume hardening or not in fruit.
- The following genera 30--32, 36--38 are usually included in the *Panicææ*. They are somewhat intermediate in character between the two groups. In *Perotis* and *Zoysia* the spkts. are jointed on a simple rhachis, but there is only 1 fl. gl.:—
- a.* Spkts. not articulate on the pedicels, but pedicels articulate and upper part or whole falling with the spkts., or in *Perotis* and *Zoysia* spkts. articulate on a simple rhachis
- i. Spkts. spicate, 1-fld. only. Gl. 2--3 only.
- PANICACEÆ.**
8. *Zoysiæ.*

- ii. Spkts. in decomposed panicles with 4 glumes, obscurely jointed on pedicel, but falling with part of pedicel iii empty hardening, iv membranous with stiff hairs. A large Reed-like grass Genus 36. *Thysanolaena*.
- b. Neither spkts. nor pedicels articulate. Gl. 4. Gls. i and ii usually separately deciduous. Gl. iv subcoriaceous or hardening in fruit, articulate at base:—
Spkts. lanceolate or oblong. Gl. iv smallest, lanceolate, subcoriaceous and scaberulous in fruit Genus 37. *Arundinella*.
Spkts. small or minute subglobose or obovoid. Gls. iii and iv similar, usually both fertile, iv hemispheric, coriaceous in fruit, never awned Genus 38. *Isachne*.
- B. Spikelets distinctly articulate on their pedicels and falling from them or from the joints of an articulate rhachis when mature. Glumes normally 4, i and ii rarely suppressed. Gls. iii and iv both flowering or iii empty or palcate, often male. iv always 2-sexual (exc. in *Spinifex* and *Maydax*, q.v.). Cp. p. 982:—
1. Rhachis of inflorescence inarticulate. Flg. gl. well developed, usually coriaceous or chartaceous in fruit. Gl. i and ii sometimes reduced:—
- a. Spkts. 1-fl'd. Gls. i and ii often reduced to a rim or 0. Stamens 6, more rarely 3. Gen. 33—35 9. *Oryzæ*.
- b. Spkts. 2-fl'd., upper fl. 2-sexual, lower male or neuter, rarely both fertile or spkts. dioecious. Gl. iii generally like ii in structure and nervation; iv rarely finely awned (*Alloteropsis* spp.). Stamens 3—1 (genera 36—38 also included in *Panicææ*) **Panicææ**.
- i. Spikelets 2-sexual:—
† Spkts. falling in groups or if singly then subtended by an involucre of bristles (*Cenchastræ*) Genus 39. *Pennisetum*.
†† Spkts. falling singly and entire from the rhachis or persistent pedicels, not awned or if awned then similar and in secund spikes and the awn from the entire tip of gls. ii and iii (*Echinochloa*) or from the tips of i or ii (*Oplismenus*):—
‡ Gl. iv crustaceous in frt. with in-rolled margins embracing the similar palea; palea of iii if developed not attached to the fruit. Gen. 40—50 10. *Panicæstræ*.
‡‡ Gl. IV with usually flat to hyaline margins, in fruit thinly cartilaginous, with the usually minute palea of iii attached to its base. Inflor. of digitate or sub-digitate or somewhat distant spikes. Gen. 51—52 11. *Digitariæstræ*.

ii. Dioecious. Suffruticose. Male spkts. 2-flid. articulate in rigid umbellate spikes. Fem. in large globose heads of stellately spreading quill-like rhachises, one spkt. at the base of each **Genus 53. Spinifex.**

2. Rhachis of spikes usually articulate and spkts. normally in pairs sessile and pedicelled, rarely one of a pair suppressed (*Dimeria*) or both pedicelled, or spkts. in triplets (1 sess. and 2 pedicelled). Spikes simple or variously arranged. Sessile spkts. (exc. sometimes the basal) 2-sexual or female. Gl. i and ii firmer than iii or iv, iv hyaline, often reduced to the hyaline base of an awn. (Ped. spkts. usually fall from their pedicels. Sess. spkts. fall with the collateral joint of the rhachis and its companion pedicel. Rhachis rarely tenacious or fused with pedicel) **. Andropogoneæ.**

a. Joints and ped. not bulbous or adnate with one another, if thick then spikes digitate or in spathaceous panicles. Sess. spkts. usually 1-flid. and awned (2-flid. in some *Ischæmastræ*). Gen. 54-80:—

i. All spkts. alike in shape and sex or if unlike then palea very short:—

† Spikes in compound panicles or racemously arranged on an elongate common axis. Spkts. 1-flid. Gl. iv awnless or awned from the entire tip or from the sinus of a 2-toothed tip. Gen. 54—55

12. *Saccharastræ.*

†† Spikes digitate or solitary, 1-flid. or if 2-flid. then glume i channelled:—

‡ Rhachis inarticulate. Spkts. not paired **Genus 56. Dimeria.**

†† Rhachis articulate:—

Spkts. in solitary terminal capillary spikes, 2-awned **Genus 57. Pogonatherum.**

Spkts. in digitate spikes 1- or 2-awned. Gen. 57—60

13. *Polliniastræ.*

ii. Sess. and pedicelled spkts. dissimilar or if similar (*Pollinidium*) palea well developed and rhachis compressed. Sess. spkt. 2-sexual, ped. male, empty or 0:—

† Fertile spkts. 2-flid.:—

Both spikelets awned. Joints and pedicels often flattened or thickened. Palea well developed

14. *Ischæmastræ.*

Pedicelled spkt. reduced to its pedicel

Genus 64. Apocopsis.

Sessile spkt. awnless. Gl. i 3-toothed. Ped. spkt. awned

Genus 65. Lophopogon.

†† Fertile spkts. 1-flid.:—

‡ Panicles espatheate (spikes not subtended by spathes):—

§ All pairs of spkts. alike, in simple or compound panicles:—

|| Gl. iv awned from low down on back. Spikes digitate

Genus 66. Arthraxon

- ||| Gl. iv awned from the tip or sinus:—
 Gl. iv reduced to the hyaline stipitiform base of the awn. Joints and pedicels filiform with a depressed translucent middle line. Gen. 67, 68 15. *Amphilophiastræ*.
- Gl. iv 2-cleft with awn from the sinus. Joints and pedicels solid (slightly mesially translucent in *Sorghum fascicularis*). Gen. 69—71 16. *Sorghastræ*.
- §§ Lowest pair or pairs of spikelets differing from all those above them, homogamous (male or neuter). Joints and pedicels solid:—
 Spikes digitate, rarely solitary. Sess. spkts. dorsally compressed. Gl. iv a naked awn acute at the base 72. *Dicanthium*.
- Spikes solitary. Sess. spkt. subcylindric. iv a long very stout awn and often a hyaline base. Callus of sess. spkt. pungent 73. *Heteropogon*.
- ‡‡ Panicles spatheate. Spikes usually 2—1 (rarely more) on a common peduncle which is closely sheathed by a spathaceous leaf-sheath (spatheole), from which it is usually only shortly exerted (peduncle elongate in *Andropogon apricus*):—
 § Spikes not reduced to a central few-noded portion surrounded by an involucre of male or neuter spkts.:—
 || All pairs of spikelets similar to one another:—
 * Spikes solitary in each spatheole:—
 Joints and pedicels slender 74. *Hypogynium*.
 Joints and pedicels bucciniform. Gen. 75, 76 17. *Schizachyriastræ*.
 ** Spikes geminate in the spatheole 77. *Andropogon*.*
- ||| Lowest pair of spkts. on one or both of the geminate spikes homogamous. Lowest joint often much thickened. Panicles decomposed. Often aromatic grasses 78. *Cymbopogon*
- §§ Spikes reduced to a central few-noded portion surrounded by an involucre of modified, male or neuter, spkts. Gen. 79, 80 18. *Themedastræ*.
- b. Spike reduced to three spikelets with a bulbous base on a slender peduncle in spathaceous panicles 81. *Apluda*.

* *Andropogon* and *Cymbopogon* both belong to the *Andropogonastræ* and are very closely allied. Indeed some *Cymbopogon* have none of the sessile and pedicelled spikelets similar nor strictly homogamous. The habit is however different.

- c. Spikes many-noded. Joints and pedicels or at least the joints much swollen and often forming a cylindrical axis in which glume i is sunk in a depression formed by the inter-node and pedicel of the ped. spkt. Pedicelled spikelets sometimes entirely suppressed. Gen. 82—86
3. Male and female spikelets in different inflorescences on the same plant or occupying different parts of the same inflorescence; females below, often solitary with or without a rudimentary ped. spkt., 1-fl. Males in pairs, one sessile the other pedicelled at the top of the inflorescence. Female lower glume or bracteole often becoming hard or bony. Gen. 87—90
19. *Rottboelliastræ*.
20. *Maydæ*.

KEY II. TO GENERA IN THE GROUPS.

- Group 1. *Bambusæ*. Bamboos.
- A. Pericarp fleshy or crustaceous free from the seed:—
Spkts. 1-fl., bracteate. Fruit beaked 1. *Cephalostachyum*.
Spkts. 2—many-fl., 1 only usually fertile. Ovary hirsute at the tip 2. *Dendrocalamus*.
- B. Pericarp thin, adnate to the seed:—
Filaments free. Spkts. 1—many-fl. Palea 2-keeled 3. *Bambusa*.
Fil. connate. Spkts. few-fl. Palea 0 or not keeled 4. *Oxytenanthera*.
- Group 2. *Arundinæ*. Reeds.
- A. Spkts. 3—7-fl. Rhachilla with very long hairs. Gl. glabrous 5. *Phragmites*.
- B. Rhachilla with short hairs below the flg. gls. or glabrous. Flg. gls. toothed and awned:—
Gls. i and ii 1-nerved. Flg. gls. marginally hairy 6. *Triraphis*.
Gls. i and ii 3-nerved. Flg. gls. dorsally hairy 7. *Arundo*.
- Group 3. *Avenæ*.
Spkts. 2—more-fl., awned 8. *Avena*.
Spkts. 2-fl., awnless. Gl. membranous 9. *Cælachne*.
- Group 4. *Eragrostæ*.
A. Flg. gls. entire:—
Spkts. panicled or 2-seriatim spicate, not jointed on rhachis 10. *Eragrostis*.
Spkts. sessile and jointed on the short crowded branchlets of a tall narrow racemiform panicle 11. *Desmostachya*.
B. Fl. gls. 3—4-toothed 12. *Diplachne*.
- Group 5. *Hordææ*. Wheat and Barley.
Spkts. solitary at the nodes. Fl. gls. few, 5—9-nerved 14. *Triticum*.
Spkts. clustered at the nodes. Spkts. 1-fl. Fl. gl. 5-nerved 15. *Hordeum*.
- Group 6. *Chloridææ*. Marua, Dub-grass, etc.
A. Spike solitary, terminal:—
1. Spkts. minute, more or less sunk in the rhachis, 1—3-fl. Gl. i minute or 0. iii hyaline 16. *Oropetium*.
2. Spikelets not sunk in the rhachis:—
a. Spikelets awnless, minute, unilateral on flattened rhachis, 1-fl. 17. *Microchloa*.
b. Spikelets awned:—
Spkts. 1—2-fl. in pedicelled articulate clusters 18. *Gracilea*.
Spkts. many-fl. Fl. gls. 3-awned 19. *Tripsogon*.

- B. Spikes digitate, spicate or racemed (rarely only 1 in *Chloris*):—
1. Spkts. awnless, 1-flid. Spikes digitate
 2. Spkts. awned (*exc. Leptochloa*):—
 - a. Spkts. 2-nate secund on geminate, fascicled digitate or whorled terminal erect or radiating spikes:—

Glumes 3, iii flg. and one or more reduced differently shaped neuters (sometimes reduced to awns)

Spkts. 3—12-flid.
 - b. Spkts. in racemosely arranged spreading or deflexed finally deciduous spikes. Fl. gls. thin, obtuse or emarginate shorter than the empty glumes
 - c. Spikes paniced, filiform. Spkts. very minute, alt. 1—more-flid., awnless
20. *Cynodon*.
21. *Chloris*.
22. *Eleusine*.
23. *Dinebra*.
24. *Leptochloa*.
- Group 7. Agrostes.**
- I. Glumes thin or membranous:—
 - A. Spikelets persistent on their pedicels (with gls. i and ii):—

Gl. iii 5-nerved. Spkt. 1-flid.
 - B. Spikelets jointed on their pedicels (jointed but not falling in *Polypogon*):—
 1. Spkts. awnless. Gl. iii 1-nerved
 2. Spikelets awned:—

Spkts. 1—2-nate, not laterally compressed, paniced

Spkts. laterally compressed, keeled, crowded on the short branches of a spiciform panicle. Gl. iii hyaline
 - II. Fl. glume rigid or hard, usually awned, tightly wrapping round the fruit. Awn sometimes 3-branched
25. *Agrostis*.
26. *Sporobolus*.
27. *Garnotia*.
28. *Polypogon*.
29. *Aristida*.
- Group 8. Zoysies.**
- A. Gls. 3, narrowly linear, 1-nerved, awned. Spkts. articulate on rhachis
 - B. Glumes 2 only. Spkts. articulate on the rhachis or not:—

Glumes both thickly coriaceous, 5-ribbed and spinous

Gl. i coriaceous, shining nerveless, ii membranous
30. *Perotis*.
31. *Tragus*.
32. *Zoysia*.
- Group 9. Oryzes. Rice, etc.**
- A. Gls. i and ii minute or setaceous, iii chartaceous, strongly 3—5-nerved
 - B. Glumes i and ii absent:—

Gls. iii and iv broad thin. Awnless

Gls. iii and iv narrow thin. Awned
33. *Oryza*.
34. *Leersia*.
35. *Hygrophiza*.
- Group 10. Panicstræ.**
- I. Inflorescence an open, contracted cylindric or spiciform panicle:—
 - A. Spikelets, or at least the upper on each branchlet subtended by 1—more bristles
 - B. Spikelets not subtended by bristles:—
 1. Spkts. usually somewhat gibbous, in spiciform panicles, the branches of which are more or less adnate to the axis (so that the pedicels appear to spring more or less directly from the axis)
40. *Setaria*.
41. *Sacciolepis*.

2. Branches of panicle not adnate to the main axis:—
 Panicle much contracted, dense, very compound with erect narrowly lanceolate spkts. Gl. iii tapering into a beak; iv rather thin. 42. *Hymenachne*.
 Panicle usually open. Gl. iii not beaked, iv crustaceous 43. *Panicum*.
- II. Inflorescence of variously arranged usually secund spikes. Spkts. mostly paired, unequally pedicelled, or solitary and alternately to right and left of the median line of a dorsiventral rhachis:—
- A. Glumes caudate, awned or cuspidate acuminate:—
 Gls. cuspidate or awned from the entire tip. Gl. i not awned. 44. *Echinochloa*.
 Gls. awned from slightly notched tip. Gl. i long-awned 45. *Oplismenus*.
- B. Glumes neither awned nor caudate, if cuspidate then abruptly so from the rounded or obtuse gl. iv, and margins of iv inrolled all along:—
1. Gl. i, if present abaxial, back of fruit adaxial*:—
 a. Gl. i absent or reduced to a minute scale. Spkts. conspicuously plano-convex. 46. *Paspalum*.
 b. Glume i often small but distinctly developed:—
 Spkts. solitary, closely 2-seriate, laterally contiguous in rigid spikes. Gl. iv acute in fruit. 47. *Paspalidium*.
 Spkts. solitary or paired, when solitary dorsally contiguous, in often flexuous spikes. Gl. iv obtuse or rounded and cuspidate in frt. 48. *Urochloa*.
 2. Gl. i, if present, adaxial. Back of fruit abaxial:—
 Gl. i small. Gl. iv acute. Spikes usually racemed. 49. *Brachiaria*.
 Gl. i rudimentary, forming with base of rhachilla a knob-like callus 50. *Eriochloa*.
- Group 11. **Digitariastræ.**
 Spkts. awnless. Gl. i minute rarely 0; iii usually with 5—7 close straight prominent nerves. 51. *Digitaria*.
 Spkts. awned. Gl. iii more or less hardened and like iv 52. *Allotaropsis*.
- Group 12. **Saccharastræ.** Sugar-cane, etc.
 Rhachis of racemes tough, racemes in dense thyrsoid solitary villous panicles. All spkts. pedicelled, awnless. 54. *Imperata*.
 Rhachis of racemes readily disarticulating. Panicles thyrsoid or with distinct whorls of branches. Spkts. sessile and pedicelled, often awned 55. *Saccharum*.
- Group 13. **Polliniastræ.**
 A. Glume i not dorsally grooved:—
 Sess. spkt. gl. ii awnless; iv very short, 2-lobed. Perennial 58. *Eulalia*.
 Sess. spkt. gl. ii awned. iv narrow-oblong 2-fid or 2-toothed. Annual 59. *Puliculum*.
 B. Gl. i dorsally channelled, iv minute entire or 2-toothed 60. *Pollinia*.
- Group 14. **Ischnastræ.**
 A. Rootstock and base of stems clothed with woolly sheaths:—
 Rhachis of spkts. flattened. Spkts. similar and homogamous 61. *Pollinidium*.

* Where gl. i is *adaxial*, i.e. the nearest of all the glumes to the rhachis, it follows that the back of the fruit will be turned away from the rhachis or *abaxial*, and *vice versa*. Thus in *Paspalum* the flat side is outwards or turned away from the rhachis, the back is convex and faces the rhachis.

- B. Stem not woolly below. Joints and pedicels stout.
 Spkts. heterogamous:—
 Spikes clustered. Gl. i not channeled . 62. *Ischæmum*.
 Spikes solitary. Gl. i mesially channelled 63. *Setima*.
- Group 15. **Amphilophiastæ.**
 Racemes in compound panicles 67. *Capillipedium*.
 Racemes subdigitate or fascicled or subverticillate on an
 elongate central axis 68. *Amphilophis*.
- Group 16. **Sorghastræ.**
 A. Primary branches of panicle whorled, racemes of many
 pairs of spkts. Gl. i coriaceous, muricate (in our sp.) 69. *Vetiviera*.
 B. Racemes of few pairs of spkts. (rarely 6), sometimes
 reduced to 1 sess. and 2 ped. Gl. i not coriaceous or
 muricate, or old sometimes coriaceous:—
 Spkts. dorsally compressed. Ped. spkt. sometimes
 reduced to the pedicel. Sess. spkt. awned or not 70. *Sorghum*.
 Spkts. usually laterally compressed nearly always
 reduced to 1 sess. and 2 ped. on the tips of the
 peduncles, awned 71. *Chrysopogon*.
- Group 17. **Schizachyriastæ.**
 Ped. spkt. much larger than the sess. Sess. gl. i linear;
 ii awned 75. *Diectomis*.
 Ped. spkt. subequal or smaller than sess. Sess. gl. i oblong
 coriaceous. Gl. ii awnless 76. *Schizachyrium*.
- Group 18. **Themedastræ.**
 Central spikelets jointed on rhachis and deciduous leaving
 the involucrel spkts. on the peduncle 79. *Themeda*
 (*Anthistiria*).
 Whole cluster jointed below the involucrel spikelets and
 falling together from the short peduncle 80. *Iseilema*.
- Group 19. **Rottboelliastræ.**
 A. Sessile and pedicelled spkts. very dissimilar. Sessile
 globose 72. *Manisuris*.
 B. Sessile and pedicelled spkts. subsimilar and flattened
 or ped. spkt. obsolete:—
 1. Spike readily disarticulating; subterete:—
 a. Gl. i convex. Ped. spkt. completely suppressed
 and the pedicel fused with the internodes . 83. *Ophiurus*.
 b. Gl. i flat. Ends of the joints cupular or deeply
 hollowed out:—
 Ped. spkt. distinct and its pedicel only partially
 adnate 84. *Rottboellia*.
 Pedicelled spkt. suppressed, its fused pedicel
 rarely bearing a rudimentary glume. Fertile
 spkts. opposite and deeply sunk in cavities,
 only separated by a thin evanescent mem-
 brane 85. *Mnesithea*.
 2. Joints coherent, tips truncate. Spikes compressed 86. *Hemarthria*.
- Group 20. **Maydæ.** Maize, Job's Tears, etc.
 A. M. and Fem. spikes not in separate inflorescences (or
 rarely terminal inflorescence wholly male):—
 Fem. spkts. often several at base of spikes, male spkts.
 at top. Fem. gl. i hardening, only open by a ventral
 slit 87. *Polytoca*.
 Male spikes projecting from the top of a globose or
 ellipsoid closed bract which contains one fem. spkt.
 with membranous gls. and is finally of stony
 hardness 88. *Coix*.

B. Male spkts. numerous in terminal panicles. Fem. spikes fascicled in the axils of foliage leaves and with large coriaceous bracts. Stigmas very long:—

Fem. spikes of each cluster free from one another, jointed

89. *Euchlæna*.

Fem. spikes of each cluster entirely fused by their axes into a club-shaped radial inflorescence, common rhachis non-articulate, very thick

90. *Zea*.

1. CEPHALOSTACHYUM, *Munro*.

Large or shrubby bamboos with slender straight stems. Stem-sheaths auricled. Leaves shortly petioled. Spikelets in terminal globose heads, or a panicle of bracteate heads, 1-fl., elongate, rhachilla produced beyond the fig. glume; empty glumes 2—3, broad, chaffy, many-nerved, usually long awned; fig. gls. more membranous, convolute, awns shorter; palea thin, many-nerved, keels 2 approximate. Lodicules 3, 3—5-nerved. Stamens 6, free, anthers long. Ovary stipitate, ovoid, narrowed into a long thickened style, stigmas 2—3, plumose. Grain oblong, beaked, pericarp separable.

1. *C. pergracile*, *Munro*.

A moderate-sized handsome cæspitose bamboo with culms rarely exceeding 2—2.5" diam. in our area, 30—40 ft. high, glaucous and whitish below the scarcely thickened nodes, internodes slender, often 18" with very thin walls. Stem sheaths short with rounded, long-fringed auricles light-brown soon deciduous, 4—6" long, young with felted deciduous shining black hairs, afterwards much polished and a bright brown. Leaves 6—14" by 1—2.5", linear-lanceolate, shortly sparsely hairy on both surfaces or glabrescent, sub-glaucous beneath, sheath glabrous except on margins of the small auricles which are ciliate or (in one specimen) with stiff setæ .25" long, callus small ciliate. Panicle large, spikelets in bracteate clusters forming filiform drooping spikes, gls. 3—4, lower 1—2 sterile, fertile solitary densely hairy, terminal sterile; palea long 2-fid, anthers obtuse purple.

Deep ravines and valleys in Singhum but rare (Luia in the Kolhan, Kiringkolor in Porahat and a few places in Saranda)! Fls. gregariously and sporadically. Deciduous.

Blade of stem-sheaths triangular acuminate 2" only long, felted within towards the base and with densely fimbriate setose sometimes reflexed auricles, ligule very narrow. Leaves with rounded or cuneate base, midrib conspicuous, side nerves 6—12 each side, sparingly tessellate between.

The green culms split and crack in drying in Chota Nagpur, but *Gamble* says they are used for building in Burma.

2. DENDROCALAMUS, *Nees*.

Large or mod.-sized unarmed bamboos with densely branching root-stocks. Leaves shortly petioled, transverse nervules represented by pellucid glands. Spikelets in globose clusters on the long branches of a compound panicle, ovate, 2—6-fl.; empty glumes 2—3, ovate, acute, many-nerved; fig. gls. like the empty; palea of lower fls. keeled, of upper dorsally rounded ciliate. Lodicules 0 or rare. Stamens 6,

filaments free. Ovary hairy above, often depressed, stigma usually simple. Grain small, pericarp coriaceous or crustaceous.

- A. Spikelets hard, spinescent, crowded in heads, which are interruptedly spicate on the panicle-branches. Leaves narrow:—
 Spkts. pubescent or hairy, anthers apiculate 1. *strictus*,
 Spkts. silkily hairy or hirsute, anthers obtuse var. *sericeus*.
- B. Spikelets in large soft congested heads:—
 Leaves large broad, culms very large 2. *Hamiltonii*.

1. *D. strictus*, Nees. Buru-madh or mat', K., S.; Salimbo, Saliabans, Or.

A gregarious, more or less cæspitose bamboo with culms 20—50 ft. high and 1—3" diam., the central cavity usually comparatively small, sometimes 0. Lower stem-sheaths 3—12" oblong, top rounded or waved, not or only slightly auricled, blade lanceolate not very distinctly differentiated on the outside, the striæ passing continuously into the sheath, on the inside with a very narrow ligule. Leaves narrowly oblong slightly narrowed from the rounded base (where it suddenly contracts into the short petiole) to the twisted subcuspidate tip, pubescent beneath, nerves 3—6 each side of midrib, transverse nervules reduced to pellucid dashes rather obscure when dry, sheath striate hairy or glabrous. Spikelets .25—.5" long forming globose spinescent heads at intervals along the branchlets, fertile and smaller sterile spkts, intermixed, empty glumes 2 or more ovate spinescent or muticous, many-nerved, fig. gls. about 2 ovate spinescent and pubescent at tip; palea of lower 6—7-nerved between the ciliate keels, anthers apiculate.

The commonest wild bamboo in the province but confined to the hills where it is sometimes gregarious to the exclusion of all else. Kymore Hills! Rajmahal Hills! Throughout the hill forests of Chota Nagpur, especially Porahat! Puri (Bhainsgot Hill, etc.)! Angul (common in Durgapur forests especially)! Sambalpur, common! It flowers nearly every year sporadically in Nov. Deciduous in the hot season.

A most useful bamboo and very strong but the culms in Behar and Orissa are not as solid as in dryer provinces and have not been marketable for lance-shafts. The new shoots are eaten. It is easily raised from seed. The best culms are always found where the bamboos have been least cut.

Var. *sericeus*. Syn. *D. sericeus*, Munro (sp.).

Characters of the type but spikelets silkily hairy or hirsute, anther-tips obtuse.

Hazaribagh, summit of Parasnath 4000 ft. J.D.H., etc.

The heads are only .6—7" diam. and those of *D. strictus* usually 1.2" but smaller heads are very often found in *strictus* and the pubescence is also variable.

2. *D. Hamiltonii*, Nees & Arn.

A very large bamboo with stems up to 80 ft. high and 4—7" diam. much branched above and often rather straggling, the nodes often with rootlets or root-scars, internodes 12—20" long with relatively thin walls only .5" thick and large lumen. Stem sheaths glabrous or nearly so, truncate with acute auricles, blade lanceolate acute with a small glabrous triangular point on each side, often 12" long with incurved margin and black bristles at base within. Leaves large or small on side

branches, often 15" by 2.5" on new shoots, broadly lanceolate cuspidate with rounded shortly petioled base and finely serrate margin. Panicle very large, branches scabrous and white-pruinose. Spikelets in hemispheric heads .5—1.5" diam., nearly .5" long, ovoid purple glabrous, empty gls. usually 2 short rounded, fig. gls. 2—4 orbicular, margins ciliate, anthers purple with a long black hairy twisted point.

A common tropical Himalayan bamboo, rare in our area. N. Champaran, on the Nepal boundary in the Sameswar Hills! It flowers sporadically.

The young shoots are eaten. The large size of the internodes and lumen make it very useful as water pipes and like other bamboos it is used for a variety of purposes.

3. BAMBUSA, Schreb.

Usually large and cæspitose bamboos, rarely shrubby or with scattered culms. Stem-sheaths broad, blade often triangular. Leaves shortly petioled not tessellate by nervules, but sometimes by pellucid glands (*vide Gamble*; I have seen no anatomical investigation of these marks), sheaths auricled. Inflorescence generally a large leafless panicle bearing heads on spiciform branches, or of leafy panicles, or paniced spikes. Spikelets 1—many-flowered; lower gls. 1—4 empty or gemmiferous; fl. gls. ovate-lanceolate, uppermost imperfect; palea 2-keeled. Lodicules 2—3, membranous, ciliate, rarely 0. Stamens 6. Ovary oblong or obovate, tip hairy; style long or short, stigmas 2—3. Grain oblong or linear-oblong, furrowed on one side; pericarp thin adherent.

I. Branches unarmed:—

A. Large bamboos, culms 2" diam. and more:—

1. Spikelets terete in loose heads. Leaves 6—10" long by .75—1.5" wide, glaucous and puberulous beneath:—

Cæspitose. Palea not ciliate. Anths. obtuse.

1. *tulda*.

Culms solitary. Palea long-ciliate. Anthers apiculate

2. *nutans*.

2. Spikelets flattened in dense heads:—

L. 1—2" wide. Nodes with a white ring below, swollen

3. *balcooa*.

Culms often yellow streaked, L. under 2" wide.

Nodes hardly raised without white band

4. *vulgaris*.

B. Shrubby, culms not exceeding 1" diam

5. *nana*.

II. Branches spinescent. Very large bamboos

6. *arundinacea*.

1. **B. tulda**, *Roxb.* Talda bans, *Beng.* (also djowa, mitenga, matela); Peka, *H.* (*vide Roxburgh*); Ropa-mat, *S.*; Pepe siman; *K.* (*f. Gamble*).

A very large bamboo attaining 70 ft. in height and 2—4" diam.; cæspitose, internodes 1—2 ft. white-ringed below the nodes with walls .3—5" thick. Stem-sheaths 6—9" long by 6—10" broad (when unrolled), gradually narrowed upwards with mouth sub-truncate rounded or sub-triangular; blade with coarsely fringed auricles and hairy within, triangular or broadly lanceolate cuspidate. Leaves linear-oblong or lanceolate, 6—10" by .75—1.5", base usually rounded, tip subulate twisted, glaucous and puberulous beneath. At flowering time the whole plant becomes a huge leafless panicle or the flowering is confined to short leafy panicles or spiciform branches. Spikelets 1—3"

long in interrupted clusters or loose heads mixed with chaffy bracts, usually 1—2-bracteolate, not flattened; gls. i to iii or iv acute, many-nerved, usually gemmiparous, the next 4—6 flowering .5—1" long, ovate acute acuminate or mucronate, palea shorter cymbiform, anthers obtuse glabrous purple, ovary obovate-oblong.

Widely cultivated and perhaps wild in the Santal Parg. (on the Rajmahal Hills! but see remarks under *B. nutans*). Flowers gregariously and in single clumps.

Stem-sheaths glabrous, hairy or white powdered. L. with faint pellucid glands, lateral (principal) nerves 6—10 each side; petiole often hairy; its sheath glabrous, ending in a smooth callus and oblong fringed auricle; ligule narrow, obscure. Rhachilla clavate, flattened, fragile; palea 5—7-nerved between the keels, tip penicillate. Lod. 3.

2. *B. nutans*, Wall. Makor, Mal Pah.

Stems solitary from a creeping rhizome, leaves linear-lanceolate tessellate with pellucid glands, ligule long obtuse hairy, spikelets in bracteate fascicles many empty or gemmiparous, not flattened, fertile few .75—1" long; 2—3 lowest glumes neuter, 3—7 fertile, all ovate acute mucronate, many-nerved, puberulous within; palea shorter ovate flattened, keels overlapping, long-ciliate; anther-tips long apiculate or slightly penicillate, ovary subovoid.

Rajmahal Hills, on trap rocks and cultivated by the paharias! (see below).

This bamboo is scarcely distinguishable without fls. from the last; it is said however to be recognised by the scattered culms and to be less hairy and bristly than *B. tulda*. The common wild bamboo (exc. *Dendrocalamus*) of the Rajmahal hills which I have not seen in flower appears to agree better in these respects than with *tulda*, although *nutans* is usually confined to the Himalayan region and Assam. The culms in our plant are 3—4" diam. with internodes 18". Stem-sheaths 8—12" densely covered with black deciduous bristles at back, blade triangular acuminate with rather small fimbriate auricles. L. softly downy (white when dry) beneath with scaberulous margins, ending in a twisted scabrid point, base generally obtuse or subacute, not cordate, rarely rounded but attenuate into the distinct .12" long petiole; nerves 8—9 each side of mid-rib.

3. *B. balcooa*, Roxb. Balku-bans, Sil-barua, Beng., Boro-bans (Duars).

A large caespitose bamboo with stems 50—70 ft. high and 3—6" diam., much clothed with long horizontal leafless stiff branches below, internodes 8—18" with a whitish ring below and a hairy one above the swollen nodes, walls thick. Stem sheaths of two forms, lower short, broad, ciliate, top rounded; blade short triangular decurrent into short fringed auricles; upper 10—14" by 8—10", almost glabrous, ciliate, truncate with blade 6—8" by 3—4", closely hairy above, margins recurved, base rounded and decurrent as a narrow band; ligule broad toothed. Leaves oblong-lanceolate with rounded base, 6—12" by 1—2", pellucidly tessellate, tip twisted scabrid, margins scabrous ciliate, nerves 7—12 each side. Panicle compound, spikelets .3—5" or more long in dense bracteate heads, ovate-lanceolate, flattened, empty glumes 0—2 ovate acute many-nerved, fig. gls. 4—6 larger, margins ciliate, palea as long as the gl., ovate acute keels long-ciliate, anthers glabrous connective produced, ovary broadly ovoid.

In the plains districts, frequently cultivated. Purneah! Perhaps formerly wild there.

I have not seen the flowers exc. in herbarium, the description being entirely from *Gamble*. Leaf-sheaths appressed-hairy, truncate above with a narrow callus, bristly or not; ligule broadly triangular, membranous. Rhachis of panicle pubescent or scurfy, swollen above; palea obscurely nerved. Lodicules 3, ovate or obovate, fimbriate. Anthers, glabrous, pointed.

4. *B. vulgaris*, *Schrad.* Sundrogai, *Or.*

A caespitose bamboo 20—50 ft. high, culms 2—4" diam., green or often with yellow stripes or quite yellow, nodes hardly raised with usually a ring of brown hairs, internodes 10—18", walls rather thin. Stem-sheaths 6—10", often streaked yellow, thickly hairy above, top rounded retuse, blade 2—6" by 4", appressed hairy, base decurrent with rounded falcate fimbriate auricles, ligule broad, toothed or fimbriate. Leaves 6—10" by 7—1.7", linear-lanceolate glabrous tessellate with the transverse nervules, sheath laxly hairy, auricle ciliate, ligule short, nerves 6—8 on each side of midrib, marginal very scabrous. Spikelets 6—8" long, oblong-lanceolate, laterally compressed in bracteate clusters or in compact semi-whorls on long interrupted paniculate spikes. Empty glumes 1—2 ovate acute ciliate at tip; flg. gls. larger, 6—10; palea as long, keels white-ciliate; anthers obtuse apiculate or penicillate with short hairs; lodicules 3, winged, ciliate.

Commonly cultivated, but chiefly in gardens! *Gamble* states that it is not native in India.

5. *B. nana*, *Roxb.*

A dwarf shrubby bamboo with culms 6—10 ft. high and 5—1" diam., densely caespitose, green turning yellow, branched from the base, nodes thickened. Stem-sheaths glabrous rounded at top, blade linear acuminate, ciliate. Leaves small linear-lanceolate, 2—4", not tessellate, auricle of sheath fringed. Spikelets straw-coloured, not compressed, 5—1.5", solitary or few clustered on the branches of short diffuse panicles. Gls. 5 or more all flg. or lowest only empty, palea shorter than gl. minutely ciliate on keels near tip only.

Cultivated in gardens only.

6. *B. arundinacea*, *Willd.* Katanga, Katam-madh, *K.*; Kantabans, Ketua, *Beng.*

A very large densely caespitose bamboo 80—100 ft. high and 6—7" diam. with numerous horizontal branches below which, as well as many of the other branches, are armed with strong 1—3-nate recurved thorns. Internodes rather short usually about 1 ft. or upper 18", walls fairly thick and lumen large. Stem-sheaths 12—15" by 9—12", top rounded, edges plaited, young densely yellow-hairy, blade triangular, up to 4", acuminate, concave, felted with dark bristles within, margins decurrent on the sheath wavy densely long-ciliate, hardly auricled. Leaves relatively small, linear or linear-lanceolate glabrous or slightly pubescent beneath, usually about 5—8" by 5—7", rarely 1" broad and often very small leaves occur at base of twigs, sheaths pubescent or glabrous. Panicle often occupying the whole plant. Spikelets 5—1" long sessile in close dense clusters along the twigs or 3—7" in much laxer clusters (*var. spinosa*); empty glumes 0—2 ovate or ovate-lanceolate acute or

mucronate many-nerved, fl. gls. 3—7, lower 2-sexual upper male with 2—3 uppermost imperfect, keels of palea ciliate, anthers yellow obtuse .2" long.

Essentially a bamboo of moist valleys, forming dense gregarious crops in the vicinity of some rivers, often planted in the open. Singbhum, wild along ravines! Very common in some of the Orissa States (e.g. Athmallik)! Puri (common in Arang and other forests)! Angul, very common, often covering large areas!.

It flowers more or less gregariously but those in the immediate vicinity of streams will sometimes flower some years after the ones in less favourable localities. It flowered and seeded in Puri and Angul from 1896—1899 and again in 1913—1915. In the former case the larger better bamboos in the damper localities are said not to have flowered; it was these however which flowered in the latter period.

There are three separate varieties recorded by *Mr. Gamble*:—

α. *arundinacea*, proper, rhachis of infl. glabrous hard shining, spikelets few long 6—12-fld., rhachilla evident hirsute, leaves smooth, sheath hairy.

β. *spinosa*, rhachis striate hard not shining, spikelets many shorter 4—6-fld., rhachilla obscure, leaves glabrous above, hairy beneath, sheath hairy then sub-glabrous.

γ. *orientalis*, rhachis glaucous-green angled almost soft, spkts. membranous 5—8-fld., leaf-sheath hairy with white cilia, petiole hairy.

A Khurda (Puri) specimen collected in 1893 (perhaps one of the first to flower in the 1896 flowering) is named by *Gamble spinosa*, but the rhachilla is very evident with swollen ciliate nodes, the spkts. are few-fld., the leaf sheaths have long bristles and are hairy.

No specimens are to hand of the later flowering in Angul.

The usefulness of this bamboo is marred by the terrible cost of extraction due to the interlacing thorny branches which also render it one of the worst forms of forest to cross after dusk that I know of.

4. OXYTENANTHERA, *Munro*.

Unarmed bamboos, sometimes scandent, with a stout usually creeping and stoloniferous rootstock. Leaves large or small, shortly petioled. Panicle large, branches with few or many heads of whorled or capitate spikelets. Spikelets elongate, cylindrical or conical, 1—3-fld.; terminal fl. usually fertile; empty glumes 1—3; fl. gls. elongate, mucronate. Palea of lower fls. 2-keeled, of uppermost convolute, keel 0 or obscure. Lodicules 0. Stamens 6, filaments connate into a short thick at length elongate membranous tube. Ovary ovoid, style slender, stigmas 1—3 more or less plumose. Grain elongate, beaked, smooth.

As in most other of the bamboos the description of the inflorescence has been taken almost verbatim from *Gamble* in the *Flora of British India*, which again is abbreviated from his work in the *Annals of The Calcutta Botanic Gardens*.

1. *O. nigrociliata*, *Munro*. Bolanji, Or.

Stems 30—40 ft. high, .5—2" diam., sometimes striped with yellow, internodes scabrous. Stem-sheaths about 6"—10" long slightly narrowed to the truncate tip, auricles small oval or oblong rounded erect glabrous, when young hairy, blade lanceolate or ovate-lanceolate deciduous on old culms. Leaves 6—12" by 1—2", lanceolate, tip subulate often twisted, base unequal and rounded then suddenly narrowed to the short petiole, or more or less cuneate, young pubescent beneath, margins scabro-ciliate towards base or smooth, nerves 9—12 each side of midrib: sheath stiff, at first hairy, margins ciliate, auricles rounded naked. Panicle large, compressed. Spikelets 1", gls. fringed with black

or purple cilia, many-nerved, empty gls. 2—3-ovate acute and mucronate, flg. gls. 2—3 perfect and a terminal lanceolate-acuminate long-mucronate imperfect one; palea narrow 2—3-nerved between the ciliate keels, anther-tips elongate-slender hirsute.

Valleys in the Mals of Puri!

I believe the flowers of the Puri plant have never been collected and the bamboo has been identified by comparison of the vegetative organs only. The description of the fls. is from Gamble (from Burmah specs.). The bamboo must have flowered in Puri not many years before my arrival there in 1915 as I found young plants up to 15 ft. high and less. These have leaves 11" by 2.5" and are pale beneath but glabrous, the small transverse nervules (described as glands in *F.B.I.*) are very distinct, the sheath has a notch just below the petiole which appears articulate on it, the nerves at the base are somewhat flabellate and the blade at the base hairy above. When young the stem- and leaf-sheaths are dorsally black-strigose. The green oblong or ovate and rounded erect auricles are a very good character for recognising this species.

5. PHRAGMITES, Trin. Reed.

Tall stout perennial grasses with long leaves. Spikelets in large decompound panicles, not jointed on pedicel, laterally compressed; rhachilla jointed at the base above glume iii* and between the other flowering glumes not produced beyond them, elongate between the glumes and with very long silky hairs above gl. iii. Glumes 5—9, glabrous; i and ii unequal lanceolate, 1—3-nerved, membranous, persistent; iii much longer narrowly oblong-lanceolate, acute, 3-nerved, male or neuter, persistent*; iv and other flg. glumes subulate-lanceolate, subaristate, hyaline; palea much shorter. Lod. obtuse. St. 1—3. Styles 2, terminal, free, stigmas plumose. Grain oblong, terete.

1. **P. karka**, Trin. Syn. *Arundo karka*, Roxb. *Nal. H.*; Jankai, K.; Narkat, Vern.

A very large grass 10—20 ft. high with rather close-jointed hollow stems, often widely spreading by means of long stolons. Leaves stiff erect distichous 1—2 ft. long by 1—1.5" broad, smaller upwards. Panicles erect lanceolar oblong or oval with branches ultimately widely spreading. Spikelets grey or brown; gl. i linear-lanceolate 1", 1-nerved; ii 3", 3-nerved; iii 5—5.2"; iv as long or longer, other 3—4 flg. glumes successively a little shorter, tip aristiform. Pedicels glabrous.

Along rivers and marshes. Purneah! Santal Parg! Shahabad! Monghyr! Gya! Throughout Chota Nagpur! No doubt throughout the province. Fl. Sept.—Dec.

The stems are made into shepherds' pipes (*rotu*) and are used for preparing fishtraps (*kumbat*, K.). The tender shoots are greatly appreciated by horses but are laxative.

Triraphis madagascariensis, Hook. f. Syn. *Neyraudia madagascariensis*, Hook. f. (in *F. B. I.*)

This is a very large handsome grass, resembling a *Phragmites* in general appearance, which is frequent in sandy nalas in the Tarai and Duars and may perhaps be found in Purneah and the Santal Parganas.

* According to books consulted but I find the rhachilla often articulate above ii and gl. iii readily falling like the other flg. glumes.

Stem terete smooth shining 5—6 ft. very leafy. L. attaining 2 ft. by 3—5" ligules fimbriate. Panicles 1—2.5 ft. effuse, with innumerable small spkts. much more graceful than in Phragmites, branches 7—8 nate. Spikelets only 2"—3" long. Glumes 6—7, iii male, awnless, iv and other fl. gls. 3-nerved with long hairs on the submarginal nerves and with a terminal straight or finally recurved awn and 2 minute awlets on either side. Rhachilla produced between the glumes but only shortly bearded beneath them, and bearing a terminal flowering glume. Fl. Oct. —Dec.

7. ARUNDO, L.

Tall stout perennial grasses with broad flat leaves. Spikelets in large decomposed panicles, not jointed on pedicel, laterally compressed; rhachilla glabrous or shortly hairy sometimes bearded between ii and iii, jointed at the base and between the flowering glumes. Glumes 4 or more; i and ii empty, subequal, acute acuminate or aristate, narrow, glabrous, persistent 3-nerved; flg. gls. similar or 2-fid or 2-aristulate at apex either side of the short awn, dorsally hairy all over below the middle; palea hyaline, 2-nerved. Lod. obovate. St. 3. Ovary glabrous, styles distinct, stigmas plumose. Grain oblong.

1. *A. donax*, L.

A tall stout reed-like grass with fistular stems 6—10 ft. high, creeping below. Leaves 1—2 ft. long, by 1—2" broad, ensiform with amplexicaul base, ligule of long hairs. Panicle 1—2 ft. erect, thyrsiform with scaberulous branches. Spikelets 3—5" long. Gl. i and ii lanceolate as long as spkt. aristo-acuminate (or obtuse and apiculate, *vide F.B.I.*; I have not seen this form from our area where gl. i and ii are almost as much awned as the flg.); flg. gl. 2—4, lateral nerves produced into two slender awn-like teeth each side of the central awn, whole length about that of spkt. or less, palea 2" oblong, contracted at base, nerves closely shortly ciliate, rhachilla very shortly produced between the glumes.

Chiefly in the northern area along ditches and streams. Monghyr, *Mokim! Gya, Mokim!* Fl. Oct. It no doubt also occurs but has not been collected along our northern boundary.

The rhachilla between gl. i and ii is elongate and minutely pubescent, it is bearded above ii.

8. AVENA, L. Oat.

Annual or perennial grasses with usually flat leaves. Spikelets 2—more-flowered, in effuse contracted or spiciform panicles, not articulate on their pedicels; rhachilla jointed at the base (or rather tenacious in cultivated specimens) and sometimes between the flg. gls. Gls. dorsally rounded; i and ii empty, subequal or unequal, thin persistent, few- or many-nerved; flg. gls. ovate to lanceolate, entire 2-toothed or -cleft, 3—7-nerved, lateral nerves sometimes obsolete, lobes awned or not but usually a long and geniculate or reflexed awn with a twisted base dorsal from below the cleft. Palea narrow, keels scabrid or ciliate.

Lodicules usually 2-fid. Style short free. Grain various, usually free or in some species (with a villous tip) adherent to the palea.

1. **A. sativa**, L. The cultivated oat.

An annual 1—3 ft. high with pendulous spikelets about 1" long without the '5—7" exserted awn. Gl. very long-acuminate. Bristly hairs at the base of glume iii (in variety *orientalis*). Rhachilla tenacious or disarticulating below gl. iii. Ovary tip villous.

Var. *orientalis* is frequently cultivated in the northern area in the cold season, chiefly by Europeans. Soane Valley, J.D.H.

9. **CÆLACHNE**, Br.

A small leafy variable marsh grass. Leaves short, flat or convolute. Spikelets in open or contracted or spiciform panicles, not articulate on the pedicels, with 2 flowers, upper sometimes imperfect. Rhachilla jointed at the base and elongate between gl. iii and iv. Gl. i sub-orbicular concave obtuse and delicately nerved; ii smaller, more oblong, both persistent; iii longest, with shortly bearded callus, palea similar, rather coriaceous; iv on the elongated rhachilla, smaller, hairy, palea developed or small. Stamens 3, anthers long narrow. Ovary ovoid, stigmas free. Grain free within the glume and palea.

1. **C. pulchella**, Br. Var. *spicata*, Hooker f.

Small, spreading from the root with branches 3—4" long only or suberect. Leaves flat, '5—1" long, erect, linear-lanceolate, with many equal nerves (without midrib), ligule a few hairs. Panicle sub-spiciform with rather flexuous rhachis and very short branches in the sinuses. Spikelets '08" long; gl. i suborbicular suddenly contracted to an obtuse tip, very concave, delicately 5-nerved; ii oblong concave 3-nerved, shorter; iii longest, concave ovate, obtuse, nerveless with a large similar palea; iv on the '02—'03" -long internode of the rhachilla, pubescent, with imperfect flower.

Ranchi, Clarke! Fl. Nov.—Dec.

10. **ERAGROSTIS**, Beauv.

Annual, rarely perennial, with erect or geniculately ascending usually slender stems, very rarely prostrate. Leaves narrow. Spikelets in open or contracted panicles, rarely in simple spikes, not articulate at the base (exc. *cynosuroides*), usually strongly laterally compressed; rhachilla firm or articulate, not produced beyond the uppermost glume. Glumes many, sometimes very many, broad (when unfolded), never awned, dorsally rounded or keeled; i and ii equal or unequal, usually separately deciduous, 1-nerved or ii 3-nerved; fig. gls. imbricating, finally deciduous, 3-nerved, 2-sexual or uppermost imperfect; palea broad, membranous, concave towards the rhachilla or margins reduplicate, sometimes persistent on the rhachilla, keels 2. Lod. 2, very minute. Stamens 2 or 3. Ovary glabrous, styles 2. Grain minute, globose, oblong, ovoid or obovoid, free in the glume and palea.

I. Spikelets not secundly spicate, though sometimes in spiciform panicles (Spp. 1—13):—

A. Rhachilla of spkts. jointed and breaking up from above downwards:—

1. Margins of flg. gls. ciliate, panicle spiciform:—
 Spiciform panicle terete. Flg. gls. mucronate or cuspidately acuminate. 1. *ciliata*.
 Spiciform panicle usually lobed. Flg. gls. mucicous 2. *coarctata*.
2. Margins of flg. gls. eciliate:—
 - a. Panicle mostly spiciform, appearing hairy from the long cilia of the palea. Spkts. $\cdot 1''$. 3. *ciliaris*
(p. 1001).
 - b. Panicle open or contracted, not spiciform. Spkts. under $\cdot 1''$ or if $\cdot 1''$ palea not long ciliate:—
 - i. Leaf-sheaths ciliate at mouth. Panicle not in interrupted whorls, nodes usually ciliate. Keels of palea ciliate or not:—
 Panicle various. Not glandular and odorous 3. *tenella*.
 Panicle mostly cylindric with short spreading branches glandular and odorous below. Keel of palea rigidly ciliate 4. *viscosa*.
 - ii. Leaf-sheaths not ciliate at mouth. Panicle not ciliate at nodes, usually elongate, frequently interrupted with branches often fascicled or whorled 5. *interrupta*.

B. Rhachilla of spikelets tough persistent. Flg. gls. falling away from its base upwards, with or without the paleæ:—

1. Spkts. much compressed, ovate to oblong; side nerves of flg. gls. prominent straight. Paleæ deciduous. Spkts. $\cdot 15$ — $\cdot 5''$ long, pale or pink. Rhachilla straight, closely nodose 6. *amabilis*.
 2. Spkts. linear or linear-oblong, side nerves less prominent or if side nerves prominent then paleæ persistent. Spkts. often blue-grey or brown. Rhachilla zigzag with distinct internodes:—
 - a. Spkts. close, pointing forward, lateral pedicels 0 — $\cdot 2''$:—
 - i. Gls. $\cdot 06$ — $\cdot 08''$ acuminate. Grain oblong, striolate $\cdot 03''$ 7. *gangetica*.
 - ii. Gls. $\cdot 04$ — $\cdot 06''$. Grain broadly ellipsoid or subglobose $\cdot 01$ — $\cdot 02''$:—
 Spkts. under $\cdot 25''$ long 8. *stenophylla*.
 Spkts. $\cdot 25''$ long or more 9. *elongata*.
 - b. Spikelets scattered, spreading or pendulous, pedicels capillary:—
 - i. Leaf-margins with small round glands:—
 Gls. $\cdot 07$ — $\cdot 08''$, i 1—3-nerved, ii 3-nerved 10. *major*.
 Gl. $\cdot 06''$, i and ii 1-nerved 11. *minor*.
 - ii. Leaf margins eglandular. Gl. i and ii 1-nerved:—
 Spkts. $\cdot 25$ — $1''$ long linear. Pedicels $\cdot 2$ — $\cdot 5''$. Rhachilla obtusely zigzag 12. *tremula*.
 Spkts. $\cdot 15$ — $\cdot 17''$ (elongating to $\cdot 2''$ after fall of lower gls.). Rhachilla sharply zigzag 13. *pilosa*.
- II. Spikelets secundly 2-seriately spicate on a simple rhachis or on the branches of an oblong or lanceolate panicle:—
- A. Spkts. sessile and jointed on the branches of a panicle 14. *cynosuroides*
(p. 1007).
 - B. Spikelets secund on a simple spike:—
 1. Leaves convolute, filiform:—
 L. mostly under $6''$, uniformly closely puberulous on upper surface 14. *coramandelina*.

L. often 9" with tufts of or scattered long slender hairs

2. Leaves linear flat obtuse or subacute, 1—4"

15. *nardoides*.

16. *brachyphylla*.

1. *E. ciliata*, Nees.

A grass 1.5—3.5 ft. high with many stems erect or ascending from a tough perennial horizontal rootstock. Leaves short, linear or linear-lanceolate spreading and suberect, 2.5—6" by .1—.27", sheath bearded below the mouth. Panicles densely spiciform, 1.5—3" long, .1—.2" diam. Spikelets .1—.18" long, much compressed; gl. i and ii acute ciliate; iii .08—.09" long, ending in a mucro or cuspidately-acuminate, keel scaberulous, margins with fine rather long cilia except at the apex; palea about $\frac{3}{4}$ ths as long, reduplicate keels strong, long-ciliate, also hairy within, tip rounded between the keels; other flowering glumes 5—11 similar, slightly shorter upwards. Grain .02" long, terete.

Singbhum, often in the sandy beds of rivers! Hazaribagh, 2000 ft., Clarke! Fl. Nov.—Dec. Perennial.

The stems are swollen towards the rootstock and many arise together in the same year. Ligule a few hairs. The rhachilla sometimes terminates in an imperfect glume.

2. *E. coarctata*, Stapf. Tor Chandbol, S.

A very closely allied species to *E. ciliata*. The panicle is dense and subspiciform 3—5" long and .5" broad or lobed, or contracted but somewhat laxer and up to 6" by .75", often red. Flowering glumes 5—10, obtuse, .06", margins long- or short-ciliate; palea as in *ciliata*.

A very common grass, chiefly in pastures, gardens, etc. Purneah, Kurz! Santal Parg., Nusker! Gya, Clarke! Ranchi, very common! Hazaribagh, Anders., etc.! Udaipur, Herb. Cal.! Manbhum, Clarke, Camp.! Singbhum, very common! Puri, sandy tracts, Walsh! Fl., Fr. Sept.—Feb.

Rootstock in our specimens less creeping than in *ciliata*, stems tufted, erect or ascending, 1—3 ft. high, though sometimes flowering when much smaller. Leaves spreading 2—10" long with long hairs towards the mouth of the sheath, usually flat below and involute finely acuminate upwards. Rhachis of the panicle bearded at the nodes. Old panicles only show the lower glumes of the spkts. which break up from above downwards as in *ciliata*. Grain highly polished, brown, ovoid-oblong, .02" long.

E. ciliaris, Link, is distributed from the United Provinces to Calcutta, but there appear to be no specimens from our area. Superficially it resembles *ciliata*.

3. *E. tenella*, Roem. & Sch. Bharbhusi, Vern.

Usually a small very elegant and slender grass, rarely 18" high, with many slender tufted stems and slender acuminate leaves attaining 5" by .22", usually much less. Sheaths long-ciliate near the mouth. Panicles decomposed excessively branched, branches not whorled with innumerable minute to small spikelets on capillary branchlets and pedicels, usually with long-ciliate nodes, open oval or in some varieties contracted. Spkts. not very strongly compressed, .05—.17" long, up to .04" broad. Glumes 5—11, .05" long or less, oblong, obtuse, convex, lateral nerves about one-third of width of glume (measuring from margin to midrib) from margin which is not ciliate; keels of palea distinctly or obscurely ciliate. Grain broadly ovoid, pale-brown, polished, .015" long.

Throughout the province. Often gregarious and (with the next) characteristic of overgrazed heavily trampled areas. The plants are very thickly covered with dew on cold-weather mornings and in the hot weather are dangerous carriers of fire as they often occur on fire-lines and burn like tinder, though from their dwarf nature the line looks well cleared. Fl., Fr. Oct.—Jan. Annual.

Var. α. plumosa, Stapf (*tenella* proper).

Panicle open, branches capillary, nodes bearded. Spkts. long- or short-pedicelled, 3—9-fld., rhachilla subarticulate, gl. i and ii unequal, ii sometimes 1½ times longer; fig. gl. .03—04", anthers very minute.

Behar, *Hope!* Santal Parg., *Nusker!* Gya, *Mohim!* Monghyr, *Kurz, Mokim!* Ranchi, *Wood, etc!* Hazaribagh, *Clarke!* Manbhum, *Camp., Clarke!* Puri, *Walsh.* (one specimen 2 ft. high)!

Var. β. riparia, Stapf.

Stems laxer, geniculate at base from a rather elongated rootstock. Panicle contracted, lower ascending branches not more than 4" long, subfiliform or capillary, rhachis glabrous. Glumes and grain as in *plumosa*. Sandy tracts, Puri, *Walsh!* Perennial.

Var. γ. breviculmis, Stapf.

Stapf describes this as with stems 1—3", usually ascending from a prostrate base, panicle 1—1.5", by .25—3" broad, oblong to ovate-oblong, rather dense but not compact, rhachis bearded or not, empty glumes subequal, fig. gls. .04" long, grain .02".

Monghyr, near the hot springs, *J.D.H.!* Two specimens are ascribed to it in the *Cal. Herb.*, one from Sant. Parg., the other from Puri. Except for the smaller panicle and habit they resemble *tenella* proper.

4. E. viscosa, Trin. Syn. *E. tenella*, var. *viscosa, Stapf.*

Tufted 6—15" high, the panicles occupying the greater part of the plant. Leaves mostly convolute erecto-patent 1—3" long with rigid tips, base and mouth of sheath with very long cilia. Panicles dense, cylindrical or oblong, 3—5" long by .7—1.5" broad, with very numerous more or less spreading equal sometimes opposite or 2-nate principal branches, but never in interrupted whorls as in *interrupta*, ciliate at the nodes or not, with scattered microscopic glands chiefly on the pedicels and glumes which render the plant viscid and sweet-scented. Spkts. usually about .12" long and 7-fld., up to 16-fld., rhachilla readily breaking up. Gl. i and ii subequal .04"; fig. glumes broadly ellipsoid obtuse or rounded .05" with keel minutely scaberulous. Palea nearly as long as glume, rigidly ciliate on the keels. Grain pale-brown polished oval .02" long.

Shahabad, *Nash!* Patna, *Ham.!* Ranchi, common! Sambalpur, common! Probably throughout the province. Fl., Fr. Sept.—Dec.

I have kept this distinct chiefly on account of the form of the panicle and the glands which give the plant a distinct smell noticeable as one walks through it, so that it is easily recognisable in the field. Cattle dislike it.

5. E. interrupta, Beauv.

A variable slender grass from a few inches high to 3 ft., stems often geniculate and ascending from the base, tufted. Leaves slender up to about 9" by .2", often only 2", glabrous, sheaths not ciliate at the mouth. Panicle very variable, usually stiff, eciliate at the nodes, interrupted with the main branches often pseudo-verticillate. Spikelets

·06—·25" long, ovate to linear, few to many-flowered. Flg. glumes obtuse, nerves slender, keels of palea scaberulous or smooth, stamens 2, grain obovoid.

There are many varieties:

Var. α . **Koenigii**, Stapf.

Panicle long narrow with short dense suberect or erecto-patent pseudo-whorls, spikelets shortly pedicelled usually 6—14-fld., flg. gl. lower ·04" long; pedicels, nerves and keel of palea scaberulous in a Behar specimen, usually glabrous or nearly so. Grain ·01".

Patna, Ham.! Gya, Clarke! Santal Parg., Gamble! Ranchi, Clarke! Manbhūm, Clarke! Puri, Lace! Fl., Fr. May—Jan.

Var. β . **diplachnoides**, Stapf.

Stem tall stout branched, panicle long, often over 1 ft. effuse or contracted with solitary or 2—3-nate branches elongate to 1—5", simple or if branched the whorl rarely overtopped by one or two branches, ultimate branches not divaricate, spkts. 6—12-fld. Rhachis and pedicels often scabrid.

Gya, Mokim! Hazaribagh, Clarke! Puri, Walsh! Fl., Fr. Oct.—Dec.

Var. γ . **tenuissima**, Stapf.

Panicle long loose narrow usually stiff, branches ·5—2", pseudo-whorled, spreading ramified from the base, branchlets and pedicels divaricate filiform to capillary, spikelets few-fld., fl. glumes very obtuse ·03" long.

Santal Parg., Gamble! Ranchi, Gamble, Clarke, etc., common! Hazaribagh, on Parasnath, Clarke! Palamau, Gamble! Fl., Fr. Oct.—Dec.

Var. δ .

Perhaps the same variety as *tenuissima*, but with the more elongate erect branches of *diplachnoides* spkts. very short with only 3—5 flg. glumes are specimens from Rajmahal Hills, Kurz, Mokim! and Gya, Mokim! These are called *tenuissima* in the *Cal. Herb.*

6. **E. amabilis**, Wight & Arn.

A pretty grass with rather slender stems 6—18" high. Leaves 1—6", mostly convolute, sometimes flat, up to ·15" rarely ·25" broad, sheaths usually with a few cilia near the mouth. Panicle narrow or ovoid oblong, contracted or effuse, with alternate branches. Spikelets ·15—·65" long pale or purple, much compressed, ovate or ovate-oblong with 16—70 very close-set imbricating distichously spreading broadly elliptic or ovate (unfolded) glumes ·06—·1" long, which fall off with their paleas from below upwards; palea ovate as long as glume, keels near margin, scaberulous. Rhachilla tough, very nodose after fall of glume, but straight. Grain ellipsoid or obovoid, somewhat laterally compressed, ·03".

Common, mostly in wet ground. Purneah! Monghyr, Mokim! Santal Parg., Mokim, etc.! Ranchi, Wood, etc., common! Singbhum, very common! Hazaribagh, Clarke! Manbhūm, Camp.! Orissa, Walsh! No doubt throughout the province. Fl., Fr. Oct.—Dec. Annual.

This grass often strongly resembles superficially the English "Quaking Grass," (*Briza*). The lateral nerves of the flg. glumes are very prominent, their apices do not quite reach the margin. As the spikelets elongate the lower glumes fall away so that the glumiferous portion is usually only ·15—·3" rarely ·5" long.

7. *E. gangetica*, Steud. Syn. *E. elegantula*, Stapf. (in *F.B.I.*)

Stems 1—3 ft. high suberect or ascending, slender or rather stout. Leaves erect, flat or subconvolute, up to 6" by .17" nearly glabrous or with a few hairs at base and mouth of sheath. Panicle contracted or with long slender erecto-patent branches which again divide into erect filiform branchlets. Rhachis and pedicels often scabrid. Spikelets .2—·3" long (or sometimes after fall of lower gls. elongating to .5") on 0—·2" long pedicels (terminal longer), rhachilla only slightly zigzag but with distinct internodes. Flg. gls. cymbiform somewhat acuminate .06—·08" long, sometimes minutely scaberulous or pulverulent. Anthers .02—·03" long. Grain oblong or narrowly ellipsoid, longitudinally striolate, .03" long.

Behar, *J.D.H.*, "pratis ubique"! Edge of hot springs, Monghyr, *J.D.H.*! Santal Parg., *Nusker*! Gya, *Mokim*! Ranchi, *Mokim*! Hazaribagh, *Wood*, also Parasnath ascending to 4200 ft., *Clarke*! Palamau, elev. 2000 ft.! Angul, *Lace*! Fl., Fr. April—Dec. Perennial.

It is very similar to *E. stenophylla* in the character of the panicle and the slatey-blue spikelets, but the longer striolate grain is correlated in all the specimens with the longer usually more acuminate glumes and slightly stouter pedicels than occur in *stenophylla*.

8. *E. stenophylla*, Hochst.

Very slender, tufted, erect or geniculate at the base, 6"—2 ft. high. Leaves flat or mostly convolute, attaining 8" by .1", usually hairy at base and mouth of sheath. Panicle 2—8" long, usually oval and effuse, sometimes contracted when old with very slender or capillary branchlets and close erect or suberect slatey-green or -blue spikelets .15—·25" long; pedicels 0—·3" long (terminal sometimes longer) smooth; rhachilla zigzag with distinct internodes but rather rounded angles. Flg. glumes membranous ovoid or ellipsoid acute, sometimes after falling leaving the rhachilla entirely clothed with the paleas, .04—·06" long, back convex, lateral nerves not strong; palea .03—·05", marginal keels scabrid. Grain usually broadly ellipsoid and often oblique at the base, rarely sub-globose, shining light-brown, not striolate, .01—·02" long.

Very common, usually near the sandy beds of rivers or in nalas, throughout the province. Shahabad, *Levinge*! Monghyr, *Mokim*! Santal Parg., *Kurz*, *Gamble*, etc.! Ranchi, *Clarke*, *Wood*! Manbhum, common, *Camp.*, *Clarke*! Hazaribagh, *Clarke*! Singbhum! Puri, several times collected! Fl., Fr. Oct.—Jan. Annual.

Lower leaf sheaths usually loose, ligule of sparse slender hairs.

9. *E. elongata*, Jacq.

Stems tufted, variable in height (6—12" in our specimens) geniculate at base with very narrow flat or convolute leaves bearded at the base and mouth of sheath. Spkts. long .25—·5" long usually close-set on short distant spreading branches. Flg. gls. .07—·09" long, rather suddenly acute, lateral nerves distinct when dry. Rhachilla rather stout with short internodes, angular. Grain sub-globose .021—·025" diam. or broadly ellipsoid .03—·037" long.

Manbhum, *Campbell*!

Palea curved nearly as long as glume, suddenly acute or almost apiculate, margins reduplicate minutely ciliolate.

10. *E. major*, Host.

Erect or ascending at base 1—2 ft. high, usually branched with flat rather flaccid leaves 3—7" by .15—'3", very acuminate from above the middle, margins with small circular glands. Panicle oblong or ellipsoid, rather stiff, the spikelets (somewhat resembling those of *amabilis*) suberect, rather regularly alternating on the branchlets, oblong, or ovoid-oblong, .2—'3" long, by about .1" broad at base, on pedicels mostly under .1" long. Gls. i. 1—3-nerved, ii 3-nerved, ovate; fig. gls. rather large, .07—'08" long, broadly ovate and concave, scarcely keeled though midrib strong, scarcely reaching the rounded tip, side-nerves strong. Paleæ remarkably persistent, often clothing the whole rhachilla after fall of the glumes and sometimes semi-amplexicaul with their reduplicate margins, broadly obovate, much curved with scabrid or ciliolate keels. Grain brown, quite globose, slightly striolate, .02" diam.

Bhagalpur, *Cal. Herb.*! Monghyr, *Mokim*! Gya, *Clarke*, etc.! Ranchi, *Wood* (from garden)! Fl., Fr. May—Dec. Annual.

L. with sheath sparingly bearded. Panicle mostly effuse, branches solitary or nearly so, pedicels scabrid. Spikelets grey. An easily recognised species.

11. *E. minor*, Host.

A much more delicate plant than *E. major*, which it closely resembles except in smaller dimensions. Stems 6—18", slender. Leaves 2—5" long by .2" or less sometimes incurved (probably pressed after wilting), finely acuminate, margin with small disciform glands as in *major*. Panicle ovate or oblong, branches solitary capillary, branched from near the base. Spikelets .12—'3" long on slender mostly short pedicels, up to 12-flid. Gls. .06" long or slightly less upwards, broadly ovate rounded as in *major*, midrib reaches margin. Grain not quite so globose as in *major*, but similarly microscopically striolate and .02—'022" long.

Behar (probably Shahabad), *Levinge*! Purneah (near, at Maldah), *Clarke*! Santal Parganas, *Mokim*! Monghyr, *Mokim*! Fl., Fr. April—Oct. Annual.

I would call this a form of *E. major*, though it is supposed to differ by gls. i and ii being both 1-nerved. Mouth of leaf-sheath slightly bearded.

12. *E. tremula*, Hochst.

A slender grass with tufted stems 1—2 ft. high with large very effuse and lax ovoid panicles somewhat resembling *amabilis* but spikelets much narrower (linear) and longer, .25—1" long on capillary solitary pedicels, axils of panicle-branches with long cilia. Paleas persistent.

Subsequent, in dry sandy places. Shahabad, *Levinge*! Gya, *Mokim*! Ranchi, *Clarke*, etc.! Hazaribagh, *Prain*, (Damodar River), *Clarke* (Parasnath)! Singbhum! Puri, *Walsh*! Sambalpur! Fl., Fr. Aug.—Nov. Annual.

Leaves up to about 9", suberect, usually convolute, sometimes flat and .15" broad, base of blade and mouth of sheaths villous. Panicle-branches all solitary, filiform. Spikelets 10—70-flowered. Flg. gls. .06—'07", closely imbricate, broadly ovate (when unfolded), subobtus. Rhachilla zigzag with rounded corners (flexuous), bearing the sub-permanent paleas after fall of the glumes, internodes thickened upwards. Palea a little shorter than glume, keels scabrid. Grain globose pale .02".

13. E. pilosa, Beauv.

Very slender with mostly simple stems (clustered at base) 3"—3 ft. high. Leaves attaining 4", rarely over 1" at base, tapering from base to apex, base and mouth of sheaths with cilia up to .15" long. Panicles open, rarely contracted, usually exceedingly delicate with very capillary branches and slender spikelets, at other times rather stouter. Branches of panicle in rather distant pseudo-whorls, usually with long cilia at their axils. Spikelets mostly purple or grey, .15—.17" or over .2" after fall of some of the glumes. Glumes laxly arranged on the slender sharply zigzag rachilla, the angles of the zigzag nodose with the minute bases of the glumes and flowers. Flg. gls. .04—.05" long, ovate (when unfolded) subacute, very thin, lateral nerves weak. Palea with recurved sides, nearly as long, some sub-persistent, others quickly falling, keels sparsely scaberulous. Grain .02—.03" long, oblong with one side straighter than the other and sometimes with a small apiculus at base of it, brown.

Mostly in sandy ground. Gya, *Clarke*, etc.! Monghyr, *Mokim*! Hazaribagh, *Clarke*! Singbhum! Manbhum, *Camp*, *Clarke*! Ranchi, *Wood*! Orissa, *Walsh* (probably Puri)! Fl., Fr. Aug.—Jan. Annual.

Gl. i ls very minute, nerveless and hardly .01" long.

14. E. coromandelina, Trin. Syn. Poa coromandelina, Koen.

A tufted erect wiry grass 12—20" high with a number of dry leaf-sheaths at the base of stem. Leaves 1—4" filiform, convolute, puberulous all over the inner surface, radical often recurved, cauline erect or slightly curved. Spikelets grey .2—.35", rarely .5" long, on one side of the rachis but suberect and inclined alternately to either side, close set or over their own length apart below. Gl. i oblong-lanc. 1-nerved with scaberulous keel, .08" long; ii subequal but broader and more obtusely keeled; flg. gls. .09", ovate, somewhat tapering upwards to an obtuse or acute tip, lateral nerves very weak; palea .06", reduplicate or concave towards rachilla, keels slender, not quite marginal, minutely ciliolate. Grain broadly ellipsoid .025—.03" long, minutely striolate, sometimes obtusely 3-gonous.

Dry pastures and rocky places. Purneah, *Kurz*! Santal Parg., *Nusker*! Ranchi (Damuda ghats)! Hazaribagh, *Prain*! Manbhum, common, *Camp*! Fl., Fr. Sept.—Dec. Perennial.

According to *F.B.I.* the rachis of spike is slender terete and smooth, but it is angled and grooved on the side of the spikelets and sometimes scaberulous. The grain is described as shortly ellipsoid or subovoid, obtusely 3-quetrous, with epicarp loosely reticulate.

Var. or nardoides ?

Four sheets from Gya and Hazaribagh (near Parasnath, 1000—3000 ft. elev.) are called *nardoides* in *Herb. Cal.* They appear only to differ in the longer leaves (attaining 8"), but they are all puberulous on upper (inner) surface.

15. E. nardoides, Trin.

A densely tufted grass with long erect filiform leaves 6—9" with very delicate long scattered or grouped hairs which project from between the involute margins chiefly below the middle, also sometimes minutely

puberulous above. Spike long slender 6—10" with a smooth terete rhachis and many close-set erecto-patent spikelets .3—5" long by .06" wide at base. Flg. gls. turgid, .07" long; gls. i and ii subequal, acutely keeled. Grain ellipsoid-oblong with oblique base, striolate.

Gya, Mokim! Hazaribagh, Clarke! also on Parasnath, Clarke! (*Kew Herb.*). These are not the same sheets as are doubtfully referred to under *coromandelina*. It is possible that the long hairs are deciduous.

16. *E. brachyphylla*, Stapf.

Erect 10—18" high from a tuft of old fibrous leaf-sheaths and short linear flat or conduplicate leaves 2—4" long by .08—1" wide, obtuse or subacute. Spikelets .2—75" long, close-set, linear or linear-oblong, secund, 2-seriate, lenticular in section, in long simple terminal spikes 3—8" long. Glumes closely imbricate, i and ii .05—06" long, subequal; flg. gl. .08—1" long, rather turgidly broadly ovate (when unfolded) with rounded tip or obtuse, lateral nerves very weak, midrib microscopically scabrid; palea as large, somewhat obovate, concave towards rhachilla, keels scabrid. Grain .02—025", shortly ellipsoid, obscurely 3-gonous, reticulate.

Monghyr, Ham! Singbhum, on high ground! Fl. Aug.—Sept. Perennial. Leaves nearly all radical.

11. DESMOSTACHYA, Stapf.

Spikelets much compressed, imbricate, secund sessile and *articulate* on the very short densely crowded branchlets of a tall narrow racemiform panicle, acute and deciduous; rhachilla subarticulate.

Other characters of *Eragrostis*.

1. *D. cynosuroides*, Stapf. Syn. *Eragrostis cynosuroides*, Beauv.

Rather stout 1—3 ft. high from a vertical deeply subterranean root-stock. Leaves up to 18" and 2" wide, tips setaceous, margins minutely scabrid, mouth of sheath with or without long hairs. Panicle strict racemiform, linear or oblong 3—12" long by .25—1.25" broad, grey-green bearing densely secundly arranged spikelets .25—3" rarely .5" long in 2 series along the 1—3-nate short branches of which the lower are about .7—1" long or less, or spikelets borne direct on the main rhachis above. Glumes 15—30; ii twice as large as i; flg. gl. .6—07" long, ovate obtuse or apiculate when unfolded, lateral nerves reaching about half way to margin.

In open grass lands. Behar, Hope! Shahabad, Levinge! Gya, Mokim! Monghyr, Mokim! Santa! Parg., Nusker! Ranchi and Palamau, near Neterhat, elev. 2000 ft.! Fl. Fr. June—Nov. Perennial.

Panicle sometimes interrupted at base and narrowly pyramidal, branchlets glabrous or hispidulous. Flg. gl. rather coriaceous, keels scaberulous. Palea nearly as long, reduplicate, keels microscopically scabrid. Grain obliquely ovoid, obscurely trigonous. Rhachilla easily disarticulate.

12. DIPLACHNE, Beauv.

Tall perennial grasses with narrow flat or convolute leaves. Spikelets many-fl. spicate on the slender simple branches of a tall simple

panicle; rhachilla jointed at the base and beneath each fl. gl., not produced beyond the uppermost glume. Glumes many, i and ii unequal, obtuse, membranous, 1-nerved, persistent; flg. gls. rather longer, oblong, 1-3-nerved, tip 2-4-toothed, mucronate or awned; palea linear. Lod. broad. Stamens 3 with short anthers. Styles distinct. Grain ovoid-oblong, subtrigonus, free within the gls. and palca.

1. *D. fusca*, Beauv.

A tall grass 3-5 ft. with long narrow smooth leaves and large membranous lacerate ligule. The panicles are 6-18" long with long erect, finally nodding, branches. Spkts. .3-.4" long, linear, 4-10-flid., very shortly pedicelled. Gls. i and ii with cross tips and nearly smooth keels; flg. gls. .12" long, 4-toothed at tip and aristulate by the excurrent midrib, lateral nerves inconspicuous submarginal.

In swamps. It has a wide distribution and occurs all round our area, near Purneah and the north-west provinces, Calcutta and the peninsula; it will probably therefore be found inside the province.

13. ELYTROPHORUS, Beauv.

An annual erect grass with narrow flat leaves. Spikelets very minute in globose or ovoid sessile clusters densely or interruptedly packed along a central rhachis and forming a long more or less cylindrical often lobed or interrupted spiciform panicle; each cluster consists of very many densely crowded sessile compressed spikelets with awned glumes subtended by many empty glumes, not jointed at the base; rhachilla jointed at the base and between the flg. glumes. Glumes of perfect spkts. 5-7; i and ii subequal empty membranous, mucronate, keeled, 1-nerved, persistent; flg. gls. rather larger, narrowed into short awns, 3-nerved, uppermost empty; palea complicate, one or both keels winged. Lod. 2, obliquely oblong. Anthers 1-3 minute. Styles free, stigmas long hairy. Grain obliquely oblong, beaked free.

1. *E. articulatus*, Beauv.

A tufted erect usually small grass 6-10" high, sometimes up to 18". Leaves .5" to as long as the plant, up to .1" wide. Spiciform panicle often flowering to the base, cylindrical .2-.4" wide or lobed with the more unequal and oblong clusters, bright-green. Fl. glumes strongly 3-nerved with the scaberulous awn about as long as the .06-.07" long blade, palea .04-.05" long and with the wings nearly as broad above, wings sometimes lacerate.

Rice-fields, common. Purneah! Ranchi, Prain, Gamble! Singbhum! Manbhum, Camp. Fl., Fr. Nov.-Dec.

14. TRITICUM, L.

Annual or perennial grasses with flat leaves. Spikelets sessile tumid, distichously spicate with their sides opposite recesses in the articulate or inarticulate rhachis, solitary in the cavities. Glumes few, rigid, often unequal-sided; i and ii empty, obtuse or shortly awned, few-nerved, persistent; flg. gls. oblong or ventricose, dorsally rounded or

keeled above, awnless or 1—3-awned, 5—9-nerved, lateral nerves not conniving with the central; upper fl. male or neuter; palea with ciliate keels. Lod. entire, ciliate. St. 3. Styles very short. Grain grooved ventrally, often hairy, free or adhering to the palea.

1. *T. sativum*, Lamk. Syn. *T. vulgare*, Villars; Gehun, giun, H.; Gom, Beng. Wheat.

Wheat is commonly grown in the province, but mainly in the Northern area along the Gangetic plain, especially Patna, Shahabad, Monghyr and Bhagalpur. Very little is grown in the Central area and hardly any in the Southern, the last chiefly an inferior red grain.

15. HORDEUM, L.

Erect annual, rarely perennial grasses with flat leaves. Spikelets sessile in 2—more rows spicate in the recesses or at the nodes of a simple inarticulate rhachis, 2—3-nate with the plane of the spkts. tangential to the rhachis, the lateral often imperfect, rhachilla jointed at the base of the flg. gl. and produced above it with sometimes an imperfect glume. Glumes 3, i and ii empty very narrow, rigid, persistent, the outer of each cluster of spkts. together often resembling an involucre; iii 2-sexual dorsally rounded, 5-nerved above, narrowed into an erect or recurved awn; palea 2-keeled. Lod. ciliate. Stamens 3. Styles very short. Grain grooved in front, tip usually villous, adherent to the palea or not.

1. *H. vulgare*, L. Jau, Vern. Barley.

Barley is very little grown in the province. Small crops are found in the Gangetic plain and also in Chota Nagpur. Soane Valley, J.D.H.!

Hooker's specimen is var. *hexastichon* with spikelets in 6 ranks. L. scabrellous on nerves. Spkts. 4—5" long to base of the long awn, fertile smooth or nearly so, abortive spkts. pubescent ending in filiform awns. Awn of fertile spkts. projecting some 4—5" beyond the ear, very stout, flattened and spinulosely scabrid.

16. OROPETIUM, Trin.

A very small caespitose grass with filiform leaves and very minute distichous spikelets half immersed in the alternating cavities of the rhachis of a simple slender curved inarticulate spike; rhachilla bearded, articulate at the base. Glumes 3, i and ii empty, persistent; i very minute, hyaline appressed to rhachis; ii linear-lanceolate, rigid, recurved in fruit, tip obtuse or emarginate; iii shorter, broader, hyaline, obtuse or truncate, 1-nerved; palea narrow, keels smooth. St. 3. Styles short. Grain oblong, terete, free.

1. *O. Thomseum*, Trin.

A curious little grass, the whole plant only 2—3" high forming dense hard tufts with filiform leaves .5—.75" long, ciliate with long hairs, ligule lacerate. Spikes .75—1.5" long, solitary, or fascicled on very short branches, slightly curved with a flexuous flattened rhachis, the spikelets in the undulations of the narrower sides; gl. i very minute; ii .05" long, slightly recurved and convex; iii very thin, curved inward, .04" long slightly exceeding the small oblong grain.

On old walls. Gya! Monghyr, Mokim! Fl., Fr. Sept.—Oct.

17. MICROCHLOA, Br.

Slender perennial grasses with filiform convolute leaves. Spikelets very narrow, minute, 2-seriate and unilateral on a solitary terminal filiform somewhat curved spike, not jointed at the base; rhachilla jointed at base not produced beyond gl. iii. Gl. 3, i and ii empty, membranous, 1-nerved, keeled persistent; iii very small, oblong, hyaline, palea as long, with ciliate keels. Lod. truncate. Anthers linear. Styles distinct. Grain oblong fusiform, glabrous, free within the hyaline glumes.

1. *M. setacea*, Br.

A very small grass only 3—6" in our specimens (6—10", *J. D. H.*) with tufted very slender stems and filiform leaves .3—.75" long, glabrous striate and with about 3 fine raised nerves, blades often curved. Spike 1—4" long very slender, rhachis flattened with rounded back. Spikelets .07—.08" long erect, close-set. Gl. i and ii subequal, as long as spkt. with a very narrow opaque center looking like a double nerve and hyaline margins, linear-lanc., acute; iii on very minute rhachilla, about three-fourths to four-fifths as long as i and its palea villous (nerveless, *F. B. I.*, but both it and its palea appear to me 2-nerved).

Gya, Mokim! It usually grows on old walls according to *Roxburgh*.

18. GRACILEA, Koen.

Small grasses with short leaves. Spikelets in deciduous clusters which are secund and jointed on the filiform flexuous rhachis. Upper spikelets in the cluster sometimes imperfect. Rhachilla not jointed at the base, sometimes produced between the glumes and beyond the last imperfect glume and bearing empty glumes. Glumes 4—6 altogether, i narrow rigid long-ciliate, produced into a long rigid scabrid awn; ii broader with broad hyaline margins, ciliate, awned; iii broadly ovate or -oblong, membranous, 3-nerved, 1—3-awned or 3-cuspidate, usually 2-sexual, palea nearly as broad, 2-cuspidate; iv smaller, usually male. Lod. cuneiform. Anthers small. Grain oblong, free.

1. *G. Royleana*, Hook. f.

A pretty little grass 3—8" high, with filiform leaves .5—1" long more or less convolute often sparsely ciliate, sheaths rather loose, with scattered long hairs with minute tubercle-bases. Clusters .15—3" long (exc. the awns), 1—6 rather remote on the flexuous rhachis. Gl. i (with its awn) .3" long, densely ciliate on to the awn; iii elliptic-oblong, 3-cuspidate or 1-awned and 2-cuspidate, .2" long with the cusps, palea narrower, 2-cuspidate, as long; iv on a short extension of the rhachilla, and its palea .1" long, both shortly awned. Rhachilla produced above iv for .05—.06" and bearing 2 short empty awnless glumes. Grain .06" long.

Behar, Hope! Gya, Nusker! Fl. Oct. Annual.

19. TRIPOGON, *Roth.*

Slender densely tufted grasses with usually convolute leaves. Spikelets 2-seriate and unilateral on a very slender terminal spike, not jointed at the base, bearing several flowering glumes and 1—2 terminal imperfect; rhachilla produced between the glumes and *jointed at the base and below each glume. Gl. i and ii unequal, 1-nerved, empty, persistent, i usually appressed to the rhachis or lodged in a furrow in the rhachis, often toothed or lobed on one side; ii entire or notched below the mucronate or subaristulate tip; iii and other flowering glumes dorsally convex, 2-fid and awned from the keel or 4-fid with the outer lobes awned, the inner membranous and rarely awned; palea complicate. Lod. 2. St. 2—3. Styles very short. Grain narrow, free.

1. *T. capillatus*, *Jaub. & Spach.*

A densely tufted wiry grass 8—10" rarely 20" high with filiform leaves 4—10" long. Spike 4—12" long filiform, flexuous. Spikelets alternate distichous greater than their length apart with 2—4 flowering glumes. Gl. i .1" long acuminate; ii .2" long, subaristate; rhachilla .04—.05" long between the fl. glumes which are bearded at their base, lanceolate, 3-nerved, 2-fid, .2" long with keel produced into a slender awn .3—.6" long; palea lanceolate, 2-nerved, .1" long. Grain narrowly terete, brown, .05—.07" long. Rhachilla ending in 2 small imperfect glumes.

On stems of trees or rocks. Parasnath, *Clarke, Kurz!* Fl., Fr. Sept.—Oct.

Stem at base clothed with leaf-sheaths. L. usually only 4—6" by about .12", involute when dry. Spkts. .2" long. Gl. i .15—.17". Awns of fl. gls. .3—.5" or more.

2. *T. Jacquemontii*, *Stapf.*

This may be found in our area as it occurs in Central India, Deccan, Madras, and there is one specimen of *Griffith's* from Bengal, district unknown. On rocks. Fl. Oct.

A tufted grass with slender stems 1—2 ft. high and longer leaves than the last. Spkts. large up to .8" long, but awns shorter than their glumes which are about .1".

20. CYNODON, *Pers.*

Perennial, creeping or ascending, with narrow flat leaves. Spikelets minute, unilateral and 1—2-seriate on slender digitate spikes, not jointed at the base; rhachilla jointed at the base, sometimes produced beyond gl. iii.* Glumes 3, i and ii empty, thin, keeled, persistent or separately deciduous; iii broader (and larger in our species), membranous, awnless; palea as long, 2-nerved. Lod. short. Anthers large. Styles distinct. Grain oblong, free within the glumes.

* The *Flora British India* says that the rhachilla is not produced, or, if produced, then at the back of gl. iii only. I have, however, several times found it not only produced but bearing a minute rudimentary glume, so that I had named a specimen I sent to *Cal. Herb.* in 1889 *Chloris* sp. There it was correctly matched with *Cynodon dactylon*. The rhachilla is not at the back of gl. iii but in the normal position.

1. **C. dactylon**, Pers. Syn. Chloris Cynodon, Trin* ; Panicum dactylon, L. ; Dub, H. ; Dubi, Dhobi-ghas, K., S.

A rather variable creeping or ascending grass with stems widely spreading and frequently matted, at other times very slender and ascending among other grasses. Leaves on the prostrate stems usually very short, spreading, subulate, glaucous, .5—1.5", on the ascending stems up to 3" by .08—2", linear or lanceolate-acuminate; ligule hardly any or of hairs. Spikes 2—8, .5—3.5" long (sec var.), rhachis flattened, sometimes slightly winged. Spikelets very close, .08" rarely .09" long; gl. i .06" long, narrow, conduplicate acute; ii .03—04", similar; iii largest very broadly cymbiform with softly ciliate keel sometimes making the glume mucronulate, palea much narrower, strongly 2-nerved. Rhachilla sometimes produced to half the length of gl. iii and bearing a minute rudimentary glume. Grain brown, oblong or fusiform-oblong, .04—05" long.

On sandy soil throughout the province, but only on damp ground in the dryer districts! Fl., Fr. most of the year according to locality.

One of the best fodders, perhaps the best for horses, but rather difficult to collect, and it requires beating and winnowing to get rid of the dirt.

It extends into Europe and is the English *Dog's Tooth* grass, the German *Hundszahn* and the American *Bermuda Grass*. A preparation is applied by the Santals in a parasitic disease which attacks the spaces between the toes, *Campbell*. *Nadkarni* states that the fresh expressed juice of the grass is astringent. It is also used in India (as on the Continent, where it is officinal) as a diuretic and urinary sedative in cystitis and other diseases.

Var. suberectum.

A stout very nearly erect tufted form 10—15" high with long stolons. Leaves 2—3" long, by .15—22" broad, acuminate, rather strongly 3-nerved each side of midrib. Spikes 5—8, 2—3.5" long. Spkts. .09" long, 1-seriate, imbricate.

Singbhum! Rajmahal Hills, Kurz!

21. **CHLORIS**, Sw.

Perennial rarely annual, with usually flat leaves. Spikelets 2-seriate closely unilaterally arranged on solitary fascicled or shortly spicate spikes at the top of the stems, sometimes minutely pedicelled, not jointed at the base; rhachilla jointed at the base and usually produced beyond gl. iii and bearing 1 or more empty glumes. Gl. i, narrow 1-nerved, keeled, acute, usually posterior; ii larger, often shortly awned; iii 1—3-nerved, acute, obtuse or 2-toothed, usually awned; palea rather shorter, 2-nerved, complicate. Lod. 2. Anthers small. Styles free. Grain narrow, free, often with loose pericarp.

A. Rhachilla not at all produced beyond gl. iii:—

Awn of iii .7—1" long

1. *pallida*.

B. Rhachilla produced beyond gl. iii:—

1. Gl. at the end of rhachilla reduced to simple awns (or gl. very minute, flat in *incompleta*):—

Annual, simple. Spikes 1.5—2.5". Awns on rhachilla 2—3 2. *delicatula*.

* In view of the frequent presence of a rhachilla produced beyond gl. iii, the absence of an awn is the only character separating this and *Chloris*, but the upper glumes of *Chloris* are usually better developed.

- Perennial, tufted. Spikes 4—7.5". Awn on rhachilla 1 . 3. *incompleta*.
 2. Rhachilla bearing 1—2 awned tubular or inflated
 glumes:—
 Gl. ii shortly awned. Barren gl. i, semi-tubular 4. *virgata*.
 Gl. ii awnless. Barren gl. ii, subglobose 5. *barbata*.
 3. Rhachilla bearing 3—4 barren glumes. Spkts. 4-awned
 altogether 6. *montana*.

1. *C. pallida*, Hook. f.

A slender tufted grass 10—18" high with erect very narrow linear leaves 4—8" long by .08—1" broad, sparsely hairy inside towards the base and ligule of a few hairs, tip filiform. Spikes 1—3 erect digitate 3—5" long by .15—2" broad, yellow, closely pectinate with the two rows of erect-patent long-awned spikelets. Spikelets narrow tapering, about .1—1.2" long without the awns; gl. i .15—1.7" including the short awn, lanceolate; ii .13" also with a short awn, both thinly hairy on keels; iii silky and with bearded base, .08" without the long .7—1" awn, tip minutely notched; palea much narrower, ciliate on keel. Grain linear .05", including the pericarp which is produced beyond the seed.

There is no production of the rhachilla beyond gl. iii and no rudimentary glume iv.

Hazaribagh, *Anders.*! Manbhum, *Camp.*! Fl. Sept. Annual.

2. *C. delicatula*, Clarke.

A very slender erect grass 4—12" high, stems simple or with 1—2 erect branches from near the base. Leaves short spreading, concave or convolute, .3—1" long, none from the root at the time of flowering. Spikes 5—10, very slender, erect, 1.5—2.5" long, closely spicate at the top of the stem. Rhachis capillary scabrid with light-coloured center. Spikelets .1" including the subaristate tip of gl. ii; i turned towards the rhachis .08" long very slender acuminate, not awned; iii .06" long, delicately hairy on back, tip 2-lobed, awn very fine .3" long; palea very narrow, glabrous. Rhachilla produced beyond base of iii to half its length or rather more, and bearing at its tip 2, rarely 3, very fine awns nearly as long as the awn of iii.

Hazaribagh, *Clarke* (the type). Manbhum, common on high lands, *Camp.*! Fl. Oct. Annual.

3. *C. incompleta*, Roth.

A tufted grass 2—4 ft. high. Stems clothed at base with old leaf-sheaths, glabrous. Leaves linear up to 15" long by .45" wide, flat, glaucous scaberulous, often also shortly pilose towards base; ligule of long hairs. Spikes 4—10 digitate, often widely spreading, 4—7.5" long, .06" broad (without the awns). Spikelets 2-seriate minutely pedicelled, the pedicel decurrent on rhachis. Gl. i one-fourth to half ii, very narrow with subaristate tip; ii .2", including the short awn, sometimes much shorter, notched at the tip; iii with the rhachilla bearded at its base, equals ii, dorsally flattened, lanceolate, with incurved margins, minutely 2-toothed at tip, awn .25—4" long. Rhachilla produced above base of gl. iii and bearing a minute glume and an awn .2" long.

Karakpur Hills, Monghyr, *Kurz!* Hazaribagh, *Clarke!* Damp places in the forest, where it attains its greatest development, *Palamau!* Puri, *Walsh!* Fl. Oct.—Nov. Perennial.

Sheaths often very hairy. The spikelets in our specimens are mostly nearly $\cdot 2''$, but *Hooker* states that they are found as small as $\cdot 12''$. The rhachilla is produced to about half the length of gl. iii.

4. *C. virgata*, *Sw.*

A tufted leafy grass 1—2 ft. high, decumbent and often proliferously branched below. Leaves often reaching top of stem, up to $\cdot 15''$ broad, sparsely ciliate; sheaths rather loose and keeled; ligule of hairs. Spikes 6—15, erect, crowded at the end of the peduncle, 2— $2\cdot 5''$ long, rhachis minutely hairy. Spikelets $\cdot 1$ — $\cdot 13''$ excluding the awns, 3-awned including that of II (2-awned, *J.D.H.*). Gl. i slender subulate, about half ii; ii $\cdot 1''$ or with the delicate awn $\cdot 15$ — $\cdot 17''$ (always more or less awned); iii cymbiform and rather deep, or when unfolded ovate, $\cdot 1$ — $\cdot 12''$ long, base shortly bearded, tip acute or 2-toothed and ciliate with long erect hairs below the tip sometimes extending to the middle and sometimes with a few cilia below, keel produced into an awn $\cdot 4''$ long; palea much narrower and rather shorter, often reduplicate, toothed or notched. Rhachilla somewhat adnate to iii, shortly produced, $\cdot 03$ — $\cdot 04''$ long, bearing a curious semitubular or bucciniform truncate glume $\cdot 06''$ long with 2 minute auricles at tip and an awn $\cdot 3''$ long. Grain fusiform, sometimes slightly curved, $\cdot 06$ — $\cdot 07''$ long, pericarp loose.

Frequent. Sometimes on old brick walls. Santal Parg., *Kurz,* etc.! Monghyr, *Mokim!* Gya, *Mokim!* Ranchi, *Wood!* Fl., Fr. Sept.—Nov. Annual.

I doubt the specific value of the number of upper empty glumes. Some specimens of *virgata* at Kew have 2 empty glumes.

5. *C. barbata*, *Sw.*

Rather a robust species ascending 1—3 ft. high from a usually very geniculate much proliferously branched base. Leaves long, 6— $15''$ by $\cdot 12''$ smooth or scaberulous, hairy at base and at top of sheath or not, ligule very narrow. Spikes crowded 6—20 erect at the top of the stem, 1— $3\cdot 5''$ long, easily recognised from the balloon-like appearance of the barren glumes, rhachis scaberulous. Spikelets minutely pedicelled; gl. i about $\cdot 05''$; ii not awned, $\cdot 08''$; iii obovate and rounded when opened out, $\cdot 1''$ long, very ciliate above the middle, awn $\cdot 2''$; palea broadly lanceolate or obovate; rhachilla adnate then free, short, bearing 2 curiously inflated or very concave obtuse or obovate (when opened out) truncate glumes, lower $\cdot 03''$ with awn about $\cdot 15$ — $\cdot 17''$, upper shorter subglobose with shorter awn.

Purneah, *T. Anders.!* Santal Parganas, *Mokim.!* Puri, *King, Walsh!* Fl. Oct.—Nov. Perennial.

6. *C. montana*, *Roxb.*

This is recorded in *Bengal Plants* as from Western Behar, apparently on account of its general distribution, as no specimens from that region appear to be either at Kew or Calcutta, but there are some from the Upper Gangetic Plain.

The spikes are 2—6 only, rhachis glabrous. Gl. i and ii both finely acuminate or ii shortly awned; iii ovoid acute, $\cdot 09$ — $\cdot 1''$ long, upper margins more or less thickly bearded as in *virgata*, awned; iv much smaller cuneate, conduplicate and

embracing v and vi, awned from the truncate tip; v cuneate or subglobose, small and enclosing the still smaller or minute gl. vi, both awned. Rhachilla jointed at base only.

22. ELEUSINE, *Gaertn.*

Annual or perennial, leaves usually flat. Spikelets often crowded, closely 2—3-seriate and unilateral or secund on digitate capitate or subverticillate spikes, laterally compressed with their sides to the rhachis, not jointed at the base, rhachilla with internodes between the fig. glumes, not jointed. Glumes few or many, keeled; i and ii shorter than the flowering, persistent, subequal or unequal, i lanceolate, ii lanceolate, acute or acuminate or awned, or very broadly ovate, or didymous with a short stout recurved awn; fig. glumes several (uppermost often smaller and imperfect), like the empty, 3-nerved or sometimes obscurely 5—7-nerved; palea complicate or reduplicate, keels strong. Lod. 2, cuneate. Anthers 3, short. Style short, distinct. Grain free, oblong or globose, pericarp hyaline, loose, seed rugose or smooth.

A. Glumes not awned. Spkts. mostly pointing forward;—

Spikes slender, nearly glabrous at base. Seed oblong obtusely 3-gonous

1. *indica*.

Spikes stout, often incurved, pubescent at base, seed globose.

2. *coracana*.

B. Glumes awned. Spkts. at right angles to rhachis. Seed subglobose, very rugose

3. *ægyptiaca*.

1. **E. indica**, *Gaertn.* Nandia, *Or.*; Kodai, *M.*; Bir kode, *K.*; Malankuri, *H.* (f. *Roxb.*).

A rather robust tufted annual 1—3 ft. high with loose sheaths and usually flat leaf-blades 3—12" long and up to 25" wide. Spikes 3—7 erect or spreading at the top of the stem with sometimes a subsidiary lower whorl, 2—5" long, the spikelets mostly pointing forwards (empty gl. i and ii often spreading after fall of the fruit). Spikelets up to 25" long, usually much smaller, 3—5-flowered. Gl. i about 07", 1-nerved; ii 3-nerved close to the keel, sometimes apiculate, not awned; iii—v (rarely more) 12", but decreasing somewhat in size upwards, cymbiform, obtuse, subobtuse or apiculate, nerves all in the keel, margins broad hyaline; palea shorter 2-nerved, reduplicate or margins reflexed. Grain 05—06" long, seed chestnut, oblong and obtusely 3-gonous with oblique base, transversely rugose, sometimes obscurely, tip obtuse or rounded.

Common, Purneah! Santal Parg., Nusher! Monghyr, Mokim! Ranchi, Wood! Manbhumi, Camp! Singbhum! Puri, Walsh! Fl., Fr. Aug.—Oct. Annual.

Peduncle glabrous below the spikes. Keel of glumes sometimes scaberulous.

2. **E. coracana**, *Gaertn.* Syn. *E. indica*, var. *coracana*, *J. D. H.* Marua, *H.*; Murha, *Beng.*; Kode, *K.*, *S.*; Mandia, *Or.* Also Mandua, Ragi, *vern.*

Stouter than *E. indica*, 2—4 ft. high with the leaves often far overtopping the stem 2—27" broad with compressed loose sheaths and ligule of hairs. Spikes 4—7, suberect with their ends or whole spike frequently incurved, rhachis of spikes often pubescent at base, somewhat 3-gonous, or back flattened. Spikelets much congested, awnless, 3—6-fl. Fig.

glumes more broadly ovate than in *indica*, and often with 1—2 nerves in the sides, variable in size, up to .2" long. Seed globose, dark brown, smooth in some varieties, at other times somewhat rugose, about .07" diam., with a depressed black hilum and slightly flattened on one side.

Cultivated only. Gya, *Mokim!* Monghyr, *Mokim!* One of the most frequent crops throughout Chota Nagpur and indeed throughout the province! Fl., Fr. Sept.—Nov.

This is probably the cultivated form of *E. indica* according to *Hooker* and others. It is often said to be a good fodder. This is not my experience, the leaves though soft have very tenacious vascular strands and I have noticed animals frequently reject them after chewing a few times. It is easily grown and the out-turn of grain very high and of good quality. The form with straight, not incurved, spikes is called *E. stricta* by *Roxburgh*.

3. *E. ægyptiaca*, *Desf.* Suntu bukuic', S.

Erect or geniculate at the base, 8"—2 ft. high, often proliferously branched at the thickened nodes. Leaves 2—6" long by .1—2" broad, rarely up to 10" long, ciliate on nerves or midrib and margins; sheath hairy or ciliate above. Spikes stout, 3—6, .5—1.3" rarely 2" long, spreading or suberect, peduncle hairy at base of spikes. Spikelets spreading at right angles from rhachis; gl. i acuminate, scabrid on keel; ii broadly ovate or suborbicular (when unfolded) suddenly contracted to a squarrose awn as long as itself, about .2" including the awn; iii to v usually perfect, shortly awned with awn about one-third the glume, keel scabrid; palea notched, nerves hispid; vi usually imperfect. Grain subglobose, flattened on one side of the hilum, which is not depressed, .03—.04" diam., very rugose.

Common as a weed of cultivation and in pastures.

Purneah! Santal Parg., *Kurz!* Gya, *Mokim!* Monghyr, *Mokim!* Chota Nagpur, common in Singbhūm! Hazaribagh, *Clarke!* Fl., Fr. Aug.—Nov. Perennial? Probably throughout the province.

The seeds are ground into flour, of which cakes are made and eaten in times of scarcity. It is a good fodder.

23. DINEBRA. *Jacq.*

An annual leafy grass with flat leaves. Spikelets small crowded 2-seriate unilateral on short or slender 1—2-nate or whorled spikes which are again spicate on the rhachis of narrow panicles, not jointed at the base; rhachilla jointed at the base and elongate between the glumes, produced beyond the flowering glumes and bearing an imperfect gl. (always?). Gl. 4—5, 2—3-flowering. i empty persistent, lanceolate, 1-nerved, awned or cuspidate; ii subequal or longer than i, similar; iii and iv very small, broadly ovate (when unfolded) hyaline, 1-nerved, subobtuse or subacute, neither cuspidate nor awned; palea as long, reduplicate, 2-nerved. Lod. 2. Anthers 3, small. Style free. Grain oblong or ovoid, acute, trigonous, free (*Hooker* says wrinkled; the ripe grains do not appear to me wrinkled).

1 *D. arabica*, *Jacq.*

Stems 1—3 ft. tufted, geniculate at base or erect. Leaves 3—8" by .15—.17", flaccid, finely acuminate, sparsely hairy. Panicles very various

in length and length of the spikes, 4—12" with close or distant spikes .5—2", which are opp., alt., or whorled, sessile, green or yellow, at first erect, then spreading or deflexed. Spikelets close imbricate on the broad flat rhachis; gl. i and ii .2" long (*Hooker* says ii one-fourth longer than i; they are subequal in my specimen), including the short aristate tip; iii and iv .08—1", palea nearly as long. Grain brown, 3-angled, oblong.

Behar, *Kurz!* Apparently rare.

24. LEPTOCHLOA, *Beauv.*

Annual grasses with flat or involute leaves. Spikelets very minute, laterally compressed, alternate and unilaterally 2-seriate on the very slender spiciform branches of a lax panicle, sessile or minutely pedicelled, not jointed at the base, rhachilla jointed at the base and beneath each glume, produced between each glume and often beyond the terminal. Glumes usually 2 (sometimes 1—) —many flowering, membranous; i and ii subequal or unequal oblong, lanceolate or almost linear-lanceolate, 1-nerved; iii and other flowering glumes ovate (when unfolded), subacute or obtuse, 3-nerved, 1 nerve in the keel and usually 1 near each margin; palea shorter 2-nerved. Lod. cuneate. Anth. 3, short. Styles free. Grain oblong obovoid subglobose or 3-gonous, invested by the glume and palea.

Spikes .5—3" rarely 4". Spikelets 2—3-fl., under .1"
Spikes 2—4". Spkts. 4—6-fl., .1" long

1. *filiformis*.
2. *chinensis*.

1. *L. filiformis*, *Roem. & Sch.*

Very slender 1—2.5 ft. high, tufted and geniculately ascending. Leaves flat, flaccid, 4—10" long, about .15—27" or less broad, sometimes sparsely hairy on the nerves and on the sheaths, ligule .02—03" long, erose or setosely lacerate. Spikes .5—3" or up to 4 or even 5" but exceedingly filiform with 2-nerved rhachis and spikelets only .06—08" long, distant nearly their own length on the rhachis on pedicels .01—03" long. Gl. i .03—04" linear-lanceolate; ii .05—06"; flg. glumes 2—3 rather shorter than ii, with median nerve and sub-marginal nerves microscopically hairy; palea rather shorter, reduplicate. Grain .02" fusiform-oblong, pericarp adherent but slightly produced each end.

Apparently throughout the province. Shahabad, *Levinge!* Gya, *Clarke, Mokim!* Monghyr, *Mokim!* Santal Parg., *Kurz!* Ranchi, *Prain!* Puri, *Walsh!* Fl., Fr. July—Nov.

2. *L. chinensis*, *Nees.*

Stouter than *L. filiformis*, 2—4 ft. high with leaves 6—18", flat or convolute, scaberulous, ligule short lacerate. Spikes 2—4" or more. Spkts. .1" long with 4—6 flowering glumes. Gl. iii obtuse and apiculate. Grain loose obtusely trigonous, subrugose.

Said to be throughout India in moist places. Hot springs, Monghyr, *J.D.H.!* Gya, *Clarke!*

Tufted. L. .2—3" broad, numerous, erect or spreading. Panicle 6—9" long. The two species are scarcely more than varieties.

25. AGROSTIS, L.

Perennial, rarely annual grasses with usually flat leaves and small or very small spikelets in effuse or contracted panicles with capillary whorled branches, not jointed on their pedicels; rhachilla not produced beyond gl. iii. Glumes 3 only, i and ii equal or unequal, keeled, 1-rarely 3-nerved, empty; iii fig., membranous, 5-nerved, truncate, glabrous, with awn dorsal or 0, callus glabrous or with minute hairs; palea nearly as long as its glume or shorter or 0, 2-nerved or nerveless. Lod. 2. Stamens 3. Grain free within the glume.

1. *A. brachiata*, Munro.

A very slender graceful grass 2—3 ft. high. Leaves 4—5" by .2—·25", broadly linear, sheaths glabrous, ligule membranous .06—·1" long. Panicle very effuse 6—12" long with brachiate flexuous branches up to 3—4". Spkts. .04—·06" long on capillary clavate, subequal divaricate pedicels, fertile gl. about equal to the empty obtuse cymbiform ones, 5-nerved, with median awn, callus glabrous. Palea minute. Grain oblong as long as the glume.

Monghyr, Ham. (Wall. No. 3739, part of B only)! It is mixed up on one sheet with *Sporobolus Wallichii* which is at once distinguishable by its much longer narrower leaves and the ligule.

26. SPOROBOLUS, Br.

Perennial rarely annual, with flat or convolute leaves and small or minute spikelets in effuse or close or spiciform panicles, articulate on their pedicels with very short rhachilla articulate at the base. Glumes 3 awnless, i and ii nerveless or 1—3-nerved, membranous, unequal, persistent or separately falling; iii 1-nerved, longer or shorter than i or ii; palea often splitting between the two very close nerves. Lodicules minute or 0. Stamens 2—3, anthers short. Styles short free. Grain loose within the glume and palea, pericarp or its epidermis loose, deciduous, rarely adherent.

A. Gls. i and ii much shorter than iii. Spkts. not crowded:—

1. Gl. ii not = $\frac{1}{2}$ iii:—

Very slender. Panicle usually effuse, sub-pyramidal. Spkts. .04—·06", rarely .07". Gls. i and ii truncate nerveless or ii acute

1. *diander*.

Stouter. Panicle oblong with short erect branches.

Spkts. .06—·09" long. Gls. i and ii obtuse 1-nerved

2. *indicus*.

2. Gl. ii = $\frac{1}{2}$ iii or more:—

Panicle decompound, effuse. Spkts. .07—·1". Gl. i minute truncate

3. *Wallichii*.

B. Gl. i shorter than ii and iii; gl. ii and iii subequal or ii rather longer:—

1. Perennial. Panicle contracted:—

Leaves with glabrous margins. Spkts. crowded

4. *tremulus*.

2. Annual. Panicle effuse. Leaves sub-spinulose ciliate (at least near base):—

Panicle oblong. Gl. i = $\frac{1}{2}$ ii obtuse. Gls. ii and iii broadly ovate

5. *pulchellus*.

Panicle pyramidal. Gl. i minute, under $\frac{1}{3}$ th ii, acute.

Gls. ii and iii ovate-lanceolate

6. *coromandelianus*.

1. S. diander, Beauv.

A tufted very slender grass 1—3 ft. high with very slender leaves up to 10" by 12" rather strongly (about) 7-nerved beneath. Panicle 4"—1 ft. long, lanceolar or narrowly pyramidal with spreading or erecto-patent capillary solitary and fascicled branches, often without spikelets at the base. Spikelets .04—.07" long. Gl. i and ii subsistent hyaline nerveless. i subquadrate, truncate and often erose, nerveless .017" long and as broad; ii .03" rhomboid-lanceolate, obtuse or acute (*F. B. I.* describes both as truncate!); iii length of spkt., it and its equally long palea gaping in fruit. Grain chestnut brown oblong or broadly obovoid-oblong, its pericarp (in boiled specimens) easily detachable.

Common. The following forms occur:—

α. Panicles up to 12" long, open, of numerous spreading almost capillary 1—3-nate branches 1.5—2.5" long which are again branched more than once, spkts. .05—.07" long. Ranchi, *Gamble, Wood*, etc.! Singbhum! Hazaribagh (spkts. only .06"), *Clarke!* Santal Parg. (Rajmahal hills), *Kurz* (spkts. only .05")! Fl., Fr. r.s.—Nov.

β. Panicles 6—10" long, linear-oblong with short patent or erecto-patent nearly simple branches .3—7" long only. Spkts. .04—.06" rarely .07" long. Ranchi, *Prain!* Manbhum, *Camp!* Puri, *Walsh!* Fl. Nov.

γ. Panicle 4—6" long much contracted with upright branches .25—.35" long, appearing more densely clothed with spikelets, all .06" long. Santal Parg., *Nusker!* Manbhum, *Camp!*

One of the Manbhum specimens is called *S. indicum* in *Herb. Cal.* and this apparently accounts for the Chota Nagpur locality of that species in *Bengal Plants* (no others have been received from Calcutta). But all these specimens are in young flower and it seems to me that the character of the panicle is due to that only. The forms α and β are probably due to differences in vigour of the plants. They are not correlated with differences in the shape of the fruit.

2. S. indicus, Br.

A somewhat stouter plant than *S. diander*, 2—3 ft. high with leaves 8—24" rarely 3" diam., margins smooth, ligule a few hairs. Panicle up to 15", always very narrow with short erect branches not exceeding 1" in length but not always separable from narrow states of *S. diander*. Spikelets a little larger, .06—.08 rarely .09". The fruit is described as broadly obovoid in contra-distinction to that of *diander* described as obovoid-oblong but the specimens do not bear this out, and ellipsoid-obovoid fruits are found in this species and almost globose ones in *diander*.

Manbhum, *Camp.* Said to occur throughout India, but this appears the only locality from our area, and it is so young that it is difficult to be sure of it.

3. S. Wallichii, Munro.

Tall erect with long leaves over 12" and only .07" wide, sheath densely shortly ciliate on the edges at least at the mouth, ligule short closely ciliate and base of blade somewhat hairy above it. Panicle very large, 12—18" with capillary compound branches up to 4" and very scattered spikelets .07—.08" rarely .1" long. Pedicels very unequal, the terminal much longer than lateral, not nearly so divaricate as in *Agrostis brachiata* (with which it is mixed on one sheet in the Wallich Collection), lateral .1—.2".

Monghyr, *Ham!* Santal Parg., Rajmahal Hills, *Wall.* (No. 3769a)! Fl. Aug.—Jan.

Panicle oblong or sub-pyramidal, decomposed, branches opposite and whorled, flowering toward the tips. Gl. i minute or about $\frac{1}{3}$ rd iii, truncate (when unfolded), ii = $\frac{1}{2}$ iii or longer, ovate, acuminate. Grain broadly obliquely obcordate, or oblong-obovoid and retuse, .03" long.

4. *S. tremulus*, Kunth.

A small grass from a minute herb 1" high only to 8" or rarely 12", erect, strict, often tufted, from a knotted stoloniferous rootstock. Leaves short erecto-patent .3—.75" rarely 1", about their own length apart, nearly up to the panicle. Panicle narrow 1—4" with erect branches, rarely a few spreading. Spikelets .07—.08" long crowded articulate on very short pedicels half their own length or less; rachilla readily disarticulate above the lowest glumes and these also separately falling. Gl. i about $\frac{2}{3}$ ths iii, lanceolate; ii and iii subequal. Grain oblong.

Patna, Wall. (No. 3770)! Manbhūm (Raneeganj), Kurz! In grassy places and ditches. Fl. May—Dec. Perennial.

Leaves flat or convolute with smooth margins, base usually hairy and ligule of a few hairs. Glumes all 1-nerved, palea as long as the glume.

Hooker states that the spikelets are sub-persistent on the pedicels. Lower Gangetic plain specimens are much larger than our specimens, with weak stems.

5. *S. pulchellus*, Br.

A very slender grass 6—24" high with spreading or erecto-patent narrowly-lanceolate leaves 4—6" long, up to .2" broad at base and tapering from base to apex, margins pectinately ciliate (sub-spinulose). Panicle elliptic-oblong, very delicate, with whorled capillary branches. Spikelets on secund small branchlets towards the tips of the branches, .05—.06" long. Gl. i = about $\frac{1}{2}$ ii obtuse (with ciliate keels, *J. D. H.* I have not observed this). Gl. ii = iii broadly ovate acuminate. Grain ellipsoid 3-gonous .03" easily extruded from its pericarp (globose, *J. D. H.*).

Monghyr, Wall. (No. 8883)! Ranchi, Clarke! Hazaribagh, Clarke! Fl. Sept.—Oct. Annual.

6. *S. coromandelianus*, Kunth.

Densely tufted 3—9" high with linear lanceolate leaves 1—3" long, attaining .2" in breadth at base, often minutely papillose above, sub-spinulosely ciliate especially near base, flat; mouth of sheath villous. Panicle short and rather dense, pyramidal, 2" or sometimes up to 6", with 4—6 capillary subsecund whorled branches .5—2" long. Spikelets .04—.05" long on small secund branchlets. Gl. i minute nerveless, scarcely one-fourth as long as iii; ii=iii ovate-lanceolate acuminate. Stamens 2. Grain obliquely oblong or subglobose.

Patna, Wall. (No. 3764b)! No Orissa specimens except Roxburgh's collected on the Madras not the Bengal side. It is, however, widely distributed and will be probably found in other districts.

27. GARNOTIA, Brogn.

Erect perennial or annual grasses with flat or convolute leaves and small paniced solitary or geminate narrowly lanceolate spikelets articulate on their pedicels. Glumes 3, i and ii empty subequal, 3-nerved,

acuminate, or ii obtuse, equalling or longer than iii, awned or not; iii bisexual, articulate at base, 1—3-nerved, very narrow, terete, acuminate or notched at tip, terminally awned, rarely awnless or 3-awned, palea with sides at base dilated into auricles which clasp the linear or oblong grain.

1. *G. stricta*, Brogn.

A tufted grass 1—2.5 ft. high with stems usually ganiculating ascending and branched at the base, nodes bearded. Leaves flat .1—3" broad, glabrous, hirsute or scabrid above, ligule short truncate. Panicle contracted 3—8" long with upright branches in distant fascicles. Spikelets .12—.15" long. Gl. i and ii shortly ciliate at base; i lanceolate acuminate aristulate, membranous; ii as long obtuse and aristulate, linear-oblong; iii thickly membranous tapering to the .3" long awn, nearly as long as i with a linear palea .09" long slightly exceeding the ventrally compressed oblong grain.

Parasnath, Clarke! Fl. Oct.

The plant is variable; I have only described the Parasnath form.

28. POLYPOGON, Desf.

Annual or perennial with flat leaves. Spikelets minute, articulate on but not falling from their pedicels, laterally compressed, keeled, densely crowded on the short branches of a spiciform or lobed panicle. Gl. 3; i and ii equal concave keeled, 2-fid notched or entire, with a slender awn below the tip or from the sinus; iii articulate, much smaller, hyaline, sessile, truncate, toothed, awned or not; palea small 2-nerved. Lodicules falcate. Stamens 1—3, anthers small. Ovary glabrous, styles free. Grain obovoid, free within the glume and palea.

Panicle oblong or cylindric, close, not lobed. Awns of i and ii as long to many times as long as glume. iii shortly awned
Panicle lobed. Awns of i and ii less than twice as long as the glumes; iii shortly awned or not

1. *monspeliensis*.

2. *littoralis*.

1. *P. monspeliensis*, Desf.

A closely tufted small grass 2—10" high only in our area (up to 2 ft. elsewhere). Leaves 1—4" by .1—1.5" (.3—6" by .12—.25" outside our area). Panicle cylindrical or oblong .5—1.5" long and .3—.5" diam., sometimes obscurely lobulate from the projecting lateral branches. Spikelets .06" long, minutely pubescent, easily detachable from their pedicels; gl. i and ii narrowly oblong obtuse or notched at the tip with awn from or from below the minute sinus, mostly 2—3 times as long as the glumes; iii oblong 2-fid easily detachable with its palea and grain, .04" long with a minute deciduous awn. Palea and grain nearly as long.

Manbhum, Camp! Hazaribagh (Parasnath), Clarke! Fl. April. Annual.

2. *P. littoralis*, Smn.

Hooker states that "except by the uniformly shorter awns of the spikelets and usually broader lobed panicle, I find it very different to distinguish the annual form of this species from the common one of

P. monspeliensis. In India *P. littoralis* does not descend to the plains." The seed is apparently however sometimes carried down by the rivers and a plant collected by *Kurz* in the Calcutta Herbarium appears correctly named as this.

Santal Parg., banks of Ganges near Sahebganj. *Kurz!* Fl. May.

29. ARISTIDA, L.

Annual or perennial usually slender grasses with slender usually convolute leaves. Spikelets paniced small, or long and slender with the rhachilla articulate above the two lowest glumes and often elongate. Glumes 3; i and ii empty, very narrow, keeled, persistent or tardily deciduous; iii narrow, convolute, acuminate, 2-sexual, tip produced into a long 3-partite (very rarely simple) awn; palea very narrow, embraced by the glume, sometimes minute or 0. Lodicules 2. Stamens 3. Styles distinct. Grain narrow, free within the convolute glume.

I. Awn not articulate on the glume (see also *redacta*):—

A. Panicle very delicate effuse. Spkts. $\cdot 1''$ long only

1. *Cumingiana*.

B. Panicle contracted. Spkts. far exceeding $\cdot 1''$:—

Spkts. $2-3''$ long. Gl. i and ii awnless

2. *adscensionis*.

Spkts. $4-7''$. Gl. i and ii awned

3. *setacea*.

II. Awn column twisted below trifurcation and articulate on the glume, or if obscurely articulate (*redacta*) then awn branches very unequal:—

Lateral branches of awn very short or 0

4. *redacta*.

Lateral branches of awn long

5. *funiculata*.

1. *A. Cumingiana*, Trin.

A very pretty grass resembling an English "Bent," tufted, very slender, $3''-1$ ft. high with very narrow of filiform leaves at or near the base, the greater part of the plant being the graceful decompound panicle with small often purple spikelets $\cdot 08-1''$ long at the ends of the capillary branches and pedicels. Awn inarticulate, very fine, centre branch longest, about $2''$.

Along the borders of fields, etc.! Ranchi, Prain! Hazaribagh, Clarke!, etc. Manbhum, Camp.! Sambalpur! Fl. Oct.—Dec. Annual.

Stems smooth. Leaves convolute, $1-3''$. Panicle with suberect or effuse branches, lower usually 3-nate, capillary, scaberulous, as are the pedicels. Gl. i $\cdot 05-07''$; ii $\cdot 08-1''$; iii $\cdot 04-05''$.

2. *A. adscensionis*, L. Kharang jonok', S.

Tufted, very slender $1-3$ ft. high with filiform leaves and a contracted pale panicle of slender spikelets $2-3''$ long (without the awns). Gl. i about $\cdot 15-2''$, not awned, pungent or very acute; ii longest with in-rolled edges after opening, obtuse or emarginate and with slightly ex-current midrib; iii with 3-fid awn $3-5''$ long; rhachilla very short bearded below glume.

A common weed, chiefly on sandy ground. Gya, Mokim, etc.! Santal Parg., Nusker! Monghyr, Kurz, etc.! Singbhum! Manbhum, Camp.! Hazaribagh, Prain! Fl. Aug.—Jan. Annual (or perennial, J.D.H.).

Glabrous. L. short or often as long as stem, convolute or flat, and up to $\cdot 05''$ wide at base. Panicle $4-8''$, often with distant secund clusters of main branches,

rarely purplish. Gl. iii glabrous or with a row of minute bristles on mid-rib, awns scabrid, inarticulate at base, rhachilla somewhat pungent.

3. *A. setacea*, Retz. Ghora-lenji (Horse's-tail), Or; Kharan-ghas, S.

Stouter than the last two, 2—4 ft. high, simple or fastigiately branched. Panicle 6—15" contracted inclined feathery with rather close clusters of branches and secund spikelets 4—7" long (without the awn). Gl. i with a short awn; ii about 6" long with its short awn but rather variable, tip sometimes minutely 2-toothed; iii tapering imperceptibly into the rigid strong base of the 3-fid awn, the middle branch of which is usually over 1" long (.5—1.5", J.D.H.), sometimes all three branches over 1". Rhachilla .04—.06" long, very pungent, white bearded.

A weed of thin, poor forest, on sandy gravelly or kunker soil, or on heavily grazed open lands. Gaya, Nusker! Hazaribagh, Clarke! Manbhūm, Camp! Puri, Walsh! Angul, common! Sambalpur, common! Fl., Fr. Aug.—Feb. Perennial.

Leaves often overtopping the inflorescence, sometimes flat when green and up to .12" wide, sheaths at base of stem open. Panicles pale, branches scaberulous, the ultimate often bearing a central short-pedicelled spkt. and 2 lateral long-pedicelled spkts. reminding one of the sessile and ped. spkts. of *Andropogonæ*. Awn microscopically scaberulous, inarticulate at base.

A pest from its barbed fruiting glumes penetrating the clothes, helped by the 3-fid awns. Cattle do not touch it.

4. *A. redacta*, Stapf.

Very slender 6" to 2 ft. high with filiform leaves and effuse panicles. Leaves at base and sheaths with fine hairs. Branches capillary, mostly 2-nate ending in 1—3 erect or ascending spikelets. Gl. iii very slender and very gradually tapering into the twisted base of the awn which has two very fine branches (sometimes 0) about 2—.25" long and a very long slender branch often 1", whole length of glume and column up to trifurcation far exceeding glumes i and ii which are subequal and about .5" long.

Manbhūm (near Barakar), Kurz! Common in Central Provinces and therefore likely to be found in other districts of our province. Fl. Sept.—Oct. Annual.

Among a group of specimens collected I find one with all three branches of the awn equal, but it is not otherwise distinguishable from *redacta*.

The F.B.I. states that "the awn readily separates from the glume, but without any indication of the joint." When green the awn cannot be separated. In some specimens the joint is visible, the glume minutely scabrellous, and I am inclined to think this is a form of *funiculata*.

5. *A. funiculata*, Trin. & Rupr.

Stems many tufted geniculately ascending, 1—2 ft. high. Leaves at base and sometimes sheaths with sparse very long weak hairs. Panicle contracted or narrow, lax with very short branches. Gl. i and ii .5" but variable (and up to 1", J.D.H.), more or less aristate-tipped scabrid on the nerves; iii 1—1.2" to trifurcation of awn and awn with three very long slender branches 1—1.5" long. In this species the junction of column of awn with the .2" long glume is distinct.

Gaya, Nusker! Fl. Oct.

Gl. iii is scaberulous below the awn-column; callus pungent, bearded except at the extreme tip.

30. PEROTIS, *Ait.*

A slender grass with short leaves and a feathery spike of very narrow awned spikelets articulate on the slender simple rhachis. Glumes 3, i and ii empty subequal narrowly linear tapering into long capillary awns; iii minute, flowering, mucicous. Palea and lodicules hyaline. Stamens 3, anthers very short. Styles very short connate at base, stigmas short. Grain much longer than its glumes, narrow.

1. *P. latifolia*, *Ait.* Maria-buch, *Gond.*

A prostrate and ascending small grass 3—10" high or occasionally 18", branched from the root, stem leafy. Leaves .5—1" rarely 1.5" ovate to lanceolate with cordate often bristly or ciliate base; sheath short, ligule ciliate. Spikes 2" only in some plants, usually 3—6" long slender, rhachis and short pedicels pubescent. Spkts. often purplish, scattered all round the rhachis, .08" long with the 2 awns several times longer. Gl. i and ii laterally compressed, somewhat pubescent and ciliate, 1-nerved; iii very small hyaline.

Characteristic of dry over-grazed sandy soils. Purneah, *King!* Santal Parg., *Cal. Herb.!* Gya, *Mohim!* Ranchi! Manbhum, *Camp.!* Puri, *Walsh!* Fl., Fr. Sept.—Nov.

31. TRAGUS, *Hallier.*

A low rather rigid grass with short flat leaves. Spikelets subarticulate or not articulate on their pedicels, 1-flid., and geminate (appearing like a single 2-flid. spikelet) or 3—5-nate on the very short branches of a narrow spike. Glumes i and ii absent; iii thickly coriaceous, lanceolate cuspidate, 5-ribbed with a row of spines on each rib; iv embraced by iii, chartaceous, lanceolate, flat, 1-nerved with a membranous obtuse involute nerveless (or faintly 2-nerved below) palea. Stamens 3, anthers long-linear. Styles short distant. Grain free within the glumes, linear.

1. *T. racemosus*, *Scop.*

Stems 4—8" high, leafy and with many spreading and flowering branches from the base (from stolons after the first year, *J.D.H.*). Leaves .5—1.5", ovate to linear with margins and mouth of sheath setose, surface often scabrid. Spike 1—4" at the end of every branch, rhachis pubescent. Spikelets crowded, mostly geminate face to face, sessile on their common pedicel, .1—.17" long.

Singbhum, on high ground! Manbhum, *Gage* (Rániganj, close to Manbhum)! Fl., Fr. Aug.

A very easily recognised grass from the curious paired densely muricate or spinose spikelets.

32. ZOYSIA, *Willd.*

A small much branched rigid glabrous grass with subulate pungent leaves. Spikelets small ovoid or lanceolate subimbricate sessile or shortly pedicelled and appressed to a rigid notched inarticulate rhachis. Spkts. articulate at their base. Glumes 2, i absent; ii empty, coriaceous, laterally compressed, shining and nerveless with hyaline margins connate below; iii much smaller, membranous, linear-oblong, obtuse, complicate,

palea short, hyaline or 0. Lodicules 0. Stamens 3, anthers long. Styles very long, distinct with long stigmas. Grain free within the glumes.

1. **Z. pungens**, Willd.

A small stiff wiry grass. Stems creeping and rooting, with many upright or ascending branches 3—8" high with squarrose short subulately folded and sharply pointed leaves 2—1" long. Spikes 5—7" with sinuous rhachis, bearing in the sinuses narrow brown polished lanceolar-linear spikelets 1—12" long with compressed tips. Pedicels very short clavate or 0.

From Mutlah (near Calcutta), Kew Herb. 1 to Ganjam, Fischer 1 along the sandy shores. No doubt therefore on the Orissa Coast. Fl. April, Aug.

33. ORYZA, L. Rice.

Grasses with long flat leaves and spikelets articulate on the slender branches of an elongate rarely spiciform panicle, oblong, laterally compressed, 1-fld. Pedicels annular at tip. Glumes 2—3, i and ii much the smallest, empty, scale- or bristle-like, rarely 0; iii chartaceous or coriaceous, obtuse acute or awned, strongly 3—5- or obscurely 7—9-nerved; palea (gl. iv of most authors) as long as the glume, keeled. Lodicules 2, 2-lobed, rarely entire. Stamens 6, anthers linear. Styles short free, stigmas laterally exerted. Grain narrow, free or adnate to the glume and palea.

The spikelet of *Oryza* has been variously construed. The above is the account (with few modifications) as given by *Hooker* in the *F.B.I.* *Dy. Stapf* considers that the usual 2 outer empty involucral glumes are absent, that the next 2 (scales or bristles) are empty florets (valves); they fall with the fruit. He also considers the fourth glume a palea.

Cooke describes the floral glume as 5—9-nerved. It is only 3-nerved in the common wild rice unless the striæ be counted when it is many nerved.

1. **O. sativa**, L. Dhan, *H.*, Beng.; Baba, *K.*; Uri, *S.* (these names apply to the growing plants when cultivated); Deodhan, *H.*; Oridhana, *Beng.*; Urihoro, *S.*; bir-baba, *K.*; Balunga, *Or.* (the wild rice). Numerous different names are applied to the several cultivated varieties.

Annual with creeping or floating and erect stems 2—10 ft. Leaves 1—2 ft. by 25—3" or more, striate, scaberulous. Sheaths smooth, ligule long 2-partite. Spikelets awned in the wild plant, shining, in finally drooping panicles. Gl. i and ii $\frac{1}{4}$ — $\frac{1}{3}$ length of iii lanceolate; iii hispid above, dorsally spinescently ciliate, striate with minute dots.

The wild plant occurs in marshy localities in various districts, especially Sambalpur, Chota Nagpur and the Santal Parg. 1 Cultivated in all districts in both lands which are irrigated or submerged during the rains and on non-submerged lands. For accounts of the different varieties and crops see *Watt* (*Dict. Ec. Prod.*, v. 502 et seq.).

The following is a more special account of the wild rice collected in our area:

Lower parts submerged. L. 6—15" long, 25—4" broad, margins very scabrid with minute bristles, sheaths inflated many-nerved, ligule erect 4—5" long with

(in my specimen only) two lateral long subulate ciliate fleshy processes at its base in the angles between the sheath and the blade. Panicles rather effuse, sometimes scarcely exerted from the uppermost leaf-sheath (but my specimen is only in flower). Spikelets .25--.27" long, yellow, shortly pedicelled on the flexuous scabrid branches, long awned. A half-annular thickening below glume i may represent the rudiment of a suppressed glume. Gl. i lanceolate pale .1" long keeled acuminate, not laterally compressed, margins scaberulous; ii similar and subequal rather distant on the much thickened rhachilla, rhachilla with a callus thickening between ii and iii; iii sparsely hispid and minutely closely granulate or punctate, much laterally compressed, cymbiform keeled and with two lateral ridges, many-striate: apex with pink glandular swellings and then terminating in a hispid awn 2.5--3" long, palea similar in texture, markings, spinulose hairs and glands, but more oblong (less deep), equal or a little longer, with white margins to which the subquadrate lodicules are partly adnate each side. Ovary only .03--.04" long. Grain not ripe.

Purneah, *Ham.*! Sambalpur! Gya, *Mokim*! Puri, *Walsh*! Manbhum! Fl. chiefly Oct. but also as late as Feb.

2. *O. granulata*, *Nees & Arn.*

Rootstock woody. Stems slender round polished tufted. Leaves lanceolate-linear, attaining 9" by .7" but mostly much smaller and only about 2--3" by .2" near top of stem, nerves 2--5 each side of midrib, sheath very long smooth striate with a very short ligule and ciliate auricles. Spikelets .2--.25" on the flexuous rhachis of very slender long-peduncled simple or nearly simple racemes, rarely a short branch at the base of raceme. Pedicels .2". Gl. i and ii minute or 0; iii oblong scarcely cymbiform, the keel and two lateral ridges rounded or obscure; both glume and its palea granulate (not regularly or so minutely punctate as in *sativa*), tip rather horny but no sign of an awn.

Along rivers in jungles Rajmahal Hills (Sant. Parg.) *Kurz*! Hazaribagh (Parasnath), elev. 2000--2500 ft. *Clarke*! Fl. Oct.--Nov.

34. LEERSIA, *Sw.*

Slender marsh grasses with narrow flat leaves and spikelets in slender contracted usually nodding panicles, very similar to those of *Oryza* but glumes i and ii entirely suppressed. Glume iii strongly laterally compressed, oblong, 3--5-ribbed, thinly coriaceous, awnless, keel and margins spinulosely ciliate; palea (glume of some authors similar in texture but more slender, as long, laterally compressed, 3-nerved. Lodicules 2. Stamens 6--3 (rarely fewer). Grain oblong free within the glume and palea.

1. *L. hexandra*, *Sw.*

A slender grass 2--3 ft. high from a rooting geniculate base, nodes hairy. Sheaths and leaves striate very scabrid, blade 3--12" by .25--.3", narrowed at base, acuminate, ligule truncate. Panicle 2--4" long with slender distant branches .5--3" long, often again branched, flexuous. Tip of pedicel not much dilated. Spikelets .13--.15" long, green. Gl. iii 5-ribbed (including the marginal) cymbiform with a short obtuse cusp; palea much more slender 3-nerved, keel bristly. Stamens 3 or 6 in the same inflorescence.

Jheels and marshes. Purneah, *Kurz*! Ranchi, *Wood*! Manbhum, frequent, *Camp.*! Hazaribagh, *Cal. Herb.*! Fl., Fr. Oct.--Dec.

35. HYGRORHIZA, *Nees.*

A floating aquatic with short broad leaves and few lanceolate 1-fl. spikelets articulate on their pedicels on the spreading branches of a short broad panicle. Pedicels short or rather long with annulate tips. Glume solitary (involucral glumes suppressed), membranous, 5-nerved, narrowed into a long awn, keel and nerves ciliate; palea acuminate 3-nerved, keel scabrid. Lodicules gibbous. Stamens 6, anthers very long. Styles short free, stigmas laterally exerted. Grain narrowly oblong, free within the unhardened glumes.

1. *H. aristata*, *Nees.*

Stems floating with whorled feathery green roots from the nodes. Leaves ovate, ovate-lanceolate or oblong, 7—3" long by 5—7" broad, rounded more rarely acute, base rounded or cordate, usually shortly petioled, sheaths much inflated sometimes pubescent, mouth auricled, ligule 0. Panicle 2—3" with few spreading branches, lower whorled often deflexed. Spikelets 3" (without the awn which is 3—4"); palea 25—3" subaristate-acuminate with white margins. Pedicels articulate far below the tip.

Santal Parg., *Mokim!* Gya, *Mokim!* Ranchi, *Wood!* Singhum! Fl. Oct.

36. THYSANOLÆNA, *Nees.*

Very large with solid stems and large distichous leaves. Panicle very large effuse decompound with crowded long compound suberect branches, branchlets bearing myriads of subsecund very minute 1-fl. spikelets obscurely jointed in their pedicels, pedicels often in pairs articulate on the branchlets. Glumes 4, i shortest, about half spikelet or less, membranous, concave nerveless; ii similar but rather longer; iii longest very acuminate empty 1-nerved, hardening; iv rather shorter membranous ciliate with spreading (or erect) white hairs, palea short, truncate. St. 2—3, anthers broadly oblong. Styles free. Grain most minute, free within the hardened glumes.

1. *T. agrostis*, *Nees.* Dodri, Gara-jonor (ravine-broom), *K.*; Karsar, bushnia, *S.*; Phulbari, *Gond.*; Jopono, *Birja.*

A very large bamboo-like or reed-like grass 5—10 ft. high with stems often 5" diam., large broad flat oblong-lanceolate leaves often 18" by 3" and panicles up to 3 ft. by 2 ft. Spikelets variable in length 03—06" long.

On shady slopes in the forests but especially on damp steep banks along ravines and watercourses. Rajmahal Hills! All the forest districts of Chota Nagpur, ascending to the top of Parasnath and the *pats* in ravines! Sambalpur! Fl., Fr. May—June.

Leaves usually broadest above the rounded or cordate base, punctulate, margins nearly smooth, mouth of sheaths somewhat hairy, ligule truncate nearly obsolete. Panicle-rhachis glaucous, main branches often 1 ft. long, swollen and pubescent or tomentose at the axils. There may be two varieties. In our area the glumes ii and iv are subequal and only 03—04" long, in the Jalpaiguri district gl. iii is 06" long. In our plant the cilia of iv spread widely in flower. *Hooker* describes

them as erect, which of course they are in the bud, and possibly also in fruit, though this seems unlikely.

The panicles are used for brooms.

37. ARUNDINELLA, *Raddi*.

Grasses of very various habit and aspect. Spikelets minute to rather large, not jointed on their pedicels, 1—2-fl., in panicles or panicked spikes. Glumes 4; i usually ovate acute or acuminate shorter than the next two, 3—5-nerved; ii lanceolate or ovate-lanceolate acuminate or subaristate, 5—rarely 7-nerved, longest; iii subacute or narrowly truncate 5—7-nerved paleate, male or neuter; iv smallest, 2-sexual, articulate at the base and deciduous with the grain, membranous in flower, subcoriaceous and scaberulous in fruit, with a terminal subgeniculate awn with lower part twisted or awnless or sometimes with 2 very slender awns lateral to the terminal, base usually bearded. Styles 2 free or connate below, stigmas long. Grain free within glume iv.

I. Glume iv awned:—

A. Awns 3, two lateral capillary. Tall perennial

1. *setosa*.

B. Awn solitary:—

Spikelets minute in delicate panicles. Annual

2. *tenella*.

Spkts over .1" long. Tall perennial.

3. *brasiliensis*.

II. Gl. iv with awn short or 0. Spkts. spicate

4. *Wallichii*.

1. *A. setosa*, *Trin.* Jharu, Motamui-jhar, K.; Buru lukui-ghas, S.

A caespitose slender grass 3—4 ft. high with thick stoloniferous rootstock, smooth glabrous stems, flat or involute setaceous acuminate leaves 6—9" on the stem (radical longer) and 2—5" broad. Panicle sometimes 9" long, green grey or purple with long suberect sub-solitary or 2—4-nately whorled branches 3—5" long. Spikelets 2—25" (without the long awn of the fertile glume), in unequally pedicelled pairs, narrowly lanceolate acuminate. Gl. iv .07—08" long with a long very slender awn .25—5" long with a black thicker twisted base and also with 2 slender tails or short very capillary awns; black and scaberulous when ripe and wrapping the grain, base villous.

Chiefly on rocky ground in the forests where it is often gregarious especially on dry hills. Rajmahal Hills! All districts of Chota Nagpur! Sambalpur! Fl., Fr. Sept.—Dec.

Rootstock nodose developing early the next season's young pointed shoots. L. margin scabrous and ciliate with long rather rigid hairs (but these are seldom seen in herbarium specimens), ligule short truncate. Rhachis with scabrid angles. Lower spkts. sometimes reduced to empty glumes. Gl. i cymbiform strongly 3-nerved, awned; ii 5-nerved long beaked; iii 3-nerved membranous with hyaline palea.

Used for brooms.

2. *A. tenella*, *Nees*.

A very elegant and delicate grass, 6—20" high, sometimes the whole plant reduced to a large panicle with a single leaf. Glabrous. Leaves from ovate- to linear-lanceolate 2—14" long, up to .6" broad, acuminate, membranous. Panicle very large for the plant 2—10" long by nearly as broad with long slender spreading branches and capillary branchlets and pedicels. Spikelets minute innumerable, only .06"

(exc. the delicate awn of iv), on pedicels many times longer than themselves, glabrous or sparsely hairy.

Chota Nagpur. Manbhum, *Camp.*! Ranchi, *Clarke*! Hazaribagh, *Clarke*, on the mountains and along the Trunk road. Also mountains of Central Provinces and possibly common though not often collected. Fl., Fr. Sept.—Nov. Annual.

Stem glabrous or usually with few very delicate hairs. Leaf-sheaths rarely hairy, ligule short hairy. Spikelets with their pedicels often in pairs on a capillary peduncle. Gl. i .04" 3-nerved; ii longest finely acuminate 5-nerved; iii longer than i acuminate; iv .03", when ripe deep brown and wrapping round the grain, scabrid, base with a pencil of hairs, awn .15" basal half brown.

3. *A. brasiliensis*, *Raddi*. Syn. *A. nepalensis*, *Trin.*?

A stout often very tall grass attaining 15—20 ft. but usually much smaller (unless the smaller kind is another species?), from a stout hard creeping rootstock. Leaves 6—18" by .17—.9", with more or less dense hairs inside towards the base which meet those of the ligule and become indistinguishable from them. Panicle 6—20" with very numerous fastigiate rigid, fascicled or subverticillate branches about one-fourth as long as the main rhachis, usually simple and sulcate, bearing more or less secund spikelets densely imbricate in several series. Spkts. lanceolate acuminate .14—.16" long, longer than their pedicels one of which is about .1", the other very short. Gl. i narrow .12", 3-nerved, keel scabrid; ii longest subaristately acuminate 5-nerved; iii about .12" ovate-lanceolate with centre nerve and 2 others each side near the margin, glabrous or base with thin hairs, paleate, male; iv oblong-lanceolate .1" scaberulous with a terminal caducous awn about .12" long, base of glume bearded or with few thin hairs.

Duars! and Sikkim Tarai (the large form)! and no doubt also in Purneah. Fl. Oct.

4. *A. Wallichii*, *Nees*.

A robust grass 1—3 ft. high with a woody creeping or tufted rhizome. Very different in appearance from any of the others, the spikelets being densely 3—4-seriately imbricate on the outer side of the short spiciform branches of a strict contracted panicle 4—15" long. Spiciform branches .7—1.7" long suberect stiff, lower sometimes whorled in threes, rhachis angular scabrid. Spikelets sparsely setose on the nerves .09—.12". Gl. iv ovoid or lanceolate with a short fine awn or awn 0.

Damp places. Chiefly over 3000 ft. in Chota Nagpur but in the plains in Purneah. *Kurz*! Ranchi (over 3000 ft.)! Hazaribagh (Parasnath) *T. Thoms.*! Fl., Fr. Aug.—Nov.

Nodes of stem sometimes bearded. L. 12—18" by .3—.7", glabrous or hairy and sheaths often very hairy with tubercle-based hairs, ligule of hairs. Rhachis of panicle ridged shortly pubescent and often also hairy. Gl. i ovate sometimes sub-aristate 3—5-nerved; ii ovate acuminate 5-nerved, longest; iii oblong or ell., subacute or obtuse 3—5-nerved male, with 2-nerved palea as in iv; iv naked at the base. Pedicels short stout.

38. ISACHNE, *Br.*

Perennial, with small or minute subglobose or obovoid spikelets in loose panicles and *not* or obscurely articulate on the pedicel. Glumes 4, often all separately deciduous from a minute rhachilla; i and ii

subequal convex, herbaceous; iii and iv very similar and indurated or iii larger flatter and rather thinner, both paleate and 2-sexual or iii more often male only; iv articulate and often stipitate on the rhachilla, hemispheric, coriaceous, female or 2-sexual. Lodicules very minute. St. 3, rarely 4—6. Grain free within the hardened glume and pale.

The genus appears to have affinities with the *Pooideæ*.

Ascending. L. 1—3" linear-lanc. to lanc. Spkts. .08" . 1. *australis*.
Prostrate. L. .3—1" lanc. to ovate-lanc. Spkts. .05—07" 2. *miliacea*.

1. *I. australis*, Br.

A pretty grass with tufted ascending stems from a creeping branched base 8"—2 ft. high, short lanceolate or linear-lanceolate leaves 1—3" long, and lax panicles 2—4" long of small subglobose green or purplish spikelets .08" long at the ends of the capillary flexuous glabrous or obscurely scaberulous branchlets. Gl. i and ii subequal 6-nerved or more, shortly hairy glabrous or setulose; iii and iv with incurved edges as long or iii rather longer flatter and thinner, shining, iv glabrous or pubescent.

In marshy ground. Purneah, Kurz! Ranchi, common! Hazaribagh, Clarke! Singbhum! Fl., Fr. Sept.—Dec.

Leaves subscaberulous above or on both surfaces, margins ciliolate, not or very slightly thickened, about 7-nerved beneath, striolate above, the midrib not more prominent than the other nerves, sheath smooth, with mouth and often margins ciliate. Panicle pyramidal and open when mature, pedicels slightly clavate at the tips.

2. *I. miliacea*, Roth.

A small grass with very slender widely creeping prostrate and shortly ascending stems rarely 4—8" high, often growing in masses with interlaced roots. Leaves ovate-lanceolate or lanceolate .3—1" long, usually spreading nerveless or nearly so, glabrous or sparsely hairy on both surfaces. Panicles 1—2" loose with lower branches .7", or contracted. Spikelets oval .05—07" long, glabrous, rarely setulose.

Purneah, Kurz! Fl., Sept.—Oct.

39. PENNISETUM, Pers.

Annual or perennial usually tall grasses with the spikelets involu-cellate by scabrid or plumose bristles on the rhachis of a very contracted spiciform panicle appearing sometimes as a simple spike. Spikelets 1—2-fl. not articulate on their pedicels, 1—3 in each involu-cell which is often deciduous together with the spkt. Glumes normally 4, but i sometimes reduced to hairs or 0, if present always small; ii and iii 5-nerved hyaline; ii often longest (sometimes absent in cultivated species); iii paleate or not, male or neuter; iv coriaceous, fem. or 2-sexual, articulate at base and falling separately. St. 3, anthers linear. Styles and stigmas long, free or connate at base. Grain free within the glume from narrowly oblong to orbicular (in cultivated plants).

I. Anther-cells with bearded tips. Styles connate:—

Robust cultivated plant with stout spike

1. *typhoideum*.

II. Anther-cells not bearded:—

A. Bristles not plumose

2. *parviflorum*.

B. Inner bristles copiously plumose:—

1. Involucel pedicellate with 2—5 spikelets

3. *orientale*.

2. Involucel sessile with 1—2 spikelets:—

Spikelets shortly pedicelled, 1—2 in each involucel, somewhat villose. Bristles (inner) densely woolly-villose

4. *pedicellatum*.

Spikelets sessile in the involucel, solitary, glabrous, inner bristles with close straight villi

5. *setosum*.1. *P. typhoideum*, Rich. Bajri, H.; Tuti, K.; Lendha, S.; Spiked Millet.

A tall erect usually stout annual 3—6 ft. high, rooting at the lower nodes, upper nodes sometimes woolly, densely pubescent under the inflorescence. Leaves 1—3 ft. long by .25—2" broad, sheath rather inflated, ligule of hairs. Spikelets .13—.18" long crowded into a compact cylindrical spike of very varying dimensions, usually 4—8" in the commoner forms by .25—1.2" diam. with hairy or woolly rhachis, they are in clusters of 1—8 on abbreviated hairy branchlets concealed by the involucels of scabrid and ciliate bristles as long as or exceeding the spkt. Gl. i minute or 0, orbicular or sub-quadrate 1—3-nerved; ii rudimentary or 0 or up to $\frac{1}{2}$ iv, truncate obtuse or retuse 3-nerved, very rarely resembling iv; iii paleate or not, male or neuter, 5-nerved, truncate and apiculate or obtuse; iv coriaceous or herbaceous, ovate, acute, 5—7-nerved; palea very broad, truncate, ciliate at tip and back with 2 approximate excurrent nerves. Lodicules 0. Grain oblong, obovoid or pyriform, free with exposed top.

Cultivated in small quantities throughout our area, more especially in the Northern Tract and on the Central plateau! Monghyr, *Mokim*!

The Monghyr plant is a very small variety with spikes 3—4" long, .4—.5" diam. in flower.

2. *P. parviflorum*, Trin.

Erect and rather slender with a general resemblance to *setosum* and *pedicellatum*, stem and rhachis both glabrous (or slightly rough). Spike narrow erect tapering purple 3—5" long by .3" (without the bristles). Spikelets .12—.14" long, close but not clustered on the undulate-toothed angles of the rhachis. Bristles all free to the base, unbranched and scaberulous, without any cilia, some attaining .6" long.

Damuda Ghats (Hazaribagh), *Gamble*! Hazaribagh, *Clarke*! Manbhurn, *Camp*. Parasnath. Fl., Fr. c.s.

Leaves suberect, 4—10" by .17—.3", base and mouth of sheath ciliate. Gl. i minute suborbicular; ii length of spkt. 5-nerved truncate cuspidate; iii 5-nerved truncate toothed paleate male; iv lanceolate obtuse nerveless shining.

3. *P. orientale*, Rich.

A perennial 2—6 ft. high from a densely tufted often stout creeping branched rootstock. Leaves 1—2 ft. by .17—.5", narrowly linear, glabrous or hairy. Panicle .10" long with very patent mostly secund spikelets .75" long including the purple bristles, rhachis hairy. Spkts. .16—.17" long lanceolate, 2—5 in each involucel which has hispid shortly branched pedicels.

Parasnath, Clarke! Fl. Oct.

Rhachis of spike stout, subterete. Outer spkts. of a cluster often imperfect, bristles 6—75" long, very slender, flexuous, free at the base, very unequal, villous below. Gl. i ovate or oblong, nerveless, as long as iii; ii ovate-lanceolate 3-nerved; iii aristately acuminate, 5-nerved; iv aristate shining, longer than ii.

4. *P. pedicellatum*, Trin.

A handsome grass 1—5 ft. high branched from base and often fastigiate branched above with flaccid leaves 6—10" by .25—9" broad and reddish dense spikes 1.5—3" long conspicuous by the involucrel tufts of densely plumose bristles. Spikelets solitary and geminate, one or both shortly pedicelled, .17" long. Bristles in sessile groups of 15—22, very unequal, longest attaining .5", inner densely cottony-villous in the lower half or three-fourths. Gl. i very small oblong woolly or reduced to a tuft of villi; ii longest hyaline or chaffy lanceolate shortly awned or cuspidately acuminate 5-nerved (7-nerved, *F. B. I.*), sparsely villous; iii .1—12", oblong truncate 5—3-nerved often minutely toothed and with minute bristles or cilia at tip; iv broadly lanceolate but margins infolded, tapering to the truncate minutely ciliate or hispid tip, coriaceous and polished when ripe.

In rocky places, often subgregarious locally. Behar, Hope! Monghyr, Kurz, etc.! Gya, Mokim! Ranchi, Gamble, etc.! Hazaribagh, Prain, Clarke etc.! (common in Koderma Forest)! Palamau, common! Manbhum, Camp! Fl., Fr. Oct.—Nov.

This has been relatively often collected compared with many other more common grasses, probably from its striking usually pink or purple inflorescences.

5. *P. setosum*, Rich.

Very similar to *P. pedicellatum* and possibly only a variety of that species, the characters employed to separate them being vague in practice. The bristles are said to be sparsely ciliate, they are better described as somewhat less and more shortly villose than in *pedicellatum* and the villi straight, i.e., less woolly, often unilateral, sometimes they are merely scabrid.* Spikelets always solitary in the involucrel and glabrous and (in specimens seen by me) always sessile (but these two characters are not usually given as specific). Gl. i minute or 0, glabrous; ii with truncate conspicuously 3-toothed tip, also glabrous.

Santal Parg., Kurz, etc. (one specimen is from near Sahibganj, where the other species, *pedicellatum*, has also been collected)! Manbhum, Clarke. Hazaribagh, Gamble, etc.! Orissa, Walsh! Fl., Fr. Oct.—Dec. (The Palamau specimen mentioned in *Fl. Chota Nagpur I* have now transferred to *pedicellatum*.)

40. SETARIA, Beauv.

Grasses of various habit. Ligule of hairs. Spikelets clustered, rarely solitary on the short branches of spiciform or narrowly pyramidal panicles articulate on very short pedicels, most of which bear or the branchlet below them bears, 1—many scabrid or barbed bristles which also often end the rhachis (supposed to be barren branchlets). Glumes 4, awnless, membranous, i small, 3-(5-) nerved; ii usually 5-(7-) nerved;

* Indeed they are so variable in respect of the hairs that the character appears to me useless for separating the species.

iii 5—7-nerved, as long as or longer than ii; iv convex coriaceous about as long as iii, 2-sexual, 3-androus. Grain free within the hardened glume and 'palea'.

- I. Bristles below the spkts. solitary. L. more or less plicate:—
 Perennial. L. very plicate. Panicle over 6", rhachis scabrid 1. *plicata*.
 Annual. L. slightly plicate. Panicle under 6", rhachis hairy 2. *rhachitricha*.
- II. Bristles below the spkts. clustered. L. not plicate:—
 A. Bristles not retrorsely barbellate:—
 1. Gl. iv smooth. Bristles 2—3 below each spkt. Cultivated 3. *italica*.
 2. Gl. iv rugose:—
 Pan. spiciform continuous. Bristles 6 or more 4. *glauca*.
 Pan. interrupted or subpyramidal. Bristles 1 on pedicel and usually 3—4 below pedicel 5. *intermedia*.
 B. Bristles retrorsely barbellate 6. *verticillata*.

1. **S. plicata**, T. Cooke. Syn. *Panicum plicatum*, Lamk.

A striking grass 2—5 ft. high erect from a short woody stock. Leaves plicate, the lower elliptic-oblong finely acuminate, 15" by 2·5" or larger, upper gradually more linear; sheaths very striate, ligule of stiff hairs. Panicle large very compound narrowly pyramidal erect 6—12" with long lower strict branches with wavy scabrid rhachides, ultimate branchlets ending in a rigid awn-like continuation of the rhachis beneath the spikelet. Spikelets alternate sessile or shortly pedicelled '12—'15" long glabrous or nearly so, often open at the tip. Gl. i '05—'06" broadly oblong-ovate obtuse, 3- or faintly 5-nerved; ii elliptic acute or mucronate 5-nerved '1"; iii longest ovate acute and mucronate 5-nerved with a short oblong palea; iv subequal narrow-elliptic very acute, minutely trabeculate (at least when unripe) finally polished dark grey or brown.

Moist valleys in the hill forests, not common. Singhum! Hazaribagh (on Parasnath)! Ranchi and Palamau (at Neterhat, 3000 ft.)! Mayurbhanj, above 3000 ft.! Fl., Fr. Sept.—Dec. Perennial.

There are many forms. I have only described the Chota Nagpur one. Leaf-sheaths appressed-hairy at the nodes and ciliate above. The leaves resemble those of a *Curculigo* or young Palm and wave in apparently still air.

2. **S. rhachitricha**, T. Cooke. Syn. *Panicum rhachitrichum*, Hochst.

A tufted erect leafy grass 8—18" high, stems with pubescent nodes. Leaves lanceolate-linear to lanceolate, slightly or scarcely plicate, 6—8" by 1—1·3" flaccid glabrous or sparsely hairy, base rounded. Spikelets '1" ellipsoid, green-nerved, membranous, on the spiciform erectopotent or spreading slender branches of a subpyramidal panicle 2—6" long. Bristles supporting the spikelets solitary, twice as long as the spkt. Gl. i 5-nerved (1—3-nerved, F. B. I.) minute orbicular membranous; ii 7-nerved (5—6-nerved, F. B. I.) obtuse; iii 5—7-nerved=ii, with a minute palea; iv ellipsoid white transversely rugulose.

Ranchi, rare, Clarke! Fl. Oct.

Leaf-margins and mouth of sheath villous. Branches of panicle very slender flexuous, pilose as are the pedicels. Spkts. 1—2-seriate secund, more or less imbricate, dorsally compressed.

3. *S. italica*, Beauv. Kangni, kangu, *H.*; Marang kukru, Haraba, *K.*; Erba, *S.*; Tangun, *Or.*; Kango (Bonai); Arga (Khondmals); The Italian Millet.

An erect tufted annual 2—5 ft. high with linear or lanceolate-linear acuminate leaves 3—5" broad (often broader in specimens from outside our area), sheath densely ciliate on margin and mouth. Panicle cylindrical spiciform dense, often inclined or cernuous, 3—5" long, .4" diam. or more (without the bristles). Spikelets oval, .08—1" long in small clusters on the abbreviated branchlets of the panicle with 2—3 bristles below each pedicel, bristles nearly smooth or microscopically barbellate, 2—3" long, barbs suberect or spreading. Gl. i ovate hyaline, .03—04"; iv oval or elliptic or subglobose, concave, hardening, about .08"—1 but variable, not rugose but smooth and microscopically cancellate.

Cultivated on high (not rice-) lands. Probably in most districts. Purneah! Monghyr, *Cal. Herb.*! Singbhum, cultivated sparingly! Fl. Aug.—Oct.

Margins of leaf retrorsely hispid (*vide F. B. I.*; they seem to me merely scabrid). Rhachis of panicle very hairy. Gl. ii ovate obtuse or rounded, about $\frac{1}{4}$ ths iv, 5-nerved; iii hyaline delicately 4—5-nerved, as long as and same shape as iv, but not concave.

The grain is yellow or reddish and is eaten.

4. *S. glauca*, Beauv. Bandra, *H.*; Pingi-natchi, *Beng.*; Kukru, *K.*, *S.*

A somewhat tufted grass 1—3.5 ft. high with glabrous stems, narrow flat leaves 6—12" by 2—3" often with long soft hairs above and villous towards base, ending in a long filiform tip. Panicles narrowly cylindrical spiciform, dense erect usually 2—3.5" long by 2—2.5" (without the long bristles). Spikelets ovoid usually about .08—09" long (see var.) with a cluster of 9—12 (6—12, *F. B. I.*) unequal bristles 1.5—2.5" long below, bristles barbellate with spreading or erect barbs, often yellow. Gl. i ovate acute under $\frac{1}{2}$ iii 3-nerved; ii about $\frac{1}{4}$ iii, broad, 5-nerved orbicular mucronate pale membranous; iii broad-oblong or ovate 3—5-nerved flat with 2-nerved palea; iv shallowly transversely rugose, hardening.

Grassy places and commonly occurring among other crops, self-sown and sometimes cultivated on uplands. Monghyr, *Cal. Herb.*; Gya, *Mokim*; Santal Parg., *Cal. Herb.*; Ranchi, to 3000 ft.! Very common in Singbhum! Manbhum, *Gage, Camp.*! Parasnath, *Cal. Herb.*! Probably all districts of Chota Nagpur. Orissa, *Walsh!* Fl., Fr. Sept.—Oct.

Stems often geniculate at base, grooved and striate above, often pubescent below panicle, sometimes purple. Sheaths glabrous; ligule of stiff hairs. Margins of leaf smooth or scabrous. Rhachis of panicle villous. Often small imperfect spkts. present and sometimes gl. i—iii dark red when mature. Grain pale yellow.

- Var. α . *macrocarpa*, *F. B. I.*

Spiciform panicles very stout. Ripe gl. iv .12—14" long by .08—1" broad, conspicuously rugose. In the true var. *macrocarpa* Hooker states that gl. "iii and iv are subsimilar in the ripe state forming a subglobose crustaceous sphere .17" diam." Bristles up to .5". Behar, *Kurz!* In a cultivated form in Ranchi! the gl. iii remains membranous and this scarcely belongs to the variety.

- Var. β . *parviflora*, *Munro (F. B. I.)?*

A small form about 1 ft. high. L. 3—4" by .25", margins red, slightly scabrid, sheaths compressed. Spike almost simple .6—1.5" only. Bristles about 10, purple.

Rhachis of panicle white-pubescent. Spkts. ovoid .1". Gl. iv less strongly rugose, transversely lineate with fine ridges.

Ranchi!

Var. β *parviflora*, Munro MSS.

The spikes are very short, only .2—3" long with a few grains at the base nearly white in colour.

Monghyr Hills, Kurz! Gya, Mokim! Santal Parg., Nusker!

5. *S. intermedia*, Roem. & Sch.

A weak flaccid grass from a few inches high to 2.5 ft. and with leaves from narrowly linear under .1" to .5" broad and lanceolate-linear. Panicles with flexuous rhachis tapering spiciform and interrupted, or with branches up to 1" long below and subpyramidal. Rhachis of panicle angular scabrid (not villose). Bristles flexuose barbellate with suberect barbs. Spikelets .08" long broadly ovoid. Gl. i suborbicular hyaline .03—.04", 3-nerved, sometimes apiculate; ii orbicular, .04" concave almost truncate and apiculate, distinctly 5-nerved; iii ovate, membranous, as long as iv which is clasped by its margins, often apiculate; iv brown transversely rugulose broadly-oblong or ovate sometimes slightly ridged on the very convex back, often apiculate, its palea smoother fitting its open side.

Gya, Mokim! Santal Parg., Nusker! Ranchi, Wood! Singbhum, grassy places in the rains! Puri, Walsh! Fl., Fr. r.s.—Oct.

Leaves usually sparsely hairy, especially with long hairs towards base; sheath ciliate above; ligule hairy. Bristles usually one on the pedicel and 3—4 below it.

6. *S. verticillata*, Beauv. Bir-kauni, S.

Stature and habit similar to *S. intermedia*, sometimes dwarf and much tufted with small narrow leaves, at other times 3 ft. high with leaves 10" by .9" broad. Panicles usually more cylindrical but tapering, somewhat interrupted with the spikelets appearing sub-verticillate but frequently dense. Always easily recognisable from the long bristles being retrorsely hispid (the barbs reflexed). Glume iv more finely rugulose or only dotted.

Gya, Mokim! Patna (Wall. 8642 b)! Santal Parg., Mokim! Monghyr (Wall. 8642 c), Ham.! Hazaribagh, Wood! Manbhum, common, Campbell! Orissa, Walsh! Fl., Fr. Sept.—Oct., also April—June.

Hairiness of leaves and sheaths as in *intermedia*. Rhachis of panicle very shortly pubescent. Spkts. .08" long, very similar to those of *intermedia* but paler, glumes usually less apiculate and gl. iv less rugose.

41. SACCOLEPIS, Nash.

Perennial, more rarely annual with linear or convolute and filiform leaves. Spikelets often deep purple on short filiform pedicels in contracted spiciform panicles with a stout fluted rhachis formed of the main rhachis and its adnate branches (very rarely in lax panicles and not in our area), more or less gibbous (very gibbous when panicle is loose), oblong ovate-oblong elliptic or lanceolate, subterete or slightly compressed, usually somewhat turgid, articulate on the pedicels. Gl. i shortest, sometimes scale-like; ii very concave with a curved or basally gibbous back, mostly 7—9-nerved, rarely 5- or up to 13-nerved; iii similar and subequal but less convex, palea narrow, hyaline or

rudimentary; iv oblong, very convex ultimately coriaceous or crustaceous with firm narrowly involute margins, palea almost as long, embraced by the glume all round, similar in texture, 2-nerved. Grain tightly enclosed, elliptic with almost flat back and convex face.

A. Gl. i 3-nerved. Spikelets mostly .1" or less:—

Spikes .4—2" long. Spkts. lanceolate-ovoid, hispid, .08—1" 1. *indica*.
Spikes 2—9". Spkts. ovoid, glabrous, .05—08" 2. *myosuroides*.

B. Gl. i 5-nerved:—

Spikes 6—10" rigid. Spkts. lanceolate, .12—18" 3. *interrupta*.

1. *S. indica*, comb. nov. Syn. *Panicum indicum*, L.

A slender grass 6"—2 ft. high with linear acuminate leaves 2—5" long up to .17" wide, glabrous. Panicle spike-like, green or slightly purplish .5—1.5" by .15—2" diam. with crowded ovoid acute or acuminate often curved shortly or hispidly hairy spkts. .08—12" long. Gl. i ovate, one-third to one-half of iii, lanceolate from a broad base, 3-nerved acute; ii usually subcymbiform curved obtuse 7—11-nerved, .1—11"; iii broadly ovate, obtuse, 9-nerved as long as iii; iv narrowly ellipsoid very acute .06—07" long, white, smooth, polished, sides overlapping margins of the similar palea, base obtuse mucronulate with remains of the rhachilla.

Wet places, Santal Parg., frequent, *Mokim*, etc. Ranchi, common! Hazaribagh, common (often very small)! Sambalpur, *Cal. Herb.* Fl., Fr. Sept.—Nov.

I think it is better to confine this species to those specimens with hairy spikelets. The variety *gracile* so far as applied to those specimens from our area have longer more slender spikes and glabrous smaller spikelets, and appear to be better referred to *myosuroides*. Possibly it belongs to *Sacciolepis augusta*, *Stapf*. Typical *S. indicum* with small weak stems, leaves narrow .7—1.5" long and small spikes .4—7" has been collected in Ranchi, Hazaribagh and Sambalpur.

2. *S. myosuroides*, comb. nov. Syn. *Panicum myosuroides*, Br.

A very slender glabrous plant with erect stems 1—4 ft. high from a creeping rhizome. Leaves 2—9" by .07—2" acuminate. Spikes (panicles) 2—9" long, the longer ones often nodding, only .1" broad in flower, .15" in fruit, often deep purple. Spikelets oblong-ovoid crowded sub-erect in flower, more spreading in fruit, .05—09" long, mostly 2-nate. Gl. i half or slightly under half as long as iii, ovate, 3- (—5-) nerved with semi-amplexicaul base, sometimes apiculate; ii as long as spkt. very convex 7—9-nerved, nerves prominent; iii similar, both sometimes minutely apiculate on the obtuse tip; iv pale or white, .04—06" smooth shining elliptic acute; all quite glabrous.

Frequent in marshes. Behar, *Hope*! Santal Parg. Ranchi! Singbhum! Manbhum, *Camp.* Hazaribagh, *Clarke*! Sambalpur, *Criff.* Orissa, *Walsh*! Fl., Fr. Sept.—Nov.

Whole plant often purple. Stems striate, polished. L. with 5—6 nerves each side of midrib, ligule a membranous rim .02" long, sheaths loose, glabrous. Pedicels unequal, half to three-fourths length of spkt., puberulous.

This may be the same species as *indica* grown in more marshy localities, *i.e.* with water right up to December. Small specimens have the spikes as short as 1".

3. *S. interrupta*, Stapf. Syn. *Hymenachne interrupta*, *Bühse*; *Panicum interruptum*, *Willd.*

Stem tall 3—5 ft., stout and spongy below, with linear tapering leaves 6—12" by .2—5" and long narrow spiciform panicles 6—10" long by

·3" diam. Spikelets patent or sub-patent ·15—·17" long, fascicled, very shortly pedicelled narrowly ovoid. Gl. i broadly ovate acute or obtuse, 3—5-nerved, about one-third length of iii; ii ell.-lanceolate acute (obtuse, *F. B. I.*) strongly 7—9-nerved; iii similar and equal with small palea; iv ·11" long ell.-lanceolate acute (lanceolate acuminate, *F. B. I.*) palea similar, both hardened white in fruit.

In swamps in the damper districts. Purneah! Ranchi, *Clarke!* Puri, *Walsh!* Fl., Fr. Oct.—Nov.

Leaves with rounded or subcordate base, glabrous. Sheath glabrous. Ligule short membranous. Common peduncle of spkts. sometimes to short that the panicle is almost a spike, imperfect spkts. often present.

42. HYMENACHNE, Beauv.

Rather stout grasses with broadly linear leaves. Panicles thyrsoid the branches erect appressed with spiciform branchlets and very numerous crowded narrowly lanceolate secund acuminate spikelets articulate on their minute pedicels. Gl. i membranous cuspidate keeled, shortest; ii with sheathing amplexicaul base on the long internode of the rhachilla between ii and iii, prominently 3-nerved, cuspidate or awned; iii longest, lanceolate acuminate passing gradually into the awn, with 3 strong nerves meeting in the base of awn and 2 lateral weaker ones, empty; iv longer than ii, oblong, membranous in flower, scarcely hardened in fruit, smooth, faintly 2-nerved embracing the palea except at the tip, palea similar and as long. Lodicules minute. Stamens 3. Styles free.

1. *H. myurus*, Beauv. Syn. *Panicum myurus*, *H. B. & K.*

A stout grass with a prostrate rooting base and an erect leafy stem 2—4 ft. high. Leaves 8—18" long by ·4—1" broad, tapering from the broad cordate base to the acuminate tip, sheaths glabrous or ciliate, ligule short hyaline. Panicle very dense narrow very compound with closely appressed branches; up to 12" long by 1" diam. Spikelets variously grouped shortly unequally pedicelled secund on the erect branches of the panicle, ·25" long (including the awn) narrowly lanceolate. Gl. i narrow from an amplexicaul base aristulate ·06—·08" (including the cusp), hispidulous on keel and cusp; ii narrowly lanceolate subaristate ·16—·18" hispidulous, 3-nerved; iii narrowly lanceolate gradually tapering into the awn as long as spkt., exceeding ii, strongly 3-nerved, hispidulous on nerves; iv narrow and finely acuminate almost embraced by iii, shorter than ii, about ·14", enclosing its palea on the edges. Anthers ·05". Styles distinct.

Marshes. Santal Parg., *Mokim!* Also Jalpaiguri and probably Purneah. Fr. Oct.—Nov.

Rhachides of partial panicles broadly winged, subsidiary rhachides less winged or margined, margins hispid, branchlets secund. Pedicels 1—3-nate, ·01—·04" long. Internode of rhachilla between gl. ii and iii ·03—·04" long.

43. PANICUM, *L.*

(*sensu circumscripto*).

Grasses of various habit and duration. Spikelets symmetrical, articulate on the usually elongated pedicels of a much divided, at least

temporarily open, panicle; branches of panicle free (not adnate into a false spike), orientation of spikelets to axis indefinite. Glumes herbaceous-membranous, i shortest, often minute, very rarely as long as ii; ii as long as spikelet, rounded on the back, 5-9-nerved; iii very similar to ii, 5-9-, rarely 3- or 11-nerved, palea subequal or reduced, rarely 0; iv subcoriaceous to coriaceous with firm margins, obtuse to subacute, mucous, faintly nerved or not, palea similar in texture tightly embraced by margin of the glume. Lod. 2, broadly cuneate. St. 2. Styles distinct. Grain tightly enclosed by the hardened glume and pale, biconvex to almost plano-convex.

- I. Gl. ii 9-11-nerved, or if 7-n. then iii 7-9-n.:—
- A. Gl. iv smooth and polished:—
1. Spkts. .14-.17" long, mostly rostrate:—
Leaf-sheaths hirsute with spreading hairs. Panicle usually dense. Cultivated only. 1. *miliaceum*.
 2. Spikelets .08-.12" long (.14" in *proliferum*, .3" in a diseased state of *psilopodium*):—
 - a. Spikelets not gaping:—
 - i. Annual, not stoloniferous. Gl. i 5-nerved:—
 - † Stems slender. Leaves linear:—
Leaves without long tapering upper half. Panicles quickly effuse. Gl. iv .07". Wild only 2. *psilopodium*.
 - Leaves narrow tapering from the base or with tapering upper half. Panicle contracted, nodding. Gl. iv .08-.1". Cultivated 3. *miliare*.
 - †† Stems up to .3" diam. at base. L. lanceolate-linear with subcordate base:—
Panicles sub-thyriform. Spkts. .08-.09" 4. *cæsium*.
 - ii. Perennial. Stems below creeping or stoloniferous:—
 - Spkts. .1-.11". Pedicels glabrous with small cupular tips 5. *repens*.
 - Spkts. .12-.14". Ped. angular scabrid, tips clavellate truncate 6. *proliferum*.
 - b. Spikelets gaping:—
Panicle open. Spkts. .12". Gl. i 4-5-nerved; ii cuspidate 7. *trypheron*.
- B. Gl. iv finely rugulose:—
Spkts. .12-.15" long. Very large perennial. Cultivated 8. *maximum*.
- II. Gl. ii 5-nerved, or if 7-n. then iii 5-nerved:—
- A. Panicle very effuse lax with capillary branches and pedicels:—
- Spkts. .07-.1". Height 3-4 ft. L. lanceolate 9. *montanum*.
 - Spkts. .05-.06". Height 2-15". L. linear 10. *humile*.
- B. Spikelets fascicled subsecund sessile or shortly pedicelled. 11. *auritum*.

1. **P. miliaceum**, L. China, H., Beng., Marha (the boiled and parched grain); Common Millet.

Tufted 1-4 ft. high with erect or ascending terete usually only 4-5-noded simple or sparingly branched stems, softly hirsute below the nodes and leaf-sheaths with copious spreading tubercle-based hairs. Leaves 4-12" by .25-.8" linear, usually glabrous except the often ciliate lower margins, sometimes sparsely hairy. Spikelets rostrate .14" or with the cusp .16-.17" long, glabrous, in lax or (in cultivation) often very dense or thyriform cernuous inclined or rarely erect

panicles often 8" long by 2" broad. Gl. i large, broad-ovate, $\frac{1}{2}$ — $\frac{2}{3}$ rds iii, 5-nerved; ii largest rostrate or sometimes only apiculate, convex, 11-nerved; iii similar or less beaked, empty, plicate; iv oval very convex subacute usually deep yellow with pale nerve lines but various in coloration, crustaceous, smooth and shining, .08—12" long, palea similar with 2 nerve lines.

Cultivated in Champaran, Balasore and Cuttack. Cultivated and apparently feral in Santal Parg. Probably cultivated to some extent in all districts, but rare in Chota Nagpur. Fl., Fr. c.s. Annual.

Usually a much larger stouter plant than *P. miliare*, but some specimens from the Santal Parg. are very slender with very lax inflorescence.

Grain wholesome. The plant is a good fodder.

2. *P. psilopodium*, Trin.

A tufted grass with erect or quickly ascending stems, 8—20" high. Leaves rather broadly linear, acute or somewhat acuminate, 3—6" by .15—3" glabrous or with few short spreading hairs towards base, rarely thinly hairy all over; sheaths often with spreading hairs which leave minute raised dots after falling, more usually glabrous loose striate; ligule of hairs. Panicle spreading, 2—5", with very capillary branches and slender pedicels which are often .4" long. Spikelets narrowly elliptic .08—1" rarely .12" long (but see monstrous form below) with abruptly acute tip. Gl. i very broadly ovate acute, about $\frac{1}{3}$ rd spikelet, base amplexicaul but not overlapping itself in front, 5-nerved; ii oblong-ovate as long as spkt. minutely cuspidate, 9- (11-) nerved; iii similar with delicate oblong margined palea; iv narrow-ellipsoid acute, .07" very smooth and polished as is its palea.

Patna (*Wall.* No. 8712 d), *Ham.* Singbhum, in rice-fields and waste land! Manbhum (on the Tundi Hills), *Camp.* (No. 42)! Hazaribagh (called var. *coloratum*) with purple spkts., *Clarke!* Fl., Fr. July—Nov. Annual.

An interesting monstrous form, due to insect-puncture, occurs of this grass, which is rather common. In it the spikelets are .3" long, gl. i .08" ovate-oblong, amplexicaul, 5-nerved very herbaceous; ii .15" ovate, 9—11-nerved, only, half as long as the spkt.; iii ovate, .2" long, cuspidate, up to 14-nerved, elliptic palea half as long, the 2 marginal nerves puberulous; iv .25" long, broadly ovate, slightly cuspidate, 15-nerved, its palea is glume-like very boat-shaped, .22" long, 9-nerved obtuse, the ovary is apparently occupied by a pupa. The rhachilla is very stout and it and the base of gl. iv are bearded. Neither iv nor its palea are at all hardened.

3. *P. miliare*, Lamh. Condula, Beng.; Cundli, K.S.; Mota Gundli (the cultivated form in Ranchi), Vern.; Pani Kuhuri (Khondmals).

Usually a slender grass 1—3 ft. high but sometimes geniculate and stout below with the stem attaining .3" diam. Leaves linear 6"—2 ft. long, gradually tapering from a broad base, usually under .5" but up to 1" broad in some cultivated forms, glabrous or finely hairy, sheaths glabrous. Panicles very compound, contracted or thyriform and often nodding, 4—10" long (without the subsidiary axillary panicles which are often developed). Spikelets suddenly acute or slightly cuspidate .08—12" long, mostly paired on unequal pedicels but often solitary at the ends of the branchlets, lanceolar in flower, elliptic or broadly elliptic in fruit. Gl. i very broad amplexicaul, subtruncate then

suddenly acute, or scarcely acute, about one-third spikelet, very thin; ii elliptic obtuse (when unfolded, sometimes appearing cuspidate or mucronulate in *sitá*), 9-nerved; iii similar; iv narrow-ell. or ell.-oblong .08—1" long, truncate at base minutely apiculate at tip, white or pale brown, or dark brown and more broadly elliptic when ripe.

Cultivated, feral and wild. Western Bengal and Behar, *Kurz!* Santal Parg., *Kurz!* In all districts of Chota Nagpur and very frequently cultivated on non-rice lands (*gora* and *tanr* lands). Fl., Fr. Aug.—Oct.

P. miliare is probably the cultivated form of *psilopodium*. But in Chota Nagpur the cultivation is so poor that the two forms would be expected to be indistinguishable. *Prain* (*Bengal Pl.*) gives as the characters of *miliare* "Leaves hairy; cultivated," and of *psilopodium* "Leaves glabrous; wild"; but he has nevertheless named most of the glabrous-leaved forms in the *Calcutta Herb.* as *miliare*, and I have myself noticed whole crops with glabrous leaves, whereas I have collected *psilopodium* with hairy leaves. *Campbell* says "sown on second-class lands at the beginning of the rains. The grain is inferior in quality, and is only cultivated and eaten by the poorer classes." His specimens have also glabrous leaves.

Hooker (in *F.B.I.*) says "*Stapf* thinks that the true *psilopodium* has nearly always glabrous leaves, smaller spikelets and a shorter gl. i," but no dimensions are given and indeed the *F.B.I.* describes gl. i (= $\frac{1}{2}$ ii) in *psilopodium* as relatively longer than in *miliare* (gl. i = $\frac{1}{2}$ ii)! Although absolutely the leaves of *miliare* are often broader than in *psilopodium*, yet they are relatively narrower and much more attenuate. Moreover the cultivated *miliare* and its feral forms always appear to have more or less contracted panicles in contrast to the shorter, always quickly effuse, panicle of *psilopodium*. The grain of *miliare* is, as would be expected, rather larger, being .08—1" long as compared with .07" long in *psilopodium*.

4. *P. cæsius*, *Nees*.

A very stout grass 2—3 ft. high erect with tufted stems .3" diam. at base. Leaves lanceolate-linear 6—9" by .25—7" near the subcordate base, blade soft hairy, sheaths inflated hirsute with often tubercle-based hairs, ligule of hairs. Panicle large 10—18" long, subthyrsiform with suberect branches, lower fascicled, branches angular, scaberulous. Spikelets elliptic .08—09" long on very long (or lateral short) pedicels. Gl. rather membranous, i = $\frac{1}{4}$ — $\frac{1}{3}$ iii, ovate, 5-nerved; ii ovate acute 7—9-nerved; iii similar with linear margined palea; iv as long, elliptic-ovate obtuse pale smooth and polished.

Sant. Parg. (*Wall.* 8744, *Rajmahal!*) Fl. Aug. Annual.

5. *P. repens*, *L.* Da-gundli, *K.*; Pani-dal, *Or.*

Stem creeping and ascending stoloniferous, 2—5 ft. high, many-noded, clothed below with loose very striate leaf-sheaths which are hairy at the mouth. Barren shoots closely distichously leafy. Leaves linear-lanceolate to linear, those on barren shoots spreading 1—3" flat, others usually involute, 2—12" long glabrous or hairy on upper surface, base rounded ciliate as is the top of the sheaths, ligule obscure ciliate (a narrow coriaceous ring, *J.D.H.*). Panicle much resembling that of *gundli* contracted or sub-effuse, 3—8" long. Spikelets mostly paired, unequally shortly pedicelled, .1—11" long, erect, lanceolar, very acute. Pedicels with small cupular tips. Gl. i $\frac{1}{4}$ — $\frac{1}{3}$ th iii, hyaline or white amplexicaul truncate nerveless or 3-nerved; ii membranous, broadly ovate acuminate 5—7-nerved; iii similar, male or neuter, paleate (or not, *J.D.H.*) 7—9-nerved, palea 2-nerved truncate; iv narrow-elliptic acute .09" nerveless, polished, sides embracing the palea.

Aquatic or semi-aquatic, common. Purneah! Santal Parg. (Wall. 8710f)! Ranchi, Clarke! Manbhum, Camp! Singhuru! Puri, sandy tracts, Walsh! Fl., Fr. July—Dec.

Said to be a good fodder. It is undoubtedly closely allied to *P. miliare* though placed far from it in the floras. Stapf says gl. ii 9—7-nerved.

6. *P. proliferum*, Lank.

A large grass. Stem creeping or floating at base, rooting at the often black nodes as in the last species, often 3—5" diam., much branched with inflated striate leaf-sheaths, erect for 2—3 ft. Leaves 3—12" by .25—7" tapering from base to apex, or linear, margins scabridly serrulate. Panicle 3—8" long with many erecto-patent branches. Spikelets .12—14" long erect lanceolar acuminate on scabrid angled pedicels. Gl. i .03" rarely .04" long, white, suborbicular; ii lanceolate acuminate 9-nerved; iii similar, paleate or not, male or neuter, occasionally 2-sexual (*F.B.I.* p. 51); iv oblong sub-acuminate .09" long, pale brown smooth and polished.

Marshy places and tanks. Sikkim Tarai! and probably Purneah. Monghyr Mokim! Santal Parg., Nusker, etc.! Sargujah, Clarke! Fl., Fr. Aug.—Nov.

Leaves rounded at base, ligule of stiff hairs. Panicle branches 3-quetrous with scabrid angles. Pedicels mostly much longer than the spkts., with clavellate truncate tips.

7. *P. trypheron*, Schult.

A tufted grass, slender upwards, 6"—3 ft. high, usually leafy only near the base. Leaves narrow-lanceolate or linear 2—8" long, usually copiously hairy on both surfaces with tubercle-based hairs, rarely glabrous. Panicle open but often rather narrow from the branches being short or suberect, up to 9" long in the larger plants. Spikelets unequally slenderly pedicelled in pairs and single on the branchlets, .12" long, at first oblong but soon with open glumes. Gl. i $\frac{1}{2}$ — $\frac{3}{4}$ of iii, base amplexicaul, 4—5-nerved, acuminate or cuspidate; ii inserted some distance above i, elliptic long-acuminate or aristulate, 9-nerved; iii similar but acumen rather shorter, paleate, neuter; iv oblong but rather narrowed to the rounded tip, .09" long, polished yellow (variable in breadth and in colouring, from pure white to greenish brown with 3—5 darker dorsal stripes, *J.D.H.*).

Purneah, Kurz! Santal Parg. (Rajmahal Hills), Kurz! Monghyr, Mokim! Ranchi, Wood! Hazaribagh, very common! Manbhum, Camp! Bare stony ground. Puri, N. & C.! Fl., Fr. Sept.—Nov.

Ligule short, fimbriate or of hairs. The divergent cuspidate glumes make this species easily recognizable.

8. *P. maximum*, Jacq. Syn. *P. jumentorum*, Pers.; Guinea Grass.

A very large coarse tufted perennial 6—10 ft. high usually bearded at the nodes with lower leaves 2—3 ft. long by .5—1" gradually narrowed from the small rounded or auricled base to the long filiform tip, sheaths with villous mouth and ligule of long hairs or with long hairs from behind the short ligule proper; midrib conspicuous white. Panicle 1—2 ft. long, erect, decompound, lower branches whorled from a hairy node and usually hairy, up to 1 ft. long. Spikelets lanceolate oblong .12—15" long, often purplish with very membranous glumes.

Occasionally cultivated and succeeds well in Chota Nagpur. Singbhum! Ranchi, *Wood* (cult.)! Parasnath, *Clarke* (without remark)! Fl. May—Oct. Perennial. Native of Africa.

Gl. i very short rounded almost nerveless, about one-fourth spkt.; ii as long as spkt., 5-nerved; iii similar, 7-nerved with slightly shorter palea; iv pale or white nearly as long as iii, somewhat crustaceous, finely transversely rugose.

It proved a useful fodder in Singbhum and should be more largely cultivated for this purpose. It is easily propagated both by seed and by division of the roots, and can be cut several times annually.

9. *P. montanum*, *Roxb.*

An erect grass from a short stout upright rootstock with very slender stems 3—4 ft. high, lanceolate leaves 5—6" by .7—1", or rather larger and large terminal very effuse loose panicles 8—18" by 8—12" with long 1—3-nate capillary branches and very long capillary pedicels bearing minute spikelets .08—1" long.

Monghyr (*Wall.* 8722a), *Ham.*! Common in Chota Nagpur in the forests and also in the open. Ranchi, *Wood*! Manbhum, *Camp.*! Singbhum! Hazaribagh (Parasnath), *Cal. Herb.*! Palamau, ascends to the top of the pats! Also Santal Parg., Rajmahal Hills, *Kurz!* and as it is found too in Jalpaiguri! no doubt in Purneah. Fl., Fr. Aug.—Nov. Perennial.

Stem smooth and hard. L. glabrous or usually shortly hairy and ciliate, base sub-cordate, long-ciliate, sheaths glabrous or usually pubescent and edges ciliate, ligule obscure truncate. Panicle with the axils of the branches often swollen. Gl. i 3—5-nerved, $\frac{1}{2}$ — $\frac{2}{3}$ rds length of iii ($\frac{3}{4}$ iii, *F.B.I.*); ii and iii subequal, 5-nerved, elliptic, acute or obtuse, epaleate; iv polished brown or grey, .08" long, oblong with truncate base and very acute tip.

10. *P. humile*, *Nees.*

A tufted very slender grass 2—15" high, much branched at and often flowering close to the base. Leaves linear-lanceolate, tapering from the subcordate base to apex, or nearly linear, 1—6" long by .12—2", conspicuously (usually 6-) nerved and with rather inflated strongly nerved sheaths. Panicle broad with effuse delicate branches and capillary branchlets, lax flowered. Spikelets very small long-pedicelled, ovoid, .05—.06" long, pale or purplish. Gl. i relatively large .04—.05", broadly ovate acuminate or minutely mucronate from excurrent midrib, 3-nerved; ii longest ovate-lanceolate, very acuminate or sub-aristulate, 3-nerved; iii nearly as long as ii, ovate-acuminate, 3—5-nerved towards tip, paleate, neuter; iv .04" ellipsoid obtuse pale polished.

A very common grass, often found in rice-fields and probably occurring throughout our whole area. Monghyr, *Mokim!* Santal Parg., *Mokim!* Ranchi, *Wood!* Manbhum, *Camp.*, *Clarke*, etc.! Hazaribagh, *Wood*, *Clarke!* Singbhum, common! Orissa, *Walsh!* Fl., Fr. Aug.—Nov.

11. *P. auritum*, *Presl.*

A tall erect grass with broadly linear leaves 8—14" by .7—1.2", and with very compound paniced inflorescence of numerous small lanceolate spikelets, 8—18" long, contracted or more or less effuse, much fastigiately branched, branchlets and crowded fascicles of spikelets subsecund. Gl. i = $\frac{1}{2}$ iii, obtuse or acute 3—5-nerved; ii and iii subequal acute or acuminate 5-nerved; iii neuter with small palea; iv thinly coriaceous, white, as long as iii.

Tarai, near Purneah! Monghyr (at Jamalpur), *Cal. Herb.*! Fl., Fr. July—Nov.

L. with broadly cordate base, glabrous or sparsely hairy beneath, sheath glabrous or sparsely hairy with villous mouth, ligule very short. Panicle green with scaberulous rhachis, primary branches 2—5". Spikelets .07—1", sessile or shortly pedicelled, strongly-nerved, subacute, not membranous as in *P. maximum* which it sometimes somewhat resembles (it is called *P. maximum* in *Wall. Cat.* No. 8715f). In one specimen gl. ii is 7-nerved.

44. ECHINOCHLOA, Beauv.

Annual or perennial with linear leaves, ligule 0 or a transverse fringe of hairs. Panicles of crowded or loosely arranged secund spiciform racemes with triquetrous rhachis. Spikelets secund on the racemes (or "spikes"), close, 2-nate or clustered, articulate on their short pedicels, ovate to elliptic or lanceolate-oblong, usually cuspidate or awned, flat or depressed ventrally, the flat side turned away from the axis, dorsally convex. Gl. i much the shortest, more or less amplexicaul and ovate, 3—5-nerved, often mucronate or cuspidate; ii as long as spkt., concave, 5—7-nerved, acute to cuspidate or aristulate; iii as long, depressed dorsally, often cuspidate or aristate, palea nearly equal or reduced, finely 2-keeled; iv ovate to elliptic-oblong, obtuse or apiculate, coriaceous or crustaceous polished, very convex on the back with the back towards the axis, margins involute and embracing the sides but not the tip of the palea, palea similar in length and texture. Grain broad-elliptic.

The following key is based on Stapf's (in *Fl. Trop. Africa*):

I. Wild species:—

A. Gl. i and iv equally obtuse acute or cuspidate. Spikes 3—4-ranked, mostly short suberect:—

Ligule 0. Gl. i and ii minutely rigidly and appressedly pubescent between the nerves. Annual

1. *colona*.

B. Gl. i and iv cuspidate or aristate. Spikes suberect or spreading:—

Ligule 0, region of junction of blade and sheath discoloured inside, very finely pubescent or glabrous:—

Spkts. .12", gl. iii cuspidate or more or less awned. An annual weed

2. *crus-galli*.

Ligule a distinct fringe of hairs (at least in lower leaves):—

Spkts. ovate-oblong to lanc-oblong .17—25" long, awn 0—1" long. Spikes more or less nodding, loosely arranged in a secund panicle. Perennial or occasionally annual and then meagre and slender

stagnina
(p. 1044 bis).

frumentacea
(p. 1044 bis.)

II. Cultivated

1. *E. colona*, *Link.* Syn. *Panicum colonum*, *L.*; *P. cuspidatum*, *Roxb.*; Jhari (Khondmals).

A tufted slender grass sometimes only a few inches high but usually ascending to about 2 ft. Leaves up to 3" broad, glabrous or scaberulous. Ligule 0. Spikes not crowded but mostly longer than the internodes of the panicle-rhachis, suberect 3—7" long rarely 1". Spkts. .1—12" long, almost exactly as in *crus-galli* except that the glumes are never awned but acute or usually shortly cuspidate, glabrous or hispidulous, 3—4-seriate.

Purneah, Cal. Herb.! Monghyr, Mokim! Sant. Parg., Nusker! Chota Nagpur (without dist.), Wood! Singhbhum, common! Manbhum, in wet rice-fields, Camp.! Orissa, Walsh! Fl., Fr. July—Nov.

Panicum frumentaceum, Roxb., is perhaps rather a variety of this species* than of *crus-galli*, and is only distinguishable by its very crowded panicles and broad leaves with usually longer incurved spikes.

L. 3—12" by 17—3", rather flaccid, margins smooth or scaberulous, closely nerved or striate each side of the slender midrib. Panicle 2—5" long, narrow, its rhachis 3-quetrous above and scabrous on the angles. Spikes erect or somewhat erecto-patent, rhachis often with sparse fine hairs. Gl. i acute or minutely cuspidate, scaberulous; ii 1—12", 5—7-nerved, hirtellous or scabrid, ell.-ovate; iii as long; iv minutely cuspidate or apiculate, polished.

2. E. crus-galli, Beauv. Syn. *Panicum Crus-galli*, L.; Sama-ghas. Vern.

Erect or usually with a creeping and rooting base, often creeping in mud, 1—3 ft. high. Spikelets awned about 15" (without the awn), hispid, crowded on the more or less secund spike-like branches of a simple oblong or pyramidal panicle, 3—5-seriate subsessile on the flexuose flattened hispidulous and bristly rhachides which are 7—17" at base and often decrease in length towards the top of the panicle. Gl. i concave ovate acute or cuspidate 3—5-nerved .09" with the cusp, .08" if only acute; ii 14" without the cusp, very concave, strongly 5-nerved and also with fainter intermediate nerves, sharply shortly cuspidate or aristulate; iii 7-nerved, 15—16" without the awn, back depressed, nerves hispid, paleate, male or neuter, awn 1—8" long; iv 14" elliptic-ovate suddenly acute or almost cuspidate, smooth, shining; palca of the same shape, its margins above not embraced by but appressed to the fruiting glume.

In moist ground or sometimes growing in water. Jalpaiguri, common! probably therefore Purneah; Sant. Parg., Mokim! Gya, Mokim! Singhbhum! Manbhum, Camp! Orissa, Walsh! Fl., Fr. Aug.—Nov.

Stems often 3" diam. below, spongy. L. linear flat, often 1 ft. long, 2—7" broad at base, glabrous or somewhat hairy. Ligule 0 or, in var. *stagnina* (*E. stagnina*, Beauv.), of stiff hairs. Rhachis of panicle frequently with groups of bristles at insertion of spikes, angular with grooves opposite the spikes. Rhachis of spikes sometimes with long tubercle-based setæ.

Var. **frumentacea**, J.D.H.† Syn. *Panicum frumentaceum*, Roxb.; Shama, Beng.; Sawan, H.; Khir (Champan. when boiled with milk).

Culms erect, 2—4 ft. Panicle erect; spikes secund, incurved, crowded. Spkts. mostly 3-nate, unequally pedicelled, one at least sessile, awnless. Glis. ii and iii cuspidate or scarcely acuminate.

Monghyr, Mokim! Singhbhum! Said also to be commonly cultivated in Champan., Angul and Bonai. Fr. c.s.

This is a cultivated form used for grain and fodder, and in the absence of a distinct awn connects *crus-galli* with *colona*.

The grain is cream-coloured, about 1" long, convex-ovoid flat and margined on one face, sometimes slightly ridged down the centre of the convex side.

All our wild specimens have a more or less pronounced fringe of stiff hairs in the place of a ligule, and should therefore according to some authorities be maintained as a separate species (*E. stagnina*).

* Since writing this I observe that Stapf in *Fl. Trop. Africa* states that *P. frumentaceum* is evidently descended from *E. colona*, Link.

† See note under *E. colona*.

45. OPLISMENUS, Beauv.

Leafy weak grasses creeping below then ascending. Leaves ovate-lanceolate to broadly lanceolate, acuminate, flat, with scaberulous margins, base narrower than the middle, unequal, ligule short with long hairs. Spikelets sessile or subsessile, 1-flowered, solitary or fascicled on a simple spike or on paniced (racemed) secund spikes. Glumes 4. Invol. glumes usually subequal, i awned, ii often with a shorter awn; iii longest 5-9-nerved with a very short awn or not, paleate or not; iv 2-sexual, 5-7-nerved, coriaceous hardening in fruit, palea similar. Lodicules 2, minute stamens 3. Grain free within the glume and pale.

Rhachis of spikes without long white hairs. Spkts. over .1"

with rigid viscid awn to glume i 1. *compositus*.

Rhachis of spikes with long white hairs. Spkts. .1" or less

with capillary minutely barbellate awns 2. *Burmanni*.

1. *O. compositus*, Beauv. Bans-pati, Vern.; Kau-guria, Or.

Stems creeping and rooting below then ascending and 1-3 ft. high slender glabrous striate. Leaves lanceolate acuminate 2-7" by .75-1", base often ciliate, ligule short membranous ciliate. Panicle with 3-quetrous rhachis 4-8" long with sub-secund solitary, geminate or clustered distant spikes 1-3" long. Spkts. 1-2-nate, .12-.14" (exc. awn), sometimes one imperfect reduced to an awned glume, generally several hairs or long bristles at their insertion. Gl. i, .05-.1" with a red viscous rigid rather stout awn .15-.4" long; ii 5 (-7)-nerved shortly awned or not, shorter than iii, iii longest, lanceolate, elliptic 7-9-nerved, mucronate; palea narrow or 0; iv lanceolate to elliptic coriaceous shining. All glumes frequently silky or hispidulous.

In damp shady places, usually sub-gregarious. Rajmahal Hills, Kurz! Ranchi, especially on the higher elevations! Palamau, 3000 ft.! Singhum, near nalas! Hazaribagh, on Parasnath, Clarke, etc.! Fl., Fr. Oct.-Dec. Perennial.

There are numerous forms. That in our area has usually leaves 5-6" long with the sheaths ciliate above and often with long villi at the base of the blade (pubescent beneath in the Parasnath plant). Rhachis shortly hispid-pubescent. Spikes erect or spreading. Spkts. solitary or often with a rudimentary added and frequently with bristles at the base. The awns always glandular.

It is not eaten by cattle and horses also dislike it.

2. *O. Burmanni*, Beauv. Same vernacular names as the last.

A very delicate leafy grass diffusely branched with ascending stems 6-18" long. Leaves .5-2" long ovate-lanceolate acuminate, with fine scattered white hairs both sides, sheaths closely ciliate towards the mouth. Peduncle usually very long and slender under the short panicle which has 3-6 secund spikes .2-.6" long only, the axes of which are clothed with slender white hairs often exceeding the spkt. Spkts. .07-.1" long, secund, 1-2-nate on short pedicels furnished with slender hairs like those on the axis. Gl. i with a capillary, not viscid but minutely scabrid awn .3-.4" long, ovate, 3-5-nerved; ii subequal, 5-nerved also awned, awn .1-.2" long; iii .1 with an awn about half the length of that of ii, 7-9-nerved; empty; iv subequal, ovate, acute.

Gregarious on shady banks and often carpeting the ground in the forest (as in the Betlah Forest, Palamau). Gaya, Mokim! Santal Parg., Nusker! Ranchi and Singbhum! Hazaribagh (Parasnath), Clarke! Maubhum, Camp., common! Palamau! Puri, Walsh! Fl., Fr. Sept.—Nov.

This also is, I believe, not eaten by cattle under ordinary circumstances.

46. PASPALUM, L.

Annual or perennial with linear, lanceolate or ovate-lanceolate leaves. Spikelets orbicular to oblong obtuse secund and generally 2-seriate on the flattened, winged or 3-gonous rhachis of solitary digitate or racemose spikes. Glumes 3, i absent, ii membranous as long as the floral glumes (rarely short or obsolete), iii empty similar, iv 2-sexual, chartaceous to sub-coriaceous, hardened in fruit. Palea nearly as large, hardened in fruit. Lodicules 2 connate. St. 3. Styles distinct, stigmas plumose, exerted from near the top. Frt. tightly enclosed in the hardened glume and palea, dorsally subcompressed, the flat side turned away from the rhachis.

1. *P. scrobiculatum*, L. Kodo, H.; Khodoa-dhan, Beng.; Garakode, K.; Janhe, S.; Kodus, Or.

Stems 2—4 ft. high usually erect or ascending from a creeping root-stock. Glabrous. Lower sheaths inflated and compressed, hairy at the edges and ligule of long hairs hiding the very short membrane. L. up to 4" broad, with scabrous margins. Spikes 2—6, usually about 3 distant spreading on an angular almost 2-winged rhachis, their own rhachis being 2—5" long expanded flat .07" broad, scabrid on the edges. Spikelets very shortly pedicelled broadly ellipsoid or orbicular .1" long subimbricate in two rows. Gl. ii and iii 3—7-nerved membranous; iv crustaceous with inflexed margins embracing the edges of the coriaceous palea. Palea with the lower margins broadly inflexed shallowly lobed and embracing the grain, striolate with minute raised dots.

Wild in ravines and glades in Singbhum and Purneah! Santal Parg., Nusker! Often cultivated on a small scale and frequently appearing self-sown in other crops in most districts. In the Santal Parg. and Maubhum it is sown about the beginning of the rains on high land and reaped in November. Fl., Fr. Oct.—Nov.

Watt states that the grain requires much care in preparation as it sometimes develops a poisonous principle.

47. PASPALIDIUM, Stapf.

Usually tufted and prostrate or branched from a decumbent base, mostly perennial and growing in wet places with linear flat or involute leaves. Ligule a ciliate rim. Spikelets ovate to ovate-oblong or ovate-lanc., awnless solitary very shortly pedicelled secund on the 3-quetrous sometimes marginate rhachis of slender sessile spiciform racemes, which are secund on a common 3-quetrous rhachis of a panicle to which they are more or less appressed to the alternately hollowed-out flanges of the latter. Gl. i minute to half as long as iv, abaxial; ii dissimilar longer 5—7-nerved; iii similar to ii with the inner side-nerves more distant, subequal with iv, palea if present, slightly shorter

with conspicuous inflexed flaps on the lower margins; iv dorsally convex, oblong to ellip., mucous or minutely apiculate, crustaceous with firm involute margins; palea tightly embraced by glume all along the margin, crustaceous; lodic. small; styles distinct. Grain tightly enclosed in the gl. and palea.

A. Leaves mostly obtuse or acuminate from the inrolling of the margins:—

Lower spikes shorter than internodes. Spkts. .08—.09" 1. *flavidum*.

B. Leaves acuminate:—

Lower spikes as long as or exceeding the internodes. Spkts. .1—.12". Gl. ii about $\frac{1}{2}$ iv 2. *punctatum*.

Lower spikes as long or shorter than internodes. upper crowded. Spkts. .08". Gl. ii mostly equals iv 3. *geminatum*.

1. *P. flavidum*, Stapf. Syn. *Panicum flavidum*, Retz.

A grass of very varying size with usually several decumbent and ascending stems from a few inches long to 3 ft., small forms caespitose. Leaf sheaths inflated compressed, leaves sub-bifarious linear obtuse or suddenly acute (sometimes described as acuminate but rarely somewhat acuminate or only acuminate when the edges become inrolled). Spikelets ovoid .08—.09" long subdistichously secund on the flattened rhachides of very short spikes which are racemosely arranged on the long or short rhachis of a simple panicle and are much shorter than its internodes. In very small specimens there may only be a single terminal spike, in large ones up to 9 or 10 spikes on a rhachis attaining 15". Spkts. very pale, glabrous awnless. Gl. i .04—.05" long sub-orbicular.

A very common grass on moist or wet ground. Santal Parganas, Kurz, etc. Throughout Chota Nagpur, all districts! Khurda (Puri), Walsh! Very common in Bengal and no doubt in Purneah, if not throughout the province in the rainy season. Fr. r.s.—Oct. Annual?

Depauperated states are only 2—3" with leaves .5—1", large states have leaves 10" by .4" glabrous, or margins scabrid. Rhachis of spikes up to .03" broad, scabrid on edges. Spkts. sessile. Gl. ii = $\frac{2}{3}$ ths iv, 7-nerved; iii shorter than iv, convex, sub-orbicular, often shortly cuspidate, 5-nerved; iv more minutely punctulate than in *punctatum* but similar.

2. *P. punctatum*, Stapf. Syn. *Panicum punctatum*, Burm.

A very similar grass to *P. flavidum*. Stems 1—3 ft. long with often black nodes (as also occurs in *flavidum*) but leaves always acuminate rarely over .2" broad. Inflorescence similar but internodes of panicle shorter and the spikes sometimes as long or longer than the internodes, .5—1.3" long by .1" wide the rhachis more 3-quetrous with 2-seriate depressions in which the spkts. lie, often produced with a few imperfect spkts. towards tip. Spkts. elliptic very acute .12" long (.08—1" long, J.D.H.). Gl. i .03" long, truncate, broader than long; ii thin obovate .06", 3-nerved; iii elliptic as long as spkt. with inflexed edges and depressed 3-nerved back; iv as long as iii, shortly cuspidate minutely striolate with rows of microscopic dots.

Also in wet places (with lower parts sometimes floating) and perhaps as common as the last. Monghyr, Mokim; Gya, Mokim; Santal Parg., Nusher; Chota Nagpur, Wood, Campbell, etc.; Fl., Fr. Sept.—Nov. Perennial.

The spongy stems with their sheaths attain .3" diam. in the larger plants and root at the nodes. It is very closely allied to *flavidum* and none of the distinguishing characters are absolute. I would have called them varieties only of the same species.

3. *P. geminatum*, Stapf. Syn. *Panicum fluitans*, Retz; *Panicum paspaloides*, Pers.

Habit and appearance of *P. punctatum*; usually floating below and rooting at the nodes with long branched spongy stolons. It is said to differ in the rhachis of the spikes not produced at the tip with a few imperfect terminal spikelets but it is produced into a short point. It differs more markedly in the gl. ii nearly equalling iv and the smooth (or scarcely punctulate) glume iv.

Chilka Lake, in salt water, Atcock!

Leaves spreading, linear, obtuse, acute or acuminate, lower sheaths dilated. Spikes erect, .5—1" longer than the internodes and appressed to the narrow compressed setulose rhachis. Spkts. under .07" long, subglobose, glabrous, sessile. Gl. i very short white, suborbicular retuse; ii 5-nerved; iii plicate, broadly ovate acute, 5-nerved; iv broadly ovate subacute or obtuse, slightly shorter than iii, shining pale brown when ripe.

48. UROCHLOA, Beauv.

Annual or perennial grasses with linear to lanceolate leaves, ligule reduced to a ciliate rim. Spikelets more or less dorso-ventrally compressed, convex dorsally with the convex side towards the axis, closely secund on the 3-quetrous, rarely flat, rhachis of spiciform racemes, which are again racemose on the rhachis of a simple panicle. Spkts. articulate on their pedicels which are solitary or paired or 3—4-together and very short. Racemes spreading and usually several times longer than the internodes of the panicle. Glumes as in *Brachiaria* and *Paspalidium* but glume iv rounded or very obtuse at apex and with an abrupt mucro or aristula.

The separation of this genus from *Brachiaria* appears to me somewhat unsatisfactory as the different orientation of the spikelets, probably due to variable torsion of the pedicels, does not appear constant and of little taxonomic value. In *U. reptans* they are sometimes as much abaxial as adaxial, and in this species also the mucro is not more than an apiculus. Indeed I had placed *reptans* in *Brachiaria* before consulting the *Kew Herbarium*. There is sometimes similar doubt as to the dominant orientation of the spikelet in some *Brachiaria*.

A. Spikelets .15—.17" long. Gl. iv aristulate:—

Annual. Spkts. ovate to ovate-oblong acute turgid; gl. ii
7—11 (mostly 9-) nerved. L. mostly 3—6" 1. *helopus*.
Perennial. Spkts. lanceolate acuminate. Gl. ii 7-nerved. L.
mostly 2—3" 2. *setigera*.

B. Spikelets .07—.09". Gl. iv apiculate or nearly mucous 3. *reptans*.

1. *U. helopus*, Stapf. Syn. *Panicum javanicum*, Poir.

An annual erect grass 1—2 ft. high or decumbent and rooting at the base, nodes hairy. Leaves large narrowly or linear lanceolate, attaining 8" by .7" or sometimes (*vide F.B.I.*) only 1—5" by .3—.7", with scattered tubercle-based hairs or glabrescent, sheaths hairy. Spkts. .16" long elliptic acuminate pubescent 2-scriate alternate on the flattened 3-quetrous 1—2.3" long rhachides of the 4—10 spreading branches (spikes

or contracted racemes) near the top of a simple long-peduncled panicle. Gl. i ovate acute '04—'05" long ($\frac{1}{2}$ ii, *F.B.I.*) 3-nerved; ii 7—9-nerved sub-acuminate = spkt.; iii similar but with depressed back and 5-nerved; iv pale elliptic with a long mucro or short abrupt awn closely finely dotted or rugulose.

Singbhum! Manbhum (near), Nusker! Fl., Fr. r.s.—Oct.

L. minutely wrinkled crenulate along margins when dry, base rounded or amplexicaul, margin with long cilia especially near the base, ligule of stiff hairs. Rhachides of panicle and spikes scaberulous and with few long hairs. Pedicels very short with few long hairs, tip with a saucer-shaped base of glume left after fall of spkt.

2. *U. setigera*, Stapf. Syn. *Panicum setigerum*, Retz.

Stems 2—3 ft. slender, prostrate and straggling below with long lower internodes; nodes rooting, tomentose. Leaves 2—3" or sometimes 6" by '9" ovate lanceolate with long cilia towards the amplexicaul base, margins crenulately wrinkled towards the base. Spikes 3—6 spreading or suberect. Spikelets lanceolate cuspidate-acuminate '14—'17" long 2-seriate alternate imbricate glabrous or pubescent the very short pedicels with scattered long setose hairs. Gl. i broadly ovate amplexicaul, 3- or sub-5-nerved; ii 7-, rarely 9-nerved; iii 5-nerved, neuter, palea nearly as large; iv about '1" long, finely rugose, aristulate.

Frequent in the districts along our eastern boundary from Maldah! southwards, though no specimen appears yet to have been actually collected within it. Fl. Sept., May (May—Sept.?).

3. *U. reptans*, Stapf. Syn. *Brachiaria prostrata*, Griseb.; *Panicum prostratum*, Lamk.; *P. reptans*, L.

A small caespitose grass with stems 4—15" long and very short amplexicaul lanceolate cordate leaves '5—'1.5" long, rarely 2" by '6", with the base and sheaths long-ciliate and frequently white-hairy on both surfaces. Spikes usually few at the top of the panicle-rhachis longer than its internodes, secund suberect '3—'1" long with slender angular rhachis smooth or hispidulous on the margins. Spkts. ellipsoid with acute tip, '07—'09" long, glabrous, unequally pedicelled, pedicels with long (rather caducous) cilia. Gl. i scarcely '02" long, broader than long, truncate or retuse with a small apex; ii acute 5—7-nerved; iii strongly 5-nerved, paleate; iv as long as iii, elliptic, acute, dorsally rounded, obtuse and apiculate, thinly coriaceous, minutely transversely rugulose in fruit.

A common weed in grazed fields, etc. Patna (*Wall.* 8734)! Bhagalpur, King! Monghyr! Santal Parg., Nusker! Gya, Clark! Singbhum! Manbhum! Puri, Walsh! Fl., Fr. r.s.—Dec. Annual or perennial.

The cilia are frequently on the common abbreviated peduncle of the spikelets rather than on their pedicels. I had placed this species in *Brachiaria* before consulting the *Kew Herb.*

49. BRACHIARIA, Griseb.

(*Panicum*, Sect. *Brachiaria*, *F.B.I.* in part, and Sect. *Paspaloideæ*, *F.B.I.* in part.)

Annual or perennial with linear to lanceolate leaves, ligules reduced to a ciliate or ciliolate rim. Spikelets more or less elliptic or oblong.

articulate on their very short 1—2- (rarely more-) nate pedicels, dorso-ventrally compressed, convex on the back, adaxial (with gl. i towards the axis and the convex side of gl. iv away from the axis) closely appressed to and 2-seriate (sometimes obscurely) on the 3-quetrous or flat rhachis of spiciform racemes, which are sessile on the rhachis of a simple or somewhat compound (racemes sometimes branched near the base) panicle. Gl. i shortest, usually very small; ii 5—7-nerved; iii resembling ii and subequal but side nerves more towards the margin (unequally spaced), male or neuter, palca with conspicuous inflexed flaps below, rarely absent; iv oblong or elliptic mucous or contracted into an apiculus, crustaceous with involute margins tightly embracing the 2-keeled palca. Lodicules 2. St. 3. Styles distinct. Grain tightly enclosed, more or less flattened on both faces.

Very close to *Brachiaria* and the difference in the orientation of the spikelets not always very clear (see note under *Urochloa* and *U. reptans*).

I. Spikelets minute, .05—08" long, crowded:—

Pedicels all very short, racemes simple with filiform rhachis on a simple panicle

1. *isachne*.

II. Spikelets .1—15":—

A. Pedicels very short, Racemes 2—4 simple, spreading

2. *distachyum*.

B. Spkts. solitary and 2-nate, one of each pair with elongated pedicels or all pedicels elongated. Racemes often with a short branch at the base:—

1. Leaves lanceolate with cordate base ciliate or ciliolate (linear in one form of *ramosa* but then spkts. crowded):—

Spkts. mostly densely crowded, spikes suberect close, rhachis often with few fine hairs

3. *ramosa*.

Spkts. remote, spikes few distant without hairs

4. *Kurzii*.

2. Leaves linear, glabrous or minutely pubescent at base:—

Spkts. remote in lax rather irregular racemes

5. *remota*.

1. *B. isachne*, Roth.

A very slender grass with many decumbent and ascending stems 6—18" long, the nodes and mouth of sheaths bearded. Leaves narrowly lanceolate, lower 1—3.5" upper often very small, acuminate. Spikelets .05—07" long only, crowded, distichously secund in erect or suberect spikes .3—8" long closely alternately arranged on the angular rhachis of a simple raceme, and longer than its internodes. Rhachis of spikes flattened, villous, as are the spikelets.

Rajmahal (Santal Parg.), Mokim! Singbhum. Clarke! Fl., Fr., Oct.—Nov.

L. glabrous or softly hairy slightly narrowed to the rounded base. Rhachis of spikes narrower than the spikelet. Spkts. very pale, glumes membranous. i minute, only about .01" long, but very broad and embracing the rhachilla; ii elliptic-ovate, silky, 3-nerved, acute, iii = ii, back rather depressed, margins inflexed, 3-nerved, silky; iv .05" oval, smooth polished; palca rather concave on the back.

2. *B. distachyum*, comb. nov. Syn. *Panicum distachyum*, L.

A slender creeping grass with ascending stems 8—20" long, glabrous or panicle sparsely hairy. Leaves lanceolate to linear-lanceolate or linear acuminate 2—6" by .12—25" widest at the rounded or amplexicaul

base; sheaths closely ciliate. Spkts. spicately arranged in two (—one) series on the 2—4 spreading flattened branches 1—2·5" long of a simple panicle-rhachis, elliptic-oblong, glabrous, 1—1·5" long (mostly about 12"). Gl. i embracing the spkt. and margins overlapping below, one-third to nearly $\frac{1}{2}$ spkt., 3-nerved, obtuse or subacute; ii 5—7-nerved; iii acute, 5-nerved paleate or not, palea if present narrow, neuter; iv ellipsoid obtuse or rounded, 0·8" long, brown and minutely transversely lineolate or obscurely rugulose when ripe.

Monghyr (var. *brevifolia*, with leaves 3—1" only, ovate-lanceolate), Mokim! Santal Parg., Nusker! Ranchi, Wood, Gamble, etc.! Hazaribagh, Clarke! Manbhūm, Camp! Puri, Walsh! Probably throughout the province. Fl., Fr. Sept.—Dec.

3. *B. ramosa*, comb. nov. Syn. *Panicum ramosum*, L.; Mota Gundli, Sant.

Stems 1—3 ft. high often from a branched decumbent base, leafy, nodes pubescent. Leaves lanceolate or narrowly lanceolate or sometimes linear amplexicaul 1—5" long, rarely attaining 7" broad, sometimes pubescent, sheaths always finely pubescent on the edges and often with sparse scattered hairs above, ligule a fringe of short hairs. Spikes or racemes erect or suberect 1—2·5" long few or many in an oblong or pyramidal panicle, rhachides 3-quetrous hispidulous and sometimes with a few long hairs. Spkts. geminate, sessile and pedicelled, glabrous or usually pubescent, elliptic-obovoid 12—13" long, apiculate. Pedicel often with few long hairs. Gl. i one-third to nearly half as long as iii, embracing base of spkt., truncate, with an obtuse tip; ii very membranous = iii, 7-nerved, ell.-obovate apiculate, very convex; iii 5- (—7)-nerved with flat back and narrow palea; iv elliptic apiculate thinly coriaceous, closely minutely trabeculate, becoming minutely transversely rugulose in fruit, sides embracing the pale except towards apex, 1" long, hardened. Pale similar but flat.

Monghyr, Mokim! Santal Parg., Kurz, etc.! Patna, Ham. (Wall. No. 9727 c)! Singbhum! Manbhūm, "found self-sown with *Panicum miliare*," Campbell! Parasnath, Clarke! Fl., Fr. May—Dec.

Stature and habit very variable, sometimes only 6" and very ramose with branches 3—4" with small leaves. In some Rajmahal specimens the leaves are 5·5" by 7" and racemes branched. I would include both *Kurzii* and *remota* under this species; it varies in the direction of both.

4. *B. Kurzii*, comb. nov.

A weak grass, decumbent and rooting below with slender stems 1—2 ft., and short lanceolate leaves 2—3" by 3—7" acuminate, base cordate ciliate and margins crisped below, sheaths with villose margins. Spikelets 1—12" long lanceolar, submucronate, mostly with very elongate pedicels, the longer up to 2" on slender branches. Spikes few, 2—3" long, very remote, sometimes with a short branch at base, naked or with few hairs.

Parasnath, J.D.H.! Annual.

I would call this a variety or growth form of *B. ramosa*. There is little or no difference in the glumes. Hooker states that a doubtful specimen from Baidyanath (Santal Parganae) has the narrow leaves of *remota*.

5. *B. remota*, *comb. nov.* Syn. *Panicum remotum*, *Retz.*

A very slender straggling grass 1—2 ft. much branched with linear or somewhat linear-lanceolate leaves 2—4" by .25—3" finely acuminate; membranous, glabrous except at extreme base and top and edges of sheath where shortly pubescent. Spikelets .11—.12" long very loosely scattered, solitary or in distant pairs on the lax racemes and sometimes racemes with a short branch below, suberect, the whole approaching in habit a true panicle; main rhachis and rhachides of racemes 3-quetrous with scaberulous margins. Gl. i adaxial, orbicular, .04—.05"; ii ovate apiculate; iii equals ii, acute or subapiculate, 5-nerved; iv apiculate or mucronulate, elliptic, minutely somewhat transversely rugulose!

Orissa, *Walsh!*

This comes very close in the character of its inflorescence to *B. regularis*, *Stapf.* The inflorescence is much more irregular than most of the genus, but many specimens of *ramosa* show a similar lax tendency in parts of their inflorescence and the species is scarcely separable from narrow-leaved specimens of the latter or from *Kurzii*. *Dr. Stapf* thinks it is better kept distinct.

50. *ERIOCHLOA*, *H. B. & K.*

Annual or perennial with flat lanceolate or ovate-lanceolate leaves. Spkts. secund on the spiciform branches of a raceme or panicle, more or less dorsally compressed, lower glume rudimentary forming with the foot of the rhachilla a swollen annular callus at the base of the spkt. which is articulate on the thickened top of the short pedicel. Rhachis of spike 3-quetrous. Gl. ii and iii subequal, membranous; iv shorter hardened and mucronate in fruit. The rest as in *Digitaria*.

1. *E. ramosa*, *O. Kuntz.* Syn. *E. polystachya*, *H. B. & K.*

A slender erect or ascending grass 1—5 ft. high. Leaves 3—10" by .17—.4" linear, acuminate. Spkts. very pale .12" long, broadly lanceolar or ovoid subcuspidate or very acute close erect in very numerous erect or erecto-patent peduncled spikes 2—4" long, forming a narrow secund compound panicle up to 8", silky or villous rarely glabrous.

Purneah, *Kurz!* Santal Parg., *Kurz!* Monghyr, *Cal. Herb.!* Patna, *Ham.* (*Wall. No. 8750f*, "*Milium Carar*")! Shahabad, *J.D.H.!* Manbhum (*Raniganj* and *Burdwan*), *Nusker!* Orissa, *Walsh!* Fl., Fr. Aug.—Nov.

Stems and leaves glabrous or hairy. Ligule very short. Panicle in some Behar plants only 1—2" with spikes only .5". Rhachides 3-gonous, sometimes nearly glabrous. Gl. ii and iii 3—5-nerved; iv with short awn or cusp 2 mm. long, cusp .3 mm. The callus forms a distinct thickened node at the top of the .02—.04"-long puberulous pedicel.

51. *DIGITARIA*, *Rich.*

Annual or perennial with linear or lanceolate leaves. Spikelets usually 2—3-nate, jointed on the pedicel in digitate or racemose spikes, with a 3-quetrous or flat (winged) rhachis. Glumes 4—3, rarely i quite absent, but usually very small hyaline and not embracing the next; ii membranous 1—5-nerved or nerveless; iii usually largest 5—7-nerved, the nerves close parallel straight and prominent; iv subequal chartaceous

or coriaceous usually 3-nerved with a similar subequal 2-nerved palea. Lodicules 2 minute, broadly cuneate. St. 3. Styles distinct, stigmas plumose laterally exerted near the apex of floret. Grain oblong, slightly dorsally compressed, enclosed in the hardened glume and pale, which are generally striolate with longitudinal lines of microscopic dots.

I. Rhachis of spikes winged, over .02" broad. Pedicels shorter than the spikelets:—

A. Spkts. .07—14" long, lanceolate

1. *sanguinalis*.

B. Spkts. under .07" long, elliptic-lanceolate:—

Spkts. glabrous or with fine hairs. Fr. pale or slate-coloured, not shining

2. *longiflora*.

Spkts. with short capitate hairs. Fr. shining black

3. *Royleana*.

II. Rhachis 3-quetrous under .01" broad. Pedicels of some spkts. in each cluster longer than the spkt.

4. *pedicellaris*.

1. **D. sanguinalis**, Scop. Syn. *Paspalum sanguinale*. (F.B.I.); *D. marginata* and others, Link.*

A slender grass 18"—3 ft. high, ascending from a geniculate branched base, with linear to linear-lanceolate leaves, mostly 1—5" long, up to .3" wide. Spikes slender 3—10 digitate or shortly spiked, mostly 2—4" long sometimes 6" with the rhachis triquetrous or winged. Spikelets imbricate usually 2-nate, sessile and pedicelled, or rarely 3-nate on abbreviated peduncles, lanceolate .07—12" long. Gl. i minute or 0, ii up to two-thirds iii or shorter or also sometimes minute or failing; iii as long as spkt. ell.-oblong acute or acuminate 3-nerved on the flat back and with 1—2-nerves on the incurved margins; iv coriaceous, lanceolate very acute or sub-acuminate, minutely striate with micro. dots, wrapping round the similar pale and flower. Rhachis of spike and pedicels of spkts. scabrid-hispid on margins, and glumes in some varieties densely ciliate.

Throughout the province. Fl., Fr. Sept.—Nov. A very variable grass of which the following forms occur in our area:—

α. **extensa**, J. D. H. Syn. *P. sanguinale*, var. *extensum* F.B.I.; *D. pruriens*, Herb. Kew.

Lower sheaths usually with tubercle-based hairs, sometimes glabrous. L. 2—4". Spkts. more or less ciliate. Gl. i usually absent, ii half iii or minute, ciliate. iii is scarcely ciliate in the Monghyr specimens, ii .02—025" only.

Santal Parg., Kurz, Nusker, etc. common. Monghyr (Wall. 8181 f)! Fl., Fr. Oct.

β. **Rottleri**, J.D.H.

Usually dwarf under 1 ft., much branched from the base, glabrous or hairy. Spikes 2—5 only, 1—3" long digitate or nearly so, rhachis with wings 2—3 times

* NOTE.—As far as I can gather from the arrangement in the Kew Herbarium and from Dr. Stapf's notes in the *Fl. Trop. Africa* none of the Indian material is now considered to be true *D. sanguinalis*, Scop. Much of it is placed under *D. marginata*, Link. He calls the var. *commutatum* (F.B.I.) var. *Linkii*; var. *ciliaris* var. *fimbriata*. I note that Link described his *marginata* from a Brazilian plant but the species is cosmopolitan in the tropics. *D. sanguinalis* occurs in Southern Europe. My descriptions and arrangement maintain the whole plexus under *sanguinalis*.

broader than the midrib. Spikelets broader. Gl. ii rather shorter and narrower than iv and iii, glabrous or ciliate. Monghyr, *Mokim* (*vide J.D.H.*)!

γ. **commutata**, *J.D.H.* Syn. *Panicum commutatum*, *Nees*; *D. marginata* var. *Linkii*, *Stapf*.

Usually tall, often stout with hairy sheaths, leaves 3—6" and spikes up to 20, 3—6" long fastigate or sub-corymbose, the lower often whorled or fasciated. Rhachis flexuous rather narrowly winged. Spkts. .12—14" by .03—04" broad, rather crowded, shortly pedicelled. Gl. i minute; ii lanceolate rather shorter and narrower than iv; iii with lateral nerves glabrous or pubescent; iv lanceolate acuminate.

Chota Nagpur, *Wood*!

δ. **cruciata**, *J.D.H.* Syn. *Digitaria cruciata*, *Nees*.

Spikes several, 2—3", usually horizontal, rhachis slender narrowly or rather broadly winged, spkts. acute or cuspidately acuminate rather loosely imbricate glabrous, purple or green, gl. ii half iii, ovate-oblong, obtuse 3-nerved; iv ovoid or obovoid turgid cuspidately acuminate.

Parasnath, *C.B.C.*! A mountain form. The species is kept distinct by *Stapf*.

ε. **purpurea**, *forma nova* (perhaps *cruciata* with much smaller gl. ii).

Stems dark purple below, lighter purple above. Lower sheaths with tubercle-based hairs. L. 2—3" by .2", a few long hairs near base, ligule prominent oblique. Spikes 6—12 suberect, shortly racemed, 2—2.5" long, winged rhachis .03" wide (wings broader than keeled centre) scabrid. Spkts. glabrous, gl. i absent; ii minute; iii .08—09" long; iv minutely cuspidate. All glabrous.

Ranchi, at Neterhat, elev. 3000 ft.

ζ. **ciliaris**, *J.D.H.* Syn. *Paspalum ciliare*, *Retz*; *Digitaria ciliaris*, var. *quadrastachya*, *Wight*; *D. marginata*, var. *fimbriata* (*Stapf* in *Kew Herb.*).

Usually tall. Spikes 2—6, 3—6" long with slender rhachis winged and .03—04" broad, usually flexuous. Spkts. lanceolate .12". Gl. i scale-like; ii nearly as long as iii but narrower, 2—4-nerved and villous, with long spreading villi in the pedicelled spkt.; iii with thin 3-nerved back and inflexed 2-nerved margins which especially in the pedicelled spkt. have two rows of dense spreading villi longer than breadth of glume and often hooked at their tips; iv subacuminate.

Very common. Monghyr, *Mokim*! Santal Parg. (*Rajmahal*), *Wall.*! Throughout Chota Nagpur in all districts, common! Puri, *Walsh*! No doubt throughout the province.

2. **D. longiflora**, *Pers.* Syn. *Paspalum longiflorum*, *Retz*.

Stems much tufted, procumbent below and rooting with ascending branches or prostrate. Leaves lanceolate short (in all specimens from our area). Peduncles and rhachis very slender. Spikes 2—many sub-terminal, 1—3" or sometimes 4" long, usually white. Spkts. elliptic-lanceolate .05—06" long, geminate or alternate sessile and shortly pedicelled, the hairs if any slender crisped. Glume i obsolete, ii as long as iii, with 3 prominent nerves and usually sparsely hairy or shorter or obsolete, iii elliptic about 5-nerved.

Monghyr Hills, *Kurz*! Western Bengal and Bihar, *Kurz*! Santal Parg., *Nusker*! Ranchi, *Gamble*, *Wood*! Manbhum, *Campbell*, etc.! Hazaribagh, *Clarke*! Fl., Fr. July—Dec. Probably annual.

L. sheaths glabrous or somewhat hairy, blade .5—2" or (*vide Hooker*) sometimes long and linear, erect or spreading. Rhachis of spikes up to .03" wide with scabrid edges. Fruiting glume grey (not shining black as in *Royleanum*).

Hooker states that gl. iv is acuminate; it seems to me only acute.

3. D. Royleana, Prain. Syn. *Paspalum Royleanum, Nees.*

Erect or shortly decumbent below, 1—3 ft. high with long linear erect leaves 3—6" long. Peduncle and rhachis very slender. Spikes 2—10 erect or suberect, 1.5" on small specimens to 4.5". Spikelets oblong-ellipsoid geminate and shortly pedicelled, .04—.05", the hairs short and capitate or clavate. Fruit black and shining.

In the hills. Monghyr, *Ham.* (*Wall.* No. 8752 b)! Patna (*Wall.* 8684)! Santal Parganas, *Camble, Mokim*, etc.! Ranchi, *Clarke!* also collected by me in Bilaspur near our western borders in the hills. Fl., Fr. Sept.—Nov.

Sometimes tinged purple. L. up to .2" wide, surface often scabrid. Rhachis of spikes flexuous scabrid. Gl. i absent; ii sometimes reduced to a tuft of hairs, at other times = $\frac{1}{3}$ ths iii, shortly hairy; iii shortly hairy = iv; Pedicel setose or setulose at tip.

4. D. pedicellaris, Prain. Syn. *Paspalum pedicellare, Trin.*

Tufted erect branched from the base 6—18" high with linear acuminate leaves 2—6" by .12—.17". Peduncles slender with 3—10 alternate suberect or spreading filiform spikes 1—4" long. Rhachis trigonous under .01" broad. Spkts. 2—5-nate, .05—.06", one or more of each group with pedicels one and a half times as long as the spkt.

Patna (*Wall.* No. 8747 a), *Ham.!* Rajmahal Hills, *Kurz!* Singbhum, *Clarke!* Manbhum, *Campbell!* Hazaribagh, *Clarke!* Fl., Fr. Sept.—Nov. Annual.

Sheaths sparsely hairy. Ligule short, scarious. Glumes sometimes slightly hairy. ii and iii subequal 5-nerved, iv pale.

52. ALLOTEROPSIS, Presl.

(*Axonopus, F.B.I.* not of *Beauv.*)

Perennial grasses with ovate to linear leaves and 2-fld. spikelets articulate on their pedicels in whorled or digitate spikes. Glumes 4; i shortest, ovate acuminate or cuspidate 3-nerved; ii ovate-lanceolate, awned or acuminate, 5-nerved, fringed with hairs; iii 5 nerved with a very short 2-fld or 2-partite palea; iv as long as ii, coriaceous, narrowed into a straight awn and with coriaceous 2-nerved palea. Lodicules cuneate. Stamens 3, anthers long. Styles distinct. Grain small, sub-orbicular, free within the hardened glumes.

Leaves ovate to ovate-lanc. Spikes subverticillate at top of stem. Spkts. ovate

Leaves long linear. Spikes few sub-digitate. Spkts. lanceolar

1. *cimicina*,

2. *semi-alata*.

1. A. cimicina, Stapf. Syn. *Anonopus cimicinus, F.B.I.*

A hairy grass 1—2 ft. high with numerous ascending stems from the root and ovate or ovate-lanceolate hairy and ciliate leaves .8—2.5" long with cordate base and ligule of long hairs. Spikes simple or 2-furcate, 4—8 in a terminal whorl, 2—6" long. Spikelets dorsally compressed 1—3-nate on short slender pedicels, ovate or lanceolate-ovate, .1—.14" long (exc. the slender awn). Gl. ii fringed with dense pink hairs. Gl. iv with a very slender tail or awn .02—.04" long.

Monghyr Hills, *Kurz!* Santal Parg. A common grass in the rainy season in semi-shade in Chota Nagpur. Ranchi! Manbhum, *Camp!* Singbhum! Fl., Fr. r.s.—Oct.

The hairs are tubercle-based and the grass is a very easily identified one. L. 8" wide in well-grown specimens.

2. *A. semi-alata*, Hitch. Syn. *Axonopus semialatus*, *Hook. f.*

An erect grass 2—3 ft. high from a bulbous rootstock which is clothed with densely pilose sheaths. Stem glabrous except at the bearded nodes. Leaves mostly near base of stem linear tapering 3—10" long by .3" wide at base or less, sparsely hairy both sides, sheaths very hairy. Spikes 2—5 digitate 1.5—5.5" long interrupted, rhachides hairy or villous, 3-angled and channelled. Spkts. lanceolate .2" long, mostly 3—4-nate (1—2-nate, *F.B.I.*) with unequal pedicels up to .25" long.

Chota Nagpur, above 2000 ft. A very common grass both in the open and in the forest at about 3000 ft. Ranchi and Palamau! Parasnath, *Clarke!* Fl., Fr. April—July.

Base of stems often over .5" diam. with the sheaths. Gl. i .1" purplish, scarious 3-nerved, ovate, 2-toothed and with midrib excurrent; ii and iii subequal, ii elliptic strongly 5-nerved and ciliate, cuspidate; iii lanceolate, 3-nerved, somewhat crustaceous with hyaline unequally 5-toothed palea, 2 lodicules and 3 stamens; iv lanceolate glabrous coriaceous 5-nerved with slender awn .04", 2-sexual with hyaline 2-nerved palea and broadly cuncate lodicules.

The toothed palea may not be constant. It is not noticed by *Hooker*.

53. SPINFEX, L.

Stout rigid bushy polygamo-dioecious xerophytic grasses with long rigid involute leaves. Inflorescence in large subglobose umbels or heads. Male spkts. large 2-flid. subsessile articulate on rigid peduncled spikes, which are collected into umbels surrounded by spathaceous leafy bracts; glumes 4, i and ii empty; iii and iv paleate triandrous. Fem. spikelets collected into large globose heads of stellately spreading long rigid subulate bracts and barren prolongations of the rhachides together with shorter flattened-subulate bracts; each spikelet solitary and articulate at the very base of the rhachis, lanceolar, 2-flid. Glumes i, ii, iii as in the male but mostly larger, iii paleate, empty or 3-androus; iv female or 2-sexual. Lodicules 2, large, nerved. Styles long free or connate at base, stigmas long shortly feathery. Grain free within the hardened glumes.

Natives of sandy shores and deserts.

1. *S. squarrosus*, L. Burkonko, Rabana, *Or.*

A large glaucous fruticose grass forming bushes 2—4 ft. high and broad and with long underground or superficial stolons. Leaves 4—6" long squarrose, recurved, pungent, margins spinulose-serrulate; sheaths often imbricate inflated dry striate hirsute at the mouth; ligule hirsute.

Sandy places on the coast. Balasore! Cuttack! Puri, Fl., Fr. r.s.

Male umbels sessile at the angles of a zigzag rhachis with pungent lanceolate bracts .7—1.2" long; spikes 2—3" with the scabrous rhachis produced at the tips into pungent spines resembling those of the female but short. Spikelets .4" long, glabrous scaberulous. Gl. i shortest about .2—2.5" long 7—9-nerved; ii similar but a little longer; iii lanceolate 5-nerved rigidly acuminate or subaristate; iv usually a little longer (in our specimens, *Hooker* says shorter) subaristate or cuspidately acuminate. Fem. spkt. .4—4.5" long partly sunk in the base of the needle-like rhachis which is supported by distichous bracts, some of which are similar to

itself 3—6" long, others short flatter and 1" long. Glumes and palea all lanceolate-acuminate membranous and subequal, outer puberulous, i 11-nerved; ii 7—9-nerved; iii 5-nerved; iv 5—7-nerved, 2-sexual; palea 2-nerved, lodicules quadrate-oblong 2-nerved. Style with stigmas .75" long.

The long stolons (which are not mentioned in the *F.B.I. or Beng. Plants*) run for a considerable distance and then give rise to a further clump; they serve, with the grass itself, to fix the sands along which the large globose infrutescence may often be seen bounding along before the wind on its long elastic spines.

54. SACCHARUM, L.

Robust very large perennial grasses with flat or convolute leaves, those from the base usually very long. Spikelets 1-flid. small or very small similar or nearly so, 2-nate, sessile and pedicelled on the articulate fragile rhachis of racemes, racemes simply whorled on an elongate common rhachis or panicles large silky much and densely branched, the branches often spreading in flower, erect in bud and fruit. Glumes 4, membranous or outer chartaceous towards the base. Gl. i with inflexed margins and usually 2-keeled or with an even number of nerves; ii 1—5-nerved; iii hyaline awned or not, empty; iv shortest, rarely 0, awned or not; palea hyaline nerveless or 0, lodicules cuneate. Stamens 3. Stigmas laterally exerted. Grain oblong to subglobose.

As remarked by me in *Fl. Ch. Nag.* the awned gl. iv of some *Saccharum* breaks down the only distinction between that genus and *Erianthus*. *Dr. Stapf* has sunk *Erianthus* in *Saccharum* in the *Flora of Tropical Africa* which course is adopted here.

Much interesting information and further details on the plants of this genus will be found in *Hole's* *Ecology of some Indian Forest Grasses* (*Ind. For. Memoirs*, vol. i, Part D).

I. Awn of gl. iv not or scarcely exerted from spkts. or 0:—

A. Hairs on callus much exceeding the spkt. Gls. i and ii not dorsally villous:—

Culms not leafy above, under .7" diam. L. under .8" in width. Gls. i and ii ciliate

1. *spontaneum*.

Culms densely leafy above, over 1" diam. L. over 1" in width. Gls. i and ii glabrous .

2. *officinatum*.

B. Hairs on callus of sessile spkt. shorter or not much longer than spkt. Gls. i and ii often dorsally villous:—

1. Nodes of culm not bearded. Sheaths not hirsute.

Gls. i and ii dorsally villous:—

Foliage not glaucous. Culms densely leafy above.

Sessile spkt. shorter than internodes

3. *arundinaceum*.

Foliage glaucous. Culms not leafy above. Sessile

spkt. longer than internode of rhachis

4. *munja*.

2. Nodes of culm bearded. Sheaths hirsute. Gls. i and ii not or sparsely villous dorsally .

5. *narenga*.

II. Awns of gl. iv distinctly exerted from the spkt.:—

Panicles thyrsiform. Spkts. .13—16" long. Awn .1—23" long

6. *ravennae*.

Panicles not thyrsiform. Spkts. .17—19" long. Awn .3"

7. *fastigiatum*.*

1. *S. spontaneum*, L. Kans, Khansi, H., Beng.; Puyal, K.; Kariba, M.

A coarse grass 5—7 ft. or attaining 15 ft. along canal-banks, usually glaucous with solid stems, .1—5" diam. (fistular below, *Hole*). Easily

* Transferred to *Eulalia* at Kew.

recognised by its very narrow leaves frequently with incurved or rolled-up margins, and by the white silvery narrow panicles 1—2 ft. long with the callus hairs many times longer than the small spikelets. Branches of panicle 3—4", more or less whorled on the silky rhachis and articulate to it. Spikelets very variable in size, .08—2" long. Gl. i lanceolate, basal third becoming hard and polished in fruit, 2-keeled, entire or minutely 2-toothed, ciliate, minutely adpressed-pubescent above; ii broad-lanceolate, subequal, 1-keeled with inflexed long-ciliate margin, sometimes mucronate; iii shorter, ovate-lanceolate, long-ciliate, minutely pubescent above on back; iv minute, hyaline, linear, ciliate (or 0?, *Hole* says he has always found it in fresh flowering specimens).

Usually along river-banks and in swampy localities.

Champan, very common! Monghyr, *Mokim!* Gya, *Mokim!* All districts of Chota Nagpur! No doubt in all districts of the province. Fl., Fr. Aug.—Nov.

Sometimes more or less stoloniferous, at other times tufted. *Hole* points out that although the species varies greatly the differences are not of taxonomic importance. He distinguishes (1) a form of dry sandy soil with culms usually under .2" diam., erect and tufted, L. exceedingly narrow sometimes only .05" wide; (2) a swamp form, where there is abundance of moisture throughout the year. Culms .2—6" diam., usually decumbent at base and not tufted, L. attaining a width of .7", callus hairs only $1\frac{1}{2}$ — $3\frac{1}{2}$ times as long as spkt.; and (3) an intermediate form, the loam form.

Used for thatching and brooms, and the panicle for decorating the hair at the Kol dances. The long callus hairs spread when ripe and waft the seed to immense distances; they may often be observed hanging together in large masses.

2. *S. officinarum*, L. Uk, ak, ik, *Vern.* Also Katari (Behar). The Sugar-cane. There are numerous vernacular names for different varieties.

A gigantic grass with the solid leafy stems often 15 ft. high and 1—1.5" diam.; internodes shining polished yellow or purple. Leaves 3 ft. or more by 2—3" or more wide, cutting, glaucous beneath. Panicle 2—3 ft. long, rhachis glabrous below the panicle, silky higher up, branches fascicled as in *S. arundinaceum*; ultimate spikes with internodes little longer to one and half times as long as the spikelets, bases of internodes and spikelets with a ring of long villi, longer than the spkt., ends of the internodes and pedicels cupular glabrous. Spikelets sessile and pedicelled exactly similar, .13—16" long, glabrous.

Nowhere known either wild or feral. The sugar-cane is widely cultivated to the north of the Ganges and to a less extent in the Gangetic plain on the south. It is also cultivated in Balasore and other plains districts to a small extent but hardly at all on the central tableland. Our only specimen is *Prain's* from Dalsing Serai, Tirhut, from which the description of the flowers, etc., is drawn.

Mouth of sheath silky inside otherwise glabrous, ligules very short, ciliate. The spikelets have a jointed callus, the lower joint only bearing the long cilia, the upper is glabrous. Gl. i, 2-keeled acuminate; ii equal narrowly cymbiform, sharply acuminate, glabrous in both spikelets or ciliolate towards tip; iii nearly as long, lanceolate, finely acuminate, 3-nerved, sometimes with minute palea; iv: there is a narrowly lanceolate or subulate hyaline ciliate or fimbriate body .09" long which is apparently regarded as the fourth glume by *Stapf*, but in our specimens it is on the *same side* as gl. iii and would appear to be the *palea* of gl. iv; on the opposite side is a very short truncate membranous glume or palea wrapping, and not longer than the ovary. These organs require further investigation in more specimens.

3. *S. arundinaceum*, Retz. Syn. *S. procerum*, Roxb.; Kagra, Vern.; Ekra (when cut); Teng, Beng. (fide Roxburgh).

A gigantic tufted grass, the leafy stems somewhat with the habit of the sugar-cane, branched, often 15 ft. high, the flowering culms sometimes nearly 30 ft. high and over 75" diam.; stem glabrous smooth or slightly rough with very long internodes. Leaves attain 6 ft. and width 2". Panicle 2—4 ft., pink, white or silvery, diffuse while flowering with smooth glabrous axis, main branches tufted on the axis, tufts alternate or sub-verticillate. Spikelets 1—13" rarely 15" long, much shorter than the internodes of the spike. The rest much as in *S. munja*.

In the wet savannah tracts of the Duars spreading westwards into the Sikkim Tarai and Purneah! where, however, it does not attain its full development. Fl., Fr. Nov.—Dec.

Leaves (according to my notes) with rib stout and as broad as the lamina at base, keeled below, villous with long silky hairs above, margins cutting. Hole, however, says in basal leaves midrib at base occupies one-third or less of the width of the lamina and he says nothing of its being villous. Upper cauline leaves becoming folded and filiform. Sheaths glabrous, ligule truncate with a ring or tuft of long silky hairs one-quarter to one inch distance from its base. Internodes of spike filiform and often three times as long as spkt. (Hole says usually longer, from three-fourths to 1½ths sessile spkt.), rather sparsely villous with very long hairs up to 3". Callus hairs not dense, as long as spkt. (shorter than or subequal, Hole). The glumes are very like those of *S. munja*, but i and ii usually shorter and subequal, iii is very little shorter than i or ii, glabrous in my specimens, iv together with its minute awnlet equals iii in length, sometimes ciliolate.

The culms are used for making the walls of native houses in the Tarai and Duars.

4. *S. munja*, Roxb. Syn. *S. arundinaceum* (part), F.B.I.; *S. arundinaceum*, var. *ciliare*, Fl. Ch. Nag.; *S. ciliare*, Anders.; *S. sara*, Roxb.? Munj. H.; Sar (arrow), S.; Sara, Beng.; Karai, Kandikhar, Th.; Ekra (when cut).

A very large tufted grass attaining a height of 18 ft. and diam. 5" in favourable situations. Leaves lower 5—7 ft. long by 75—1" in the middle or sometimes narrow and only 15" wide especially near base, upper cauline tapering to a setiform tip, densely white-villous near the ligule. Panicle 1—3 ft. long, thyrsoid, more or less lanceolate, purple to cream coloured or grey silvery or white in fruit with a glabrous rather angular or sulcate rhachis and sub-verticillate compound branches. Rhachis of spikes, pedicels of spikelets and back of gl. i with long dense silvery hairs 1—2 times as long as the spkt. Spkts. mostly exceeding the internodes of rhachis, 16—2" long, the pedicelled subequal (usually a little shorter). Sessile, gl. i lanceolate, almost cuspidately acuminate, 2-keeled with faint mid-nerve, dorsally villous for from one-third to three-fourths way up; gl. ii more cymbiform glabrous or obscurely hispid on keel. Pedicelled spkt., gl. ii dorsally villous, with villi usually overtopping glume to twice its length.

Usually in the open or along river beds in the forest. Often gregarious, Common in the Northern area, especially on the west in Champaran! Spreading south to Palamau, in Valley of Sonel and Hazaribagh (Koderma Forest)! Also Maubhum, Campbell! Fl., Fr. Oct.—Dec.

Foliage glaucous. Pedicel shorter than the spikelet. Callus hairs much shorter than spikelet. Sessile spkt. gl. i with keels scabrid above; ii sometimes sub-aristulate, usually a little shorter than i; iii chartaceous (hyaline when boiled), about .13—.14", lanceolate, acuminate, sometimes minutely aristulate, obscurely ciliate; iv broader, ciliolate, usually aristulate, but awn rarely .04—.05" long, glume and awnlet together about = iii in length, ciliolate; palea short broad, wrapping round the linear oblong .05—.07" long grain.

The fibre of the upper leaf-sheaths is used for making mats, ropes, etc., and it has been very favourably reported on as a paper material. The plant is, however, very much more abundant in Upper India than in Behar and Orissa.

5. *S. narenga*, Wall.

A very large grass 9—12 ft., rarely 15 ft. in our area with a stout horizontal rootstock, stems pubescent above and nodes with a ring of erect long erecto-patent silky hairs, whole plant often reddish. Leaves, lower up to 6 ft. long by 1" wide, dark-green with white midrib, long-acuminate, narrowed also at base, margins cutting (scabrid), upper surface more or less pubescent and sheaths hirsute or hairy with bulbous-based hairs. Panicle purple, strict, 1—2 ft. long lanceolate or oblong with numerous close short erecto-patent or spreading 1—4-nate branches .75—3" long with bearded nodes, lower often compound. Spikelets .08—.12" long, both similar, usually longer than or nearly equal to the internode of rhachis or sometimes only two-thirds as long. Gl. i sparsely villous or not dorsally, villi not overtopping the glume.

In the damper districts or in damp valleys both outside and inside the forest, often in glades in Sal Forest, N. Champaran, frequent on high ground as well as near streams! to Purneah! Singbhum! Ranchi and Palamau, ascending in valleys to 3000 ft.! Manbhum (Tundi Hills), Camp! Hazaribagh (on Parasnath)! Fl. Fr. Aug.—Nov.

Leaf below the panicle often reduced to a brown hirsute sheath with villous margins and setaceous blade, ligule very coriaceous, 2-fid, with very long hairs from the base. Panicle erect stiff. Hairs on rhachis of spikes and callus of spikelets usually red or purple, those on callus shorter or as long as spkt. Gl. i brown shining coriaceous 2-keeled, margins above ciliolate, tip narrowly truncate; ii similar but 1-keeled, equal, obtuse or minutely apiculate, margins ciliate above; iii elliptic, hyaline, equal, very ciliate; iv rather smaller 1-nerved above, imbricate or ciliate.

Used for rough mats, ceilings, etc., also for arrows.

6. *S. Ravennæ*, L. Syn. *Erianthus Ravennæ*, Beauv.

A large tufted grass somewhat resembling *S. munja* with nodes shortly finely bearded and dark green leaves attaining 6 ft. by 1.5". Sheath hirsute with bulbous-based brittle sub-appressed hairs which are often continued on to the inside of leaf-blade, ligules very short, membranous with dense white hairs. Panicle erect, up to 2 ft. silvery-silky often with a tinge of grey or purple, rhachis glabrous, branches solitary or subverticillate tufted (branched from close to base), lower up to 12". Spikelets .13—.16" long, and most of the pedicels longer than the internodes of the spike. Callus-hairs subequal to spkt. Glumes i and ii subequal, i 2-keeled with the keels more or less ex-current, ii cymbiform, minutely aristulate, margins ciliolate, glabrous or with few hairs dorsally and keel scabrous; iii white hairy; iv with an awn .1—.23" long, distinctly exerted from the spikelet, palea glabrous. Pedicelled spkt. similar.

Although common in the Upper Gangetic Plain this grass is not at all frequent in our area though it possibly occurs in Champaran.

7. *S. fastigiatum*, Steud. Syn. *Erianthus fastigiatus*, Nees; *Eulalia fastigiata*,* *Kew Herb.*

A very coarse tufted grass with a superficial resemblance to *S. narenga* than which it is a somewhat smaller grass, usually 5—7 ft. high, and at once distinguishable by its smooth nodes. Leaves, lower 2·5 ft. by '35", ending in a long filiform tip, beneath somewhat glaucous, margins minutely serrulate (scabrous), cutting, cauline few 18" by '1—'15" with revolute margins. Panicles shining red 6"—1 ft. erect, inclined or slightly nodding, branches simple or compound at base, in sub-verticils of two or three, 3—4" long or sometimes up to 7·5", rhachis laxly villous. Spikelets dense '17—'19" long. Gl. i coriaceous minutely 2-cuspidate laxly villous, villi longer than the glume; ii rather shorter subcoriaceous boat-shaped with rounded 1-nerved keel, slightly ciliate towards membranous tip, iii membranous '1", adhering to grain; iv small hyaline '06—'07" minutely 2-toothed with awn '3" long. Grain oblong '07."

This grass forms one of the principal constituents of the grass lands in the north of Purneah! Fl., Fr. Nov.—Dec.

Attains 10—15 ft. in the neighbouring savannahs of the Duars. Stems brownish-polished '15—18" diam. in our area. Sheaths glabrous or very slightly villous on margins at base and inside at base of ligule, ligule very short lacinate or 0. Peduncle villous below the panicle.

55. IMPERATA, Cyrill.

Perennial erect grasses with flat leaves and spikelets 1—2-fld., similar, 2-nate and pedicelled, in spiciform or thyrsiform silvery-silky panicles. Upper flower (if two) alone perfect with 4 membranous awnless glumes. Gl. i and ii lanceolate hairy; iii much smaller hyaline glabrous; iv smallest hyaline glabrous with hyaline palea. Lodicles 2, broad, toothed. Stamens 1—2, anthers large, linear. Styles connate at base, stigmas linear. Grain small, oblong, free.

1. *I. arundinacea*, Cyrill. Chero, K., S.; Siru, Ulu, H.

A common caespitose coarse grass 1—3 ft. high with erect flat leaves usually short at the time of flowering. Very conspicuous at the end of the hot weather, especially after jungle fires from its silvery-white spiciform panicles 2—6" long with the dark anthers and stigmas among the hairs; when quite young the panicles are purple.

Usually gregarious, especially on open loamy or clayey ground, and when low-lying, where it may become a considerable pest. Probably in all districts but, like some other common plants, only two specimens from our area exist in the *Cal. Herb.*, one from Manbhum, *Camp.*! the other from Mayurbhanj, *Hooper!* It is common at Neterhat, 3000 ft. on the pats and in many other places! Fl. April—May, but also noted in flower Oct.—Dec.

Rootstock widely creeping and stoloniferous. Stems thickened, pubescent or woolly at base, solid, glabrous above or nodes bearded. Leaves when mature

* *S. fastigiatum* is transferred to *Eulalia* in *Herb. Kew* (probably by Stapf). The panicle is somewhat of an intermediate character, but its general appearance in the forest is a *Saccharum* and gl. iv is less deeply 2-fid than most *Eulalia*.

3—4 ft. long by .5—7" diam., finely acuminate, when young often thinly hairy as are the sheaths; ligule short hairy. Branches of the panicle not breaking up, short crowded appressed. Spkts. unequally pedicelled, .12—15" long, lanceolate, hairs on callus twice as long.

It used to be one of the grasses recommended for paper-making and is sometimes used for thatching. The white stolons are grubbed up by animals. It is scarcely touched by cattle except when first sprouting (when there is scarcely any grass which cattle will not eat).

The following additional notes are from *Hole*:—

Three forms can be distinguished: (1) The depauperate form common on lawns or areas where the grass is continually cut or grazed, with minute almost filiform culms and small leaves. Leaf-insertions usually long bearded. Gl. iv and palea usually glabrous. (2) The ordinary savannah form which usually attains a height of about 3 ft. with leaves up to .7" wide. Leaf-insertions bearded or glabrous. Palea and gl. iv ciliate. (3) A robust form found in swamps or marshy soils where there is abundance of moisture more or less throughout the year. This plant attains a height of 9½ ft. L. up to 1.1" wide, leaf-insertions glabrous. Palea and gl. iv ciliate; (this is var. *latifolia*, *Hook.f.*).

56. DIMERIA, *Br.*

Slender grasses with narrow leaves and spikelets 1-fl. unilateral alternate (not geminate) on single terminal or usually several racemed or digitate spikes, sessile or pedicelled, rhachis inarticulate. Glumes 4; i linear, rigid; ii broader compressed; iii smaller, hyaline, empty; iv hyaline, 2-sexual, entire or 2-lobed, keeled, 1-nerved, usually awned; awn terminal or from the sinus, capillary, twisted at or below the middle. Lodicules minute or 0. Stamens 2, filaments short, anthers small. Styles distinct, stigmas short. Grain linear, laterally compressed, free.

Spikelets under .12" long. Gl. i glabrous; ii .02" wide 1. *ornithopoda*.
Spikelets .12" long or over .12" long. Gl. i ciliate; ii .04"
wide 2. *connivens*.

1. *D. ornithopoda*, *Trin.*

A very slender annual 3—15" high with many leafy stems from the root. Leaves erect linear .5—2", rarely 3", hairy or ciliate and sheaths with long spreading hairs (or, var. *tenera*) glabrous. Spikes 2, rarely 3, .5—1.5" long with slender very flexuous rhachis about .02" broad with scaberulous margins. Spikelets about twice as long as joints of rhachis, .05—1", alternate sessile or subsessile .1" long with a pencil of hairs at their base. Gl. i linear, a little shorter than the spkt.; ii linear, coriaceous with hyaline margins, as long as spkt., .02" wide when folded (they are strongly conduplicate), a few fine hairs on keel near apex; iv about ½ths ii, very narrow hyaline with terminal awn .25" long. Grain linear .07" long.

Singbhum, *Clarke*! Hazaribagh, *Clarke*! ascending to top of Parasnath, *Clarke*, etc.! Orissa (Khurda), *Walsh*! Fl., Fr. Sept.—Nov.

The flowers of the Parasnath specimen are exceedingly small (.04"), and *Hackel* called it *minutiflora*. The spkts. of var. *tenera* are .08" long.

2. *D. connivens*, *Hack.*

A much tufted grass with leaves chiefly near the base of the very slender ascending stems, 4—10" high, nodes minutely bearded. Leaves

linear with long tubercle-based hairs chiefly on their margins acuminate, .5—3" long, not over .15" broad. Spikes erect parallel, 1—1.5" long, rhachis .03" wide. Spkts. .14—.15" long excluding the .3" long awn, with a minute pencil of hairs at their base. Gl. i slightly shorter than spkt. finely pointed, dorsally ciliate; ii as long as spkt. acuminate, .04" broad, prominently keeled and ciliate, with cilia especially long towards the top; iv hyaline 2-fid. Grain .1" long linear slightly curved.

Singbhum, *Clarke!* Ranchi, *Clarke!* Sambalpur, common on fire lines! Fl., Fr. Oct.—Dec.

Clarke's Ranchi specimen is the type of *D. connivens*. The leaves are hairy. Rhachis and glumes ciliate. Spkts. .12" or a trifle longer. In view of the great variability in size of the spkts. of *ornithopoda* and that on the Singbhum sheet both species appear represented, it is possible that *connivens* is only a form of *ornithopoda*.

57. POGONATHERUM, Beauv.

Slender but often tough and wiry grasses with suberect narrow leaves and very slender peduncles with solitary terminal spikes. Spikelets binate, sessile and pedicelled similar except that the pedicelled is smaller and gl. iii sometimes absent. Gl. i narrow-oblong, membranous, tip truncate or rounded with a tuft of hairs; ii subequal or longer with acute or 2-toothed tip and terminal awn; iii hyaline, paleate, male; iv narrow, hyaline, 2-fid, long-awned, palea oblong glabrous. Lodicules 0. Stamens 1—2, anthers long. Stigmas narrow. Grain oblong, free.

1. *P. saccharoideum*, Beauv. Bonga-carec'. S.

A tufted much branched and very leafy elegant grass 1—2 ft. high with firm or almost woody polished slender stems from a perennial rootstock. Leaves 1—2.5" long only, linear, bearded at the base and margins of sheaths. Spikes .7—2" long, terminating all the branches, each spikelet with 2 long fine scaberulous awns .6—1" long.

Very common and sub-gregarious along banks overhanging streams and water-courses, and on cool sides of high hills. Purneah, *Kurz!* All districts of Chota Nagpur ascending to top of Parasnath, *Clarke*, etc.! Puri, *Walsh!* Fl., Fr. all c.s. and h.s.

Nodes of stem glabrous or bearded. L. .1" broad or less, acuminate. Rhachis of spikes compressed and pedicel bearded. Sessile spkt. gl. i narrow-oblong, broadest above, faintly 2—4-nerved, tip bearded; ii largest conduplicate .1", 1-nerved, keel produced into a long awn, tip densely ciliate; iii sometimes absent; palea of iv broadly ovate-oblong much exceeding the minute ovary. Pedicelled spkt. about two-thirds to three-fourths as long as sessile.

58. EULALIA, Kunth.

Perennial with simple erect or ascending stems and leaf blades convolute when young, then flat, usually narrow and gradually passing into the sheath. Spikelets all alike or nearly so (rarely *E. Clarkei*, heterogamous and pedicelled, narrower, and then palea short, broad and ciliate), 2-nate, one sessile, the other pedicelled, on the articulate fragile rhachis of 2-nate, digitate or fascicled spikes. Gls. i and ii equal

or somewhat unequal, rigidly membranous to coriaceous; i dorsally flattened or shallowly concave, (never grooved), more or less 2-keeled with inflexed margins; ii 1—3-nerved, keeled; iii empty, sometimes much reduced, muticous, hyaline; iv very short, 2-lobed (2-toothed only in *fastigiata*)* awned, palea small or 0. Lodicules small, cuneate. Stamens 3. Stigmas linear, laterally exerted. Grain oblong, hilum basal, punctiform.

A. Gl. i and ii subequal, acute or narrowly truncate:—

Sess. and ped. spkts. dissimilar, .2" long

Sess. and ped. spkts. similar, .14—.16" long

1. *Clarkei*.

2. *argentea*.

B. Gl. i and ii somewhat unequal, ii broadly truncate

3. *Cumingii*.

1. E. Clarkei, Haines. Syn. *Erianthus fastigiatus*, Beng. Pl. (part).

Nodes densely bearded with long silky hairs. Leaves glabrous (only one on the specimen below the panicle). Panicle of fascicled branches 2.5—4" long, joints of rhachis and pedicels .1" villous, pedicel compressed somewhat channelled and translucent in centre. Spikelets paired, sessile and pedicelled, .2" long. Sess. spkt. with short thick callus, dorsally flattened with keel of gl. ii fitting between rhachis and pedicel. Gl. i oblong-lanceolate acute or subacuminate, back distinctly 3-nerved, 2-keeled, margins 1-nerved narrowly inflexed nearly to the base, keels hispid; ii cymbiform aristulate, nerves 3 green, margins very hyaline ciliate; iii lanceolate hyaline subobtuse; iv reduced to the slightly expanded 2-fid .1" long base of the .5" long microscopically scaberulous awn; palea broadly oblong, very short .04" with long cilia on its rounded apex, 2-sexual. Anthers linear .1". Ovary minute. Styles slender free to base. Ped. spkt. gl. i 7—9-nerved as in sessile spkt.; ii 3(—5)-nerved with broadly inflexed hyaline margins, not keeled dorsally; iii and palea as in sessile spikelet; iv 0, lodicules 2 obtuse, slightly cupular.

Singbhum, elev. 2500 ft. Clarke (No. 20551)1 Fl. Oct.—Nov.

2. E. argentea, Brongn. Syn. *Pollinia argentea*, Trin.

A tall slender grass 4—5 ft. high, with flat leaves 1—2 ft. long by .1—.25" broad and long and brown shortly racemed or sub-digitate spikes mostly 4—7" long of sub-secund 3-gonous sessile and pedicelled spikelets .14—.16" long, the sessile spkt. being a little longer than the pedicelled. Gl. i linear-oblong, brown, 2-keeled, narrowly truncate, villous, edges inflexed, dorsally flattened; iv with two very slender hyaline lobes, and a long awn, .6" long.

Open forest on dry and stony soils. Champaran! Throughout Chota Nagpur, a very common grass in open Sal forests on the hills! Santal Parg.! Sambalpur! Probably in all districts except, perhaps, the moister eastern ones. Fl., Fr. Oct.—Jan. Perennial or perhaps sometimes annual (the rootstock usually has buds, but not always).

Rootstock very short with many stems. Stems and sheaths shining. L. with scattered long soft hairs towards base, tip filiform. Rhachis and pedicels with long white hairs. Gl. ii as long as i, polished keeled acuminate to narrowly truncate tip, margins sparsely ciliate; iii as long lanceolate hyaline; iv .07" cleft half way down, narrow, hyaline.

* *E. fastigiata*, comb. nov. See *Saccharum*.

3. E. Cumingii, *comb. nov.* Syn. *Pollinia Cumingii*, *Nees*; *Lopud dumbu*, *K.*

Stems very slender, many from a stout stoloniferous horizontal rootstock. Leaves short flat narrow. Spikelets sessile and pedicelled .1" long in slender, rarely more than 2 brown or yellow-brown spikes 1—3.5" long, densely covered with brown hairs.

On damp soil, sites of deserted villages, etc. Purneah, *King!* Ranchi, *Clarke!* Singbhum! Hazaribagh, *Clarke!* Fl., Fr. Oct.—Nov.

L. 3—4" by .1—.17", glabrous, ligule short truncate glabrous. Rhachis and pedicels compressed with long brown hairs on the edges. Spikes sometimes 3—4. Spkts. subterete with short blunt hairy callus. Gl. i involute oblong truncate brown-hairy, 2-nerved or nerveless, tip shortly ciliate; ii very slightly longer, broadly truncate less hairy, keel sometimes said to be shortly awned (*F.B.I.*; there hardly is any keel in my specimens); iii absent; iv reduced to a long bent awn (in our specimens) 2—3 times length of spkt., sometimes narrow with subulate lobes (in up-country specimens).

This is a good fodder grass.

59. PULICULUM, *Stapf.*

Closely allied to *Eulalia* but annual. Gl. i as long as ii narrowly truncate or bicuspidate, keels usually villous; ii of sessile spkts. awned; iii or its palea present, palea short broad, ovate.

1. P. articulata, *Stapf.* Syn. *Eulalia concinna*, *Nees*; *Pollinia articulata*, *Trin.*

An erect tufted grass, sometimes very slender about 4—10" high or somewhat stouter and up to 3 ft., with filiform leaves and numerous grey-brown spikes 1—2.5" long in a dense contracted raceme. Stem and leaf-sheaths glabrous. Spikelets sessile and pedicelled or (var. *pedicellata*) both equally pedicelled, .08" long, rhachis, pedicels and short obtuse callus of spkts. with long silky hairs, rhachis fragile articulate. Gl. i narrow-elliptic-oblong, shining (in nature, appearing hyaline when boiled), with truncate apex but with the two marginal keels shortly produced, dorsally hairy and ciliate; ii subequal, scarcely keeled, slightly hairy, minutely 2-fid at its apex and with a very fine awn longer than itself, nerveless; iii obsolete; iv narrowly oblong 2-fid or 2-toothed (*vide J.D.H.*) and awned, or (in our specimens) reduced to the narrow base of the long twisted awn which is about .75" long. Palea lanceolate-oblong hyaline nerveless about .02—.03" long.

Common in open ground and open forest. N. Champaran! Very common on half-bare soils of hard clay associated with *Laggera flava*, *Vicoa*, etc., in all districts of Chota Nagpur! Santal Parg.! Probably in other districts, but not collected. Fl., Fr. Oct.—Dec. Annual.

All the Chota Nagpur specimens belong to variety *pedicellata*.

60. POLLINIA, *Trin.*

Annual or perennial often decumbent below. Leaves conspicuously contracted at the base or petioled. Spikelets 2-nate, sessile and pedicelled or both pedicelled, in fragile (easily disarticulate) subdigitate or fascicled usually very hairy spikes. Glumes 4, i membranous or coriaceous, dorsally deeply channelled or concave, truncate or narrowly

truncate or 2-toothed with margins narrowly inflexed throughout their length; ii as long, usually laterally compressed, keeled, acute, iii hyaline or 0, ciliate, paleate or not; when glume 0 sometimes palea as long as glume i, male or neuter; iv very short, hyaline, entire 2-fid or 2-auricled or reduced to the dilated base of the long awn, palea small or 0. Lodicules obliquely truncate. St. 3, rarely 2. Stig. as long. Grain free.

Stapf in *Kew Herb.* splits up *Pollinia* into *Pollinia*, *Eulalia*, and *Puliculum*. Of our original species *P. articulata* is referred to *Puliculum*, *P. argentea* and *Cumingii* are referred to *Eulalia* and only *ciliata* remains in *Pollinia*.

1. *P. ciliata*, *Trin.*

A straggling branched grass 2—4 ft. high with rather thickened nodes and firm terete polished internodes. Leaves narrow-lanceolate tapering both ends acuminate 1—4" by .2—5". Spikes 3—10, 1.5—2.5" long; joints of rhachis rather stout, somewhat triangular in section and slightly thickened upwards, shorter than the spikelets, bases bearded, laterally ciliate at least in their lower halves. Spikelets sessile and pedicelled. Sessile .09" long, callus short blunt bearded. Gl. i flattened dorsally and grooved, oblong, margins inflexed keels scabrid-ciliate and tips ciliate; ii cymbiform acuminate keeled scabrous-ciliate on keel; iii absent; iv minute hyaline with an awn .4" long; palea oblong hyaline .04".

Singbhum, 2500 ft! Hazaribagh, on Parasnath from 2500 ft. to top, *Clarke!* Fl. Fr. Oct.—Nov.

The pedicelled spkt. usually seems shorter than the sessile, but is otherwise similar. The *F.B.I.* speaks of a palea to iii which I do not find. The anthers are .08" long. ii is often aristulate (sometimes with the awn longer than itself, *F.B.I.*) and hispid on the sides; iv is sometimes 2-toothed.

61. POLLINIDIUM, *Stapf.*

(In *Kew Herbarium*, name only.)

Densely tufted perennial with woolly rootstock and basal sheaths. Leaves convolute when old, wiry, mouth of sheaths ciliate. Spikelets binate, sessile and pedicelled, similar, on the articulate fragile compressed, not stout rhachis of digitate or fascicled spikes, fascicles with filiform peduncles on a more or less branched panicle. Callus densely clothed with long brown hairs. Glume i flattened 2—3-dentate, dorsally hairy at base, 5—7-nerved, margins inflexed; ii cymbiform minutely cuspidate, 3—5-nerved, with a slender awn; iii hyaline, sparsely ciliate, elliptic, palea finely ciliate; iv narrow, conduplicate, entire or 2-toothed shortly awned from the tip or minute sinus, palea broad and nearly as long as glume, densely ciliate on the top.

1. *P. angustifolium*, *comb. nov.* Syn. *Ischaemum angustifolium*, *Hack.*; *Pollinia eripoda*, *Hance*; *Spodiopogon angustifolium*, *Trin.*; *Bhabar*, *Sabai*, *H.*; *Barchon*, *K.*; *Bachkom*, *S.*; *Babuia*, *Bagali*, *Or.*; *Panasi*, *Khond*; *Baib* (a trade name).

A much tufted grass 1—2 ft. high, with long drooping wiry leaves when old and clothed with wool at the base of the tuft. Spikes .7—1.7"

long compound terminating filiform axillary and terminal peduncles, rhachis glabrous but the joints and callus clothed with dense yellow or brown long hairs which almost conceal the spkts. Spikelets 15—18" long (exc. the awns), both similar or only differing in the number of nerves and teeth of gl. i. Gl. i narrow-oblong 5—7-nerved, with 2—3 small sharp teeth or 2—3-cuspidate, more or less hairy on the back, margins narrowly inflexed, brown-ciliate below.

Common and often gregarious in hilly forest, especially in the Central and Southern Areas. In the Northern Area it occurs in the Bettiah and Ramnagar Hills! Rajmahal Hills! Throughout Chota Nagpur, especially common in Singhbhum! Puri, chiefly on kankar (Haripur Forest)! Angul, common in Baghmunda, Tikapara and Durgapur forests, especially on lime soils! Mayurbhanj, common! Fl. Feb.—June. Fr. May—July.

Rootstock stout, base of stems (old leaf sheaths) woolly. Very young leaves flat and erect about 1" broad, old prostrate up to 3 ft. in length, soon becoming concave or involute and harsh, strongly nerved, glabrous except at the ciliate mouth of the sheath; ligule of hairs. Hairs on gl. i chiefly in the lower fourth; ii normally cymbiform cuspidate or shortly awned, scaberulous on the keel above and ciliate on the margins, towards tip, dorsally hairy below, faintly 3—5-nerved. I have, however, seen plants with a broadly oblong glume ii lacerate at tip with short awn and 6-nerved from the base! iii hyaline elliptic 11—14" long, minutely sparsely ciliate above, male, with 2 stamens and large finely ciliate palea; iv narrow conduplicate subequal with very slender microscopically scaberulous awn 2—3" long, palea broad nearly as long as glume, densely ciliate at top, stigmas narrow penicillate, exserted.

Sabai grass is the most important wild grass economically in our area and it is also largely cultivated, especially in the Rajmahal Hills near Sahibganj. It is used locally for strings, ropes and mats (the Baib matting of Calcutta, and it is very largely employed for paper-making. In Singhbhum alone the quantity sold for paper yielded 42,000 rupees net revenue annually for a series of years. Fires improve the crop by removing shade. It is easily grown by division of the rootstock or from seed. From seed it yields a crop in about 3 years. Cattle do not eat it.

The species is closely allied to *Pollinia*.

62. ISCHÆMUM, L.

Usually perennial with the leaf-blades convolute when young and generally membranous ligules. Spikelets binate, sessile and pedicelled similar or more or less heteromorphous on the articulate fragile compressed rhachis of 2-nate, digitate or fascicled spikes (spiciform racemes). Joints and pedicels flattened or subconcave on the inner side and usually stout. Sessile spkts. dorsally compressed, often rather broad. Glumes 4. Gl. i dorsally flattened or somewhat convex and usually coriaceous below, thinner and distinctly nerved above, truncate or 2-cuspidate (2—3-toothed in *angustifolium*), more or less 2-keeled with inflexed margins; ii as long or longer, narrower and cymbiform, sometimes with a slender awn; iii usually male, membranous with narrow ciliate palea nearly as long as gl.; iv usually 2-sexual and nearly as long as i, cleft into lanceolate lobes with a long awn from the sinus, nerves usually 3 above meeting in the base of the awn, palea nearly as long, linear-lanceolate (broad in *angustifolium*). Ped. spkt. usually more or less reduced, sometimes laterally compressed, often broader male or neuter. Lodicules cuneate-quadrangle.

Stapf has separated from *Ischæmum* the new genus *Pollinidium*. This unfortunately affects one of our best-known grasses, *Ischæmum angustifolium*, which is apparently the only species in it. I have retained *angustifolium* therefore in our key to species. It certainly differs in several points from *Ischæmum*, but the multiplication of genera of one or few species appears undesirable, especially where it upsets well-known names. The section *Schima* is also restored to generic rank. This is altogether desirable and the genus is a good one. It includes *laxum* which I have also retained in the key below for convenience of those who should look for it there.

- I. Glume i of sessile spkt. not channelled or depressed along the mesial line. Spikes clustered, only exceptionally solitary:—
- A. Glume i of sessile spkt. with margins only narrowly inflexed throughout:—
1. Base of stems not woolly. Gl. i not toothed:—
 - Gl. i nearly flat dorsally. Perennial *aristatum*.*
 - Gl. i very convex and prominently transversely rugose dorsally. Annual 1. *Rugosum*.
 2. Base of stems woolly. Gl. i 2–3-toothed at apex and with a tuft of hair dorsally *angustifolium*.†
- B. Gl. i with broadly incurved margins below the middle, flat membranous and nerved above:—
- Gl. i with 2 terminal wings; ii with alate keel 2. *ciliare*.
 - Gl. i 2-keeled, not winged above; ii not winged 3. *hirtum*.
- II. Gl. i of sessile spkt. deeply depressed along the mesial line. Spikes always solitary *laxum*.‡

1. *I. rugosum*, *Salisb.* *Moraro*, *S.*

Erect, 1–2 ft. high with branched leafy stems. Leaves narrow 2·5–10" by ·15–3", widest at or little above the middle, sharply acuminate. Spikes 1–2 together yellow scarcely exerted from the leaf axils or long-peduncled, 1–3·5" long. Spkts. ·15–·18" long, easily recognised by the broad-oblong gl. i of the sessile spkt. being transversely rugosely ridged or folded for about three-fourths of its length, and the several-nerved membranous remainder.

A common grass chiefly in rice-fields. Santal Parg., *Mokim*, etc. Ranchi, *Wood*! Hazaribagh, *Clarke*! Singbhum! Manbhum, *Camp.*, etc. Orissa, *Walsh*! Throughout India, *F.B.I.* Fl., Fr. Aug.—Dec. Annual.

Often caespitose. L. somewhat tapering to the base or broadly subcordate, hairy or usually glabrous, sheaths rather inflated, ligule erect ·1–2" long. A villous tuft sometimes occurs at junction of blade and sheath. Internodes of spikes and pedicels very stout, ciliate, callus bearded. Sess. spkt. gl. i sometimes oblique (subdimidiate oblong, *J.D.H.*), rounded at tip; ii as long narrow keeled, 2 lateral nerves faint; iii hyaline; iv 2-fid to below the middle, narrow, with an awn ·5" long (more or less). Pedicelled spkt. like the sessile or imperfect or smaller and narrower; pedicel one-third to one-half sessile spkt.

2. *I. ciliare*, *Retz.*

A stout or slender grass 1–2 ft. high, erect or decumbent below or sometimes creeping at base, leafy. Leaves 2–6" linear, glabrous, pubescent or villous. Spikes ·7–2" long, rather stout, 2–3 together on a long peduncle. Spikelets ·14–·17" long or, with the long acumen of gl. ii, up to ·2"; easily recognised by gl. i being very coriaceous

* *Aristatum* is said to occur throughout India, but although found in Central Bengal there is at present no specimen from our area.

† See under *Pollinidium*.

‡ See under *Schima nervosum*.

with broad inflexed sides below and with 2 membranous wings at the top; ii longest, often 2" long (including the acumen but not the short awn), coriaceous convex below, cymbiform, keeled upwards, the keel alate, often shortly awned.

Western Bengal and Behar, *Kurz!* In all districts of Chota Nagpur, common! Puri, *Walsh!* Fl., Fr. Oct.—Dec.

Nodes often bearded with deciduous hairs. Sheaths glabrous or hirsute, ligule short ciliate. Joints of rhachis and pedicels strongly compressed firm, straw-coloured, ciliate on one edge, straight or incurved, about half as long as spkt., tips or lower node of callus bearded.

Three varieties are distinguished by *Hackel*. Our plants all appear to be var. **genuinum** with joints and pedicels diverging at the base, gl. iv of pedicelled spkt. (as well as of sessile spkt.) with slender awn up to 4". Form *prorepens* has creeping stem (Ranchi, Manbhum, Puri). Form *malacophyllum* is tall, gl. i broadly winged at tip, keel of ii ciliate (Bihar and Chota Nagpur). Form *villosum* has leaves and sheaths villous (Chota Nagpur).

3. *I. hirtum*, *Hack.*

An erect or suberect rather stout grass 2—3 ft. high often similar in appearance to *I. ciliare*, stems straw-coloured with nodes bearded (or glabrous, *F.B.I.*). Leaves linear-lanceolate, tapering both ends 3—8" by 25—1" with prominent white costa. Spikes rather stout clustered, 2—20, erect, 1—4" long (not seen more than 2.5" in our area). Spikelets 15—2" long. Gl. i boat-shaped but with rounded back below, flattened and 2-keeled above, about 8-nerved including the keels which are slightly excurrent, not at all winged; ii boat-shaped, keel not at all winged, cuspidate or very shortly awned, slightly exceeding i; iii membranous, nearly as long as i, 3-nerved, somewhat boat-shaped, palea similar but flatter; iv as long, hyaline, 2-fid with slender awn from the sinus as long as glume, 3-nerved from the awn downwards, palea as long, lanceolate. Grain ellipsoid, .08".

Singbhum, on rocks in streams! Ranchi, *Clarke!* Fl. Oct.

L. (in our specimens hairy) glabrescent (glabrous or sheath sparsely hairy, *F.B.I.*) and sheaths sparsely hairy; ligule short ciliate. Joints and pedicels trigonous subequal about half spkt., bases bearded, rarely a few hairs at tip, callus large bearded. Gl. i subcoriaceous villous above; ii 3—5-nerved glabrous (villous or glabrate, *F.B.I.*).

63. SEHIMA, *Forsk.*

Perennial or annual with leaf-blades narrow, ligule of stiff hairs. Spikelets 2-nate, heterogamous and sometimes heteromorphous, on a solitary terminal articulate spiciform raceme, dorsiventral and laterally compressed, usually slightly curved, joints and pedicels sub-linear, parallel. Gl. i deeply grooved, rarely flat, 2-dentate, acutely 2-keeled upwards and winged, margins inflexed; ii cymbiform, keeled upwards, awned; iii hyaline, entire with palea nearly as large; iv 2-fid, awned, palea as long. Pedicelled spkt. flat, gl. i and ii much as in sessile spkt. but not grooved; iii and iv more or less reduced or barren; iv awnless.

1. *S. nervosum*, *Stapf.* Syn. *Ischæmum laxum*, *Br.*; *Andropogon nervosus*, *Rottl.*; *Raboga*, *K.*; *Sedwa*, *H.*

A perennial grass 3—4 ft. high tufted on a short stout rhizome and with a superficial resemblance to Spear-grass. Stems leafy, straw-coloured

when mature, rather slender and constricted at the nodes with the single terminal spikes falling off entirely leaving a truncate end with a short peg-like projection (entirely different from old spear-grass). Leaves flat 6—12" by .2—'3" below the middle, sheaths densely hirsute to glabrous. Spike 3—5" long with fragile rhachis and 4-ranked compressed spkts. .2—'25" long appressed to it. Sessile spkt. with secund awns 1.5—2" long, pedicelled spkt. awnless. Gl. i narrowly oblong glabrous with margins strongly incurved, 3-ribbed margins, and deeply depressed 1-nerved centre, obtuse or keels produced into 2 short cusps; ii membranous with a delicate awn .5" long.

Frequent in hilly forests. Singbhum! Ranchi! Hazaribagh, *Clarke!* Rani-ganj (near Manbhum)! Angul! Fl. Sept.—Oct. Fr. Nov.

L. with scabrid edges, tapering into a very long filiform tip, not much narrowed towards the base, ligule of hairs. Peduncle pubescent above. Gl. iii hyaline, lanceolate, acute or truncate ciliate, palea as long very acute; iv oblong, about $\frac{1}{2}$ iii, deeply 2-fid, awn black below, palea as long. Ped. spkt. Gl. i 2-cuspidate, green or purplish, 5—7-nerved, nerves scabrid; ii 3-nerved, acuminate.

This is one of the best fodder grasses and is eaten by cattle even after the fall of the spikes.

64. APOCOPIS, *Nees.*

Annual or perennial often small grasses with short leaves. Spikelets binate with the upper reduced to its pedicel, or solitary, distichously imbricate on solitary, 2-nate or fascicled articulate spikes, dorsally compressed. Glumes 4. Gl. i very broad, flat and membranous above with truncate ciliate tip, its sides incurved below and coriaceous, many-nerved; ii much narrower sometimes with central keel, always laterally 2-keeled with broadly inflexed margins, tip truncate; iii oblong hyaline, male or neuter with palea as large; iv hyaline, entire 2-lobed or 2-fid awned or aristulate or sometimes reduced to an awn with dilated base; palea much shorter, convolute, truncate, tip ciliolate. Lodicules 0. Stamens 2—3. Styles very short, stigmas long narrow apically exerted. Grain free terete.

Perennial. Gl. iv oblong 2-fid, awn short or 0.

1. *Royleanus.*

Annual. Gl. iv linear entire or 2-dentate, awn long

2. *vaginatus.*

1. *A. Royleanus*, *Nees.*

Stem usually simple erect from a creeping rootstock, 1—2 ft. high with short narrowly lanceolate leaves .5—2" (2—4", *F.B.I.*) long, sheaths and blades with spreading hairs (softly hairy or glabrous, *F.B.I.*). Spikes 1—2, concurrent, .5—1.5" long. Spikelets usually sessile only, distichously secund on the rusty-villous rhachis, joints about half spkt. Spkts. .22" long (.16", *F.B.I.*) with short very broad brown-bearded callus. Gl. i adnate to callus at base, rather shorter than ii, very broad (.1" wide above), dorsally convex below and margins at base somewhat broadly inflexed and partly embracing ii, upper part expanded, tip truncate 2-mucronulate from the excurrent lateral nerves, slightly denticulate between, 7-nerved, 2 lateral each side meeting at base of the mucro, others not reaching tip; iv as long, oblong, hyaline with a broad nerve or discoloration down the centre ending in a minute mucro not longer than the two short lobes of the obtuse ciliolate tip or

(*fide F.B.I.*) awn very slender included, or if exerted not twice the length of spikelet.

Purneah, *Kurz!* Fl. May—Sept.

Remarkable from the broad imbricate spikelets from between which the pedicels (if present) project and the densely hairy side of the spikes being turned towards one another. Gl. ii keeled below, flat above; iii very broadly lanc.-oblong obtuse ciliate convolute and its palea similar; palea of iv broadly oblong hyaline truncate .12", microscopically ciliate at tip.

2. *A. vaginatus*, Hack. Syn. *A. Wightii*, *Nees*, var. *vaginata*, *F.B.I.*

Low and tufted with stems decumbent at base or tall and erect. Leaves 1—3" glabrous or hairy, tapering both ends, about .1—1.5" broad in middle; sheaths strongly nerved, hairy (in our specimens, sometimes glabrous?). Spikes .5—1.5" long mostly 2 together, exerted or not from their spathiform sheaths, stout or slender. Spikelets .16—2" long alternately awned and awnless, both with a small barren pedicel representing the abortive pedicelled spkt. Awn of awned spikelets .75—1" long, hispidly hairy below, glume iv narrowly oblong or linear entire, 1-nerved as long as spikelet or, in the awnless spkts., absent.

Hazaribagh, *Clarke!* Fl. Oct.

The Hazaribagh specimen is var. *vaginata*, *J.D.H.*, with the spikes more or less included in the long spathiform sheaths of the upper leaves, blade often rudimentary. Gl. i densely brown-villous dorsally, broadly oblong, 7-nerved, truncate or rounded tip pectinately ciliate, base surrounding and somewhat adnate to base of gl. ii; ii broadly oblong when unfolded, *in situ* narrow, strongly 2-keeled and plicate or depressed between the keels, truncate, ciliate, villose below; iii hyaline oblong .12—1.4", glabrous or ciliate. Palea .08" and nearly as broad when unfolded, convolute round the linear tapering ovary, stigmas .18" long. Anthers .05". Pedicels of abortive spkt. .05" bearded. Joints of rachis about one-third spkt., bearded.

65. LOPHOPOGON, *Hack.*

Small densely tufted perennial grasses with very narrow leaves and very short solitary 2-nate or fascicled spikes at the ends of very slender branches, joints very short, slender, fragile, tips cupular. Spikelets small, homogamous or heterogamous, 1—2 fld., 2—3-nate, one sessile, callus obtusely conical villous. Glumes 4, i and ii chartaceous, i oblong, broadly truncate, irregularly 3—4-toothed, 7—8-nerved, dorsally convex; ii longest, lanceolate, narrowed into a straight awn, 3—7-nerved hispidly hairy on the sides and with dorsal tufts of hairs below the middle; iii hyaline, oblong-lanceolate, acute or aristulate, ciliate, 1-nerved, 1—2-androus or neuter, palea linear 2-nerved; iv nearly as long as iii, fem. or 2-sexual and 2-androus, linear-oblong, 2-fld, lobes setiform and margins hispidulous, awn in the cleft much longer than the glume tortuous; palea quadrate, lobulate, 2-nerved. Lodicules 0. Anthers narrow. Style connate below, stigmas very long.

1. *L. Kingii*, Hook. f.

Densely tufted with many fastigiately branched stems 9"—1 ft. high, sometimes subcorymbose above. Leaves narrowly linear, radical 8—9", gradually smaller upwards and sheathing the peduncles, lower .05"

broad, nodes, base of leaves and mouth of sheaths softly villous. Peduncles very slender, the branched spike breaking off shortly above the mouth of the sheath, .5—7" long (without the long awns), base of joints and callus all with a barb of brown hairs, obtuse. Spikelets sessile and pedicelled or sometimes a pair of sessile and pedicelled together. Sessile spkt. .25—3" long (without the awns), gl. i .16—18" oblong, 8-nerved below the membranous truncate tip which is 2-cuspidate and obtusely 3-toothed between the cusps; ii 3-nerved keeled, .25" or more, sides villous except at base and a dorsal tuft of hairs above base on each nerve, awn slender; iii oblong-lanceolate or linear, if linear then 2-toothed with a short central awn half as long as glume, if oblong-lanceolate then entire, acute aristulate and ciliate; iv .2" long with 2 long acuminate scabrid lobes and a central long awn .6" long, palea often .1" long, very broad.

Monghyr, *Mokim!* Fl. Oct.

Basal spikelets all male in some specimens. Pedicelled spkt. very similar to the sessile but gl. ii 5—7-nerved with the tufts of hair forming a continuous transverse band, awn about as long as spkt. (as in the sessile). The peculiarity of the dimorphous gl. iii appears to occur in both sessile or pedicelled spikelets! Pedicel .08" long, bearded.

66. ARTHRAXON, Beauv.

Slender grasses with many short lanceolate to ovate deeply cordate leaves and digitate or fascicled or shortly racemed simple or branched spikes. Spikelets solitary, or binate with the pedicelled spikelet reduced, male or neuter or the pedicel only represented. Glumes 4; i not or scarcely embracing the inner; ii subequal or shorter, keeled, 3-nerved, conduplicate embracing the inner; iii smaller hyaline nerveless; iv as long as iii or shortest, lanceolate, keeled, hyaline with a long dorsal or sub-basal awn; palea minute or 0. Lodicules sub-quadrate. Stamens 2—3. Styles short or 0, stigmas long, laterally exerted. Grain linear.

- | | |
|---|--------------------------|
| I. Anthers nearly as long as gl. iv. Gl. i pectinately toothed | 1. <i>lanceolatus</i> . |
| II. Anthers not half the length of gl. iv. Gl. i not pectinately toothed:— | |
| Rhachis of spikes glabrous or ciliate. Spikes mostly over .7" long. Spkt. .12—2". Gl. i with entire tip | 2. <i>ciliaris</i> . |
| Rhachis of spikes villous. Spikes mostly under .7" long. Spkts. .08—12". Gl. i with 2-toothed or 2-aristulate tip | 3. <i>microphyllus</i> . |

1. *A. lanceolatus*, Hochst.

A suberect or sub-scandent branched leafy grass 1—3 ft. high with very firm polished stems and glabrous or very hairy lanceolate (more rarely ovate) leaves .5—3" by .25—1.5" or sometimes narrowly lanceolate 1—4" long. Spikes 3—5, .5—2" long. Spikelets .17—22" long linear-lanceolate often purple. Gl. i dorsally convex smooth or muriculate acute with hyaline 5—7-nerved tip, marginal nerves with very characteristic pectinate curved teeth, each ending in a hair towards tip. Pedicelled spkt. linear-lanceolate awnless, bearing a male fl.

Manbhum, *Camp.*!* Hazaribagh, on Parasnath, 4200 ft. *Clarke!* Fl. Oct.

* *Campbell's* specimen bearing "Flora of Manbhum" label without locality may also be from Parasnath.

Our specimens have broadly lanceolate amplexicaul leaves 1—2.5" long with slightly to densely hairy sheaths, margins of blade pectinately ciliate. Joints of rhachis bearded on one side, transversely truncate at tip. Sessile spkt. gl. ii hyaline keeled, slightly shorter than i, keel sparsely hispid; iii shorter; iv about two-thirds i, acute, hyaline with awn .4" long from its base. Ped. spkt. gl. i about .18" long, 7-nerved, slightly ciliate towards tip; ii linear-lanceolate, very acute; iii hyaline .1" with 2 perfect stamens; iv 0.

2. *A. ciliaris*, Beauv.

A small rarely tall and then clambering, usually densely gregarious grass with the lower leafless parts of the slender stems often decumbent, the upper parts with short broad ovate to lanceolate leaves 1—3" long with cordate base and ciliate margins. Spikelets sessile .15" (.1—2" *F.B.I.*), green or purple arranged alternately on opposite sides of the flexuous rhachis of 3—5 sub-digitate (shortly racemed) spikes .7—1.5" long, which are sometimes branched from the base, or whole inflorescence a single branched spike. Gl. i linear-oblong scabrid or scaberulous or echinate upwards, coriaceous in fruit and cylindrically folded, faintly 7—10-nerved, tip entire; ii keeled, acute or acuminate, keel slightly scabrid with short hairs obscurely 3-nerved, margins broad hyaline embracing the inner glumes. Pedicelled spkt. reduced to the pedicel.

In moist places under shade. Santal Parganahs, Rajmahal Hills, Kurzi Ranchi and Palamau, common at 2000 ft. and above! Hazaribagh, common, up to top of Parasnath, *Clarke*, etc.! Singbhum, 2500 ft., *Clarke*! Manbhum, 1000 ft., *Clarke*! Fl., Fr. Oct.—Nov.

Nodes often bearded. L. glabrous or hairy 7—11-nerved, sheath with ciliate margins, ligule of long hairs. Joints of rhachis glabrous or more or less ciliate. Gl. iii about $\frac{1}{2}$ i, oblong hyaline; iv subequals iii with delicate sub-basal awn .3" long or less, and linear terete grain about .1" long.

3. *A. microphyllus*, Hochst.

Closely resembling states of the last species. A delicate diffuse leafy grass with branched filiform stems hairy at the nodes, and short oblong or oblong-lanceolate finely acuminate leaves .5—1.5" long glabrous or hairy and ciliate, base amplexicaul cordate. Spikes mostly 2—10 short slender .3—7" rarely 1" long with villous rhachis at the end of filiform peduncles which are hairy at the end. Spikelets .08—1" rarely .12" only; pedicels of upper spikelets not one-third as long as sessile spkt. often with 2 barren glumes. Gl. i of sessile spkt. narrow-linear dorsally scabrid faintly 2—4-nerved, 2-toothed or 2-aristulate at tip, margins inrolled; ii acuminate or aristulate, laterally compressed, the awn sometimes as long as the dorsally scabrid keel, sides hyaline; iv sometimes obtusely 2-toothed .05", with a delicate awn about .25" long. Grain linear.

Gregarious on damp banks and in ravines, very common. Behar, *Hope*! Gya, *Mokim*! Monghyr, *Mokim*! Santal Parg., *Kurz*, etc.! Ranchi, *Wood*, etc.! Parasnath (Hazaribagh), elev. 4000 ft. Anders, etc.! Singbhum! Fl., Fr. Sept.—Dec. Annual.

67. CAPILLIPEDIUM, Stapf.

Annual or perennial slender grasses with simple or often copiously branched culms frequently bearded at the nodes. Panicles delicate,

usually lax and very compound, the branches capillary often repeatedly 2-furcate (in our species) spikes (or racemes) few-, usually 1—2- (very rarely up to 8-) noded, ending in one sessile and 2 pedicelled spikelets. Joints and pedicels filiform, longitudinally grooved or depressed and translucent in the centre, leaving a minute transverse truncate or very shallowly cupular scar on the peduncle after falling. Sessile spikelet dorsally compressed, callus short rounded shortly bearded. Gl. i 2-keeled, with narrow inflexed margins; ii cymbiform and more or less 3-keeled or 3-nerved, the awn of gl. iv fitting into the rounded central keel; iii hyaline, nerveless or 0; iv reduced to the acutely based awn. St. 3. Lodicules minute. Grain ellipsoid-oblong or oblong. Ped. spkt. narrower than sessile; gl. i dorsally flattened; ii usually rounded on back; iii oblong hyaline, with 3 stamens and a very narrow palea (rudimentary gl. iv?) or palea 0.

Panicle oblong. Sess. and ped. spkts. equal. Ped. spkt. with 4 glumes 1. *parviflorum*.
Panicle pyramidal. Ped. spkt. much longer than sess., with 3 glumes 2. *assimilis*.

1. **C. parviflorum**, Stapf. var. *villosulum*. Syn. *Andropogon micranthus*, Knth.; var. *villosulus*, Hack.

Stems polished rather stout 2—4·5" ft. high, nodes bearded, hirsute, or very hairy on the leaf-sheaths and leaves, at least the lower. Leaves 6—12" by ·17—·25", or up to ·4" (in Neterhat specimens), flat, setaceously acuminate, ligule short truncate, hairs with tubercle bases. Panicle decomposed effuse, red, oblong or narrowly pyramidal, 2—8", primary branches clustered 2—4-together, unequal, 1—2·5" long, repeatedly bifurcate or 3-furcate with capillary quite glabrous, flexuous, spreading branchlets. Spikes reduced to one sessile and 2 pedicelled spikelets with sometimes an extra 1—2 prs. of spkts. below them, joints and pedicels usually villous on one margin only. Sessile spkt. linear-oblong to ell.-oblong ·11—·15" long. Gl. i dorsally hispid and with somewhat longer hairs on the keels, rather opaque and obscurely 2-nerved between the keels; ii sub-3-keeled, also with inflexed margins, sparsely hispidulous or puberulous; iii short, obtuse, nerveless (I cannot find it in some fls.); iv awn ·5—·7" long. Anthers red ·08".

Champan, Ramnagar Hills, 2000 ft.! Ranchi and Palamau, above 2000 ft. (Neterhat, frequent)! Parasnath (Hazaribagh), elev. 2000 ft. to top, where it has been collected by Hooker, Clarke, etc.! Fl., Fr. Sept.—Nov. Perennial.

Ped. spkt. with pedicel about two-thirds to four-fifths as long as spkt. Spkt. as long as sessile. Gl. i 5—7-nerved, scarcely keeled, margins incurved, minutely hispidulous, acute; ii with incurved villous margins. 3—5-nerved; iii broadly oblong with 3 stamens; iv (or palea of iii?) linear, hyaline, sometimes split and one segment ending in a filiform tip. The two ped. spkts. and their pedicels often unequal.

The fresh panicle is distinctly and rather unpleasantly scented.

2. **C. assimilis**, *comb. nov.* Syn. *Andropogon assimilis*, Steud.

A copiously branched grass with creeping rootstock, easily recognised by its hard almost woody slender polished stems, short leaves and short diffuse pyramidal panicles 2—5" long by 2—3" broad with capillary clustered primary branches, and spikes of only 2—3 prs. of

spikelets and a terminal trio. Nodes of the panicle ciliate, joints and pedicels slender, villous, ending in a minute shallow cup with transverse rim. Pedicelled spikelet much larger than the sessile.

Northern Champaran, gregarious under shade in some hill forests! Valleys in the Rajmahal Hills! Singbhum, forest valleys! Hazaribagh, especially on Parasuath! Western Bengal and Behar (without district), Kurz! Ranchi ghats! Valleys in the hill forests of Palamau! Fl., Fr. Oct.—Dec.

Attains 6 ft. in height in the upper hill forests, not more, often sarmentose and proliferously branched, nodes bearded. L. lower lanceolate, upper linear, 2—5" long, setaceously acuminate, glabrous or sparsely hairy, margins scabrid. Main branches of panicle 2—4 in a cluster, flexuous. Sessile spkt. .09", gl. i pale, ell.-oblong, narrowly truncate, 2—4-nerved between the keels which are hispid above; ii slightly longer, lanc.-oblong with rounded keel in which the awn lies; iii half i; iv reduced to the acutely based 4—5"-long awn. Grain oblong .05". Ped. spkt. .14—15" long, with pedicel about two-thirds sess. spkt.; gl. i 3—7-nerved very acute, keels sparsely hispidulous; ii back rounded, 3-nerved, mid-nerve excurrent as a minute mucro; iii broadly lanceolate nearly as long as i; anthers .07" long.

68. AMPHILOPHIS, Nash.

Perennials. Panicles with a short primary axis so that the branches or spikes are sub-digitate or elongate. Spikes often simply branched, frequently with tubercled axils; joints and pedicels many filiform, longitudinally grooved and translucent along the groove, disarticulating horizontally. Pairs of spikelets sessile and pedicelled, heterogamous and sometimes dissimilar in shape. Sessile spkt. with small shortly bearded callus dorsally compressed. Gl. i thinly chartaceous to membranous, 2-keeled, with narrow sharply inflexed margins; ii cymbiform, acutely keeled, 3-nerved; iii hyaline nerveless, palea 0 or very minute; iv reduced to the hyaline base of the slender awn, palea minute or 0; lodicules minute, glabrous. Stigmas exceeding the styles. Grain oblong obtuse. Ped. spkt. awnless, usually narrower than the sessile and male; gl. i many-nerved, iv 0 (awnless).

A. Panicle-branches mostly with axillary ciliate tubercles. Gl. i often pitted, iv the simple base of awn:—

Panicle-branches or spikes much shorter than rhachis. Sess. spkt. .12—14"

Spikes more or less fascicled, longer than the rhachis. Sess. spkt. .15—17"

B. Panicle-branches without axillary tubercles. Gl. i not pitted:—

Panicle-branches longer than panicle-rhachis. Sess. spkt. .2". Gl. iv simple base of awn

1. *glabra*.

2. *pertusus*.

3. *Kuntzeana*.

1. **A. glabra**. Stapf. Syn. *Andropogon intermedius*, R. Br., inc. *A. glaber*, Roxb., *A. punctatus*, Roxb., and *A. montanus*, Roxb.? Sudugan, K.; Gandha-gurana, Beng. (*fide* Roxb.).

A very common and variable grass flowering from 12" high (probably in its first year and then appearing annual) to 7 ft. with many stems from the perennial rootstock. Culms erect or decumbent at base, usually 3—6 ft., nodes with a dense ring of hairs which fall off in age, straw-coloured, simple or much branched above, up to 2—25" diam. at base, polished but lower parts usually covered with numerous loose dry sub-compressed leaf-sheaths. Leaves glabrous or very hairy,

nearly always with long setæ towards base, narrowly to broadly linear, middle cauline 12—15" by .2" or often 20" by .3—·55" with strong midrib, 3—4 or 6—7 strong nerves between the setulose margin and midrib, apex finely caudate, broadest at base; sheath somewhat compressed loose glabrous or hairy, ligule very short truncate with usually strigose erect hairs on the blade behind it, itself glabrous exc. ciliolate margin. Panicle often red, rhachis 3—7" much longer than the spikes, more or less regularly pyramidal or oblong with alternate, opposite, or irregularly subverticillate glabrous (below the spikes) branches always with ciliate tubercles in their axils and with small glabrous cupular tips, simple (bearing a single spike) or more or less compound; internodes of panicle glabrous, lower long, gradually shorter. Spikes with joints and pedicels subequal, about half to two-thirds length of sessile spkt., compressed, bearded on both margins, with thin translucent centre between the thickened margins. Spikelets with obtuse callus with beard less than one-eighth length of spkt., narrowly elliptic-oblong or ped. spkt. convolute and linear. Sessile spkt. .12—·14" long, gl. i flattened 2-keeled with narrowly inflexed margins, obtuse or narrowly truncate, pitted or not, usually more or less dorsally hairy in lower half and keels hispid or scabrid-ciliate above, 4—9-nerved between the keels; ii cymbiform polished acute, subequal, faintly 3-nerved, rarely ciliolate; iii .09—·1", broadly oblong or lanceolate, hyaline, obtuse, nerveless, glabrous; iv reduced to the narrow base of the .4—·7" long slender geniculate awn which is smooth below, scabrelous above; palea 0, lodicules minute quadrate-cuneate, anthers 3 brown .05", ovary minute, grain oblong .08" long. Pedicelled spkt. always neuter with usually only one glume, rarely 2—3, usually shorter than sessile spkt., gl. i similar with more nerves between the less marked keels, often (as in the sessile) with 1—3 median pits.

Distributed throughout the whole province and one of the commonest grasses in forest glades as well as more open tracts, also occurring under shade. Perennial. Fl., Fr. Oct.—Jan. In addition to the localities noted under the following varieties* I have also recorded the plant, without notes of variety from Champaran (common) and Gyal

I. Panicle usually thin, branches opposite each bearing only one spike or sometimes 2 (branches subverticillate in var. *lævis*). Spikelets usually purple:—

A. Gl. i appressed hairy below the middle, not pitted, keels hispid-ciliate above

a. genuinus, Hack.

1. Leaves and sheaths usually broad, hairy, 7-nerved each side of midrib.

One form from Singbhum has pale, not purple panicle. Singbhum, common! Palamau! Angul, *Lace!* Probably in all districts.

2. L. glabrous. Gl. i sometimes dorsally villous above middle. Rhachis of panicle short. Singbhum, *Clarke!* This comes very close to *A. Grahami, Haines.*

* These varieties are after *Hackel* and were described before I consulted *Stapf's Gramineæ in Fl. Trop. Africa*, where he reduces *Hackel's intermedius* to *Roxburgh's glaber*. The names (e.g. *genuinus*) in some cases become inapplicable if *Roxburgh's glaber* is the type. Var. *Haenkii* is, I think, a distinct species and easily distinguished in the field. It should be called *Amphilophis Hoenkii*.

- B. Gl. i thinly or not hairy below middle, 1—3-pitted in many spkts. both sessile and pedicelled . *β. punctatus, Hack.*
 One form from Parasnath, *Clarke!* has pale panicles.
 Singbhum, common! Santal Parg., on the hills, very common! Hazaribagh, *Clarke!* Probably all districts.
- C. Gl. i with back shortly uniformly hairy or hispid . *γ. hirta, Haines.*
 Sambalpur! Stem tall 2" diam, much branched above. L. 3—4" wide sparsely hairy towards base and strigose behind ligule. Sess. spkt. 13", keels scabrid, awn 4".
- D. Gl. i glabrous, 7—9-nerved between the keels. Panicle with sub-verticillate branches . *δ glabra, proper?*
 Angul! Tufted, 4 ft. high. L. glabrous slender with 3—4 nerves each side of midrib. Spkt. 14" long. This might be *Roxburgh's glaber*, except that the glumes are not pitted. From *montanus* it appears to differ in the much larger spikelets. It forms a transition to the next group:—
- II. Panicle dense with many sub-verticillate branches which each bear branched spikes with generally a sessile spkt. at each fork (without ped. companion).*
 Gl. i usually medianally depressed and somewhat hairy below. Panicle not purple *ε Hoenkii, Hack.*
 (including *A. fascicularis, Stapf*).†
- A. Leaves glabrous or ciliate below.
 Ranchi, common! L. usually narrow and only 3-nerved each side, panicle 7—8". Manbhum, *Camp!* Panicle 8". Rajmahal Hills, *Kurz!* L. 5-nerved each side. Orissa, *Walsh!* Stout below, panicle 7", keels of gl. i scabrid only.
 Form with nearly or quite glabrous gl. i occurs in Monghyr, *Mokim!* and Gya, *Mokim!* Sarguja, *Clarke!* Parasnath (called *fascicularis* at Kew).
- B. L. hairy (but less so than in most *geminus* and *punctatus*). Gya, *Mokim!* Parasnath, *Prain!*

2. *A. pertusa*, comb. nov. Syn. *Andropogon pertusus, Willd.*

A creeping, ascending or erect grass, slender or with culms 12" diam. up to 1—3 ft. high, nodes more or less bearded. Spikes 1—1.7" long digitately fascicled or one or more somewhat distant from the others and racemose, but rachis of raceme always much shorter than the spike. Joints and pedicels slender subequal, translucent in centre, about half to four-fifths spkt., villous on both margins. Sessile spkt. 15—17" long (2", *J.D.H.*), gl. i narrowly elliptic-oblong narrowly truncate or minutely 2-cuspidate from the strong hispid produced keels, back flat with a dorsal pit above the middle and a tuft of villi usually below or glabrous, 5—7-nerved between the keels. Callus obtuse with unequal hairs about one-fourth spkt.

Monghyr, *Mokim!* Gya, *Mokim!* Santal Parg., *Nusker!* Behar, *J.D.H.!* Ranchi, *Clarke,* etc.! Singbhum! Manbhum, a common grass, *Camp.,* etc.! Orissa, Puri, and again without district, *Walsh!* Fl., Fr. Oct.—Dec.

* This and similar cases show that the pedicel is morphologically a branch of nearly equal value to the rachis.

† *Amphilophis fascicularis, Stapf,* is not *Andropogon fascicularis, Roxb.* See remarks under *Sorghum fascicularis.* This group might be called *Amphilophis Hoenkii.*

L. 2—12" long (*F.B.I.*, not over 6" in our specimens), 1—17" broad with long hairs near the base and often shortly hairy on one or both surfaces, scaberulous after fall of the hairs. Sheaths usually scaberulous. Ligule short, membranous, truncate. Spikes usually 3—9. Sessile spkt. gl. ii cymbiform acute or acuminate, keeled and with marginal nerve and sometimes 1—2 faint ones between keel and each margin, slightly longer than i; iii narrow lanceolate hyaline about four-fifths i; iv the slightly dilated base of the .5—.75"-long capillary awn. Ped. spkt. equals the sessile, gl. i keels sometimes minutely produced, 11-nerved (7—13, *F.B.I.*), glabrous, pitted or not, keels ciliolate; ii flat dorsally, 3—5-nerved, obtuse; iii broadly oblong (linear-oblong, *F.B.I.*) glabrous.

The following form or varieties occur:—

a. *genuinus*, *Hackel*. Gl. i thin, not shining, villous below the middle, spikes 3—9. Singbhum and Manbhum (*see above*).

The others have very shining gl. i often glabrous, and glabrous leaf-sheaths, but it is not apparent under which of *Hackel's* varieties they come unless *insculptus* with gl. i sometimes 2-pitted and the keels of gl. i longer ciliate which they sometimes are. Var. *genuinus* has sometimes shining glumes.

3. *A. Kuntzeana*, *comb. nov.* Syn. *Andropogon Kuntzeanus*, *Hack.*

Stout, about 4 ft. high with culms .25" diam. at base, nodes mostly⁴ densely villous. Leaves and sheaths glabrous, blade up to 2 ft. by .3" or upper appressed hairy within above the short hard truncate ligule, blade narrow up to 2 ft. by .3" tapering from base to tip, with 5—7 strong nerves between margin and midrib, margins setulose. Panicles 3" with the rhachis much shorter than the alternate, rarely also opposite, simple peduncled spikes which lack the axillary ciliate tubercles of *periusa* and *glabra*. Spikelets purple, callus obtuse bearded. Sessile spkt. .2"; gl. i thinly hairy on lower half dorsally, narrowly elliptic-oblong, obtuse, keels hispidulous above; ii cymbiform, very acute, .18" long, 3-nerved; iii hyaline, .14", broadly oblong, obtuse; iv linear 1-nerved forming the base of the short nearly straight awn which is only .25" long. Palea ciliate one-third gl. iii. Ovary small with 2 long styles and plumose stigmas. Ped. spkt. .18", gl. i like that of sess. spkt. but 9—11-nerved between the keels and often punctate above the middle; ii oblong obtuse with rounded back, hyaline with 5 green nerves, subequal; iii ell.-oblong hyaline ciliate obtuse .15" with 2 lodicules and 3 stamens, palea minute ciliate, anthers linear, yellow, .09" long.

Chiefly on rocks in streams, Sant. Parg.! Towards top of Parasnath, *J.D.H.* Fl. Dec.

The Santal Parganah's plant is much stouter than any specimens at Kew and is the one more especially described.

69. VETIVERIA, *Thouars.*

Coarse perennial nearly glabrous grasses with stout rhizomes, and culms more or less compressed below. Lower leaf-sheaths much compressed, flabellate-imbricate, leaves firm, conduplicate in bud, flattening out upwards, gradually passing into the sheath. Spikelets 2-nate, sessile and pedicelled, subsimilar, differing in sex, on the articulate fragile rhachis of peduncled 3—many-noded racemes which are in many-rayed whorls round the rhachis of nearly simple elongate panicles, racemes rarely compound hispidulous or glabrous except for the frequently shortly bearded calli. Joints and pedicels slender, slightly thickened

upwards. Sessile spkts. slightly laterally compressed, awned or not; glumes 4, i more or less coriaceous with broad rounded back and sub-inflexed margins; ii cymbiform keeled upwards, with broad hyaline ciliate margins sometimes aristulate; iii hyaline empty 2-nerved; iv hyaline minutely 2-toothed, mucicous mucronulate or awned from the sinus, palea minute, nerveless; lodicules glabrous. Stamens 3. Grain oblong, top slightly oblique. Pedicelled spkt. dorsally compressed, glumes thinner than in the sessile, usually awnless, male.

1. **V. zizanioides**, *Stapf*. Syn. *Phalaris zizanioides*, *L.*; *Andropogon squarrosus*, *Hack.*; *Andropogon muricatus*, *Retz.*; *Khatra*, *Th.*; *Srom*, *K., S.*; *Kas-kas*, *H.*; *Bena*, *Or.*; *Kus-kus*, *Eng.*

A stout tufted often gregarious rigid grass. Leaves closely distichously imbricate at base, suberect, conduplicate below and often hairy (always?, they are usually described as glabrous) within, glabrous upwards, 1—2 ft. long on the stem (radical much longer), rarely over 3" wide, margins distantly setulose-scabrid, larger nerves about 6—8 each side of depressed (above) midrib, ligules a mere rim. Panicle 6—12" oblong or pyramidal. Spikelets muricate and muriculate, linear to linear-lanceolate, sessile 13—17", pedicelled shorter.

Open damp or almost swampy ground, often gregarious. Champaran! Purneah, very common! Santal Parg.! Monghyr, *Mohim!* Chota Nagpur, all districts on low ground, not common on the plateau, sometimes found in forest glades! Purl, *Walsh!* Angul! Sambalpur! No doubt therefore in all districts. Fl., Fr. Aug.—Jan. Perennial.

Lower panicle branches (with the raceme) up to 4" long, erecto-patent or suberect. Raceme with flexuous rhachis. Joints as long as or usually much longer than the sessile spkts., tips truncate or slightly oblique, minutely or scarcely ciliolate. Callus unequally shortly bearded on one side.

The dried roots are well known, being the material of which kus-kus tatties are made and yield a delightful fragrance when wetted. The fresh root is only slightly odorous.

70. SORGHUM, *Pers.*

Annual or perennial, often robust grasses. Leaf-blades usually flat and large, convolute in bud. Panicles erect or nodding with scattered, fascicled or verticillate branches, often large (in cultivated forms frequently very dense). Spikelets 2-nate, those in each pair differing in form and sex, one sessile, the other pedicelled or reduced to its pedicel, on the articulate fragile or (in cultivated forms) tough rhachis of panicle few- (sometimes only 1-, rarely up to 6—8-) jointed spikes. Glumes 4; i and ii equal coriaceous, rarely permanently chartaceous, mucicous, i with a broad flattened or convex back with the margins narrowly inflexed near the tips and elsewhere involute; ii cymbiform with narrow hyaline usually upwards ciliate margins; iii empty hyaline ciliate; iv oblong to ovate 1—3-nerved, 2-lobed or -dentate with an awn or mucro from the sinus, lobes sometimes adnate to the awn. Palea hyaline, often minute or 0. Lod. glabrous or ciliate. St. 3. Styles terminal or subterminal. Grain (in the wild species) mostly obovoid, dorsally compressed. Ped. spkts. if present much narrower than the

sessile, male or neuter, sometimes reduced to 1 or 2 glumes, permanently herbaceous; iii and iv if present 1—2-nerved hyaline ciliate awnless.

- | | |
|---|--------------------------|
| I. Cultivated. Annual. Panicle usually dense. Rhachis of spikes tenacious | 2. <i>vulgare</i> . |
| II. Wild species. Perennial. Panicle usually lax. Rhachis of spikes fragile:— | |
| A. Spikes 3—4-noded. Spkts. green or red | 1. <i>halapense</i> . |
| B. Spikes 2—8-noded:— | |
| Spkts. black, callus hairs deep brown | 3. <i>nitidum</i> . |
| Spkts. white, callus hairs white | 4. <i>fascicularis</i> . |

1. S. halapense, Pers. Syn. *Andropogon halapensis, Brot.*

A stout grass with a long creeping stoloniferous rootstock, which has appressed hairy sheaths at its nodes. Culms 2—3 ft. high only or attaining 8 ft. and .25" diam. sometimes decumbent at the base with numerous adventitious roots, nodes finely silky-pubescent. Leaves broadly linear setaceously acuminate, rarely 1" wide (in our area), somewhat tapering to the broad rounded sub-amplexicaul base, junction of sheath and blade often pubescent or villous externally and densely silky or villous inside above the ligule, otherwise glabrous, margins setulose broad, about 6—8-nerved between margin and midrib, sheaths rather loose glabrous except at the nodes, ligule .08" crose strigosely hairy behind. Panicle 5—10" long with sub-erect or diffuse branches which are angled and often scabrellous on one of the angles upwards, 1—3-nate, distant, villous at their axils with alternate branches and spikes in their upper half or more. Spikes sometimes branched with a branch taking the place of the pedicelled spkt., 3—4-noded, joints longer than the pedicels, compressed, margined, villous ending in a minute cup, easily disarticulate and the ripe sessile spikelet falling (as in most *Andropogoneæ*) with the joint of the rhachis and the pedicelled spikelet. Sess. spkt. elliptic or narrowly elliptic, acute, .18—22" long, callus hairs short spreading. Gl. i dorsally flattened, silkily villous or centre glabrescent, keels pectinately hispid in upper third, about 11-nerved altogether or 7-nerved between the keels, margins incurved or inflexed.

Along rivers and streams, where it is sometimes gregarious. Singbhum! Monghyr, *Mokin!* Perennial. Fl. Oct.—Dec.

Sessile spkts. gl. ii narrower than i, very convex or keeled upwards, very acute or almost cuspidate, 7-nerved, sparsely silky on back, keel scabrid; iii little shorter than i and ii, broadly lanceolate, hyaline, margins inflexed from the 2 marginal nerves which are ciliate; iv about three-fourths i, either broadly oblong obtuse without an awn (the most of the spkts.) or awned from near the base and 2-fid, always very ciliate or sub-fimbriate, awn when present .4—5". Lodicules fleshy compressed quadrate crescentic at top with a few cilia on each horn. Anthers .1". Grain obovoid fuscous, .07". Ped. spkt. linear .16" (Monghyr) to lanceolate .24" (Singbhum), pale green to red; gl. i narrow-lanceolate 7-nerved, dorsally depressed between the prominent hispid keels and margins inflexed, subcuspidate, 7-nerved; ii cymbiform-lanceolate sharply acuminate, 5-nerved, midrib scabrellous, inflexed margins silky; iii about three-fourths i, glabrous 2-keeled and with incurved margins (Singbhum) sparsely ciliate (Monghyr); iv (0 in Monghyr specimen) two-thirds iii with base embracing the red lodicules.

Hooker states of this grass that "it is no doubt the wild form of *Andropogon Sorghum*" (*Sorghum vulgare*). It is a good fodder and the grain is eaten.

2. *S. vulgare*, Pers. Syn. *Andropogon Sorghum*, Brot.; *Gangai*, K.; *Juar*, H., S.; *Sissua*, Mal Pah.

A stout usually tall annual with broadly linear leaves with a prominent white midrib and a usually thyrsiform decomposed panicle with crowded whorls of erect branches and branchlets, rarely subeffuse. Rhachis of spike tenacious, joints leaving a ragged scar at the tip when forcibly separated. Pedicelled spkts. usually neuter, pedicels short.

Frequently cultivated in the Northern area, sparingly on the Chota Nagpur plateau or in the Southern area! Usually reaped Nov.—Dec.

Hackel makes 37 varieties of this plant. *Stapf* has made several species of it. The material at my disposal is altogether inadequate to assign most of the B & O. crops to one or the other. The following forms only have been noted:—

Var. *Roxburghii*, (*F.B.I.* vii, p. 184). Syn. *S. Roxburghii*, *Stapf*. Panicle oblong dense. Sess. spkt. .2", ovate acuminate awnless. Gl. i of sess. spkt. not depressed below the tip, very villous, tip hyaline, nerves obscure. *Monghyr*, *Mokim*!

Var. *Vulgaris*, (*loc. cit.*). Panicle erect contracted or sub-effuse. Spikes several on the flexuous branches, axils villous. Gl. i of sess. spkt. distinctly 10-nerved below tip, .2", tip acute depressed and triangular above, villous, apiculate; ii 7-nerved; iii white silky; iv 2-fid with awn .25". *Chota Nagpur*!

Var. *cernuus*, (*loc. cit.*). Syn. *S. cernuum*, *Host*. Very robust with a thick dense ovoid cernuous head. *Frequent*!

3. *S. nitidum*, Pers. Syn. *Andropogon nitidus*, *Kunth*. *Sorghum serratum*, *Haines* (*C.P. List*); *Andropogon serratus*, *Thunb.*; *Sorghum fulvum*, *Beauv.*

A tall tufted grass 3—8 ft. high, densely villous at the nodes and with leaf-sheaths villously hairy on one side. Leaves on stem 9"—2.5 ft. by .3—8" with narrow long-hairy base. Readily recognised by the brown or black shining and brown-hairy spikelets in 2—8 (usually 2—4) nodal spikes solitary at the ends of the filiform sub-verticillate branches of a subsimple lax oblong panicle 5—12" long.

Rocky shady hill forests. *Santal Parg.*! *Singbhum*, frequent! *Manbhum*, *Campbell*! *Hazaribagh*, on *Parasnath*, *Clarke*, etc.! *Palamau*, frequent! Fl., Fr. Sept.—Dec. Perennial.

L. setaceous acuminate, with prominent white midrib, often sparsely hairy on both surfaces, hairs often tubercle-based, margins scabrid, cutting, mouth of sheath silkily villous; ligule very short truncate. Rhachis and branches of panicle often flexuous, .75—2.5" long. Joints and pedicels equal, bearded, one-half to two-thirds sess. spkt. Sess. spkt. broadly ellipsoid .15" long, callus rounded (acute, *F.B.I.*); gl. i broadly oblong or elliptic acute or obtuse, dorsally flattened with incurved margins, brown-hairy and keels hispid, 7-nerved, or about 3-nerved between keels, sometimes nearly black, polished; ii broadly cymbiform with rounded back, truncately acuminate, margins hyaline ciliate; iii as long, hyaline, margins inrolled, 2-keeled, ciliate; iv linear-oblong .08" long, 2-lobed and with an awn .5" long from about midway, or the awn of lower spkts. 0 (according to *Hackel* *Andropogon serratus* var. *genuinus* has gl. iv 2-lobed and awned and var. *nitidus* has gl. iv entire awnless! All our specimens have some of the spkts. with awns). Ped. spkt. linear-oblong, .12", pale or greenish with brown hairs; gl. i oblong rounded or sub-truncate, dorsally depressed and 2-nerved between the keels; ii equal, rather narrower obtuse, margins much inflexed, 3-nerved between keels; iii linear hyaline, male.

4. *S. fascicularis*, Haines. Syn. *Andropogon fascicularis*, Roxb.; *Sorghum gangeticum*, Stapf.*

Erect slender simple or branched 2—3 ft. high (3—5 ft. Roxb.), culms with glabrous or slightly villous nodes. Leaves very slender, sometimes only 1—2" long and .06" wide, but in other cases attaining 16" by 4", finely acuminate with sparse tubercle-based hairs near the base and on the margins of the sheaths, about 4-nerved each side of midrib. Panicle pale, from nearly simple to compound, branches fasciated never as long as main rhachis, nodes sometimes slightly villous, joints and pedicels equal compressed more or less translucent channelled (subterete, not or obscurely channelled with no translucent centre, F.B.I.), densely villous on margins, the villi usually covering the face of gl. ii. Sessile spkt. .16—18" long, very shining glabrous dorsally. Gl. iv .08" deeply 2-fid the segments appearing as wings to the .5—.6" long awn. Pedicelled spkt. with 3—4 glumes and male, base obtuse.

Santal Parg. (Rajmahal Hills), Kurz! Singbhum, Clarke! Manbhum, Clarke! Palamau (Betlah and Kechki forests)! Fl., Fr. Oct.—Nov.

Sessile spkt. with rounded slightly bearded callus. Gl. i ell-oblong, hispid on the keels above, 6—8-nerved between the keels, truncate; ii equal or slightly longer, cymbiform or with rounded back, delicately 5—9-nerved; iii lanceolate hyaline, a little shorter, obtusely acuminate, ciliate; iv 2-fid to below the middle, ciliate with very delicate palea. Grain oblong fusiform, dark brown, .08" long. Ped. spkt. .15—19" long; gl. i 9—11-nerved; ii cymbiform with keel ciliate; iii four-fifths i, lanceolate ciliate; iv, if present, over half i, narrowly oblong entire ciliate (perhaps the palea of iii).

71. CHRYSOPOGON, Trin.

Perennials with narrow leaves, ligule of minute hairs, and mostly lax panicles with whorls of simple or basally divided filiform branches, rarely the branches only 1—2-nate. Spikes of 3 spikelets (one sessile and 2 pedicelled) at the ends of the branches, the triplets falling together from the thickened obconic obliquely truncate tips which are crowned with a ring or beard of stiff hairs. Sessile spikelets narrow, laterally compressed; gl. i linear or narrow, rigid, usually 4-nerved and laterally compressed; ii broader, more or less cymbiform, 3-nerved, tip 2-lobed, awned or not; iii hyaline 2-nerved; iv the narrow hyaline 1—3-nerved base of a long awn; palea 0 or small. Lodicules glabrous. Grain linear, laterally compressed. Pedicelled spkt. dorsally compressed; gls. i and ii awned or not.

I. Small, 1—2 ft. Callus of sessile spkt. very long (as long as spkt.) acicular. Spkts. .15"

1. *aciculatus*.

II. Stout or slender, mostly over 3 ft. Callus shortly adnate, not nearly as long as spkt. Spkts. over .15":—

A. Pedicels half as long as sessile spkt. or longer. Ped. spkt. over .3". Panicle 6—12":—

Panicle oblong, lower branches mostly less than twice the internode. Spkt. hispid on nerves. Ped. spkt. under .4"

2. *lancearius*.

* Stapf considered the *Andropogon fascicularis* of Roxburgh to be an *Amphilophis* and has named an *Amphilophis* accordingly. But neither Roxburgh's description nor his detailed drawing are consistent with an *Amphilophis*, and although the general (habit) figure is somewhat more like an *Amphilophis* it also very well agrees with some specimens of this *Sorghum*.

Panicle ovoid or lanceolate, very dense, more than twice length of internode. Spkts. glabrous. Ped. spkt. over .4" long

B. Pedicels less than half as long as sessile spkt. Panicles 3—6"

3. *Hamiltonii*.

4. *montanus*.

1. **C. aciculatus**, *Trin.* Syn. *Andropogon aciculatus*, *Retz.*; *Chorakanta*, *chui-kanta*, *Vern.*

A small grass 12—18" high with creeping stem and short densely tufted leaves 1—5" by .12—.2". Panicle very narrow 1—4" long, usually turning red or purple, with capillary branches solitary and subverticillate apparently scaberulous or villous below the spikelets from the villous callus being produced downwards and adnate on one side in a long needle-like appendage .15—.17" long separating when the spikelets are ripe. Sess. spkt. .14" long; gl. i linear acuminate or minutely 2-cuspidate, convex with inflexed margins, keels hispid above; ii cymbiform aristulate .18" long with the awnlet, keel hispid above; iii .1" hyaline lanceolate ciliate with inflexed margins, 2-nerved; iv with its scabrid awn .2—.3", palea oblong hyaline obtuse glabrous about half iii. Pedicels about .1", often unequal. Ped. spkt. .16—.2" including the cuspidate scabrid cusp of gl. i; ii rather shorter aristulate; iii and iv hyaline shorter softly villous, male.

A weed of damp and heavily grazed lands, and a pest from the sharp callus and small awns sticking to the clothes. The leaves which lie close to the ground escape to a large extent the lips of cattle. Most frequent in the Northern districts esp. Purneah and Santal Parg. but occurring in all. Fl., Fr. Aug.—Nov.

2. **C. lancearius**, *comb. nov.* Syn. *Andropogon lancearius*, *Hook, f.*; *Korpo dumbu*, *K.*

A large coarse grass 4—6 ft. or more high and culms .2—.25" diam. at base, compressed, with dry leaf-sheaths below, very leafy above; minutely downy below the panicle. Leaves 18"—2 ft. by .3—.5" broad with spinulose-serrulate cutting edges. Panicles oblong 6—12" long very many-rayed, with irregularly verticillate capillary suberect branches 2—4" long which exhibit the characteristic clavate oblique brown-bearded tips (seen best after fall of spkt.). Sessile spkt. .25" long, callus elongate .05" long and pedicels at base adnate to it, pungent and with a barb of brown hairs, shortly adnate to the oblique brown-bearded tip of peduncle. Gl. i conduplicate, tip oblique, 2-nerved each side, slightly scabrous on nerves; ii as long but much broader, conduplicate and each side .04" broad, keel rounded, 3-nerved hispid, and broad membranous margins pilose, awn .3—.4" long slender; iii hyaline, .16" (reaching the tips of the anthers), ciliate; iv membranous linear, not 2-fid but the sides meeting in front of the 1.5—1.75" long awn which is stout and hairy up to the knee, then slender and scabrid. Pedicels compressed somewhat translucent, bearded on each margin with long brown hairs, about .2" long or slightly exceeding half the sessile spkt.

Usually in shaded positions on rocky hill sides. On grassy spurs, North Champaran! Monghyr Hills, *Kurz!* Gaya ghats, common! Singbhum, frequent! Palamau! Hazaribagh (in Koderma forest)! Ranchi, *Clarke, Prain!* Sarabhapur! Fl., Fr. Sept.—Nov.

After the fall of the spikelets it may be recognised among its congeners (exc. *Hamiltonii*) by the robust habit and the culms minutely pubescent below the large panicle. L. only slightly narrowed towards the rather broad base, sheaths very smooth, ligule a rim with a close band of short silky hairs. Ped. spkt. .28—4" long, subterete, the two of each pair not always quite alike, more especially in regard to the existence or length of the awns. Callus with linear-oblong oblique scar. Gl. i finely acuminate and awned, 7-nerved, awn usually about .25"; ii acuminate long-ciliate subaristulate or (in a Gaya specimen collected by *Mohim*) with an awn .1—12" long; iii .22—27" hyaline ciliate or villous, linear-oblong; iv similar or (in the Gaya specimen) with an awn 1" long in some spkts. only.

The grass is a good fodder.

3. *C. Hamiltonii*, comb. nov. Syn. *Andropogon Hamiltonii*, *Hook. f.*

A tall stout leafy grass, glabrous except beneath the panicle where the culm is minutely closely pubescent. Leaves 1.5" ft. or more by .25—5" finely acuminate, smooth or minutely scaberulous above, margins scabrid. Panicle 6—10" long by 2.5—3" broad lanceolar dense of many long smooth suberect branches in many closely approximate whorls each bearing 1—3 spikes. Sessile spikelet .25—28" long, callus long brown-villous all round .05" long; gl. i polished linear-oblong, 2-nerved on each margin, the stronger (keels) slightly excurrent and scabrid at the tips; ii with brown very coriaceous 3-nerved back and membranous sides, awn .5" long, margins finely ciliate; iv with awn 1.8—2.5" long. Pedicelled spkt. .4—5" long; i with awn .4—5" long, scabrid at the acuminate tip only. Pedicel brown-villous.

Monghyr (*Wall. No. 8792a*), *Ham.* Fl. Aug.

Hamilton's is the only collection, and I am inclined to think that this is but a form of *C. lancearius* and perhaps diseased; the only spike I have been able to dissect had certainly a diseased ovary .2" long. It is chiefly distinguishable by the very dense panicle and more glabrous spikelets. *Hooker* gives also the following distinctions: "L. very long linear (he calls those of *lancearius* narrowly lanceolate) scaberulous beneath (I find them no more so than in *lancearius*). Callus villous all round (whereas he describes the callus of *lancearius* as glabrous in front. This I do not understand as both have the usual oblique glabrous scar in front, that of *lancearius* being perhaps a little more pronounced). Ped. spkt. .5" long (but some are only .44" long and I have found *lancearius* with the ped. spkts. up to .4" long)."

4. *C. montanus*, Trin. (1821). Syn. *A. monticola*, *Schult. (1824)**

A variable grass with usually slender erect or ascending glabrous stems, robust in some forms. Leaves very narrow glabrous, rarely pubescent or ciliate, lower sheaths compressed. Panicles rarely 6" long, of several whorls of few or many capillary flexuous very unequal branches bearing solitary spikes, rhachis of panicle often puberulous or pubescent but culm below it glabrous. Sessile spikelets pale, .16—2" long, rarely .3", tip of peduncle brown-bearded clavate, callus short usually .03" or less with oval scar and dense beard. Gl. i laterally compressed usually scabrid or ciliate above the middle, sometimes glabrous; ii dorsally more or less ciliate with short or long rigid bristles, rarely glabrous (in var. *Trinii*, *Hack.*); back rounded, sides membranous embracing the inner glumes, often exceeding i and with

* I quoted this as 1817 in *C. P. List*, the date at commencement of volume, but the "additamenta" in which the name *monticola* occurs is 1824.

a short slender awn; iii shorter hyaline conduplicate ciliate; iv with a slender awn from about the middle .5—1.5" long. Pedicelled spkts. .15—2" long; gl. i 7-nerved usually scabrous or hairy, awned or not, pedicels compressed, shortly adnate to callus, .04—07" long, bearded on the edges with the hairs longest upwards.

In the hills, but not nearly so common as in the Central Provinces.

Ramnagar Hills, common! Santal Parg., *Kurz!* Gya, *Mokim!* Palamau, frequent! Ranchi, at Neterhat! Hazaribagh, on Parasnath, *Clarke!* Angul (common in Durgapur range)! Sambalpur, very common! Fl., Fr. Sept.—Dec.

Stems sometimes fastigiately branched above. Leaves with scaberulous margins, lower sheaths usually compressed, ligule a belt of short hairs. Panicle branches in whorls of 3—12, smooth or scaberulous. Spikelets variously coloured pale to purple. Sess. spkt. gl. i with rounded tip; ii conduplicate with rounded back and membranous broad sides .03—05" wide, tip ending in two short rounded lobes, awn sometimes recurved; iii hyaline, about .18"; iv 1—3-nerved, the midrib gradually passing into the awn from the middle. Ped. spkt. gl. ii 3-nerved with incurved villous margins which close over the inner; iv about two thirds i, linear, sparsely ciliate. Stamens usually 3.

The following forms occur in our area which are difficult to arrange under *Hackel's* varieties. Specimens from Angul and Sambalpur were not kept. They ranged themselves under the two forms described on p. 259 of my C.P. List, which are apparently *montanus*, *Trin.* (described below) or *monticola* proper of the *F.B.I.*, and *robustus* (see below):

I. Sessile spkts. .16—2" long:—

A. Leaves .1—2" wide only:—

1. Leaves glabrous on the surfaces:—

Slender 2—3 ft. L. ciliate. Panicle 2—3".

Gl. i and ii of sess. spkt. scabrid or ii with few bristles. Ped. spkt. hispid all over .15" long, both awned.

a. scabrada.

(*C. serrulatus*, *Trin.?*)

Gya, Rajmahal Hills.

Slender 3—4 ft. L. with long tubercle-based cilia towards the base. Panicles 3—4".

Gl. i with few short hairs at tip; ii with a ridge of bristles in the central three-fourths of back. Ped. spkt. .2" nearly glabrous, not awned.

β. montanus, *Trin.*

Saidope Forest, Palamau.

2. Leaves pubescent on the surfaces:—

Panicle 4", rachis pubescent. Gl. i scabrid-ciliate on nerves; ii bristly along back and the bristles extending on to the awn

γ. pubescens.

Parasnath.

B. Leaves .3—4" wide, somewhat glaucous beneath:—

Panicle 5—6". Gl. i hispid at tip, much shorter than ii; ii with red bristles on the back. Ped. spkt. awned or not. This is perhaps *robustus* of *F.B.I.*, but the leaves are much broader

δ. robustus, *J.D.H.?*

Palamau.

II. Sessile spkt. .25—3" long:—

Tall, up to 6.5 ft. and .25" diam. at base, lower leaves 20" by .6" with spinulose hispid margins and sometimes ciliate, young glaucous beneath, upper surface puberulous or hispidulous. Panicle (spkts.) pink lanceolate 5—6". Sess. spkt. gl. i

2-dentate or minutely 2-cuspidate, hard; ii .05" broad at sides, bristly above base, awn .25—3" long; iii .22" with villous margins; iv .2" awn .8" long puberulous below. Ped. spkt. .28—3" long, pedicels .1"; i hispid or scabrid; ii 3-nerved with villous margins; iii 2-nerved; iv about three-fourths iii. 1-nerved. anthers yellow .15" long. Hairs on callus and pedicels yellow

e palamaunsis.

Hills of Palamau. 3000 ft.

This last is possibly a distinct species. *Hole* states that all the forms he has seen apparently pass into one another.

The grass is a valuable fodder.

72. DICHANTHIUM, *Willem.*

Perennial or annual usually slender cæspitose grasses with narrow leaves and short ligules, or ligule of hairs. Spikes solitary or in subdigitate panicles with a short primary axis, rarely spikes 2—3 on the short branches of panicle, branches or spikes shortly peduncled. Spikelets often subimbricate, 2-nate, sessile and pedicelled similar in shape or nearly so, lowest one or two pairs also homogamous, male or neuter, others differing in sex. Joints and pedicels filiform, without thin translucent centre, articulations more or less transverse. Sessile spkts. dorsally compressed, callus short rounded shortly bearded or glabrous. Glumes 4, i usually oblong obtuse 2-keeled with margins narrowly inflexed; ii much narrower cymbiform 3-nerved, 1- or 3-keeled, centre keel very pronounced; iii hyaline; iv reduced to the hyaline base of a slender awn, palea minute or 0; lodicules minute glabrous; grain oblong, obtuse, dorsally compressed. Pedicelled spkt. i oblong many-nerved; ii flat with sharply inflexed margins closing over the hyaline iii if present and the 3 stamens; iv usually 0, never awned.

I. Perennial. Sessile and pedicelled spkts. concolorous:—

Nodes rarely villous. Spikes 1—few. Gl. i (sess. spkt.) elliptic-oblong often winged above or denticulate. Callus glabrous. Joints and pedicels .04—05" only

1. *caricosum.*

Nodes mostly villous. Spikes 3—20. Gl. i oblong, never winged nor denticulate, with few or many long hairs. Callus shortly bearded. Joints and pedicels over .05"

2. *annulatum.*

II. Annual. Sessile spkt. white villous, ped. spkt. brown glabrous

3. *Clarkei.*

1. *D. caricosum*, *comb. nov.* Syn. *Andropogon caricosus*, *L.*

Stem 1—2 ft. erect or ascending from a creeping base or almost entirely decumbent, slender (in our area) with narrowly linear leaves 2—5" by .1—15" (sometimes larger outside our area and see variety), finely acuminate, glabrous or sparsely hairy, ligule very short membranous truncate ciliolate. Spikes 1—4 subdigitate (shortly spicate) on the peduncle, 1—4" long with the spikelets closely subdistichously imbricate. Sessile spkt. with callus rounded and glabrous, gl. i .14—15" broadly elliptic-oblong or somewhat obovoid, rounded truncate or denticulate at the tip, often winged on the shoulders and shoulders hispid, tip often 2-toothed, back sparsely shortly hairy, 5—7-nerved between the keels, keel-nerve the only ones reaching the tip; ii

oblong-lanceolate, 3-keeled, obtuse or, when opened out, narrowly truncate, glabrous. Joints and pedicels .04—.05" only, villous on one side and with few hairs at base and tip. Ped. spkt. .15" obovoid-oblong, gl. i 11-nerved, laxly hairy, shoulders scabrid, ii margins broadly inflexed closing over. iii and the 3 stamens.

Ranchi, Wood! Manbhum, Campbell! Orissa, Walsh!

I believe there is no single character by which *caricosum* can be distinguished from *annulatum*. I have successively tested all those given in the *F.B.I.* and found them fail on specimens named by Sir J. D. Hooker himself; the key characters in *Bengal Plants* are also unworkable as applied to the same specimens, many of which have bearded nodes, and the character of spiral or subdistichous spikelets is difficult to apply. *Linnaeus* described *andropogon caricosus* as with solitary spikes, and *Willdenough* adds "leaves with sparse hairs and sheaths hirsute at the base" (probably he refers to the nodes).

Var. *mollicomus*, Hack.

This appears to be more distinct. A specimen collected by me from Bilaspur not far from our area is a very robust plant with 2—4 broad spikes up to 3" long and .15" wide with very hairy peduncles and toothed bidentate winged broad glume i. The nodes are pubescent.

2. *D. annulatum*, Stapf. Syn. *Andropogon annulatus*, Forsk.

Cæspitose, erect or ascending from a geniculate base, 1—3 ft. high, nodes mostly bearded. Leaves linear, finely caudate, 3—6" long .1—2" broad, glabrous or slightly hairy and often with long cilia near the base, hairs often leaving small tubercle-bases. Ligule scarious short or oblong, obtuse. Spikes subdigitate (spicate on a short rhachis) 1—2" long, 4—20 rarely fewer on a rhachis .25—.7" long. Joints and pedicels .05—.08" long, villous one or both sides and callus scantily bearded. Sessile spikelets subimbricate, gl. i oblong, rarely elliptic-oblong, obtuse, 5-nerved between keels, tip neither winged nor denticulate, shoulders hispid and with long cilia and back more or less hairy, rarely glabrous; ii with ciliolate margins; iii glabrous or ciliolate; iv awn .3—.8" long. Ped. spkt. about as long as sessile rather narrower, gl. i 7—8—rarely 11-nerved between the keels.

Monghyr, Mokim! Santal Parg., frequent, Kurz, Gamble, etc.! Singbhum! Manbhum, Camp.! Fl. Aug.—Nov.

The spikes are sometimes compound and the branches have ciliate tubercles in their axils otherwise their peduncles are glabrous.

3. *D. Clarkei*, comb. nov. Syn. *Andropogon Clarkei*, Hack.

A very distinct and pretty species, very slender and much branched, 12—18" high; nodes mostly pubescent. Leaves 2—4" linear to almost linear-lanceolate, up to .15—.2" broad in the middle, cuspidately acuminate, ligule of hairs. Spikes solitary .7—1" long, on capillary peduncles scarcely exerted from the spathiform leaf-sheaths or leaves (the bases of which embrace them). Easily recognised from the contrast of the very white villous joints and pedicels, white-tomentose gl. i of the sessile spikelets, and dark brown glabrous pedicelled spikelets. Sessile spkts. distichously secund, pedicelled distichous.

Parasnath, at the top, Clarke! Fl. Sept.—Oct. Annual.

Joints and pedicels sulcate, two lowest pairs of spikelets neuter. Other sess. spkts. .12" long, gl. i elliptic-oblong truncate 2 toothed, keels scaberulous, callus

very short; ii white, narrowly cymbiform, margins ciliate; iii oblong hyaline ciliate; iv, awn $\cdot 5-1''$ long.

73. HETEROPOGON, *Pers.*

Short or usually tall grasses with linear or sub-ensiform leaves and solitary terminal many-jointed spikes. Spikelets 2-nate, sessile and pedicelled, lowest 2—8 prs. closely imbricate subsimilar in shape and colour and alike in sex, male or neuter, awnless, their joints firmly cohering, the sessile and pedicelled spkts. of other pairs very different and their joints disarticulating. Sess. spkts. subcylindric, callus long and often pungent with a barb of hairs; gl. i sub-cylindric or oblong; ii cymbiform or linear with a rounded keel in which the awn of iv lies, awnless; iii hyaline; iv reduced to the base (or base hardly any) of a long awn with a stout column. Pedicelled spkts. male or neuter, very different from the heterogamous sessile, often similar to the homogamous, more or less concealing the sessile; gl. i usually many-nerved; iv hyaline, awnless. Lodicules fleshy obtuse-quadrate with depressed glabrous top.

1. *H. contortus*, Roem. Syn. *Andropogon contortus*, L.; Sauri, M.; Saiyu, Ho.; Sauri ghas, S.; Chorant, Kharw.; Kher, H.; Sukla (Sambalpur); Dauria, Sinkola, Or.; The Spear grass.

A tufted and usually densely gregarious grass, 1—3 ft. high on poor soils, often 5 ft. in valleys and rich soils, often fastigiately branched. Leaves somewhat glaucous 4—12" by $\cdot 1-2''$, acute or obtuse, scabrid above and on midrib below, sometimes somewhat hairy, sheaths keeled and also sometimes hairy, ligule very small scarious truncate ciliolate. Spikes on filiform peduncles 1.5—3" without the awns, 4—6" with the awns, clothed with spreading white tubercle-based stiff hairs from the outer glumes. Lower pairs of subsimilar spikelets 4—8, green, male or with 3 minute unfertile anthers. Sessile female spkts. $\cdot 2''$ or together with the elongated brown-barbed pungent callus $\cdot 25-26''$. Gl. i with involute margins, scabrid, brown; ii with inflexed nerved margins.

Chiefly in the drier districts and disappearing towards Purneah and Cuttack, though found on the drier hills of Orissa. Champaran, common in the hills! Shahabad! Gaya! Monghyr Hills, Kurz, etc.! Chota Nagpur, all districts on the hills and open ground in the valleys, also in forests thinned by fires! Santal Parg., Rajmahal Hills, common! Mayurbhanj! Puri, drier hills! Angul! Sambalpur! Fl. Sept.—Dec. Fr. Oct.—Jan., but all the fruits may not become detached until March when the spike with the disarticulating lower joints and the homogamous spikelets still remain. Annual.

Nodes glabrous, rarely pubescent. Leaf-sheaths and base of leaves sometimes with long tubercle-based hairs. Homogamous sessile spikelet $\cdot 2''$, callus glabrous, gl. i oblong-lanceolate or oblong, margins inflexed, keels symmetrically winged, many-nerved between; ii narrower with inflexed margins slightly ciliate, sharply acuminate; iii $\frac{3}{4}$ ths i, lanceolate with inflexed margins ciliate; iv $\frac{1}{4}$ to $\frac{1}{2}$ i with few long cilia, hyaline, awnless. Ped. spkt. like the sessile, but gl. i is unsymmetrical having one inflexed margin and winged only on that side, mostly longer than the sessile (basal one often much shorter), ii more cuspidate exceeding gl. i; pedicels about half as long as the joint. The pedicelled heterogamous spkts. are sub-similar and male. Awn of female spkt. hirsute on the column scabrid above.

A well-known grass from its gregarious character and the annoyance of the pungent barbed fruits which penetrate the clothing and skin. It is much used

for thatching and lasts longer than rice straw. The young grass is a fair fodder, the old grass is also used, but only because there is nothing better; it causes a reddish colour in the dung of horses, and sometimes severe ulceration (from the barbs) in the gums of horses and cattle. The awns, as in other similarly awned grasses, are very hygroscopic and by their contortions and the barbed callus serve to thrust the seed into the ground.

74. *HYPOGYNIUM*, *Nees*.

Spikes solitary, peduncled in the axil of a spathiform leaf-sheath; joints and pedicels slender, tops obliquely truncate. Sessile spikelets dorsally compressed; gl. i with inflexed or involute keeled margins; ii keeled, awnless; iii hyaline or 0; iv a simple awn. Pedicelled spikelets somewhat similar to the sessile, male or neuter, gl. v 0, sometimes iii also absent.

1. *H. foveolatum*, *comb. nov.* Syn. *Andropogon foveolatus*, *Del.*

A tufted grass from a few inches high to 2 ft., simple or fastigiately branched above with very narrow, sometimes almost filiform acuminate leaves mostly somewhat hairy and ciliate near the base. Spikes 1—1.5" long with very slender peduncles, often 3—6 peduncles each with its own proper very slender spathe from a single axil and frequently sharply geniculate just below the spathe, limbs and pedicels slender villous. Spikelets subequal, .08—14" long, linear-oblong, often purplish. Gl. i of sessile spkt. mostly with a dorsal pit above the middle, keels scabridly hispid 3—5-nerved between the keels.

Behar, *J.D.H.*! Manbhurn, *Camp., Clarke!* Also Ganjam and probably therefore in Puri.

Sheaths near base of stem finely silky, upper shorter than the internodes (in *Hooker's* Behar specimen which is only 3" high the internodes are scarcely developed). L. scaberulous beneath, ligule short truncate ciliate. Sessile spkt. gl. ii as long as i, acute, 3-nerved; iii much shorter glabrous; iv with awn .5—.7" long, the glume reduced to a faint margin at the base. Ped. spkt. with 2 glumes, i sometimes pitted, 5-nerved; ii 3-nerved.

75. *DICTOMIS*, *Hack.*

Perennial grasses with linear leaves and solitary spikes. Peduncle in the axil of a spathiform leaf sheath. Limbs and pedicels bucciniform, the mouths with large teeth. Sessile spikelets laterally compressed with short callus. Gl. i applied to the edges and only as broad as the opening of gl. ii, keels marginal, margin very narrowly inflexed; ii cymbiform, much broader, long-awned; iii narrow hyaline shorter; iv 2-toothed with a long stout awn from the sinus. Pedicelled spikelet with a very large gl. i, which, with its flattened villous pedicel, conceals the inner sessile spkt.; ii and iii successively smaller, neuter.

1. *D. fastigiata*, *H. B. & K.*

An erect much fastigiately branched grass 1—2 ft. high, sometimes decumbent at base. Leaves 3—12", narrowly linear, acuminate, scabrid with elongate acute ligule. Spathes 2—3", linear. Peduncle short or long. Spike 1—2", limbs compressed, densely bearded on the margins, shorter than the spkts., tips with 2 large teeth. Sessile spkt. .18" long;

gl. i linear acuminate (sometimes appearing 2-cuspidate from the very thin hyaline centre between the keels), dorsally villous above; ii .16" long, .04" broad (without unfolding), tapering towards base, membranous, 2-fid with very slender awn, keel villous above; iii with ciliate margins; iv cymbiform, 2-toothed with awn 1.5", stout. Pedicelled spkt. with gl. i .3" long, 2 strong nerves on the margins ending in cusps and about 11-nerved between, oblong acuminate with slender terminal awn; ii half as long and iii half ii, oblong hyaline.

Gya, *Mohim!* Ranchi, *Clarke!* Hazaribagh, *Clarke!* Manbhum, *Camp.!* Fl., Fr. Sept.—Dec. Perennial.

76. SCHIZACHYRIUM, *Benth.*

Stout or (in our area) very slender, annual or perennial grasses with linear leaves. Spikes solitary on the peduncle which is partially enclosed by a narrow spathiform leaf-sheath and is articulate at base of spathe. Limbs and pedicels of spikes clavate or bucciniform with cupular irregularly toothed or equally 2-lobed or -toothed mouths, rhachis articulate fragile. Spikelets sessile, and neuter imperfect pedicelled. Sessile spkt. dorsally compressed, callus short. Gl. i keeled; ii not or minutely awned; iii hyaline empty epaleate; iv hyaline 2-fid, awned in the cleft.

Divaricately branched. Spikes glabrous or sparsely hairy 1. *brevifolium*.
Fastigiatley branched. Spikes pubescent and villous 2. *exile*.

1. *S. brevifolium*, *Nees*. Syn. *Andropogon brevifolius*, *Sw*: (1788); *A. parviflorus*, *Roxb.*

A delicate much-branched straggling and ascending leafy grass 8—18" high. Branches filiform. Leaves .7—2.5" suberect or divaricate linear or broadly linear obtuse or subacute. Spikes few to each leaf-axil .5—1" long, each solitary in its very narrowly linear spathe with filiform peduncles, joints and pedicels glabrous or sparsely hairy, clavate oblique and hollowed at the tip, margin toothed or (usually 2-) lobed, bearded or not. Spikelet .12—.17" long. Gl. i coriaceous, tip 2-fid, ii acuminate or cuspidate; iv deeply 2-fid; awn .3—.5". Pedicelled spkt. reduced to a long-awned glume.

In dry low jungles. Purneah, on gravelly knolls, *Kurz!* Behar, *J.D.H.!* Monghyr, *Mohim!* Santal Parg., *Kurz*, etc. (Rajmahal Hills)! Ranchi, *Clarke!* Hazaribagh, *Clarke!* Manbhum, *Clarke!* Orissa, *Walsh!* Fl., Fr. Oct.—Dec.

L. glabrous except the margins and nerves which are scabrid beneath. *Hooker* states that the spathes are spreading, whereas in *exile* they are erect. The specimens do not always show this distinction.

2. *S. exile*, *Stapf*. Syn. *Andropogon exilis*, *Hochst.*

Very similar to *brevifolium* but branching much more fastigiate, leaves acuminate or very acute glabrous or sparsely hairy. Spikes 1—1.5", joints pubescent and densely silkily villous towards the tips which have a long tooth or lobe each side. Sessile spkt. .15—.18" (.25", *J. D. H.*), subulate-lanceolate. Gl. i coriaceous, dorsally villous, with very slender 2-fid apex; ii linear-lanceolate, 1-nerved, cuspidate or with a short awnlet; iv 2-fid, awn .3—.7" long. Pedicelled spkt. subulate silky, gl. i shortly awned.

Cya, Clarke! Hazaribagh, Clarke! Manbhum, in dry sunny places, Kurz, Clarke! Fl., Fr. Oct.—Dec.

The plant usually dries red. Upper spathes often aristulate. Spikes often concealed among the leaves.

77. ANDROPOGON, L.*

(*Andropogon*, section *Arthrolophus* of F. B. I.)

Mostly perennial grasses of various habit. Spikelets 2-nate, the sessile and pedicelled differing from one another in sex and more or less heteromorphous, all pairs similar, or if the lowest sessile spkt. male or imperfect then resembling the others. Spikes (spiciform racemes) many-jointed fragile, paired (sometimes digitate and more than two, but not in our area) on terminal peduncles embraced below by a spathe-like leaf (spatheole), frequently 2 or more pairs with their spathes subtended by a common spathe and so on to more composite branching, the whole forming a panicle. Joints and pedicels slender, or stout, clavate or thickened upwards, tips more or less cupular or auricled. Glumes 4, membranous or somewhat chartaceous or sub-coriaceous. Sessile spkts. gl. i flat or concave or channelled on the back, 2-keeled with sharply inflexed margins from the keels, at least from the middle upwards; ii subequal, cymbiform, keeled upwards, 3—1-nerved, sometimes awned; iii hyaline, 2-nerved, usually ciliate, empty; iv small hyaline 2-fid or 2-dentate with an interposed awn, sometimes reduced to the awn, palea small or 0. Lodicules glabrous. Grain narrowly lanceolate to oblong, subterete to plano-convex. Pedicelled spkt. more or less compressed dorsally, never concave dorsally, sometimes rudimentary.

Height 3—6 ft. Gl. ii of sess. spkt. awned 1. *apricus*.
Height 8—15". Gl. ii of sessile spkt. minutely cuspidate 2. *pumilus*.

1. *A. apricus*, Trin.

Stems clustered 4—6 ft. high branched above. Leaves at base 1—3 ft. long, cauline, 10—20" long by .25", pubescent or glabrescent beneath, thinly hairy on the nerves above, those on shoots pubescent or hairy. Branches with slender peduncles sheathed with a spathiform leaf-sheath and bearing geminate spikes 1—2.5" long or (*vide J. D. H.*) in fascicled spikes of 3—5 (though I doubt whether this form occurs in our area). Limbs (or joints) and pedicels (of pedicelled spkts.) bucciniform with 2-toothed cupular apices and densely clothed with long hairs below on the margins. Sessile spkt. .17—2" long, callus shortly bearded. Gl. i linear with margins strongly inflexed and centre deeply depressed between the keels, keels scabrid towards tip which is truncate or appearing 2-cuspidate or 2-aristulate when dry from the shrivelling of the delicate hyaline centre; ii cymbiform hyaline 1-nerved with fine awn

* This is only part of *Linnaeus's Andropogon* and a very small part of the *Andropogon* of the F.B.I. and of *Hackel's* monograph. Following *Dr. Stapf (Fl. Trop. Africa, etc.)*, the various sub-genera of *Hackel* have been restored to generic rank. These are *Schizachyrium*, *Diectomis*, *Hypogynium*, *Amphilophis*, *Sorghum*, *Vetiveria*, *Chrysopogon*, *Dicanthium*, *Cymbopogon*, *Heteropogon* and *Pseudanthistria*, in addition to a new genus *Capillidium*.

·12" long; iv with awn 1" or more from between the sparsely ciliate lobes.

Rather common in the open grass tracts in the forests of Chota Nagpur on the hills! Fl., Fr. Oct.—Nov.

Culms yellow. Ligule scarious oblong truncate ciliolate. Peduncles 2—4" long numerous, forming a large false panicle, each spike shortly stipitate. Gl. iii of both spkts. narrow hyaline broadly ciliate. Ped. spkt. gl. i 2-cuspidate from the shortly excurrent keels and often with a fine scabrid awn ·25—·3" long, keels ciliate; ii and iii as in sessile spkt.; iv shorter hyaline finely awned with 3 stamens and a 3-fid quadrangle scale.

2. *A. pumilus*, Roxb.

A small tufted often gregarious grass 8—15" high with narrow linear leaves 1—3" long with few long delicate hairs near the base when young. Spikes ·5—·7" long, geminate, secund, on slender sheathed peduncles, leaving each a cup-shaped clavately cupular 3-toothed 3-quetrous joint after falling, the peduncle itself also jointed below the spathe. Two—more peduncles arise from the axil of a spathiform leaf on a branch of a lower order and these from others, the whole forming a false panicle. Sessile spkt. ·15—·18" dorsally compressed, callus united with that of the next upper joint and of the pedicelled spkt. rounded glabrous. Gl. i linear with 2 very strong keels each diverging and ending in small tubercles below, and in a short cusp at the apex, back of glume infolded between the keels, margins narrowly inflexed. Joints and pedicels equal 4—8 only, ·1—·12" long, white bearded on the outer edge, much less on the inner edge. Ped. spkt. ·15" (·17—·25" *vide J. D. H.!*) with 3 stronger nerves and about 3 more slender nerves between, lateral nerves scabrellous.

Sambalpur (borders of the Central Provinces, Bilaspur and Raipur!) Fl. Dec.

Often red when mature and noticeable from this and its secund panicles. Sessile spkt. gl. ii chartaceous cymbiform as long as i, minutely cuspidate; iii ·12" linear hyaline; iv about ·08" long, scarcely more than the base of the awn, narrowly linear and with 2 capillary lobes; awn ·4—·3" long slender. Ped. spkt. gl. ii nearly as long as i, scarcely keeled, 3-nerved; iii as long, hyaline, delicately 4-nerved, lanceolate, obtuse, stamens 3.

78. CYMBOPOGON, Spreng.

Perennial densely tufted and usually aromatic grasses with often coarse leaves and frequently much compound and contracted spatheate panicles. Spikes geminate, usually rather short, on a common peduncle supported by a spatheole; spatheoles variously arranged in racemes and panicles, each order of branching being in its turn sheathed by a more or less spathiform leaf. Joints disarticulating when mature. Spikelets 2-nate, those of each pair heterogamous and more or less heteromorphous except the lowest pair of one or both spikes which are homogamous (male or neuter).^{*} Joints and pedicels filiform or linear with frequently more or less cupular or auricled tips, those of lowest pair (base of spike) often hard and swollen. Sessile spkts. (above the lowest) female or 2-sexual, dorsally compressed, callus very short, obtuse, shortly bearded; gl. i flat or slightly depressed or deeply grooved on

^{*} But see remarks under *C. microtheca*, var.

the back, 2-keeled, margins, at least above, sharply inflexed and often winged; ii cymbiform, usually 1-nerved; iii entire, hyaline, oblong, 2-nerved; iv hyaline, 2-fid or -lobed or firmer below the insertion of the awn, column of awn smooth, lodicules minute, glabrous, st. 3. Grain oblong, subterete or plano-convex. Ped. spkt. strongly dorsally compressed, male or neuter, gl. i never depressed or grooved; ii thinner in texture; iii hyaline 2-nerved; iv 0 but usually a male flower present.

- A. Back of gl. i of sess. spkt. not reduced to a narrow channel between the keels, sometimes partially grooved:—
1. Joints of spikes and pedicels of spkts. with villi 2" long half concealing the sessile spkts.:—
Panicle narrow with dense fascicles of branches. Spkts. 2" long
1. *jwarancusa*.
 2. Joints of spikes and pedicels of spkts. shortly villous or ciliate:—
Keels of gl. i of sess. spkt. winged, back flat with a partial median longitudinal cleft (usually below centre)
Keels of gl. i of sess. spkt. very narrowly winged or not, back flat or slightly depressed or concave without a cleft.
2. *Martini*.
- B. Back of gl. i of sessile spkt. reduced to a narrow channel between the prominent keels. Panicle odourless:—
3. *nardus*.†
 - Tall. Panicle decompound. Channel between keels extending to the base
4. *microtheca*.
 - Height about 3 ft. Panicle not very compound. Base of gl. i with a boss extending partly between the two short forks of the channel
5. *gidarba*.

1. **C. jwarancusa**, Schult. Syn. *Andropogon jwarancusa*, Jones.

Usually a tall grass 3—6 ft. high with very aromatic roots, densely tufted, the stems from clusters of firm persistent finally loose and open and tortuous leaf-sheaths, more or less widened below. Leaves flat up to 2 ft. long and 2" broad, narrowly linear, filiform above and ending in a long capillary tip, ligule .02" membranous. Panicles long narrow interrupted, with very compound short fascicled branches bearing spathes about 2" long and spatheoles .25—.75" long. Spikes about 5" but unequal; spikelets 3—4 prs. half hidden by the 2" long villi of the joints and pedicels. Sessile spkts. 2" long, gl. i flat or concave between the keels, which are neither winged nor margined (i.e., of course, omitting the ordinary inflexed margins of the glume common to the genus) or sometimes narrowly margined, scabrid or ciliolate, nerves 2—4 or 0 between the keels. Joints of rhachis and pedicels subclavate with toothed tips. Ped. spkts. equal or rather longer than the sessile, narrowly lanceolate, purplish, gl. i 7—9-nerved.

Patna, Wall. (No. 8793 c)! Fl. April.

One of the Oil-grasses. See Stapf in *Kew Bulletin*, 1906. Patna is outside its normal distribution, but it was probably collected near the Ganges.

2. **C. Martini**, Stapf. Syn. *Andropogon Schoenanthus*, F. B. I.; *Sail tati*, K.; *Nanha-dudhi-ghas*, S.; *Rusa-oil grass*.

A tall sweet-scented grass 5—8 ft. high with glabrous straw-coloured leafy-stems and flat usually broad leaves with a rounded or subcordate

† NOTE.—Stapf splits up *nardus* into several separate species.

base, more or less glaucous beneath, those below the inflorescence rarely under 9" long by 4" wide at the base but often 1" wide below, tapering from a little above the base or from the middle to a fine tip, glabrous except for the scabrid margins, margins sometimes smooth near the base. Geminate spikes .5—1.75" long oblique or divaricate or less often deflexed. Peduncle about half the length of the .75—1" long spatheole, several spatheoles and their peduncles from a spathe of a lower order, these arranged in long usually narrowly oblong panicles not more than 1.5—2" wide, but sometimes panicle with many branches and broader. Joints and pedicels slenderly clavate (exc. the much thickened lowest) about ½ sessile spkts., tips with lanceolate tooth or 3-toothed, margins long-villose. Sess. spkt. .15—2" long, gl. i (above the lowest spkt.) with lanceolate centre becoming oblanceolate or oblong from the keels being membranously winged above the middle, back with vertical median depression below middle corresponding to a ridge on the inside; ii cymbiform with the dorsal keel winged above, minutely ciliate below.

Chiefly on rocky hills with sparse forest. Monghyr, *Mokim*! Gaya, common on the ghats! Santal Parg. and Chota Nagpur, all districts, common, ascending to the top of Parasnath, chiefly in the valleys and on the northern or shady sides of the hills, locally abundant! Angul! Sambalpur! An undoubted perennial (*Hooker* says "annual?") forming buds in the autumn from a thick nodose root-stock. Fl., Fr. Oct.—Dec.

3. *C. nardus*, L.* Syn. *Andropogon nardus*, L.

A tall grass 5—7 ft. high copiously branched above and forming a large decomposed nodding panicle. Culms up to 4" diam. at the base, solid, pale polished, with black finely pubescent or glabrescent nodes. Leaves narrow with conspicuous white midrib, lower several feet long and about 6" wide, upper cauline rarely over .35" wide, narrowed to the base, apex filiform, glaucous beneath, glabrous except sometimes at top of sheath, with scabrous margins; ligule scarious .08—1" long glabrous or ciliate. Panicle ultimate branches strict with 2—3 peduncles and spathules from each spathe. Spathules .4 to about .1", peduncles of spatheoles filiform .5—1" very shortly exerted from the spathe; spikes soon strongly reflexed on their, common .4" long peduncle, base swollen ciliate. Spikes .4—1" long unequally pedicelled, joints and pedicels, rather slender .08—1" not clavate (tip only dilated and toothed), villous. Sessile spkt. not tightly squeezed between joint and pedicel nor covered by their hairs, .15—2" long, gl. i oblong-lanceolate flat or slightly concave below, hyaline and nerveless or with 2 green nerves between the keels which are not or very narrowly winged above the middle, scabrous and slightly excurrent, proper margins inflexed throughout.

In the northern area chiefly. One of the commonest savannah grasses in Purneah! N. Champaran! Santal Parg., *Mokim*! Monghyr, *Mokim*! Fl., Fr. Sept.—Dec. Perennial.

Var. *α. flexuosus*, *Hack.* (?*flexuosus* is supposed to be South Indian only).

Tall with very decomposed panicle and slender erect often flexuous branches. Outer spathes 1.25", but much larger and foliaceous on main branches. Spikes

* This is not *C. nardus* according to *Stapf* who confines that species to the cultivated awnless plant.

unequal, about .4 and .5" respectively in spatheoles about .7" long. Longer spike subsessile with the lowest pair of spikelets homogamous and the sessile spkt. nearly resembling the pedicelled one .16" long, and its gl. ii not cymbiform, iv 0. Other sess. spkts. .2", gl. i strongly 2-keeled ending in 2 small cusps above, keels scaberulous towards tip and rather broader but not winged, margins narrowly incurved throughout, back pale flat nerveless (or 2 very obscure nerves); ii cymbiform, its keel well developed and scabrid above but scarcely winged, tip acuminate; iii .17" hyaline, ciliate; iv narrow-linear .08", 2-toothed and sparsely ciliate at tip with a fine awn .18—2" long. Grain terete .1" long.

This is common in Purneah and the Duars. The joints and pedicels are slender with cilia .05—08" long. Leaves .25" broad.

Var. β *grandis*, Hack. The following description is from the F.B.I.:—

Tall, stout, L. 2—3 ft. long by .3—5" wide. Panicle narrow, loosely branched, branches distant often drooping, outer spathes 1.5—3", spatheoles 1—1.2", joints and pedicels shortly ciliate, sessile spkts. .17—2" long, oblong-lanc., obtuse, dorsally flat or slightly concave below, keels margined or winged above the middle, nerves obscure, keel of ii sometimes shortly winged above the middle, lobes of gl. iv ciliate, awn .3—5".

Rajmahal, Mokim! (This was the specimen seen by Hooker.)

Var. γ *microstachys*, Hook.f.?

Culms pale with dark nodes. L. 15" by .4", glaucous beneath, tip filiform. Panicle rather strict with very long slender erect branches with numerous sheaths bearing several peduncles, some again branched. Spatheole .4", spikes divaricate and reflexed .5" or less with about 3—4 prs. spkts. only. Joints and pedicel .08—09", cilia up to .06" long. Sess. spkt. .14—15", gl. i 2-keeled, oblong lanc., with 2 very distinct green nerves between the keels, dorsally flat, keels slightly excurrent, narrowly winged or margined above the middle and scabrous; ii with scaberulous keel, inflexed margins softly ciliate; iv .08" 2-fid with filiform segments, awn .25".

Champanan, common! This may be *A. nardus* proper of F.B.I., but the spikes and spikelets are very small. It differs from var. *microstachys* in the denser decomposed panicles and prominent nervation of gl. i.

4. *C. microtheca*, Hook. f. Var. *sameshwariensis*.

Tall 4—5 ft., nodes dark-coloured or not. Upper leaves 15" by .2" with scabrelous margins and marginal nerves and sometimes scabrelous above on all nerves, somewhat silky above the scarious .07"—long ligule. Panicle decomposed odourless. Spatheoles .4—5" finely acuminate or sub-aristulate, two to four very shortly exerted from a spathe not much exceeding them which has the peduncle bearded on one side near the pale swollen tip and is often subaristate. Spikes very short .3" or less, strongly reflexed on their very short common peduncle which is also ciliate on inner side and under .5" long, base of spikes long-ciliate, joints and pedicels .07—08" long slender gradually wider upwards, toothed (mostly with one large and 2 smaller teeth). Sessile spkts. .13", long fitting between the joint and pedicel the hairs of which fringe its glume i on either side. Gl. i deeply channelled to base between its nearly glabrous minutely excurrent keels, margins much inflexed, not at all winged; ii rather shorter cymbiform mucronate, keel scabrous; iv very narrow, 2-fid with capillary segments about one-fourth of its length, awn about .25" long only.

Ramnagar Hills, Champanan! Common. Fl. Oct.

The deeply channelled glume i with the 2 keels approximate make this easily recognizable from any form of *C. nardus*. It differs, however, in some other respects almost as much from *C. microtheca*. Both have one spike of the pair pedicelled and all pairs of spkts. similar, and the other spike sub-sessile with the lowest sessile spkt. not differing much in appearance from the others, but lacking

gl. iv and with a very minute palea (or rudimentary gl. iv) and rudimentary ovary (they are therefore in floral characters as near section *Piestium* of *Andropogon* as to *Cymbopogon*). The joints, however, especially the lowest of typical *microtheca*, are .04—.05" long and much swollen, so that they are nearly as broad, one edge (that adjacent to the sess. spkt.) is villous, the other more rounded edge minutely villous, the joints are deeply excavate above and 2-toothed on the margin. In our variety the corresponding lowest joint (subtending the persistent imperfect sessile spkt.) is only .03" long and narrowly trumpet-shaped, i.e. not at all swollen, both edges are nearly equally villous. Both have the very rudimentary 2-lobed glume iv (or palea) in the imperfect sessile spkt. and this is only about twice the length of the lodicules. I have found no stamens but an imperfect ovary, so that the lowest pair of spkts. is *not* homogamous, the adjacent pedicelled spkt. having 3 well-developed stamens.

5. *C. gidarba*, comb. nov. Syn. *Andropogon Gidarba*, Ham.

Slender 2—3 ft. high with glabrous nodes. Leaves very narrow .1—.2" broad, puberulous or shortly hairy above, glaucous beneath, ligule scarious appressed to the culm, .1" long glabrous. Panicles strict erect. Spatheoles .6—1.2" long convolute subcuspidate glabrous, their peduncles compressed, peduncle of geminate spikes about one-third to half as long as spatheole not or shortly exerted, tip slightly toothed. Spikes unequal and with unequal bases, the one with the longer base heterogamous throughout, the more sessile one with lowest sessile spikelet differing from the others and male. Joints and pedicels rather stout, basal sometimes very stout, flattened and concave sometimes even conduplicate and embracing the lowest sessile spkt. on one side, often purple and hirtellous, top toothed and slightly ciliate. Sessile spkts. wedged in between the joints and pedicels the hairs of which do not conceal its gl. i (cp. *C. jwarancusa*), callus glabrous or nearly so. Gl. i .13—.14" long, deeply channelled from one-third of its length above the base, the channel slightly forked below, strongly 2-keeled with broadly inflexed margins, not at all winged, oblong-lanceolate, keels scaberulous, scarcely excurrent, not nerved between. In most spkts. there is a deep pit in the callus at the base of gl. i.

Monghyr, Ham. (Wall. n. 8797)! Gya, Mokim! Hazaribagh (Koderma Forest)! Fl., Fr. Oct.—Nov. Annual.

79. THEMEDA, Forsk.

(*Anthistiria*, L.).

Tall annual or perennial grasses with narrow leaves and short ligules. Spikelets 3-morphic, in clusters with the 4 outermost forming an involucrel whorl or sub-whorl round the inner; inner in a central spike on a very short internode to which it is obliquely articulate. Central spike of 1—3 sessile 2-sexual (or female) spikelets each with a pedicelled male or neuter spkt. or terminal (or if only one) with 2 pedicelled spkts. Clusters shortly peduncled in the axil of a proper bract or spatheole. Spatheoles in spathaceous panicles, the partial panicles often fascicled. Involucrel spikelets male or neuter, awnless with 3—4 glumes. Sessile 2-sexual or fem. spkts. with oblique often pungent barbed callus, gl. i subterete, convolute round the inner except the keel of ii, coriaceous, finally hardened; ii as long, coriaceous with broad keel which receives

the awn of iv; iii hyaline, 1-nerved; iv reduced to the hyaline base of the awn, or sometimes awnless, palea 0. Lodicules more or less cuneate, often large. Anthers large. Grain oblong. Pedicelled spikelets dorsally compressed with 1—3 glumes, i many-nerved, embracing the others which are hyaline.

I. Grasses 4—7 ft. high. Invol. spkts. in a symmetrical whorl (exc. sometimes in *strigosa*), glumes 3:—

A. Sessile spkts. only one in the spike. Gl. i of involucral spkts. not uniformly covered with tubercled setæ:—

1. Branching strict. Clusters very numerous in numerous fascicles:—

Perennial, erect. Clusters in globose or fan-shaped drooping spatheate fascicles. Invol. and sessile spkts. mostly over .25"

1. *imberbis*.

Annual, erect or scrambling. Clusters or fascicles in erect or suberect racemiform partial axillary inflorescences or very close at the ends of the branches. Invol. and sessile spkts. under .25"

2. *quadrivalvis*.

2. Branching very effuse. Clusters very few in few small superposed fascicles on the filiform branches

3. *laxa*.

B. Sessile spkts. 2—3 in the spike. Gl. i of invol. spkts. densely covered with tubercle-based setæ. Invol. spkts. about .17" long

4. *strigosa*.

II. Grasses 6—20 ft. high. Invol. spkts. with two of their number on a higher level than the other two, glumes 4:—

Invol. spkts. scabrellous or nearly glabrous. Sessile spkt. densely brown appressedly hirsute

5. *caudata*.

Invol. spkts. covered with long spreading tubercled-based yellow hairs. Sessile spkt. not densely hairy

6. *arundinacea*.

1. *T. imberbis*, *T. Cooke* (partly). Syn. *Anthistiria imberbis*, *Retz.*

A usually tall tufted grass 2—7 ft. high. Stems terete or compressed, yellow polished. Leaf sheaths below loose open often .5" wide (when laid out flat), upper much compressed and keeled, polished smooth, leaves very narrow 12—15" by .15—.25" tapering to a point from a little above the base which has sometimes a few slender villi, margin and midrib beneath minutely scabrous; ligule scarious often torn, .05—.1" long glabrous. Panicle leafy slender, very lax with main rhachis minutely scabrid below the leaves. Partial panicles (those in the axils of the leaves) never spiciform, consisting of fan-shaped fascicles or a system of fan-shaped fascicles with a leaf-like bract subtending a fascicle and 1—3 short capillary naked branches each of which in its turn bears a leaf-like bract and a fascicle or a further system. Bract-leaf subtending the fascicle 1—3" long with sheath glabrous or with a submarginal row of tubercle-based bristles, its peduncle more or less pubescent or scabrid and with a short beard on one side of the swollen tip. Fascicles consisting of a much abbreviated thickened axis with many barren bracts and several spike-bearing bracts (spatheoles) of various ages. Spatheoles always glabrous, .5—8" long cymbiform acuminate with scarious margins and scabrellous keel, very shortly stipitate and bearing in its axil the minute stipes .02—.07" long of the cluster. Involucral spikelets .25—.35" long, 4 in a complete whorl, their slightly thickened calli contiguous. Invol. spkts. gl. i oblong 2-keeled with inflexed margins and one or both margins with a hyaline wing

(sometimes 2 with both margins and 2 with one margin winged), back more or less setose but bases of hairs scarcely tubercled, tubercles mostly on the keels, few (hairs deciduous and more noticeable on the very young involucre). Bisexual spkt. usually only present in the young involucre, solitary, terete .25—3" long (including the callus) on a very short flattened glabrous joint from which it separates with an oblique scar, the callus being at first wedge-shaped ultimately more pungent and with a barb of long brown hairs up to .15" long somewhat unilateral; gl. i pale below and quite smooth ultimately deep brown, upper third or fourth brown and scabrid, tip truncate, about 9-nerved; ii as long; narrow oblong with rounded keel which receives the awn, 1-nerved in centre and 2—3-nerved in each margin; iv reduced to the long awn which is 1.2—2" long, its base filiform, column brown or black hispid and arm scabrous. Ped. spkts. caducous, very unequal, .12—28" long, linear acuminate, glabrous.

2. T. quadrivalvis, O. Kuntze. Syn. *Anthistiria ciliata, L.f.*

A rather stout, usually gregarious, grass 4—6 ft. high with several stems often geniculate at the base, usually terete, .15—2" diam. between the nodes, lower sheaths mostly lax and open, upper keeled, ligule scarious usually lacerate .05—1", blade rarely over .25" wide, scabrellous on margins or those on inflorescence with bristly margins, occasionally some leaves with tubercle-based bristles, glaucous beneath. Panicles mostly dense with the leaves not much longer than the partial inflorescences. Partial inflorescences (in the axils of the leaves of main rhachis) racemiform and paired erect or suberect or cernuous 1.5—3" long, close and almost forming a thyrses at the ends of the stems, with slender shining peduncles. Each partial inflorescence with subdistichous or spiral erecto-patent bract-leaves 2.5—1" long and .1" wide with a short sheath clasping the rhachis and bearing in its axil a series of peduncled spatheoles, the lower also a branchlet which in its turn bears spatheoles and perhaps another branchlet. Bract-leaves often with tubercled bristles on margin chiefly near the base of blade and mouth of sheath, their peduncles clavate but not bearded at tip. Spatheole conduplicate lanceolate finely acuminate, keel scaberulous. Involucral spikelets .17—18" long; gl. i oblong or lanc-oblong sub-spinulose-tipped, with tubercle-based bristles chiefly near the top, about 9-nerved, keels scaberulous, one sometimes slightly winged. Bisexual spikelet solitary .18" long (with callus), callus articulating obliquely to the minute flattened pedicel, barbed with long brown hairs; gl. i often clothed uniformly with sparse very short appressed hairs but lower hairs usually deciduous (sometimes leaving microscopic dots) and then only tip hispidulous as in *imberbis*. Pedicelled spkts. with gl. i narrowly linear but flat (it usually remains convolute in *imberbis*).

Commonest on laterite and on cotton-soil but not nearly so abundant as in the Central Provinces where it frequently takes possession of whole acres of cotton soil. Santal Parg., *Gamble*, etc.! Gya, *Mokim*! Ranchi, very common at Neterhat on laterite! Palamau, frequent! Singhum, not very common! Manbhum! Angul to Sambalpur, frequent! Fl. Oct.—Dec. and sometimes up to May. Annual.

The bract-leaf subtends a shortly peduncled spatheole or branchlet; in their axil each of the spatheole-peduncles in turn is subtended by a sessile hyaline bract and contains in the axil the next younger spatheole without evident internodes. Some of the peduncles are subtended by two hyaline bracts, the last spatheole in the axil of the previous spatheole-peduncle and its bract is the youngest.

In one form among bushes the stem is weak and clambering.

3. *T. laxa*, Stapf (in *Kew Herb.*). Syn. *Anthistiria laxa*, Anders.; Tatian, *Vern.*

A very distinct species in the field, being a tufted slender much branched and feathery grass 2—4 ft. high, feathery from the very numerous short soft narrowly linear leaves, and with many lax leafy panicles of sub-solitary or few (3—4) small heads one over the other in verticilliform clusters on the filiform branches. Lower leaves on main stem up to 12", upper 2—4" by 1" ending in a filiform tip, with few long white soft hairs near the base, sheaths compressed striate, keeled. Heads about .5" diam. Spikelets of involucre .2—·25", often reddish, with green glabrous callus; gl. i narrowly oblong, tip almost spinulose acute, nerves 9—11, distinct, back with scattered tubercles each with a long white hair, chiefly in upper half and sometimes very few. Central spike with one sessile spkt. .18" long (including the bearded callus) and 2 pedicelled spkts. .2—·25" long tapering at base into the short (.04—·05") pedicels. Upper fourth of gl. i of sess. spkt. closely scabrid-hispid.

This common Central Provinces grass (*C. P. List*, p. 264) barely enters our area in its gregarious state but isolated specimens occur in Sambalpur! Porahat division (Singbhum)! Fl. Oct.—Nov. Fr. Dec., when the clusters usually turn red.

Ligule 0. Spatheole long-acuminate, very narrowly cymbiform, 1—1.5", hispid-scabrid on margins. Invol. spkt. gl. ii .22" with a fine median nerve and 2—3 nerves in each margin, margins narrowly inflexed, ciliate; iii as long, hyaline, lodicules cuneate, micro-ciliate on the truncate end; iv apparently sometimes present (or a minute palea) and sometimes a rudimentary ovary. Sessile spkt. gl. i truncate, obscurely 9-nerved; ii narrow, longer, with incurved margins and rounded keel which receives the awn of iv; iii hyaline, linear, rather shorter than i (about .12"); iv reduced to hyaline base of nearly smooth awn 1.2—1.5" long; lodicules very large, .03—·04" long, oblong-obcuneate. Ovary linear-oblong. Ped. spkt. very narrow, very sharply acute, gl. i many-nerved, ii scaberulous on keel, margins ciliate inflexed.

The grass is a very poor fodder.

4. *T. strigosa*, comb. nov. Syn. *Anthistiria strigosa*, Ham. (*F. B. I.*).

A leafy grass about 4 ft. high with compressed and keeled glabrous polished leaf-sheaths, leaves 1—1.7" wide with scabrid margins, ligule under .05". Panicle very compound with long slender upright branches, 2—3 branches from a leaf axil leafless for 1—3", then with a leaf-bract bearing 2—several spatheoles and often a further slender branchlet which may be again similarly branched. Spatheoles and their spikes not hidden among the bracts (as in *imberbis* and *ciliata*). Spatheoles strongly-nerved or -ribbed, .4—·5" long ciliate or not at the keel, subaristate, geniculate and bearded on the peduncle. Involucral spkts. about .17" long sometimes two higher than the other pair; gl. i oblong-lanceolate closely covered with tubercled setæ, many-nerved; ii as long subaristate; iii narrow colourless. Bisexual spkts. usually 2, pale, ciliate

on the callus with pale hairs, .13—.15" long; gl. i hispidulous above; ii wrapped round the slender .3—.5" long awn; ped. spkts. usually one to the lower and 2 to the upper 2-sexual spkt. on glabrous .05"-long pedicels, gls. i and ii .17", i with tubercled bristles, lanceolate, aristately-acuminate; st. 3.

Purneah, frequent! Monghyr, *Mokim!* Fl., Fr. Oct.—Dec. Annual.

A very distinct species. The invol. spkts. are usually described as inserted on a level which mine are not.

5. *T. caudata*, Dur. & Jack. Syn. *Anthistiria gigantea*, Cav.; subsp. *caudata*, Hack; *Anthistiria caudata*, Nees.

A very large caespitose grass from a stout rootstock with flattened stems 10—20 ft. high and leaves markedly equitant below 3—5 ft. long by .3—.75" broad with scabrid margins. Spikes with their spatheoles on slender peduncles in very large spatheate and leafy drooping panicles, the whole top of the plant being converted into a compound panicle, with pendulous spikes. Peduncle of spike about half as long as the spatheole, slender, long-pilose upwards. Central spike with 2—3 sessile spkts., the terminal with 2 ped. spkts. Sessile spkts. .4" long, densely hirsute with appressed dark brown hairs; awn 1.7" long, dark-brown, scaberulous, but often absent (caducous?).

Not uncommon in ravines and on the higher ghats, in the forest on the higher plateaux and mountains. N. Champaran, common at low elevation. Singbhum! Ranchil Palamau, Neterhat (3000 ft.)! Hazaribagh, on Parasnath (4000 ft.)! Clarke, etc.! Manbhum, on the Tundi Hills, *Camp!* Fl., Fr. Sept.—Dec.

Culms greenish-yellow, or pinkish. Petioles compressed, deeply grooved above with very scabrid edges, blade glaucous beneath. Spatheoles 1.5—2" narrow and finely acuminate, many-nerved, glabrous, on slender peduncles enclosed with others and a branch in a spathe, these with other peduncles and branches in spathes of a lower order and so on. Invol. spkts. 4—6" long in somewhat unequal pairs, one pair with longer calli than the others, one of each pair apparently often empty, the other spkt. staminate, gl. i long subulate sub-aristulate, one margin much inflexed and its keel scantily ciliate and scabrid, back flat scabrellous, about 9-nerved; ii about $\frac{3}{4}$ ths i, 3-nerved and an additional nerve in margins, scaberulous; iii and iv sub-similar, ciliate, hyaline. Anthers nearly as long as glume (.3"). Central spike obliquely articulate on very short internode with brown hairy sides; sessile spkt. with oblique, densely brown-bearded, ultimately pungent callus, falling with its joint (.12" long) and pedicelled spkt., gl. i very coriaceous nearly covering ii, 11-nerved (best seen from inside); ii with hirsute keel and involute coriaceous margins; iii and iv $\frac{3}{4}$ ths as long thinly brown-hairy, lodicules very large oblong-lanceolate, .06", 2-cuspidate. Grain free oblong brown, .14" long.

The grass becomes a pest from its ripe pungent glumes.

6. *T. arundinacea*, Ridl. Syn. *Anthistiria gigantea*, Cav.; *A. arundinacea*, Roxb.

A very handsome grass 10—20 ft. high with polished yellowish culms up to .5" diam. below, more or less elliptic in section with very compressed keeled leaf-sheaths of the same colour when old. Leaves on the panicle only .1—1.5" broad, setaceous tipped. Panicle mostly erect with inclined branches, the numerous golden yellow horizontal clusters appearing to be arranged in more or less vertical rows on the erect branches. Peduncle of clusters very shortly hairy or pubescent towards tip. Invol. spkts. staminate .5—.75" long, covered with beautiful golden or deep-yellow spreading bristles with tubercled bases. Gl. i

spinulosely acuminate. Sessile spkts. .45" with long pungent callus bearded with brown hairs, gl. i thinly hairy below, above hispid or scabrid. Awn 3" long. Ped. spkts. .4—6" long, with long yellow bristles.

Purneah! Ranchi (at Neterhat, 3000 ft.)! Seemah forest, Palamau, 2500 ft.! Fl., Fr. Oct.—Dec.

80. ISEILEMA, Hack.

Annual or perennial not large grasses with slender compressed many-noded stems usually from a basal persistent tuft of leaves. Leaves narrow or very narrow; sheaths compressed, keeled, shorter than the internodes. Spikelets in clusters resembling those of *Anthistiria* with a whorl of outer involucre male or neuter spikelets dorsally flattened with short pedicels (or long callus) and a very short central internode bearing a central spike of one, rarely 2, sessile spikelets and their pedicelled companions. Differing however from *Anthistiria* in that the whole cluster is articulate below the involucre and the central spike is not articulate on the minute internode but falls together with the involucre spikelets; pedicelled spkts. separately articulate. Clusters on short peduncles in the axils of spatheoles, leaving a saucer-shaped disc at tip of peduncle on fall of cluster. Spatheoles few to many in the axils of spathes and these sometimes together with branches in the axils of spathes or leaf-sheaths of a lower order, but in general the branching less compound than in *Anthistiria*. Involucral spikelets with 2 or 3 glumes; i usually strongly nerved; ii thinner 1—3-nerved; iii, if present, narrow hyaline; anthers yellow or purple. Sessile spkt. lanceolar or bottle-shaped in outline; gl. i narrowly truncate or minutely 2-cuspidate (from the excurrent keel nerves); ii keeled with the keel lying between the pedicels; iii hyaline; iv reduced to membranous base (2-fid in *Holei*) of its awn. Ped. spkts. usually slender, male or neuter.

The spikelets or clusters are not pungent and their dispersal is by the wind.

I. Tubercles not present on the spatheoles or spikelets (rarely few present in *anthephoroides*). Nodes of stem not bearded:—

Invol. spkts. with pedicels as broad as long, gls. 2. Sess. spkt. pubescent on lower half dorsally

1. *anthephoroides*.

Invol. spkt. with slender pedicels, gls. 3. Sess. spkt. glabrous on lower half dorsally

2. *laxum*.

II. Tubercles or granules present on most of the spatheoles or on the margins of gl. i of the spkts.:—

Clusters not in dense fascicles. L. .1—15" wide. Peduncles often exerted beyond spatheole. Invol. and sessile spkts. subequal .16—18" long

3. *Wightii*.

Clusters in subglobose fascicles. L. .2—25" wide. Ped. hardly any. Sessile spkt. much longer than involucre

4. *Holei*.

1. *I. anthephoroides*, Hack.

A much tufted grass, very leafy below, with many stems 1—2.5 ft. high sometimes pink, nodes glabrous. Leaves mostly short, longer about 5" by .16", sub-obtuse, ciliate at base and tip of sheaths, cilia with small tubercle-bases, blades with scabrid margins, nerves usually

fine and uniform; ligule of short fine hairs. Panicles long, rather strict, but some of the spatheoles divergent, lower spathes foliaceous, upper with shorter blades, base of blade and top of sheath with very long cilia. Spatheoles cymbiform not acuminate, smooth and glabrous or minutely tubercled and scaberulous, margins scarious, several spatheoles from each spathe or leaf-sheath. Peduncle of cluster very short .1—2", invol. spikelets broadly oblong .17" long, rounded at tip, their pedicels .04—05" long and nearly as broad at top, compressed, glumes 2 only. Central pedicel slender .02—03" long only. Sessile spkt. .2—22" long, the suddenly tapering part or beak rather longer than the lower broader part; gl. i hispid-hairy on the back on the wider portion, the beak scabrid or scabrellous.

Angul! Probably also Sambalpur, as it is frequent in the Central Provinces! Fl. Oct.—Nov. Perennial? (Hole thinks annual).

Spathes often with many tubercles on the margins. Clusters scantily bearded at the base. Invol. spkts. not or very sparsely, ciliate, pedicels bearded, gl. i with narrowly inflexed margins, strongly 3-nerved on the back and almost sulcate either side of midrib, 2 other partial nerves between the strong ones; ii nearly as long, flat, oblong, obtuse, 1-nerved; anthers .09" yellow. Sess. spkt. 2-cuspidate at tip, 4-nerved between keels; ii as long, narrowly lanceolate with prominent ciliate keel on lower third, scabrellous above, margin inflexed; iii very narrow, 2-nerved, ciliate; iv awn .5—55" long, very slender, nearly smooth.

2. *I. laxum*, Hack. Mushan, Vern.; Panda-suali, Or.

Erect or suberect 1—3 ft. high with many weak stems from a tuft of radical leaves, base of stems covered with loose dry glabrous sheaths, nodes (at least the lower) glabrous. Leaves up to 7" by .15" rarely larger, acute, sometimes with a few long hairs or cilia towards the base, margins scabrellous; ligule very short, membranous shortly ciliate. Panicles long slender very strict, spathes distant, erect with several spatheoles and clusters. Spatheoles smooth and glabrous, or scabrellous on keel, margins often hyaline, .3—45" long. Peduncle scarcely exerted .1—2" long only, slender, ending in a concave disc from which the cluster falls. Base of cluster white-bearded. Pedicel of invol. spkt. .02—04" only, and about half as wide. Invol. spkt. glumes 3; central pedicel slender .04—07" with scattered erect long white hairs to top but callus of sessile spkt. not bearded. Sess. spkt. .17—2" long, tapering from about half way up and base rather contracted, gl. i depressed dorsally and smooth and polished below, upper half minutely scabrellous or keels almost scabrid.

Especially on cotton soil. Gya, Mokim, frequent! Manbhurn, Clarke! Orissa, Walsh! Perennial (always?). Fl., Fr. Oct.—Jan.

Branches of inflorescence sometimes bearded at the nodes (base of spathes or spathaceous leaf-sheaths), lower spathes passing into leaves. Cluster (from base of involucre to tip of ped. spkt.) .3—35" long. Invol. spkt. narrow-oblong .15—2" long, obtuse or sub-truncate, strongly 3—5-nerved and with 1—2 weaker nerves each side, keels with erecto-patent white cilia, back minutely scabrellous; ii sub-chartaceous, as long, acute; iii hyaline very narrow about two-thirds i; anthers brown .1" long. Sess. spkt. gl. i narrowly truncate or appearing minutely 2-cuspidate (from the hyaline intermediate tissue disappearing) at the tip; ii acuminate, chartaceous, with the keel lying between the slender minute hairy or delicately ciliate .07—08"-long pedicels. Ped. spkt. separately deciduous .17—2" long, slender, acuminate, strongly 3-nerved and scabrellous. St. brown or yellow.

This is one of the best Indian fodder-grasses for both horses and cattle.

Forma ciliatum. This has the leaves much more ciliate and scabrid, and is as leafy as *anthephoroides*, the cilia have small tubercles at their base. The involucre and pedicels are rather wider than usual but the pedicels are relatively longer than in *anthephoroides*, the callus of the sessile spkt. is bearded but the glume i is as in *laxum*. Puri

3. *I. Wightii*, Anders.

A tufted very leafy, almost feathery grass, 1–3 ft. high, nodes bearded. Leaves very slender up to 9" by .1–.15" rarely more, finely uniformly nerved, or 4–5 nerves each side stronger, margin scabrid or sub-spinulose as also is midrib beneath, sheaths usually with some sparse white hairs, top of sheaths and base of blade often setose with tubercle-based hairs. Panicle very leafy or not, spathes and spatheoles tubercled on keel and margins, spatheoles divergent .4–.5" long, peduncles of clusters shorter than spatheole or far exserted, minutely pustulate towards the end as often are the branches below the spathes. Base of clusters villose. Invol. spkts. .16–.18" long on pedicels .02–.04" long and much narrower, glumes 2, staminate or neuter, tip narrowly truncate, midrib and margins usually minutely tubercled and also often sparsely white-ciliate. Central pedicel about as long as involucre, with sparse white erect hairs. Sessile spkts. sometimes 2, with a joint .06" long, callus sometimes bearded, lower spkt. if 2 about .13" long, if solitary .17" long, lanceolar acuminate in outline as in *laxum*, gl. i dorsally smooth below, minutely scabrid or hispid above, tip narrowly truncate.

Usually on damp ground. Singbhum, common! Ranchi, Wood! Manbhum, Clarke! Hazaribagh, Clarke! Fl., Fr. Aug.—Dec. Perennial.

Invol. spkt. gl. i strongly 5-nerved, altogether 7–9-nerved, sulcate when dry, narrowly oblong, truncate, midrib and margins usually pustulate with minute red tubercles, inflexed margins embracing ii; ii as long, 1-nerved, anthers .07" long black. Sessile spkt. gl. i medianally depressed or nearly flat, about 2-nerved above between the keels; ii as long scabrelous on keel; iii linear hyaline truncate; iv awn .5" slender glabrous. Ped. spkt. .17" long, the pedicels as long as joint; lower about .06", upper .03" where there are two sess. spkts.

The grass is a fair fodder.

4. *I. Holei*, Haines.

A robust species 3–4 ft. high with much compressed polished stems up to .2" diam. densely bearded at the nodes. Leaves erect 8–16" long by .25" broad, glaucous beneath, glabrous or villous near base, margins spinulosely scabrid; sheaths with very prominent keels, mouth ciliate; ligule very short truncate hairy. Panicle nearly leafless with erect branches, partial inflorescences with subglobose fascicles of spathes, spatheoles and small sessile clusters. Spatheoles about as long as the cluster, .25–.3", red, tubercled or not on keel, peduncle of the cluster .05–.07" long, tip saucer-shaped. Cluster villous at base, red (in our specimens). Involucre spkts. narrowly elliptic-oblong .12–.15" long on slender pedicels .015–.03" long, acute or mucronulate, glumes 2, stamens 3. Central pedicel as long as involucre and callus white-ciliate with long hairs; sessile spkt. .2" long, lanceolar or linear-lanceolar in outline, gl. i minutely 2-cuspidate or truncate, smooth and polished below dorsally, keels granulate and scabrid, nerves about 4 between the keels.

Palamau, in moist ground in the forest! Fl. Oct.

Peduncles and peduncle of cluster smooth. Spatheole .25—3", not at all acuminate, mostly with a row of small tubercles along the keel but not on the submarginal nerve, often strongly geniculate on the short peduncle and villous at the flexure, margins broadly hyaline or scarious. Invol. spkts. gl. i about 9-nerved altogether (7 n. between the keels of which 2 are imperfect), keels granulate, margin broadly inflexed; ii 3-n. also with broadly inflexed margins; st. 0 or 3. Sess. spkt. .2", callus bearded, gl. i narrowly lanceolar, keels scabrid except at top and bottom, about 4 imperfect nerves between keels, margins broadly inflexed over ii; ii polished, suddenly acuminate from one-third way up, 3 n. above, margins wrapping over iii; iii linear, hyaline, truncate, minutely denticulate; iv deeply 2-fid, .05" long including the finely subulate segments, awn very slender, sharply porrect near the base, .25" long, smooth. Styles reaching tip of gl. ii and feathery stigmas exerted far beyond the awn. Grain ellipsoid brown .05" long.

81. APLUDA, L.

Annual or perennial, leafy and usually tall grasses. Leaves flat, upper reduced to spathiform sheaths. Inflorescence very compound, leafy. Spikelets in triplets (one usually very imperfect) subtended by a spathiform peduncled bract and articulate on a very short peduncle above the bract, usually 2—3 triplets and their bracts together with other imperfect spikelets fascicled on a branchlet which is again subtended by a common spathe, the arrangement being continued indefinitely according to the size of the panicle and the spathes gradually becoming more like ordinary foliage leaves downwards. Triplets (spikes) of one sessile 2-fid, 2-sexual spkt. with two pedicelled spikelets seated on a swollen common basal internode with a shelf-like support for the sessile spkt. Sessile spkt. Gl. 4, i chartaceous concave many-nerved, margins not or very narrowly inflexed; ii laterally compressed 5—7-nerved dorsally gibbous and keeled; iii ovate lanceolate hyaline, male, paleate; iv smaller, 2-sexual, ovate or oblong entire or 2-toothed or 2-fid, awned or not, palea small, lodicules 2, cuneate. St. 3, anthers short. Styles free. Grain oblong, embryo large. Pedicelled spkts. with their pedicels compressed equal and symmetrical to the plane of the sessile spkt., or one displaced laterally smaller and its spkt. reduced to a single glume in continuation of the plane of the pedicel, the other also somewhat reduced or usually flowering with 4 glumes more or less resembling the sessile spkt., but ii not gibbous and iv never awned, usually both fls. male.

1. *A. varia*, Hack. *A. mutica*, L., inc. *A. aristata*, Willd. Syn. *A. varia*, Hack.; Tati, K.; Dhudhia-sauri, S.

A very variable grass with the characters of the genus. The two sub-species as here conceived look very different in the field, but *Hooker*, *Stapf* and *Hackel* all unite them into one species. There are many intermediates.

- a. Sub-sp. *mutica* proper. Syn. *A. geniculata*, Roxb., and also (?) part of *Roxburgh's aristata*.

A very slender grass creeping, climbing or suberect and geniculate with pale smooth delicate stems. Leaves narrowed above and below, acuminate. Panicles strict with numerous very slender flexuous branches bearing distant narrow spathes, each with 3 or more fascicles of spikes, some of the spikes being reduced to their proper spathes with often

scales at the bases of the peduncles. Spikes short about '3", proper bract or spathe to each triplet '12-'25", mucronate or shortly awned. Barren pedicelled spkt. lateral, often hirsute (var. *humilis*). Sessile spkt.; keel of gl. ii flattened above the gibbosity. Awn of gl. iv very weak or 0.

Chiefly in damp places and under shade. Purneah (common in the Tarai and Duars)! Behar, Hope! Santal Parg., Kurz! Ranchi (on the ghats), Wood! Singbhum! Manbhum, Camp! Fl., Fr. Sept.—Nov. Annual or perennial?

B. Sub-sp. *aristata*, Hack.

A tall perennial erect grass, often 6—8 ft. high, with a rather stout rootstock and very leafy stems and inflorescences. Cauline leaves distichous up to 18" long, smaller upwards, '3—1" broad, setaceously acuminate, narrowed and sub-petiolate at the base, somewhat scabrid on the edges and sometimes with a few short hairs along the principal nerves. Panicle very leafy much branched with the fascicles close, spathes often with a long acumen or short blade. Spikes attaining '52" in length and curved, twice as long as their proper spathes. Both pedicels often equal and symmetrical, one with one glume, the other with 4 glumes and usually 2 male fls. Gl. ii of sessile spkt., pubescent upwards. Bulbous base of peduncle often '1" long.

This is var. *rostrata*, the extreme form of the subspecies. It is frequent on rocky hills in Gaya! and Chota Nagpur and Central Provinces!

Var. *aristata* proper is described as having a proper spathe rather shorter than its spike, sessile spkt. under '2" with a small bulbous base. Gl. i glabrous with scabrid nerves, barren spkt. minute and lateral.

It or intermediates are also common in the forests. Gya, Mokim! Monghyr! Singbhum! Parasnath! Fl., Fr. Oct.—Dec.

The grass is quite useless and cattle do not eat it.

82. MANISURIS, Sw.

Erect much branched annuals with cordate or subcordate-based leaves and axillary spikes sometimes forming a leafy panicle, rhachis fragile with short internodes deeply excavate, tips 2-pitted. Spikelets sessile and pedicelled very dissimilar, 1—2-flid. Sessile globose, 2-sexual, gl. 4, i hard orbicular, and only open towards the rhachis by an oblong aperture, enclosing the inner glumes, pitted outside in vertical rows or reticulate; ii chartaceous, filling the cavity in gl. i; iii hyaline empty; iv and its palea hyaline. Callus much swollen. Lodicules 2 broadly cuneate. Anthers minute. Styles free with short stigmas, exerted from the opening in gl. i. Pedicelled spkt. ovate or lanceolar, neuter with pedicel adnate to rhachis.

1. *M. granularis*, L. f.

A very distinct looking grass 6—8" or up to 2 ft. high, very hairy with usually short leaves linear-lanceolate from a subcordate base or sometimes broadly linear and up to 8" by '5", flat, flaccid, acuminate with hirsute inflated sheaths; ligule a raised ciliate margin. Spikes '25—1", each sheathed at the base, often several from one leaf axil. Sessile globose spkts. subsecund '04" diam. in two rows. Pedicelled spkts. green distichous '09—'1" long, gl. i and ii subequal with winged keels.

Common in wet fields. Monghyr, *Mokim*! Santal Parg., very common! Hazaribagh (ascending to top of Parasnath), *Clarke*, etc.! Manbhum, *Anders*, etc.! Singbhum, on clay soils. Mayurbhanj, *Hooper*! Probably in all districts. Fl., Fr. Aug.—Dec.

83. OPHIURUS, Gaertn.

Tall or medium erect grasses usually branched upwards. Leaves linear to broadly linear, often convolute, ligules very short membranous. Spikes solitary or fascicled in the axils of leaves or spathes, their structure as in *Rottboellia* but the pedicelled spikelets completely suppressed or very rudimentary, the pedicels completely fused with the internodes. Gl. 4, i thickly coriaceous, convex, obtuse; ii almost membranous, keeled; iii elliptic, obtuse, hyaline, faintly 2-nerved, margins infolded, paleate, male; iv as long, oblong, obtuse, 2-nerved or nerveless, 2-sexual, palea narrow, lodicules 2 cuneate. St. 3. Grain oblong free.

A. Spikes very numerous from the axils:—

L. ensiform, very hairy. Robust 5—6 ft.

L. linear, glabrous. Slender 2—4 ft.

B. Spikes subsolitary:—

L. linear, hairy. Very slender 1—2 ft.

1. *megaphyllus*.

2. *corymbosus*.

3. *monostachyus*.

1. **O. megaphyllus**, Stapf. Syn. *O. corymbosus*, F. B. I. (in part).

A large stout grass 5—6 ft. high, very leafy to the top. Leaves narrowly ensiform, tapering from base to apex, upper 4—75" wide, lower much wider, flat, very hairy as are the sheaths, but more or less glabrescent with age, hairs with small tubercle bases, margins of sheath hirsute. Spkts. 12—18", slightly shorter or longer than the joints, in very numerous peduncled spikes 3—4" long (perhaps longer but very fragile), from the leaf axils. Peduncles 3—5" sheathed at the base, finally far exserted, each solitary on a branch with a villous node, often geniculate at the node. Gl. i oblong glabrous with rounded tip, smooth or with few lines of small pits.

In marshy places Tarai and Duars! probably in Purneah. Fl. Dec.

The spikes are .05—06" diam. The lowest pedicelled spkts. are sometimes free at the top and bear a small brown free appendage. Gl. i of sessile spkt. does not become recurved, it also sometimes bears a small appendage; ii is white and becomes inclined forward quite free from the rachis when the spkt. opens.

2. **O. corymbosus**, Gaertn. Syn. *Rottboellia corymbosa*, L.

Stems very numerous glabrous erect slender 2—4 ft. high bulbous at the base, the bulbous bases connected into a horizontal rhizome. Leaves linear glabrous up to 2" broad, margins minutely tubercled at base, the tubercles bearing cilia when young. Spikes very slender, 2—5" long, only .04" diam. sometimes ending in a small tail like that of a rattle-snake, spikelets 1" equalling the joint. Gl. i glabrous with many longitudinal lines of small pits, narrowly-oblong, tip rounded, finally recurved.

Chiefly on cotton soil in the Central Provinces. Purneah, *Kurz*! It is, however, I believe, common but seldom collected. Fl. Aug.—Nov. Perennial.

Gaertner gives no description of the leaves (nor does *Linnaeus*) and he shows the glumes too pointed, but there seems little doubt that this is the plant intended.

THE
BOTANY OF BIHAR AND
ORISSA

AN ACCOUNT OF ALL THE KNOWN INDIGENOUS
PLANTS OF THE PROVINCE AND OF THE
MOST IMPORTANT OR MOST COMMONLY
CULTIVATED EXOTIC ONES

BY
H. H. HAINES, C.I.E., F.C.H., F.L.S.
LATE CONSERVATOR OF FORESTS, BIHAR AND ORISSA

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PART VI
INCLUDING APPENDICES AND INDEX TO PARTS II—VI

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BOTANICAL SURVEY OF INDIA
CALCUTTA

3. O. monostachyus, Presl.

Slender 1—2 ft. high, leafless upwards. Leaves linear, 1—4" long by .16" or less, flat, hairy, margins smooth, ligule villous. Spikes very few solitary terminal and 1—2 axillary, very slender, 1.5—3" long, .05—.06" diam. ending in a filiform tip marked with scars. Spikelets .1—.12" long, rather shorter than or as long as or slightly exceeding the joint, aperture with a thickened margin. Glume i oblong suddenly acute, smooth or with a few minute pits near base, a distinct transverse furrow between glume and callus.

Santal Parç., Kurz, Mokim! Hazaribagh, Clarke! Fl. Oct. Annual.

Much resembling at first sight *Mnesithea laevis*, under which all the *Calcutta Herbarium* specimens are included, but easily recognised from that plant by the hairy leaves and alternate (opening) spikelets.

84. ROTTBOELLIA, L. f.

Tall grasses, usually branched upwards, often with stilt roots from the lowest nodes. Leaves large, flat, broadly linear, ligules short membranous. Spikes few or many, cylindric and glabrous, sub-solitary racemose or laxly paniced, with very fragile (articulate) rhachis, the internodes cupular at the tip and excavate on one side. Spikelets 2-nate, usually heteromorphous, sessile and pedicelled, almost flush with the spike (fitting into the excavate rhachis) before opening, sessile 2-fid., pedicelled often imperfect, male or neuter, the pedicel flattened more or less adnate to the internode, but superficially distinct, the spikelet overlapping the node next above. Uppermost pairs both similar and barren and finally forming a tapering appendage to the spike. Sessile spkt. with narrow callus adnate to the bases of the internode and pedicel into a glabrous ring with a knob in the centre which fits into the hollow of the next lower internode. Gl. 4, i coriaceous, flat or nearly so with very narrow inflexed margins, 2-keeled upwards, obtuse or subobtuse; ii boat-shaped thinner, acute; iii hyaline, male; iv hyaline 2-sexual, 3-nerved; palea as long 2-nerved; lodicules 2, cuneate. St. 3. Grain broad-oblong or ellipsoid, dorsally compressed. Pedicelled spkt. with 2 male flowers or reduced.

1. R. exaltata, L. f.

A very large stout grass with polished stems .3—.4" diam. standing on stiff adventitious stilt-roots. Leaves up to 4.5 ft. long by 1.2" broad, flat, hispidly hairy above or glabrescent leaving minute tubercle-bases, margins spinulose-scabrid. Spikes terete 3—4" long, finally long-peduncled, each peduncle with its own proper very narrow spathiform leaf-sheath, diam. of spike .05—.1" before divergence of gl. i. Gl. i of sessile spkt. nearly flat, .15—.22" pale diverging in flower, oblong obtuse sometimes very narrowly winged towards the apex, nervation obscure, pitted between base and callus. Gl. i of pedicelled spikelet .15—.2" long, green, many-nerved, with white scabrid margins, acuminate with the acumen more or less 2-fid. Pedicel pale flat, shorter than spkts., distinct or free along its margins.

Grassy places in the forests or wet cultivated lands. Ranchi! Hazaribagh, Koderma forest (and Gya, *Cal. Herb.*)! Singhum, 2000 ft.! Monghyr, *Cal. Herb.*! Santal Parg.! Puri, "a pest in the paddy," *Walsh*!

85. MNESITHEA, *Kunth.*

Slender erect with very narrow leaves. Spikes as in *Hemarthria* but cylindrical with the ends of the internodes hollowed out as in *Rottboellia*, the two spikelets sessile opposite, sunk in cavities which are only separated by a thin sometimes evanescent septum. The internodes are different on each face between the spkts., one side is broader than the other with 4 pale flat ridges spreading fan-wise above and three intermediate green grooves (not always clear in dry specimens); the other side is narrow with 2 lateral parallel narrow ridges or nerves and a broader green centre; this narrow side is the completely fused pedicel and sometimes bears a minute rounded or truncate glume (very rarely two glumes) representing the abortive pedicelled spikelet. The narrow and flat sides alternate in successive internodes.

The uppermost nodes sometimes bear only one sessile spkt. The genus then comes exceedingly close to *Ophiurus*, and it would be a more natural arrangement to combine the 4 genera *Rottboellia*, *Hemarthria*, *Ophiurus* and *Mnesithea* into one. *Sir J. D. Hooker* united three but still kept *Ophiurus* distinct.

1. *M. perforata*, *comb. nov.* Syn. *Rottboellia perforata*. *Roxb. Pl. Cor.*, ii (1798); *Mnesithea lœvis*, *Kunth. Revis. Gram.*, i (1829).

Erect or somewhat decumbent at base, stems slender 2—4 ft. high, simple or branched above, nodes distant glabrous. Leaves linear very narrow 3—20" (—30", *J. D. H.*) by .15" flat or conduplicate strongly nerved, glabrous or with scabrous margins and midrib. Sheath villous at the mouth. Spikes 4—8" long by .07" diam. (before the divergence of gl. i) or less; internodes slightly longer than or equalling spkt. Gl. i .1—15" long, oblong rounded at tip or sometimes contracted at tip and obtuse, base sometimes with 3—4 pits, nerves obscure.

Common in wet ground, probably in all districts. Gya, *Mokim*! Monghyr, *Mokim*! Santal Parg.! Hazaribagh, *Anders.*, *Clarke*! Manbhum, *Camp.*! Singhum, common! Orissa, *Walsh*! Fl., Fr. Aug.—Nov.

86. HEMARTHRIA, *R. Br.*

(Included in *Rottboellia* in *F. B. I.*)

Decumbent or ascending perennial grasses with branched many-noded culms and linear, conduplicate or flat leaves with very short membranous ligules. Spikes compressed, often curved, tips more or less subulate from the slender terminal spikelet, rhachis not or tardily breaking up. Spikelets 2-nate, nearly similar, pseudo-opposite and decussate owing to the fusion of joints and pedicels, each pair made up of a sessile spkt. and the pedicelled spkt. of the next lower node; internodes with the adnate pedicels semi-terete, tips truncate not hollowed out nor appendaged. Glumes 4; i flat dorsally, 2-keeled, very narrowly inflexed along the margins, coriaceous, filling the excavated internode; ii membranous, adhering to the inner face of the

cavity, subequal; iii hyaline 2-nerved; iv usually nerveless. Pedicelled spkt. with more elongate acuminate glumes, ii mucronate or aristate.

Weak, rarely erect. Spkts. 1—15". Gl. ii of ped. spkt. acuminate, 7—9-nerved 1. *compressa*
 Stout, erect. Spkts. 17—1". Gl. ii of ped. spkt. awned 1—3-nerved 2. *protensa*.

1. *H. compressa*, R. Br. Syn. *Rottboellia compressa*, L. f.

Cæspitose, dwarf and usually creeping below with many spreading branches, sometimes subscandent among bushes. Leaves linear acute, margins and sometimes upper surface scaberulous, mouth of sheath hairy. Spikes 1.5—5.5" usually appearing fascicled in the leaf axils (one with a branch in a spathaceous bract or leaf, the branch bearing a spike and another branch and so on; before the elongation of the branches the whole forms a congested fascicle as in so many other grasses) or spathaceous sheaths; rhachis coherent, ending in an acute tip. Sessile spkts. 1—15" (—2", F. B. I.). Gl. i coriaceous obtuse or acute, 7—9-nerved; ped. spkt. i narrowly lanceolate, tip scabrid; ii acuminate or aristulate 7—9-nerved.

Wet places. Singbhum! Purneah (Kissenganj)! Santal Parg., Kurz! Fl. July—Oct.

2. *H. protensa*, Steud. Syn. *Rottboellia protensa*, Hack.

Erect from a decumbent base, 3—6 ft. high with linear leaves 3—12" long by .17—.25" wide, narrowed each end, glabrous, margins smooth. Spikes often very long and numerous from the close leaf sheaths, 4—8" long. Rhachis coherent (not breaking up), joints shorter than the sessile spkt. Spkts. 17—2" long, awn or cusp .04—.06". Sessile spkt. gl. i many-nerved, narrowed from the middle upwards, subacute. Ped. spkt. gl. i 7-nerved; ii long-awned, 1—3-nerved.

Santal Parg., Kurz! Fl. March—May.

Both this and the preceding are, I believe, much more common than the collected specimens make appear.

87. POLYTOCA, Br.

Large erect grasses with bearded nodes and long flat leaves. Flowering branches fascicled sheathed by spathaceous bracts, proliferously paniced with often long naked internodes up to the next fascicle. Spikelets geminate, sessile and pedicelled on the articulate rhachis of solitary or paniced spikes, usually lower only on the spike, female or 2-sexual, upper spikelets male or sometimes upper spikes entirely male. Male spkts. lanceolate 2-fld. glumes 4, i many-nerved, 2-keeled; ii 5—7-nerved; iii and iv hyaline, palcate, 3-androus with very long anthers and cuneate lodicules. Fem. spikelets with the pedicelled imperfect, its pedicel confluent with the rhachis; sessile spkt. with the lowest glume (or bract?) oblong, coriaceous with the margins inflexed and embracing the rhachis, at length crustaceous or more coriaceous; ii thin acuminate; iii hyaline, epalcate; iv hyaline, palcate, fertile; staminodes and lodicules 0. Ovary minute, styles long and stigmas long. Grain very small, orbicular enclosed in the hardened outer

glume (or bract?), which can always be distinguished from that of *Coix* by its being open or grooved on one side.

Inflorescence of simple spikes, male above, female below. Glume of fem. ped. spkt. very short or 0 1. *barbata*.
 Inflorescence compound, sometimes entirely male. Glume of fem. ped. spkt. very long, up to 9" and bractiform 2. *bracteata*.

1. ***P. barbata***, *Stapf*. Syn. *Chionachne barbata* (*Fl. C.P.*); *Coix barbata*, *Roxb.*; *Phultainr*, *Or.*; *Karpia*, *Gond.* Sometimes also the names properly applicable to *Coix gigantea* are used.

A tall coarse grass 5–8 ft. high bearded at the nodes and more or less clothed with deciduous tubercle-based rather stiff hairs. Leaves lower cauline 2–3 ft. long over 5" wide, upper 12" by about 3–5" becoming smaller on the panicle. Flowering branches several from each upper leaf axil, 4–12" long, bearing a foliaceous bract with several peduncles and one or more branches with long naked internodes which only bear a bract and peduncles or also continue the branching. Peduncles flattened above bearing a spathaceous obovate many-nerved truncate open bract 5" long with a more or less elongate cusp, in its axil is the short proper peduncle of the spike. Spike 5–15" long with a single basal female spikelet (and sometimes a pedicelled imperfect one), ultimately coriaceous or crustaceous, and 5–15 (2–7 pairs and an odd) male spikelets.

In savannah tracts and grassy forest. Common on cotton soil. Santal Parg., Mokim! Ranchi, ascending to the top of the pats (common at Neterhat, 3000 ft.)! Singbhum! Sambalpur, frequent! It becomes very common in the Central Provinces. Fl., Fr. Aug.—Oct.

Stems hollow or solid, straw-coloured or somewhat purple, often 3" diam. at base, sometimes grooved above the ascending branches. Sheaths and leaves both sides densely hairy but hairs falling off with age leaving the small tubercular bases. Ligule very short. End of peduncles villous. Spikes articulate on their short proper peduncles the end of which is cup-shaped. Coriaceous gl. i of fem. spkt. oblong 22" long, tip oblique entire or notched, involute margin tightly clasping rhachis of the spike. Male spkt. 35" long, gl. i oblong obtuse 9-nerved, margins inflexed keeled ciliate; ii lanceolate, white, margin inflexed, 7-nerved; iii lanceolate hyaline 3-nerved, staminate; iv similar but rather narrower, palea of both as long as glume.

It is said to be a bad fodder.

2. ***P. bracteata***, *Br. ?*

A stout grass 3–5 ft. high with villous nodes. Leaves 18"—2 ft. long by 7–1" broad caudate-acuminate, somewhat narrowed towards the base, margins spinulose-serrulate. Inflorescence ultimately on slender peduncles, very fragile, mostly compound, some wholly male, others female below and male above, tightly enclosed in a convolute spathe with linear acuminate bracts at its base, which together with another rhachis, peduncle or axis is again enclosed in a spathe and so on indefinitely. Proper spathe of inflorescence 2.5–6" long, with the margins above hirsute and bearing a filiform blade 3–7.5" or more long. Female sessile spkts. oblong, 35" in flower to 42" in fruit, appearing 3-toothed from the 2 teeth of the glume i and the intermediate tip of the closely appressed acumen of glume ii. Gl. i dorsally compressed with inflexed margins about half way up which become

hardened, and inflexed membranous margins above, the keels also winged; ii broadly ovate with a very long narrow abrupt acumen, the tip of which reaches tip of i and fits in between its 2 flaps, both glumes many-nerved and becoming coriaceous in fruit, i more or less villous. Stigmas .75" long on capillary styles. Callus large rounded.

Frequent in the Duars and the Sikkim Tarai close to the Purneah border! and no doubt occurs within it. Fl., Fr. Oct.

This appears to agree with the specimens called *bracteata* in *Herb. Kew*, but if it is that species the description in the *F.B.I.* is very inadequate and in many respects it appears to combine the characters of *Cookii*, *Stapf*. The pedicelled female spikelets at the base of the inflorescence have long free pedicels about three-fourths length of sessile spkt., those at the top have very short or no free portion except the cup which projects from near the top of the joint. Ped. fem. spkt. .9" long, bract-like, with involute margin to the long and often only glume. The rhachis both of male in all stages and female after flowering exceedingly fragile with cupular ends to the joints. Male inflor. compound, gl. i bract-like, the margins sharply inflexed as far as gl. ii, lanc.-acuminate, sometimes with 2 teeth each side of acumen, .45" long; ii shining narrow oblong acuminate .3" with inflexed margins covering edges of inner glumes, 7-nerved; iii similar, 3-nerved with an accurately fitting flat palea and 3 st.; iv .28", narrower but similar. Ped. male spkt. .5" with pedicel adnate nearly to tip, gl. i conduplicate, the margin inflexed on one side; ii .3" sharply subalately keeled, 9-nerved; iii keeled, 3-nerved, .3", its palea with margins folding the 2—3 st.; iv .28", very hyaline with flat palea and 3 st.

88. COIX, L. Job's Tears.

Stout long- and broad-leaved grasses with numerous axillary and terminal spikes sometimes forming a large leafy panicle. Lower spikelet solitary female enclosed in a finally hard polished nut-like bract which sometimes also includes 2 rudimentary spkts. and through which the male portion of the spike projects. Male spikelets 2—3-nate at the nodes of the rhachis, one sessile and 1—2 pedicelled, lanceolate. Glumes 4; i and ii subequal empty; i keeled or winged along the inflexed margins; iii and iv hyaline, paleate, 3-androus or empty, lodicules 2. Fem. spkt. ovoid acuminate, glumes 4; i chartaceous; ii—iv successively thinner, iv paleate with minute staminodes. Lodicules 0. Ovary ovoid, styles 2, free, slender. Grain orbicular, ventrally furrowed, enclosed in the hardened globose ovoid or cylindric involucre bract. Whole spike ultimately deciduous from the truncate annulate tip of peduncle.

The following three species which are distinguished by *Roxburgh* may be merely varieties of one. *Prain* distinguishes *Lachryma-jobi* by its having only 2—3 male spikelets, but it often has many.

Stems 3—5 ft., leaves relatively broad. Spikes mostly short and spkts. mostly 2-nate

1. *Lachryma-jobi*.

Stem very tall erect, leaves relatively narrow, spikes elongate often cernuous. Spkts. mostly 3-nate

2. *gigantea*.

Stems very long, floating and creeping, spikes elongate drooping

3. *aquatica*.

1. *C. Lachryma-jobi*, L. Horeng. M. (also Danghir in Ranchi); Jargadi, S.; Kasai, Gond.; Sankru, H.; Gurgar, Kunch, Beng.

A very stout grass with stems often .5" diam. near base and with large broad leaves 4—18" long by 1—2" broad, linear-lanceolate from a broad often cordate base, margins cartilaginous scabrid and cutting.

Peduncles 1—2·5" long, flattened or 3-gonous, usually a large number from the axil of one leaf together with oblong bracts. Male inflorescence ·5—1·5" long, glabrous (mealy, *Roxb.*), erect or nodding. Spikelets sessile and one pedicelled. Gl. i ·3—·35" long, lanceolate or with the narrow or broad wing becoming obovate. Pseudocarp mostly broadly ovoid ·3" long, white or bluish polished.

Common along water courses, ditches, etc. In all districts of Chota Nagpur! Santal Parg.! Puri, *Walsh!* Probably throughout the province. Fl., Fr. Sept.—Feb.

Horses are fond of the leaves but soon tire of it. A poor fodder for cattle.

2. *C. gigantea*, Kön. Same vernacular names, also Danga gurgur, *Beng.* (*vide Roxb.*).

A tall erect grass up to 15 ft. high by ·7" diam. at base, terete and polished. Leaves, lower 2—4 ft. long by about 1" broad, base obtuse or subcordate, margins scabrid and cutting, upper leaves erect narrow-lanceolate 8" by ·7—·8" or longer and narrower, sometimes scabrid above. Peduncles 2—6". Male spikes often very short when young but elongating with ternate spikelets, the large outer glumes of which form 6 imbricate rows on the spike which is ultimately drooping and with a long internode between the female and the lowest male spikelet.

Frequent on rocky northern slopes in Chota Nagpur and Orissa! Also Purneah, *Cal. Herb.*

It is doubtful whether any of the characters of the inflorescence given here are peculiar to this species or even universal in it, as very few specimens have been examined and fewer still preserved.

Sessile spkt. gl. i elliptic or obovate with the broad wing of pedicelled spkt. somewhat cymbiform but with rounded keel, many-nerved, ·5" long; ii smaller lanceolate, pale; iii included in i, pale hyaline with a raised plicate longitudinal ridge inside bearing 2 large pulvinate lodicules between which arise the 3 stamens, palea as large; iv smaller hyaline with 2 large erect quadrate lodicules and large palea, bearing a rudimentary ovary. Bract of fem. with a distinct ligule, often conical in fruit, including also 2 rudimentary pedicelled spkts.

3. *C. aquatica*, Roxb.

The following account is taken from *Roxburgh* (in slightly different words):—Stems perennial jointed, round, smooth, filled with pith, about as thick as a man's forefinger, floating on lakes or creeping along their margins for 50—100 ft., shoots arising in an oblique direction to 4—5 ft. above the surface. Leaves, lower linear lanceolate, upper linear or ensiform 1—3 ft. long 1—1·5" wide long-acuminate, margins hispid. Spikes terminal and from the exterior axils, peduncled, solitary or in pairs, drooping, many-fid., 3-nate, two sessile and one central pedicelled. Female generally solitary at the base. Involucre turbinate, perforated, valves (glumes) 6—7 with two abortive corolllets and their common valve, as in *gigantea* (this perhaps refers to the rudimentary spikelets noted by me in that species). Ovary oblong with 3 short abortive staminodes.

There are two specimens labelled *aquatica* from our area. The first from Monghyr resembles *gigantea* in the herbarium and possibly is *gigantea*. The second from Balasore, a more likely locality, is a very interesting specimen as the

involucral bract has a well-developed lamina 2-5" long. The leaves in both are linear and there are no remarks on habit.

89. EUCHLÆNA, Schrad.

Stout and tall annuals with very broadly linear or oblong leaves. Male spikelets 2-nate (sessile and pedicelled) on the spiciform fascicled branches of a terminal panicle, 2-flid. with coriaceous glumes. Female spikelets in 2-ranked spikes which are clustered in the leaf axils, not fused as in the Maize, joints trapezoidal oblique articulate excavate with the margins of the excavation embracing the cartilaginous outer glume and with it forming a smooth pseudocarp.

1. *E. mexicana*, Schrad., var. *luxurians*. Syn. *Reana luxurians*, Brogn.

A large very succulent grass 3-6 ft. high. Leaves long 2-3" wide. Male spkts. 3-35" long crowded in long spikes in a corymb 6-10" long. Fem. spikes in the leaf axils.

Native of Central America. Often grown for fodder (by Europeans), but it does not stand drought well. Horses are very fond of it.

90. ZEA, L. Maize.

Tall stout annual with large leaves, the axils of the lower bearing the female inflorescences. Male inflorescence terminal on the same plant, of paniced spiciform racemes with 2-nate spikelets shortly unequally pedicelled or one sessile on the inarticulate rachis, both similar, 2-flid., with subequal ext. glumes 9-10-nerved, floral gl. more or less hyaline 3-5-nerved, palea similar 2-nerved, lodicules fleshy, stamens 3. Female spikelets sessile densely crowded in vertical series on the thick central axis of a cylindro-conical sheathed inflorescence, which is probably the coalescent axis of several spikes, 2-nate, each with a lower barren and an upper fertile floret; ext.-glumes very broad, fleshy below, hyaline above, nerveless, ciliate; floral glumes 2 shorter and ciliate. Ovary obliquely ovoid, style very long, 2-flid at the tip, exerted in long silky tassels from the large bracts which sheathe the inflorescence. Fruit large, becoming exerted from the small glumes.

One species only, native of America.

1. *Z. Mays*, L. Bhutta, Makai, Vern.; Jondra, M.; Maize; Indian Corn.

Cultivated in all districts, but chiefly in Chota Nagpur, Gya and north of the Ganges (Bhagalpur, Darbhanga, etc.). Frequently the first crop sown on jhumed lands. Usually reaped at the end of the r.s. (Sept.—Oct.).

Yellow, red and white grained varieties are grown in Chota Nagpur; the usual colour being a deep yellow. Special varieties are grown in gardens for cooking and eating in the unripe state.

Satwa, which is so often given in water as a drink for horses, is frequently made of ground Maize (at other times of ground parched gram and barley), but it is considered inferior.

SERIES.—ENANTIOBLASTÆ.

FAM. 140. ERIOCAULACEÆ.

Marsh or aquatic herbs with narrow or grass-like radical or (in aquatics) cauline leaves and very minute flowers bracteate in involucre capitate scapose heads, unisexual but usually monœcious. Perianth in 2 whorls inferior. Male fl.: outer perianth whorl or sepals of 2—3 free or connate scales, petals 2—3, equal or unequal, often very obscure, inserted on the top of a clavate elongate stipes or corolla-tube, stamens 6 or fewer, some often reduced to filaments, anthers dorsifixed, pistillode minute or 0. Fem. fl.: sepals 2—3 caducous, petals 3, rarely 2 or 0, persistent, spathulate or oblanceolate, usually ciliate or villous, and with 1 rarely 2 black glands. Ovary 3, rarely 2-celled, style short persistent, stigmas 2—3 slender, with sometimes interposed lobes or appendages, ovules solitary in the cells, pendulous, orthotropous. Fruit a loculicidal 3-lobed membranous capsule, lobes globose. Seeds pendulous, testa coriaceous, striolate and often papillose, embryo outside the floury albumen.

The Indian species all belong to the genus *Eriocaulon*. The family is sometimes called the Compositæ of the Monocotyledons. They present great difficulty in the variability of the bracts and flowers in a single head. I have consulted *Ruhland's* monograph and *Fyson's* paper on the Indian species.

1. ERIOCAULON, L.

Inner scales of the involucre not forming a ray. Fls. 2—3-merous, inner perianth lobes (petals) free, often with glands on the inner side, sometimes also in the male. Stamens 6 or 4 or fewer by abortion, anthers 2-locellate.

- I. Water plants, only the peduncles rising above the surface, stems elongate, submerged:—
 Anthers black. Peduncles numerous sub-corymbose, short. 1. *setaceum*.
 Anthers white. Peduncles solitary, very long. 2. *rivulare*.
- II. Terrestrial on wet ground, leaves all radical forming a tuft or rosette. Peduncles scapose:—
 A. Anthers white:—
 Very small. Male calyx spathaceous. Bracts glabrous. 3. *Sieboldianum*.
 B. Anthers black:—
 1. Involucral bracts not longer than the floral, reflexed or spreading:—
 a. Floral bracts with dark tips closely covered with short stout hairs. Recept. or base of fls. villous:—
 i. Small plants 3—8" high. Sepals flat. M. petals small, one usually larger than the other two:—
 L. not red. Hds. dark, 1—2" diam. Fl. bracts obtuse or suddenly acute. 4. *trilobum*.
 L. usually red at base. Hds. white (from the dense hairs) 2—25" diam. Fl. bracts acuminate.
 ii. Taller, attaining 12—15". One M. petal often twice as long as the other two. Two sepals cymbiform:—
 Hds. white 25—3" diam. Invol. bracts 2-seriate. 5. *quinguangulare*.
 6. *collinum*.

- b.* Floral bracts glabrous or nearly so. Recept. glabrous or villous. M. petals all minute or 0:—
Height 7—16". Recept. villosc. Fl. bracts subaristate 7. *oryzatorum*.
Height 3—7". Recept. glabrous. Hds. broader than long. Fl. bracts obtuse or acute. Fem. sep. 3—2 8. *truncatum*.
2. Bracts all pale or inner dark grey. Invol. campanulate, bracts never reflexed, erect or finally spreading, exceeding the floral:—
a. Floral bracts short rounded or truncate and hirsute at the tips. 9. *xeranthemum*.
b. Floral bracts glabrous or slightly hairy at the more or less pointed tips:—
Invol. bracts rounded, not longer than the rest of the head 10. *achiton*.
Invol. bracts acute, exceeding rest of the head 11. *Edwardii*.

1. *E. setaceum*, L. Inc. *E. capillus-naiadis*, Hook. f.

A submerged aquatic with the stems clothed with short capillary leaves 1.5—2" long, densely disposed like the hairs of a tail; the tip of the stem floats at or near the surface and bears very many slender umbellately fascicled 6-ribbed peduncles 1.5—3" long which are exerted from the water. Heads small, only about .1" diam., pale grey or nearly black.

Floating in stagnant waters, Northern Bengal (Titalyah), Kurz! Probably also Purneah. Fl. Aug.—Sept.

Leaves very slender flexuous 1-nerved. Sheath of peduncles .75—1" long with membranous tip. Receptacle convex or conical, villous. Invol. bracts very small, oblong or cuneate, glabrous. Fl. bracts cymbiform all or outer glabrous, said to be coriaceous and black in form *setaceum*, membranous and whitish in form *capillus-naiadis* (but I think *Ruhland* rightly unites the two in one species), inner with long white dorsal hairs in form *capillus-naiadis* (always?). Male sepals usually connate into a split spathe, corolla-tube with 3 very minute petals with white hairs, stamens 6 with black anthers. Fem. sepals obovate-cymbiform, hairy on the back at apex, petals 3 narrow ciliate, usually with a black gland. Seeds oblong smooth dark brown.

Our plant is named *E. capillus naiadis* in the *Cal. Herb.*

2. *E. rivulare*, Dalz. Var. ?.

A submerged aquatic with long stems clothed with slender flaccid leaves 6—9" long dilated membranous and conspicuously fenestrate at the base. Peduncles few, very long, 12—20", 10-sulcate, the grooves corresponding to inner tubes round a central core. Heads .3" diam., white-villous on a pale or black ground. Invol. bracts pale grey or black glabrous suborbicular or transversely oblong, partly reflexed in fruit, concealed by the broader head.

Deep running streams in the forests, Saranda, Singbhum! Fl. Feb.—April (probably also at other times).

Stems often emitting roots in the water. L. .07" wide above the dilated sheath, with 4—7 nerves and fine cross-nervules, tips filamentous opaque. Sheath of peduncles 3" long, inflated, oblique and split at mouth. Head broader than long, invol. br. about .05" long, often twice as broad, somewhat irregularly truncate. Fl. br. .08—09" linear-oblongate or cuneate-oblongate and suddenly acute, usually black towards tip where it is clothed dorsally with white short stiff hairs. Receptacle convex glabrous (or pilose, *Ruhland*), clothed at tip with persistent bracts. M.: calyx spathaceous obcuneate or splitting into sepals, shortly white-

hairy at tip, pet. minute, one longer and exceeding calyx, villous, st. 6, anthers white. Fem. sepals 2 (or 3?), linear-oblong narrowed below, .08" long, black with few hairs at apex and on back, concave; stipes and pedicel about .02" or less, petals narrow-clavate, one rather larger, nearly as long as sepals, densely fimbriate-woolly and with a small black gland, sometimes with 2 glands. Capsule broader than long, .2" diam., seeds amber-coloured, broadly ellipsoid with a broad hilum and smaller micropylar scar the other end.

Prof. P. F. Fyson has kindly examined my specimens of this plant but has been unable to decide to which of the species of this group (*rivulare*, *breviscapum*, *fluviatile*, *miserum*) it should be assigned or whether it is a fifth species. I have thought it best therefore to name it as above, *rivulare* being the first described. They may be varieties of the same species grown under different conditions.

3. *E. Sieboldianum*, Sieb. & Zucc.

A very small annual 2—4" high with numerous radical subulate or setaceous leaves .6—2" long and slender peduncles. Heads small globose or ovoid .07—2" long, pale or sometimes purplish, with glabrous scarious bracts. Invol. bracts obovate or oblong, truncate toothed or lacerate, much shorter than the head and concealed by it. Floral bracts lanceolate or linear-oblong and subacute, shining, M. calyx spathaceous broadly spatulate toothed, anthers white.

Common in old rice-fields, North Bengal (and probably Purneah), Kurz! Singbhum! Hazaribagh, C. B. Clarke! Fl., Fr. Oct.—Nov. Probably in all districts.

Fl. bracts about .08" long. Recept. columnar, glabrous or sparsely villous. Fem. sepals 1—2 very slender or 0, corolla 0, stipes long. Style arms about as long as shank. M. petals most minute or 0, st. 1—6. Seeds brown broadly ellipsoid or ovoid .01" scarcely marked (even under 20 diam.), hilum broad, tip mucronulate.

4. *E. trilobum*, Ham. Syn. *E. Solleyanum*, Royle (Ill. t. 97).

A small plant 3—8" high with the ensiform leaves mostly erect, .7—2.5" long, many-nerved. Heads small, rarely over .15" diam., globose, dark-coloured. Invol. bracts oblong nearly glabrous, obtuse, usually exceeding the radius of the head, spreading or reflexed. Floral bracts obtuse with triangular obtuse tip or suddenly acute (but not acuminate as in *E. quinquangulare*), triangular tip with short white hairs at the back. Sepals: fem. oblanceolate concave and more or less keeled at the tip, with a few white hairs, in male more or less connate with rounded tips. Petals: fem. linear slightly broader upwards, with few white hairs. Male: not longer than the stamens and almost concealed by the hairs, usually with a black gland. Seeds amber-coloured .017" long, with close minute lines (only seen when magnified about 20 diam.).

Behar, J.D.H.! Hazaribagh, Anders., Clarke! It is also found in the Sikkim Tarai, and as it extends from the Upper Gangetic Plain to Eastern and Lower Bengal, it will probably be found in most of our districts. Fl., Fr. Oct.—April.

L. fenestrate, not red as usually in *quinquangulare*, which it much resembles. Receptacle globose, villous.

5. *E. quinquangulare*, L.

Usually dwarf 5—7" high with a crowded rosette of linear ensiform leaves 1—3" long, usually tapering from base to apex without distinct sheath, 8—12 nerved, obscurely fenestrate between nerves. Peduncles few or densely crowded 5—8-ridged upwards. Heads globose or some-

what ovoid .2", rarely .25" diam., intruded at base. Receptacle globose or columnar, covered with fine villi (sometimes adhering to the base of the flower). Involucral bracts pale concave reflexed, oblong-oblan-ceolate or broadly obtusate. Floral bracts hyaline, .6—'08" long, broadly obtusate, shortly pubescent in upper half, suddenly cuspidate, cusp triangular sometimes almost aristulate at tip ciliolate.

The commonest of our species, specimens collected or seen by me from nearly all districts! and no doubt occurring throughout the province. In swamps and paddy fields. Fl., Fr. Nov., Oct.—Feb.

Leaves opaque or sub-translucent, often bright red when dry. Some of my specimens have over 100 heads. Peduncle without conspicuous tubes within; sheath short acute with membranous tip. M. fl. subsessile, sep. linear-oblan-ceolate, shortly hairy at the obtuse tip, only about half as long as bract; cor. long-stipitate, one petal much larger than others, but scarcely protruded beyond the bract, stamens 6. Fem. fl. shortly pedicelled or subsessile, sep. narrowly linear-clavate, hairy in upper half, pct. nearly as long as slender stipes and with filiform base, sparsely hairy, and each with a black gland, style very short, stigmas slender. Capsule .2" diam. Seeds yellow, only .01" long, broadly ellipsoid, appearing transversely lineate under high magnification (20 diam.), and sometimes with longitudinal lines or microscopically hispidulous (usually described as smooth and not ridged), hilum prominent.

6. *E. collinum*, Hook. f.

Rather robust attaining 12—15", with subulate leaves 1.5—2.5" long. Peduncles often flexuous. Heads .25—'3" diam. white. Invol. bracts, outermost narrow-oblong reflexed, next orbicular-oblong rounded dark-grey, glistening, spreading, concealed by the head, glabrous or nearly so, minutely irregularly toothed or entire. Floral bracts narrowly obtusate with acute triangular tip, .08—'1" long, tip incurved and densely covered with short white stout hairs, base villous. Male fl.: .1" long with the pedicel, villous at base. Sepals connate about half the length of the flower or more but easily separable and sometimes 3 distinct, obtusate, rounded, dark-grey, ciliolate with papillose hairs, .05" long, corolla-tube stipitate funnel-shaped, petals 3 white, one nearly twice as long as the others, the other 2 often reduced to a slender very hairy axis (but in some fls. subequal), all petals with a black gland. Fem. fl.: Sep. linear, 2 somewhat cymbiform, .08—'09" long, grey with few white hairs. Petals as long, more narrowly linear with very narrow base, hairy in upper half. Seeds .02" long, ellipsoid, amber-yellow, minutely transversely white-striate and with few (about 6) whitish longitudinal striæ.

Netherhat, elev. 3000 ft. near streams! Fl., Fr. May.

I have described our plant only without generalizing from other specimens as this is a marked extension of the hitherto known distribution. I have, however, collected similar plants on the Central Provinces plateaux.

L. gradually tapering from base to apex, often conspicuously fenestrate on the back with 7—9 rows of cells. Peduncles about 7-angled. Invol. bracts 2—3-seriate the outermost much narrower than the 1—2-seriate inner. Receptacle and base of flowers with long delicate villi. The transverse striations on the seeds are easily seen with a mag. of 10 diam.

7. *E. oryzetorum*, Mart.

Usually stout 7—16" high with leaves 1.5—3" long by about .2" at base, spongy, many-nerved, tapering from base to apex or linear obtuse,

usually very fenestrate at the base when dry. Heads globose elongating to oblong-ovoid, not at all white, but pale brown when dry, said to be yellow when fresh, externally glabrous and somewhat shining. Recept. conical or columnar, villous. Bracts all membranous or scarious, involucre glabrous obtuse, floral glabrous or nearly so (minutely scabrid), densely imbricate, cuneate-obovate sharply cuspidate or sub-aristate. Male sepals 2, fimbriate or glabrous at tip, pct. minute or 0, st. 6. Fem. sep. 3, slender, caducous; petals filiform to oblanceolate, glabrous or ciliolate. Seeds yellow, transversely lineolate.

Sirguja, *Clarke!* Probably also in the Northern Area. Fl., Fr. Oct.—Nov.

An easily recognised species from the glabrous heads with sub-aristate floral bracts.

8. *E. truncatum*, *Ham.*

Small 2.5—7" high with leaves .7—2.5" long tapering from base to apex, closely striate. Peduncles many, rather stout. Heads small .15—2" diam. or attaining .3" diam. very depressed and always much broader than long with glabrous membranous shining broadly lanceolate or cuneate involucre bracts reaching to the top. Receptacle glabrous, narrow. Fl. bracts obovoid scarious almost truncate to acute, incurved and imbricate, glabrous. M. fl. with free or connate sepals and minute ciliate petals. Fem. fl. sepals 3 or 2, linear to linear-lanceolate or narrowly oblanceolate, flat or boat-shaped, petals 3 linear or filiform, ciliate. Seeds pale-yellow, ribbed, ribs papillose.

Monghyr, *Ham.!* This is the type (*Wall.* No. 6076). Fl. June.

I have been unable to examine the type except superficially, but I see that I noted the involucre bracts as obtuse and the floral bracts as acute, whereas the *F.B.I.* says "floral bracts obovoid, tip concave truncately rounded." The species is easily recognized by the very depressed heads and glabrous or nearly glabrous receptacle and bracts.

9. *E. xeranthemum*, *Mart.* Syn. *E. xeranthemoides*, *Heurck.*

A minute herb .7—3" high with comparatively broad leaves .3—1.3" long, .05—2" in breadth, many-nerved, subulate-acuminate. Sheaths of peduncle inflated. Peduncle stout striate. Heads very characteristic from the involucre of about 6 suberect, ultimately stellately spreading, lanceolate acute scarious pale shining outer bracts .15—2" long, far exceeding the rest of the head. Floral bracts less than half length of involucre subquadrate, obovate rounded or truncate with hirsute tips. Receptacle globose, glabrous or hairy (*xeranthemoides*). Fls. sessile, M. sepals 3 free or somewhat connate, petals minute or 0. Fem. sepals narrowly oblanceolate 3 equal or third capillary or 0. Seeds linear-oblong, pale yellow, papillose all over.

Chota Nagpur, *F.B.I.* and *Beng. Pl.*, but the only specimens seen from our area are those now referred to *Edwardii* or *achitan*.

The type is *Wallich's* 6081 from Nepal and Silet. The outer invol. bracts are .15" long subacuminate, outermost floral similar but much shorter and other floral quite different. The drawings show 2 female sepals, 3 oblanceolate hairy black-glandular petals, clavate male flower with 3 hairy-tipped rounded oblanceolate sepals.

10. E. achiton, Koern.

A very small species 1—4" high with subulate or ensiform leaves .2—7" long, delicately 3—5-nerved and with cross-nervules (fenestrate), base dilated scarcely differentiated into a sheath, sparsely woolly. Peduncles mostly showing a spiral twist, their sheaths .3—6" also often twisted, membranous above. Heads button-shaped to ovoid, .1—18" diam. pale. Invol. bracts longer than the floral, ovate-lanceolate to narrowly lanceolate acute or obtuse. Floral bracts cuneate obovate or oblanceolate, sometimes slightly hairy at back towards the minutely cuspidate tip. Receptacle distinctly villous, columnar. Male calyx with 2 distinct sepals, sepals linear tapering to the base, tipped with few hairs, corolla stipitate very minute imperfect with usually one distinct linear petal shorter than the stamens, pedicelled. Fem. fl. pedicelled; sepals very slender or 0. Petals 3—0, linear acute with few erect hairs, ovary usually slenderly stipitate. Seeds broadly ellipsoid, with minute transverse areoles.

Singbhum! Fl., Fr. Nov.—Dec.

This is not typical *achiton*, which has very small rounded heads .1—15" diam., with very rounded silvery membranous involucre bracts not longer than the head, inner dark grey, female sepals 2—3 oblanceolate hairy, petals 3 linear narrowly linear hairy or of 3—0 hairs.

11. E. Edwardii, Fyson (Journal of Indian Botany, vols. ii and iii).

The following is *Fyson's* description (transcribed): L. 2—5 cm. long, 4—6 mm. broad at the base, acute, glabrous, slender. Peduncle 6—20 cm. slender. Heads 3—5 mm. obconic but finally globose, involucre bracts not reflexed, 4 mm. long, scarious, glabrous, elliptic, acute, a little longer than the floral bracts. These glabrous, obovate acute, grey (*pallido-nigræ*). Receptacle tall villous. Fem. fl. Sep. 2, slender, petals 2 linear or 0. M. fl. sepals 2? connate into a spathe, petals 0, anthers 6, black. Heads globose or nearly so, in bud overtopped by the acute involucre bracts.

Ranchi (*Clarke's* No. 34327)!

From an examination of the same material I find that the base of the leaves is somewhat hairy, the floral bracts sometimes minutely hairy. M. sepals sometimes 2 quite distinct and lanceolate or linear-oblanceolate. Fem. petals often filiform, sometimes 2 capillary and a third linear, so that I conclude the Singbhum plant referred by me to *achiton* is almost intermediate between that species and this. The involucre bracts are too short and obtuse to be true *Edwardii*, which species however I would personally consider merely a form of *achiton*.

Var. Clarkei.

To this species I refer provisionally *Clarke's* No. 24788 collected at Giridih (Hazaribagh), which was left unnamed by *Hooker* for the *F. B. I.* as being too young. It appears to be a variety with very acutely cuspidate bracts, involucre bracts erect .12" as long as whole head, about 6, oblong, pale, finely acuminate. Fl. bracts .1" fuscous, almost awned. Fem. sep. 2, narrowly linear. Petals 0 but stipes sometimes apparently villous above the sepals! Male sepals spathaceous, sometimes 3-toothed (but *Fyson* described his *type* as spathaceous with a "?," and I think it is either a matter of age, or position in the head,

as I found obviously 2 free sepals in the type), staminal column clavate with about 3—5-stamens and a black gland, petals 0 or 1 minute linear.

In the villous stipes it appears allied to the Brazilian *E. griseum*.

FAM. 141. XYRIDACEÆ.

Tufted herbs with radical linear or subulate leaves and axillary and terminal simple naked scapes sheathed at the base, and with a terminal 2-sexual head or spike of small sessile flowers in the axils of rigid dark-coloured imbricating bracts. Flowers heterochlamydeous. Calyx bilateral, with an anterior dorsal larger caducous sepal embracing the corolla and 2 lateral oblique smaller ones, scarious, persistent or deciduous.* Petals 3, clawed, yellow, marcescent, claws connate into a slender short or long tube below. Stamens 3 fertile, and 3 outer obsolete or converted into staminodes, anthers sagittate, filaments adnate below to corolla tube. Staminodes usually of 2 long hairy filaments. Ovary superior 1-celled or incompletely 3-celled, with 3 parietal or basal and confluent placentas, style 3-fid, stigmas capitate or dilated. Ovules numerous orthotropous. Fruit a loculicidal 3-valved capsule or top circumsciss. Seeds many, linear or ellipsoid, with floury albumen and minute embryo at the top of the seed.

1. XYRIS, L.

The only Indian genus.

Stout 1—2 ft. high. L. .12—3" broad. Hds. mostly .4—5" diam. Fls. .5" diam. Throat of corolla not bearded	1. <i>indica</i> .
Slender 2 ft. high. L. .1" broad. Hds. mostly .25—3" diam. Fls. .4—5" diam. Throat of corolla bearded	2. <i>coronata</i> .
Slender 8—12" high. L. under .1" broad. Hds. .25—3" diam. Fls. about .3" diam. Throat of corolla not bearded	3. <i>pauciflora</i> .

1. *X. indica*, L.

Very robust as compared with the two following species, 1—2 ft. high with leaves .12—3" broad and brown heads mostly .3—6" diam. and up to .7" long, on prominently ribbed and grooved peduncles. Bracts orbicular or cuneately obovate, .25" broad, usually broader than long. Flowers bright yellow, .5" diam. with orbicular erose petals.

Dinajpur and Maldah and probably, therefore, Purneah. Puri (Khurda and Mendasal), *Lace!* Fl. Oct.—Nov.

Leaves spongy, obtuse, sometimes as long as scape. Head ovoid or globose with closely imbricate dark red-brown shining bracts with scarious margins. Lateral sepals narrowly boat-shaped, with dorsal serrulate wing. Claw of petals as long as sepals. Filaments short broad, staminodes shown by *Clarke* as slightly lacinate scales but in a drawing in *Herb. Rottl.* as feathery hairy tufts. The character of the staminodes requires further examination in fresh specimens, as also in the following species.

Said to be a cure for ringworm in Bengal (*Watt*), but it is not mentioned by either *Dutt* or *Nadkarni*.

* *Prain* says all caducous, but they are persistent in all our species till the fruit ripens.

2. *X. coronata*, n. sp. ? (see remarks under *X. pauciflora*).

Slender 2—2·5 ft. high. Leaves 0 or one sheathing the scape and much shorter than it, blade flat with acuminate tip, ·1" broad at its base. Scape obtusely angled and with a single ridge, very minutely scaberulous. Spike subglobose, usually broader than long, ·25—·3" diam. Outer bracts empty ovate, nerved, obtuse or subcuspidate, uniform (not winged). Flowering ·25" long, broadly cymbiform, keeled near the top and some cuspidate, 3 lateral nerves at some distance each side of mid-rib. Median sepal very caducous (0, ?), lateral cymbiform, keeled, ·25" long, nerveless, persistent. Corolla ·45" long including the ·25" long tube, petals yellow, obovate, ·2" diam. nerved, shallowly irregularly toothed. Stamens half as long as petals, stout, throat of corolla between the stamens and in addition to the feathery staminodes densely bearded with closely septate hairs as long as the stamens, some of them slightly clavate. Style and its branches stout, stigmas lobed. Capsule broadly elliptic, ·2" by ·15". Seeds ellipsoid or oblong, longitudinally ridged, ·02" long.

Ranchi pats, amongst grass, 3000 ft. elev. ! Fl., Fr. Oct.

3. *X. pauciflora*, Willd.

A small marsh plant 8—12" high with erect rigid grass-like leaves 3—8" by ·06—·08" and slender striate subterete or compressed and 2-edged smooth or scaberulous scapes with a globose or ovoid head ·25—·3" long. Bracts orbicular or obovate, rounded and emarginate, very concave, uppermost sometimes cuspidate, with central lanceolate brown centre and lighter coloured thinner wings or margins, all scarious, brown, shining. Flowers about 6 altogether, median sepal very caducous, lateral persistent scarious conduplicate or cymbiform, ·18" long oblanceolate. Corolla about ·3" diam.

Frequent in marshes. Plateaux of Chota Nagpur! Gya, T. Thomson! Puri, Clarke! No doubt also in the northern districts, as though no specimens have been collected it has been collected each side. Fl., Fr. c.s.

Root a small fibrous tuft. L. usually 3—4 shorter than the scapes, smooth or scaberulous, very rarely ·1" broad. Scapes 1 or more, sheathed at the base by a leaf.

I have not dissected the fresh fls., and from herbarium specimens find it impossible to describe either corolla or staminodes, but they appear to be quite different from those in the last described specimens, which are doubtfully a variety or a separate species.

FAM. 142. FLAGELLARIACEÆ.

Stems leafy, erect or scandent by the cirrhose leaf-tips. Leaves many-nerved or plaited, with petiole 0 or sheathing. Flowers small in terminal panicles, homoichlamydeous, 1—2-sexual, regular, except for the somewhat unequal tepals. Tepals 6, 2-seriate, persistent, imbricate, free, inferior, dry or sub-petaloid. Stamens 6, hypogynous with erect basifixed anthers. Ovary 3-celled with styles 3 or one 3-cleft. Ovules 1 in each cell, anatropous. Fruit fleshy or drupaceous or with 1—3 pyrenes. Seeds laterally attached with copious floury albumen

Embryo lenticular, with the radicle lying on the outside close to the hilum.

1. FLAGELLARIA, L.

Stem climbing by the cirrhose leaf-tips. Flowers 2-sexual. Perianth subpetaloid. Style arms 3, entire or 2-partite. Fruit drupaceous with a thin succulent exocarp and bony 1—2-seeded endocarp.

1. *F. indica*, L. Ban-chanda, Beng.; Harcharal, H.; Bomugra, Or.

A tall plant with reed-like stems, sometimes climbing. Leaves sessile on their truncate 7—11"-long tubular sheaths, lanceolate, 3—9" long with finely acuminate cirrhose tips, many-nerved. Flowers sessile clustered very small, sub-scarious white, clusters in irregularly branched panicles 3—12" broad at the ends of the branches. Tepals persistent, .08—1" long, unequal, one or two outer suborbicular or ovate sometimes emarginate and inner whorl usually narrower. Stamens exerted, filaments persistent. Drupe globose with a produced base, 2" diam., red or finally black with black endocarp, 1-seeded, rarely more.

Deltaic forests of the Mahanadi, Cuttack! Fl. r.s. Fr. up to the following May.

FAM. 143. COMMELINACEÆ.

Annual or perennial herbs, rarely somewhat fruticose. Leaves with a midrib and more slender parallel nerves, sheath always present, rarely shortly petioled above the sheath. Inflorescence various. Flowers heterochlamydeous more or less irregular, usually 2-sexual. Outer perianth whorl sepaloid, often persistent, inner of 3 usually blue or red petals, often united into a tube at the base, marcescent. Stamens typically in 2 3-merous whorls, inserted at base of corolla, 2 or more often reduced to staminodes, filaments often bearded with jointed hairs, anthers oblong or globose, often dissimilar. Ovary superior, 2—3-celled with terminal style and small stigma. Ovules 1 or few axile, orthotropous. Fruit loculicidal or indehiscent. Seeds angled with smooth or rugose testa and copious floury albumen. Embryo minute in the periphery of the albumen, remote from the hilum.

The placentation is axile, the seeds showing a characteristic lateral (axile) umbonate or clypeal hilum, the ends where touching other seeds are truncate or even concave, the free end of the terminal seeds however often conical.

I. Fertile anthers 3—2, staminodes 3—4:—

Inflorescence few-fl., enclosed in large conduplicate spathes 1. *Commelina*.
Inflorescence not enclosed, bracts small 2. *Ancilema*.

II. Fertile anthers 6 (rarely 5), staminodes 0:—

A. Petals combined into a tube below. Ovules usually 2 in each cell:—

Sepals free. Fls. sometimes enclosed by large imbricating bracts or axillary

3. *Cyanotis*.

- Sepals united into a tube. Not indigenous *Zebrina*
 B. Petals free or nearly so. Ovary with one ovule in each cell:— (p. 1131).
 Fls. sub-globose, secund on the branches of a close panicle. Ovary 2-celled 4. *Floscopa*.
 Ovary 3-celled. Not indigenous *Rhæo*
 (p. 1131).

1. COMMELINA, L.

Herbs, sometimes tuberous, usually slender and creeping below. Flowers emerging (usually only one at a time) from and retracted into a large spathaceous complicate bract or spathe, in few-fld. usually 2-nate or 2-fid cymes, those of upper branch deciduous, one or more of lower branch fertile, pedicel sharply recurved and thickened in fruit. Sepals 3, membranous; 2 inner often connate at the base. Stamens 3 perfect and 2—3 imperfect; anthers oblong, one usually largest. Ovary 3- rarely 2-celled, 2 cells 1—2-ovuled, third cell, if present, 1-ovuled or empty. Capsule loculicidal, or third cell indehiscent or the 2 anticus cells empty connate indehiscent and forming a persistent ligulate body from which the posticus cell falls away. Seeds ellipsoid or angled, reticulate smooth pitted or rugose. Petals equal or 2 larger or differently coloured from the third.

The ovary and capsule show a tendency to the more or less complete abortion of the posticus cell and its ovule (the fact that the cell never contains 2 ovules is a general case of this). The division into sections based on this tendency appears to me unnatural and to separate widely closely allied species so that I have not adhered to the usual grouping of the species.

I. Spathes complicate with dorsal margins free to the base:—

A. Seeds reticulate, rugose inside the reticulations.

Ovules 5. Capsule usually 5-seeded:—

L. ovate-lanc. to lanc. Spathes ovate cordate 75—2" 1. *nudiflora*.

B. Seeds smooth, often with a hoary bloom. Ovules 5—4:—

1. Capsule 3-celled (sometimes 2-celled in *salicifolia*):—

L. linear or linear-lanceolate 3—6" by .17—5".

Spathe lanceolate, usually acuminate. Seeds appendiculate 2. *salicifolia*.

L. lanceolate or oblong-lanc., 1.5—2.5". Seeds mucous 4. *Hasskarlii*.

2. Capsule 2—1-celled. Ovules 2 in each cell:—

L. linear 1.5—3". Spathes lanceolate acuminate, hairy within. Seeds or seed appendiculate 3. *attenuata*.

3. Ovule 1 in each cell. Capsule 2—3-celled

appendiculata
 (p. 1125).

II. Spathes funnel-shaped or with the margins connate nearly to the top, never acuminate:—

A. Ovules 5. Capsule 3-celled, 2 cells usually 2-seeded:—

L. ovate 1—3". Spathes 1—3 together 5. *benghalensis*.

B. Ovules 3—2. Capsule 3—2-celled. Stout species with spathes crowded to subsolitary:—

Spathe .75". Cap. 3-celled, dorsal scabrid. Seed white-margined 6. *Kurzii*.

Spathe .75—1.5". Cap. 3- (rarely 2-) celled. Seed grey smooth compressed 7. *obliqua*.

Spathe 3—7". Cap. 2-celled. Seeds with large pits 8. *suffruticosa*.

1. *C. nudiflora*, L. Syn. *C. communis*, Clarke, in Comm. & Cyrt. Tab. 1.

A rather succulent creeping herb with sheathing lanceolate leaves 1—3" long, usually glabrous with hairy sheaths .5—75" long. Flowers

blue considerably exserted from the conduplicate spathe, in 2-forked cymes, the upper branch often with 2 barren flowers, the lower with usually 3 fertile flowers all retracted into the spathe after fertilization. Capsule 3-celled, 2 cells 2-seeded, 1 cell 1-seeded keeled deciduous. Seeds rugose-reticulate, the rims of the reticulations subhexagonal continuous, the depressions minutely granular.

Common in damp grassy places. Singbhum! Probably in all districts, at least in the more humid ones, but very poorly represented in herbaria. Fl., Fr. Aug.—Oct.

Rooting at the nodes. L. sometimes only .8" and ovate-lanceolate, sometimes scabrous or puberulous (*Clarke*) and ciliate. Spathes .75—2" long ovate cordate (when unfolded) or base rounded, tip sometimes acuminate. Peduncle of spathe .5"—.75". Fls. about .5" diam. Sepals green, 2 anterior larger. Petals blue or outer pale or white. The far-exserted cyme branches are rather characteristic, and often 2 fls. open at once.

2. *C. salicifolia*, *Roxb.*

Stems diffuse with long branches and internodes and leaves linear-lanceolate or almost grass-like, 3—6" by .17—.5", glabrous or nearly so, sheaths ciliolate. Flowers of a most intense blue, smaller than in *nudiflora*, 1—2 on the cyme branches, which are usually considerably exserted. Spathe complicate lanceolate, axillary solitary, often acuminate. Seeds smooth black with a white bloom, 2 anticus cells of capsule 2-seeded and posticus usually 1-seeded as in *nudiflora* but third cell sometimes obsolete.

Wet or watery places, frequent. Jalpaiguri (and probably Purneah)! Bengal, many times collected. Chota Nagpur, *Clarke*. Parasnath, *Cal. Herb.*! Also Northern Madras, so that it probably extends throughout the province.

L. sessile on their cylindrical sheaths, a little hispid on the upper side and margins (*Roxb.*). Petals equal except that the lower has a shorter claw. Capsule oblong, shortly suddenly acute. Seeds subglobose truncate, appendiculate.

Some states closely resemble *C. attenuata*, to which it must be very closely allied.

3. *C. attenuata*, *Koen.* Syn. *C. Rajmahlensis*, *C. B. Clarke* (in *Comm. & Cyrt.*)?

Small, diffuse with slender stems and branches angled, usually with a line of short pubescence. Leaves linear, mostly conduplicate, or slightly tapering to one end or the other, acute or acuminate, 1.5—3" long by 1.5—3" broad, midrib and marginal nerves prominent, glabrous. Sheath cylindric, .25—.3" long, about 6-nerved, margins thinly pubescent. Spathes (when opened out) lanceolate long-acuminate, the acumen longer than the rest, sub-sagittate with rounded auricles, copiously minutely dotted, sparsely hairy within, glabrous outside (or with some long white hairs in Parasnath specimen), .8—1.4" long, margins not coherent, sometimes closely ciliate. Flowers very small, deep blue with brownish lower sepal. Capsule oblong .27" long, retuse, 2—1-celled, each cell 1—2-seeded. Seeds .1" long (excluding the prominent pale soft process each end), brown, subterete, with a line down one face at right angles to the scar, truncate and appendaged each end, one appendage minutely toothed.

Rajmahal Hills, *S. P. Kurz*! Ranchi, *C.B.C.*! Hazaribagh (Parasnath), *C.B.C.*! Manbhum, *C.B.C.*! Angul, *Chattarjee*! Fl., Fr. Oct.—Nov.

This species is very closely allied to *C. salicifolia* and *C. appendiculata*, Clarke, and appears to show that too much importance has been attached to the more or less complete suppression of the third loculus in the fruit. Clarke says "close to *C. Hasskarlii*, differs by the 4 ovules (never?) 5, by the appendiculate seeds, 2—3 frequently abortive." In his *Commelynaceæ* he also says under *C. rajmahlensis*, close to *C. appendiculata*, but in which the spathes are less elongate, less hairy and the seeds much smaller. But although *C. rajmahlensis* is given as a synonym in Clarke's Monograph and in F.B.I., the figure in the *Commelynaceæ* shows a distinctly 3-celled capsule and 3 muticous seeds!

In my specimen the flowers are only just exerted from the very narrow beaked spathe. The capsule is retuse instead of shortly beaked, but I have been unable to confirm the constancy of this character as the capsules in herbaria are mostly mutilated. Hooker (in F.B.I.) restricts the species to plants with leaves only 1—2" long, recurved, and 1-celled capsules.

C. appendiculata, Clarke, is found in the Darjeeling Tarai and may therefore be found in Purneah. The plant is in general larger than *attenuata* but this may be due to the forcing locality. Spathes 1.5—2.5" copiously minutely dotted. Capsule .25" not retuse. Seed 1 in each cell, more elongated and less truncate, .14".

4. *C. Hasskarlii*, Clarke.

Stems diffuse, creeping and rooting at the base, glabrous (or pubescent, Clarke), or sometimes a few short hairs below the nodes. Leaves lanceolate or oblong-lanceolate, subacute or obtuse, 1.5—2.5" long by .3—.6" broad, glabrous (or sparsely ciliate, Clarke), rather suddenly contracted to the ovoid inflated conspicuously 7—10-nerved pale .3—.5" long sheath which has ciliate margins. Spathe .6—1" long with a peduncle .3—.5" long when unfolded, ovate-lanceolate or ovate and slightly acuminate, complicate, margins free to base, deeply cordate with 4—5 principal nerves each side of ciliate midrib, glabrous or midrib ciliate and margins hispidulous. Peduncle .3—.5" long, pubescent along upper side. Capsule only one developing to each spathe, .3—.4" long, oblong shortly beaked, with 2 widely dehiscent cells and one smaller, very tardily dehiscent cell more or less keeled. Seeds usually 2 in each of the larger cells, brown-black with a hoary sheen, oblong and obscurely keeled, minutely reticulate, .14" long.

Singbhum! Ranchi, Clarke! Hazaribagh, Clarke! Angul! Fl. Sept.—Nov.

Close to *C. salicifolia*, differing by the broader leaves, inflated sheaths, less acuminate spathes rarely over .8", inappendiculate seeds truncate one end, subacute the other. But I have a specimen with seeds very slightly appendiculate. The habit is often rather characteristic from the axillary shoots bearing many leaves and smaller than those of the parent stem.

5. *C. benghalensis*, L.

Stems sub-succulent, creeping and rooting below, glabrous or pubescent, often pilose below the nodes. Leaves ovate or elliptic-ovate 1—3" by .5—1.5", obtuse or rounded at the tip, suddenly contracted or rounded at base. Sheaths pubescent or villous or both and usually with long hairs at mouth extending on to a short petiole. Spathes 1—3 together, conduplicate with the margins connate for a considerable distance at the base, turbinate or conical in form and with very short apex, only .3—.6" long and as broad. Capsule membranous,

2 cells 2-seeded dehiscent, third smaller 1-seeded, tardily dehiscent striolate. Seeds rugose, closely pitted.

Very common in damp places. Gaya, *Nusker!* Chota Nagpur, all districts; Santal Parganas, *Kurz!* Orissa, *Hooper!* Probably in all districts of the province. Fl., Fr. July—Nov.

L. sometimes hairy, sometimes sessile on the sheath, but usually with short petiole, base often ciliate. Cymes 2-nate, one with 2—3 fls., the other with 1, rarely 2 fls., sometimes 0. Fls. small blue, appearing (as in others of the genus) one at a time. Ovoid cleistogamous underground flowers .25" long often occur on bracteate peduncles near the root.

The plant is eaten as a pot-herb.

6. *C. Kurzii*, Clarke. Possibly a variety of *C. obliqua* and *C. suffruticosa*.

Clarke says "somewhat doubtfully distinct from *obliqua* but the mealy piloseness of the leaves generally enables *Kurzii* to be separated without reference to the capsules." The capsule is 3-celled, 2-valved, the dorsal cell indehiscent, deciduous and scabrid. Seeds sometimes 2 only.

Rajmahal Hills, *Kurz!* Fl. May.

The leaves are finely hoary-pubescent as are the sheaths and spathes. Spathes about .7" across the top. Seeds sometimes with very white corrugate edges.

7. *C. obliqua*, Ham. Probably a variety of and synonymous with *C. Kurzii*, *Clarke*, and *C. suffruticosa*, *Blume* (*q. v.*).

A stout species with branched stems 2—3 ft. straggling among bushes. Leaves very variable 4—7" by 1—2" lanceolate acute or caudate, glabrous pubescent or villous beneath, sheaths .75", margins often bearded. Spathes .75—1.5" long and broad, in crowded heads, rarely solitary, funnel-shaped, *i.e.* the margins on both sides connate nearly to the top. Capsule obovoid, 3-gonous, 3-valved and 3-celled, with one seed in each cell about .13" long and usually somewhat compressed on one side.

Throughout India, *J.D.H.* Sikkim Tarai, *J.D.H.!* Monghyr, *Wall*, 8985C (part). Ranchi, *Prain!* Hazaribagh (Parasnath), *T. Thoms.!*

This appears to be another case of very closely allied (if not the same) species being widely separated by the number of cells in the ovary and capsule. In this connection I may recall that *Clarke* in his *Commelynaceæ* says: "I have frequently met 3-celled and 2-celled fruits on the same plant, the 2-celled fruits being without a trace of the third cell." This is my experience, and my *suffruticosa* from Neterhat appears to be this species (if they are distinct) with 2-celled capsules. In a sheet of *Wallich's* (see above) one scrap only has been called "*obliqua*" by *Clarke*, the rest "*suffruticosa*." I think they are all possibly one collection. In this the spathes have long hairs on the faces.

8. *C. suffruticosa*, Blume.

A stout branching and scrambling species with creeping rhizome and fleshy roots. Stems polished, up to .4" diam. with thickened nodes. Leaves large sessile on the 1—1.3"-long ciliate sheaths, lanceolate finely acuminate with unequal base, scaberulous above, margins scabrid, larger about 7.5" by 2" (in my plant; 3—14" by .75—2", *Clarke*). Spathes usually much smaller than in the last two, about 3.7" long and broad and usually villous, paniced or clustered. Capsule

2-celled. The seeds are said to be straw-coloured and fascetted or with large pits (but I doubt their being ripe).

Bettiah, *Hieronymus* (with very long hairs in leaf axils and margins ciliate)! Monghyr, *Wall* (part No. 8985C, spathes .7 by .8")! Singbhum, *Clarke* (spathes few, .7"). Capsule retuse 2-celled! Ranchi (Neterhat, but spathes .9" by .8", obtriangular, truncate, with very short acumen)!

My specimen from Neterhat, to which most of the description above applies, the only one with undoubtedly ripe seeds, is essentially *C. obliqua* with 2-celled 1-2-seeded capsules .17 by .15" compressed on sharply reflexed pedicels; seeds oblong grey with a matt minutely papillose surface, .15" long, not at all rugose! If the capsule character be omitted the only distinction left between *suffruticosa* and *obliqua* are the smaller more villous spathes and doubtfully the seeds.

2. ANEILEMA, Br.

Herbs, sometimes tuberous. Flowers and fruit not enclosed in a large spathaceous bract, in axillary and terminal panicles with ordinary bracts and bractcoles. Sepals 3, membranous. Petals equal obovate. Stamens 2 or 3, filaments naked or bearded, anthers oblong, one usually smaller or larger than the others; staminodes 2-4, rarely with minute polliniferous anthers. Ovary sessile, 2-3-celled. Ovules 1-2-many. Capsule loculicidal, cells 1- or more-seeded. Seeds with a thick hard rugose or pitted testa.

I. Flowers cymose and paniced:—

- | | |
|---|-------------------------|
| A. Panicles on a leafless scape appearing before or with the young leaves. Flowers .75" diam. | 1. <i>scapiflorum</i> . |
| B. Cymes or panicles on the leafy stems:— | |
| 1. Stout species with oblong or ensiform leaves mostly 6" or more. Capsule-cells 3-4-seeded | 2. <i>lineolatum</i> . |
| 2. Slender diffuse species with small or narrow leaves 1-6".— | |
| Ovules and seeds 3-7 in each cell. L. under 2" | 3. <i>spiratum</i> . |
| Ovules and seeds 2 in each cell. L. 2-5" | 4. <i>nudiflorum</i> . |

II. Fls. 1-4 clustered on short axillary peduncles:—

- | | |
|--|------------------------|
| Ovules and seeds about 16 in each cell | 5. <i>terminalis</i> . |
| Ovules and seeds solitary in each cell | 6. <i>vaginatum</i> . |

1. *A. scapiflorum*, *Wight*.

A very beautiful little plant throwing up its scapes after the jungle fires and before the appearance of the leaves. Flowers purple-blue or sepals red and petals violet, .75" diam. on a narrow panicle 8-18" high. Stamens 3 perfect with purple anthers, staminodes 2 or 3 shorter with small yellow anthers, filaments bearded. Capsule .25" elliptic mucronate 3-gonous. Ovary-cells mostly about 4-5 ovuled.

Frequent in grass tracts annually burnt and also in sparse forest. Common in Chota Nagpur! Purneah! Mayurbhanj! Kalahandi! Probably in all districts. Fl. March-May. Leaves appear with the rains (May in Mayurbhanj).

Tuberous roots numerous elongate from a thickened small stock. L. narrowly ensiform, 4-10", erect, finely acuminate. Lower bracts of panicle 1" long, tubular or amplexicaul, often with erect panicle-branches, upper ovate .2-1.5" usually dotted and puberulous. Petals sometimes .5", obovate or suborbicular. Seeds straw-coloured with a minutely reticulate glandular epidermis, 1-seriate, 3-6 superposed in each cell.

The tuberous roots are credited with various medicinal properties.

2. *A. lineolatum*, Kunth. Syn. *A. herbaceum*, Clarke (in Monog.).

A stout species with erecto-patent large lanceolate or oblong amplexicaul leaves 6" by 1.5" or radical up to 12". Flowers blue in large axillary and terminal panicles with marcescent bracts. Filaments all bearded. Capsule broadly ellipsoid 3-gonous, .25" diam., mucronate, with 3—4 smooth reticulate seeds in each cell.

Chiefly in Eastern India and the hills. Ranchi (Hundrughagh), *Prain!* and Bundu (Tamar), *Wood!* Hazaribagh (Parasnath), *Thoms.!* Fl., Fr. Aug.—Sept.

L. with white margins, acuminate, often crisped, base cuneate rounded or cordate. Panicle stout glabrous with spreading and ascending branches. St. 2—3 with 2—3 staminodes. Seeds glandular-puberulous (*F.B.I.*).

3. *A. spiratum*, Br.

A procumbent or ascending much branched slender herb with amplexicaul small oblong to somewhat ovate or lanceolate leaves up to 2" long and small bright blue or violet flowers .25" diam. in axillary and terminal paniced scorpioid cymes with the rhachis often zigzag. Bracts minute persistent. Pedicels slender .25". Sepals brownish. Petals obovate .17". Capsule oblong .15" long, acutely trigonous mucronate or shortly beaked with a single row of 3—7 seeds in each cell. Seeds cuboid, shining, light brown, minutely knobbed (smooth or scaberulous, *F. B. I.*).

Common, mostly in drying-up rice-fields. Purneah, *Kurz!* Gya, *Thoms.!* Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Sept.—Jan. Annual.

Root fibrous. Stems many from the root 6—15" with the panicle. Branches with a line of pubescence. Leaves mostly .5—1.5", usually glabrous, acute or subacute, margin thickened often scaberulous. Sheaths short with pubescent edges in continuation of the branch lines of pubescence. St. 3, staminodes 3, filaments naked or bearded.

4. *A. nudiflorum*, Br.

A herb with many slender branches decumbent and rooting or ascending. Leaves linear or linear-lanceolate, 2—5" by .15—.4" rarely .5" broad, acute or sub-obtuse, sheath bearded. Flowers small, blue or purplish in terminal or leaf-opposed few-fl'd. cymes, cymes becoming paniculate with elongate peduncles marked with the scars of fallen bracts at the cyme. Ovary with cells 2-ovuled. Capsule broadly oblong-ellipsoid, mucronate, .15" long, each cell with 2 broadly oblong very rugose and pitted seeds, truncate at their common end, rounded or obtuse at the other, nearly as broad as long.

A common weed. Near Purneah, *Kurz!* Santal Parg., *Kurz!* Singbhum! Ranchi, *Prain!* Manbhum, *Wood!* Probably throughout the province. Fl., Fr. r.s.

L. glabrous in our specimens, sometimes hairy or subvillous (*F.B.I.*). Fls. on pedicels .1—2" long. St. 3 fertile with bearded filaments, 3 staminodes with filaments bearded or not.

In var. *compressa*, Clarke (not so far reported from our area), the seeds are 3 in each cell.

5. *A. terminalis*, comb. nov. Syn. *A. Hamiltonianum*, Wall.; *Tradescantia terminalis*, Blume (1827).

Diffuse but less branched than *spiratum* with creeping and rooting stems 6—12". Leaves suberect linear-lanceolate, often complicate, amplexicaul 1—3" by 1·2—2·2", nearly glabrous. Flowers more or less concealed in the leaf-bases, pedicels jointed. Ovary many-ovuled. Capsule oblong shining ·25" long with about 16 seeds in each cell.

Sarguja, C. B. Clarke! Also in United Provinces (Moradabad) and Goalpara, so probably throughout our northern area. Fl. Sept.—Oct.

L. acute or subacute. Flowers white or pinkish. Filaments naked. Peduncle under ·25".

The oldest specific name is *terminalis*, but this was subsequently utilized by Wight for a different plant subsequently reduced by Clarke to a variety of *A. nudiflorum*.

6. *A. vaginatum*, Br.

A slender grass-like herb with erect and prostrate branches from near the root 6—18" long often rooting at the nodes. Leaves 2—6" long by 3—4" broad. Flowers small purple-blue star-like, ·25" diam., 1—3 rarely 4 together in the axils of distant convolute bracts. Stamens 2 perfect and 3—4 with aborted anthers, bearded with long purple hairs (or naked, F.B.I.). Capsule 3-celled and -seeded, ·12—·16" diam. subglobose, glabrous.

Very common in wet ground. Purneah, King! Chota Nagpur, all districts! Probably throughout the province as it is common in the Deccan, etc. Fl., Fr. July—Oct.

Stems striate, often puberulous. L.: upper reduced to bracts and erect, sheaths short open pubescent. Pedicels ·5—·75" on a short peduncle scarcely exerted from the bract, "twice jointed in the middle" (F.B.I.). Seeds hemispheric, black, rugose. Sepals pubescent, narrow, persistent, equalling the petals. Petals broader, ovate or oblong.

3. CYANOTIS, Don.

Herbs, usually prostrate or creeping, sometimes tuberous. Flowers rarely clustered in the leaf sheaths, usually 2-seriate secund on the stout curved rhachis of axillary and terminal small helicoid cymes and enclosed in the biseriate falcate imbricating bracts, the petals and stamens, rarely the whole flower exerted, very rarely in exposed racemes. Sepals subequal, free or connate below. Petals subequal, often united into a tube below. Stamens 6, all perfect subequal, filaments usually bearded, often expanded towards the apex, anthers oblong. Ovary 3-celled; ovules 2 collateral in each cell, one erect, the other pendulous. Capsule 3-celled, loculicidal. Seeds superposed, cuboid or pyramidal, usually rugose.

- A. Flowers in the axils of the leaf-sheaths 1. *axillaris*.
 B. Flowers in spiciform scorpioid cymes with pairs or secund closely imbricating foliaceous bracts:—
 Root fibrous. Bracts glabrous or villous on the margins only 2. *cristata*.
 Root of fascicled tubers. Bracts villous all over 3. *tuberosa*.

1. *C. axillaris*, Roem. & Sch.

A glabrous sub-succulent creeping and rooting herb with numerous erect and spreading branches often 2 ft. long with sheathing linear acuminate leaves mostly 3–4" long, lower up to 5" by .5", floral .5–1" long. Flowers pretty, bright blue in short axillary clusters in the inflated leaf-sheaths, 1–6 in each axil, .75" long and .3" diam. Calyx .3" long, split about half-way into 3 narrow greenish or hyaline segments, keeled in fruit. Cor-tube very slender .5", petals ovate. Filaments with long blue jointed hairs, clavate at tip. Capsule .2" long, glabrous, acute, 6-toothed or -lobed (each valve being 2-fid). Seeds sub-cylindric, punctate.

Very common in rice-fields and other wet places. In all districts! Fl., Fr. July–Jan. Annual.

Stems shining, glabrous or sparsely hairy. L. tapering from base to apex. Fls. sometimes white or violet. Top of filament clavate. Anths. yellow, oblong, inserted near base, cells with convolute walls, pollen purple. Style filiform spiral, clavate above.

2. *C. cristata*, Schultes.

Stem slender branched creeping below, root fibrous, branches erect or ascending glabrous or patently hairy. Leaves rather distant sessile spreading 1.25–3" by .5–.75", ovate-oblong. Cymes recurved not clustered, .5–.8" in the axil of a lanceolate spathe which usually greatly exceeds the spike and is 1–1.5" long. Bracts imbricating, .4–.6" long by .17–.2" broad, very falcate obtuse and apiculate, glabrous or with margin only villous.

In wet ground. Gaya, Nusker! Rajmahal Hills, Kurz! Chota Nagpur, Wood (without locality)! Parasnath, Col. Herb.! Manbhum, Thoms.! Fl. Oct.

Stems 1–2 ft., pubescence sometimes confined to a line decurrent from the sheaths. L. rather fleshy, obtuse or subacute, usually densely ciliate and with short hirsute sheaths. Flowers blue, sepals linear-oblong acute hairy, filaments bearded, clavate below the tip. Capsule .1", slightly hairy above. Seeds 2 in each cell, conic-oblong, truncate at their mutual extremity, other end umbonate, slightly ribbed and warted (3-gonous, striate and pitted, Clarke).

3. *C. tuberosa*, Schultes.

Flowering stems stout prostrate ascending and erect, 12" to 2 ft. high, hirsute at the base, hairy above. Leaves mostly radical, ensiform, or narrowly oblong, 5–10" by .4–1", subacute, without costa, shining and with sparse long silky hairs beneath, margins densely villous or woolly, cauline sheaths often inflated, silky. Spathes oblong-lanceolate .5–.6" usually shorter than the spiciform recurved cymes, which are mostly clustered in several-nate heads. Bracts falcate dimidiate-cordate, acute, .3–.5" long by .17–.2" wide, very villous outside, sessile, each pair enclosing 2 (or more?) sessile flowers with linear-oblong or lanceolate villous or hirsute sepals .3" long. Capsule broadly oblong .13–.15" hairy above, each cell with 2 broadly conical seeds with an umbonate base and truncate or depressed mutual apex, rugose.

Singbhum, in the forests and under bushes! Fl. r.s. Fr. Sept.–Oct.

Tubers elongate fascicled (resembling those of *Ancilema scapiflorum*). Leaves often purple beneath. Petals blue-purple. Filaments bearded with tumid tip.

Var. *adscendens*, Clarke. Smaller, far less hairy, branches rooting and proliferous at the nodes. Heads and spathes smaller.

Chota Nagpur, Ranchi, Clarke! Singbhum!

The roots are eaten. Under the Santali name *Hodo jereng arak*, Campbell states that "the root is given in long-continued fevers and also for worms in cattle. The leaves are eaten as a pot-herb."

4. FLOSCOPA, Lour.

Erect or subscaudent herbs with flowers in secund cymes in axillary or terminal thyrsoid panicles. Sepals 3, free, oblong. Petals free, obovate. Stamens 6, perfect (rarely one imperfect), filaments glabrous. Ovary 2-celled, style simple. Ovules one only in each cell. Capsule 2-celled, loculicidal, crustaceous. Seeds hemispheric.

1. *F. scandens*, Lour.

Not scandent in our area but erect and gregarious with stems creeping below. Leaves sessile (or petioled, *F.B.I.*) on the bearded or ciliate sheaths, 2—4 by 4—1", elliptic-lanceolate, acuminate, base narrowed. Flowers lilac, in dense terminal panicles 1.5—2" long, branches, pedicels and calyx closely glandular-hairy or hirsute.

Wet places or in water. Purneah! Ranchi and Palamau, elev. 3000 ft. Fl., Fr. Sept.—Nov.

Glabrous or thinly pubescent on stems and leaves, sheaths always hirsute or bearded on margins and mouth, 6—8" long. Panicles shortly peduncled, broad-ovoid or pyramidal. Flowers subglobose, lower bracteate, sometimes white or pink. Petals broadly obovate. Filaments purplish, anthers, yellow. Capsule subglobose, .08", about equalling the calyx. Seeds pale-glaucous.

Rhœo discolor, Hance (called *Tradescantia discolor* in horticultural works) is an erect plant 1—2 ft. high commonly grown in pots in verandahs, etc., with somewhat the habit of a dwarf *Agave*, the leaves being close sessile ensiform rather stiff and erecto-patent, deep green with crimson undersurface and sometimes coloured margins. The flowers are small white numerous in cymes enclosed in axillary spathes. Capsule enclosed in the marcescent perianth, cells 1-seeded.

"Grows in deep coppices," Mexico.

In true *Tradescantia* the ovary-cells are 2-ovuled and seeds usually 2 and flowers in short racemes.

Zebrina pendula, Schnizl. (usually called *Tradescantia zebrina*, Hort.) is a pretty creeping and rooting herb with rather glistening ovate leaves marked with pale or silvery and dark stripes, underside purple. The flowers are small red-purple enclosed in a spathe. Stamens 6 inserted in the mouth of the corolla-tube. Ovary-cells with 1—2 ovules in each. Native of Mexico.

SERIES.—LILIFLORÆ.

FAM. 144. JUNCACEÆ.

Erect, usually perennial herbs with stems usually tufted on a creeping rootstock (in one of our species annual). Leaves flat or terete or reduced to sheaths. Flowers green, or whitish and membranous, or brown and scarious or coriaceous, bracteate in axillary or terminal cymes, 2-sexual. Perianth inferior, tepals in two whorls, persistent,

imbricate. Stamens 6, rarely 3, hypogynous or partly adnate to the tepals, anthers basifixed. Ovary 1—3-celled, style filiform or short or 0, stigmas 3 filiform. Ovules many axile in the 3-celled, 3 only and basilar in the 1-celled ovary, anatropous. Capsule 1—3-celled, loculicidally 3-valved. Seeds erect, testa membranous, often produced at each end; albumen dense, embryo small, next the hilum.

1. JUNCUS, L. Rush.

Glabrous. Leaves sometimes septate within. Perianth with the outer segments keeled or the midrib thickened. Stamens 6, rarely 3. Ovary 3-, rarely 1-celled, ovules many.

Annual. Stems copiously dichotomously branched. L. not septate

1. *bufonius*.

Perennial, strict, caespitose. L. distantly septate

2. *prismatocarpus*.

1. *J. bufonius*, Toad-rush.

A densely tufted much dichotomously and sometimes 3-choromously branched very slender herb 1—10" high. Leaves few, chiefly near the base of the stems, grass-like, very narrow concave above, 1—4" long. Flowers pale green solitary, in the forks of the cymes and unilateral in helicoid often flexuous cymes. Bracts scarious less than half length of perianth, outer tepals .2" long, lanceolate acuminate with membranous margins, inner about $\frac{3}{4}$ ths as long, similar. Capsule oblong or slightly obovoid .12", at first closely embraced by the perianth, when quite ripe loculicidal and septifragal and the axis again splitting into three. Seeds very numerous oblong .02" long, yellow, sometimes with black tip and finely reticulate.

In the Upper Gangetic plain! and extending eastwards to Beaulah, *Clarke!* Fl., Fr. c.s. This little rush is common in Europe. No specimens appear to have been collected actually inside our area, but from its distribution it is sure to occur in the northern area.

2. *J. prismatocarpus*, *Br.*

A variable caespitose erect (or in one variety prostrate) rush 10—24" high. Stems terete or compressed, not septate. Leaves soft terete or compressed tubular or with several tubes, distantly septate. Cymes terminal erect with erect or spreading branches bearing the flowers densely clustered in hemispherical heads. Fls. green or brown, outer tepals scarious .12—'17" long, subulate or linear-lanceolate. Stamens 3 much shorter. Style very short. Capsule prismatic or conical, usually much exserted from the perianth.

In wet places. Bengal, *J.D.H.* (without district)! Purneah (*Kissenganj*), *J.D.H.*! Santal Parg., *Kurz!* Gangpur, *Prain's Collector!* Fl. May. Perennial.

Rootstock very short. Stems sometimes decumbent and rooting at the nodes. Leaves 2—10", shorter than the stem, sometimes filiform, but attaining .12" in width. Lower bract of cyme erect foliaceous, shorter than cyme, floral bracts hyaline, lanceolate acuminate. St. very short. Seeds minute, apiculate, testa appressed reticulate.

FAM. 145. LILIACEÆ.

Mostly perennial herbs with underground rootstock or bulb, sometimes climbing, more rarely suffruticose or shrubs or trees with a secondary growth in thickness. Leaves various, cauline or radical, sometimes reduced to scales with their function assumed by leaf-like cladodes (*Asparagus*), sometimes fleshy, usually parallel-veined. Flowers 2-sexual, rarely 1-sexual by abortion, regular, rarely somewhat irregular, axillary or in a terminal scape which is 1—2-flid. or sometimes umbellate, spicate, racemose or paniced. Bracts various (rarely spathiform under an umbel as in so many Amaryllidaceæ). Perianth inferior and free from the ovary, petaloid, often marcescent, tepals combined into a tube at the base or free, in 2 series of 3 each, both series similar or very slightly different, occasionally tepals 4, 8 or many, slightly imbricate or outer valvate. Stamens most usually 6 hypogynous or on the perianth opposite the lobes, filaments free or connate, anthers variously affixed to the filaments with usually 2 longitudinally dehiscent cells rarely with terminal pore. Ovary superior, 3-celled with axile placentation, occasionally 1-celled with parietal placentation, rarely 2- or 4-merous with 2- or 4-merous perianth, style and stigmas various. Ovules in each cell 2 collateral or many 2-seriately superposed, rarely solitary or numerous and irregular, anatropous, hemianatropous or in a few genera orthotropous. Fruit baccate or septicidally or loculicidally capsular or rarely irregularly rupturing. Seeds with copious albumen. Embryo minute globose or elongate, sometimes much shorter than the albumen, straight or slightly curved, radicular end near or remote from the hilum.

- I. Arboreous, shrubby suffruticose or climbing or if erect and herbaceous, then flowers irregularly paniced. Rootstock never bulbous. Fls. never in involucrate umbels or solitary (exc. *Gloriosa* and then stem elongate climbing):—
 - A. Fls. very small, often umbelled. Stems branched often prickly, usually scandent and suffruticose. L. not elongate:—
 - L. 3—9-costate, reticulate-nerved between. Fl. umbelled 1. *Smilax*.
 - L. scale-like with acicular cladodes in their axils. Fls. mostly racemose 2. *Asparagus*.
 - B. Fls. large or mod.-sized. L. usually elongate or fleshy. Stem not scandent (exc. *Gloriosa*):—
 1. Woody plants or with thick fleshy leaves densely clustered and often spinose. Fls. racemose. Anthers introrse:—
 - a. Ovule 1 in each cell (*Sansevieria* is usually placed in *Hæmodoraceæ*):—
 - Stem slender elongate (in our species). Perianth funnel-shaped or narrow-campanulate. Berry 3—1-celled, pericarp persistent 3. *Dracæna*.
 - Stems subterranean, rhizomatous. Fruit sub-3—1 coccous, pericarp evanescent 4. *Sansevieria*.
 - b. Ovules many in each cell. L. usually thick and spinose:—
 - i. Filaments not inserted in a pit in the connective:—
 - Fls. relatively small, paniced, tube short. Frt. baccate 5. *Cordylina*.

- Fls. large, tepals nearly free, anths. small on a thick filament. Frt. capsular or baccate
- ii. Fil. inserted in a pit in the connective:—
- Tepals connate or conniving nearly to tip. L. spinous
2. Scarcely woody with short rhizome. L. not very thick, often distichous. Ovules many (2—6 in *Disporum*):—
- a. L. linear elongate. Rhizome short woody:—
- Fls. few large erect irregularly paniced, funnel-shaped with short tube. Fil. inserted in a pit. Frt. 3-gonous
- Fls. mod.-sized laxly cymose on the panicles. Tepals free, filaments thickened. Frt. baccate
- b. L. short or tips cirrhose. Rhizome tuberous or creeping. Anthers extrorse:—
- Erect. Fls. sub-umbellate on recurved pedicels
- Scrambling or climbing. Fls. large axillary solitary
6. *Yucca*.
7. *Aloe*.
- Hemerocallis*
(p. 1141).
8. *Dianella*.
9. *Disporum*.
10. *Gloriosa*.
- II. Herbaceous with rootstock a bulb or corm or very short with a fascicle of tuberous roots (roots fibrous in *Asphodelus*). L. mostly radical (exc. *Iphigenia*). Fls. in involucrate umbels or radical racemose scapes:—
- A. Fls. in heads or umbels sheathed by 1—more spathes (cultivated only in our area):—
- Rootstock with many very fleshy fibres. Fls. large blue (rarely white)
- Rootstock a tunicate bulb. Fls. small or mod.-sized
- Odour characteristic (alliaceous)
- Agapanthus*
(p. 1143).
11. *Allium*.
- B. Flowers racemose or fascicled in racemes (in axils of leaf-like bracts in *Iphigenia*):—
1. Rootstock a bulb or corm:—
- a. Fls. on a leafless scape:—
- L. appearing after the fls. Seeds flattened
- L. and fls. coætaneous. Seeds globose or ovoid
- b. Raceme leafy or fls. subcorymbose
12. *Urginea*.
13. *Scilla*.
14. *Iphigenia*.
2. Rootstock small with many fleshy or tuberous roots or root annual:—
- a. Ovules 2 in each cell. Seeds wrinkled
- b. Ovules 4 or more in each cell:—
- Raceme often dense. Capsule prominently 3-angled
- Raceme very lax. Capsule not prominently 3-angled
15. *Asphodelus*.
16. *Chlorophytum*.
Anthericum
(p. 1148).

1. SMILAX, L.

Shrubs (rarely herbs) usually climbing by their twisted petioles and by the 2 stipular tendrils produced from above their leaf-sheaths. Leaves alternate, rarely opposite, persistent, 3—5-basal or sub-basal-nerved and reticulate, petiole short, often articulate above the tendrils, sheath often dilated. Flowers small, usually greenish or white, dioecious, in umbels, umbels solitary or paniced. Tepals free, 6. Male fl. with usually 6 (sometimes more) stamens at the base of the perianth, free; anthers didymous, oblong or linear-oblong, or the cells separated by a forking of the filament. Fem. fl. with 3 or 6 staminodes. Ovary 3-gonous, 3-celled; style short or stigmas sessile, stout recurved. Ovules 1 or 2 in each cell, orthotropous, pendulous. Fruit a globose or ellipsoid berry. Seed solitary, or more often 2 hemispheric, rarely 3; albumen horny. Embryo small.

- I. Umbels solitary. Stems unarmed or nearly so. Branches unarmed. L. under 6", membranous, 3-costate 1. *lanceæfolia*.
- II. Stems prickly, branches prickly or not. Umbels rarely solitary. Leaves mostly over 6":—
- A. Umbels 1—3, rarely 5. Sheath not large nor auricled:—
 Branches terete. L. 6—12", usually very broadly ovate, 5—9-costate 2. *macrophylla*,
 Branches 4-angled. L. under 7", elliptic or ovate-lanceolate, 3—5-costate *zeylanica*.
 (p. 1136).
- B. Sheath with large auricles which often embrace the branch:—
 Umbels 1—3 very unequally peduncled 3. *Roxburghiana*.
 Umbels many, usually verticillate on rhachis 4. *prolifera*.

1. *S. lanceæfolia*, Roxb.

A slender wiry unarmed climber, branches terete or with fine raised lines, not angular. Leaves oblong or ell.-oblong or some ovate-oblong, thin, only up to 3" by 1.4" in our specimens, sometimes 4—6" by 1.5—3", base obtuse or acute, glossy both sides and slightly translucent-dashed when fresh. Petiole .5", sheath obscure, tendrils from the sides of the older petioles. Umbels solitary axillary, peduncle of inflorescence .2—3" long with small bracteoles separating it from the proper peduncle of the umbel which is .3—4" long and pedicels about the same. Berry .3" diam.

Ramnagar Hills! Fl. r.s. Fr. Nov.

Rather a variable plant if specimens outside our area are considered, with stems sometimes slightly prickly and some leaves broad. The peduncle of umbel not always differentiated into general and special. Male umbels .7—9" diam. and their peduncles usually simple, naked and short, tepals linear, .12—25" long. Fem. umbel sub-similar, staminodes 3, ovary obtusely 3-gonous, stigmas short obtuse recurved.

2. *S. macrophylla*, Roxb. Syn. *S. ovalifolia*, Roxb.; Atkir, K., S.; Raupawan, Kharw.; Muter, Rajdantni, Or.

A stout prickly climber with stems sometimes 1" diam. below, flowering branches mostly unarmed. Leaves broadly elliptic, or orbicular, 6" by 5" to 12" by 12", sheath neither broadly winged nor auricled. Umbels 1—3, rarely 5, in axillary short cymes rarely 3" long on peduncles shorter than the diameter of the umbel, with bracts at the nodes ovate or truncate.

Common in the damper forests. Champaran! Purneah! Chota Nagpur, all districts! Santal Parg.! Mayurbhanj! Sambalpur! Fl. April—July. Fr. Nov.—Jan. Subdeciduous in May.

Prickles small. Branches quite terete or with 4 lines or angled, striate when dry. Leaves with a short hard cusp, base rounded or subcordate, but sometimes suddenly acute and decurrent on the petiole, usually 7-costate, sometimes even 9-costate in the larger leaves, 3 ribs often produced on to the petiole, sometimes 1—2 adnate to midrib for .5—7" above the base. Base of petiole sheathing, triangular in section, enclosing a hard bud or base of the inflorescence, sheath not broadly winged, but its thin edges often infolded and meeting above at the base of the articulation of the petiole proper where the two cirrhi thus arise almost base to base. Peduncle of inflor. .5—1", proper peduncles of umbels .5—1.5", in male, .5—75" in female, large basal bract at base of inflorescence exerted from the sheath. Pedicels .25—3" or .5 in fruit. Male sepals .27" long by .06" broad, oblong, rounded with thickened tips, petals about .25" narrower and thicker.

St. slightly longer than sepals, anthers .07—.08" linear-oblong. Berry globose .3—.5" diam., 1—3-seeded, seeds biconvex.

A preparation of the root is applied for rheumatism and pains in the lower extremities, *Camp.*

S. zeylanica, L.

I cannot distinguish this from *macrophylla* except by the branches being more or less 4-angled and its smaller leaves, both unsatisfactory characters as the branches of *macrophylla* have sometimes raised lines or several angles. The upper leaves of *macrophylla* appear often to be like those of *zeylanica*. If the two are identical, they will, however, all have to be called *zeylanica*. A specimen from Sirguja, *Wood*, is named *zeylanica* in the *Calcutta Herbarium*.

3. S. Roxburghiana, Wall.

Branches terete, branchlets 4-angled unarmed. Leaves elliptic ovate or ovate-lanceolate, obtusely acuminate without a hard cusp, 5—8". Sheaths with large auricles. Panicles with 1—3 very unequally peduncled umbels on a common peduncle 1—3" long. Berry .3", seeds 1—2 biconvex reddish.

Parasnath! Santal Parg.! Fr. May.

I have only seen fruiting specimens in the field. The proper peduncles vary from .12"—.2" on the same plant. The type looks like *prolifera* with few umbels. The Parasnath specimen has large prickles on the branches, ovate-lanceolate to lanceolate leaves, larger 7" by 3.7" with finely reticulate nervation. M. peduncles slender, fl. buds .2". I think further study in the field will reduce it to a form of *prolifera*.

4. S. prolifera, Roxb. Same vern. names.

A stout prickly climber with stems up to 1" diam., branches mostly terete, armed throughout. Leaves narrowly elliptic, ovate-oblong or more rarely broadly elliptic, attaining 8" by 6", usually 5" by 2.5" to 7" by 4", sheaths with large incurved wings with auricles often amplexicaul at base, apex often auricled laterally compressed and forming a rounded keeled tip above the petiole, from the junction of which and the petiole arise the two long cirrhi. Umbels in axillary and terminal panicles 3—6" long usually whorled 3- (1—4-) nate, slender proper peduncles about 1" long, bracts at the nodes small acute up to .12" long (in very compound panicles the main branches are supported by leaf-sheaths without petiole or blade).

More frequent than *S. macrophylla* especially in dryer localities, but it also prefers the sides of streams, ravines, etc. Champaran, Ramnagar Hills! Purneah, more common than *macrophylla*! Chota Nagpur, all districts, frequent especially in the hills! Mayurbhanj! Fl. Feb—April. Fr. Nov.—Dec.

Branches sometimes somewhat angled, prickles under .12". Leaves with a short hard cusp, base rounded subacute or subcordate, 5-costate, of which the two stronger lateral costæ are connate with midrib to about .3" above the base, the next outer from the base weaker, and there is sometimes another slender nerve proceeding above the base close to the margin each side. The large sheaths on older leaves are sometimes 2.5" long with the sides inrolled to form a closed chamber, finally hardened. Petiole above the sheath .5—8" long, stout. Peduncle of inflorescence 1—2", male proper peduncles slender 1—1.5" fem. .75—1.25"; pedicels .25—3" or fruiting .5", perianth recurved. Male sepals .17" long, linear-oblong with rounded tip, pet. linear, as long; st. about as long, anthers white linear, .06". Fem. sep. stouter lanceolate from a rather broad base (.05" wide). Pet. with an

ovate-lance. base, staminodes filiform. Ovary ellipsoid, ovules 1 in each cell, narrow-oblong. Berry ovoid, red to black, 3—4" long, or subglobose. Seed usually 1, rarely 3, pale yellow, shining, rounded with a dark basal umbo.

(One specimen had sepals and petals nearly as large as in *macrophylla*).

2. ASPARAGUS, L.

Shrubs or undershrubs, erect or often scandent, rarely herbaceous, with stout creeping rootstock. Leaves reduced to minute scales, often spinescent, bearing in their axils tufts of more or less leaf-like acicular, flattened or 3-quetrous barren branchlets (cladodes). Flowers small or minute, axillary, rarely 1-sexual, solitary fascicled or racemed, on jointed pedicels. Perianth 6-partite white or greenish. Stamens on the bases of the segments. Anthers oblong. Ovary 3-gonous with style and 3 stigmas, cells 2—more-ovuled. Berry globose. Seeds 2—6 with black brittle testa; embryo dorsal.

- A. Leaves becoming spines below. Fls. distinctly racemed:—
 Cladodes slender 5—1", often falcate, shorter than the racemes 1. *racemosus*.
 Cladodes stout 1—2.5", straight, exceeding the racemes 2. *acerosus*.
 B. Leaves spurred but not spinescent. Cladodes .25—4" long. Fls. solitary, 2—3-nate or laxly racemed. Erect 3. *gracilis*.

1. **A. racemosus**, Willd. Huring Atkir, K.; Kedar nari, S.; Satawar (the roots), Th.; Gaichera, Or.; Isparjar (Sambalpur).

A slender scrambling or scandent suffruticose perennial with woody prickly shoots with reflexed spines. Cladodes more or less acicular and 3-quetrous, falcate, 5—1" long, divaricate, finely acuminate. Flowers white, sweet-scented, .12" diam. on filiform articulate pedicels .12—1.7" long in very short racemes, or some racemes compound and up to 3.5" long. Berries .1—2.5" diam., scarlet.

Common in the forests and scrub jungles, Champaran! Santal Parg.! Chota Nagpur, all districts! Puril! Mayurbhanj! Sambalpur! i.e. throughout the whole province. Fl. Sept.—Dec. Deciduous, or dying back to the root in the h.s.

The plant is rather variable. The following forms occur in our area:—

Var. *a. Prainii*.

This is a very distinct plant from the ordinary *racemosus* in its very short cladodes. Stems with strong straight reflexed thorns .3" long below. Branches spreading striate, 3-quetrous or not. Cladodes only .3—4" rarely .5", and only 2—3-nate, rarely 2- or 4-nate divaricate, 3-grooved or unequally 3-quetrous, tip with a minute white spinulose point, and angles minutely scabrid. Racemes usually very short, often with rhachis under .2" and few fld., but sometimes they are 1—1.5", which connects the variety with the ordinary form, bracts about half as long as the pedicels. Berries .17—2.5" diam. Seed usually only 1, black, somewhat ellipsoid-globose.

The common form in Singhum forests. Prain (to whom it was sent in 1902) remarked that it was a very puzzling form.

Roxburgh draws a distinction in the position of the embryo in *racemosus* and *acerosus*. As far as I follow him the embryo of var. *Prainii* is that of his *acerosus*; the radicle starts in the umbilical hemisphere low down, and the filiform embryo ascends in a large semicircle remote from the umbilicus and down again to the equator the other side. The arch, however, is not in one plane but wavy.

Var. β . (near *racemosus* proper).

Branches sharply angled. Cladodes 1", 4--8-nate, very falcate. Racemes long and branched often 2"-3.5" and sometimes bearing spines and flowering when leafless. Bracts as long as the .07--.09" pedicels (they are much shorter in ordinary *racemosus*). *Puri!*

I find that the seedling from the very commencement only shows scale-leaves and cladodes. These are no normal leaves.

A decoction of the root is used medicinally by the Tharus and also given in fever by the Santals.

2. A. acerosus, Roxb.

A slender scrambling or scandent suffruticose perennial similar to *A. racemosus* but with very much stronger cladodes often 2.5" long, 3--6-nate, triquetrous, acuminate, many times longer than the slightly recurved spines. Racemes shorter than the cladodes, 1--1.5", bracts lanceolate concave. Flowers pure white, fragrant.

Karagolah ghat, Purneah, *Clarke!* Fl. May. Also in the Duars.
It appears to pass into states of *racemosus*.

3. A. gracilis, Royle.

An erect very graceful plant about 4 ft. high with feathery branches and small white star-like flowers .2" diam. in lax racemes. Cladodes straight terete acicular in clusters of 6--9, .25--.4" long.

Forests near Neterhat. Elev. 2500--3000 ft. New shoots and flowers in May. Fr. Oct.--Nov.

Stems and branches terete polished. Bract leaves scarious. The blade .05--0.7", acuminate, somewhat hastate at base and with a spur as long as the blade; spur somewhat hardened but never developing as a spine. Bracts and bracteoles at base of pedicels similar. Flowers distant solitary and scattered along, or sometimes 2--3-nate on the top of, special flowering branches (racemes) 1--2.5" long, which sometimes terminate ordinary leafy shoots or are lateral and bare except for the bracts. Pedicels .1--.15" jointed near the base. Tepals .1" oblong with rounded tip. Fil. .07" subulate flattened membranous. Fruit subsolitary red .2" diam.

3. DRACÆNA, L.

Shrubs or trees with alternate or crowded and subterminal, sessile or petioled leaves, either with strong costæ or many fine parallel nerves. Flowers rather small for the size of the plants, in terminal racemes, panicles or heads with small bracts. Perianth tubular, campanulate or funnel-shaped, 6-cleft, lobes narrow. Stamens 6, inserted at the base of the tube, filaments filiform or flattened, anthers versatile. Ovary 3-celled with filiform style and capitate stigma. Ovule 1 in each cell, erect. Fruit baccate, globose didymous or 3-lobed. Seeds globose or angled, testa thickish, albumen horny. Embryo small.

A number of beautiful species of *Dracæna* are cultivated in Indian gardens and in verandahs. They have mostly more or less lanceolate or sword-shaped leaves which are often brilliantly coloured, especially at the back. They are usually known as Dragon-plants.

The following are wild species:

L. elliptic or ell.-lanceolate, 5--10". Raceme simple
L. linear or ensiform, 8--20". Panicle large

1. *terniflora*.
2. *angustifolia*.

1. *D. terniflora*, Roxb.

Shrubby 2—4 ft. high with elliptic or elliptic-lanceolate very broadly petioled leaves 6" by 2" to 10" by 3" or (in the Angul plant) more slenderly petioled and only 1.5" wide, tip finely but shortly acuminate, base passing imperceptibly into the petiole. Flowers 2—3-nate shortly pedicelled in the axils of small bracts of a simple cernuous raceme 3—4" long or about 6" in fruit. Perianth very slender, .7—8" long, greenish-white, sometimes curved, segments linear valvate, free two-thirds or more of the way down, very obtuse, twisted soon after opening. Fruit red, .35—6" diam., globose didymous or sub-3-lobed according to the number of seeds.

Under rather dense shade. Puril. A similar-looking plant but with narrower leaves (see above) and neither in flower nor fruit has been sent to me by *Mr. Chatterjee* from Angul! Fl. May—June. Fr. Sept.—Oct. Evergreen.

Stems ringed at the nodes, thickened and nodose at the rootstock. There are remarkable lanceolate leaf-sheaths or bracts clothing the stems between groups of leaves, possibly the beginning of each year's growth; they are mostly finally deciduous, but some appear to grow up into small leaves. L. with numerous parallel nerves. The petioles are very variable from slender and .06" wide to stout and .2" wide; length varies from 1—3".

2. *D. angustifolia*, Roxb.

An erect shrub 4—10 ft. high with cylindrical stems .5—75" diam. Leaves ensiform or linear, 8" to over 2 ft. long by .75—2" broad, sessile on the sheathing base. Flowers white 2—3-nate on the branches of a large decurved spreading panicle. Perianth .75" long, lobes .5" linear, spreading and reflexed.

Shady banks and edges of streams in the Duars!, and possibly extends westwards into Purneah. Fl. Nov.—Dec.

4. SANSEVIERIA, *Thurle.*

Stout often fleshy herbs with a short often stoloniferous rootstock or creeping rhizome. Leaves narrow, cartilaginous or fleshy, flat or terete, nerves immersed. Flowers racemose on a stout scape, white or greenish. Perianth more or less slenderly tubular with narrow erect, spreading or revolute lobes. Stamens 6 inserted opposite the tepals with slender filaments and dorsifixed anthers. Ovary superior, attached by a broad base, 3-celled with filiform style and simple stigma. Ovules solitary erect or ascending from the lower angle in each cell. Fruit membranous indehiscent with 1—3 large globose fleshy seeds appearing like 3 fleshy carpels, the membranous pericarp evanescent.

Several species, including *S. Roxburghiana*, are cultivated as garden plants in our area and known as *Sword and Bayonet plants*. The genus affords a valuable fibre known as *Bowstring Hemp*, which is usually said to be derived from *S. guinensis*. A revision of the whole genus is given by *N. E. Brown* in the *Kew Bulletin* for 1915. From this it appears that *S. guinensis*, *Baker*, etc., is *S. metallica*, *Gér. & Labr.*; *S. g. Gér. & Labr.* is *S. trifasciata*, *Prain*, which is closely allied; *S. g. Hort* is *S. cylindrica*, *Bojer*; *S. g. Willd.* is *S. thyrsiflora*, *Thunb*; *S. guinensis*, *Schwein*, is *S. abyssinica*, *N. E. Br.*? etc., and it is not known which of these species yields the best quality fibre.

1. *S. Roxburghiana*, Schult. Murba, Beng.; Murga, Or.

An erect fleshy plant with tufted leaves 12—18" high by 1—1.3" broad, linear-oblong, flat but convex on lower surface, not semi-terete,* the young only concave on upper surface, widest about the middle, clouded with irregular bars of darker green on both surfaces, tip ending in a solid cusp 1" long. Raceme strict dense, shorter than the leaves, about 12" by 2" including the 4" long peduncle, flowers in clusters of 2—3 on small tubercles and with as many scarious bracts, suberect. Perianth .6—7" long and same distance across at the mouth, tubular with finally revolute lobes free over half-way down, lobes linear obcuneate with obtuse somewhat inflexed thickened papillosely pubescent tips.

Gregarious as an undergrowth on rocky soils under shade in the Kaburi, Baruni Hill, Selingpara and other forests in Puri division! Steep slopes along shady ravines. Angul!* Fl. June—July. Fr. Dec.

Rhizome horizontal creeping sending up tufts of leaves at intervals. Pedicels jointed, .1—3" tinged violet, broader above the joint. St. somewhat shorter than tepals, anthers oblong, lobes distinct at base up to the filament. Ovary broadly oblong, somewhat 3-grooved, with style .6" long and exserted capitellate stigma. The scape is sheathed with about 3 linear-lanceolate concave pale bracts with solid tips.

Flowers each last a day, lobes erect up to 3 p.m., then spread and become revolute about 4 p.m., when the anthers become far exserted. The plant yields a very good fibre used for bowstrings, etc.

5. *CORDYLINE*, Commers.

Characters of *Dracæna*, but ovules 4—16 in each cell of the ovary, testa black shining. Embryo nearly as long as the albumen.

1. *C. terminalis*, Kunth. (Often called a *Dracæna* by horticulturists.)

A moderate-sized shrub with long oblong-lanceolate or linear-lanceolate distichous green or purplish leaves 1—3 ft. long by 2—5" broad with broad petioles. Flowers white or purplish or rose-coloured, small, pretty, .3" long, 3-nate and sub-sessile on the branches of a large erect simply branched panicle 1—2 ft. high.

Widely cultivated and very ornamental. Fl. March. There are several varieties in cultivation, some with coloured or variegated leaves, not distinguishable from *Dracæna* without the flowers or fruit.

6. *YUCCA*, L.

Handsome stout shrubs or trees with simple or branched stems and terminal clusters of large linear-lanceolate or ensiform coriaceous or fleshy thorn-tipped leaves. Flowers large drooping campanulate in a many-fl. terminal panicle of racemes. Perianth segments free or nearly so. Stamens much shorter than corolla with thickened filaments and small sagittate anthers. Ovary-cells many-ovuled, incompletely 2-locellate. Fruit capsular or baccate.

Natives of the United States and Central America. The two following are commonly cultivated in gardens and known as Adam's Needle or Spanish Bayonet. They are very ornamental both in foliage and flowers.

* The Angul plant had semi-terete leaves 2 ft. long and was not in flower.

1. *Y. aloefolia*, L.

Often attains 15 ft. in height with generally a simple stem and a crown of narrow sword-shaped grey-green finely toothed leaves. Flowers usually white in a large dense panicle 1—1½ ft. long. Fruit baccate.

2. *Y. gloriosa*, L.

Woody stem rarely exceeding 3 ft. Leaves more broadly ensiform. Panicle much larger, up to 3—6 ft. in length with larger bell-shaped white flowers. Frt. dry but not dehiscent.

7. ALOE, L.

Dwarf fleshy leaved plants, more rarely arborescous. Leaves forming rosettes or 2-ranked, usually spinosely dentate. Flowers in terminal simple or branched racemes, usually reddish-yellow with green; perianth segments united into a cylindric or campanulate straight or slightly curved tube, tips sometimes free. Stamens as long as perianth or longer, filaments inserted into a pit in the connective. Frt. loculicidal.

The Aloes are especially abundant in South Africa. The most widely spread species is probably *A. vera*, L., which, originally from North Africa, has been introduced into most warm countries. It is probably the plant alluded to by *Firminger* under the name of *A. indica*, "a common plant throughout the country with leaves thorn-edged, thick, soft, pale-green and bearing dull red flowers." The spike is simple erect elongating, the lower flowers usually falling off as it lengthens.

The plants usually called Aloe are species of *Agave*.

Hemerocallis fulva, L. The Day Lily.

A robust plant with a very short rhizome and numerous fleshy roots. Leaves 1—3 ft. long, linear. Flowers large erect tawny-yellow in a few-fl. panicle at the top of a leafless scape. Perianth funnel-shaped with a short cylindric tube and many-nerved erecto-patent tepals. Stamens at the top of the tube, declinate, shorter than the perianth, with dorsifixed anthers, the filament inserted into a pit. Ovules many. Capsule coriaceous 3-quetrous.

Common in gardens and verandahs.

8. DIANELLA, Lamk.

Herbs, stout in our species, with usually branched stoloniferous root-stock and rigid, distichous, linear, often equitant leaves. Flowers in cymose panicles, nodding, jointed on their pedicels. Perianth marcescent, segments distinct spreading. Stamens 6 hypogynous, or 3 inner on the bases of the petals, filaments much thickened; anthers basifixed, reflexed, opening by terminal pores or short slits. Ovary 3-celled with filiform style and minute stigma. Ovules 4—8 in each cell. Fruit baccate. Seeds few ovoid or compressed with shining black testa and fleshy albumen.

1. *D. ensifolia*, Red.

A stout herb 18"—3 ft. high with equitant linear distichous leaves strongly laterally compressed at the base and 18"—3 ft. long. From the centre of the leaves rises one or more slender scapes terminating

in a panicle of umbelliform racemes of greenish or white flowers developing in fruit beautiful cobalt-blue berries '3—4" diam.

Rocky ravines. *pâts* of Ranchi and Palamau (Neterhat. 3000 ft.)! Fl., Fr. April—June.

Rootstock stout creeping. L. narrow below, sharply keeled by the midrib, flat above and sharply acuminate, '8—1.2" wide in middle, midrib beneath and margins scabrid. Scape somewhat compressed and angled with sharply keeled foliaceous bracts, panicle narrow, 3—10" long, with suberect branches, lower longest bearing one or more short close racemes of nodding flowers with oblong tepals '25—3" long, chiefly remarkable for their stamens, the top of each filament being suddenly expanded and of an orange or yellow colour as is the '12"-long anther. Pedicels '3—5" jointed under the flower. Berry 3-celled with 1—2 oblong-ovoid black shining compressed seeds '17" long in each cell.

The flowers open in the evening and close the following morning.

9. DISPORUM, *Salisb.*

Erect, sometimes almost suffruticose, herbs with creeping rootstock and angular leafy often 2-chotomously branched stems. Leaves sessile or sub-sessile rather strongly nerved. Flowers in terminal or axillary few-fld. umbels with decurved pedicels. Perianth campanulate, deciduous, with 6 erect segments, base saccate or spurred. Stamens 6, hypogynous, with dorsifixed extrorse anthers. Ovary 3-celled with long or short style and 3 short stigmas. Ovules 2—6 in each cell. Fruit a pisiform black fleshy berry. Seeds few, subglobose with appressed testa, brown.

1. *D. pullum*, *Salisb.*

A stout herb 3—4 ft. high dichotomously branched above, stem '3" diam. below. Leaves alternate and opposite ovate-lanceolate 3—5" by 1—1.6", acute or acuminate, stronger nerves about 6—8, petiole very short decurrent as a raised line on the stem. Flowers about 5—6 in a short-peduncled deflexed umbel on angled or fluted decurved 1—1.5"-long pedicels which are very scabrid on the angles. Fruit black depressed sub-trigonously globose, '3" diam., with 1 seed only in each cell.

Shady banks and along naals usually over 1000 ft. elev. Forests of Singbhum, chiefly Porahat! Ranchi, Neterhat, 3000 ft.! Parasnath, 3000 ft.! Fl. r.s. Fr. Oct.—Dec.

I have not seen the fresh perianth, the plant being always in fruit when I have met with it. It is '7—8" long, and described as white or dull purple with spatulate or lanceolate acute or acuminate segments which are saccate or subsaccate at the base. The seeds are light brown, orbicular-oblong '2" long.

10. GLORIOSA, *L.*

Stems from a tuberous naked rootstock, leafy, scrambling or climbing by the cirrhose leaf-tips. Leaves alternate, opposite or 3-nately whorled, lanceolate, with prominent midrib and elongate spiral tip. Flowers large, axillary, solitary and subcorymbose, slightly irregular. Perianth persistent, tepals 6 subequal, narrow, spreading or reflexed, often waved or crisped. Stamens 6, hypogynous with filiform filaments and linear dorsifixed versatile extrorse anthers. Ovary 3-celled with slender style sharply bent upwards, dividing at tip into 3 filiform or subulate introrsely stigmatose lobes. Ovules many. Fruit a large

septicidal capsule. Seeds subglobose with spongy testa and cylindrical embryo.

1. **G. superba**, L. Bunum-ki-chung, Bing-ki-chung, K.; Jagara, M., Sinic; samansom, S.; Karihari, Kharw.; Kariari-bishalanguri, Beng.

A beautiful and well-known plant 3—10 ft. high, scrambling among other bushes and supporting itself by the sessile or subsessile leaves, which are 5—6" long excluding the circinate tip. Flowers inverted, tepals 2—3" long by 4—6" broad, beautifully waved and crisped, lower half yellow, upper half red, finally the whole turning more or less red, often subcorymbose at the ends of the branches.

Hedges and low jungles. Central and southern areas, common! Fl., Fr. r.s. The aerial shoots are annual and die down completely by the end of the cold season.

Rootstock large torulose. Leaves finely parallel-nerved each side of midrib, base rounded. Peduncles often 7" long.

The roots give one of the seven minor poisons of Sanscrit writers, and *Dutt* gives *langatika* as well as *kalikari* as Sanscrit names. It is used in Hindu medicine and is also said to yield a violent poison with which the Kols used to tip their arrows. Many Kols, however, profess not to have heard of this, and also state that the root is sometimes eaten after preparation.

Agapanthus umbellatus, L'Her. The Blue African Lily.

A very beautiful plant with tough branched rhizomes and numerous fleshy roots. Leaves linear, rather thick, basal and shortly distichous. Flowers with short cylindrical tube and longer suberect oblanceolate segments, blue (a white variety also occurs). Stamens filiform adnate to the tube. Ovary cells with many ovules. Seeds numerous black flattened imbricate in the almost 3-lobed capsule.

Frequently cultivated in verandahs, especially on the plateaux. Native of South Africa.

11. ALLIUM, L.

Usually pungently foetid (alliaceous) herbs with tunicate bulbs. Leaves radical and scapose, mostly narrow, terete fistular flat or grooved. Flowers capitate or umbelled, sheathed by 1—2 membranous spathes, sometimes replaced by bulbils. Perianth leaves 6, free, spreading or campanulate. Stamens 6, hypogynous or at the base of the tepals, or perigynous; filaments free or connate below, anthers oblong. Ovary 3-gonous, style filiform simple or 3-cleft with simple stigmas. Ovules few in each cell. Fruit a membranous 3-lobed capsule, with usually depressed top, loculicidal. Seeds 1—2 at the base of each cell, turgid or compressed, black. Embryo curved, excentric, radicle next the hilum.

All the following species are cultivated only in our province.

I. Bulbs not seated on a rhizome:—

- | | |
|---|--------------------------|
| A. Leaves flat, sometimes keeled. Filaments of inner whorl 3-cuspidate, the central cusp anther-bearing:— | |
| Head with many bulbils. Fls. white | 1. <i>sativum</i> . |
| Head without bulbils. Fls. red or greenish-white | 2. <i>ampeloprasum</i> . |
| B. Leaves fistular, terete or semi-terete. Filaments not cuspidate, but those of inner whorl sometimes with a tooth each side of the broad base:— | |
| St. included. Perianth red | 3. <i>schænoprasum</i> . |

- St. about as long as perianth. Fls. white or lilac
 St. longer than perianth. Fls. greenish-white .
- II. Bulbs elongate seated on a creeping rhizome. L. flat:—
 St. shorter than perianth, perigynous
4. *ascalonicum*.
 5. *cepa*.
 6. *tuberosum*.

1. *A. sativum*, L. Lasuni, beluli, *Vern.*; Garlic.

Bulb with membranous outer scales in the axils of which are 10—12 lesser bulbs (*cloves* of gardeners). Leaves flat, linear, with sheaths about half their length. Scape slender. Heads subglobose with a long beaked involucre deciduous in one piece, and with numerous bulbils. Fls. white, sepals lanceolate acuminate, inner filaments 3-toothed at apex, centre tooth with anther.

Widely cultivated by the natives of India, not often by Europeans. The crop is taken up at the commencement of the h.s., and the "cloves" after being dried stored away for use.

2. *A. ampeloprasum*, L. Syn. *A. porrum*, L.; The Leek.

Bulbs cylindric. Scape with flat leaves 2—3 ft. high. Head almost globose with very long-beaked spathe, without bulbils. The wild plant (Mediterranean region) has reddish flowers. The commonly cultivated (var. *porrum*) variety is distinguished by the almost complete absence of subsidiary bulbs in the axils of the bulb scales and the whitish or greenish flowers. It is cultivated chiefly in European gardens in the c.s.

3. *A. schœnoprasum*, L. Chives.

Bulbs weakly developed. The thin awl-shaped onion-flavoured leaves are the parts eaten. Heads globose. Perianth red. St. included with subulate anthers. Rarely cultivated.

4. *A. ascalonicum*, L. Gundham, *Vern.*; Shallot.

Bulbs ovate-oblong fasciated, outer skin brown-yellow. Leaves subulate fistular but compressed towards apex. Scape slightly swollen below. Spathe shorter than umbel with 2—3 irregular subovate segments. Fls. white or lilac but rarely flowering in cultivation. Anthers ovate, green (*Roxb.*).

Much cultivated in Indian gardens in the c.s.

5. *A. cepa*, L. Piyaj, *Vern.*; Onion.

Leaves subdistichous fistular. Head often with bulbils, pedicels shorter than the stellate greenish-white flowers; stamens exerted, inner often 2-toothed at the base.

Largely cultivated in both Indian and European gardens.

6. *A. tuberosum*, Roxb. *Vern.* Banga-gandina (*vide Roxb.*).

Bulbs cylindric with white fleshy root-fibres on a rhizome. Leaves narrow-linear compressed or 3-gonous. Head 1—1.5" diam. lax-flid. Pedicels much longer than the small white or pink stellate fls. Fil. simple linear included, connate below and perigynous.

Roxburgh says he finds it cultivated about Calcutta. It will therefore be very probably cultivated in Orissa.

12. URGINEA, *Steinh.*

Bulbous scapigerous herbs, scape naked, flowers sometimes appearing before the leaves, racemed, white, green or brownish; bracts small. Perianth campanulate or widely stellately spreading, of 6 subequal segments. Stamens shorter than the perianth, inserted at the base of the segments; anthers versatile set on filament close to its base between the lobes. Capsule oblong, 3-quetrous, loculicidal, many-seeded. Seeds flat, uneven, with black membranous testa.

All the Floras give "perianth campanulate" as a chief generic character, having failed to note that some of the species at least are night-flowering, and that at night the perianth is widely spreading.

1. *U. indica*, *Kunth*. *Kandri*, *H.*; Indian Squill.

Scape 1—2.5 ft. high, appearing long before the leaves, slender and very lax flowered. Flowers usually only about 4—8 on the scape on very long pedicels which are erect and about .75" long before flower expands, and then elongate to 1.5" or even 2.5" in fruit and become recurved and then finally erect again. Perianth rotate when open, campanulate .3—4" long before and after opening, segments greenish with a brown streak outside, white within, narrowly oblong, sometimes pubescent at the tip. Ovary oblong 6-grooved with short stout style and 3-gonous stigma. Capsule .4—7", narrowly ovoid-oblong, coriaceous, 3-quetrous, each carpel ribbed in centre and on the margins.

Frequent, often seen on fire lines in the forest and on grassy plateaux. Singbhumi! Ranchil! Palaman! Near nalas, Gangpur! Angul! Mayurbhanj! Kalahandi, *Cooper!* Probably therefore in all districts of the central and southern areas. Fl. March—May. Fr. May—July. L. appear June. Each flower only lasts one night, opening in the evening and closing early in the morning.

Bulbs globose-ovoid 1.25—1.5" diam. with a neck 1" or more long, tunicate with adhering grey fleshy scales without any smell. L. linear 6—18" by .5—1", flat, acute. Bracts subtending the pedicels of the buds .08", ovate-lanceolate auricled, soon withering. Seeds .3" including the wing, irregularly orbicular.

The bulb is said to have the properties of *Scilla indica* and *Urginea scilla* (see under *S. indica*). It is also used for sizing cloth.

13. SCILLA, *L.*

Herbs with tunicate bulbs and radical usually narrow leaves. Flowers racemed on a leafless scape with small bracts. Perianth campanulate or stellately spreading, marcescent, with 6 subequal often recurved segments. Stamens 6, inserted at or near the base of the perianth segments with usually filiform filaments and ovate or oblong anthers introrsely dehiscent. Ovary 3-celled with filiform style and small capitate stigma. Ovule 2-few in each cell. Fruit a globose 3-lobed loculicidal capsule with cells 1—2-seeded. Seeds obovoid or subglobose with thin black testa. Embryo shorter than the firm albumen.

1. *S. indica*, *Baker*. Indian Squill.

Rather a pretty small bulbous herb, especially when the leaves which are coætaneous with the flowers are blotched with deep black. Scapes 4—7" high, very many-flowered. Fls. greenish-purple with purple filaments. Per. segments linear-oblong, .15—25" long, campanulate below

then spreading, erect in fruit. Capsules membranous .17" long and broad.

Although common locally in the Central Provinces it is rare in our area.

Manbhum, *Camp.*! Fl. June—July. It usually grows in grass areas and produces leaves and flowers after the grass is burnt.

Bulb globose or ovoid, 1—1.5" diam. L. 3—6" by .5—1", oblong, lanceolate or oblanceolate, rather fleshy, wavy, uniformly green or variegated with black, sometimes bulbiferous at the ends where they touch the ground. Scape stout with minute bracts. Pedicels .25—3" long, filiform. Ovary tridymous with each lobe didymous, stipitate.

It is used in medicine as a stimulant, expectorant and diuretic. The squill of the English *Pharmacopœia* is *Urginea scilla*, *Steinh.*, from the Mediterranean coasts, but *Urginea indica* was also made official in 1914. *Scilla indica* and *Urginea indica* are probably mixed up in the bazars, but the bulb of *Urginea* has a longer neck.

14. IPHIGENIA, *Kunth.*

Herbs with erect leafy stems rising from a coated corm. Leaves few, cauline, linear, upper bractiform. Flowers small erect solitary or corymbose. Perianth 6-partite, stellately spreading, deciduous with equal narrow-clawed segments. Stamens 6, hypogynous with short flat filaments and versatile, oblong introrsely attached anthers. Ovary sessile, 3-celled with minute styles connate at the base, linear recurved, introrsely stigmatose. Ovules many in each cell. Capsule loculicidal. Seeds subglobose; testa thin, appressed, brown.

1. *I. indica*, *Kunth.* Chutia chandbol, *S.*

Erect 6—12" high with rather flexuous leafy stems. Leaves almost grass-like 3—8" by .17—3". Flowers purplish, 1—3 on axillary and terminal bracteate peduncles, bracts like the leaves but small. Capsule oblong .5—8" long (only .25" according to *F.B.I.*), valves rounded, depressed along the median line and somewhat beaded opposite the seeds.

Ramnagar Hills, on gravel! Manbhum, *Camp.*! Fl. r.s. Fr. Oct.—Nov.

Corm globose, .5" diam. with a neck 1—2" long and covered with brown sheaths. Perianth .25—3" long with linear-subulate segments spreading and reflexed. Pedicels .5—2" long. Seeds about 16 in each cell in the larger capsules, subglobose, sometimes somewhat angled, .07" diam., falling with part of the placenta attached.

The flowers are said to yield a red dye.

15. ASPHODELUS, *L.*

Annual or perennial herbs with slender or fleshy root-fibres. Leaves all radical, linear, triquetrous or terete and fistular. Flowers white, racemose, solitary in the bracts, perianth marcescent, 6-partite, segments conniving into a tube below. Stamens 6, hypogynous; filaments dilated at the base and embracing the ovary, anthers versatile with a pit on the back into which the filament is inserted. Ovary 3-celled with filiform style and sub 3-lobed stigma. Ovules 2 collateral in each cell. Capsule usually 1-seeded, loculicidal. Seeds 3-quetrous, testa black appressed. Embryo nearly as long as the cartilaginous albumen.

1. *A. tenuifolius*, Cavan. Syn. *A. clavatus*, Roxb.

A rather weedy-looking annual with slender erect semi-terete fistular leaves 6—12" long by under 1" wide, and one or several erect terete often much fastigiate branched scapes sometimes 3 ft. high, bearing white rather scattered erect flowers about 25" long on clavate pedicels jointed below the middle. Bracts scarious, 1" long. Perianth segments with a brownish costa, filaments fusiform-tipped. Capsule globose, 15—17" diam. with deeply transversely wrinkled valves. Seeds 3-gonous, with 3—4 dorsal ridges and as many lateral pits.

In cultivated fields, Singbhum! Behar, 1000 ft. J.D.H.! Common in corn-fields in the United Provinces and extending into Bengal. Fl., Fr. May—June.

16. CHLOROPHYTUM, Ker.

Herbs with a short rhizome and often fascicled fleshy or tuberous roots, radical clustered often broad leaves, more rarely loriform or linear, and leafless simple or branched scapes. Flowers white, pedicelled, usually several in the axils of the bracts, densely or laxly racemed, sometimes sub-panicled. Bracts small or large. Perianth marcescent, not twisted, sometimes finally deciduous from the fruit, segments distinct, rotate 3—7-nerved. Stamens 6, hypogynous or very shortly adnate to the base of the petals, shorter than the perianth with filiform filaments usually dilated above the middle; anthers linear or oblong, erect, inserted by their base or dorsally by a small pit in the connective, introrse. Ovary sessile, 3-quetrous, 3-celled with filiform style and small stigma. Ovules 4—many in each cell. Fruit a coriaceous or fleshy capsule, truncate 3-lobed and acutely angled, loculicidally dehiscent. Seeds broad, more or less compressed, not angled,* with black testa. Embryo rather shorter than the cartilaginous albumen, often incurved.

A. Leaves 1—2.5" wide. Perianth white 3—6" long:—

Racemes continuous, often subpyramidal with short branches at base. Tepals oblong-lanceolate, mostly acute. Bracts far overtopping the buds

1. *arundinaceum*,

Racemes strict interrupted. Tepals elliptic rounded. Bracts mostly shorter than the buds

2. *tuberosum*.

B. Leaves linear under 5" wide. Perianth greenish-white under 25" long

3. *laxum*.1. *C. arundinaceum*, Baker. Jerenarak', S.; Bis-Kandri, H.

Rather a pretty herb when young with suberect lanceolate many-nerved leaves and erect dense-flowered racemes or contracted panicles of white star-like flowers 7—9" diam., the tepals oblong-lanceolate and usually acute, anthers as long or longer than the filaments, straight, green to yellow. Bracts usually long and overtopping the shortly pedicelled buds.

Monghyr, Ham.! Very common in Sal forests in all districts of Chota Nagpur ascending to the tops of the pats (3000 ft.)! Fl. March—July. Fr. c.s.

Stems stout truncate at base, with many long fibres at the ends of which are

* Hooker says "rugose." They may be in some species, but this is perhaps from herbarium specimens. The seeds of our species are certainly not rugose when fresh.

thick cylindrical tubers 1—1.5" long by .5—6" diam. greyish-white within. L. at first short with very broad amplexicaul base, often up to 15" by 2.5" while plant is in flower; ultimately the growing base becomes narrower so that the leaf may become oblanceolate. Scape 6" to 15", also elongating with age, very dense-flowered, raceme sometimes with strict erect branches at base and flowers 2—several in the axils of the lanceolate-acuminate bracts. Lower bracts 1" or more, or in some specimens short but 5—more-nerved, mostly green. Pedicels .15—2" jointed in the middle. Tepals .3—4" rarely .5", sometimes narrowly oblong and obtuse. Fil. .15—2". Style declinate.

Fruiting scape often 18" long. Capsules 1—3 at each node, .25—3" each way or .4" diam, retuse or truncate. Seeds 1—6 in each cell, .1" wide suborbicular compressed but somewhat cordate or retuse at the hilum with a small prominence in the recess, black, turgid, minutely tessellate or punctate, not at all rugose.

Opens in the morning and closes in the afternoon. This is the most common species in the hill forests of our area.

The flowers are eaten.

2. *C. tuberosum*, Baker. Syn. *Anthericum tuberosum*, Roxb.

A very pretty herb with broadly linear leaves and erect or nodding lax-flowered racemes 4—10" long of pure white flowers 1—1.3" diam., the tepals elliptic with rounded tips. Anthers yellow recurved usually shorter than their slender filaments. Bracts mostly shorter than the buds, which have slender pedicels.

Santal Parganas (Rajmahal Hills)! Open forest lands usually on the gneiss and below the laterite in the hills of Ranchi and Palamau! Fl. May—June. Fr. c.s.

A much more slender and graceful plant than the last and with larger and prettier flowers. Root-fibres soon swelling into long cylindrical tubers 2—5" long, but only about .3" diameter. L. .3—6" wide, widest a little above the base, and tapering to the acuminate tip, base sheathing. Panicle rarely with 1 or more slender upright branches. Fls. mostly in pairs .3—7" apart and raceme 2—5" long, often half expanded and reminding one of snowdrops. Bracts very slender, lowest attaining 1" with broad scarious base faintly 3-nerved, convolute above and linear setaceous. Pedicels slender, .5" articulate above the middle. Tepals .5—6" ell., ell.-oblong, or sometimes obovate. Fil. .2", slender, glabrous, anthers papillose. Capsule (unripe) as broad as long, cells 1-seeded.

It opens in the morning and continues more or less open until evening.

3. *C. laxum*, Br.

A small herb with distichous grass-like leaves and a very slender somewhat flexuose scape of small greenish-white flowers arranged in distant pairs in the axils of small membranous bracts.

In thin soil overlying rocks on the páts of Ranchi and Palamau! Fl. May—June. Roots ending at the distance of several inches in small tubers. L. 2—6" long linear acuminate slightly keeled, rather thin and shining, usually under .5" wide, Scape sometimes bifurcate and bracteate at the fork. Tepals scarcely .2" erect. Anthers green with yellow pollen, minute.

Opens only in bright sunshine and never seen widely expanded.

Anthericum variegatum, Hort. = *C. elatum*, R. Br.

An attractive small plant with a fascicle of fleshy roots and tufts of leaves 12—18" long lined with green and white. Inflorescence an ample panicle of branched racemes with distant clusters of small white flowers. Perianth .3—5". Common in verandahs and grass greenhouses. Native of S. Africa.

FAM. 146. HÆMODORACEÆ.

Perennial herbs, mostly growing under shade with usually radical, distichous, narrow leaves with parallel nerves. Flowers 2-sexual, regular, in scapose spikes, racemes or panicles. Perianth petaloid, persistent, segment free or more or less connate, 2-seriate, imbricate or induplicate-valvate. Stamens 6 inserted opposite the tepals, or 3 only inserted at the base of the *inner* tepals; anthers erect or versatile, 2-celled, rarely opening by pores. Ovary inferior, half-inferior or superior, 3-celled; with short 3-partite or entire style or sessile simple or 3-notched stigma. Ovules 1—many, axile, or with 1 ascending from the inner angle, anatropous or semianatropous. Fruit superior or inferior, capsular or indehiscent. Seeds various. Embryo small, partially enclosed in the fleshy albumen.

The family is an intermediate group with transitions from the Liliaceæ, in which family *Sansevieria* is here included (although it is placed in Hæmodoraceæ in the *Genera Plantarum*), to the Irideæ and Amaryllidaceæ in the genera with inferior ovary.

Peltosanthus with purple fls. and filaments connate in a ring closing the mouth of the perianth has been found by me under dense shade in the Duars, and will probably be found in Purneah and the Mals of Orissa.

FAM. 147. ROXBURGHACEÆ.**(Stemonaceæ)**

Herbs with short creeping or tuberous rhizome, erect or climbing, with petioled alternate opposite or verticillate lanceolar or cordate 3—many costate leaves with parallel transverse sec. n. Flowers regular, 2-sexual, on axillary peduncles. Perianth superior or half-superior of 2 2-merous whorls, tepals sub-similar, free or more or less connate. Stamens 4, inserted opposite to and on the base of the tepals or sub-hypogynous, anthers dorsifixed. Carpels 2, forming a 1-celled free or half-inferior ovary. Ovules 2 or more, erect from the base or pendulous from the top of the cell, anatropous. Fruit (where known) a 2-valved capsule. Seeds oblong with coriaceous testa, funicle more or less hairy. Embryo nearly as long as the albumen with its radical not far from the hilum.

1. STEMONA, Lour.

Root tuberous. L. lanceolar or ovate 3—9-costate. Flowers solitary or few racemose, rather large. Stamens subhypogynous, filaments very short, more or less connate in a ring, with linear erect anthers, connective produced in a very long linear-lanceolate appendage. Ovary free, compressed, with small sessile pointed stigma. Ovules 2 or more erect. Capsule compressed, few-seeded. Seeds erect, ovoid or oblong, terete, grooved, beaked, with thick testa.

1. *S. tuberosa*, Lour. Syn. *Roxburghia gloriosoides*, Jones.

A twiner with somewhat the foliage of a *Dioscorea* except for the secondary venation. Leaves ovate, cordate, caudate or shortly caudate,

5" by 3" to 10.5" by 5.8", with 7—11 primary nerves from the base of which 3—5 reach the tip, arcuate, with very fine close parallel secondary nerves. Petiole 2—3", somewhat thickened both ends. Flowers erect foetid, greenish with many parallel purple nerves, campanulate, 1.3—2" long, tepals lanceolate acuminate, .2—2.5" broad below. St. very large erect with stout red filaments deeply grooved in front with crenulate margins, anthers linear, inner layer of the cells produced into a subulate point, pollen between waxy and floury. Capsule 1.5", ovoid-oblong, 5—8-seeded.

Bengal, *J.D.H.* (without locality)! *Prain* (*Beng. Pl.*) records it from Orissa, probably on the strength of the Northern Circars locality, but there are no specimens from Orissa as now constituted. Fl. June.

FAM. 148. PONTEDERIACEÆ.

Aquatic herbs with erect or floating parallel-nerved leaves. Flowers 2-sexual, irregular in spikes or racemes from the uppermost leaf-sheath, with irregular sheathing bracts. Perianth unequally 6-partite, marcescent, blue or white. Stamens 1—6, inserted at the base of the perianth with erect or versatile anthers, one usually longer than the others. Ovary free, 3-celled, or 1-celled with 3 parietal placentæ, style slender, stigma sub-entire or lobed. Ovules 1—more on each placenta, anatropous. Fruit a membranous loculicidally 3-valved capsule. Seeds small with horny or floury albumen. Embryo cylindrical.

Tepals nearly free	1. <i>Monocharia</i> .
Tepals forming a distinct tube below	2. <i>Eichornia</i> .

2. MONOCHARIA, *Presl.*

Marsh herbs with short or creeping rootstock. Leaves radical, and solitary at the top of the emerged stem or branches. Flowers racemose or subumbellate campanulate with segments nearly free. Stamens 6, one larger with the filament toothed on one side, anthers basifixed, slit terminal at length elongating. Ovary 3-celled, many-ovuled.

Rootstock creeping. L. sagittate or hastate many-nerved	.. 1. <i>hastata</i> .
Rootstock short. L. linear to ovate, few-nerved	2. <i>vaginalis</i> .

1. *M. hastata*, *Solms.* Syn. *M. hastæfolia*, *Presl.*; *Pontederia hastata*, *L.*

A pretty marsh herb with the exserted leaf sagittate or hastate with the basal lobes often rounded, 6—7" long, 4—6" broad, acute or obtuse and many-nerved, petiole about half as long, its sheath dilated and embracing the short peduncle of the shortly racemed or subumbellate inflorescence. Flowers long-pedicelled bright blue, .75—1" diam., with one large blue stamen and 5 smaller yellow ones. Inflorescence reflexed after flowering and capsule enclosed in the persistent twisted perianth.

Slow streams and standing water, common! Probably in all districts. Fl. r.s. Perennial.

Rootstock creeping. Radical leaves on petioles 18—24" long, broad and sheathing at the base. Scape below the inflorescence 9—18". Pedicels .7—1". Larger sepal

obovate, smaller oblong. Perianth according to *F.B.I.* violet-blue dotted with red (I have not seen it so coloured). Filament spurred. Capsule subglobose or oblong, .25" diam.

2. *M. vaginalis*, Presl.

A smaller and less pretty plant than the last with short rootstock and usually narrow leaves, linear or lanceolate, more rarely ovate or ovate-cordate, sheaths embracing the scape for a considerable distance so that the stem sometimes appears leafy; blade 5-nerved only 2—4" long by 1—2" broad or in var. *plantaginea* linear to lanceolate, 2" by .2—.6", narrow cordate or base entire. Flowers blue with short pedicels reflexed after flowering, 6—12 subspicate or var. *plantaginea* as few as 2—3. Pedicels .75" or less.

In ditches, rice-fields, etc. Fl. r.s. Annual.

Rootstock very short, stem often flaccid with the leaves floating. Perianth and stamens much as in *hastata*. Capsule oblong.

2. EICHORNIA, Kunth.

Water plants rooting in mud and sometimes rhizomatous or free floating by means of the swollen vascular petioles. Flowers with a well-developed perianth-tube and somewhat irregular spreading limb or limb distinctly 2-lipped, segments 6. Stamens 6, declinate, irregularly inserted in the tube, upper included; anther oblong, dorsifixed near the base. Ovary sessile. Ovules very many in each cell. Capsule included in the marcescent perianth, ovoid, oblong or linear, very thin. Inflorescence sessile in the leaf-sheath or peduncled, simply racemose, rarely paniced.

An American and tropical African genus of which the following has become widely naturalized.

1. *E. crassipes*, Solms. Kajaropati, Or.; Water Hyacinth.

A very beautiful plant with sympodial rhizome creeping in mud and freely floating, the termination of each joint of the sympodium bearing a rosette of broadly spoon-shaped leaves with very turbinate swollen petioles and very numerous adventitious roots. From the centre of the rosette rises a sheathed scape 6—10" high of violet-blue flowers.

Frequent in Orissa. Fl. h.s. This plant now forms a *sud* on the Irawadi and other Burmese rivers, and can be seen drifted far out to sea.

FAM. 149. AMARYLLIDACEÆ.

Herbs, or large stout shrubs with short or elongate usually unbranched stem and a terminal crown of rigid leaves; stock bulbous tuberous or a corm or rhizome, rarely merely fibrous. Leaves usually radical or clustered at the apex of a caudex, sometimes shortly distichous, thick and fleshy or narrow with parallel venation, rarely plicate or broad or petioled. Flowers 2-sexual regular or somewhat zygomorphic, often showy, most often umbellate and with an involucre of one or more spathaceous bracts on the top of a naked spathe; sometimes umbel reduced to one flower, more rarely flowers cymose or paniced and then

sometimes panicle gigantic. Hypanthium sometimes produced into a beak above the ovary. Perianth often tubular at the base, tepals 2-seriate, usually both series similar and petaloid but sometimes different. Stamens 6 on the bases of the tepals, rarely epigynous, filaments mostly alternately longer and shorter, rarely connate at base, but frequently with stipular appendages or petaloid appendages which may become variously connate and form a staminal corona; in other cases the corona appears ligular in origin and the filaments arise from the inside of it. Anthers erect or versatile, extrorse or introrse. Ovary inferior, 3-celled. Style usually undivided, stigma subcapitate or 3-lobed. Ovules usually many and 2-seriate in each cell, rarely few. Fruit mostly loculicidal, very rarely baccate. Seeds numerous or few. Embryo small straight eccentric, enclosed in albumen.

I. Leaves clustered at the top of a more or less well-developed caudex or (*Polianthes*) rootstock pseudo-bulbous on a rhizome and then scape leafy at base. Scape simple or branched, flowers racemose on the rhachis or its branches or cymose on the branches:—

A. Very robust plants with large thick fleshy or coriaceous often spinose leaves on a stout erect thick caudex. Scape very large or gigantic:—

Perianth-tube usually short. St. exerted. Style filiform

Per.-tube hardly any. St. included, fil. and style swollen at the base or below middle

B. Herbaceous with tuberos or pseudo-bulbous rhizome. Fls. paired in each bract on a long raceme, bracts foliaceous below. Perianth-tube long dilated above.

II. Leaves all radical from a bulb, rarely a corm or slender rhizome. Scape leafless, never on a well-developed aerial caudex, sometimes appearing at a different time from the leaves:—

A. Leaves from a tunicate bulb, never plicate. Scape naked, bearing at the top 1 or more membranous involucre bracts and an umbel of usually showy flowers or a solitary fl.:—

1. Stamens not united by a membrane. Squamellæ rarely present around or between the stamens:—

a. Scape 1-fl. (or 1—5-fl. in *Hippeastrum*):—

i. Bract 1 (sometimes 2-fl. in *Zephyranthes*):—
Per.-tube 0. Squamellæ small. Fls. with leaves, large, zygomorphic

Per.-tube long. Squamellæ small or 0. Often fl. before leaves. Crocus-like fls.

ii. Invol. bracts 2 distinct. Fls. before leaves, large

b. Scape with usually many fls. in the umbel, often mixed with filiform bracts. Corona or squamellæ 0:—

i. Ovules many closely sessile or subimmersed in the fleshy placenta:—

Fls. sessile or nearly so. Per.-tube long, usually narrow

Fls. pedicelled, declinate, tube short, lobes oblong-lanceolate

ii. Ovules distinct from the placenta:—

†Ovules 2-seriate superposed, many. Fil. connate at base

1. *Agave*.

2. *Furcraea*.

Polianthes
(p. 1156).

Sprekelia
(p. 1156).

Zephyranthes
(p. 1156).

Hippeastrum
(p. 1156).

3. *Crinum*.

Amaryllis
(p. 1159).

Nerine (p. 1159).

- †† Ovules 2 or few in the middle of the cell:—
 Ovules 6. Fls. large with the leaves *Clivia* (p. 1159).
 Ovules 1—2 collateral. Fls. relatively small
 in dense umbels before the leaves *Hæmanthus*
 (p. 1159).
2. Stamens united into a cup by the corona:—
 a. Leaves broad, perianth lobes broad:—
 Ovules many, rarely 2—3 superposed. Tepals
 patent *Eucharis*
 (p. 1159).
 Ovules 2 collateral in the middle of the cell
 Tepals erecto-patent *Eurycles*
 (p. 1159).
- b. Leaves narrow. Perianth lobes narrow or fili-
 form:—
 Ovules many superposed 4. *Pancratium*.
 Ovules 2 ascending from the base 5. *Hymenocallis*.
- B. Leaves usually plicate and petioled, from a corm or
 slender tuberous rhizome. Scape very short, some-
 times subterranean. Fls. usually yellow, not large,
 solitary racemed or capitate:
 Hypanthium produced into a beak above the ovary.
 Stigmas erect appressed. Fruit indehiscent 6. *Curculigo*.
 Hypanthium not produced into a beak. Stigmas erect
 stout distinct or connate into an oblong mass. Frt.
 circumsciss 7. *Hypoxis*.

1. AGAVE, L.

Stout shrubby rhizomatous plants with a short aërial stem more or less concealed by the leaf-bases, and with thick fleshy spine-tipped and often spinosely toothed rigid leaves. Hypanthium produced into a short stout beak above the ovary. Perianth more or less funnel-shaped or campanulate with the tube short or very short, rarely elongated, lobes linear, erect or spreading. Stamens inserted at the base of the tepals and considerably longer than these with filaments filiform or flattened at the base, anthers large linear, fixed by the middle of the back. Ovary often fleshy 3-locular, style filiform above the short conical base. Ovules very numerous in each cell. Fruit an ovoid globose or cylindrical coriaceous erect beaked capsule, crowned at first by the sub-persistent perianth, loculicidally dehiscent at the apex. Seeds numerous, flattened, closely superposed with black testa.

The inflorescence varies much in the different sections and is either spicate with flowers sessile or shortly pedicelled, solitary in the bracts or 2 or more in each bract, or the inflorescence is paniced, the flowers closely aggregated in peduncled erect cymes on the spreading branches of a gigantic scape ("pole" of growers). The genus is entirely American.

The *Agaves* are usually propagated by bulbils which are often formed in place of or in addition to the fruits.

The following descriptions are mainly taken from "Notes on *Agave* and *Furcraea* in India," by J. R. Drummond and D. Prain (*Agricultural Dept. Bulletin*, No. 7; 1906).

I. Leaves over 3 ft. in length, in a lax rosette or tufted:—

A. Perianth segments not constricted towards the tip:—

1. L. broadest in the middle, tapering to both
 extremities:—

L. oblong-lanceolate, neck sharply constricted

1. *americana*.

- L. linear-oblong, neck not constricted 2. *vera-cruz*.
 2. Leaves linear-lanceolate, hardly widened in the middle. 3. *cantula*.
 B. Perianth segments narrowed from about the middle to a
 ligulate tip:—
 L. straight and narrow, often spineless 4. *sisalana*.
 II. Leaves never exceeding 3 ft., in a close globose rosette 5. *Wightii*.

1. *A. americana*, L.

Leaves very stout, commonly variegated yellow, sharply constricted into a neck just above the very swollen bases, margin distinctly sinuate and bearing the mostly reflexed spines on the eminences, apical spine 1–2" long.

It is a common ornamental plant in gardens throughout the province, and is said to be the species from which the Mexican drink "pulque" is prepared (from the scapes).

Trunk short stout usually hidden by the thick leaf bases. L. lanceolate, many in a lax rosette, sometimes rather glaucous, spreading at base, then ascending, and finally with tips often recurved, 4–6 ft. long and up to 1 ft. broad above the middle (the widest part). Marginal spines strong dark brown, margins becoming involute for about 3" from the tip and hardening, ultimately horny and forming the terminal slightly grooved dull brown 1–2"-long spine. Scape with panicle 15–25 ft. high, primary branches almost horizontal, fascicles of fls. crowded at the ends of subsidiary ascending branches. Ovary faintly sulcate, about equalling perianth or shorter. Tepals ovate lanceolate, tips obtuse, amber-coloured as are fil.; pollen orange; style faintly 3-lobed. Capsule bluntly 3-gonous or oblong-cylindrical, rather broader upwards.

2. *A. vera-cruz*, Miller. Syn. *A. cantula*, Beng. Pl.; Muraba, K., S. Murba, murga are common vernacular names for agaves, aloes, etc. Mordha is also given as a vern. name in the Notes.

A stout plant usually producing numerous shoots from the rhizome, which render it polycarpic. Leaves very deep green and glaucous, linear-oblong, 4–6 ft. long and attaining 10" in width, scarcely constricted above the base, margins not or only slightly sinuate, apical spine 5–1" long, dark brown.

Tirhut, in hedges, D. & P. More or less naturalized in Singbhum (e. g. near Anjedbera)! Hazaribagh, Daltonganj (Palamau), etc.! Balasore! Fl. Sept.—Dec.

Trunk short, hidden by the thick leaf bases. L. often rather concave at the widest part (just above the middle), early curving upwards and ends more or less recurved, sage-green, interval between spines 5" or less, rarely 75", marginal spines spreading or decurved, black or dark-coloured. Main branches of panicle 3-chotomous, curved or flattened. Fls. in pairs with a subsidiary bud laterally developed at a different level; tepals linear-lanceolate, pale amber tint, cup herbaceous, anthers 5" and more, much exerted, pollen dark yellow. Ovary smooth cylindrical longer than perianth, style very faintly lobed. Capsules rather turgid, oblong-cylindrical, tip rounded, seeds black, shining.

3. *A. cantula*, Roxb.

Leaves in a lax but even tuft from a short ascending rhizome, pale-green, older darker, sometimes glaucous, attaining 4 ft. or more, but usually only 2.25" broad, rarely over 3" at the widest part (just above the middle), apical spine usually acicular, 5–1" long, reddish or dark brown, marginal spines conspicuous falcate pointing forwards, 25" or

more and very sharp. Flowers 1—2 together, tepals 1.5", linear-oblong obtuse, greenish-yellow.

Tirhut, D. & P. Cultivated at Hazaribagh Jail, Wood. Cultivated at Sambalpur!

L. linear-lanceolate, very narrow, curving gradually outwards from the moderately thick base, or in weak specimens bent over almost from the base, upper surface more or less concave, sometimes trough-shaped in the lower portion, marginal prickles always ascending, pale brown or garnet-coloured, from a small light-coloured cushion. Scape with panicle 12—18 ft. high, inflorescence on flexuous rather slender branches, fascicles 1—2-fld. Ovary equal or shorter than perianth. Tepals bluntly linear-lanceolate, 1.5", or linear-oblong, greenish yellow, obtuse, free almost to their bases, 1.5" long, cup hardly any.

4. A. sisalana, Perrine. Sisal Hemp.

Rhizome sometimes ascending, hidden by the leaf-bases. Leaves closely tufted, not at all constricted above the moderately thick base, deep green, glaucous or not, up to 6 ft. in length and 10" in breadth, marginal prickles 0, or if present weak scattered and pale.

Introduced into Tirhut, Ranchi Jail, the Santal Parganas, etc., for the sake of its fibre. It is stated that a somewhat poor land of a loose stony nature is best suited to produce good fibre.

L. not forming a rosette, but closely tufted on the rhizome or on a very short ascending caudex completely hidden by their moderately thick bases, inner making a very sharp angle with the axis, the outer gradually receding, but still making less than a right angle, widest part just above the middle; terminal spine not channelled, glossy, purple or dark brown. Scapes with the panicle 15 ft. or more, fascicles of fls. rather crowded, ovary equal or shorter than perianth, slightly broadened upwards. Base of per. convex and somewhat dilated, limb suddenly contracted, segments narrowly ligulate, tip slightly hooded. Style long, stigma faintly lobed.

5. A. Wightii, Dr. & Prain. Syn. *A. vivipara*, Wight.

Leaves ensiform linear-lanceolate, very many, forming a stiff even rosette 3—5 ft. diam., pale green often tinged with ashy grey, base thin, broadly amplexicaul, attaining 3 ft. in length, but not usually more than 2.5" wide, flat or very slightly convex. Marginal prickles rather weak about .75" apart, spreading or erect, terminal spine about .5", pale, slightly decurrent.

Tirhut (Tarkaulia), D & P.

Trunk stout, usually conspicuous, ascending throughout or partly procumbent. L. sometimes attaining 3.5" in width at the middle (the widest part), marginal prickles usually consisting of a small brown cushion carrying a semi-transparent garnet-coloured spine which is often sharply recurved parallel to the leaf edge, but ends in a finely barbed hook which invariably points upwards. Scape 12—15 ft. high with the oblong-pyramidal panicle, main branches short 3-chotomous, fascicles rather crowded. Ovary nearly spindle-shaped, rather shorter than the perianth and constricted below it. Per. cup soon dividing into lanceolate segments, each ending in a narrowly ovate lanceolate limb which is slightly thickened at the obtuse tip and (in dried specs.) obscurely hooded, greenish yellow. Capsule brown, very broadly turbinate, 1.25—1.5" long, rostrate by the hardened bases of the tepals. Seeds opaque dull black.

2. FURCRAEA, Vent.

Habit of *Agave*, stem erect, often elongated and marked with the scars of fallen leaves. Leaves densely clustered, spinose-dentate or

entire. Perianth with scarcely any tubular portion, the tepals being free nearly or quite to the base and with the segments spreading and more or less ovate-oblong instead of linear. Stamens at the base of the tepals and shorter than these, erect, lower part of filament swollen, above shortly subulate. Ovary oblong 3-celled, contracted into a beak, style columnar swollen below the middle, prominently 3-angled. Ovules many in each cell, 2-seriate. Capsule ovoid or oblong, loculicidal.

1. *F. gigantea*, Vent. Mauritius Hemp.

A noble-looking plant when well grown with large vivid green leaves 6 ft. and more long, scarcely armed, and immense panicles of greenish pendulous flowers, attaining 30 ft. in height.

Frequent in gardens, though not, I believe, grown for its fibre.

Drummond and *Prain* state that there is a doubt about the name, and had not seen the flowers. *F. gigantea* according to *Baker* has a brown pungent point to the leaves, whereas in our plant it is green and scarcely pungent. The leaf of *Baker's* plant is described also as only $\frac{1}{4}$ th in. thick in the middle as against $\frac{5}{8}$ — $\frac{7}{8}$ th thick in our plant.

Scape with panicle 10—15 ft. high. Flowers pendent on slender pedicels and about 2" long. Hypanthium $\frac{7}{8}$ —1" long, rather slender, slightly pulvinate on the pedicel. Outer tepals narrowly elliptic 1.2" long by $\frac{1}{4}$ " broad, obtuse, inner elliptic subequal in length, $\frac{1}{6}$ " broad, all white and free to the base. Stamens appressed to but not adnate to the styler column, $\frac{1}{4}$ — $\frac{1}{2}$ " long, flattened throughout, oblong at base, then much dilated in middle and finally acuminate, bearing a stout oblong versatile anther $\frac{1}{2}$ " long. Styler column stout deeply 3-lobed for $\frac{1}{3}$ ", each lobe with a 2-lobulate cornice above which the column has a tapering beak $\frac{1}{4}$ " long bearing a sub-simple obscurely 3-lobed stigma perforate at the apex.

Polianthes tuberosa, L. The Tuberose.

A very beautiful plant, the scapes leafy below and 2—4 ft. high from a rhizome, with bulbous swellings. L. linear. Flowers white, very fragrant, funnel-shaped, the tube being expanded above and bearing suberect segments. Inflorescence racemose with two fls. in the axil of each bract.

Very common in gardens and verandahs.

Sprekelia formosissima, L. Jacobæa Lily.

A bulbous plant with a hollow scape bearing vertically on the top a single large crimson flower about 4—6" across. Tepals unequal, inner clawed, one broader than the others, which are recurved. Native of Mexico.

Zephyranthes spp. Zephyr-flower.

Beautiful crocus-like plants with narrow grass-like leaves usually appearing after the first flowers, but the flowering commencing in the h.s. also continues after the appearance of the leaves. Perianth more or less funnel-shaped, white, rose or yellow. Very commonly cultivated. The species are probably *carinata* and *rosea* with rose-coloured flowers, *candida* (or *tubispatha*?) with white and *flava* with yellow flowers.

Hippeastrum spp. Knight's Star-lily (sometimes called Amaryllis).

Beautiful flowering bulbs usually producing (as known in our area) the scapes in the h.s. before the leaves appear. Flowers large funnel-shaped 1—5 sheathed by 2 membranous bracts, inclined horizontally or downwards, somewhat zygomorphic with declinate stamens, brilliantly coloured. Stamens shorter than the perianth. L. linear. Frt. capsular, seeds many flat.

Very common in gardens. Natives of tropical America. The garden varieties are mostly hybrids. In its native state the genus has usually a number of flowers in the umbel.

3. CRINUM, L.

Stout bulbous herbs, sometimes with a considerable aërial stem. Leaves fleshy, elongate, lorate, ensiform or somewhat lanceolate. Flowers large in umbels subtended by 2 spathaceous bracts and with linear bracts to the flowers. Perianth funnel- or salver-shaped, straight or upcurved, with linear to oblong lobes and no corona. Stamens on the throat, erect spreading or declinate: anthers linear, dorsifixed, introrse, often curved. Ovary 3-celled with filiform style and minute stigma. Ovules few or many. Fruit large, subglobose, membranous or coriaceous, irregularly breaking up. Seeds few large rounded with thick testa and very copious albumen.

The following species are indigenous in our area; others may be found in gardens.

- A. Leafy stem not dying down annually. Fls. white, with the leaves:—
- | | |
|--|-----------------------|
| Erect, caulescent. Leaves 4—7" wide | 1. <i>asiaticum</i> . |
| Prostrate or aquatic or at least scape declinate. L. under 3" wide | 2. <i>defixum</i> . |
- B. Leaves dying down annually. Flowers before leaves are mature, very large, with tepals 1" broad, often rosy
- | | |
|--|------------------------|
| | 3. <i>latifolium</i> . |
|--|------------------------|

1. **C. asiaticum**, L. in part, not of *Roxb.* Syn. *C. toxicaria*, *Roxb.*; *Bara-kanur*, *Beng.*; *Arsa*, *Or.*; *Hathikanda*, *H.*

A very robust herb with large stout erect caudex up to 3 ft. high and 4" diam. Leaves oblong-lanceolate 3—4 ft. long. Scape 2 ft. strongly compressed. Flowers over 20 (up to 50, *Roxb.*) in the umbel, shortly pedicelled with a slender tube 2—2.7" long and linear spreading tepals 2" long. Fruits broadly ellipsoid about 1", few-seeded.

On the higher sandy ground fronting the sea, in the Cuttack deltaic jungles! Also apparently wild, but usually near villages in the Purneah jungles. Fl. at all seasons. Common in gardens. I have recorded from Purneah another large *Crinum*, apparently wild, but neither in flower nor fruit, and which I now think was probably young plants of this species.

Bulb not much wider than the rest of the stem. L. 5—7" wide in the middle, striate beneath. Flowers rather small for the size of the plant and perianth never rosy as in some other species. Pedicel and ovary together .7—1" long. St. spreading and recurved with white or pink filaments and brown versatile linear straight or curved anthers. Style erect pink exerted 1—1.5". Spathe bracts 2, lanceolate, 3.5"; inner bracts filiform. Seeds large rugose.

2. **C. defixum**, *Ker.* Syn. *C. ensifolium*, *F. B. I.*; *C. asiaticum* of *Roxb.*; *Sukh-darshan*, *Beng.*; *Kondai*, *Or.*; *The Ditch Crinum*.

A stout herb with the leaves erect in water, or spreading on the soil from a very broad amplexicaul base 1.25—2" wide, from which it gradually tapers to the tip, which is somewhat obtuse, length usually 12—18", but it is difficult to find mature perfect leaves as they are usually bitten off. Scape from the outer leaf-axils, 1—2.5 ft. long, compressed, .5—7" broad, ultimately declinate and resting on the water, soil or other herbage. Umbels 7—12-flid. with 2 spathaceous lanceolate or broadly lanceolate bracts with rounded tip, 2.5—3" long, greenish membranous, finally scarious; floral bracts filamentous with clavate tips. Perianth-tube 3.5—4" slightly exceeding the spreading white

linear or linear-lanceolate tepals, which are 3—4" by 4—5" when spread out, but they are somewhat conduplicate or incurved in nature, and partially enclose the bases of the rather shorter pink filaments. Anthers very slender, linear, 7—9" long, very slightly curved with yellow pollen, the anther appearing at first yellow and finally turning black. Fruit with membranous pericarp, globose, beaked with the long perianth tube, 1—2-seeded.

Along muddy banks of rivers and often immersed, throughout Chota Nagpur! Gangpur! Sambalpur! and also along the sea front in wet mud and sandy pools in Puri and Cuttack! in places where the plants must receive a considerable amount of salt. Fl. Aug.—Oct.

Fl. Aug.—Oct. Bulb 2.5—3" diam., globose or ovoid, terminating suddenly in a neck or when ovoid passing gradually into a very stout neck 2.5—4" long clothed with leaf-bases; the bulbs are frequently (always?) attached to a creeping rhizome. Leaves 12 or more on the bulb, often very concave or channeled above, margins hyaline and with sparse hyaline hairs especially towards the base. Perianth tube straight or somewhat curved, according to the inclination of the scape, tepals soon stellately spreading. The plant does not appear often to set seed, but large greenish bodies, plano-convex or doubly convex, may be found floating about in the water in the cold season which are apparently bulbils; they are 1.2—1.5" diam, and contain a clavate curved "embryo" of apparently homogeneous parenchyma with slightly green epidermis; the root end breaks through the outer tissues at any point. They are very similar to the seed-like bulbils found in the *Spider-lily* (*q.v.*).

Var. **ensifolium**, *Baker*. Syn. *Crinum ensifolium*, *Roxb.* (and in *F. B. I.*).

Baker includes *ensifolium* as a variety of *defixum*—I think correctly, unless it is merely a form. It only differs by the *ensiform* leaves tapering gradually from base to apex. Many plants occur in which it is doubtful whether they are referable to *defixum* or *ensifolium*.

3. C. latifolium, *L.* Syn. *Amaryllis latifolia*, *Willd.*; *Sikiyom-baha*, *S.*

A beautiful species flowering before the leaves are fully developed and bearing 8—10 large white inclined or drooping flowers more or less tinged with rose along the centre of the tepals, tube 4—5", lobes erect 3.5" oblanceolate and 1" broad, terminating in a sharp cusp and a curious reflexed villous appendage 2—2.5" long, from the inside of the cusp, very delicate and rose-hyaline. Stamens declinate included, about .75" long; anthers white, grey or black, usually curved into a semi-circle before dehiscence, linear-oblong. Style pink. Fruit 2—2.5" diam. with membranous epicarp striate with about 25 vertical lines.

In dry jungles, though often on the (high) banks of rivers. Singbhum! Manbhum, *Campbell!* Palamau! Hazaribagh (Tatijheria jungles)! Gangpur! Fls. May—June. The leaves appear in June and die down in the c.s.

Bulbs globose 5—5.5" diam. with a long stout neck 3—5". Leaves ultimately many, 30"—4 ft. long by 3—4.5" wide in the middle (whether or not the margins are denticulate in our plant as described by *Roxburgh* for his *latifolium* I am unfortunately unable to say as leaf-specimens have not been kept and this point was not noted. Such denticulate leaves however I have from an up-country specimen which otherwise appeared similar). Scape about 12" by 1" wide, compressed. Spathe-bracts 2, lanceolate, 2.7—3" long, sometimes tinged rose. Floral bracts linear, 3". Tube straight or slightly curved. Ovary sessile .75". Seeds about 12, large, but very variable in the same capsule, angular.

Roxburgh lays stress on the colour of the anthers, but unless there are 2 species in our area included by me here (which is unlikely), this appears to be of no importance, and a similar conclusion is reached in the case of *C. defixum*.

Amaryllis belladonna, L.

A beautiful plant, often, not always, flowering with the leaves. Flowers zygomorphic, soft rose-colour shading into white within, in an umbel with an involucre of 2 spathes. Ovules sunk in the placenta. Capsule 3-quetrous, seeds roundish.

Nerine spp. Guernsey Lily.

Usually grown in verandahs. Fls. not very large, in umbels with narrow perianth; segments recurved. Stamens swollen and connate at the base. Ovary small oblong.

Clivia nobilis, Lindl.

Less common. A stout plant flowering with the leaves. Perianth segments and stamens erect, orange red. Native of the Cape.

Hæmanthus Kalbreyerii.

A very handsome plant bearing before the leaves develop large globose umbels of very many rather small scarlet flowers with far-exserted stigmas. Bracts of the involucre coloured.

L. in a large tuft, oblong, closely tessellately nerved.

Usually grown in verandahs and grass greenhouses.

Eucharis grandiflora, Planch (better known as *E. amazonica, Lindl.*).

A very beautiful plant with a crown of ovate-lanceolate petioled leaves and scapes of usually 5—7 large pedicelled pure white firm, almost wax-like sweet-scented flowers 3" diam. with spreading broad perianth-segments. Tube widened in the throat and with a complete erect staminal cup undulate or 2-lobed between the stamens. Involucral bracts 2—3, floral narrow. Ovules many in each cell, 2-seriate superposed. Fruit 3-dymous, depressed globose. Seeds large.

Found in nearly every European plant-house or verandah. The leaves never completely die down.

In *E. candida, Planch*, there are only 2 ovules in the cells and the staminal membrane is interrupted except at the base. It is not common.

Eurycles amboinensis.

Habit similar, but foliage more handsome, flowers less so. L. large orbicular-cordate, petioled. Fls. several in the umbel. Perianth with slender tube and broad erecto-patent segments. Staminal-membrane with a broad toothed or lobed margin each side of the filament and cut almost to the base between. Ovules 2 collateral in each cell. Capsule globose.

Very common in gardens and plant-houses.

4. PANCRACTIUM, L.

Bulbous herbs with linear or lanceolate radical often 2-farious leaves. Flowers large umbelled or solitary on a solid scape, with 1—4 membranous spathes and linear hyaline bracts. Perianth funnel-shaped with long or short tube and narrow lobes. Stamens on the throat of the perianth, filaments united by a toothed or lobed membranous corona, anthers dorsifixed. Style filiform, stigma small. Ovules many superposed in each cell. Capsule large, subglobose 3-angled, loculicidal. Seeds angled with lax black testa.

A. Scape longer than the flowers. Perianth-tube 3—4", longer than the segments:—

Spathes 1—2. Fls. 3—5, filaments (free part) longer than the 10-toothed (each sinus 2-fid or 2-toothed) corona

Spathes 3—4. Fl. 2—3. Filaments about equal to the crose corona

1. *triflorum.*

2. *biflorum.*

- B. Scape much shorter than the flowers. Perianth-tube 4.5—6". Sinuses of corona oblong 2-fid *longiflorum*,
 C. Perianth tube 1—2":— (p. 1160).
 Spathes 1—2. Fls. 2—4, filaments somewhat longer than the corona, sinuses 2-toothed 3. *verecundum*.

The species seem to be rather confused, and to make the plants referred to here clearer I have compared them with the following unpublished drawings at Kew as follows:—

No. 1049 (*Roxb. Ic. ined.*). I take to be *P. verecundum*, *Ait.*, but not *P. verecundum* of *F.B.I.*, where *Hooker* says the tube is 3—4" long. *Aiton* says that it is scarcely 2".

No. 1960 (*Roxb. Ic. ined.*). This is undoubtedly *Roxburgh's P. biflorum*.

No. 556 (author?). I take this to be *P. triflorum*, *Roxb.*

I believe (from noting specimens growing) that both relative and absolute lengths of scape and perianth-tube are really characters of little taxonomic value. In this case *longiflora* may pass into *triflorum*.

1. *P. triflorum*, *Roxb.* (not of *F. B. I.*). Gering-ba, *K.*

A very pretty plant with scapes from 2—4" to 12—18" above ground, bearing 3—5 flowers subtended by 1—2 (usually 2) membranous spathes. Tube slender, 3—4" long, tepals rather shorter, 2.5—3" or only 2" by .2", outer linear-oblongate, inner rather shorter and broader, all mucronate or apiculate, pure white. Corona about $\frac{3}{4}$ ths. as long as perianth or 1.5" long, obconic, including the 3—5" long teeth, of which there are 2 between each stamen, free part of filament 4—7" long with yellow slightly curved anthers .2" long. Fruit globose ellipsoid, ribbed, on a pedicel 3—4" long.

Frequent in the forests. Singbhum, esp. Porahat! Ranchi! Palamau! Fl. April—May.

Bulb globose 2" diam., with or without a neck according to the state of the brown sheaths forming it, usually neck 2" long. L. about 6" by .5" at time of flowering. Spathes .7—1.5". Per.-tube scarcely angled, outer tepals more acute than the inner. Teeth triangular, acuminate or acute.

It would be a very ornamental garden plant, but that the flowers only open at evening and fade on the following day. The scent is faint and not very pleasant.

2. *P. biflorum*, *Roxb.*

This is distinguished from *P. verecundum* by the 3—4-merous spathe, and flowers 2—3 only in which the corona between the filaments is not prominently toothed but crose. The corona is broadly funnel-shaped and scarcely one-third the length of the corolla.

It was recorded by me in the *For. Fl. Ch. Nagpur* and in *Bengal Plants*, but there are no specimens in the *Calcutta Herbarium*, or in my herbarium nearer than Raipur (in the Central Provinces), and I suspect that specimens of *P. verecundum* were taken for it.

Roxburgh's drawing (*ined.* No. 1960) agrees well with his description. It shows 2 fls. only and 4 spathes. Perianth tube 4" and long linear segments 3.5", corona 1.3" crose between the stamens. Leaves over 1" broad. *Baker* says *P. biflorum*, *Ait.* = *P. verecundum*, *Ait.*, but *Aiton* says that the lobes of the corolla in *verecundum* are 2-fid and in other respects the two are very different.

P. longiflorum, *Roxb.*, is frequent in the Central Provinces and is likely to be found on the western plateaux of our area. It has a globose or bottle-shaped bulb 2.5" diam. with a long neck. The scape is remarkably short, only 1—2" high, whereas the perianth-tube of the 1—2 flowers is 4.5—6" in length of a pale green colour. Tepals white lanceolate 2—2.5". Corona 1—1.5" long including the oblong 2-horned segment between each filament, free part of filament about as long. Fl. June.

3. *P. verecundum*, *Ait.* Syn. *P. triflorum*, *F. B. I.*; Ku-kanda, *Or.*

Scapes 1—2 from the bulb, 6—10" long (without the flowers), 3—4-fld., spathes oblong-lanceolate 1". Pedicels 3-gonous, 3—4" long. Perianth-tube slender for about 7—1" only, then funnel-shaped for about 7", segments lanceolate recurved slightly shorter than the tube, 25—3" broad. Corona campanulate with 2 large equal acute lobes between each filament.

Kalahandi! Fl. May.

Bulb globose 1.5" diam. with a stout neck. *Aiton* describes the leaves as about 1.5 ft. long and .5" broad, and the drawing quoted above, which I take to be this species, shows the plant flowering with 7—8 leaves 6—12" long by .5—6" broad, but the leaves in my specimen were quite young. Corona in my specimen 6—7" long and free part of filaments about 1", anthers pale yellow, 3".

5. HYMENOCALLIS, *Salisb.*

Bulbous herbs with leaves lorate or somewhat broad and contracted into a petiole. Scape solid with 2 involucreal spathe-bracts, inner floral bracts linear. Perianth sub-hypocrateriform with the long tube little or not widened at the apex, tepals linear. Stamens inserted at the top of the tube, filaments united at the base by a cup-like corona, anthers linear dorsifixed, often curved. Ovary 3-celled, with 1—2 erect basal ovules in each cell or some of the loculi empty. Seed often 1 only perfect, large, green with a hard spongy testa.

An American genus described here on account of the wide-spread cultivation of the following species (which I have never yet seen assigned to its proper genus in Calcutta horticultural collections), and on account of its interesting bulbils. There is a closely allied species, *H. littoralis*, *Salisb.*, which is very similar.

1. *H. tenuiflora*, *Herb.* (App. 44, 1821.) The Spider-lily.

A stout bulbous herb with ovoid bulb 2—2.5" diam. not much wider than the stout neck which is covered with leaf-sheaths. Leaves 15—27" by 1.5", 2-farious, lorate with acute or subacute apex and amplexicaul base, obtusely keeled. Flowers with the leaves, 7—20, delicately-scented, on flattened fleshy scapes longer than the leaves. Spathes 2, broadly-lanceolate. Perianth-tube 5—6" slender, tepals spreading linear cuspidate, 4—4.5" by 2—3". Coronal cup 1.5—2" diam. white membranous, 1—1.5" long, free part of filament 2", anthers linear straight 1" long with deep orange pollen.

In gardens and verandahs everywhere and grows freely near water in the Calcutta gardens. It never set seed with me, but produces together with the ovaries irregularly spindle-shaped or obovoid green bulbils 1—1.25" long. These have no distinct skin, but at the time of germination is differentiated a central core occupying the long axis and from which grows a hypocotyl-like structure emerging near the original point of attachment of the bulbil, and acts generally like an embryo, first forming roots and then an erect stem, while the other blunt end remains in the bulbil, to which it is attached by a small-celled absorptive tissue.

6. CURCULIGO, *Gaertn.*

Herbs with a tuberous rootstock or corm and radical or shortly cauline plicate and lanceolate or linear smooth leaves. Flowers usually yellow

and unisexual, spicate racemed or subcapitate on a scape sometimes lateral to the leafy stem or tuft. Hypanthium produced above the ovary as a solid stipes bearing the rotate perianth, or perianth subsessile (in sec. *Molinicra*). Stamens at base of perianth, short, anthers erect dorsifixed, sometimes cohering. Fruit indehiscent, usually more or less beaked. Seeds subglobose or ellipsoid with crustaceous shining testa beaked at the hilum.

Hypanthium markedly beaked. Flowers few small

1. *orchioïdes*.

Hypanthium not or scarcely beaked. Fls. capitate, many

2. *recurvata*.

1. *C. orchioïdes*, Gaertn. Turam, K.; Musor, Musal-khand, Kalamusali, H.; Tallura, Beng.; Kua-kenda, Or.

A small herbaceous plant, first conspicuous after the jungle fires by its small bright-yellow flowers .5—.75" diam. which rise just a little above the soil, accompanied by or shortly followed by the new leafy shoot with plicate linear-lanceolate leaves 6" by 1" attaining 18" by 1.5" with age, tapering into an elongating petiole. The flowering scape is sheathed with long lanceolate hairy bracts and is for the most part beneath the surface of the soil, above which the flower-buds are thrust by the elongating beak of the hypanthium. Capsule sessile in the axil of a bract, .6—.7" long with short beak and villous tip, rather fleshy, with spongy septa, 1—4-seeded.

Common in the forests throughout Central and Southern areas, especially on clay soils! Fl. May—Aug. Leaves appear in June and die down the following cold season. Perennial.

Rootstock of long tubers about the thickness of a lead-pencil, and base of stem with many fibrous sheaths. L. with microscopic white dots above and with sparse silky hairs when young, tapering imperceptibly into a petiole which may attain 6" at the end of the rainy season. Rhachis of spike quite hidden by the sheathing bracts. Flowers few, opening in succession, or 2—3 together, only the lowest usually hermaphrodite or female. Tepals dimorphic, male .25—.3", herm. .5—.7" long, oblong, hairy without. Anthers green or yellow. Stigma linear 3-cleft. Seeds black shining with faint wavy ridges and a peculiar hooked white strophiole or beak .12" long.

The roots are used in medicine and are considered alternative and tonic. The Kols boil and eat them. The powdered root is also used for bruises by the Oriyas.

2. *C. recurvata*, Dryand.

A stout herb with plicate palm-like leaves 2—3 ft. long by 3—7.5" broad and long petioles 1—2 ft. long. Flowers yellow .6—.75" diam. in dense cernuous heads 2—4" diam. on compressed villous scapes 3—9" long. Ovary turbinate scarcely beaked. Fruit globose hairy, .25—.3" diam.

In shady marshy localities in the forests. Singbhum! Puri! Fl. April-June.

Rootstock tuberous. Leaves curved, lanceolate or broadly lanceolate, petiole channelled and hairy below. Bracts ovate-lanceolate acuminate, more or less hairy. Pedicels .25". Filaments very short and anthers cohering. Stigma minute. Seeds black, deeply closely grooved.

A handsome plant with the leaves like those of young palms, and, like many others with plaited surface, displaying a continuous wavy motion even when there appears to be no breeze.

7. HYPOXIS, L.

Herbs with rootstock tuberous or a corm. Leaves radical narrow, strongly nerved but scarcely plicate. Flowers solitary, racemed or umbellate with rotate 6-partite persistent perianth not raised on a beak of the hypanthium. Stamens 6 on the base of the perianth, with short filaments and erect dorsifixed anthers. Ovary 3-celled; style short columnar, stigmas 3, erect stout distinct or connate. Ovules 2-seriate. Fruit capsular, 3-valved or circumsciss below the top. Seeds subglobose, testa crustaceous shining, beaked at the hilum.

1. *H. aurea*, Lour.

A small plant not usually more than 2—4" high at the time of flowering, from a short erect sub-cormose rootstock about 7" long with fibrous or not very fleshy roots. Leaves very narrow, about the length of the scape when in flower by about 1" broad, elongating to 6" by 2" when mature, scarcely plicate, usually recurved, nearly glabrous or rather hairy. Scapes 2—3" long with 1—2 linear bracts, sparsely hairy with spreading hairs above, sometimes 2-flowered, bracts 3—4" long in fruit. Fls. 2-sexual, with the ovary quite evident below the perianth (which is not the case in *Curculigo*, with which the species is sometimes confounded). Tepals 25" long ell.-lanceolate or ell-oblong, anthers 66" and filaments nearly twice as long. Capsule cylindric-turbinate 5" long, crowned by the marcescent perianth.

Amongst grass in open jungle but not common. In the hills. Páts of Chota Nagpur! Parasnath! Fl., Fr. June—July.

The leaves sometimes attain 12" long, but have not been seen so large in our area. *Curculigo orchioides* has sometimes been called "*H. aurea*, male fl." in herbaria. It can easily be distinguished by general habit as well as by the anthers being 12" long and twice as long as the filaments.

FAM. 150. TACCACEÆ.

Tuberous-rooted herbs with large radical petioled, sometimes deeply partite, lobed or pinnatifid leaves. Flowers densely umbellate at the apex of a leafless scape, outer spathe bracts broad, often 4, herbaceous or coloured forming an involucre to the umbel, inner filiform, overtopping the flowers and drooping. Perianth petaloid or sub-herbaceous, broadly urceolate or globosely campanulate with a short broad tube often constricted at the mouth, lobes 6, 2-seriate, subequal or the inner broader, all conniving or outer or all very spreading. Stamens 6, inserted on the tube or base of the segments, included, filaments very short with dilated base or furnished on each side with a swollen fleshy process dilated above into an incurved interiorly 2-ribbed or 2-horned cowl with the anthers sessile inside the cowl, ovate or oblong with 2 longitudinally dehiscing cells. Ovary inferior 1-locular with 3 parietal placentæ, style short columnar, often 3-angled, included, with 3 broad, often petaloid stigmas reflexed umbrella-like over the style. Ovules many, anatropous or almost amphitropous. Fruit baccate or rarely at last 3-valved, often 3-angled or 6-costate.

1. TACCA, *Forst.*

Characters of the family:—Fruit baccate or indehiscent.

1. *T. pinnatifida*, *Forst.* Dhai, K., S.

An interesting herb with a large globose tuber and long-petioled succulent leaves which remind one of some aroids, being 3-partite with each segment, very coarsely unequally pinnatifidly lobed. Flowers broadly campanulate, greenish, 3—5" long on pedicels 5—1" long. Inner filiform bracts 3—4.5" long. Fruit about 1", 6-ribbed, yellow.

Among rocks in the forest and more open jungles. Singbhum! Manbhum! Hazaribagh! Fl. Aug.—Sept.

Tuber said to attain 12" diam. in cultivation. L. 1—2 ft. wide, lower part of the segments with a sinuous, lobed or toothed wing and more or less oblong leaflets, upper part usually terminating in three very much larger elliptic or ovate leaflets 3—6" long with often a wavy or lobed margin. Involucral bracts 4—12, subequal or very unequal and variously linear, oblong or acuminate or with 2-lobed tip, sometimes striped purple.

The tuber, which is acrid and poisonous when fresh, yields a nutritious starch when macerated and repeatedly washed with cold water.

FAM. 151. BROMELIACEÆ.

Herbs, rarely shrubby or arboreous, very often epiphytic, mostly with clustered radical rosettes of leaves spirally arranged with the base amplexicaul and sheathing, often with white glistening scales and margins very frequently prickly. Inflorescence generally from the centre of the rosette, terminal, sessile or peduncled in spikes, racemes, or panicles often densely aggregated in heads, and frequently with brilliantly coloured bracts on the axis below the flowers and passing into the proper bracts of the flowers, sometimes also a crown of bracts or foliage leaves (as in the Pine-apple) terminates the axis. Flowers 2-sexual, usually regular. Perianth separable into 3-merous calyx and corolla, calyx persistent herbaceous or coriaceous, sepals free or connate, petals free or united into a tube below or entirely connate, frequently with 2 scales at the base within. Stamens 6, free or connate or one whorl free, the other connate, anthers introrse. Ovary inferior, half inferior or superior, if superior then sessile by a very broad base, 3-celled, style with 3 stigmas or stigmatose branches. Ovules in each cell indefinite, usually very many, anatropous. Fruit baccate, sometimes combined below into a syncarp, and often crowned by the calyx, sometimes dehiscent. Embryo small, at the lower end of the seed near the hilum in a small pocket or fork of the mealy albumen.

The family is exclusively tropical and sub-tropical American, but several beautiful plants of the family are common in India in grass conservatories, verandahs, etc., a few like *Pitcairnia* with long leaves white scaly on the undersurface are large plants and grow in the open.

Ananas sativus, *Lindl.*, is the Pine-apple, which is largely grown and is semi-naturalized in some of the warmer moister districts. There are also ornamental-leaved pine-apples in gardens.

FAM. 152. DIOSCOREACEÆ.

Climbing, very rarely erect, herbs or suffruticose, usually from a tuberous rootstock or hard rhizome with fleshy and tuberous roots. Leaves opposite or alternate entire lobed or digitately 3—5-foliolate, palmnerved and with reticulate venation between; petiole often angular and twisted at the base. Flowers regular, small or minute, usually diœcious, rarely hermaphrodite, spicate, racemed or paniced. Perianth usually shortly tubular below, tepals 2-seriate, male and female sub-similar. Male with stamens inserted at the base of the perianth or on the lobes, 3 or 6 or 3 perfect and 3 staminodes, anthers small, pistilode sometimes present. Female with 3, 6 or 0 staminodes, ovary inferior, 3-quetrous and 3-celled (in our genera), styles 3 very short or stigmas sub-sessile entire or 2-fid, recurved. Ovules 2 superposed in each cell, pendulous, anatropous or subamphitropous. Fruit a 3-valved capsule or baccate. Seeds flat or globose with small embryo included in hard albumen.

1. DIOSCOREA, L. Yam.

Our only genus. Fls. 1-sexual, usually diœcious. Capsule coriaceous, 3-winged with 2 flattened or winged seeds in each cell.

Although the wild Yams are of great importance as food to the forest tribes, very little reliance can usually be placed on the vernacular names, and I have heard the male and female plant of the same species called by different names by the same man. In general the deeper rooted yams are the most esculent and considerable labour is involved in digging up the tubers.

KEY (A.) TO MALE PLANTS.

I. I. all simple. Stamens 6 fertile. Fls. sessile:—

A. Sepals broad. Male spikes usually stiffly spreading 2" or less in length:—

1. Spikes not zigzag. Stems not alate nor continuously angled (they are sometimes ridged below nodes):—

a. Whole plant, esp. inflorescence and shoots pubescent or tomentose:—

Bulbiferous. L. all opposite, broadly ovate or orbicular. Epipetalous stamens inserted on the petals.

1. *anguina*.

b. Glabrous, or inflorescence slightly pubescent (rarely shoots somewhat pubescent in *oppositifolia*):—

i. Buds somewhat oblong-globose with very broad, often pulvinate base, not prominently 3-lobed. Base of petioles not persistent nor greatly hardened:—

† L. not glaucous. Inflorescence sweet-smelling usually somewhat pubescent. L. all opp. more or less oblong. Tubers direct from rootstock. Unarmed

2. *oppositifolia*.

†† L. glaucous beneath, opp. and alternate. Inflor. glabrous. Tubers at the ends of long fleshy fibres:—

Usually prickly below. L. pale glaucous beneath, nerves not scalariform. Fls. sickly smelling. Petals fleshy

3. *glabra*.

- Unarmed. L. dark blue-green beneath with scalariform sec. n. Petals thin. Bulbils narrow or clavate, muricate.
- ii. Buds globose, prominently 3-lobed. Base of petioles persistent hardening thickening and often spinous:—
- L. rather coriaceous, orbicular, not glaucous, sec. n. not, or obscurely scalariform. Stamens central. Tubers fascicled direct from thickened base of stem.
2. Spikes zigzag with a globose flower at each angle. Stems regularly angled or alate:—
- Wild species, slender stems angled not alate, unarmed, L. lanceolate to ovate. Bulbils 0. Climbs left to right.
- Cultivated only. Stout stems 4-angled or 4—more alate. L. very broadly ovate. Bulbils large.
- B. Sepals linear. Petals linear tapering. Spikes slender drooping 1—3.5" or more long. Rhizome or tuber large and subglobose. Bulbils frequent, tubercled.
- II. Leaves some or all digitately 3—5-foliolate. Fls. often shortly pedicelled:—
- A. Stamens 6 perfect. L. 3-foliolate, lfts. large (3—12")
- B. Stamens 3 perfect and 3 staminodes. L. 3—5-foliolate or upper simple:—
- L. softly white-tomentose beneath. Staminodes and st. nearly as long as sepals
- L. glabrous to tomentose, but not softly tomentose. Staminodes and stamens much shorter than sepals
- C. Doubtful species. L. 6-foliolate. Lfts. large
4. *belophylla*.
5. *aculeata*.
(Wallichii).
6. *Hamiltonii*.
7. *alata*.
8. *bulbifera*.
9. *dæmona*.
10. *tomentosa*.
11. *pentaphylla*.
Kalka-pershadi
(p. 1174).

KEY (B.) TO FEMALE PLANTS.

- I. Leaves all simple. Spp. 1—8:—
- A. Sepals not linear. Capsule broader than long, seeds winged all round (not seen in *alata*). Spp. 1—7:—
1. Stems not alate nor regularly angled. Fem. perianth not attaining .06" (exc. *aculeata* which reaches .07"):—
- a. Whole plant more or less pubescent or tomentose. Ovary tomentose, capsule not quite glabrous
- b. Whole plant glabrous, or somewhat pubescent in oppositifolia and then ovary nearly glabrous:—
- i. Petiole-bases not persistent and woody or aculeate. L. mostly opposite. Fem. per. under .06":—
- † Rhachis of inflor. often pubescent. L. not glaucous. Ovary and young capsule with short thick beak below the perianth
- †† Leaves glaucous beneath. All parts glabrous:—
- Usually prickly below. L. pale glaucous beneath. Perianth quite sessile on the ovary and capsule
- Unarmed. L. dark-glaucous beneath. Ovary and capsule with a short thick beak
- ii. Petiole bases persistent enlarged and often aculeate. L. mostly alternate. Perianth quite sessile attaining .07" in young fruit
1. *anguina*.
2. *oppositifolia*.
3. *glabra*.
4. *belophylla*.
5. *aculeata*.
(Wallichii).

2. Stems alate or regularly angled. Fem. perianth attaining 1—12" in length, thick and fleshy or coriaceous in young fruit. Ovary and young capsule beaked:—
 Stems regularly angled. L. lanceolate to ovate. Sepals dorsally keeled
 Stems sharply 4-angular or 4-more alate. L. broadly ovate. Sepals convex dorsally
- B. Sepals linear. Capsule oblong. Seeds not winged all round
- II. Leaves 3 digitately 3—5-foliolate, at least the lower. Capsules oblong:—
 A. L. 3-foliolate, lfts. with 3—5 costæ, large, attaining 12" by 6". Capsule 1.5—1.7" long by .7—8"
 B. L. 3—5-rarely 6-foliolate or uppermost sometimes simple, lfts. mostly 1-costate, not exceeding 5.5" by 2.5". Capsule not exceeding 1" by .5":—
 L. softly white tomentose beneath, upper often 2-foliolate or entire simple. Capsule cuneately oblong
 L. glabrous to tomentose beneath, not as soft and dense as in *tomentosa*. Capsule not all cuneate
- C. Doubtful species. L. 6-foliolate. Lfts. 1-costate, up to 6" by nearly 3"
6. *Hamiltonii*.
 7. *alata*.
 8. *bulbifera*.
 9. *dæmona*.
 10. *tomentosa*.
 11. *pentaphylla*.
Kalka-pershadi
 (p. 1174).

1. *D. anguina*, Roxb. Kukuri, M.; Kukui-sanga, Ho.; Kosa-alu, Or.

Stems unarmed from a small woody rootstock, developing immediately from its base a straight cylindrical tuber 18"—2 ft. long which is often palmately branched. Branches densely pubescent. Leaves all opposite, pubescent even when old on the nerves beneath, very broadly ovate-cordate or suborbicular, upper ovate. Male spikes pubescent .5—1.25" long dense-fld., closely 1—3-nate on axillary or shortly paniced rhachises 2—4" long or sometimes falsely whorled on long branches 12" and more long, buds globose pubescent or tomentose. Fem. spikes densely pubescent, 2—4" long, solitary axillary or mostly in short axillary panicles 4—6" in length. Capsules .5" long, excluding the short obconic base, and 1" broad, depressed (subcordate) top and bottom, margin of wings thickened, rarely quite glabrous.

Common in the moister forests. Purneah! Chota Nagpur, all districts! Angul! Fl. Sept.—Nov. Fr. Dec.—Jan.

An easily recognized Yam from its pubescence and its potato-like axillary bulbils, which are 1—2" across with a thin greenish or grey brown skin, without conspicuous eyes. The tuber is about .5" diam. at the neck and 1—1.5" in middle covered with rootlets. Leaves attain 10" by 10", acute or acuminate, with a characteristic silvery appearance beneath, costæ 7 with obliquely transverse sec. n., raised beneath, upper surface dull. Petiole half to as long as blade, pubescent. M. sep. .05" long, broadly oblong or ovate-oblong obtuse, petals shorter ovate membranous, slightly imbricate in bud, glabrous or somewhat pubescent outside, membranous or somewhat mesially thickened. St. 6 perfect, small, adnate to tepals to half way up. Bract ovate acuminate reaching nearly half-way up flower, deflexed, base somewhat decurrent on rhachis, pubescent. Fem. ovary densely pubescent or tomentose, not at all beaked, perianth .05" long, both sepals and petals much thickened at base with age, bearing a staminode on the callus, sep. broadly ovate rounded, petals rather smaller. Seed winged all round.

The tubers are eaten and are usually said to be good, but they are sometimes reported to have an offensive smell when cooked. The bulbils are also eaten.

2. *D. oppositifolia*, L. Pani-alu, Or.

Stems often purplish when young, swollen at the nodes, unarmed, sparingly puberulous, fleshy below and ending a few inches below the surface in a very small stock and a fascicle of tubers, ends of shoots pubescent. Leaves green and shining both sides, oblong to broadly elliptic, all opposite, cuspidate, mostly 2.5–3" long with translucent dashes, 3–5-nerved, of which 3 unite in the tip, glabrous or nearly so, margin thinly cartilaginous. Petiole half as long as blade or much less. Male spikes dense .5–.8" long, subverticillate, false whorls on an axillary rhachis 1–4" long or on a long terminal pendulous rhachis 1 ft. or more long which is thinly pubescent or hairy. Fls. sweet-scented .08–.09" yellow-green herbaceous on a very broad base on the deflexed suborbicular but cuspidate bract, sepals orbicular oblong concave 2.2 mm. or .06" long with pale margins, glabrous, petals obovate or obovate-oblong slightly fleshy 2 mm. or about $\frac{1}{4}$ ths as long as sepals only. St. 6 erect. Pistillode of three green glands. Fem. with short beak between ovary and perianth. Capsule .9" long, 1.5" wide, depressed base and apex.

Angul, in the moister forests! Fl. Aug.—Sept. Fr. Nov.

In the Cent. Provinces List I united this with *D. glabra* on account of the difficulty in separating them in the herbarium from published descriptions, but I have now found the true *oppositifolia*, and the two species are absolutely distinct and easily recognized in the forest. The most conspicuous marks of *oppositifolia* in the forest are the very broad, sometimes almost parallel-sided and sub-truncate leaves with sudden cusp, never glaucous beneath and not cordate (for very slightly so in lowest leaves). Petioles relatively shorter than in *glabra*. Shoots and fem. rhachis pubescent (sometimes glabrous according to *F. B. I.*). Smell of flowers different.

Tubers proceeding direct from the fleshy end of the rootstock, several, with a narrow neck, then fusiform downwards, 6–8" long. Cusp of leaves glandular when young; in addition to the 5 nerves there is sometimes a weak basal pair close to margin, base rounded or very obtuse, not cordate. Bract of male flower with the base decurrent on the rhachis both sides of the flower, under one-third as long as the flower and bracteole nearly as long as bract. Petals not as thick as in *glabra*. Anthers 6 perfect oblong, fil. as long as anther. Female rhachis solitary often 8" long, or panicle; perianth .03–.04" long. Seeds orbicular with large wing all round.

The tubers are eaten, and are among the most esteemed of the yams among the Oriyas.

3. *D. glabra*, Roxb. Syn. *D. nummularia*, Lamk. in part; Unursanga, K.; Ato-sang, alto-sang, Baiyang, S.; Konta-alu, Or.

Stem quite glabrous with numerous prickles below or in rich moist soil sometimes quite unarmed, often .3" diam., swollen at the nodes and with swollen petiole-bases (but these not much hardened nor aculeate as in *Wallichii*), base woody passing into a nodose woody perennial superficial rhizome 3–4" diam. from which proceed long stout fibres ending in the tubers. Leaves glaucous or nearly white beneath, opposite or lower alternate, variously shaped but lower, sometimes all, deeply cordate at the base or sagittate, those towards the inflorescence with the base generally straight or rounded, costæ 5–7 or even 9 on very broad leaves. Petiole long, from half as long to as long as the blade. Male spikes dense or lax, .5–1.25" long, opposite or

verticillate on axillary rhachides 1—3·5" long or in long terminal more or less leafless panicles, rhachis always quite glabrous. Flowers subglobose or oblong 1·5 mm. long, sep. ovate-oblong obtuse, gibbous at the base, petals obovate or oblanceolate, very thick. Stamens 6 perfect. Pistillode very minute. Fem. rhachis quite glabrous. Capsule '6—8" long including the obconic base, 1—1·3" wide, depressed at the apex.

One of the commonest of the yams in our area. Most frequent in open forest. Purneah! Gaya! Santal Parganas! All districts of Chota Nagpur, especially at about 2000 ft. though frequent also in the valleys of Saranda! Jaspur and Kochang, Wood! Puri! Angul, common! Kalahandi! No doubt therefore in all districts. Fl. Sept.—Nov. Fr. Nov.—March. Old male flowers may also be frequently found in a dry state as late as March and at this season the leaves turn yellow and fall.

The tubers are at the ends of long fleshy and stringy fibres which are 2 ft. long or even 3—4 ft. long; they are 5—12" by 1—2" in some cases; in others I have found them 1—2·5 ft. long by 2—3" diam. more or less cylindrical, frequently curved. L. exceptionally suborbicular 7" by 6" or subsagittate 8·5" by 3·5", usually cuspidate, most commonly ovate and cordate, 5—9-nerved, sec. n. not scalariform between the costæ (as in *belophylla*), apex acuminate or cuspidate. Petiole half to as long as the blade or in very long leaves only one-third as long. Male spikes finally whorled direct on the main axis, the leaves of which gradually become smaller and bractiform. When in full flower with a strong rather unpleasant odour. Buds oblong. Base of the perianth-tube very broad and pulvinate on the upper side. Bracteole much shorter than the lanceolate acuminate bract which is about half as long as perianth, base of bract not decurrent on rhachis each side of the flower. Fem. perianth quite sessile on ovary, '04" long. Seeds winged all round.

No bulbils appear to be formed on this species.

There are two forms, one with much smaller laxer flowers than the others.

The tubers are largely eaten, but are not among the best of the yams. The Santals say that they are too sticky when boiled.

4. *D. belophylla*, Vaight. Syn. *D. glabra*, F.B.I. (in part); Durisanga, Hasa-sanga, K.; Muttur-sang, S. (also San-kanda); Tanga-
alu, Khond.; Geti or dura-sanga, Kharw.; Korondi-*alu*, Or.;
Kunda-*alu*, Tara-kanda (in Angul); Malara (in Khurda).

Stems quite smooth, enlarged at the base into a small rhizome, bearing tubers at the ends of long fleshy fibres as in *D. glabra*. Leaves opposite and alternate, sap-green and dull above, glaucous beneath, both shape and size variable but usually ovate and deeply cordate with well-marked close sub-parallel cross-nervules between the costæ beneath. Male spikes '75—2" long, lax-flowered, not whorled but unilaterally 2—3-nate on the rhachis, usually branched and frequently copiously paniced, the panicles axillary 4—6" long, more rarely on long slender leafless branches. Flowers broadly oblong, base of perianth very broad and sessile, sep. nearly free oblong obtuse dotted and with scarious margins, pet. ell.-oblong nearly as long. Fem. with cylindrical beak between ovary and perianth. Capsule 1" long by 1·5" broad, often with the wings inclined upwards so that it is deeply cordate or retuse above, but not at base, sometimes apex truncate (except for the short beak).

Rocky valley forests, less common on the ridges and slopes. Singbhum! Palamau! Hazaribagh (also on Parasnath)! Puri! Angul! Narsingpur!
Sambalpur! Fl. Sept.—Nov. Fr. Jan.—March.

Woody rootstock .5—1" diam. From this proceed the fleshy fibres which end in tubers 3—12" long and up to 1.8" diam. with grey skin and slender rootlets, roughly turbinate or cylindrical but often irregular in shape and flattened by wedging themselves between rocks. Bulbils linear or linear clavate, brown, somewhat muricate with incipient roots. L. sometimes attain 12", as variable in shape as those of *D. glabra*, but even those on the flowering branches nearly always more or less cordate at base, costæ often 9, and secondary nerves distinctly scalariform, although some of them may be forked one end; cusp or acumen frequently curved. Petiole long slender, nearly always thickened and ridged or sub-alate in the upper portion by the decurrent costæ of the blade, base thickened and sometimes curled round a support. Fls. .06" long or rather less. Bract very short ovate cuspidate appearing deflexed and base decurrent upwards on the rhachis forming a shallow trough in which the bracteole and flower sit, apex not reaching half-way up the flower; petals much rounded, not thickened, sometimes 2-ridged within. St. on a short column about $\frac{1}{3}$ ths as long as petals, filaments rather longer than the 6 perfect broadly oblong anthers. Pistillode 3-gonous at top. Fem. spikes usually 1—3 in each axil, 3—5" long with angular rhachis, glabrous, ovary long-beaked. Per. up to .05" long, sep. broadly ovate rounded, not keeled; pet. obovate nearly as long.

The most highly prized of our forest yams. I have found it excellent and very floury when cooked. But it is often impossible to obtain from being wedged in the fissures of rocks.

5. *D. Wallichii*, H. f. Syn. *D. aculeata*, L.; Kulu, Tungam-sanga, K.; Tunga-alu, Pita-alu, Or.

Stems very stout and woody, often thorny below and characterized by the hard thick bases of the articulate petioles which (the bases) are also frequently thorny. Tubers attached directly to the base of the stem without the intervention of long fibres or roots. Leaves all alternate or some opposite, rather coriaceous and shiny or dull, large, suborbicular or broadly ovate with a large broad basal sinus, usually cuspidate or caudate, nerves between the costæ rarely somewhat scalariform, petioles long. Male spikes .5—1" long, rather lax, 2—3-nate on the branches of a compound panicle 1.5—4" long. Fl.-buds subglobose and 3-lobed, sometimes puberulous, fls. subglobose .04—0.05" long and broad or sometimes broader when open, base broad adnate to base of bracteole. Fem. spikes paniced on an abbreviated lateral branch, often very short 1—2.5" long, sometimes 10" long, rhachis often sharply ridged, but not regularly angled as in *Hamiltonii*, ovary and fruit not at all beaked under the perianth. Ripe capsule .6—0.7" long excluding the .1" obconic base, 1.2—1.5" broad, depressed at the apex.

Singhbum, esp. in the Valley forests and on northern slopes, frequent! Hazari-bagh! Puri! Angul! Fl. Oct.—Nov. Fr. Dec.—Feb.

Tubers numerous fascicled 2—3 ft. long and 1—3" diam. Young leaves shining, older shining or dull, sec. n. scarcely visible beneath and not continuous from one costa to the next, scarcely raised and reticulate, or sometimes sub-scalariform; costæ usually 9 of which lowest often forked, 3—5 reach the apex; translucent dots and dashes are visible by transmitted light; underside of blade somewhat paler than upper, but not glaucous. Petiole often as long as the blade, subterete, flattened on upper side near the apex, but not ridged with the decurrent leaf-nerves (though it sometimes appear ridged or striate when dry). Rhachis of panicles sometimes flattened. Bracts ovate half as long as the sepals or less, deflexed and base somewhat adnate and decurrent on the rhachis under the flower, bracteole subequal. M. sepals broadly oblong, slightly tapering to the rounded apex, concave; petals suborbicular little shorter; anthers large broad, as long as fil. Fem. sep. broadly ovate up to .07", rather thick, pet. obovate nearly as long,

very thick, each with a small staminode in a depression near the centre. Young fruit pyriform in outline. Seeds winged all round, wing much dotted.

The tubers are eaten in the rainy season. They are said to require a large number of successive boilings to remove the acrid principle.

6. *D. Hamiltonii*, Hook. f. Bri-kanda, *Ho.*; Barujharia, *M.*; Piskasang, *S.*

A climber with distinctly angled, sometimes subalate, and often twisted unarmed stems. Leaves closely resembling those of *D. belophylla*, but less blue-green, and when dry the cross-nervules are less scalariform, being joined up into sub-isodiametric arcoles by other equally strong nervules, opposite or sub-opposite, lanceolate, ovate or deltoid or ovate-lanceolate with deeply cordate or sagittate base with rounded auricles, 4—7.5" by 2—4.5", uppermost smaller and narrower. Male inflorescence very characteristic, the spikes which are .5—75" long having a markedly zigzag rhachis with a flower at each angle, spikes mostly ternate (1—4-nate) or subverticillate on long slender angled branches 6—15" long. Fem. spikes axillary 1.5—9" long, fls. much larger than in *belophylla* (at equal stages of development),* sepals very thick crescentic, concave inside and with a very thick keel outside, attaining 1" in length, petals thick oblong only $\frac{1}{2}$ — $\frac{3}{4}$ as long. Capsules very large 1" long (excluding the short obconic base) and up to 1.6" broad with distinctly margined wings.

In the forests, but rather local and locally abundant. Saitba Forest, Singbhum Ranchi, Horhap forest, common (also Hundrughagh, *Wood*, and without precise locality, *Clarke!*)! Manbbum, *Campbell!* Hazaribagh, on Parasnath, *Prain, Clarke!* Santal Parganas. very common about Siliguri, Narjanj. Korcho Hill, etc.! Fl. Sept.—Oct. Fr. Dec.

From descriptions of the Kols the tubers resemble those of *D. belophylla*, but I have not personally dug them up. Bulbils 0. L. 7—9-nerved as in *belophylla*, with 5 reaching the apex and decurrent on petiole as in that species, apex suddenly acuminate or gradually tapering to a very acute tip; between the nerves are numerous translucent dashes. Petiole about half blade or as long, similar to that of *D. belophylla*. Male fl. yellow, .05" long, sep. ovate-oblong rounded concave, obscurely keeled, pet. smaller oblong, not thick; st. about half as long, 6 perfect.

Hooker in *F.B.I.* says "Capsule longer than broad, seeds laterally winged." This is not the case in my plant, which has capsules (in dried specimens) up to 1.75" broad and only 1.1" long, including the obconic pedicelliform base; moreover the seed (although the nucleus is somewhat eccentric and with one part, as is usual, narrowed to the point of attachment) is clearly winged all round. The ripe capsules are in fact the broadest of any of our species. My ♂ and ♀ specimens have been carefully matched in the field.

It climbs from left to right.

7. *D. alata*, L. Merom-tuar sanga, *K.*; Sang, *S.*; Kham-alu, *Beng., Or.*

A very stout twiner with large tubers proceeding direct from the base of the stem which has sometimes scattered prickles below and on the petiole-bases, is compressed or strongly 4-angled at the base and 4—many-winged above. Leaves mostly opposite, glabrous, lower very broadly ovate cordate with a very broad sinus, often 8 by 6" and suddenly cuspidate, 9-costate with lowest costa forked, transverse

*The female perianth in both species continues to increase in size in young fruit.

sec. n. sub-scalariform; upper leaves smaller and narrower, those on the flowering branches often lanceolate 3" by 1.2" or less, acuminate, 5-costate of which 3 reach apex, always somewhat cordate at base. Male spikes with zigzag winged rhachis 4—7" long, 2—3-nate or sub-verticillate on axillary branches, one flower at each angle of the spike as in *Hamiltonii*. Fls. subglobose, .05", sep. ell.-oblong rounded and concave .05" long, pet. little shorter obovate, st. 6 perfect short, in central column around small pistillode. Fem. spikes 4—8" long axillary solitary sometimes forming large brachiate panicles by suppression of upper leaves, young fruit shortly stoutly beaked and wings with thickened margins, sep. attain .12" long, thick concave boat-shaped but sharply convex rather than keeled outside, concave within, petals broadly obovate or subquadrate, very thick and fleshy.

This is the commonly cultivated yam of Chota Nagpur, and apparently occurs all over the province, but flowers have only been collected in Chota Nagpur, and I have not seen the ripe capsules. Fl. (and unripe capsules) Oct.—Dec. Not known wild.

It appears very close to *Hamiltonii* and chiefly distinguishable by the much stouter, often armed strongly angled or winged stems, larger broader coarser leaves and winged rhachis of male spikes. In my specimens the female has broad lamellate staminodes at base of petals, much more conspicuous than those of *Hamiltonii*, but I have examined too few specimens to make this a key character.

Prain (in *Bengal Plants*) gives several varieties, but these are from the shape and colour of the tubers only. Our plant has usually large irregularly clavate tubers with a narrow neck at the stem, white within and pinkish outside, and comes apparently under the variety *rubella* (syn. *D. rubella*, *Roxb.*) to which the Bengali name *Guramiya-alu* is given.

D. alata bears large geminate bulbils not seen in *Hamiltonii*, often many on special branches, mostly oblong brown with a tessellated or longitudinally cracked corky surface; they attain 3" by 1—2".

8. *D. bulbifera*, L. Syn. *D. sativa*, L.; *Pisika*, *Ho.*; *Harad-bo*, *M.*; *Bengo-nari*, *S.*; *Pita-alu*, *Or.*

Stems smooth, sometimes sub-alate, from a large brown subglobose rhizome covered with roots and prominent eyes not bearing other tubers. Leaves alternate, rarely opp., suborbicular or broadly ovate, abruptly caudate and usually deeply cordate. Male flowers green or purple in numerous long very slender axillary and paniced spikes 1—3.5" long, sepals and petals linear. Fem. spikes slender, drooping, several fasciated at each axil, sepals and petals as in male. Capsule broadly oblong .75" by .4—5", reflexed.

Common. Purneah! Santal Parg! Throughout Chota Nagpur! Bonai, Cooper! Angul! No doubt throughout the province. Fl. Aug.—Sept. Fr. Nov.

A very distinct species. Bulbils common, axillary, roundish, brown with prominent numerous uniformly distributed tubercle-like eyes exactly like the rhizome on a small scale. Stem sometimes with 10—15 small crisped wings (var. *crispata*, *Prain*, syn. *D. crispata*, *Roxb.*). L. often 10" long and broad, sometimes more, smaller upwards, always alternate where I have noted them, sometimes opposite according to *F.B.I.*, costæ 7—11, with very distinct scalariform cross-nervules, sinus usually very wide, sometimes shallow. Petiole as long as or usually much shorter than blade. Male buds ovoid, fls. .06—1" long or more, variable, petals narrower than the sepals, more tapering. St. very small, 6 perfect, not $\frac{1}{4}$ th as long as petals. Bract half to $\frac{3}{4}$ ths as long as flower with filiform acumen. Seeds with an oblong wing above.

. The rhizomes are said to be very acrid, but sometimes eaten in times of famine after much preparation. They lie quite close to the surface.

9. *D. dæmona*, Roxb. Kolo, S.; Taina, Ghatw.; Baichandi (in Cent. Prov.).

A strong twiner with stems often .25" diam. with few small weak prickles, young tomentose. Leaves large 3-foliolate, long-petioled, lfts. of lower leaves often 8" by 4", and attaining 12" by 6", central one elliptic or obovate suddenly acuminate 3-5-costate, or those on the flowering branches only 2.5" by 1.4" with rounded suddenly apiculate apex, lateral leaflets very oblique; petiolules of lower lfts. .5-1.75" pubescent. Male fls. in very dense short-oblong spikes .25-3" long in long narrow axillary pubescent panicles 6-8" long. Fem. spikes usually 2-nate, simple pubescent or tomentose, 8-12" long. Capsule large oblong 1.5-1.75" long and .7-1" broad.

Purneah! Santal Parg! Hazaribagh (Koderma Forest)! Manbhum, Camp! Angul! Sambalpur! Probably in all the damper forests. Fl. June-July. Fr. Aug.-Sept.

Tuber subglobose or irregular, up to 12" diam., marked with eyes and covered with root-fibres. Petioles of lower leaves 6-12", those on the branchlets exceeding the leaflets. L. more or less permanently pubescent on the nerves. M. pedicels of spikes pubescent; bracts under the fls. very small, orbicular with broad base, concave, pubescent, .05-.06" diam. Petals oblong-obovate incurved, .04-.05" long, and about twice as long as the rounded membranous sepals. Anthers 6 perfect, minute, globose-oblong, filaments hardly any. Fem. bracts lanceolate .1-1.2" long. Ovary tomentose oblong .15" rapidly enlarging.

According to Roxburgh the root is dreadfully nauseous even after boiling, and according to the Gonds it is sometimes eaten after frequent washings, while it is also said to be made up into sweetmeats in the Central Provinces (possibly through confusion with *pentaphylla*?).

10. *D. tomentosa*, Heyne.

Stems and leaves beneath with a matted tomentum and leaves thinly tomentose or hairy above. Leaflets 3 or 5-6, central obovate or elliptic, shortly cuspidate or shortly caudate, 2.5-4.5" long, lateral very gibbous at the base, sec. n. 2-3 each side. Petioles up to 4", petiolules .1". Inflorescence white-tomentose. Bracts .06" long. Male fls. .06" on pedicels .02-.04" long in paniced usually ternate spikes .7-1" long. Female racemes sometimes simple up to 8" long or with branches 3-5" long. Capsules at first tomentose, finally glabrous, somewhat cuneately oblong .8" by .4" or sometimes $\frac{3}{4}$ ths as broad as long.

Angul, Laccl

The stems are more or less prickly and hairy. Upper leaves sometimes 2-foliolate, 2-3-lobed or entire. It is doubtful whether this species is more than a variety of *D. pentaphylla*, but it is chiefly South Indian.

11. *D. pentaphylla*, L. Baiom-sanga, Itulad-sanga, K.; Hascor, M.; Khania kanda, Kharw.; Karba, Koraba-ahu, Or.; Kanta-ahu, Beng.

A much more slender climber than *D. dæmona*, more or less prickly below, with 3-5-foliolate leaves, glabrous or pubescent beneath. Leaflets of lower leaves attain 5.5" by 2-2.5", rarely larger, centre ones obovate

or elliptic suddenly cuspidate or acuminate, cuneate towards base, 1-costate only, lateral leaflets sometimes 3-costate, but the lateral costæ from the midrib. Male spikes 4—1.5" long, 1—2-nate in long axillary racemes and sometimes terminally paniced, or the axillary racemes sometimes branched. Female spikes long and solitary or 2-nate rarely paniced, 2—4". Capsule large oblong 1" by .5" deflexed.

Frequent. Purneah, *Ham.*! Monghyr, *Ham.* (*Wall*, No. 5098). Ranchi, especially above 2000 ft.! Palamau! Hazaribagh (Koderma Forest)! Singbhum! Angul! Fl. r.s.—c.s. Fr. c.s.—h.s. Probably in all districts.

There are probably two distinct species included under this name. One has elongate obpyriform bulbils, the other with larger roundish corky and tessellate bulbils; this latter is much more pubescent or hairy than the former; but as the bulbils are not attached in the herbarium, I cannot with certainty correlate their form with other characters. *Prain* and *Burkill* (*Journ. of Asiatic Soc.*) have recorded two varieties according as the plant is silvery-grey with tuber white and soft (var. *Linnsæi*) or rusty red with root puce-coloured and stringy (var. *Rumphii*), but they do not give the shape of the bulbils in these two varieties, nor have I seen any description of other characters.

The tubers are oblong or clavate, proceeding direct from the base of the aerial stem and thickening downwards. The following very distinct varieties occur in our area:—

Var. communis, *Burkill*, m.s. ?

Prickly. Lfts. mostly 5-foliolate or 3—5-foliolate, up to 4—5" by 2" mostly suddenly cuspidate, blade thinly hairy, but petiolules densely closely rusty-pubescent. Male fl. shortly pedicelled above the bract, bracts rather large, the bract and bracteole together deltoid in outline with very broad partly amplexicaul base .08" wide, .06—07" long, pubescent, sepals .04" long pubescent, petals subequal more oblong, pistillode far exceeding the stamens. Fem. spikes 2—3" in flower, sometimes paniced, 5" excluding the slender peduncle in fruit; bracts .08" long, lanceolate, ovary .15" densely tomentose, sepals .08". Fruit .7" by .35" to 1" by .5".

Ranchi! Singbhum!

Var. cyathiformis,

Leaves mostly or all 3-foliolate, lateral relatively much broader than in last variety, semi-ovate, central broadly elliptic, less suddenly acuminate, sparsely hairy. Pedicels .03" long below the bract, flower quite sessile in the bract and bracteole which are glabrous and form a nearly complete cupule round the flower, both orbicular concave, bract with a minute almost filiform sudden cusp. Sep. triangular or lanceolate, petals more ovate, both thickened below and glabrous or nearly so. Stamens longer than the pistillode.

The bulbils are yet small and globose. The racemes laxer than in first variety. Ranchi! Angul!

The tubers of *D. pentaphylla* are eaten but that of our second variety is said not to be very good.

D. Kalka-pershadi, *Burkill* (in *Kew Herb.*), is, I think, a form of *D. pentaphylla* with 6 very large leaflets attaining 5" by nearly 3" and with 8 sec. nerves. *D. pentaphylla* has, however, leaflets often as large, and up to 8 sec. nerves in such larger leaflets. The tubers are short cylindrical up to 1 ft. long, densely covered with roots and the stems sparingly prickly. It is apparently considered to be a hybrid between *pentaphylla* and *tomentosa*, but does not appear to me to have anything to do with *tomentosa* (except in so far as *pentaphylla* passes into that species).

Ranchi (Biru), *Cardon*!

FAM. 153. BURMANNIACEÆ.

Herbs with linear, chiefly radical leaves or leaves reduced to scales. Flowers regular, rarely zygomorphic, 2-sexual, spicate or racemed and unilateral, sometimes solitary on the rhachis, more usually sympodially spicate or racemose on the branches of forked cymes. Perianth adnate to the ovary and produced above it into a persistent 6-, rarely 3-lobed gamophyllous often angled tube, lobes valvate. Anthers 3 or 6, 2-celled, sessile on the perianth. Ovary inferior 3-celled or 1-celled with 3 parietal placentas; style 1, short, stigmas various. Ovules many, small, anatropous, with 2 integuments. Fruit capsular, sometimes with transverse or irregular dehiscence. Seeds minute, testa reticulate, often produced. Albumen few-celled only. Embryo very minute.

1. BURMANNIA, L.

Annual herbs, leaves often inconspicuous. Flowers solitary or few or more on the branches of a forked cyme. Perianth tube winged or angled, 3-lobed. Petals smaller or 0. Anthers 3, sessile or subsessile, cells short separated by a broad connective, dorsally crested, dehiscence transverse. Ovary 3-celled, style 3-lobed.

1. *B. coelestis*, Don.

A very pretty little plant with erect very slender or filiform strict stems nearly leafless except towards the base, 2—12" high, terminating in a solitary flower, or 2—5 flowers in luxuriant specimens. Flowers cobalt blue 3—5" long, oblong-elliptic or almost orbicular in outline, prominently winged.

In wet grassy places. Purneah, common! Ranchi, 2000—3000 ft. Singbhum, usually above 1000 ft. Hazaribagh (Giridih), Clarke! Behar and Tirhut, *Bengal Plants*. Probably in all districts. Fl., Fr. c.s.

Leaves usually clustered near the root, 2—7", lanceolate or subulate with a filiform tip, cauline few usually narrower. Bracts similar to the leaves.

FAM. 154. IRIDACEÆ.

Herbs, often with rhizomatous tuberous or bulbous rootstocks and usually narrow distichous or equitant leaves. Flowers 2-sexual in terminal 1—many-flowered inflorescence, 2-bracteate, regular or zygomorphic. Perianth superior, with 2 different or usually similar and petaloid, 3-merous whorls usually with long or short tube at base, tepals imbricating. Stamens always 3 (belonging to the outer whorl of the normal Liliiflorous type), free or connate, epigynous or adnate to the outer perianth whorl, anthers often narrow, basifixed, extrorse. Ovary 3-celled. Style-branches usually branched or divided above, rarely simple, frequently more or less petaloid or expanded. Ovules many, 2-seriate axile anatropous. Fruit a 3-gonous, 3-celled, loculicidal capsule. Seeds many, roundish or angled by pressure, with thick or thin testa. Embryo immersed in the albumen, short, cylindrical.

There are no wild species in our area, but several beautiful garden or verandah plants are commonly cultivated, such as *Cipura*, *Freesia*, etc., and the following is included in the *F.B.I.*

1. **BELAMCANDA**, *Adans.*

1. **B. chinensis**, *Leman.* Syn. *Pardanthus chinensis*, *Ker.*; Leopard-flower.

A free-growing plant with iris-like equitant leaves from a creeping rootstock. Flowers tawny-red or orange-red, black or scarlet-spotted, in a branched spathaceous panicle about 2—2.5 ft. high, regular with very short perianth-tube and oblong spreading subequal segments. Stamens inserted at the base of the perianth, filaments filiform. Ovary obovoid, tips of style-arms reniform. Capsule obovoid, membranous.

Very common in gardens in all districts! Fl. r.s. Native of China, and doubtfully wild in the Lower Himalayas.

SERIES.—SCITAMINEÆ.

FAM. 155. MUSACEÆ.

Large or gigantic herbs with a short or long pseudostem formed of the stout convolute leaf-sheaths often from a rhizome, or small trees with a true stem marked with leaf-scars. Leaf blade very large, pinnate-veined, petioled above the sheath. Flowers zygomorphic, often large but inconspicuous, or sometimes showy, the inflorescence (of simple or compound spikes) often very conspicuous by large brilliantly coloured bracts and spathes. Outer and inner perianth segments usually petaloid, free or variously united. Fertile stamens 5, very rarely 6, the posterior usually replaced by a staminode, anthers linear 2-celled. Ovary inferior 3-celled. Style free often 3—6-lobed. Ovules 1—many in each cell. Fruit baccate or capsular. Seeds, often arilled, with straight embryo in a mealy perisperm.

The flowers are sometimes functionally 1-sexual. In the male the ovary is almost entirely converted into a nectary. Glands occur in the ovarian septa as in the Marantaceæ.

- | | |
|---|---------------------|
| I. Leaves spirally arranged. Sepals connate and also adnate to the corolla. Stem of convolute sheaths | 1. <i>Musa.</i> |
| II. Leaves 2-farious. Sepals free. True stem often present:— | |
| Petals free | 2. <i>Ravenala.</i> |
| Two lateral petals connate | <i>Strelitzia</i> |
| | (p. 1178.) |

1. **MUSA**, *L.* Banana; Plantain.

Large or gigantic rhizomatous (in our species) herbs, often arboreous in form with a stem composed of the convolute leaf-sheaths. Leaves very large, spirally arranged and forming a compact crown, lateral nerves spreading. Flowers mostly 1-sexual, not brightly coloured, in the axils of large, usually coloured, closely imbricate spiral bracts of a stout spike which arises from the rhizome and is pushed up through the

centre of the pseudostem until it emerges from the top; flowers at the base of the spike usually female or 2-sexual, top of spike sometimes ending in a cone of flowerless bracts. Sepals and 2 of the petals usually connate into a 3—5-cleft or -toothed tube, posterior petal free and usually much shorter than the rest. Stamens 5 fertile (6 in *M. ensete* an African species), the 6th obsolete or a staminode. Ovary 3-celled with many ovules and seeds in the wild plants (often suppressed in cultivated fruits). Fruit baccate, elongate, crowned with the remains of the flower.

Spike decurved in flower, bracts ovate purple, very many
Spike erect in flower. Bracts oblong, a bright rose, few

1. *sapientum*.
2. *ornata*.

1. *M. sapientum*, L. Khela, Vern.

Pseudostem 8—15 ft. with oblong leaves 4—6 ft. long. Spike soon decurved and finally drooping, 3 ft. or more long with very large ovate deep red or dull purplish, more or less pruinose bracts, lower 6—8" long and deciduous, upper often forming a club. Lower bracts with numerous 2-seriate female or hermaphrodite greenish or yellowish flowers about 1.5" long, above these the bracts contain male flowers only or the terminal ones are empty. Connate part of perianth 5-toothed, free petal about half as long. Fruit oblong, 3-gonous in the wild form, about 3" long with very astringent scanty flesh and numerous black or brownish black rugose seeds.

Wild in deep rocky ravines in Singbhum and in the Rajmahal Hills! On northern slopes of Parasnath! Ravines in Angul! The locality, provided it is damp, is a good deal determined by its inaccessibility to wild elephants. Fl. March—July. Fr. r.s. and c.s.

There are very numerous varieties in cultivation and the best of these have no trace of seeds. They are sometimes divided into *M. sapientum* proper, the banana, of which the fruit is edible uncooked, and *M. paradisiaca*, L., the plantain, of which the fruit is only eaten cooked, and is larger than in *sapientum*. They are increased by separating the rhizome with its new shoots. The old stems die after flowering.

2. *M. ornata*, Roxb. Syn. *M. rosacea*, F. B. I.

A stout herb 3—5 ft. high with leaves about 4.5 ft. by 1 ft. and petiole 1—2 ft. Spike perfectly erect 15—18" from the base of the linear rose-coloured spathe, the tip of which is foliaceous; bracts bright rose-colour or pink, oblong-lanc. to ovate-oblong, 3—5" long, only the lowest 4—5 fertile and each bearing 3—4 flowers. Fruits 2—4 in a cluster, trapezoidal in section.

A very beautiful plant growing in deep black mud alongside sluggish streams in the wildest Singbhum valleys! Fl. May—July. The plant is said to be cultivated for ornament and the F.B.I. says that the spike droops in the cultivated form (!).

Rhizome producing new shoots as in the common plantain. Rhachis of the inflorescence quite glabrous in our plant (but I have found a very similar-looking *Musa* in Upper Burmah, in which the rhachis is densely pubescent and fls. 5—8 in each bract). Perianth 1.5", greenish below, yellow upwards, 5-toothed, free petal as long, colourless.

2. RAVENALA, *Adans.*

Stems often tall and slender, bearing a terminal crown of large long-petioled, markedly distichous leaves, spreading like a fan. Flowers large in short axillary racemes from the axils of large distichous cymbiform bracts. Sepals 3 free similar. Petals 3 free, 3 lateral like the sepals, median shorter. Fertile stamens 5 or 6 with linear anthers sometimes exceeding the filaments. Ovary 3-celled. Style 6-toothed at the tip. Fruit a long loculicidal many-seeded capsule. Seed with a large, intensely coloured, fimbriate aril.

1. *R. Madagascariensis*, *Sonnerat*. The Traveller's Tree.

A very striking and picturesque, easily recognized tree with a fan-shaped crown of lanceolate-oblong leaves with long petioles, somewhat resembling those of the plantain.

Native of Madagascar and Reunion. Often seen in large gardens.

Called Traveller's Tree from the large amount of water collected in the leaf-sheaths which can be drunk.

Strelitzia reginæ, *Ait.*, and *S. augusta*, *Thunb.*, are more rarely seen. Their leaves are similarly arranged on short or slender stems and their flowers often brilliantly coloured, in *S. reginæ* orange-coloured with 2 deep blue or purple petals. *S. augusta* is sometimes called the white-flowered bird-of-Paradise flower.

FAM. 156. ZINGIBERACEÆ.

Perennial herbs, often very large, usually with fleshy rhizomes and thick roots. Stem well developed or composed of the leaf-sheaths only. Scape sometimes distinct from the leaves. Leaf-sheaths usually with a ligule. Inflorescence various. Flowers moderate-sized or large, usually zygomorphic. Perianth superior, differentiated into 3-merous calyx and corolla. Calyx more or less tubular or spathaceous, generally shortly 3-toothed, often colourless. Corolla usually on an elongated quasi-hypanthium (corolla-tube) bearing the 3 petals (of which the dorsal is usually somewhat cucullate or different) and also the andrœcium. Stamen only one perfect, being the dorsal one of an inner whorl, of which the two anterior members are combined into a petaloid lip with its hinder margins embracing the fertile stamen. Besides these are usually present the two obliquely posterior members of the (theoretical) outer staminal whorl, *lateral staminodes*, which are sometimes reduced to teeth or are petaloid or absent, the third (anterior) member of the outer whorl being always absent. Connective of fertile stamen often produced or appendaged. Ovary 3-celled with axile placentation, more rarely 1-celled with 3 parietal placenta. Style very long and delicate often placed in a groove of the stamen, and the usually funnel-shaped ciliolate stigma projecting beyond the anther-cells. Ovules many. Fruit usually capsular but often tardily dehiscent, sometimes indehiscent or irregularly breaking up. Seeds often arilled, with large mealy perisperm enclosing smaller endosperm. Embryo straight, cylindrical.

The plants of this family are often aromatic when bruised.

1. Ovary 1-celled:—

Herbs under 3 ft. Flowers not large, yellow

1. *Globba*.

II. Ovary 3-celled:—

A. Lateral staminodes well-developed, usually free, broad (exc. sometimes in 5):—

1. Inflorescence a dense bracteate spike crowned with a crest of coloured barren bracts (coma) .

2. *Curcuma*.

2. Inflorescence without a coma of barren bracts:—

a. Connective very broad or crested. Flowers not in dense spikes, sometimes 1—2 only:—

Connective broad, not crested

3. *Gastrochilus*.

Connective crested

4. *Kæmpferia*.

b. Connective very narrow, not crested. Flowers in many-flowered usually dense spikes

5. *Hedychium*.B. Lateral staminodes very small, or narrow and adnate to lip, or 0. (In *Zingiber* spp. the broad lateral lobes of the lip might be taken for lateral staminodes):—

1. Flowers in dense, often strobilate spikes with imbricate bracts:—

Inflor. distinct from leafy stem. Connective crested or not produced

6. *Amomum*.

Inflor. usually distinct from leafy stem. Connective produced into a long beak

7. *Zingiber*.

Inflor. terminating the leafy stem. Filament petaloid

8. *Costus*.

2. Flowers in loose spikes or panicles terminating the leafy stem

9. *Alpinia*.

I. GLOBBA, L.

Herbs with stem erect from a creeping rhizome. Leaves distichous, mostly narrow. Flowers yellow in spikes or panicles, the buds sometimes replaced by bulbils. Calyx funnel-shaped, 3-lobed. Corolla-tube slender, exceeding the calyx, with ovate subequal lobes usually finally reflexed. Lateral staminodes petaloid, usually finally reflexed with the corolla, lip deflexed, with base usually decurrent upwards on the column; filament with 2 dorsal appendages, long, incurved, anther oblong, connective winged, spurred or mucous, produced beyond the cells. Ovary 1-celled with 3 parietal placentæ or base 3-celled; style filiform placed in a groove of the filament, stigma turbinate. Capsule globose fleshy, tardily dehiscent. Seeds small, often pubescent, ovoid with a small white lacerate aril.

A. Anther neither spurred nor winged. Bracts deciduous:—

1. Lip not cleft half way into narrow lobes:—

Cor.-tube 3 times length of calyx. Lip longer than petals, petals longer than staminodes, lip 2-fid. Leaves pubescent or glabrescent beneath

1. *racemosa*.

Cor.-tube twice length of calyx. Lip, petals and staminodes all equal in length. Lip 2-lobed. Leaves glabrous beneath. Ovary verrucose

2. *orixensis*.

2. Lip cleft nearly three-fourths way down into 2 linear lobes much longer than petals. Leaves finely pubescent beneath. Ovary smooth

3. *ophioglossa*.

B. Anther with spreading 2-fid wings. Bracts persistent

4. *bulbifera*.1. *G. racemosa*, Smith.

Height 1—3 ft., stems inclined or erect, with oblong or elliptic-oblong (or lowest somewhat ovate-oblong) leaves attaining 11" by 3.5", mostly 7—8" long, ending in a twisted tail 8—1" long, softly pubescent beneath, becoming glabrescent in age. Panicle narrow, lowest branches 3-fid.

Flowers bright-yellow, whole length (with stamen) 1.5". Ovary smooth or verrucose .1". Calyx .28", corolla-tube .8", puberulous. Petals broadly ovate, median hooded, shortly horned, .2", lateral ovate, apiculate, .2", often twice the length of the oblong-ovate staminodes (but equal according to *Baker* in *F. B. I.*). Lip .44" including its long adnate base, longer than the petals when all the perianth segments and staminodes are reflexed (soon after opening of the flowers), 2-fid with lanceolate lobes, the two halves reduplicate, cleft about one-fourth way down, all minutely gland-dotted (as in other species). Capsule .5", smooth or verrucose.

Shady places in Chota Nagpur, over 2000 ft. elev. Ranchi! Parasnath! Fl. Aug.—Sept.

I include this under *racemosa* though the shortness of the staminodes is not according to description. The ovary being sometimes verrucose would cause it to be placed under *orixensis* by some botanists.

Panicle sometimes pubescent, bracts very caducous, .4", narrowly oblong.

2. *G. orixensis*, *Roxb.*

Habit of preceding. Leaves glabrous beneath, 8—10" by 2—4" (*vide Roxb.*), similar to those of *racemosa*. Panicles similar. Flowers orange-yellow, smaller than in *racemosa*. Ovary verrucose. Calyx .15" only and corolla-tube only about twice the calyx. Petals broadly ovate, longer than the staminodes (equal according to *Baker*). Lip obovate as long as the reflexed petals, shallowly 2-lobed. Capsule verrucose. Seeds tomentose.

Chota Nagpur, frequent (if all the specimens so assigned to it in the *Cal. Herb.* are correctly named, but several are now indeterminable)! Rajmahal Hills, *Kurz*! Probably Orissa (Northern Circars is the country of origin of the type). Fl. r.s.

Schumann described the corolla-lobes as lanceolate. The species is very close to *racemosa* and many plants appear to show intermediate characters.

3. *G. ophioglossa*, *Wight.*

Leaves pubescent beneath, similar in shape to the last two. Panicles with the lower branches bearing 4—6 flowers, the lowest often bulbiferous. Calyx .12" long. Corolla pale-yellow with the tube three times the calyx, lobes ovate acute. Lip twice the length of the corolla, deeply 2-fid to about three-quarters the way down, segments very narrow. Capsule smooth.

Chota Nagpur, *Cal. Herb.*; but I do not think that the specimens (two only) so named are either of them *Wight's* plant and are probably *racemosa*.

The above is a description of *Wight's* plant, not of the *Calcutta Herbarium* specimens.

4. *G. bulbifera*, *Roxb.*

A more slender plant than *G. racemosa*, 1—2 ft. high. Leaves much smaller 3—5" by 1" to 4.5" by 2" or 6 by 2", lanceolate to elliptic ending in a long straight or slightly twisted tail, shortly pubescent beneath. Flowers yellow in the axils of large folded sub-persistent bracts .6" long in simple spikes 2—4" long, the lower (sometimes all) bracts usually bearing a solitary bulbil in place of a flower. Fls. 1—1.2" long including the stamen. Filament strongly arched as in the others, anther with 2

large spreading lateral wings cut nearly to the base into 2 triangular segments, larger .15" long.

Common in shady places, damp banks, etc., in the forests. Throughout Chota Nagpur! Has often been collected on Parasnath. Fl. Aug.—Oct.

Stems often inclined with spreading distichous leaves, the lowest sheath often purple. Bracts (when opened) rhomboid-ovate with broad base and very acute tip. Bulbils erect, globose-oblong, .15" long. Petals and staminodes reflexed. Dorsal petal boat-shaped .25", lateral similar, rather smaller. Lat. staminodes petaloid oblong, .45". Lip dependent from the column, .35" long, oblong but gradually wider towards tip (oblong-trapezoid) with 2 oblique lobes and base 2-clawed. Ovary often 3-locular at base. Capsule rugose. Seeds globose, pale-brown, pubescent, seated on a cupular-lobed aril.

2. CURCUMA, L.

Herbs with rhizomatous and tuberous roots and usually with accessory tubers developed at the ends of long fleshy roots. Stem, if any, composed of the convolute leaf-sheaths. Leaves usually elliptic or oblong and often very large. Flowers in dense bracteate spikes with the peduncle clothed with appressed bracts and spike terminating in a crown of barren coloured bracts (coma), floriferous bracts adnate in their lower part and enclosing several flowers opening in succession, each with its proper membranous bract wrapped round the ovary and short cylindrical, usually minutely toothed calyx. Corolla-tube narrow and terete below, ventricose above, bearing 3 petals, of which the median is larger and hooded. Lateral staminodes petaloid, broad, connate with the short broad filament, anther reclinate often with 2 long spurs, and the connective behind with a minute ridge. Stigma capitate, with a slightly 2-lobed gibbosity above and a transversely oblong stigmatic surface below the gibbosity. Capsule globose, membranous, finally 3-valved. Seeds ovoid or oblong, usually arilled.

The subterranean parts of the plant normally consist of a short, more or less conical stock ("bulb"), which forms the base of the year's shoot and the apex marked with the rings of the decayed leaf-sheaths in its second year (Fig. 8 of the *Zingiberaceæ* in the *Nat. Pflanz. Fam.* erroneously shows the "bulb" lying on its side!). From the bulb proceeds a branched or unbranched short or elongate rhizome or rhizomes ("rhizome" of my descriptions, "sessile" or "palmate tubers" of the *F.B.I.*) which bear further bulbs, or such rhizomes may be apparently absent, the whole of the short lateral rhizome at once assuming the form of the new bulb and giving rise to the new shoot. From the middle and lower parts of the bulb issue numerous roots and long fleshy fibres which bear at their ends turbinate fleshy tubers ("stipitate tubers" of *F.B.I.*, "tubers" of my descriptions, *da* or *daka* of the Kols); these do not give rise to new plants and are merely stores of nutriment. Whereas the rhizomes and their special modifications, the bulbs, are often very aromatic and deeply coloured, the tubers are usually white or watery, very slightly or not aromatic, and often yield a form of starch or arrowroot.

1. Flower-spikes lateral to the leafy tuft or distinct and usually developed before the leaves appear. (In 2 and 3 vernal spikes are lateral, and æstival spikes central):—

A. Rhizomes small or 0 the new bulb developing close to the side of the old one. Fls. far exerted. Coma red or pink:—

1. Ovary villous or hirsute. Midrib of leaf green:—
 - Leaves narrowly lanceolate, gradually acuminate, smooth
 - Leaves elliptic, suddenly caudate, plicate

1. *angustifolia*.
2. *sulcata*.

2. Ovary glabrous. Leaves broadly lanceolate with petiole and midrib deep red 3. *rubescens*.
- B. Rhizome well-developed and branched. Leaves green sub-plicate. Flowers not exserted:—
 Leaves glabrous. Petals ovate acuminate 4. *leucorhiza*.
 Leaves pubescent beneath. Petals oblong obtuse 5. *aromatica*.
- C. Rhizome well-developed. Leaves with a deep purple cloud down their centre. Fls. rather shorter than their bracts:—
 Rhizomes yellow or straw-coloured within 6. *zedoaria*.
 Rhizomes bluish grey within 7. *cæsia*.
- II. Flower-spikes always rising from the centre of the leaf-tuft. Coma usually pale pink, white or yellow and its bracts few (see also 2 and 3 above):—
 Rhizome pale yellow. Coma usually pale pink. Calyx puberulous, ovary villous 8. *amada*.
 Rhizome orange-yellow. Coma often colourless and proper bracts often barren. Calyx with few fine hairs. Ovary hairy at the tip only 9. *longa*.
 Rhizome poorly developed. All bracts a deep orange-yellow 10. *reclinata*.

1. *C. angustifolia*, Roxb. Paro, K.; Tikari, Tikur, H.

Leaves appearing after the flowers or very young at the time of flowering, arising laterally from base of the rootstock and stem hardly any composed of the convolute leaf-sheaths. Leaves few, narrowly lanceolate to elliptic-lanceolate 1—3 ft. long (including sheath and petiole) by 2·5—4·5" wide, gradually acuminate to a very fine point. Petiole with sheath 6—12". Plant in flower about 12" only from the rhizome, peduncle lateral clothed with puberulous, often coloured, leaf-sheaths. Spike 3—5" with the lower flower-bracts 1·3", the free part about two-thirds the whole length, tip rounded. Coma small with only 5—9 oblong, usually deep magenta glabrous or minutely pubescent bracts. Flowers far-exserted (for 5—7"), 1·5" long. Ovary villous, calyx 6", puberulous, colourless with 3 rounded lobes, deeply split dorsally. Petals oblong; dorsal a little longer, somewhat pubescent, the shortly hooded tip not apiculate, but somewhat acute. Lip longer than the petals, yellow, rounded deeply 2-fid or emarginate. Sometimes the flowers are a handsome reddish yellow in all parts. Lateral staminodes yellow, free portion 5" long, oblong, slightly exceeding the petals. Anther puberulous reclinate with long basal spurs and short basal knobs.

A common forest species though only collected from our area in the forests of Chota Nagpur! Fl. May and leaves appear in June, but Roxburgh says that his specimens did not flower till July in Calcutta.

Bulb short sub-erect with conical tip, pale yellow inside with an outer whitish zone, rhizome not further developed.

Special bracts (as in all the species) membranous, puberulous. The plant is not very aromatic.

Arrowroot is prepared from the tubers.

2. *C. sulcata*, Haines (Kew Bulletin, No. 3, 1923).

Habit of *C. angustifolia*. Leaves elliptic or elliptic-oblong, green above, pale beneath (with microscopic white dots), plicate, 8" by 3·5" to 15" by 6·5", inequilateral at the base, caudate tip 5—7·5" long and later petioles up to 8", green or reddish. Spike lateral in spring, central

in summer, 3.5—6" long, shortly peduncled. Flowering bracts 1—1.5" long, free for .5—.75", reddish or green with brown or at the apex purple. Bracts of the coma narrowly oblong, very parallel-sided with rounded tip which is reddish-purple or violet, obscurely puberulous. Flowers exerted .5—.75" from the bracts. Ovary hirsute. Calyx .3", pink, shortly obtusely toothed. Corolla-tube slender and white for .5", then limb 1" ventricose, split half-way down into two anterior oblong rounded petals and a posterior hooded mucronate petal, always tinged, sometimes deeply, with a brownish red. Lateral staminodes faintly tinged pink or red or a beautiful red-brown, exceeding corolla, oblong slightly broader upwards, entire, rounded, .3" broad. Lip as long, with erect sides, apex suddenly contracted to a short split umbo, sides same colour as staminodes, centre longitudinally deep yellow. Anther and filament dorsally puberulous.

This is found on high hills of the Central Provinces, and possibly in Chota Nagpur; the plant recorded under *C. rubescens* may be the same. Fl. May—Aug. Leaves appear June, fully developed July—Aug.

Bulb (rhizome?) pale yellow within 2—4" long, somewhat aromatic. Tubers turbinate or cylindrical 1.5—3" by 1".

3. *C. rubescens*, Roxb.

Roxburgh appears to distinguish this from *C. angustifolia* by the shape of the bulb and tubers, the broader leaves and the colouring. The following is *Roxburgh's* account:

"Bulbs ovate-lanceolate and with the palmate tubers (rhizome) inwardly pearl-coloured. Leaves broad lanceolate, on red winged petioles above the sheaths, rib red. Scape and scales red. Fls. longer than their bracts. . . . Root of several erect solid conical pale straw or pearl-cold., powerfully aromatic bulbs which supported the former year's foliage and are marked with scars, round their lower half issues a number of strong fleshy fibres, many of which end in ovate or sub-cylindrical, pale-white, slightly aromatic tubers. Leaves 2-farious, 6—8, 3—4 ft. long, including the sheaths and petioles, cuspidate, smooth, uniform dark-green with the nerves or ribs red, (blade) 12—24" long by 5—6" broad. Petioles and sheaths deep red. Scape radical, lateral, about 6" long, invested in several dark reddish sheaths. Spike tufted, 5—6". Coma less deeply coloured than in *Zerumber* (*C. zedoaria*, *Roscoe*). Fls. small, rather longer than their bracts, bright yellow, fragrant. Tube of the corolla slender, mouth shut with three villous, yellow glands."

Singbhum, in damp forests! (if my plant is really this, see below). Fl. May; leaves appear soon after.

A living specimen was sent by me to Calcutta in 1902 and there identified as *C. rubescens*, *Roxb.*

The following were field notes: Spike with peduncle 6"—1 ft. above ground, spike 3.5—5" long and 2" diam. Floral bracts 1.25—1.5" long, one-half to two-thirds free, varying from green to a deep crimson, .75—1" broad. Bracts of coma few, magenta, oblong or elliptic-oblong, 2", inner surface of all bracts puberulous. Fls. 1.5" long from bright sulphur yellow with colourless corolla to a chrome yellow and a delicate pink-veined corolla. Calyx .5", usually with 2 distinct keeled obtuse pubescent lobes and a third split lobe. Corolla-tube .5", upper lobe ovate-oblong .75", mucronate or apiculate above the involute margin, lateral lobes

shorter with flat margins. Stamines exceeding the corolla, obovate-oblong, obtuse, lip broadly oblong-obovate 2-fid or emarginate or sometimes with a narrow middle lobe.

It will be observed that the coloration is extremely variable, and if the specimen sent to Calcutta was correctly identified, it would appear that there is little, if any, difference between this species and *C. angustifolia*, except in the shape of the leaves (which were not developed in our plant and are certainly variable in *angustifolia*), and possibly the indumentum on the ovary. This is villous in *angustifolia*, but *Roxburgh* figures it *glabrous* in *rubescens* and does not mention it in the text. I know of no authentic specimen of *Roxburgh's* plant.

4. *C. leucorhiza*, *Roxb.* Tikur, *H.*

Whole plant 3–4 ft. high when in leaf. Leaves broad-lanceolar, glabrous, sub-plicate (from the drawing). Spike lateral 6–8", few-flid., and bracts of coma few, pale rose. Flowers only as long as the bracts, not at all exerted, but with a relatively long and slender corolla-tube .6" and a short ventricose portion. Petals ovate, dorsal slightly mucronate and hooded lateral acuminate, recurved, white slightly tinged purple. Lateral stamines yellow. Lip ovate, white with purplish tinge, 2-fid and yellow at apex.

Jungles south of Bhagalpur, *Roxburgh*. Fl. May.

This is only known from *Roxburgh's* picture and description. Bulbs conical with several rhizomes often 1 foot long, straight and cylindrical, both very pale yellow within. Tubers ellipsoid pearly white within. *Roxburgh* says that the flowers are yellow within with the exterior border slightly tinged with pink.

Yields arrowroot.

5. *C. aromatica*, *Salisb.*, not *C. Zedoaria*, *Roxb.* ? Palo, Paro, *K., S.*

Leaves not mature at the time of flowering, mature lower ovate, upper ell-oblong with the base passing gradually into the winged petiole, 16–30" by 8–10", with a finely twisted tail 1" long and margin with a white or hyaline border, surface sub-plicate with the 30–40 raised nerves, persistently puberulous beneath, young softly pubescent. Petiole 6–10" above the sheath. Flowering stems distinct with a stem or peduncle 4–7" and a spike 6–9" long by 3–5" diam. at the coma. Outer bracts sheathing soft with a minute pubescence, flowering green or slightly tinged pink, 2–2.5" with very rounded, almost truncate tip, those of the coma pale magenta with free portion 3" long. Flowers 2" reaching about level with the mouth of their bracts, several to each bract and with proper membranous narrow-obovate conduplicate bracts 1.25" long. Ovary and calyx hairy. Corolla white, upper lobe pubescent truncate emarginate with a short horn or cusp from the sinus.

Mountains of Singbhum and Mayurbhanj! *Parasnath*, *Kurz* (but the specimen is doubtful). My description is from specimens removed from the forest and grown in the garden so as to obtain fully developed leaves. Fl. May–June. Leaves fully developed in September.

Rhizomes 1.5" diam., horizontal, branched, with aromatic ginger smell, dirty white or yellowish inside, lateral tubers sessile. Spike flowering nearly to the top. Calyx .5", scarcely 3-lobed and lobes shallowly emarginate, lateral corolla-lobes as long as staminal lip, obtuse. Lateral stamines also as long, pale yellow oblong slightly broader upwards and with ends incurved. Lip yellow scarcely 3-lobed. Column of anther flat pubescent, anther pubescent, long-spurred.

Arrowroot is said to be derived from the plant described, but from *C. Zedoaria*, *Roxburgh* only speaks of a perfume. Although our plant appears to be the one

described as *aromatica* by *Salisbury*, I am very doubtful whether it is *Roxburgh's Zedoaria* which is quoted in the *F.B.I.* as a synonym. *Roxburgh* says in one place that the tubers of *Zedoaria* are a pretty deep yellow, and in another place a pale yellow. He also refers to *Zedoaria* as being a particularly ornamental species, but our plant has too pale a coma for such a description to be applicable. He, moreover, although he described from the living specimen does not refer to the very raised nervation of the leaves, and, especially, he states in his diagnosis* that they are *sessile* on their sheaths. Lastly neither he nor the *F.B.I.* refers to the pubescence of the flowers.

6. *C. zedoaria*, Roscoe (non Roxb.). Syn. *C. zerumbet*, *Roxb.*; *Kachura*, *H.*, *Beng.*

Whole height 3—4 ft., leaves 1—2 ft., oblong acuminate and narrowed to the very long petiole, glabrous, clouded down the middle with purple. Spikes appearing before the leaves, 6" by 3". Flowering bracts 1.5", often tinged with red, bracts of the coma many, spreading, bright red. Flowers pale yellow rather shorter than the bracts. Corolla lobes pale, lateral oblong, dorsal rather longer with a subulate tip. Lateral staminodes obovate. Lip .5" broad, orbicular, deep-yellow, recurved, emarginate. Ovary hairy. Capsule ovoid-trigonous, dehiscent irregularly. Seeds oblong, aril lanceolate, white, cut into slender unequal fleshy segments (*Roxb.*).

Open grassy places in the Tarai and Duars, probably Purneah and Santal Parg. Manbhum, *Camp.* Fl. April. Leafy shoot in June.

Bulb large ovoid. Rhizome well developed, cylindrical, pale yellow or straw-coloured inside. Tubers many, pearl-coloured within.

The rhizome possesses an agreeable, aromatic, camphoraceous smell. It has stimulant and carminative properties and is used in flatulence and dyspepsia, and also for clearing the throat (expectorant). The dry root powdered and mixed with the powdered wood of *Cæsalpinia Sappan* makes the red powder called *abir* which is thrown over the person during the Holi festival. *Nadkarni.*

7. *C. cæsia*, Roxb. Nil-kuntha, Kala-haldi, *Beng.*

Whole height about 4 ft. Leaves 1—2 ft. by 5—6" broadly lanceolate or oblong, glabrous, with a deep ferruginous purple cloud down the middle which penetrates to the lower surface. Petiole and sheath about as long as the blade. Spikes appearing rather before the leaves, about 6" long or altogether about a foot high with the peduncle. Flowering bracts green with a ferruginous tinge. Coma deep bright red, tending to crimson. Flowers pale yellow, reddish at the outer border, rather shorter than their bracts.

Bihar and Chota Nagpur according to *Bengal Plants*, but I can find no specimens from this area. Fl. May.

The description is mainly from *Roxburgh*. It appears to be indistinguishable from *C. Zedoaria* except by the colour of the rhizomes, and it seems to me better to regard it as a variety. *Roxburgh* says that the bulbs are ovate and these and the rhizomes a greyish blue within.

8. *C. amada*, Roxb. Ban-haldi (the wild plant); Ama-haldi, *H.*; *Amada*, *Beng.*

Whole plant from root to tip of leaves 2—2.5 ft. high, bearing scape from the centre of the leafy tuft. Leaves oblong-elliptic, oblong or

* Though later on he says the leaves are petioled he does not mention the long petioles which are characteristic.

oblanccolate, ending in a short fine somewhat twisted cusp and with a white or hyaline margin, blade 1·3—2 ft. long by 5—7" wide. Scape about 6—12", with a spike 3—6" and peduncle sometimes entirely hidden in the leaf bases. Bracts white or pale green, those of the coma very few and pinkish or nearly white. Flowers 1·75" long, exerted (in front), .5" more or less. Calyx very thin .4—·5", split above, with 3 rounded shallow lobes anteriorly, puberulous. Corolla with tubular portion .75" long then ventricose, anterior lobes oblong-ovate rounded, nearly as long as the lip, posterior hooded entire or very slightly emarginate in front of the large mucro or horn, embracing the lateral staminodes which are (somewhat obliquely) oblong rounded and as long as the corolla. Lip slightly exceeding the corolla, .5" broad, sides erect and apex very short deflexed emarginate, throat and centre deep yellow, rest of flower cream-coloured. Ovary villous.

Very common in the forests of Chota Nagpur! Fl. Aug.—Sept.

The leaves are always very slightly puberulous on the upper surface with white hairs (*Roxburgh* says glabrous, yet I don't know what else this can be but *amada*), lower surface glabrous and microscopically white-dotted, lateral nerves somewhat raised, about 20 each side. Rootstock quite small, pale yellow with white margins, fibres as usual ending in tubers. Bracts adnate half-way up, then spreading, rounded or truncate, not recurved, lower few barren and longer with a free portion of 1·5" in length, while flowering have a free portion of about .7" only.

The fresh cut rootstock possesses the smell of green mango and it is said to be used as a condiment and vegetable. They are also regarded as cooling and carminative (*Nadkarni*). The Kols however tell me that they have no use for it.

Filament short broad oblong, anther reclinate, with 2 long declinate spurs and a slight knee above base of the spurs in front, connective behind with a minute ridge (these characters are, I think, generic).

9. *C. longa*, L. Haldi, H.; Turmeric.

Habit and stature of *C. amada*, but all parts much more aromatic. Leaves quite glabrous both sides but both sides microscopically white-dotted. Spikes short with the peduncle often only exerted 2—3" from the leaf sheaths with 1—2 large barren bracts below, the lowest one with a filiform point over .5" long, floral green and those of the coma white without (in my plants) any tinge of pink. Flowers few (sometimes only 2) to a bract, 1·75" long, yellow, not at all exerted, their proper bracts white, sometimes fls. abortive and replaced by their proper bract. Calyx .4" with few fine hairs, scarcely 3-lobed, split about one-fourth way down behind and retuse in front. Lip .6" broad pale yellow with deep yellow centre and mid-lobe, the sides curved up at the margins, but scarcely forming distinct lobes and rather distinguished by their colour than from any division between them. Ovary rather stiffly hairy at the top only.

Cultivated more or less in all districts! Manbhum, *Camp!* Parasnath, *Clarke*, "fls. all orange yellow." But I doubt whether this was wild as there is cultivation on a part of Parasnath. Fl. Sept.—Oct.

Rhizomes of a deep orange colour within. Earlier leaves ell.-oblong about 16" by 6" with a free petiole 3", later leaves oblong 20—24" by 5·5" with more attenuate base and free part of petiole 6—10" above the sheath, main lateral nerves raised above, 20—30. Bracts connate half-way up, rounded, minutely pubescent. Dorsal petal hooded and cleft and with a short slightly hairy horn or beak from the sinus, lat. pet. ovate rounded glabrous. Apex of lip retuse. Lat. staminodes

large oblong with contracted inflexed tips which hide the anther and meet or overlap in front of the dorsal petal. Anther reclinate with a small yellow lamella at its apex and 2 spurs in front (much as in *C. amada*), spurs nearly as long as the anther and with a swelling above each at the base of the cell.

The rhizomes are much used in the composition of curry powders and are largely used in Hindu medicine.

10. *C. reclinata*, Roxb. Bundu, K.

A very pretty species easily distinguished from all the foregoing by the small leaves, the floral bracts, not only the flowers, a deep orange yellow, and the coma scarcely any but of the same colour.

On damp banks in the forests. Singbhum! Fl. Aug.—Sept.

Height about 1 ft. Base of stem bulbiferous and with globose tubers .25—1" diam. at the ends of the root-fibres. Leaves about 10" by 4" often bent back on their 4—7"-long petioles, elliptic, acuminate of cuspidate, base unequal. Spike central, 3—4" long, peduncle mostly hidden by the leaf sheaths, bracts 1.5—2" with recurved rounded limb. Flowers orange-yellow or dark pink. Calyx inflated, obscurely 3-toothed.

The tubers are cooked and eaten by the Kols. They are called *daka* or *da* as in the other species.

This is almost certainly *reclinata*, but it is to be observed that *Roxburgh's reclinata* had the flower-bracts green tinged with red and the coma bracts reddish. Our species is very distinctive in its coloration.

3. GASTROCHILUS, Wall.

Herbs with rootstock creeping or 0, with or without leafy stem. Flowers solitary or in a few-flowered spathe or spicate, with a short spathaceous calyx and long slender corolla-tube, petals equal connivent, narrow, ascending. Lip oblong, longer than the corolla, entire. Lateral staminodes petaloid broader. Filament very short, anther-cells parallel, connective not crested nor spurred. Ovary oblong 3-celled; ovules few or many, superposed, style filiform, stigma subglobose. Fruit an oblong capsule. Seeds ovoid with a small basal aril.

1. *G. longiflora*, Wall.

A beautiful herb with distichous oblong leaves 12—16" by 4—5.5", pale and glistening beneath and large-lipped white flowers variegated red, which appear to be long peduncled from the very long slender corolla tubes rising from the centre of the leaves or on a short radical spike about 3" long, corolla-tube bright red, 3—4" long, very brittle.

Muddy streams under shade in the Singbhum forests! Fl. June—Sept.

Root-fibres tufted. Petioles 12" deeply channelled or almost winged above. The flowers are dimorphic and possibly 1-sexual. Petals white glistening, oblong, 1—1.25" long. Lip very large ventricose, 2" long, suborbicular. Lat. staminodes spatulate obtuse as long as petals. Stamen large truncate.

4. KÆMPFERIA, L.

Herbs with often tuberous rootstock, short or 0 stems and few leaves. Flowers spicate, on radical scapes or terminating leafy stems. Calyx short cylindrical. Corolla with long slender tube and equal, usually spreading, segments. Staminodes broad, petaloid, stamen short, arcuate, with the anther-cells separated by the broad connective which

is produced above into a petaloid crest, not spurred. Lip broad, usually 2-fid. Ovary 3-celled, style long, filiform, stigma turbinate. Capsule oblong with thin pericarp. Seeds subglobose, with small lacerate aril.

A. Leaves not contemporary with the flowers:—

Leaves oval-lanceolate or oblong, erect. Fls. with white staminodes and lilac or reddish lip

1. *rotunda*.

B. Leaves contemporaneous with the flowers:—

Leaves suborbicular, flat on the ground

2. *galanga*.

Leaves ascending, lanceolate

3. *angustifolia*.

1. *K. rotunda*, L. Bhui-champa, H.

Rootstock tuberous with large erect oblong or ovate-lanceolate leaves 12" by 3–4", usually variegated with darker and lighter green above and tinged purple beneath. Flowers fragrant, borne 1–3" from the ground only, in a crowded radical spike, but only one or two opening at a time. Corolla-tube 2–3" long with spreading linear petals nearly as long as the tube. Staminodes oblong acute white, 1.5–2". Lip lilac or reddish, rather shorter, 2-fid, segments suborbicular. Anther-crest deeply 2-fid, lobes lanceolate.

Said to be wild on Parasnath. Wild in the Sikkim Tarai, in Sal forest, *Kew Herb.*! Often cultivated! Fl. March–April, after which the leaves appear and die down in November or December.

2. *K. galanga*, L.

Tuberous-rooted with suborbicular leaves overlapping one another flat on the ground, 3–6" long, deep green and forming a pretty background to the delicate flowers, 6–12 of which are fascicled on a very short central spike and open in succession. Corolla and staminodes a pearly white, lip with a purple or lilac spot each side. Corolla-tube 1". Anther-crest quadrate with 2 small rounded lobes.

Wild in the Sikkim Tarai, *Kew Herb.*! Said to be in the plains throughout British India. I have only seen it in cultivation. Fl. r.s.

The roots and leaves have a delicate fragrance, but the flowers are inodorous (scented, *Baker in F.B.I.*).

3. *K. angustifolia*, Roscoe.

Tuberous-rooted with ascending lanceolate leaves 6–8" long by 1" broad. Flowers white with lilac lip deeply cut into 2 obovate lobes. Corolla-tube 2", petals 1". Anther crest quadrate with suborbicular lobes.

Sikkim Tarai, C. B. Clarke! Northern Bengal (*Bengal Pl.*), possibly Purneah. Fl. May–July.

5. HEDYCHIUM, Koenig.

Rootstock a rhizome or tuberous with elongate leafy stems and distichous oblong or lanceolate leaves. Flowers mostly in dense imbricately bracteate terminal capitate spikes, rarely spikes lax, bracts coriaceous, 1–more-fld. Calyx tubular, 3-toothed. Corolla-tube long, slender with linear equal spreading petals. Lateral staminodes various. Filament narrow, anther-cells contiguous, connective not produced nor

appendaged. Lip large 2-fid. Ovary 3-celled; ovules many superposed; style long, filiform; stigma subglobose. Capsule globose, 3-valved.

- I. Spike strobiliform with very broad appressed imbricate bracts. Stamen not much exceeding the lip 1. *coronarium*.
- II. Bracts narrow oblong or convolute, not overlapping laterally. Stamen far exceeding the lip:—
- A. Spike dense ovoid or broadly oblong. Flowers pure white. Lip cuneate 2. *thyrsiforme*.
- B. Spike elongate cylindric, not very dense:—
1. Lip more or less cuneate:—
- L. sericeous beneath. Flowers white 3. *stenopetalum*.
- L. white-pulverulent beneath. Fls. lemon-yellow *Gardnerianum* (p. 1190).
2. Lip suborbicular above the claw. Fls. red or carneous. 4. *coccineum*.

1. *H. coronarium*, Koenig.

A stout handsome leafy rhizomatous herb 2—5 ft. high, usually suberect with the spike erect. Leaves thinly appressed-silky, pubescent or quite glabrous beneath, sub-patent, lanceolate, 1—2 ft. long, variable in breadth, sessile. Flowers fragrant, usually pure white (in our area), a few opening at a time exerted from the axils of the very closely imbricate orbicular or oblong-obovate very broad bracts of the large conical 4—7"-long head; the lower bracts sterile, the upper each containing a cluster of 3—4 flowers, the special bract of each flower enclosing all the special bracts of the next younger flowers.

Along watercourses. Ranchi and Palamau, over 2000 ft.! Jonha (Manbhum), Wood! Santal Parg.! Mayurbhanj, elev. over 3000 ft.! It is common in the wet savannahs of the Jalpaiguri district and will probably occur in Purneah. Fl., Fr. r.s. up to Oct.

The yellow-fid. form or variety is seen in cultivation. The Santal Parg. form has leaves only 2" wide, others up to 3", crowded with microscopic white dots beneath, often purple beneath when young, tapering both ends, apex acuminate; uppermost often partially clasping the base of the spike with the blade reduced to an involute appendage. Lowest bracts 1.5" broad, margin usually densely pubescent. Calyx 1.2—1.5" long, sparsely hairy, translucent, 10-nerved. Corolla-tube 3" or more. Petals linear or linear-oblong, 1—1.25". Lip orbicular-obcordate or obcuneate, 2-fid, spreading together with the two lateral oblong or subrhomboid staminodes from the mouth of the tube. Staminodes .75" by .5" and lip slightly over 1" diam. In the 6-ft.-high Duars form, staminodes 1.5" by .9" and lip 1.75" by 1.5" wide in the much dwarfer Chota Nagpur and Orissa plant, lip tinged yellow down the centre (var. *chrysoleucum*, F.B.I.?) in the Chota Nagpur plant. Filament white, anther yellow in our plant, but in the Jalpaiguri plant the filament was practically obsolete.

Our species requires re-study in the light of Turrill's article (*Kew Bulletin*, 1914) on *Hedychium coronarium*. He segregates it into 7 species and one variety. Schumann also segregates this variety (*maximum* of *coronarium*), and in addition keeps separate *flavum*, Roxb., *flavescens*, Carcy, *chrysoleucum*, Hook., and *Elwesii*, Bak.

H. coronarium proper certainly occurs in our area but possibly also some of the others.

2. *H. thyrsiforme*, Ham.

Stems inclined, 3—4 ft. high with the spike erect. Leaves oblong or broadly lanceolate, 12—20" long by 3.5—4.7" broad, shortly finely caudate, hairy or pilose beneath, thinly margined, base much or slightly narrowed to a .5—.75" long petiole, ligule large, .7" long, very

hairy, with very obliquely truncate mouth. Spike dense but the bracts not laterally imbricating, convolute around two (perhaps more) inner bracts and one (or sometimes more?) flowers. Flower white, corolla-tube not much exceeding the 1—1.5" long bract, petals 1" linear, staminodes as long more broadly linear or linear-lanceolate, lip narrow, 2-partite, segments lanceolate. Filament 1.75—2.5", anther (when dry) linear, .4" long. Ovary very hairy.

Ramnagar Hills! Fl. r.s.

The flowers in my specimen were much withered and the description of them is mainly taken from the *F.B.I.* Leaves sometimes elliptic, paler below. Sheaths sometimes purpurascens, villous, terminating in long obtuse ligule. Calyx 3-toothed, sheathing about three-fourths corolla-tube.

3. *H. stenopetalum*, Lodd.

Height 6—7 ft. Leaves oblong or elliptic-oblong 18" by 4.5" to 20" by 5.25" (sometimes 24" by 6", *F.B.I.*), closely subsericeous beneath but more or less glabrescent in fruit, ligule large, 1—1.2" long, obtuse, villous on the back as is the margin of the sheath. Petiole 0. Spike 8—12" long or more, lax, with very stout rhachis and convolute oblong spreading bracts 2—5-fld. Flowers pure white, total length (with stamen) 3.5—4". Ovary villous. Calyx .7—.9", villous above. Corolla-tube 1.3—1.5" with narrowly linear twisted petals over 1" long. Lateral staminodes linear-lanceolate or oblanceolate, .8". Lip 1", deeply 2-fid with linear-oblong lobes .3" long, entire portion narrowly obtuse.

In wet savannahs, Tarai and Duars! Probably also Purneah. Fl. Aug.—Sept.

Schumann states that the lobes of the lip are acuminate; they are only acute in my plant and are even obtuse in some of the Kew specimens.

Hedychium Gardnerianum, Rosc., is sometimes cultivated as an ornamental plant in gardens and may easily be recognized by the rather broad leaves white pulverulent beneath, and the lemon-yellow flowers in long spikes 12—18" long. Staminodes oblanceolate over 1" long. Lip obovate-cuneate. Filament bright red.

4. *H. coccineum*, Ham.

Leaves narrow, about 1.5" broad, with fine scattered hairs on margin and midrib beneath. Ligule about 1". Spike up to 1 ft., lax, with a triangular villous rhachis and bracts more or less ternate in 6 vertical rows, lanceolate villous. Flowers scarlet or brick-red or flesh-coloured, 2.5—3" long. Petals twisted narrowly linear. Staminodes lanceolate. Lip suborbicular split into 2 ovate-oblong or irregularly sub-ovate obtuse lobes, clawed.

Baragai Hill (Ranchi Ghats), "elev. 4000 ft.,"* *Wood*. It is a plant of the Himalaya.

6. AMOMUM, L.

Herbaceous leafy stem often very tall, rootstock rhizomatous. Leaves usually narrow, distichous. Flowers in dense capitate spikes produced direct from the rootstock, with imbricate bracts. Calyx cylindrical, 3-dentate. Corolla-tube with oblong or linear-oblong segments, upper often broader and more convex. Lateral staminodes reduced to minute

* I think the correct elev. is 3607 ft.

teeth or obsolete. Lip broad or linguiform. Filament short, arcuate; anther-cells divaricate, sometimes hairy and often with a petaloid crest. Ovary 3-celled. Style filiform, stigma small and globose or larger and gibbous dorsally. Ovules many, superposed. Fruit indehiscent or irregularly dehiscent, sometimes beaked, winged or echinate. Seeds globose or truncate.

- | | |
|--|-------------------------|
| A. Anther crested. Lip broad:— | |
| Anther-crest .25—3" wide, entire. Capsule winged | 1. <i>dealbatum</i> . |
| Anther-crest large, 3-fid. Capsule 3-gonous | 2. <i>aromaticum</i> . |
| B. Anther not crested. Lip narrow | 3. <i>linguiforme</i> . |

1. *A. dealbatum*, Roxb. Paro, K.

A very large herb with tuberous rootstock and leafy stems 5—7 ft. high with sheathing distichous oblong-lanceolate leaves 2—3.5 ft. long and 4—6" broad, softly pubescent or glabrous beneath. Flowers 2" long (from tip of ovary to tip of lip), in dense spikes 2—3" long and broad on a short stout peduncle sometimes 3" or in fruit 4", densely covered with bracts when young. Lip 1.5" long by .75" wide with crisped margins or 1.1" wide (in the Puri specimen), a band of yellow or red down its centre and sometimes also radiating red veins. Crest subquadrate .25—3" wide. Fruit oblong 1.6" long with 9 crenulate wings.

Purneah! Santal Parg.! Singbhum, in watery shady places! Parasnath! Mals of Puri, frequent! Fl. April—July. Fr. Aug.—Sept. Leafy stem apparently persists several years.

The leaves of the Singbhum plant are glabrous. The peduncle is naked in fruit. Whole length of flowers (including hypanthium) 2.5". Calyx .75—1" minutely pubescent.

2. *A. aromaticum*, Roxb. Morung-elaichi, Beng.; Jalpaiguri Cardamom.

Stems in tufts from the rhizome, 2—3 ft. high. Spike globose 1.25—1.5" with the peduncle subterranean (but somewhat elongating in fruit) with imbricating sheathing bracts. Floral bracts oblong, ribbed, mucronate. Flowers pale yellow. Ovary sericeous. Calyx .7—8" long, villous, 3-toothed. Corolla-tube 1" villous, petals nearly as long, sometimes white tinged with brown, sublanceolate, obtuse dorsal somewhat cucullate. Lip twice as long as the petals, sub-orbicular with cuncate base. Anther-crest about .25" diam. with 3 acute lobes. Fruit narrowly obovoid (ovate, size of a large nutmeg, Roxb.), 1.3", somewhat rugose, 3-valved. Seeds several in each cell.

Cultivated in the wetter districts near the foot of the Himalayas. Fl. May. Fr. Sept.

The seeds are used as spice and medicinally. They resemble cardamoms in flavour.

The true *Cardamom* is derived from *Elettaria cardamomum*, which is cultivated in the Himalayas to the north of our area under the shade of trees and where the rainfall is over 100".

3. *A. linguiforme*, Benth.

Rootstock creeping with leafy stems 4—8 ft. high ending in a fine point (undeveloped leaf). Leaves oblong-lanceolate 3—4" apart, 12—18"

long by 2—4" broad, quite glabrous, ending in a filiform tip. Spikes (according to *Roxburgh*) linear, rather lax with the apex only rising above the soil (mine are in fruit, 6" high and dense), outer bracts ovate whitish glabrous, inner lanceolate, pink. Corolla-tube cylindric, 2", segments oblong, bright red. Lip bright yellow, linguiform, deflexed, above 2" long, 2-fid, margins below the middle incurved.

My plant, from which the locality "Northern Bengal" in *Beng. Pl.* is given (named *linguiforme* in *Cal. Herb.*, but only in fruit), is very common in the Sal forests of the Tarai and Duars and almost certainly occurs in Purneah. But the description of the flower is from *Roxburgh* and the *F.B.I.* Fl. r.s. Fr. ripens Sept.

The *F.B.I.* describes the leaves as attaining 5" in width; they are narrower upwards on the stem. Fruit (not described by *Roxburgh*) is oblong or sub-globose, .5—75', green or yellowish green, glabrous. Seeds triquetrous in a white aril. Smell fœtid of garlic.

7. ZINGIBER, *Adans.*

Rhizome horizontal with leafy stems and mostly oblong-lanceolate leaves. Flowers in dense bracteate spikes which are usually radical (in one of our species terminal), bracts mostly 1-fld. Calyx shortly 3-lobed. Corolla with lanceolate segments, upper concave. Lateral staminodes 0 or small and adnate to the obovate-cuneate often 3-lobed lip. Stamen with short filament and contiguous anther-cells, the connective produced into a narrow crest or beak as long as the cells. Ovary 3-celled, style filiform, stigma small, subglobose. Ovules many, superposed. Fruit an oblong capsule, sometimes tardily dehiscent, with large globose arillate seeds.

I. Spikes radical or from the base of the leafy stem:—

A. Floral bracts narrow, not closely imbricate. Peduncle hypogæal. Lateral lobes of lip 0 or very small:—

Spike only 1—2" long. Inner bracts linear-lanceolate.

Lip linear-oblong or, when spread out, ovate oblong, spotted or streaked with red. Stamens red.

1. *rubens*.

Spike 3—4". Inner bracts oblong or lanceolate. Lip oblong unspotted, with waved basal flanges and shallowly-lobed or waved terminal lobe (all recurved). Stamen yellow

2. *roseum*.

B. Floral bracts broad and closely imbricate. Peduncle of spike usually elongate (exc. 5, var.). Lateral lobes of lip well developed:—

1. L. under 1" wide. Fls. with dark purple lip and stamen

3. *officinale*.

2. L. over 1" broad. Flowers yellow:—

a. Spikes long-peduncled, very stout:—

Fl.-bracts usually green. Lobes of lip orbicular. Heads usually with broad rounded top.

4. *zerumbet*.

Fl.-bracts usually deep red, hairy. Lobes of lip oblong. Heads usually conical

5. *casumunar*.

b. Spikes scarcely peduncled, oblong

var. *palamauensis*.
6. *capitatum*.

II. Spike terminating the leafy stem

1. *Z. rubens*, *Roxb.*

Leafy stem 3—4 ft. high with narrowly elliptic-oblong erecto-patent leaves of which the larger are about 16" by 4", paler and thinly appressed hairy beneath, and with minute glistening glands in the fresh

plant. Flowers 1·7" (to tip of dorsal petal), red, in small narrow heads 1·5—2" long only, sessile from the base of the stem or with a peduncle (under the surface of the ground) 1" long. Bracts not closely imbricate (as in the *Casumunar* group), but free, linear-oblong, red, flowering 1·2". Calyx spathaceous membranous. Corolla-tube 1·2". Lip linear-oblong, .9", expanded at the base then recurved and with recurved undulate margins, white, beautifully veined or spotted with red, puberulous. Stamen shorter, red, arching over the lip, appendage or beak incurved.

Ranchi, over 2000 ft.! Fl. Aug.—Sept. Fr. Sept.

Stem above with minute sparse hairs. Leaves sometimes 4·5" broad; there is often a very small one (2" only) at the base of the stem, tip with a slender but not filiform acumen. Ligule membranous, 4—5". Spike with about 2 basal barren oblong boat-shaped (longitudinally concave) obtuse red bracts 1" long. Opposed to each flowering bract is a linear convolute notched hairy bract. Corolla-lobes, linear acuminate red, .8". Staminodes or basal lip auricles 0 or minute. Ovary pubescent. Stigma simple with a ring of terminal short hairs. Capsule reddish, slightly compressed or angled, straight or slightly curved, lanceolar in outline, hairy. Seeds .2" long, 3 in each cell, oblong, red-streaked, completely enclosed in a white aril which is lobed at the apex.

2. *Z. roseum*, *Rosc.* Syn. *Amomum roseum*, *Roxb.* (*Cor. Pl.*).

Leafy stem about 4—4·5 ft. high with ascending distichous leaves 16" by 3·5" indistinguishable from those of *Z. rubens*. Heads oblong, 3", with bright red bracts, lowest one or two empty, .75—1" long, next narrow-oblong 1·5" by .3", obtuse or retuse inner lanceolate, all, but especially the inner hairy. Flower about 2" long, corolla bright red. Lip oblong recurved and with a recurved crisped margin, broad short lateral segments or flanges and a sub-3-lobed terminal segment, pale with or without light red markings. Basal auricles small, obtuse. Stamen as long as the lip or a little shorter, bright yellow.

Sal forests in Singbhum, frequent in moist situations! Fl. Aug.—Sept.

These two species may be the same, although the drawings with weak and strong inflorescence respectively look very different. Mine were described from actual living specimens, but with an interval of 14 years, and if the spotting and colouring is less important than supposed, *roseum* might well be a form of *rubens* with a more robust inflorescence. Neither *Roscoe* nor *Roxburgh* gives the colour of the stamen in *roseum*. My flowers are exactly those of *Roxburgh's Amomum roseum*, but the lower bracts are shown in his figure (*Cor. Pl.*, t. 126) as ovate and upper as lanceolate, *Clarke* has also collected this species from Chota Nagpur and in his specimen all the bracts are oblong. *Roxburgh* describes the leaves of both species as smooth (*i. e.* glabrous), and the lip of both as entire. Of *roseum* he says that the colour is a mixture of red and yellow.

3. *Z. officinale*, *Rosc.* Adrak, *H.*; Ginger.

Rhizome stout tuberous with erect leafy stems 2—4 ft. high. Leaves narrow, distichous, subsessile on the sheaths, linear-lanceolate, .4—·8" wide, glabrous. Flowers greenish with a small dark purple or purplish-black lip, in radical spikes 1·5—3" long and 1" diam. on peduncles 6—12" long. Stamen dark purple, as long as the lip, rather shorter than the corolla.

Cultivated occasionally! Fl. r.s.—Oct. But it very rarely flowers.

4. *Z. zerumbet*, *Smith*. Pharo, *Uraon*; Makabari-bach, *H*.

Leafy stems 3—4 ft., oval in section, with 8—12 leaves each side, middle ones larger, 12—15" by 3—3.5", elliptic-lanceolate (oblong-lanc., *Baker*), ending in a short finely acuminate tip under .5" long, base rounded, beneath rather paler and very thinly silky when young, more or less permanently so on the sulcate midrib, sec. n. very oblique and numerous. Petiole .2" and upper part of sheath somewhat yellow-silky; ligule .5—1", rounded. Flowers very pale nearly uniform yellow, 1.8" long, tubular-ventricose, exerted .5—8" from the ellipsoid-oblong green head, which is borne on a peduncle 9—10" long clothed with sheathing tubular bracts. Lip with lateral lobes sub-orbicular .6—7" diam. (when spread out), thin, wrinkled, nearly as long as the corolla, many-nerved, mid-lobe deeply emarginate or lobed, lateral lobes broad and rounded, three-fourths as long, wrinkled.

Palamau jungles! Cultivated in Ranchi! Fl. Aug.—Sept. Probably also wild in other forest districts.

Rhizome resembling that of the *ginger*, whitish outside, pale-yellow inside. Leaves described by *Baker* as glabrous, probably from old specimens. Spikes or heads 2.5—3.5" long 1.5—1.7" diam. when young, *Baker* says 3—4", but the spikes gradually elongate with age as in other species. Sheathing tubular imbricate bracts with cuspidate tip, that at base of head large ovate or paraboloid, 1.5", with cuspidate tip, flowering truncately sub-orbicular with apiculate tip and hyaline hirsute margin, the hairs deciduous. Wrapping the flower is an inner hyaline bract 1" long with rounded tip. Calyx .75", sheathing, very hyaline, tip rounded entire with a few hyaline hairs, base and ovary sparsely hairy. Corolla-tubes slender tubular, .7". Upper corolla segment broader than the two others, 7-nerved, others lanceolate acute 3-nerved. Stamen .6—7". Fil. very short and broad, minutely puberulous. Connective .17" broad, beak with incurved edges, shorter than the cells, which reach three-fourths of the way up. Stigma surrounded by a ring of hairs.

The rhizome appears to be used in the same way as ginger.

5. *Z. casumunar*, *Roxb*.

A large aromatic herb, taller but more slender than the preceding with the leafy stems 4—5 ft. high, base with sheaths or small leaves, the margins of the sheaths very pubescent. Leaves very numerous on each side, lanceolate to linear-oblong, lower spreading nearly at right angles from the stem, 9" by 1.7" to 12" by 2" in our area (in the Tarai and Duars they attain 20" by 2.5—3"), pubescent beneath, or midrib hairy and very few scattered hairs on the blade; petiole and edges of sheath hairy, ligule of 2 small lateral auricles and a line of hairs between. Head cylindrical, becoming conical with age, 3—8" long with closely imbricating broad bracts pubescent on the edges and usually stout peduncles (see var.) 3—8" long with tubular sheaths. Flowers 1.5" long (above the ovary), corolla segments .75", the uppermost broader than the others, white or almost colourless. Lip shorter, wrinkled, yellowish 2-fid, .75" broad and lateral lobes large oblong rounded. Stamen yellow, beak curved, as long as the anthers. Seeds black polished with white aril.

In damp shady forests. Common in Chota Nagpur! No doubt also in forest lands of Purneah, Santal Parg., and of the Southern Area. Fl. Aug.—Sept. Fr. Oct.—Nov.

Rhizome short, deep yellow within, with fleshy roots. Stem ellipsoid in section. Peduncle pubescent, sheaths not usually overlapping one another. Heads 2" or more in diam. in robust plants, elongating with age and becoming acute. Bracts of head usually red or becoming red with age, margined. Capsule scarlet, fleshy, with about 6—10 subglobose-oblong, sometimes somewhat angled seeds in each cell.

All parts of the plant are very aromatic, but it does not appear to be used.

This is rather a variable species, especially in size of peduncle, but usually easily recognizable by the indumentum, long-peduncled heads, orbicular margined bracts and cream-coloured or pale-yellow flowers with oblong not orbicular side-lobes to lip. The following must, I think, be treated as a variety, though it lacks the elongated peduncle of the section. The flowers of both are copiously covered when dry with minute purple dots (glands?), which are not noticeable when they are fresh.

Var. *palamaunsis*.

Very aromatic with linear leaves, larger about 10" by 1·2", finely acuminate, minutely white-dotted above when fresh (as in type), sheaths, ligule and indumentum as in *Z. casumunar*. Spike very small, 2" long by ·8" diam. only, just raised above the ground; peduncle 1—2" long from rootstock or side of stem but below ground, its upper bracts green and clasping the base of the spike. Flowering bracts red broadly obovate rounded with a membranous pubescent margin and minutely apiculate, back very thinly shortly hairy. Whole flower (including ovary and hypanthium) 2·3" long, white or cream-coloured; tube of hypanthium 1·5" before it becomes ventricose, enclosed by an inner convolute reddish bract 1" long, which is ell-oblong, obtuse and pubescent at the tip. Calyx ·6—·7", spathaceous, membranous, apex rounded ciliate, slightly 2-lobed, ovary silky. Dorsal petal oblong-lanceolate, slightly concave and curved, but not galeate, ·8" by ·35", 9-nerved, subacute, lateral as long linear-lanceolate, ·15" broad. Lip somewhat crisped and jagged, ·8—1" long, midlobe ·8" broad, lateral lobes ·6", obliquely oblong. Stamen cream-coloured, curved about three-fourths over the lip, ·12" broad near base, beak 2-toothed.

Palamau. Fl. Aug.—Sept.

6. *Z. capitatum*, Roxb.

A very aromatic plant with leafy stems 3—4 ft. high with distichous erecto-patent stiff linear leaves 12—18" by 1—1·5" tapering to a point, more or less pubescent beneath, quite sessile on the sheath, ligule very short. Head 3—5" long by 1—2" diam. terminating the stem, with closely imbricate oblong, or lower ovate-oblong, green or subsequently scarlet bracts 1·5" or upper 1" long, with narrow brown margins. Flowers pale yellow. Petals 1". Lateral staminodes large oblong obtuse adnate to lip, red. Lip orbicular emarginate, ·7—·8" broad.

Common in the damper forests and often in grass lands throughout Chota Nagpur! Probably in all districts. Fl. r.s. Fr. Sept.—Oct.

Well marked by the terminal spikes, and, like other species, often conspicuous by the bright red valves of the widely open fleshy capsules well into the cold season.

8. COSTUS, L.

Rootstock tuberous with long leafy stem. Flowers large in dense-flowered, usually terminal, heads or spikes. Calyx with short tube, funnel-shaped with ovate teeth. Corolla-tube not longer than the calyx, segments large, subequal. Lateral staminodes 0 or minute. Lip large, obovate with margins incurved. Filament forming with the connective an oblong petaloid process in the middle of which are placed the contiguous linear anther-cells. Ovary 3-celled; style filiform, stigma with a semilunar ciliated depression. Ovules many, superposed. Capsule globose or ovoid, finally dehiscing on one side between the ribs. Seeds subglobose or obovoid with short aril.

1. *C. speciosus*, Smith.

A handsome plant 2—6 ft. high, the stem usually spiral so that the distichous leaf arrangement is no longer apparent. Leaves elliptic-oblong, 6—12", thinly silky beneath. Flowers very large, pure white, in terminal dense heads 2—4" long with scarlet ovate bracts 1—1.5" long.

Generally distributed, in moist localities in long grass and in the forest. Chota Nagpur, common! Puri and Angul, common! Fl. July—Sept.

The stem is more solid than in most of the previous genera. Calyx 1". Petals 1—1.5". Lip suborbicular, 2—3", with the incurved margins usually meeting.

The rootstock is eaten.

9. ALPINIA, L.

Usually very tall, often gregarious, herbs with tuberous or creeping rootstock and leafy stems which terminate (with few exceptions not in our area) in the inflorescence. Leaves distichous, usually narrow. Flowers rather small to very large, in racemes or panicles, often enveloped in bud by the convolute bracts. Calyx laxly tubular, shortly 3-toothed. Petals narrow, upper usually broader and more concave. Lateral staminodes 0 or very small; lip large, sometimes with 2 subulate processes at the base of the claw. Filament flattened, anther-cells divergent above, connective furnished rarely with an orbicular crest. Ovary 3-celled, style filiform, stigma subglobose. Ovules few or many. Fruit globose, usually dry and indehiscent, irregularly breaking up. Seeds globose or angled.

I. Inflorescence paniced:—

A. Flowers rather small, lip under 1" long. Bracts small:—

Bracts small ovate amplexicaul, persistent

Bracts oblong, 4—5", free, subpersistent

B. Flowers large or mod.-sized, lip 1—1.5". Primary bracts minute or 0. Fl.-bracts very large, wrapping round and covering the bud, finally circumsciss at base:—

Bracts open. Inflor. dense erect, pyramidal

Bracts closed. Inflor. lax, cernuous

II. Inflorescence simply racemose. Bracts as in I, B:—

Bracts wrapping the bud white and wax-like

Bracts wrapping the bud soft and greenish

1. *allughas*.

2. *galanga*.

3. *calcarata*.

4. *speciosa*.

5. *malaccensis*.

6. *bracteata*.

1. **A. allughas**, *Rosc.* Taro, *Vern.*; Elephant Grass.

A gregarious herb 4—6 ft. high with somewhat compressed stems and distichous oblong glabrous leaves, larger 20" by 3·5" (12—18" by 3—6", *F.B.I.*), with a short sharp acumination or cusp (a fine twisted point, *Roxb.*), base contracted into a short petiole 3—4" long; sheath glabrous, minutely striate and lacunose; ligule 15", obtuse, shortly pubescent. Flowers rather small, pink, in slender but very compound pubescent or somewhat tomentose panicles 8—12" long with small ovate amplexicaul persistent bracts. Calyx pubescent, 3—5". Petals linear-oblong, greenish-white, 3—5". Lip cuneate, pink, 2-fid or emarginate with 2 linear-subulate glands at the base, strongly 2-veined with a deeper pink, clawed. Anther pinkish, cleft. Capsule usually globose, 5" diam., black, but sometimes (in our Purneah plant, which is apparently this) ellipsoid, 6—7" long, irregularly transversely breaking up, at first dull red, finally black, beaked by the calyx-tube. Seeds 4—6 in each cell irregularly globose, enclosed in a white pithy flesh.

This appears to be the commonest of the *Alpinias* in wet places in the open, often forming a dense jungle in the Tarai and Duars, and common in Purneah! Fl. May—June. Fr. Nov.—Dec.

2. **A. galanga**, *Sw.* Taro, the vernacular name for all the genus.

A very large herb growing mixed with other *Alpinias*, 6—7 ft. high, with oblong-lanceolate glabrous leaves 1—2 ft. by 4—6", glossy both sides lowest reduced to sheaths, ligule short rounded ciliate. Flowers small in close panicles 6"—1 ft. long with a densely pubescent rhachis and numerous short branches. Bracts small, ovate, concave. Calyx greenish-white, 25". Petals 3—5", linear-oblong, greenish-white. Lip clawed, 5", obovate, emarginate, white veined with lilac, and with reddish subulate basal glands. Stamen shorter. Fruit orange-red with 3—5 seeds.

Wet savannahs. Fl. April—May. Frequent in the Tarai and Duars and probably in Purneah. Chota Nagpur, *Wood* (but I have seen no specimen). Said to be often cultivated.

3. **A. calcarata**, *Rosc.*

Slender, 2—4 ft. high, with lanceolate leaves 6—12" by 1—2", glabrous. Flowers handsome, usually 3—4 crowded on the lower branches of a dense pyramidal panicle only 3—4" long with pubescent rhachis and white boat-shaped or oblong bracts 5" long. Corolla white. Lip beautifully variegated with red and yellow, emarginate, 1—1·5", base spurred.

Cultivated only in our arca. Fl. April—June.

4. **A. speciosa**, *Schumann.* Syn. *A. nutans*, *Roscoe.*

Height 8—10 ft. with oblong-lanceolate leaves 1—2 ft. by 3—6", finely pubescent beneath. Flowers handsome in slightly compound cernuous panicles 6—12" long with very hairy rhachis, bracts 1" long or more.

Lip ovate 1.5" long and broad, beautifully variegated with red and yellow, margins much incurved, not variegated, base spurred. Capsule red globose.

Wild in the Duars and eastwards. Only cultivated in our area. Fl. r.s.

5. *A. malaccensis*, *Rosc.*

Stems stout, 6 ft. or more. Leaves often 3—4.5 ft. long by 6—8.5" broad, narrowly oblong, narrowed and one-sided at the base, with a villous cusp at apex, somewhat hairy or pubescent, especially on the midrib beneath, and with a densely villous marginal vein. Petiole 2". Ligule rounded, ciliate. Inflorescence racemose supported when young by about 3 large caducous lanceolate thinly hairy bracts 6—8" long. Raceme 9—12" many-flowered with fulvous-hairy rhachis. Pedicels .25", hairy and pubescent. Buds a beautiful waxy white enclosed in a large white petaloid convolute bract 1.5" long. Flowers 2—2.25" long and 1.5" broad with base of hypanthium (round the ovary) densely pubescent and with stiff hairs. Petals over 1", white. Lip 2" (*Roxburgh* says when expanded 3" broad and 2.75" long; no doubt a more robust specimen), sides inrolled and margins crisped, apex somewhat produced and deeply emarginate, colour yellow with the centre variegated a deep red and yellow, base with 2 ascending horn-like glands. Capsule globose, yellow, .75—1" diam., hairy. *Roxb.* says 3-valved (but I have not seen it dehiscent). Seeds many.

This occurs usually in damp forests, not in savannahs. Frequent in Tarai and Duars! Purneah, probably. Mals of Pur! Fl. April—May.

6. *A. bracteata*, *Roxb.*

Very stout leafy herb with inclined stems and erect raceme. It much resembles the last, but the brittle bracts enclosing the buds are greenish to red.

It occurs in the Duars but has not yet been noticed in our area.

FAM. 157. CANNACEÆ.

Perennial rhizomatous herbs with large penninerved leaves and usually brilliantly coloured asymmetric flowers in spikes or paniced cymes. Calyx of 3 free sepals. Corolla with 3 perianth segments connate at base. Androecium consisting of a variable number of members, 1—5, partly adnate to the corolla tube. One of these is fertile bearing a single marginal anther-cell, the rest of the stamens being petaloid. Opposed to the fertile stamen is a recurved petaloid staminode (labellum) which is homologous with the cucullate staminode of the *Marantaceæ*; the other 2—3 petaloid staminodes (lateral staminodes) are usually erect. Style adnate at the base to the staminal tube, then broad and flattened, somewhat curved; stigma small, terminal and oblique. Ovary 3-celled with 2 rows of anatropous ovules in each cell. Fruit capsular, 3-celled, papillose, tubercled or echinate. Seeds several, globose. Embryo straight, surrounded by perisperm.

1. CANNA, L. (The only genus).

1. *C. indica*, L. Indian Shot.

Var. *orientalis*, Rosc., common in damp waste places, especially near villages. Fl., Fr. r.s. The rest of the genus is American, and various varieties are largely grown in Indian gardens.

Height 3—4 ft. L. 12—20". Fls. deep red with greenish petals 1" long and much longer than the tube. Outer staminodes 3 oblanceolate emarginate, lip reflexed emarginate at the truncate apex. Capsule globose .75" with round black hard seeds the size of a pea.

FAM. 158. MARANTACEÆ.

Perennial herbs or shrubs of various habit with distichous closely pennincined unequal-sided leaves with a long or short petiole above the sheath with a characteristic knee or swelling. Flowers mod.-sized or rather small paired in the bract axils and bracts distichously (exc. *Calathea*) arranged in spikes, or paniced. Flowers asymmetric. Calyx and corolla usually distinct. Sepals 3 free. Corolla-tube with 3 petals. Andrœcium tubular below. Of the 3 stamens of the outer whorl only 1 or 2 are developed as petaloid staminodes (lateral staminodes) or sometimes all 3 fail. Of the inner staminal whorl, one stamen only is fertile, and this has only one perfect anther-cell, the other half of the stamen being petaloid; the other two are staminodes of peculiar form, one contracted above and furnished on one side with a hood-like appendage (cucullate staminode), and a broader often hardened staminode (callous staminode or labellum). Ovary inferior, 3-celled, or through suppression, 1-celled. Style stout, curved, often lobed above, at first included in the cucullate staminode. Ovule 1 in each cell. Fruit dry or fleshy, dehiscent or indehiscent. Seed with perisperm and curved embryo and usually arillate.

I. Ovary 3-celled:—

A. Suffruticose, 2-chotomously branched. Fls. terminal

1. *Clinogyne*.

B. Herbaceous. Stem short, unbranched or rhizomatous:—

Stem with 1 leaf and a lateral head of flowers

2. *Phrynium*.

Stem or rhizome several leaved. Fls. densely spicate

Calathea,

(p. 1201).

II. Ovary 1-celled:—

Inflor. terminal, fl. pedicelled on the slender branches

3. *Maranta*.

1. CLINOGYNE, Salisb.

Shrubby or sub-herbaceous with tuberous or woody rootstock and copiously 2-chotomously branched leafy stems. Flowers mod.-sized paired in terminal panicles or paniced spikes with long narrow bracts. Sepals short free. Petals narrow, connivent. Staminal-tube cylindric with obovate petaloid unequal segments and a 1-celled anther adnate to the margin of staminal segment. Ovary 3-celled, style adnate below to the staminal tube, free and hooked above with capitate hollow stigma. Ovules 1 in each cell. Fruit indehiscent with 1—3 subglobose seeds with a lacerate aril and curved embryo.

1. **C. dichotoma**, *Salisb.* Khorsong, *Or.*; Kanchan, *Khond.*; Muktapati, *Beng.* (*f. Roxb.*).

A bamboo-like undershrub with slender cylindrical stems attaining 10—12 ft. high and 1" diam. Leaves ovate to elliptic-oblong or ovate-oblong, 4—6", cuspidate, rounded at base. Flowers white in short 2- rarely 3-fld. lateral bracteate, shortly paniced racemes with dry lanceolate bracts 1.5—2" long. Sepals 3" long. Petals 1.2". Staminal tube elongate. Labellum with a hard saccate base. Ovary tomentose. Style fleshy. Fruit 2—3-lobed and -seeded, rugose; subglobose with flattened top, .4—5" diam.

In marshes, gregarious. Mats of Puril Fl. April—May. Fr. r.s.

Root creeping, woody. Stems much polished, green. Leaves with a short petiole .2—25" long, very finely nerved, sometimes pubescent. Sheath produced into a short ligule. There is a curious hard bracteole at the base of the pedicel, .08" long, subulate and angular when dry. This does not appear to have been mentioned in works consulted.

Mats are made from the split stems.

2. **PHRYNIUM**, *Willd.*

Herbs with creeping rootstock. Stem sometimes with a single terminal broad leaf and (in our species) a lateral dense head or spike of small or mod.-sized flowers (sometimes radical in other species). Tube of hypanthium elongate bearing linear-oblong spreading petals, the staminal-tube further elongated with unequal petaloid segments. Lateral staminode entire or 3-fld, labellum broad, transversely ridged within. Stamen narrow. Ovary 3-celled, style adnate below to the staminal tube, free portion hooked. Ovules 1 in each cell. Fruit globose or oblong indehiscent or finally dehiscent with 1—3 large seeds. Aril short fleshy. Embryo curved in a horse-shoe round a central canal in the perisperm (according to *Petersen* the perisperm canal is forked below the embryo).

Bracts of inflorescence with a hardened entire tip, petals white, shorter than the tube

1. *parviflorum*.

Bracts of inflorescence with a bristly tip. Petals purple, longer than the tube

2. *capitatum*.

1. **P. parviflorum**, *Roxb.* Runkona, *Khond.*

An erect usually gregarious herb with slender stem 2—5 ft. high from a tuberous rhizome, bearing single terminal large oblong or ovate-oblong leaf 12" by 6" to 20" by 8", shining both sides, shortly cuspidate. Flowers small white, the staminodes tipped with yellow, aggregated into a sessile lateral head 1—2" diam. near the top or middle of the stem. Fruit broadly oblong .4—5" long, 1-seeded.

Wet jungles. Singbhum! Puril Fl. July—Aug. Fr. Sept.—Feb.

Leaf base rounded and shortly produced on top of petiole. Petiole about 2". Heads sometimes two together with lanceolate bracts cuspidate, as long as the corolla-tube.

2. **P. capitatum**, *Willd.*

Habit of the last but the bracts of the head have a scarious tip which breaks up into bristles. The flowers have purple petals and

rose-coloured staminodes. Petals longer than the corolla-tube. Fruit usually 3-seeded and 3-sided.

Singbhum, along shady nalas! Fl. July—Aug.

The large American genus *Calathea* has short unbranched stems from the rhizome and often handsome leaves. The inflorescence is usually strobilate or capitate with closely imbricating usually spiral bracts and several flowers to each bract. Labellum broad usually emarginate. Cucullate staminode with inrolled margins. Lateral staminode 1, usually emarginate.

C. zebrina is a very beautiful plant with a crown of large velvety leaves 1—3 ft long, shaded above with bands of darker and lighter green, and purple beneath. Often grown in grass green-houses. Native of Brazil.

3. MARANTA, L.

Herbs with usually branched stem. Leaves often very ornamental in colouring. Flowers pedicelled paired on a common pedicel, 2—4 pairs enclosed in each bract of a spike of opposite distichous bracts terminating the stem or its branches, proper pedicels of each flower unequal. Spikes sometimes paniced. Corolla-tube longer than the calyx. Two lateral staminodes petaloid, larger than the others. Cucullate staminode usually with broad curved ear. Fertile stamen with a free appendage. Ovary 1-celled, 1-ovuled.

An American genus of which several very beautiful foliaged plants are common in grass greenhouses and verandahs in India.

1. *M. arundinacea*, L. Arrowroot; West Indian Salop.

A branched herb 3—6 ft. high with creeping rootstock and fleshy cylindrical-obovoid tubers about the size of carrots, covered with pale scales which leave scars when they fall. Leaves ovate-oblong and up to 10" by 4.5" at base of stem, upper 4—6" ovate-lanceolate to narrowly lanceolate with rounded or cuneate base. Inflorescence laxly 2-choromously branched with ultimate branches 2-fld. Fls. white, .7—1" long, sepals .5".

Occasionally cultivated for the starch and sometimes seen as a pot plant in verandahs.

It is the source of the true arrowroot.

ORDER.—GYNANDRÆ.

FAM. 159. ORCHIDACEÆ.

Herbs terrestrial or epiphytic or sometimes scandent (by means of adventitious roots). Stems often thickened into one or a chain of pseudobulbs, the latter usually terminating the internodes of a sympodium. Inflorescence lateral or terminal. Flowers from minute to very large and showy, solitary or usually spicate or racemose, zygomorphic. Hypanthium adnate to the ovary and sometimes shortly

produced above it, it or its pedicel usually twisted. Perianth superior, in two alternating whorls. Calyx of 3 sepals, 2 (superior, lateral) sometimes united and forming at their base a sac or spur (*mentum*), one median (inferior). Petals 3, one (the lip) dissimilar from the other 2 (merely referred to as "*petals*") and variously developed, normally superior and turned towards the axis, but by the torsion of the pedicel or hypanthium the orientation of the parts of the flower is usually reversed, the median sepal becomes dorsal and the lip anterior and turned towards the bract. Stamens and style united into a column, the top of which is usually shortly produced (towards the lip) into a beak or process (*rostellum*). Anthers one or 2 only, sessile or subsessile on the long or short column, on the other side of the floral axis to the lip, large, often opercular; pollen cohering in each anther-cell into 1, 2, or 4 pollinia which are free or attached by pairs or fours to a viscus or gland, or to a stalk (*caudicle*) which terminates in a viscid gland; by means of the gland the pollinia become attached to the heads of insects and are withdrawn from their cells. Ovary inferior, 1- rarely 3-celled; stigma one or two viscid surfaces on the top or front or on lateral processes of the column below or between the anther or anthers. Seeds most minute and numerous, testa lax, embryo not differentiated.

All our species belong to the *Monandrx* with a single anther but species of *Cypripedium* with 2 anthers are often seen in cultivation.

I. Pollinia softly granular or sectile (in small masses), held together by viscid threads (genera 1—6):—

A. Anther erect, neither opercular nor deciduous with very short broad filament. Caudicles basal. Column very short or 0, rostellum small erect or 0:—

Terrestrial. Caudicles lying in tubes of the anther-cells

1. *Habenaria*.

B. Anthers erect or inclined, but inverted, not deciduous, filament slender or very minute, caudicles 0 or apical. Leaves convolute in bud, not articulate on the sheath:—

1. Terrestrial, with tuberous rhizomes, inflorescence at the apex of the year's (underground) shoot:—

a. Anther lying on the elongate rostellum which shows a deep cleft (rostellum 2-fid) on removal of the pollinia:—

i. Stigma single, anticous:—

Lip saccate at base

Lip neither saccate nor spurred at base

2. *Goodyera*.

3. *Spiranthes*.

ii. Stigmas 2 lateral. Pollinia 2 bipartite. Lip saccate or cymbiform at the base, inferior

4. *Zeuxine*.

b. Anther erect with the apex usually resting in cup-shaped top of column. Rostellum not 2-fid:—

Leaf one large plicate, following the flowers

5. *Pogonia*.

2 Scandent, sympodium with elongate internodes

6. *Vanilla*.

- II. Pollinia waxy 1—4 in each cell. Anther opercular, deciduous (genera 7 to end):—
- A. Terrestrial orchids (exc. *Oberonia*, *Pholidota* and *Thunia* in which inflorescence terminates the members of a sympodium) (genera 7—16):—
1. Inflorescence terminating the successive sympodially connected shoots. Leaves not plicate:—
 - a. Leaves equitant or conduplicate in bud:—
 - i. L. equitant. Fls. very minute. Small epiphytes 7. *Oberonia*.
 - ii. L. not equitant. Flowers small, resupinate (lip dorsal):—
Lip with basal appendage. Column very short 8. *Microstylis*.
Lip without basal or auricular appendages. Column long with wings or callosities 9. *Liparis*.
 - b. Epiphytes. Leaves convolute in bud:—
Shoots pseudobulbous. Fl. small globose in the axils of distichous bracts 10. *Pholidota*.
Stems leafy not pseudobulbous. Fls. large 11. *Thunia*.
 2. Inflorescence axillary or on special lateral shoots. Leaves plicate:—
 - a. Pollinia 4 or 8, not attached to a gland of the rostellum:—
Fls. large. Sep. and pct. spreading. Column long 12. *Phajus*.
Fls. m.s. Sep. cohering and with large saccate mentum. Column short stout. Anthers 2-celled 13. *Acanthephippium*.
Fls. rather small. Scape lateral, appearing before the leaves. Lat. sep. adnate to base of slender column. Anthers 4-celled 14. *Pachystoma*.
 - b. Pollinia 2 or 4 attached to a gland of the rostellum which is carried away with them when they are removed. Scape leafless. Underground stem a chain of tubers:—
Lip cymbiform, margins involute 15. *Geodorum*.
Lip with saccate or shortly spurred base, lateral lobes erect embracing the column or 0 16. *Eulophia*.
- B. Epiphytic orchids. Inflorescence never terminating sympodially connected shoots* (vegetative shoots often sympodially connected). Leaves never plicate (genera 17 to end):—
1. Foliage shoots of limited apical growth, their basal parts forming a sympodium (rhizome), their upper parts free and usually swollen into pseudobulbs. Pollinia 4 or 8 not attached to a gland or process of the rostellum:—
 - a. Upper parts of each annual shoot with several nodes (hence ringed, jointed or scarred after fall of leaves). Stems elongate and pseudobulbous:—
Fls. usually large and bright-coloured, not woolly. Pollinia 4 17. *Dendrobium*.
Fls. not large or bright-colored, often woolly. Pollinia 8 18. *Eria*.

* Often from the uppermost leaf axils or nodes of aerial shoots which have lost their leaves. Apparently terminal in *Dendrobium*, spp. 1—3.

- b. Upper part of each annual limb of the sympodium with only one node (pseudobulb not ringed). Pollinia 4:—
 Sepals subequal
 Lateral sepals very long and exceeding the median
2. Foliage shoots of unlimited apical growth, monopodial, not pseudobulbous. Leaves strap-shaped or linear, articulate on the sheath. Inflorescence lateral, usually many-fl. Gland or process of rostellum carried away with the pollinia:—
- a. Lip not spurred:—
 i. Column without a foot (or foot very short in *Vanda*):—
 L. terete. Column winged
 L. thick linear. Column short stout. Lip saccate at base
 ii. Column with a foot, lateral sepals forming a mentum with it, column winged
- b. Lip spurred or prominently saccate (see also 22):—
 i. Lip saccate or spurred at the base:—
 Spur with longitudinal septum. Fls. small
 Spur with a transverse lamella of callus. Fls. small
 Spur not divided. Fls. small, stipes of pollinia slender
 Spur not divided. Fls. usually large. Stipes of pollinia broad
 ii. Lip with an ascending or recurved hollow spur under the blade
19. *Bulbophyllum*.
 20. *Cirrhopetalum*.
 21. *Luisia*.
 22. *Rhynchostylis*.
 23. *Doritis*.
 24. *Sarcanthus*.
 25. *Cleisostoma*.
 26. *Saccolabium*.
 27. *Vanda*.
 28. *Aerides*.

1. HABENARIA, Willd.

Terrestrial tuberous herbs with 2-many leaves with sheathing bases. Flowers large or mod.-sized; more rarely small, white, green or yellow. Lateral sepals mostly spreading or reflexed, dorsal sometimes connate with the petals. Petals simple to 2-partite with often filiform segments. Lip various, usually 3-lobed, always spurred at the base. Column short with usually small erect 3-lobed rostellum, midlobe often minute between the cells of the anther or 0. Anther erect adnate to the column with cells parallel or divergent below and their bases often produced into long or short grooves or tubes in which the caudicles of the pollinia lie; pollinia granular with short or elongate basal caudicles and an exposed gland. Stigma 2-lobed or 2 more or less developed papillose often clavate processes.

(In *H. Susannæ* the stigma is a single viscid area, and on this account it is sometimes included in a separate genus, *Platanthera*, Rich. The last four species are sometimes placed in a separate genus, *Peristylus*.)

I. Flowers 5" diam. or over with lateral sepals free spreading reflexed or deflexed. Spur elongate (Spp. 1—14):—

A. Petals 2-fid or 2-partite. Lip 3-partite. Stem leafy from base upwards:—

- Sepals with filiform tips 1. *stenopetala*.
 Sepals acute 2. *digitata*.

- B. Petals entire (Spp. 3—14):—
1. Lip 3-lobed or -partite (Spp. 3—13):—
 - a. Side-lobes of lip palmately lacerate or pectinate:—
Stem tall leafy with large white flowers 3. *Susannæ*.
 - b. Side-lobes of lip entire or only slightly toothed, broad (cp. c). Fls. white (Spp. 4—8):—
 - i. Leaves appressed to the ground:—
 - † Lip not or hardly longer than lateral sepals:—
L. 2, sessile orbicular or broadly elliptic. Sep. 6—7-nerved 4. *platyphylla*.
 - †† Lip much longer than lateral sepals. L. more than 2:—
Fls. (with ovary) 1" or less. Spur .75—1.5"
Fls. (with ovary) 1.5" or more. Spur 2—4" 5. *plantaginea*.
6. *longicalcarata*.
 - ii. Leaves clothing the stem:—
L. linear. Sepals .17" long. Lip .5—7" broad 7. *longifolia*.
L. lanc.-oblong. Sep. .5" long. Lip 1" broad 8. *triflora*.
 - c. Side-lobes of lip entire, filiform:—
 - i. Anther-cells with long tubes:—
Tall, leafy. Fls. white, lip with filiform segments 9. *commelinifolia*.
 - ii. Anther-cells with short tubes:—
† L. clustered, mostly above base of stem:—
Fls. green. Sep. .15—17". Spur longer than ovary 10. *furcifera*.
Fls. green Sep. .12—125". Spur shorter than ovary 11. *affinis*.
Fls. yellow. Sep. .25". Leaf margined 12. *marginata*.
†† Leaves 2 only, nerveless, appressed to ground 13. *diphylla*.
14. *stenantha*.
 2. Lip entire, linear. Stem leafy 15. *galeandra*.
- II. Flowers very small* (exc. in 15 and sometimes 18), lateral sepals erect or ascending and more or less connivent. Spur very short, often sub-globose:—
- A. Lip entire, broad. Spur short stout .1" long only 16. *Stocksii*.
 - B. Lip 3-lobed or -lobed:—
 1. Spur elongate-clavate, .15". Fls. under .2" diam 17. *goodyeroides*.
 2. Spur subglobose, .1" long or less:—
 - a. Rather stout. Lat.-sepals .2—25":—
Lip-lobes broad sub-obtuse or obtuse. Fls. sub-secund. Perianth .15" long 18. *constricta*.
Lip-lobes narrowly lanceolate. Fls. not secund. Perianth .3—7" long 19. *Lawii*.
 - b. Slender. Fls. .2—25" diam. Lat. sep. .12"

1. *H. stenopetala*, Lindl.

A stout erect orchid 1—3.5 ft. high, basal third of stem clothed with closely-fitting sheaths. Leaves several, oblong-lanceolate or ovate-lanceolate, acute, undulate, from a broad amplexicaul base, 3—8" by 1.25—2.75". Flowers crowded about .7—1" diam., pale green except the lip which is brown, in a raceme 4—9" long, peduncle with lanceolate acuminate bracts passing into leaves at base of scape. Sepals with filiform tips .25—5" long, 3-nerved. Petals 2-parite, segments slender equal or the lower shorter (rarely obsolete). Lip 3-partite,

* See also cleistogamous form of *H. diphylla*.

segments filiform, spur equalling the ovary, slender. Anther-cells narrow with tubes nearly as long as the cells. Stigmatic processes clavate elongate. Capsule linear-oblong, .5—.7".

Chota Nagpur, Singhum, *Clarke* (*vide F.B.I.*). I have been unable to find *Clarke's* specimen. Fl. Aug.—Oct.

2. *H. digitata*, *Lindl.*

An erect ground orchid with tall leafy stem 1—2 ft. high, lowest leaves reduced to infundibular sheaths. Leaves elliptic-lanceolate acute or acuminate, 2—4" long, sessile on the sheath, papillosely ciliolate. Raceme or spike about 5" rather laxly several-flowered with greenish or green and white flowers with a resemblance to insects. Lateral sepals .3—.35" somewhat obliquely ovate, acute, without filiform tips, dorsal shorter very concave, petals 2-partite nearly to the base with linear segments, upper broader erect recurved about .25—.3" long, lower segment spreading and often recurved; lip 3-partite with linear segments, centre segment straight nearly .5" long, lateral segments more filiform often decurved longer or usually shorter, spur .6" sub-clavate, sometimes inflated, with an erect ligule at the mouth.

Manbhūm, near Parasnath! Gangpur (var. *foliosa*), *Cardon!* Fl. July—Sept.

Tubers small, about 1" diam., many fleshy roots from the stem above the tuber. Leaves variable according to the *F.B.I.*, from ovate or orbicular to ovate-oblong or lanceolate and rarely narrowed into a short petiole. Bracts lanceolate .8—1" (often almost foliaceous and exceeding the flowers, *F.B.I.*), pedicels very short (the flowers are practically sessile in my specimens). Anther-cells parallel, tubes short upcurved, glands of pollinia minute. Stigmatic processes clavate, rostellum erect, triangular. Capsule .5", fusiform with thick ribs. The flowers sometimes have a disgusting odour.

Var. *foliosa* is described as smaller and only 6—12" high with shorter broader imbricating leaves and dense-fl. raceme, bracts shorter and segments of lip filiform. My Manbhūm specimen approaches the variety in the bracts being shorter than the .9" long ovary and in the filiform lip segments.

3. *H. Susannæ*, *Bt.*

A very striking ground orchid 2—3 ft. high with robust leafy stem, elliptic-oblong or lower ovate-oblong leaves 3—8" long and few large white flowers 2.5—4" diam. with deep brown lip and lacerate side-lobes, in a few-fl. raceme.

Not unfrequent in thin forest. Singhum! Palamau! Hazaribagh, *Clarke!* Gangpur, *Cardon!* Fl. Sept.—Oct.

Tubers 3—4" long contracted into a large sheathing base, subacute, many-nerved. Bracts leafy. Flowers subsessile with an elongate ovary, fragrant. Lateral sepals spreading oblong-lanceolate (subquadrately oblong, *F.B.I.*), dorsal sepal very broad obovate or rhomboid, rounded. Petals linear. Lip with digitately pectinate broad side-lobes and broadly linear midlobe dilated downwards, spur 4.5—6" long or twice as long as the ovary. Anther very broad and large, cells slightly divergent, tubes adnate to the sides of the column; pollinia linear, about as long as their caudicle. *Hooker* (*F.B.I.*) adds: "This is a true *Platanthera*, in wanting the produced stigmatic processes, and the obscure rostellum, which is marked by a triangular line only."

4. *H. platyphylla*, *Spreng.*

A pretty ground orchid 8—12" high with a pair (rarely 3) of very dark green broadly elliptic or orbicular leaves 1.5—3" long appressed

to the ground, and pure white flowers in rather dense spikes .5—6" diam. but variable in size. Lateral sepals spreading or drooping, .22—4" long, somewhat obliquely ovate-oblong, broad, 6—7-nerved, obtuse, dorsal sepal erect shorter elliptic concave; petals linear, shorter than the dorsal sepal and erect with it; lip shorter than the sepals or equalling them with a very slenderly lanceolate often de-curved midlobe and 2 short petaloid, broader rounded side-lobes not half the whole length of lip, spur very long, .7—1.5", funnel-shaped at its base and slenderly clavate towards its apex. Tubes of anther like 2 horns, very long (up to .07").

Clayey ground on banks, especially near streams in the forest. Singbhum! Fl. Aug.—Sept.

Stem between the leaves and the tubers clothed with sheaths. Leaves, always 2 wherever I have seen it (ranging from Chota Nagpur to Chanda in the Central Provinces), but 3—6 according to the *F.B.I.* Sheaths on the scape narrowly lanceolate-acuminate, erect. Spike 2—4" long, round-topped. Flowers fragrant. Ovary elongate long-beaked sessile, only one-half to three-fourths as long as the spur. Spur with a short tooth at its mouth.

5. *H. plantaginea*, Lindl.

A pretty ground orchid with habit of *platyphylla* but always with more than 2 leaves (usually 5—7) which are oblong or elliptic-oblong 1—3" long, rarely 4.5 by 1.5" (3—6" long, *F.B.I.*). Scape slender 8—12" with a rather lax spike of white flowers. Lateral sepals spreading or erect dimidiate-ovate or falcate, .2—3" (.17", *F.B.I.*), 3—4-nerved, dorsal concave erect rather shorter than the lateral, elliptic-ovate 3-nerved; petals linear-lanceolate, erect, about equalling the dorsal sepal, 1-nerved; lip *much larger* than the sepals .4" long and flabelliformly .4—5" broad with 2 large semi-ovate or falcately oblong lateral lobes and equally long linear entire midlobe; spur very slender, usually upcurved, 1—1.5" long, scarcely widened either above or below. Anther-tubes short upcurved.

Similar localities with *H. platyphylla*, but more common. Singbhum! Manbhum, Clarke, Wood! West Bengal and Behar, Kurz! Gangpur, Cardon! Sarguja, Cardon! Parasnath (Hazaribagh), Clarke! Fl. Aug.—Oct.

Stem between the tubers and the leaves very short, clothed with sheaths. Sheaths on the scape numerous, slender, acuminate, erect. Spike 2—3" rarely 5" in robust specimens, on a peduncle 10"; flowers sometimes sub-second; perianth minutely puberulous. Ovary beaked, about half as long as spur, slender, bracts about half as long as ovary. Anther rather broad, stigmatic processes large, clavate. Capsule .75", fusiform with short slender beak. *Sir J. D. Hooker* remarks: "In this species the caudicles of the pollinia are at first inserted in the hollow of a single concave 2-lipped or incurved gland of a lanceolate form, which afterwards splits longitudinally, each pollinium carrying away half."

6. *H. longicalcarata*, A. Rich.

Habit of *H. plantaginea*, 10—18" high with narrowly oblong or lanceolate leaves 2—4" long. Flowers fewer and larger, 1.5" or more (with the slender 1" long beaked ovary), pedicelled, with sheathing bracts shorter than the ovary. Sepals .5" long, 3-nerved, obtuse. Petals oblong-lanceolate acuminate. Lip .75—1", side-lobes dimidiate-ovate acuminate fimbriate or toothed. Spur 2—4" long. Anther very

broad, tubes as long as the cells, pollinia narrowly pyriform shorter than their slender caudicles which are narrowly winged on one side.

Gangpur, *Cardon!* Fl. Aug.

7. *H. longifolia*, *Ham.*

Height 15—20". Leaves clothing the stem, almost grass-like, 3—6" long below and 1—2" wide, shorter upwards. Flowers white 9—1" long (with the ovary) in few- and lax-fl. spikes 2—3" long with slender bracts longer than the slender beaked ovaries. Sepals 17" long, oblong-lanceolate, 3-nerved, median smaller, petals gibbously ovate equalling the median sepal. Lip 5—7" long and broad, with large hatchet-shaped side-lobes and narrow linear-subulate shorter centre-lobe. Spur slender, twice as long as the ovary.

Darbhanga (Pusa), *Prain!* Bhagulpur (Nathpur, *Ham.*)* Fl. Sept.

8. *H. triflora*, *Don.*

A beautiful ground orchid about 1 foot high with the stem clothed to the top with leaves or leaf-like bracts sheathing at the base, and with 1—3 large pure white flowers with suberect sepals 5" long forming a hood, and the lip about 1" across with oblong-obovate or hatchet-shaped side-lobes and shorter linear acute midlobe. Petals small linear-subulate. Spur 1" to over 2" long, the slightly thickened or swollen tip usually concealed in the bracts.

Muddy banks of streams in the forest, Singbhum! Ranchi (a fruiting specimen only), *Clarke!* Fl. Aug.—Sept.

Leaves 1—3", lanceolate-oblong, lower embracing the stem, gradually smaller from base to top of the stem, where they pass into the bracts which embrace the ovaries, upper acuminate. Flowers shortly pedicelled, lip sessile on the mouth of the spur and there 2-gibbous, side lobes crenulate (according to *F.B.I.*, entire in my specimen), spur very slender as long as the ovary or longer, mouth funnel shaped. Anther-cells on each side of the very broad quadrate truncate anther, bases produced into short free tubes, glands minute. "Staminodes prominent" (*F.B.I.*). Capsule 5" long.

9. *H. commelinifolia*, *Wall.*

A ground orchid 1.5—2.5 ft. high with a robust leafy stem with oblong to oblong-lanceolate leaves 3—7" long, passing into lanceolate sheaths above and numerous white scentless flowers 5—7.5" diam., well marked by the deflexed gibbous lateral sepals 4" long with a small beak above (at the apex), smaller orbicular median hooded sepal and by the linear lip with two very slender filiform lateral diverging segments; spur very long, reaching 2.5" and doubly curved, with a funnel-shaped mouth and slightly inflated apex.

Open ground in the forests, common. Singbhum! West Bengal and Behar, *Kurz!* Cyra, *T. Thomson!* Plains of Behar, *T. Thomson!* Singbhum! Manbhum! Hazaribagh, *Clarke!* Ranchi, *Clarke, Prain!* Fl. Sept.

Leaves with a translucent white edge, sometimes conduplicate. Spike 4—8" long. Filiform lateral segments of lip 7—1" long. Tubes of the anthers very

* The *F.B.I.* says Nathpur, in Nepal; *Prain* says Nathpur, in Purneah; but see Appendix I.

long projecting forward; staminodes seated on the long arms of the column. Ovary with its long filiform beak 1.2—1.5", upper two-thirds filiform. Capsule .5" fusiform, beaked.

10. *H. furcifera*, Lindl.

A ground orchid 12—18" high with 3—5 leaves 3—6" long clustered towards the base of the stem, which is furnished with 3—4 bract-leaves above and a rather lax spike 4—6" long of green flowers 6—7". Sepals spreading or reflexed subequal in length 1.5—1.7", dorsal concave deltoid-ovate obtuse 3—4-nerved, lateral dimidiate-ovate or falcately oblong-lanceolate about half breadth of dorsal, subacute. Lip trifurcate, .3", side-segments filiform, nearly twice as long as the linear mid-lobe, spur longer than the .5" curved ovary, very slender, involute. Staminodes prominent as large tubercles.

Under dense shade in the forest. Singbhum! Ranchi (Ichadagh)! Gangpur, Cardon! Sarguja, Cardon! Fl. Aug.—Sept.

Tubers 2 ovoid about 1" long. Base of stem covered with sheaths below the cluster of leaves. L. variable in shape mostly narrowly elliptic or ell.-oblong, some oblanceolate, elliptic or obovate, acute or shortly acuminate, longer narrowed at base but without petiole, uppermost sometimes quite amplexicaul. Spike narrow, cylindric, with lanceolate acuminate bract about as long as the beaked ovary. Petals slightly broader than the sepals, .08" wide, oblong obtuse (or retuse, *F.B.I.*), 2-nerved. Anther rather small, tubes upcurved. Stigmatic processes short. Capsule .5", fusiform, turgid, decurved, with thick ribs and beak one-fourth as long as the body.

11. *H. affinis*, Wight.

Closely resembling *H. furcifera*. Leaves elliptic-lanceolate acuminate 4—6" by 2—2.5", hardly petioled. Spike 4—10" of green flowers about the size or a little larger than those of *furcifera*. Lip 3-partite nearly twice as long as the 2—2.5" long sepals, middle lobe narrowly lanceolate, side-lobes linear or linear-subulate, rather shorter (or longer, *F.B.I.*) than the mid-lobe. Spur incurved or even hooked, half or rather more than half as long as the ovary.

Singbhum, Clarke, *vide F.B.I.* But Clarke's specimens are in fruit, and I rather think they are *H. furcifera*, especially as this is frequent in Singbhum and I have never found undoubted *affinis*.

12. *H. marginata*, Coleb.

Rather a dwarf orchid 6—12" high. Leaves several in lower fourth or near base of stem, with a white or yellowish line round the margin, oblong or narrowly oblong, 3—4" long. Spike 2—4" long of yellow flowers or lip yellow and remainder yellowish-green (in our plant), curved, .8" long (with the ovary). Median sepal broadly ovate, nearly .25", lateral oblong-lanceolate, as long, 3—5-nerved. Lip longer 3-partite, side-lobes slender, longer than the linear obtuse central lobe. Spur stout equalling or shorter than the curved ovary, inflated clavate or fusiform below the middle.

Rajmahal Hills, Kurz! Manbhum: Tundi Hills, Campbell! Jonab, Prain! Jaspur, Cardon! Fl. Sept.—Oct.

Collett describes the (hill) plant as "very pretty with bright yellow flowers," Robertson as "a small ground orchid with orange-yellow flowers, rather fleshy."

Sheaths on the scape many erect, lanceolate. Bracts ciliolate. Petals ovate falcate, 2-nerved. Capsule .5", fusiform, curved, obscurely beaked.

13. *H. diphylla*, Dalz.

A dwarf terrestrial orchid 6—10" high with a single pair of orbicular or elliptic cordate-based nerveless blue-green leaves .75—2" long, closely adpressed to the ground. Flowers white and greenish .5" diam. (or only .25" in the cleistogamous form), in a narrow spike 2—4" long with lanceolate acuminate appressed bracts .25" long. Sepals subequal, lateral spreading white or greenish oblong 3-nerved, dorsal sepal green ovate conniving with the smaller petals. Lip 3-partite, much longer (about .25" in the cleistogamous form), with a ligulate mid-lobe and 2 short linear fleshy green side-lobes or (*vide F.B.I.*) the side-lobes longer. Ovary and spur about .5".

On damp clay. Singhum! Jaspur, Cardon! Fl. Sept.

Root of 2 tubers with fleshy fibres from base of stem. L. punctulate when fresh unequal. Scape with many small sheaths below the spike. Petals linear. Anther broad, cells diverging, tubes very short. Ovary inflated acute, scarcely beaked, rostellum obscure, stigmatic processes clavate adnate to the mouth of the spur.

14. *H. stenantha*, Hook. f.

A single specimen collected by Rev. Cardon in Chota Nagpur was so-named in the *Calcutta Bot. Gard.*, but *H. stenantha* is a plant of the temperate Himalaya and confirmation is necessary. It might be *H. latilabris*, Hook. f., which has been collected in Central India. The sepals are linear deflexed and the petals of *stenantha* are erect and linear, whereas those of *latilabris* are more or less ovate. It flowered in Aug. in the Hort. Bot. Cal., but I did not see it in flower.

15. *H. galeandra*, Benth. Syn. *Platenthera obcordata*, Lindl., in *Wall. Cat.* No. 7050.

A distinct-looking species 6—10" high with a cluster of 3—4 ellipsoid tubers and a very leafy stem, the leaves ovate to oblong and the largest only about 2" on the lower part of the stem, whence they are gradually reduced upwards and imperceptibly pass into the bracts. Spike 2—4" long, bracts oblong-ovate to lanceolate, lower much longer than the flowers. Flowers pale purple, perianth .2—'25" long and about .5" diam. with ovate dorsal sepal, falcately lanceolate lateral sepals, rather narrower obtuse petals, cuneiformly obovate or obcordate lip and a short stout cylindrical spur .1" long only.

Chota Nagpur, Wood (without precise locality). Fl. July.

16. *H. Stocksii*, Hook. f.

A very slender plant 8—10" high with oblong-ellipsoid tuber and the leaves occupying 2—3" of the stem near the middle. Leaves elliptic but acuminate both ends, 1.5—2.5", rather prominently 3-nerved. Flowers yellowish, as small as those of *Lawii* but for the spur, in a rather lax spike 3—5" long with the slender curved almost beaked ovary exceeding the bract. Lip equally 3-lobed with obtuse oblong, or central ovate, lobes; spur elongate-clavate, .15".

Parasnath, C.B.C.! Twice collected on Parasnath. Fl. Oct.

If this is *Stocksii* the distribution is peculiar, the other specimens being from the Concan and Maisor. *Hooker* describes *Stocksii* as with strict twisted spike

and second flowers (ours are subsecund), bracts longer than the ovaries, lateral sepals linear-oblong, dorsal elliptic, petals larger ovate obtuse fleshy, lip shorter than the sepals obtusely 3-fid, spur as long as the sepals, subclavate, and he remarks very like *H. Lawii*, but spur quite different.

The specimens agree fairly with this description where not otherwise specified above.

17. *H. goodyeroides*, Don. Syn. *Peristylus goodyeroides*, Lindl.

Usually a robust plant 2 ft. high with the leaves occupying 1—2" of the middle of the stem, elliptic-oblong or elliptic 3—4" long, acute. Spike dense 4—6" long with lanceolate bracts equalling or exceeding the 3" long ovary. Perianth 3—4" diam., yellowish-green, lateral sepals 2—2.5" linear- or ovate-oblong obtuse, petals gibbously ovate, lip as long as the sepals, 3-fid with oblong obtuse or rounded lobes or mid-lobe ovate, and minute stipitate bulbous spur.

Parasnath, T. Thoms., C. B. Clarke! Fl. r.s. Fr. Sept.—Oct.

The Parasnath plant is only 12" high with about 6 leaves near the centre of the stem, and sheaths below. Tuber oblong. Capsule 4" stout oblong (fusiform, F.B.I.).

18. *H. constricta*, Hook. f.

A ground orchid 18"—2 ft. high with rather stout stem clothed with large leaf-sheaths inflated at the mouth below the cluster of elliptic leaves, which are 3—5" long and aggregated near the middle of the stem. Flowers yellowish or greenish or white in narrow dense spikes 4—7" long with narrow acuminate puberulous bracts 5—6" long. Lateral sepals linear-lanceolate 2.5",* dorsal lanceolate concave, somewhat shorter. Petals white 3.2" nearly oblong (ovate-oblong F.B.I.), obtuse, 3-nerved. Lip as long or slightly exceeding the petals with narrow base and 3-furcate from about the middle with the side-lobes linear-lanceolate and slightly longer than the lanceolate mid-lobe (lobes of lip very variable, F.B.I.), spur very short globosely inflated, .08" long, greenish.

Open jungles, Manbhium (not far from Parasnath)! Also Chota Nagpur (without precise locality), Cardon! Fl. June—July.

Leaves tapering at the amplexicaul base, one sometimes inserted an inch above the others, nerves many with short transverse nervules, acute or sub-acuminate. Bracts 1-nerved. Flowers about as long as their bracts, puberulous in my specimens. Staminodes, 2 calli. Anther-cells with short tubes, pollinia clavate, caudicles short with large glands, rostellum 2-fid, erect, stigmatic processes clavate.

19. *H. Lawii*, Hook. f.

A ground orchid 6—12" high with 3—4 erecto-patent elliptic, oblong or lanceolate leaves 2.5—5" long above the middle of the stem and a narrow spike 2—4" long densely clothed with linear acuminate bracts below the flowers, but often with buds or abortive flowers in their axils. Flowers very small sub-globose white 2—2.2" diam. Lateral sepals oblong or linear-oblong 1—1.2" long, spreading, tip rounded, margin incurved; dorsal 1.3" broadly ovate slightly concave, forming a hood with the petals. Lip scarcely longer, concave, 3-lobed with

* Up to .5" or even .7" in specimens outside our area.

the central lobe larger than the lateral, lobes rounded, spur very short succulent bulbous. Anther without tubes.

Ranchi, on Ichadagh, 2500 ft.! Parasnath, *Clarke!* Fl. Aug.—Sept.

Tubers 2, ovoid, about 1" long. Stem sometimes 6" to the first leaf, clothed below with inflated leaf sheaths or uppermost sheath with a small amplexicaul leaf, leaves acute or shortly acuminate narrowed into a very short petiole-like base. Bracts 3" slightly exceeding the twisted ovary. Lateral sepals ascending (according to *F.B.I.*, spreading in my specimens when fresh). Petals obovate, slightly winged anteriorly, retuse or rounded. Lip described as 3-fid in *F.B.I.* Column hardly any with short acute rostellum. Anther-cells parallel, pollen granular, pollinia with a small elastic caudicle (caudicle 0, *F.B.I.*), and a round hyaline gland. Ovary slender twisted shorter than the 3—5"-long bracts.

2. GOODYERA, *Br.*

Ground orchids with short leafy stems, sometimes elongate and creeping below, and small flowers in terminal, sometimes twisted spikes. Sepals subequal, dorsal erect concave forming a hood with the narrower petals conniving but free; lateral erect or spreading, covering the sac of the lip or not. Lip inferior, sessile at the base of the column, entire, or with small side-lobes, cymbiform or subsaccate, sac sometimes with filiform appendages or setæ within. Column cylindric or with cupular top at the back of which the anther is hinged with its base included, anther-cells distinct, rostellum erect 2-fid, at least after removal of the pollinia, which are pendulous from a gland at its apex, pollen finely granular. Stigma occupying a single broad anticous surface below the rostellum.

1. *G. procera*, *Hook.*

Erect 12—18" high with inflated leaf sheaths at base. Leaves lanceolate 4—6" long by .8—1.5" broad, petioled, flat. Spikes 3—6" (excluding peduncle), dense, of minute globose white flowers with perianth 1—1.2" long. Lip about three-fourths as long as the sepals with a globose saccate base and very short erect side-lobes and minute tongue-shaped front lobe, palate with 2 large calli and sac softly setose within.

Growing on rocks in the middle of streams, Singbhum! Fl. March—April.

Leaves with 6—8 parallel nerves each side of midrib, but one sometimes stronger than the others, base tapering to the petiole. Bracts .3" finely acuminate sometimes thinly pubescent as are the rhachis and ovary, which is .2" long. Capsule .3", fusiform.

3. SPIRANTHES, *Rich.*

Terrestrial herbs with fibrous or tuberous roots and leafy stem, or flowering stem leafless. Leaves various, usually narrow. Flowers small secund in often twisted spikes. Sepals subequal free or more or less cohering with the petals in an erect hood, lateral gibbous at the base. Lip sessile or clawed, erect, entire or 3-lobed, base concave, palate callous or lamellate. Column short, terete, base often decurrent on the ovary. Stigma anticous broad, rostellum erect obtuse or elongate and 2-fid; anther erect 2-celled as long as the

rostellum; pollinia pendulous from the gland of the rostellum, pollen powdery.

1. *S. australis*, Lindl.

A graceful little orchid with several slender fascicled tubers; 3—15" high with linear-lanceolate or narrowly oblong leaves 1—4" by 3—5" principally near the base of the stem, upper passing into the linear acuminate bracts. Flowers white and greenish 12—15" (excluding the .08—1" usually papillose or pubescent ovary) long, spirally arranged (by twisting of the rhachis) on a pubescent scape with ovate or lanceolate bracts exceeding the ovary. Perianth very oblique to ovary, median sepal adnate to petals, lateral obliquely lanceolate 1-nerved, parallel to lip which is yellowish and saccate at base with a pair of large glands on margin of sac, blade slightly 3-lobed and crenulate or crisped, pilose above.

Extends from Garhwal to the Duars in grassy places!, and therefore probably in our Northern area, having been found each side of it. Fl. March—April.

4. ZEUXINE, Lindl.

Terrestrial herbs with stem creeping below and fleshy roots. Leaves narrow or broad. Flowers small in sometimes secund spikes. Sepals subequal or median rather broader and forming with the petals a hood, lateral free. Lip inferior, adnate to the base of the column, sessile, cymbiform or saccate with an entire 2-lobed or 2-winged terminal lobe, sac usually with calli or spurs near the base within. Column very short, 2-keeled or -winged in front; stigmatic lobes 2 marginal, distant, anther membranous, cells contiguous or diverging at base; pollinia pyriform, attached by an oblong gland to the erect rostellum with often an intermediate appendage or a linear caudicle.

A. Leaves linear:—

Median sepal .2—25", lip with fleshy terminal lobes, anther broad ovate cuspidate

1. *sulcata*.

Median sepal .1", lip with 2 thin lateral wings, anther narrow sagittate

2. *membranacea*.

B. Leaves broad, lip 2-winged at apex

3. *affinis*.

1. *Z. sulcata*, Lindl.

A small orchid 2—6" high, or in some districts up to 12", with fleshy roots and erect stem sometimes from a creeping base, clothed closely with erect grass-like leaves and terminating in a stout pyramidal spike of small white flowers 2—25" long (excluding the ovary).

In sandy and gravelly soil. Bettiah, *Hieronimus*! Purneah! Monghyr. Lockwood! Manbhurn, "marshy ground," Ball! Singbhum! Not uncommon. Fl. Jan.—Feb.

Lower part of stem with short annular sheaths. Leaves linear acuminate 1—2" long. Spike 1—2", dense, bracts erect, lanceolate acuminate, .25—5", 1-nerved. Perianth oblique on the .2" long ellipsoid glabrous ovary, median sepal gibbous .22" loosely connate with the petals, lateral sepals oblong to lanceolate obtuse .18" free 2—3-nerved. Lip green fleshy linguiform with upturned sides, side-lobes slightly elevated only, a slight constriction at base of terminal lobe which has 2 fleshy upturned lobules, obtuse or retuse. Filament very short broad hyaline

bearing a hinged red broadly ovate apiculate 2-celled anther, pollinia attached to a common membranous process of the oblique rostellum, consisting of numerous small waxy masses held together by viscid threads, rostellum 2-fid.

The *F.B.I.* says that the flowers are white, yellow or very pale rose and lip yellow. The short claw at base of terminal lobe of lip is described as pubescent; it and the side-lobes are rather papillose in my specimens. Being a wide-spread Indian orchid, it is probably variable, but the *F.B.I.* has united with *Z. sulcata* the following species, which is quite distinct.

2. *Z. membranacea*, Lindley. Syn. *Z. sulcata*, *F.B.I.* (in part).

A dwarf orchid 3—15" high with habit of *Z. sulcata* and somewhat similar leaves. Spike 5—2" on peduncles 2—4" long of white flowers .15—.18" long (without the ovary). Perianth nearly straight on the ovary which is pubescent and obconic. Lateral sepals ovate acuminate .1" free, indistinctly 1-nerved. Median sepal .15" conniving but not connate with the petals into a hood, ovate, obtuse, 1-nerved. Lip contracted between the orbicular saccate hypochile and the thin transversely oblong expanded flat .07" broad epichile which is apiculate between the wings, side-lobes 0. Rostellum deeply 2-fid. Filament very short bearing an erect sub-sagittate anther.

Growing in grass. Purneah! Fl. Dec.—Jan. Distrib. Purneah to Burmah.

Lower part of stem with short sheaths. Leaves linear or linear-oblong acute or acuminate, 1—2" long. Bracts lanceolate slightly exceeding the flowers. Median sepal not gibbous, .15". Perianth not pubescent nor papillose. Capsule .2" somewhat obovoid-oblong ribbed.

Quite distinct from *Z. sulcata*, with which it has been united.

3. *Z. affinis*, Benth.

A pretty little orchid 8—15" high ascending from a creeping base, which and lower parts of stem are furnished with membranous sheaths or leaf-bases. Leaves several, ovate-oblong, 1—1.7" sessile or with short petioles on the inflated broad hyaline sheaths. Flowers white in thinly pubescent spikes 1—3" long with perianth .15—.2" long very oblique on the erect thinly pubescent ovary. Lip saccate with 2 white hatchet-shaped wings each about .12". Bracts membranous, 3-nerved, mostly shorter than the narrow ovaries.

Sikkim Tarai and Duars and probably in Purneah! Fl. Feb.—March.

5. POGONIA, Griff.

(Section *Nervilia*, Gaud. Gen.)

Terrestrial tuberous herbs with a single remarkable leaf, being orbicular or broadly ovate with cordate base and strongly plicate, appearing after the flowers. Flowers small or mod.-sized, often green, solitary, few or many, horizontal or pendulous in a raceme. Sepals and petals subequal, narrow, connivent or spreading. Lip adnate to the base of the column, sessile or sub-clawed, usually narrow, entire or 2-fid or 3-lobed with a very short saccate or 0 spur. Column somewhat clavate upwards and cupular at the top, anther hinged on the back of the column and base resting in the hollow at the top, 2-celled, rostellum short, pollinia 2 or 4, pollen granular; stigma single transversely oblong.

1. *P. flabelliformis*, Lindl.

A curious little orchid with the scape arising from the top of a subglobose white tuber about 1" diam. followed by a cordate-based ovate-acuminate or orbicular leaf 4.5—5.5" diam. with 18—20 stronger nerves and as many or more finer intermediate ones; petiole 6—11" long. Flowers green 7" long, spreading and drooping. Sepals 6" erect connivent lanceolate-linear acute, petals 5" similar, but with faintly brown nerves. Lip very narrow 5" straight, neither saccate nor spurred, sometimes slightly gibbous, side-lobes embracing the column white, brown-veined midlobe white flat projecting 15", beyond the side-lobes, ovate but not constricted at base, palate hairy with 3 green veins. Column 3". Ovary very short, 2", winged.

Ranchi. Ichadagh, 2500 ft. | Palamau, Neterhat, 3000 ft. | Rajmahal Hills Kurz! Fl. May—June. Leaf not fully developed until September.

The leaves show two forms: a very orbicular one with a somewhat trumpet-shaped base decurrent on the petiole and a more ovate-acuminate one with the base less decurrent. These may be different species or varieties, the orbicular-leaved one being the true *flabelliformis*, but the flowers described above belong to the narrower-leaved form without doubt as the flowering plant was grown on by me in a pot until its leaf developed.

Scape with 2—3 loose pale distant sheaths 1" long on the peduncle.

6. VANILLA, Swartz.

Climbing almost shrubby orchids rooting from the nodes, branches with long internodes terete or angled. Leaves broad or reduced to scales, sessile, coriaceous or fleshy. Flowers large in terminal and axillary short-peduncled racemes. Sepals and petals subequal spreading. Lip with the claw adnate to the column which is embraced by its broad concave limb. Column elongate; anther incumbent (pendulous), cells separate, pollen granular. Capsule long, fleshy, 1-celled, loculicidally 3-valved, without septa.

1. *V. planifolia*, Andr. Vanilla.

A suffruticose climber rooting in the ground but soon entirely dependent on its adventitious roots and becoming epiphytic. Leaves 4—9" by 1.5—2.5" broad elliptic-oblong or lanceolate-oblong cuspidate with very short sheathing petiole. Racemes 2—3". Pedicels 1.5—2". Flowers 1—2" pale greenish or greenish-white with nerves of lip yellow, emitting a delicious fragrance at night. Sep. and pet. linear-lanceolate. Pod 6—10" long and 5" diam., obtusely 3-gonous.

Cultivated in Ranchi! Fl. Feb.—April. Native of Mexico.

The well-known flavouring essence is derived from the fermented and dried pods and is due to *vanillin*, $C_8H_8O_3$ secreted at first by the hairlike papillæ lining the three interior angles of the pod and ultimately diffused through the oily seed covering. The flowers require artificial pollination (in Ranchi), and are then said to yield the pods (at Palandu). They require harvesting as soon as they become pale yellowish-green.

Vanilla is also produced by *V. grandiflora* and *V. phacantha*, neither of which is believed to be grown in our area.

7. OBERONIA, *Lindl.*

Small tufted epiphytes without pseudobulbs, with equitant fleshy leaves articulate above the sheath and very minute flowers in dense subcylindric spikes or racemes. Sepals ovate or oblong, petals somewhat smaller, lip sessile, concave, entire or 2—4-lobed. Column very short, anther terminal, pollinia 4 waxy, cohering by a viscus.

A. Rhachis of inflorescence slender. Fls. shortly pedicelled:—

Perals broad, ovate, lip with small rounded or tooth-like side-lobes

Petals linear, lip with filiform side-lobes

1. *Falconeri*.

2. *rufilabris*.

B. Rhachis thick fleshy. Flowers sessile:—

Lip entire

3. *pachyrachis*.

1. *O. Falconeri*, *Hook. f.*

A curious little epiphyte with oblong-lanceolate or broadly ensiform distichous leaves 5—2.5" long and terminal spiciform racemes of inconspicuous greenish-yellow flowers .07" long, the perianth only .03" long. Hyaline bracts nearly as long as the flower, ovate-lanceolate or oblong, serrulate.

Frequent in Chota Nagpur. Singbhum! Burkutta, plains of Behar on *Ficus* and *Bassia*, *J.D.H.*! Hazaribagh, *Clarke*! Ranchi, *Prain*! Manbhum, *Campbell*! Fl. Oct. Fr. Jan.

Racemes slender with short stout peduncle, 2—3" long exceeding the leaves, erect or decurved. Pedicels very short. Petals ovate, lip oblong or subquadrate with small roundish or tooth-like lateral lobes, tip with 2 small incurved lobes separated by a broad sinus. Capsule .12" obovoid ribbed, shortly pedicelled.

2. *O. rufilabris*, *Lindl.*

This is frequent in the Jalpaiguri district whence I sent it to Mr. *Pantling*, and it probably occurs in Purneah. It is described as follows: "This lovely little gem has fascicles of thickish equitant leaves and nodding terminal inflorescence of very small flowers in dense verticils, and with setaceous bracts surpassing the flowers in length. The small fls. are light camboge-yellow, ultimately turning light red. The lip and the margins of the column are deep brick red from the first, the lip has a thick hippocrepic callus at the base."

In evergreen strips of forest on branches overhanging streams! Fl. Feb.

3. *O. pachyrachis*, *Reichb. f.*

A somewhat larger plant than the last two with leaves up to 4". Easily recognized by the thick fleshy rhachis of the spike densely covered with the minute sessile imbricate flowers, and which appears to be terminal or lateral on a leaf, the latter being adnate to its peduncle.

This also probably occurs on trees overhanging streams in Purneah and perhaps Champaran, as it has been found in the districts each side of our northern area in such situations. Fl. Feb.—March.

8. MICROSTYLIS, *Nutt.*

Terrestrial (in our area) or sometimes epiphytic, stems often enlarged or tuberous below, leaves 1 or more not articulate on their sheath. Flowers small in terminal racemes. Sepals spreading or recurved. Petals as long, slender. Lip posterior (i.e. uppermost), adnate to the base of column, concave or usually flat, sides often produced

upwards beyond the column as auricles. Column very short, with short spreading arms, anther erect subterminal, pollinia 4.

A. Leaves several. Sides of the lip not produced upwards into auricles:—

Lip subquadrately ovate, apex 3-lobed

1. *congesta*.

Lip rounded reniform or fan-shaped, pectinate

2. *versicolor*.

B. Leaves 2. Sides of lip produced upwards into auricles

3. *Cardoni*.

1. *M. congesta*, Reichb.

A stout herb with leafy stem 2–6" covered with large dry sheaths 1–3" long below, base tuberous. Leaves 2–6, large elliptic, more rarely ovate or lanceolate, 2.5–7" long, sessile or shortly petioled. Raceme dense 2–4" or with peduncle up to 8" or even 12", pedicels .12". Flowers only .2" long, perianth .1" long, pale dirty reddish or yellow and greenish (purple in one figure and according to a note dull-red), lip subquadrately ovate concave with a fold under the column and a 3-lobed apex. Bracts reflexed linear-subacute .1–.25" (usually .2") long. Capsules .3–.4" long, dense, obtusely ridged between the ribs, ridges rough or papillose, sometimes again ridged between.

Narainhati, Sikkim Tarai (probably also Purneah)! Parasnath, Clarke! Sarguja (no doubt on plateau), Cardoni! Fl. June–July. Fr. Oct.–Nov.

Leaves usually 4–7" with the stronger nerves 6–7, base lanceolate or rounded and suddenly contracted on to the short petiole. Bracts on the scape very close and always strongly reflexed, linear-lanceolate acuminate.

2. *M. versicolor*, Lindl. Syn. *M. Rheedii*, Wight.

A slender or usually stout herb, always, however, ending in a slender scape, 6–18" high, clothed with sheaths below the leaves. Leaves 3–4 aggregated at several inches above the base, elliptic or lowest ovate, 1–4" long, very shortly acuminate, base rounded shortly petiolate. Scape and peduncle together from 3–4" in weak to 9" long in strong plants, with numerous reflexed lanceolate bracts .1" long. Flowers very small, sweet-scented, with perianth about .1" long only and .2" broad, the drooping linear petals exceeding the sub-ovate sepals, lip rounded reniform or fan-shaped, pectinate. Capsule .3–.35" long.

Grows among dead leaves. Ranchi, Cardoni! Fl. July.

The Ranchi plant referred to *M. Rheedii* in the *Calcutta Herbarium* (and *Bengal Plants*) is an unusually small specimen only 3–5" high with a raceme only 1–1.5" long. The specimen was insufficient for critical examination. The leaf-nerves in the normal plant are about 7 (referring only to the stronger ones), and the flowers are described as red by *Rheede* and as greenish-yellow or purplish in the *F.B.I.*

3. *M. Cardoni*, Prain.

A small ground orchid about 6–8" high with a single pair of sub-amplexicaul orbicular to elliptic-oblong obtuse leaves 1.7–2.5" long and a not very dense raceme of small greenish flowers .2–.25". Sepals ell.-oblong much broader than the 2 linear petals. Lip with the central lobe erect and the two basal lobes divaricate from it and almost in the same plane, one on either side of the column, central lobe deeply emarginate, its apices rounded.

Sent from Chota Nagpur to the Calcutta Gardens by the *Rev. J. Cardon*, precise locality not recorded, but probably from Jaspur or Sarguja on our borders. Fl. July.

Tuber about .5—6". L. 5—6 nerved. Bracts lanceolate, .15", reflexed.

9. LIPARIS, L.

Terrestrial (in our area) or epiphytic, often with pseudobulbous base. Leaves 1 or more, sometimes jointed on the sheath or pseudo-bulb. Flowers small in terminal racemes. Sepals spreading, recurved or revolute, margins often revolute. Petals as long, very slender. Lip anterior, adnate to the base of the column, usually broad, deflexed from a very short base or recurved. Column long, incurved, margined or winged towards the tip; anther terminal, pollinia 4.

Bracts .08—1", sepals .3—4". Peduncle many-angled
Bracts .17—2", sepals .2—25". Peduncle 3-angled

1. *bituberculata*.
2. *nervosa*.

1. *L. bituberculata*, Lindl.

A stout erect herb from a sub-tuberous rootstock, often tufted. Whole plant 12—20" with raceme, stems 2—5" to top leaf insertion, one or more loose sheaths at the base and lower leaves sometimes reduced to sheaths. Leaves 2—5, upper subopposite, broadly elliptic or ell.-ovate to lanceolate (elliptic-lanceolate, *F.B.I.*), 4—6" long, base suddenly contracted into a short petiole, apex cuneate. Flowers a delicate pink, rather lax but many in the raceme with very small triangular spreading, erect and weakly reflexed bracts .08—1" long. Sepals .3—4" linear-oblong obtuse, lateral often revolute, lip .25" shorter than sepals decurved, cuneately obovate retuse, purple, 2-tubercled, margins entire.

In rocky streams, mountains of Chota Nagpur, Neterhat, 3000 ft. Sarguja, *Cardon!* Fl. Aug. Fr. Oct.—Nov.

Leaves sometimes with wavy base which causes it to appear oblique in dried specimens, strong nerves 5—7, lateral arcuate to the tip. Peduncle grooved and angled. Pedicels .25—3". Capsule .7—1". When gone out of flower it is easily distinguished from *Microstylis congesta*, which it then resembles, by the more distant fewer, shorter, less markedly reflexed bracts.

2. *L. nervosa*, Lindl. Syn. *L. odorata*, Lindl.; *L. paradoxa*, Reichb. f.

A more slender plant than the last 6—15" high with much narrower usually oblong narrowly elliptic or oblong-lanceolate to linear-lanceolate leaves 3—6" with shorter ones below, base tapering, sessile. Spikes 3—6", rhachis angled, bracts long subulate or linear and very slender .2—3", not reflexed (but see below). Perianth .2—25" long.

Marshy places. Sarguja, *Cardon!* Fl. Aug.

The following description of a plant said to be *L. paradoxa* which was taken from a living specimen flowered at Kew does not appear to agree in the bracts: "Spike 3—6". Bracts small triangular, deflexed. Sepals lemon yellow, nearly equal, margin reflexed, tip membranous. Petals oblong, shorter, inrolled, striped yellow and purple. Lip adnate to base of column purple, recurved, base minutely eared and with 2 conical glands, tip broad flat notched, upper half of column winged." Capsule .4—5" rounded between the ribs which are decurrent on the .1" long pedicel.

10. PHOLIDOTA, *Lindl.*

Stems formed of superposed elongate pseudobulbs or with 1—2-leaved pseudobulbs sessile on a rhizome. Flowers small subglobose in the axils of distichous bracts in often flexuous close racemes. Sepals concave. Petals flat. Lip sessile on the base of the column, erect, saccate, subentire or 3—4-lobed. Column very short, hooded or winged. Anther-cells subglobose, rarely elongate, pollinia 4, sub-globose, free or cohering in pairs by a viscus.

1. *P. imbricata*, *Lindl.*

A curious little epiphyte with numerous uninodal pseudobulbs seated on a creeping rhizome, 1-leaved only. Racemes drooping terminal, 4—12", on a peduncle nearly as long, closely covered with imbricating distichous broadly orbicular-deltoid bracts each bearing a subglobose whitish or pale yellowish flower .3" diam.

On trees and rocks in the forests, Singbhum! Ranchi, at Neterhat, 3000 ft. Fl. August.

Leaf 4—12", elliptic-lanceolate, rather plicate and somewhat cuspidate, almost fleshy, 3-nerved, petioled. Apex of peduncle with several empty sheathing bracts, floral bracts .3" broad. Sepals .2—25" long, dorsal orbicular 3-nerved, lateral cymbiform with winged keel, connate at the base. Petals linear-oblong falcate 1-nerved, lip 4-lobed, 2 large rounded side-lobes and 2 smaller quadrate terminal lobes. Pollinia deeply cleft, waxy. Capsule .75", ellipsoid on a thickened rhachis.

The slender flower rhachis often persists after the fruits have fallen and till the next year.

11. THUNIA, *Reichb.*

Terrestrial or epiphytic, stems slender or internodes equally thickened, not pseudobulbous, leafy with foliaceous sheaths below, terminating in the inflorescence. Leaves distichous, lanceolate. Flowers in terminal racemes with large scarious bracts. Sepals erectopate, subequal, lanceolate. Petals similar. Lip adnate to base of column, shortly spurred, side-lobes short embracing the column, mid-lobe fringed. Anther narrow, pendulous, incomplete, 4-celled, pollinia 8, waxy, attached in fours to a granular membrane.

1. *T. venosa*, *Rolfe*. Syn. *Phajus albus*, *F.B.I.* (in part), and *P. albus*, *Beng. Pl.*

Epiphytic with elongate tufted stems 6—18" long clothed with linear-ensiform leaves 6—9" long acuminate above the middle, and with usually shorter lanceolate ones passing into sheaths at the base of the stems, lateral stronger nerves each side of mid-rib 2—3 rarely only one and numerous finer parallel nerves between them. Raceme drooping short 3—5" including the very short peduncle, few-fl'd. with lanceolate sub-persistent bracts of which lower are 1.5—1.7" long. Flowers white, 1.5" long, lip 1.2" with crisped side-lobes, spur .15". Sep. and pet. spreading oblong-lanceolate acuminate. Lip 1.2" with involute crisped side-lobes, apex spreading waved and ciliate, palate with 5 longitudinal lines of soft erect purple fibrillæ and with radiating lilac-purple lines on to the side-lobes.

Sarguja, Cardon! Fl. July.

Thunia alba, Reichb. f., with which this was confused until the differences were pointed out by Rolfe, has a somewhat elongate raceme, more and much larger flowers, a yellow disc to the lip and a few lilac radiating veins on the side-lobes. It has not been found in our area.

12. PHAJUS, Lour.

Stout terrestrial orchids with large plaited leaves, usually pseudobulbous with the inflorescence lateral on the pseudobulb or axillary or terminal. Flowers large, racemose. Sepals and petals subequal. Lip adnate to the base of the column and embracing it, erect with gibbous or spurred base. Column long stout without a foot. Anther incompletely 4-celled, pollinia 8, attached by fours to a granular viscus.

Leaves 1—2 ft. Scapes 2—4 ft. Fls. 4—5" diam.
Leaves 1 ft. Scapes 6—9". Fls. 3" diam.

1. *Wallichii*.
2. *nanus*.

1. *P. Wallichii*, Lindl.

A handsome terrestrial orchid with large ovoid pseudobulbs sheathed by the plicate leaf bases. Leaves very large 1—2 ft. long by 3—6" broad, elliptic-lanceolate acuminate plicate, long-petioled. Flowers in tall erect racemes from the side of the pseudobulbs 4—5" diam. Sepals and petals spreading, pure white or sometimes coloured rosy-yellow or brown, especially inside, lanceolate. Lip with a tubular pink or red portion yellow at the base and a variously coloured truncate crisped midlobe, usually red. Spur .25—.75" long. Capsule 2—2.5".

In its native state usually found in swampy ground near streams. Often cultivated. I cannot recall having seen it wild in our area, though it is so close to it in the Tarai and Duars. Fl. April—July. Fr. Sept.—Oct.

2. *P. nanus*, Hook. f.

This was first found by Gamble in the Buxa Duars, and was afterwards collected by me in the Jalpaiguri district much further west in grass lands. It may possibly therefore be found in similar grass lands in Purneah. Fl. Feb.

Pseudobulbs 0 according to Hooker, and I have no note of any. Leaves up to 1 ft. including the petiole into which the blade tapers, about 1—1.5" broad. Scapes shorter than the leaves and axillary, 8"—1 ft., peduncle with narrow convolute or cymbiform bracts .7—1" long. Flowers few at the top of the scape. Sepals and petals spreading 1.5—1.7" long lanceolate. Lip 1" tubular with rounded spreading apex slightly crisped, spur .1—.15" (0, J.D.H.).

13. ACANTHEPHIPIUM, Blume.

Terrestrial, bulbous with several broad plaited petioled leaves. Flowers few large fleshy in very short lateral racemes, pedicels thickened after flowering. Sepals broad, cohering into a ventricose tube, lateral adnate to the foot of the column and forming a very large saccate mentum. Petals erect narrow, included. Lip very small, stipitate on the foot of the column, inflexed, with broad erect lateral lobes and entire recurved midlobe, throat with a ridge or lamellæ. Column short, stout, with very long inflexed foot. Anther 2-celled, pollinia 8, erect, cohering by a granular mass.

1. A. striatum, Lindl.

A stout orchid with elongate-obpyriform pseudobulbs 3—4" long and 1.5" diam., a scarious-sheathed stem 4—8" high and 2—3 large elliptic leaves 6—10" long. Scape coætaneous, from base of the leafy stem and lateral on the pseudobulbous base. Flowers 1.25" long and about .65" wide, pale pink with bold red lines, mentum and lip tinged with yellow.

Chota Nagpur (without precise locality), Wood! Fl. May—July.

Leaves with 4—5 very strong nerves and less strong intermediate, petiole short. Raceme sub-capitate on a stout peduncle 3—4" with long imbricate sheaths often tipped with red. Bracts large cymbiform. Sepals broadly oblong, cohering, mentum conical. Petals concealed by the sepals, dimidiate-oblong. Lip concealed, oblong, with large lateral entire incurved lobes and a small triangular terminal lobe with undulate edges and a thickened ridge down the middle.

14. PACHYSTOMA, Blume.

Terrestrial orchids with a nodose rhizome or pseudobulb. Leaves 1—2 narrow plaited appearing after flowering. Flowers mod.-sized or rather small, pendulous on racemes, the bases of which are sheathed with bracts; floral bracts large scarious. Sepals subequal, lateral adnate to the base of the column. Lip sessile on the base of the column, erect, side-lobes oblong, midlobe small, centre usually ridged with 3—5 deeply crested or fimbriate ridges. Column slender, clavate above, produced into a foot below, anther 4-celled, deciduous, pollinia 8, pyriform, connected by viscus at their base.

1. P. senile, Reichb.

A graceful ground orchid with very long scapes and no leaves at the time of flowering, 12—18" high. Flowers medium-sized, drooping, a delicate pink colour (in my specimens) or white or greenish (*F.B.I.*). Sepals white or pink 3—4" acute or acuminate 5-nerved, petals slightly longer, narrowly spatulate, acuminate, 3-nerved, forming a very short sac at base, lip short from oblong "to nearly orbicular" (*F.B.I.*), with very short claw, side-lobes oblong obtuse or subacute, midlobe oblong or obovate, retuse or pointed, throat with 5 emerald green or yellow crested lamellæ from the base to the midlobe. Top of column with 2 incurved horns.

Frequent in grassy places in the northern tract, especially towards the Sikkim Tarai! Bettiah, *Hieronymus!* Fl. Feb.—May.

Bulbous. Leaf appearing after flowering, long narrow and plicate. Base of scape with strongly-nerved premorse or erose dry sheaths, bracts long linear. Flowers with ovary about .7—8" long, glandular-puberulous.

15. GEODORUM, Jack.

Ground orchids with a tuberous rootstock and plicate leaves. Scape from the rootstock, stout erect sheathed, shorter than the leaves; flowers crowded in decurved racemes with narrow membranous bracts. Petals broader than sepals, conniving or spreading. Lip sessile on the base or short foot of the column, cymbiform, membranous, with involute margins, palate with or without ridges ending in calli, and with a

forked basal callus. Column short, stout, anther 2-celled, appendaged after dehiscence by the persistent detached faces of the cells; pollinia 2, broad foveolate sessile or subsessile on a broad strap or gland.

1. *G. dilatatum*, Br.

A ground orchid with the scape 5–9" high only flowering with the young leaves, which are lanceolate 15–18" long and without petioles. Flowers 1.25" diam. in a decurved raceme only half the height of the whole plant. Sepals white or greenish oblong acute 3–5-nerved. Petals rather broader, white. Lip spoon-shaped slightly recurved at the tip, white and pink-veined and flushed, palate yellow, quite smooth (in our plant), or with granulate nerves ending in irregular small tubercles.

Singbhum, in Sal forest! Tundi Hills, Manbhum, Campbell! Palamau! Hazaribagh, on Parasnath, Thomson! Fl. June–July. The Parasnath specimen Sept.

Rootstock a chain of ovoid tubers. L. only 6–8" at time of flowering in the Manbhum specimen, narrowly elliptic.

16. EULOPHIA, Br.

Terrestrial herbs with tubers or pseudobulbous rhizomes and plicate leaves often appearing after the flowers. Flowers mod.-sized or large in lateral racemes, rarely paniced. Sepals and petals free, spreading. Lip saccate or shortly spurred at the base or forming a mentum with the foot of the column, lateral lobes erect, embracing the column, rarely 0, throat crested, softly spinous or lamellate. Column short or long with or without a foot and with oblique entire top* and terminal 2-celled anther. Pollinia 2 or 4, sessile or attached by a short strap to a discoid gland of the rostellum.

A. Column produced into a foot. Flowers large:—

Flowers golden yellow, very large, 3" diam.

Flowers green or purple, about 2" diam.

1. *flava*.

2. *nuda*.

B. Column not produced into a foot. Fls. mod.-sized:—

Sepals linear-lanceolate

Sepals oblong-ovate

3. *campestris*.

4. *explanata*.

1. *E. flava*, Hook. f.

A striking ground-orchid with scapes attaining over 3.5 ft. bearing a raceme of a dozen to twenty golden-yellow flowers about 3" diam. with spreading very acute sepals 1.4" long. Petals narrowly elliptic-obovate obtuse 1.2". Lip 1.3" erect from foot of column, very saccate, 3-lobed, side-lobes erect rounded or truncate, mid-lobe orbicular or shovel-shaped concave, projecting about .3" beyond the side-lobes, throat with 3 lamellæ, sac purple-spotted within. Column stout, .5", with a short foot. Ovary narrow twisted, 1.5" long, to 1.75" long with the very short pedicel.

Marshy ground and white clay schist in the Singbhum forests! Ranchi and Palamau, elev. 3000 ft.! Fl. May–June.

* Top 2-fid in *E. flava* according to F.B.J.

Rhizome tuberous horizontal very large of about three flattened joints each 12—18" long. Leaves lanceolate about 2 ft. produced after the flowers. Bracts .5—75" linear-lanceolate acuminate. Lateral sepals rhomboid with obtuse base. "Anther with a 2-fid top and long anterior process," *J.D.H.*

2. *E. nuda*, *Lindl.*

A ground orchid about 12—20" high, the scape arising from the base of the ultimate joint of a chain of wrinkled somewhat flattened tubers, one of which is formed annually. Flowers white or red, greenish or crimson, sub-globose, about 1.25—1.5" from spur to tip of dorsal sepal. Sepals .8—1", linear-oblong or oblong, crimson green or yellowish, .2" wide, obtuse, lateral somewhat incurved erect, base forming a mentum with the forked foot of the column. Petals erect, .7—8" by .3" wide in middle hooded over the column, somewhat oblique, obtuse, many-nerved. Lip oblong, not constricted, with erect short rounded side-lobes, midlobe nearly .5" spreading with wavy crenulate ridges at the sides, yellowish with pink veins or red-purple or pure white; spur .15—25" long.

Frequent in Sal forests, rarer in grass-lands. Singbhum! Ranchi! Palamau! Mayurbhanj, *Hooper* (? see below)! Fl. May—June; leaves appear after flowering in June.

Annual tuber about 2" long. Leaves plicate 10—15" usually appearing after the flowers but in *Hooper's* specimen *with* the flowers, and in this also the raceme is close instead of lax as is usually the case. Bracts subulate acuminate, .5". Ovary with very short pedicel 1" or lower longer. The floor or throat of the lip is nerved, not crenulate nor tubercled, the crenulations only occurring on each side, or in some cases 2 calli in the throat and nerves tubercled. Pollinia 2 large waxy sessile on a very broad appendage (caudicle).

3. *E. campestris*, *Wall.*

A slender orchid with flowering stem 8—12" high, lateral from the last of a chain of erect ovoid tubers which are connected at their base. Flowers mod.-sized in lax racemes, sometimes secund or nodding on slender pedicels. Sepals .4—.5" linear-oblongate or linear-oblong, greenish outside, brownish inside, 5-nerved. Petals elliptic or broadly oblong obtuse, as or nearly as long as the sepals, .2—.22" broad, broader (*F.B.I.* says narrower!) than the sepals, greenish or yellowish with red or brown clouds, about 5-nerved. Lip .35—.45" long oblong, side-lobes erect or upcurved adnate to column, short, beautifully veined with red, midlobe slightly expanded and retuse at the end, yellow, palate with 2 crenulate lamellæ or ridges starting from the base of the column and tapering off to the end of the midlobe, the expanded part of which then has a crest of 5 fleshy papillose ridges. Spur hardly any and obtuse (in my notes and specimens; acute *F.B.I.*). Foot of column 0 or scarcely any. Pollinia 2, notched and perforated near the base, strap short and broad.

Not uncommon in open forest and burnt savannahs. Singbhum! Ranchi! Palamau, at Neterhat, 3000 ft.! Fl. April—May.

4. *E. explanata*, *Lindl.*

A shorter stouter plant than *E. campestris* with scape 4—8" lateral but from near the apex of an irregularly ovoid tuber or pseudobulb 1.5" long from one of the lowest sheaths of the leafy stem, the leaves

of which are very young (they just show at the surface in my specimen) at flowering time. Lowest sheaths of scape convolute much as in *E. campestris*, floral bracts 3" shorter than the 5—7" long pedicel and ovary. Flowers yellow and purplish 4" long only. Sepals oblong-ovate subacute or very obtuse. Petals broader elliptic 5—7-nerved obtuse. Lip sessile, base adnate to the lateral sepals, saccate with spreading nerves, subpanduriform upwards with 2 thick crenate lamellæ on the palate, and midrib greatly thickened and tubercled towards the truncate emarginate tip. Column very short.

Beniah, *Hieronymus!* Kalahandi plateau, *Cooper!* Fl. April—May, after the grass fires. Leaves developed in August.

The Kalahandi specimen was identified as *E. explanata* at the Calcutta Herbarium but it is a very poor one. The young leafy shoots and the scape are surrounded by one or two short broad common sheaths 5—1" long as described for *E. explanata*, but most of the description of the flowers is taken from the *F.B.I.*, not from the specimen which has only one flower left on it. Fully developed leaves are large, broadly elliptic, 9—12" by 4", or lower only 5 by 3", petioled, very shortly acuminate.

17. DENDROBIUM, Swartz.

Epiphytes with pseudobulbs or thickened or elongated stems. Leaves never plicate. Flowers often large and handsome, in 1—many-fl. racemes. Sepals subequal, lateral obliquely adnate to the foot of the column, and forming with it a sac or mentum. Lip contracted at the base, rarely clawed, adnate to and incumbent on the foot of the column, its side-lobes, if any, embracing the column or spreading, its terminal lobe variously formed, palate often lamellate. Column short, angled or 2-toothed at the top, anther opercular, at first erect (in the same axis as the column), ultimately opercular and versatile attached by the middle of the back, 2-celled, pollinia 4 free, ovoid or oblong, compressed, closely collateral in pairs in each cell.

- I. Inflorescence apparently terminal (from the base of a terminal arrested internode) or also lateral:—
- A. Pseudobulbs short ovoid tufted. L. 2—3 linear. Fls. small, white or purplish in short dense racemes 1. *pygmæum*.
- B. Stems elongate:—
- Stems copiously branched. Racemes very short, all terminal. Fls. few, small 2. *herbaceum*.
- Stems thick, leafy. Racemes mostly lateral. Fls. very large, white 3. *formosum*.
- II. Inflorescence distinctly lateral:—
- A. Mentum urceolate. Fls. few crowded in short racemes on a sheathed peduncle, small, dingy yellow 4. *bicameratum*.
- B. Mentum conic. Fls. 1—3 in short racemes from the leafless stems:—
1. Petals lanceolate, as narrow as the sepals. Fls. 1", yellowish 5. *macrostachyum*.
2. Petals broad. Flowers never yellow (exc. lip):—
- a. Fls. very large, 3—3.5" diam., magenta 6. *regium*.
- b. Fls. 1.5—2.5" diam., pink, purple or white. L. linear-lanceolate:—
- i. Stems slender, pendulous:—
- Sep. lanceolate acute. Lip with 1 or 2 broad purple blotches 7. *transparens*.

- Sep. oblong-lanc. obtuse. Lip purple edged
with white, base yellow *amœnum*
ii. Stems stout erect. Sep. oblong obtuse. Lip
yellow (p. 1227).
8. *crepidatum*.
3. Mentum short stout. Fls. large in 6—15-fl.
racemes, mostly from the leafing stems:—
Lip not calceolar. Fls. golden yellow . . . 9. *fimbriatum*.
Lip calceolar. Fls. yellow, purplish or white 10. *moschatum*.

1. *D. pygmæum*, Lindl.

A small densely tufted leafy epiphyte with oblong or somewhat tapering greenish pseudobulbs 1" long, linear-oblong or linear leaves 2—3" and numerous short dense-flowered racemes of greenish or white flowers from the ends of the pseudobulbs. Racemes .5—1". Flowers about .3" on longest diameter, mentum about half as long as the lanceolate sepals, lip narrow curved with decurrent oblong green side-lobes marked with oblique red lines, mid-lobe very short in the sinus formed by the short free tips of the side-lobes, ovate crenate white with red markings.

Jaspur, Cardon! Fl. Nov.

The plant was identified by Col. Gage at the H.B.C. The description is from a drawing made from the fresh plant. L. 2—3, caducous. Scapes many, terminal and lateral. Bracts exceeding the ovary, nearly .25". Sepals .3" white or purplish, lateral decurved. Petals oblanceolate, lip obovate, midlobe triangular crisped, disk with a crenate fleshy ridge, *F.B.I.*

2. *D. herbaceum*, Lindl.

A much-branched epiphyte with very slender fleshy pendulous stems, linear or linear-lanceolate long-acuminate leaves 2—4" long, tapering at the base, and very small yellow flowers .2—3" long on slender pedicels in very short, few-fl. racemes near the tips of the leafless branches.

Parasnath, T. Thoms.! Cardon! Fl. July—Nov.

Lower parts of stem naked, upper with short sheaths. Leaves caducous, none at the time of flowering, nerves 8—10. Racemes only .1—5" long with minute scarious bracts .05" long. Pedicels slender, .4—6". Sepals linear up to .24—3", sometimes only .15", 3-nerved, petals similar; lip very small narrow, side lobes very narrow, midlobe shorter ovate rugose.

3. *D. formosum*, Roxb.

A very beautiful orchid, without pseudobulbs but with several fleshy cylindrical somewhat furrowed stems 10—18" long clothed with short black hairs when young. Leaves bifarious, subamplexicaul, ovate-lanceolate or oblong, 3—4" long. Flowers very large, 3—4" across, pure white except for the yellow palate, in terminal (or lateral, *F.B.I.*) few-fl. racemes.

Prain records this from Chota Nagpur in *Beng. Pl.*, stating in a note in the *Cal. Herb.*: "I have seen this from Sirguja in the collection of Sir C. C. Stevens." It is frequent in the Jalpaiguri district and may occur in Purneah. I have also seen an orchid very like it but not in flower at Neterhat. It is frequent in cultivation. Fl. April—May.

Sepals lanceolate or oblong-lanceolate acuminate, mentum very large conical petals broad, cuspidate, lip broadly obovate with small rounded side-lobes and dilated retuse midlobe, palate yellow with 2 tubercled ridges. ?

4. *D. bicameratum*, Lindl.

Stems clustered sub-clavate 3—18" long and attaining .35—.5" diam. Leaves ell.-oblong to lanceolate, acute, obliquely minutely 2-fid at tip, 1.5—3" long. Flowers .4" across, yellow, greenish-yellow or greenish-white with rows of crimson spots, densely clustered on a short rhachis in a lateral or sub-terminal capitate raceme.

Parasnath, *vide F.B.I.* Also Mahendragiri (*Gamble!*). Will probably be found therefore on Meghasani. Fl. Aug.—Sept.

Bract sheathing the shortly stalked ovary. Dorsal sepal broadly ovate-oblong, lateral triangular, concave and subacute. Petals broadly elliptic, obtuse. Lip small, fleshy, very concave with broad very short truncate yellow central lobe and crimson triangular erect acute side-lobes, palate fleshy. Column very short with 2 large oblong nectaries and crimson border round the stigma.

5. *D. macrostachyum*, Lindl.

An epiphyte with rather slender terete pendulous stems 1—2 ft. long, and distichous coriaceous linear-lanceolate or lanceolate 10—15-nerved leaves, 2—3" long contracted at the broad sheaths. Flowers paired or 3 together on very short common peduncles along the leafless stems forming a spurious raceme, short scarious bracts .05" long. Sepals and petals .7—1" long lanceolate acuminate recurved greenish-yellow tipped with pink, lip with convolute base and ovate mid-lobe veined with purple.

Manbhurn (Sillee), Wood! Jashpur, Cardon! Fl. July—Aug.

Young stems with many very truncate sheaths .3—5" long. Peduncles .1—25", pedicels .5—6". Flowers fragrant, mentum .2" long, lip sometimes (always?) softly pubescent (silky to touch, *White*). Capsule 1—1.2" oblong with a thick rounded beak (remains of mentum and column).

6. *D. regium*, Prain.

A very handsome orchid with slightly compressed sub-fusiform stems 9—18" long and .4—.5" thick and internodes 1—1.3" long. Leaves linear-oblong or oblong-lanceolate 3—15", narrowed to the obliquely notched tip. Flowers 3—3.5" diam., magenta, in short 2—3-fid. racemes from the leafless stems. Sepals linear-oblong obtuse with red-purple veins. Petals elliptic or obovate, magenta or rose-purple like the sepals with red-purple veins and transverse markings. Lip trumpet-shaped glabrous with a rather narrow mouth, magenta with a pale yellow or cream-coloured tube. Capsule 2" with rounded ridges.

Epiphytic on rocks. Sent from Bassia, Sarguja, by the *Rev. Father Cardon*.

7. *D. transparens*, Wall.

A very handsome epiphyte with pendulous leafless (at time of flowering) terete jointed stems with rose and white flowers 1.5" diam. in pairs at the nodes. Leaves appear at the side of the flowering stems, linear-lanceolate 3—4".

Sarguja, *Cardon!* is again the only record from our area, though it is also abundant in the Jalpaiguri district on the east of the province on Sissu trees, and may be expected in the intermediate districts either on the hills or in Purneah. Fl. April—May.

Internodes 1—1.5" long. Bracts described (*F.B.I.*) as very large (I have no note of them). Sepals rose or pink lanceolate acute, petals broader ovate, mentum

conic, lip elliptic-oblong from a convolute base, pubescent, 1", white purple-veined or with a broad purple single or double blotch.

Closely allied to this is *D. amcenum*, *Wall.*, with 2—3 flowers on short peduncles from the leafless stems. Bracts small. Fls. 1.5—2.5" diam. Sep. obtuse white or with violet tip, pet. similar or purple-tinged larger ovate, lip ovate purple bordered with white and base yellow, undulate, crenate, ciliolate, palate villous.

Occurs near our area and in grass greenhouses in cultivation! Fl. h.s.

8. *D. crepidatum*, *Lindl.*

Stems pendulous striate green and white, thin at the base, thickened upwards, 6—18", covered when dry with the long thin scarious sheaths of fallen leaves. Leaves linear-lanceolate acuminate 2—4" by .4—6". Flowers .5—1" long, pink or white with a large yellow spot on the lip, 1—3 on very short bracteate peduncles from the slightly swollen nodes of the leafless stems. Sepals broadly oblong subequal subobtruse. Petals broadly ovate. Lip broadly obovate, pubescent, edges undulate, apex broad sometimes retuse, base narrowed to a short claw with a short transverse ridge in front of it and a small pit behind.

Chota Nagpur (without precise locality), *Cardon!* Fl. March.

Pantling (from whom the description is mainly taken) says that the flowers are .75—1" diam. and that the smaller-fl. Sikkim plant is self-fertile. The *Rev. Cardon's* plant was 1.5" diam. and pink with buff on the base of the lip. Mentum short obtuse. Column very short and broad. Ovaries stalked divergent, very slender, purple. Capsule clavate 1.75" long tapering into a long pedicel and terminated by the thick remains of the column and mentum.

9. *D. fimbriatum*, *Hook.*

Stems tufted 2—4 ft. long, grooved, terete, base swollen. Racemes pendulous on usually leafless, sometimes leafy, stems. Flowers chrome yellow 2" diam., sepals erose or entire oblong spreading flat, petals larger subequal, .75—1". Lip 1.5" long orbicular fimbriate, red-veined within and (var. *oculata*) with a deep reniform purple blotch.

Frequent in cultivation in Ranchi! and occurs wild in Jalpaiguri district! Only sent from Sirguja by the *Rev. Cardon* from our area. Fl. h.s.

Leaves distichous, ovate-lanceolate or lanceolate acuminate, 3—6" long (6—8" in var. *oculata* and strongly nerved). Flowers 7—12 in the lax raceme. Bracts herbaceous minute. Mentum short. Lip equally deeply fringed, with truncate base, undivided but sides somewhat erect and base concave.

10. *D. moschatum*, *Wall.* Syn. *D. calceolaria*, *Carey* (1823); *Epidendrum moschatum*, *Ham.* (1800).

A tufted epiphyte with stout terete erect striate stems, 3—6 ft. long and .5" thick with distichous oblong or oblong-lanceolate or (a few) ovate-oblong coriaceous leaves 3.5—6" long, and large flowers 1.5—2" or sometimes 3" diam. in laxly 8—16-fl. lateral racemes 4—12" long. Racemes one or two from a node very near the apex of a leafless or leafy stem, base of peduncle stout and with many sheathing imbricating bracts, pedicels slender 1—2" long. Colour very variable, usually golden-yellow in our area with 2 dark spots on the calceolar, pyriform or hemispheric lip, the margins of which are much incurved all round and slightly fimbriate.

Sarguja, Cardon! Occasionally cultivated in our area! Fl. May—July.

Stems leafy. L. with subamplexicaul base, obtuse or subacute, with about 9 stronger parallel nerves. Fl. rhachis deflexed often zigzag with floral bracts scarious narrowly oblong obtuse 4—6" long. Flowers fragrant, odour often musky, 1—2" long with a pronounced mentum, colour of flowers variously described or figured as white or gold or yellowish-pink, or sepals and petals ochraceous with reddish ribs and orange or red veins and lip ochraceous with 2 large brownish spots inside the cup, or (in a Khasia form) blood red with spur dark yellow. Capsule 1" obovoid with thickened truncate beak (remains of column, etc.).

18. ERIA, Lindl.

Epiphytes, usually with pseudobulbs, sometimes with leafy stems. Flowers never large nor brightly coloured, mostly spicate or racemose. Sepals free adnate to the foot of the column and with it forming a short or long and spur-like or saccate mentum. Lip sessile on the foot of the column, incumbent, rarely mobile, entire or 3-lobed with erect side-lobes. Column short. Anther imperfectly 4- or 8-celled, pollinia normally 8, pyriform or broadly obovoid, attached in fours by narrow bases to a viscus.

Flowers mod.-sized. Inflorescence woolly
Flowers very small. Inflorescence glabrous

1. *flava*.
2. *musciola*.

1. *E. flava*, Lindl.

A moderate-sized epiphyte with a stout creeping branched rhizome, branches ending in pseudobulbs 2—3.5" long with sheaths at their base. Leaves 3—5 on a pseudobulb lanceolate-linear 6—10" long by .7—1.2" broad. Racemes lateral 5—10" long clothed all over including the flowers with a dense wool. Flowers mod.-sized with sepals .5—7" long, broadly lanceolate, yellow and 7(—9)-nerved inside. Petals yellow, narrow, 3—5-nerved, lip yellow with purple markings 4—5" long with 2 short lateral lobes and broadly oblong longer mid-lobe, not woolly. Capsule linear, 1—1.3" long.

Recorded from Chota Nagpur in *Bengal Plants*, but I find no specimens. My own specimens are from the Jalpaiguri district, and from its general distribution it probably occurs near our northern boundary, esp. Purneah. Fl. Feb.

2. *E. musciola*, Lindl.

A very small orchid only 1—2" high with depressed ovoid clustered pseudo-bulbs 3—5" long and several small leaves .5—8" long. Flowers few very small greenish in filiform racemes from between the leaves. Bracts ovate or lanceolate. Sepals lanceolate finely acuminate 1—3-nerved, lateral falcate. Petals narrowly lanceolate 1—3-nerved, lip narrowly lanceolate or slightly dilated in the middle.

I have seen no authentic specimen from our area either at Calcutta or Kew, but it is given in *Bengal Plants*. Fl. June—Aug.

L. oblanceolate or linear-oblanceolate .5—1.5" long. Flowers sometimes described as pure white, .2—2.5" long.

19. BULBOPHYLLUM, Thouars.

Epiphytes with a creeping rhizome bearing pseudobulbs which are 1- very rarely 2-leaved. Flowers often small, solitary, capitate,

umbelled spicate or racemose, from the base of the pseudobulb, rarely remote from it. Lateral sepals adnate to the foot of the column. Petals usually smaller than the dorsal sepal. Lip jointed on the foot of the column, mobile, usually very small and strongly recurved. Column very short, often 2-aristate at the top; anther 2-celled, pollinia 4.

1. B. triste, Reichb.

A curious little plant with globose-ovoid small pseudobulbs under 1" and a very long slender scape 6--7", bearing a small raceme of small purple flowers .25--.3" long with pink petals and a disagreeable smell of bugs.

Sent by Rev. Cardon from Sarguja to the Botanic Gardens, Calcutta, where it flowered Feb. 1. Also fls. March--May. Leafless when in flower.

Leaves 2. Inflorescence dense, bracts minute acute. Dorsal sepal shortest triangular-ovate obtuse 3-nerved, lateral falcately oblong obtuse. Petals ovate-oblong 1-nerved. Lip stipitate broad convex obtuse. Spurs on column slender.

20. CIRRHOPETALUM, Lindl.

Habit of *Bulbophyllum* mostly with small 1-leaved pseudobulbs on a creeping rhizome. Flowers usually small, umbellate, rarely umbels reduced to 1--2 flowers. Median sepal free, lateral sepals much longer twisted on their long axis and with their outer margins more or less conniving. Petals much shorter, often fimbriate or appendaged. Lip linguiform, very small, stipitate. The rest as in *Bulbophyllum*.

1. C. ornatissimum, Reichb.

A remarkable and curious little plant with ovoid pseudobulbs bearing 1 (rarely 2) oblong leaf 3--4.5" long and purple flowers, the umbels reduced to one or two flowers.

Jashpur, Cardon! Fl. Oct.

I have only seen the one specimen. It has 2 flowers, and the tips of the sepals are broken off in one and in the other are 2.3" only, erect. In a drawing of *C. ornatissimum* at the H.B.C. the sepals are 3--4" long (as described by Prain for our plant), but on this drawing Rolfe has remarked *C. Mannii* not *C. ornatissimum*. It is also much smaller than the *C. ornatissimum* from Sikkim which has sepals filiform up to 4.5" (—*C. appendiculatum*, Rolfe?). The linear lip is .3" long. The F.B.I. describes *C. ornatissimum* as with lateral sepals 2--4" linear-lanceolate with filiform tips 6-nerved much longer than the cymbiform acuminate 5-nerved dorsal, petals subulate-lanceolate falcate 3-nerved and dorsal tipped with a brush of slender red paleæ, lip strigose, columnar, arms large decurved.

21. LUISIA, Gaud.

Tufted epiphytes without pseudobulbs, with terete rigid sheathed stem and elongate terete obtuse leaves. Flowers small drooping on a short or very stout erect axillary rhachis, bracts persistent, very short thick and imbricating. Sepals subequal or the decurved dorsal smaller. Petals narrower often longer. Lip sessile on the base of the column, base flat, concave or saccate. Column very short, truncate; anther 2-celled, pollinia 2, sub-globose, seated on a replicate short strap. Capsule narrow erect.

Leaves 4--5". Flowers .4" long
Leaves 1--2". Flowers .15" long

1. *trichorhiza*,
2. *inconspicua*.

1. *L. trichorhiza*, Blume.

Stems rather stout with thick truncate sheaths. Leaves stout terete 4—6" long. Flowers 4" long. Sepals and petals pale yellowish green with faint purple lines. Petals about as long as the lateral sepals. Lip rather longer than the sepals, dark purple with faint green lines, obovate-oblong flat grooved constricted between the broadly ovate or subcordate epichile and the quadrate hypochile. Column purple. Capsule 6" strongly ridged narrow with attenuate base.

Chota Nagpur, communicated by *Father Cardon* to the Cal. Bot. Gard., probably from Sargujal Fl. March—April.

2. *L. inconspicua*, Hook. f. *Saccolabium?* *inconspicuum*, Hook f. (F. B. I.).

Stems 6—8" long, interlaced, flexuous, internodes 5" only. Leaves 2—3" or (in our specimen) only 1—2", nearly straight, terete, obtuse. Flowers 15" long, 25" diam., shortly pedicelled clustered. Sepals and petals pale yellowish green, subequal, broadly oblong acute, lip about as long, green, suffused with purple on the hypochile, epichile subreniform, notched at apex, flat. Column short, very stout, purple. Capsule 25" long, ribbed.

Manbhum, *Campbell* Fl. June—July. Fr. Sept. *Campbell's* original plant was sent in fruit (from Jonha) and it was flowered in the Calcutta Gardens. *Hooker's* description was from a drawing of the species from Lower Assam.

Stems rather stout (*Hooker*) or slender, entirely clothed with venose sheaths. Spikes 1—3-fld., very short, floral bracts membranous triangular acuminate. Sepals sometimes described as ovate-lanceolate, subacute, spreading, hypochile hemispherically saccate, epichile decurved, flat, sometimes minutely hispid and with 5—6 vertical lines.

22. RHYNCHOSTYLIS, Blume.

Epiphytes without pseudobulbs but with stout leafy stem. Leaves very thick linear 2-lobed at apex. Flowers mod.-sized in long dense drooping cylindric racemes. Sepals and broader petals spreading. Lip adnate to the base of the column, deeply saccate and pubescent at the mouth of the sac, without side-lobes, limb clawed, dilated. Column short stout footless, rostellum shortly beaked; anther imperfectly 2-celled, pollinia 2, subglobose, 2-cleft with filiform caudicle attached to a small gland.

1. *R. retusa*, Blume.

Stem stout, closely covered with leaf-sheaths. Leaves 6—20" by 7—2", curved, deeply channelled above, keeled beneath, premorse or retuse. Flowers white, blotched with pink or violet, 5—75" diam. in drooping racemes 4—18" long with broad bracts. Lateral sepals gibbously orbicular-ovate, obtuse or apiculate, dorsal oblong, lip with the sac cylindric and much longer than the limb.

Ranchi, *Cardon*! Manbhum, *Ball* (specimen bad and scarcely determinable)! Fl. May—July.

Petals elliptic obtuse. "Epichile of lip very variable in size, usually cuneiform, entire or emarginate at the tip," *F.B.I.* Capsule 1—1.5", clavate.

23. DORITIS, *Lindl.*

Epiphytic orchids without pseudobulbs, with short stems and flat coriaceous leaves. Flowers mod.-sized in lax axillary or lateral racemes. Sepals and petals spreading, similar. Lip adnate to the long foot of the column and forming with it and its erect side-lobes a conical sac, palate with a forked plate or callus. Column narrowly winged. Anther 2-celled, pollinia 2, sulcate or 2-partite attached by a linear or spatulate caudicle to a gland.

1. *D. Wightii*, *Benth.*

Pendulous from branches with very short stout stems 1" or less long. Leaves about 3, oblong slightly wider upwards subundulate at margins, obtuse, minutely obliquely notched, 6—8" by 1.3—2". Flowers inconspicuous pale ochreous yellow with purple markings on the lip and pink-mottled at base of tepals, on a pendulous lateral raceme shorter than the leaves.

Chota Nagpur (without precise locality), *Prain* in *Bengal Plants*, but I can find no specimens, nor is it in *Wood's* list. Fl. July.

Median sepal oblong, lateral shorter and broader, falcate, obliquely truncate. Petals oblong blunt. Hypochile forming a conical sac with 2 erect very broad ridged fleshy truncate lobes, epichile obovate with a forked appendage.

24. SARCANTHUS, *Lindl.*

Characters of *Saccolabium*, but spur with a dorsal usually 2-lobed callus or an erect plate within, inserted under the column, and with the cavity more or less divided by a vertical septum.

1. *S. insectifer*, *Reichb. f.*

A small epiphyte with elongate creeping stem and 2-farious sub-imbricate amplexicaul oblong leaves .5—1.5" long, coriaceous, keeled, obtusely 2-lobed with sometimes a mucro in the sinus. Flowers small greenish in lateral short-peduncled few-fl. corymbs, .6" only from tip of lip to tip of posterior median sepal. Lateral sepals broadly oblong slightly falcate green with brown streak each side, .2", median rather narrower.

Frequent in Chota Nagpur. Singbhum! Hazaribagh, *J.D.H.*! Chota Nagpur (Ranchi?), *Wood*! Fl. June--July.

Petals similar to the sepals but oblong-oblongeolate. Lip .4" fleshy, base pale saccate, scarcely spurred, with 2 very short erect, rounded side-lobes and a large cordate pink fleshy midlobe contracted at its base. The "sac" is longitudinally septate and papillose in the throat, which is closed (as in *Cleisostoma*) by a curved ligulate process from the base of the column which can be pushed aside by an insect. Column very short 2-horned, pollinia round waxy, very strongly attached by an elastic caudicle to a broad membranous gland which is viscous in front.

25. CLEISOSTOMA, *Blume.*

Characters of *Saccolabium*, from which it differs in having a dorsal scale or callus within the spur beneath the column and differs from *Sarcanthus* only in the spur not being septate.

Sir J. D. Hooker remarks that but for the multiplication of names it would be better to unite *Cleisostoma* and *Sarcanthus* with *Saccolabium*. ☉

1. **C. micranthum**, *King & Pantl.* Syn. *Saccolabium micranthum* *Lindl.*

A small epiphyte with stout compressed stems 3—8" long covered with leaf-sheaths. Leaves narrowly oblong keeled obliquely truncate and slightly 2-fid, 2.5—3.5" by .5—6". Flowers very small, many the lateral racemes, .2" diam., white with large pink spots, entire pink or purple on the lip.

Sarguja, Cardon! Fl. July—Aug.

Leaf-base shortly sheathing. Racemes longer than the leaves with stout rhachis. Sep. broadly ovate, obtuse, spreading. Pet. smaller, oblong. L. fleshy as long as sep., base with a wide blunt spur addressed to the ovary, with large callus protruding so as to meet a smaller callus projecting from the posterior wall, lateral lobes of lip small, apical oblong convex with thin erose edges. Column with a large cheek-like protuberance each side of the rostellum. Anther depressed with a long beak. Capsule .25—3" (ripe?).

26. **SACCOLABIUM**, *Blume.*

Epiphytes without pseudobulbs, with leafy stems and flat, keeled or terete leaves. Flowers usually small in lateral spikes, racemes or panicles, sometimes subcorymbose. Sepals and petals spreading but similar free but adnate to the base of the column, lip sessile at the base of the column, usually consisting of a large saccate or cylindrical spur, small lateral lobes and a small midlobe, sac or spur not septate within (as in *Sarcanthus*) and without a large scale or callus within under the column. Column short, broad, truncate, rarely beaked without a foot; anther 1- or imperfectly 2-celled, pollinia 2, entire or 2-partite.

Our 2 species both belong to section *Acampe* with keeled thickly coriaceous leaves, flowers corymbose, lip a large hemispheric sac with truncate or short side lobes and a short warty reniform or ovate adnate erose or fimbriate midlobe, very short column and globose pollinia with linear caudicles. *Acampe* is now generally maintained as a distinct genus.

Midlobe of lip suborbicular or broadly ovate, spur a rounded

sac tubercled and pubescent at the base within 1. *præmorsum*.

Midlobe of lip ovate, spur conical, pubescent within 2. *papillosum*.

1. **S. præmorsum**, *Hook. f.* Syn. *Acampe Wightianii*, *Lindl.*

A small epiphyte with leafy stem 5—6" or up to 1 ft. Leaves 5—7", narrow. Flowers yellow with transverse red markings, .5—7" diam., papillose all over, on a short stout scape only 1—2" long. Lip deeply lobed, very complicate, midlobe broadly ovate or suborbicular, spur a rounded sac tubercled and pubescent at the base within.

Hundrughagh, Ranchi, Prain! Fl. r.s.

Internodes .5—1" long. Racemes with thick rhachis breaking laterally through the leaf-sheaths. Leaves linear, very firm, preorse, articulate just above their sheath, about 6" long and 1" broad. Bracts minute triangular, but their base shows an annular ring. Lip dotted pink. Capsule 2" narrowly fusiform.

2. **S. papillosum**, *Lindl.* Syn. *Acampe papillosa*, *Lindl.*

Stem elongate 2—3 ft. branched, creeping along the tree branches, slender with obliquely notched leaves 3—4" long. Flowers .5—7"

diam., capitate on a short scape only 1—2" long which is closely scarred (nodal scars) to the base. Lip with ovate midlobe and short conical spur pubescent within.

Sarguja, Cardon! Fl. July (Oct.—Jan., *Pantling*).

Stems (according to *Pantling*) erect rigid clustered .35" thick bearing many sub-horizontal coriaceous curved deeply channelled (as in last) leaves 3—4" by .6—8", apiculate at the unequal tip. Peduncle only about .5" bearing a sub-corymbose 4—8-fld. raceme. Flowers sometimes .7" across (*F.B.I.*), sepals and petals yellow with brown bars (*Lindley* shows red dots), oblong, petals narrower sub-spathulate, lip slightly longer, decurved, ovate-oblong, white with pale purple markings crenate and transversely rugulose and with a cylindric slightly tapering pale-yellow spur, hairy within, side-lobes 0. Capsule fusiform, ridged, 1.25" long.

27. VANDA, Br.

Epiphytes without pseudobulbs, with leafy stem and very coriaceous or fleshy flat keeled or terete leaves and usually large (rather small in *parviflora*) showy flowers in simple racemes. Sepals and petals subequal, spreading or incurved, with narrowed base, lip large with large or small, rarely 0, side-lobes placed on the sides of the saccate or spurred base, midlobe fleshy, palate usually ridged or lamellate. Column short and stout with scarcely produced foot; anther 2-celled, rostellum obscure, pollinia 2, didymous, sub-globose or obovoid with broad flat geniculate caudicle and rather large gland.

Flowers .6—7" diam. yellow with pink or bluish lip.

1. *parviflora*.

Flowers 1.5—2" diam., colours not yellow, tessellated

2. *tessellata*.

1. *V. parviflora*, *Lindl.*

A small epiphyte with short leafy stem 4—6" and distichous fleshy leaves 3—4" long keeled beneath, margins upturned and tips irregularly premorse. Flowers yellow .6—7" diam. with pink lip (according to my field notes on several occasions, with fleshy blue ridges, *F.B.I.*), in 3—12-fld. erect racemes 2—4" long with long white pedicels .7" long and very small scarious bracts at the base of each flower.

Singbhum! Manbhum, *Camp.*! Ranchil! Palamau, at Neterhat, elev. 3000 ft.! Sant. Parg. *Swindon!* Fl. April—May.

Sepals .3", oblanceolate, somewhat waved; petals slightly narrower, lip with a pronounced mentum and spur, side lobes erect decurrent on the mentum .15" long, minutely dotted with pink, midlobe .2" oblong with somewhat dilated rounded yellow tip, floor or palate thickened with 2 calli and dotted pink. Foot of column and spur together nearly .2", column short erect .07", anther with lateral hinged scale-like valves, cells finally confluent. Pollinia waxy deeply 2-fld.

2. *V. tessellata*, *Hook.* Syn. *Vanda Roxburghii*, *Br.*; *Cymbidium tesselloides*, *Roxb.*; *Epidendron tessellatum*, *Roxb.*; *Ærides tessellatum*, *Lindl.*

Stems 1—2 ft. with narrow complicate premorse leaves 6—8" and handsome tessellated flowers 1.5—2" diam. in long 6—10-fld. suberect racemes. Sepals and petals yellowish-green or bluish with brown nerves, subequal clawed obovate waved, lip half as long to nearly as long with small acute side-lobes and panduriform violet or crimson midlobe with dilated truncate 2-lobed tip, spur conical.

One of the commonest species in Behar and Chota Nagpur, especially on Mohwa trees, probably in all districts of Chota Nagpur! Mayurbhanj. Hooper! Fl. April—July.

Very variable in colouring but always recognizable from the tessellated sepals and petals, margins often white. Midlobe of lip with fleshy ridges and white margins and mesial lines.

28. *ÆRIDES*, Lour.

Epiphytes without pseudobulbs, with leafy stems and linear, coriaceous leaves. Flowers showy, usually many in dense or lax decurved racemes. Sepals broad, spreading, lateral adnate to the base or foot of the column. Petals broad, spreading. Lip spurred, side-lobes sometimes 0, midlobe larger than the side-lobes or smaller and incurved between them. Column short, foot long or short, rostellum short or long and bifid, anther 2-celled, beaked or not, pollinia 2, globose, sulcate, caudicle strap-shaped long or short, gland large or small.

A. Side-lobes of lip very small, midlobe large:—

Spur short straight

1. *multiflorum*.

Spur uncinately incurved

2. *maculosum*.

B. Midlobe of lip incurved between the much larger side-lobes

3. *odoratum*.

1. *Æ. multiflorum*, Roxb.

A rather stout orchid with stems 4—10" long clothed with deeply channelled and keeled imbricate emarginate or 2-lobed leaves 6—8" long and with copious long axillary racemes of pink or rose-purple flowers .75—1.2" diam. Sepals and petals subequal rounded oblong, lip twice as long, sides recurved, midlobe hastately ovate or triangular with rounded angles, spur one-fourth as long as the midlobe, pointing forwards under it, with an incurved fleshy 2-lobed callus on the base of the midlobe.

Manbhum, Campbell Sarguja, Cardon! Santal Parganahs, Chatterjee! Occurs also in the Sikkim Tarai and probably in Purneah. Fl. May—June.

Racemes 6—12", rarely branched (*F.B.J.*), shortly peduncled. Flowers sometimes spotted with darker purple. Midlobe of lip (according to my field notes) large spreading ovate-rhomboid, clawed, the side-lobes being insignificant and appearing as wings to the foot of the column; base of lip thick and with a retrorse callus pointing across the mouth of the rectangularly bent spur. Capsule .5—2" subclavate, .6" (ripe?) long, sharply 3-keeled and with smaller ridges between, contracted into a stout pedicel .25—35" long.

2. *Æ. maculosum*, Lindl.

Stems shorter than in *multiflorum*, leaves more flat and racemes more often branched, flowers larger but very variable in size, pale spotted with darker purple, midlobe of lip ovate, tip broad, bright rose, obtuse or retuse, margins undulate, spur longer and more slender than in *multiflorum*, uncinately incurved.

Said to occur in Chota Nagpur (*Beng. Pl.*), but I do not know on what grounds. I can find no specimens from our province.

The description is from the *F.B.J.* Capsules narrower and more elongate than in *Æ. multiflorum*.

3. *Æ. odoratum*, Lour.

Stem and roots stout, stems attain 12—18" (in the Tarai, less in Chota Nagpur) with leaves 6—10" by .75—1.75", thickly coriaceous, 2-lobed, lorate, keeled. Flowers .75—1" diam. in dense racemes 9—12" long, white with rose-purple at the tips of the perianth segments, lateral sepals larger than the dorsal and petals, lip with rose-coloured mid-lobe and upcurved mottled pink spur longer than the sepals, claw of lip long continuous with the produced foot of the column rose-coloured, side-lobes erect, white, embracing the small midlobe, which is oblong-lanceolate, entire or erose.

Jalpaiguri district and Sikkim Tarai and therefore probably Purneah! Singbhum! Fl. May. Often cultivated!

Lobes of leaf rounded. Peduncle stout and rhachis stout, bracts brown, persistent, pedicel with ovary 1" long. Flowers sweet-scented about 1" in length (excluding the ovary), sepals and petals broadly oblong-obovate and rounded, upturned tip of spur sometimes green (in a cultivated specimen), spur hollow with a 2-fid gland in the throat at the base of mid-lobe. Anther obtuse (*F.B.I.*) or beaked (*according to my notes!*). Capsule 1—1.5" oblong clavate with obtuse angles (*F.B.I.*) tapering into a pedicel .4" long.

DIVISION.—PTERIDOPHYTA.*

Order FILICALES. *Ferns.*†

FAM. 1. CYATHEACEÆ.

Mostly tree-ferns with a well-developed aërial trunk and very large leaves. Sori round dorsal or apical on the fertile nerves with a subspherical or converse very hairy receptacle. Sporangia numerous dense, sessile or stalked, obovate with a broad vertical or suboblique elastic complete annulus. Indusium inferior or absent (*Alsophila*).

1. ALSOPHILA, R. Br.

Sori dorsal, globose. Receptacle elevated, villous. Indusium 0. Frond pinnately decomposed, veins never anastomosing, simple forked or pinnate.

1. *A. glabra*, Hook.

A tree-fern 10—20 ft. high. Petiole asperous and rhachis almost purple. Fronds 2-pinnate with pinnæ 1.5—2.5 ft. long, pinnules 3—6" by 5—9" wide, glabrous beneath, pinnatifid $\frac{1}{4}$ — $\frac{1}{2}$ -way down, veins simple or few 2-furcate.

* See Introduction. All the following families should logically have been placed in the following order previous to the Dicotyledons. The Dicotyledons were taken up first because they are of prior importance and in conformity with the usual practice in English works on systematic botany.

† The order of the venation in the ferns after primary rhachis, secondary rhachides, etc., in compound fronds is costa, costule, veins, veinlets. The costule being the midrib of a lobe is not always present and sometimes the general term "vein" is sufficiently explicit.

Chota Nagpur, Wood! but no doubt from the old Commissioner's compound in Ranchi, where it was planted. There is no wild *Alsophila* in Chota Nagpur, though I have found both this and *Cyathea spinulosa* in the deep ravines of the Pachmarhi Hills (Central Provinces).

FAM. 2. POLYPODIACEÆ.

Perennial, very rarely annual, rarely tree-like ferns. Rhizome sometimes creeping over trees and rocks. Leaves with normal epidermis and many-layered lacunose mesophyll. Sori rarely marginal, though sometimes very close to margin, usually on the underside of the leaves, dorsal or terminal on the fertile veins, at times also spreading on to the parenchyma between the veins, naked, or covered by the more or less modified leaf margin or by a special variously attached and shaped indusium. Sporangia usually long-stalked, almost always with an incomplete vertical annulus which is interrupted on one side near the stalk, opening by a transverse fissure due to the elastic straightening of the annulus. Spores globosely-tetrahedral or bilateral.

In the following key I have shown some genera twice for convenience. There is much difference of opinion with regard to the position of these. Probably it would be better to restore the tribe *Grammitideæ*, in which *Gymnogramme*, *Hemionitis* and *Drymoglossum* would be placed, whereas *Diels* shows them in the position as numbered in the key. *Gymnopteris* he includes in the *Aspidiæ*, whereas *Beddome*, rightly I think, shows it as numbered below. As regards the position of several species of *Nephrodium*, included by several botanists under *Polypodium* merely on account of the absence of indusium, I have had no hesitation in placing them in *Nephrodium* as is done by *Diels* and *Beddome*, and I have not shown these twice.

- I. Sori confined to the venation, not occupying the whole surface of whole or part of the frond (Genera 1—23):—
- A. Indusium present, or margin of frond modified or recurved over the sori, or if indusium absent then fronds not articulating with the rhizome (Genera 1—19):—
1. Sori round. Indusium round or nephroid or half-orbicular, extrorse or peltate and opening on all sides, sometimes rudimentary or 0. (Genera 1—8):—
 - a. Sori dorsal or terminal on the veins, attached by a point, by the centre or a sinus. Leaf-margin unmodified. Stipes never articulate (*Aspidiæ*):—
 - i. Indusium nephroid or rudimentary or 0. Venation pinnate, often herring-bone type:—

Frond simply pinnate (in our species). One or more veins from the costule uniting with those from the adjacent costule

Frond 1—more pinnate. All veins free

1. *Nephrodium*.
2. *Lastrea*.
 - ii. Indusium peltate or, if 0, then venation reticulate:—

† Frond compound, not or only slightly dimorphic:—

Venation pinnate, free. Teeth of lobes spinulose

Venation copiously anastomosing with free included veinlets

3. *Polystichum*.
4. *Aspidium*.

- †† Frond simple, dimorphic. Fertile much contracted. (Sori occasionally scattered over the back of a normal frond) 24. *Gymnopteris*.
- b. Sori mostly terminal on the veins. Indusium extrorse attached by a broad base or partially adnate to the leaf margin, which is often modified. Fronds 1—more pinnate, sometimes articulate to rhizome. Veins free (*Davalliæ*):—
- i. Sori not confluent. Indusium attached by a broad base:—
- Stipes inarticulate, pinnæ articulate. Frond simply pinnate, with cretaceous dots 5. *Nephrolepis*.
- Stipes articulate, pinnæ inarticulate. Frond 3—4-pinnatifid, without cretaceous dots 6. *Humata*.
- ii. Indusium adnate on three sides to the frond. Frond inarticulate:—
- Fronds 2-ranked on the creeping rhizome. Receptacle distinct 7. *Microlepia*.
- Fronds tufted. Sori marginal. Receptacle not evident 8. *Odontosoria*.
2. Sori oblong or linear, straight or curved. Indusium present or margin of frond simulating an indusium:—
- a. Sori lateral on the fertile veins. Indusium introrse or if double also extrorse. Veins, at least the barren ones, free (*Asplenicæ*):—
- i. Sori attached to and parallel to the veins. Veins all free:—
- † Sori short, one only to a vein:—
- Indusium straight linear or oblong. Scales of stipes with thick-walled cells 9. *Asplenium*.
- Indusium usually curved or hooked and overlapping the vein. Scales of stipes with very thin walls 10. *Athyrium*.
- †† Sori, at least one (usually the lowest) on each lobe paired, indusia opening in opposite directions 11. *Diplazium*.
- ii. Sori attached to a special vein parallel to the costa. (See also 20. *Drymoglossum*) 12. *Blechnum*.
- iii. Sori not confined to the veins but spreading on to the parenchyma. Indusium 0. 25. *Stenochlæna*.
- b. Sori on the fertile vein or terminal and then sometimes on a special marginal vein. Indusium proper rarely present but often formed by the margin of the frond (*Pteridæ*):—
- i. Sori occupying the whole fertile vein excepting the ends (*Gymnogrammineæ*). Fronds hairy:—
- Fronds 1—2-pinnate. Veins free 13. *Gymnogramme*.
- Fronds usually simple 3-lobed. Veins copiously reticulate and completely soriferous 14. *Hemionitis*.
- ii. Sori occupying the ends of the veins only and sometimes confluent. Stipes polished black:—
- † Sori not confluent on the inside of the recurved margins of the frond (*Cheilanthes*):—
- Veins thickened at the end, free 15. *Cheilanthes*.
- Veins not thickened at the ends, anastomosing 16. *Doryopteris*.

- †† Sori confluent on the inside of the recurved margin of the lobes of the frond.
- iii. Sori on an intramarginal vein connecting the ends of the normal veins. Veins otherwise free:—
- Small palm-like fern with flabellate dichotomously divided fronds 17. *Adiantum*.
- Fronde pinnately divided. No extrorse indusium 18. *Actiniopteris*.
- As in *Pteris* but with a second extrorse indusium 19. *Pteris*.
- Pteridium*
(p. 1257)
- B. Indusium never present and margin of frond unmodified. Frond articulate on the rhizome. Venation never herring-boned. Sori dorsal on the frond, round or ellipsoid (linear or in lines in *Drymoglossum*) (Polypodiæ):—
1. Fronde simple undivided, fertile fronds contracted. Sori in a continuous line parallel to costa. Veins reticulate 20. *Drymoglossum*.
2. Fertile fronds not contracted. Sori scattered:—
- a. Fronde not dimorphic:—
- Fronde glabrous or with simple hairs, veins free *Polypodium*.
- As in *Polypodium* but veins reticulate 21. *Pleopeltis*.
- Fronde densely covered beneath with stellate hairs 22. *Niphobolus*.
- b. Fronde dimorphic. Barren sessile 23. *Drynaria*.
- II. Sori without indusium, densely covering both veins and parenchyma of the whole or part of the undersurface of fronds (*Acrostichæ*):—
- A. Fronde simple dimorphic. Fertile much contracted:—
- Veins much anastomosing with free included veinlets but often indistinct. Stipes not articulate 24. *Gymnopteris*.
- Veins much as in *Gymnopteris*. Sori at first linear and parallel to costa, ultimately confluent. Stipes articulate on the wide creeping caudex 20. *Drymoglossum*.
- B. Fronde simple 3-lobed or pinnate, fertile not contracted. Sori at first confined to the copiously reticulate veins 14. *Hemionitis*.
- C. Fronde pinnate, very large:—
- Veins simple and forked free, very close. Pinnæ articulate, fertile pinnæ contracted 25. *Stenochlæna*.
- Veins copiously reticulate, fine and close. Pinnæ not articulate, fertile not contracted 26. *Acrostichum*.

1. NEPHRODIUM, Rich.

(Including *Goniopteris*.)

(*Lastrea* is sometimes included in this genus.)

Usually robust terrestrial ferns. Petioles not articulate on rhizome. Blade with both sides sub-similar, usually firm, rarely membranous, pinnate, rarely more compound, often more or less hairy. Indusium heart-shaped or kidney-shaped and attached laterally in the sinus, sometimes weakly developed or altogether failing. Venation entirely pinnate with one or more of the lower veinlets uniting with the corresponding one of the next group, not forming arcole except by the union of these 1—2 veinlets.

When the indusium fails the artificial genus *Goniopteris* results. Some pinnæ will show indusia and others not on the same plant.

- I. Caudex widely creeping with fronds scattered, never dimorphic:—
- A. One—two veins each side of costules uniting:—
1. Sori medial on the veins:—
 Frond herbaceous. Pinnæ lobed half-way down.
 Lower pinnæ reduced to auricles, veins 6—12 each side costule
 Frond coriaceous. Pinnæ close, lobed one-third down, lower not reduced, veins 4—8 to each costule
 2. Sori terminal on the veins
- B. Three to six veins each side of costule unite:—
- Pinnæ 3—5" by 3—5" lobed $\frac{1}{2}$ — $\frac{1}{4}$ down, 3—5 veins unite
 Frond up to 8.5 ft. Pinnæ 6—10" by 7—1", lobed $\frac{1}{2}$ — $\frac{1}{4}$ down, 5—6 veins unite
- II. Caudex finally erect or suberect, with the fronds tufted at the apex (or both scattered and tufted in *prolifera*):—
- A. Fronds all erect, not dimorphic:—
1. One to four veins only uniting, pinnæ lobed $\frac{1}{2}$ to half-way down:—
 Pinnæ 4—6" by 7—8", lobes sub-falcate. 1—2 veins unite
 Pinnæ up to 10" by 1.3", lobes square often crenate, 2—4 veins unite
 2. Veins 12—20, all but 2—4 uniting, lobes very short or 0
- B. Fronds di- or tri-morphic, barren often of unlimited apical growth creeping and ending in a flagellum with very small pinnæ. Veins 6—10 uniting
1. *N. molle*, Desv.* Syn. *N. parasiticum*, C. B. Clarke; *Polypodium parasiticum*, L.

A tufted fern with the oblong-lanceolate fronds 1—3 ft. long, rarely 3.5 ft., simply pinnate with the pinnæ cut about half-way down or sometimes more deeply into rounded or sub-falcate lobes, variable in indumentum but nearly always more or less pubescent. Stipes and rhachis mostly pale, rather soft and becoming furrowed when dry, without scales except at the extreme base or scales very caducous, mostly minutely pubescent, and rhachis pubescent or hairy. Lobes of pinnæ with about 10—12 lateral venules or veins of which the 1—2 lowest meet in an intermediate venule. Sori one median on each venule down to the basal one, sometimes nearer the apices of the basal ones, .04" diam., with kidney-shaped indusium, or indusium caducous.

A very common fern near streams in the forest in the dryer districts or along ditches in the open in the moister districts. Purneah! Santal Parg., Gambel! Singbhum, common! Angul, common!

Probably in all districts. Fr. all the year round in places.

Basal scales where present narrow, pointed, brown. Fronds rather thin for a *Nephradium*. Pinnæ alternate, median 4—5" by 7—8", sometimes lobed as much as four-fifths way down, lowest distant often very short and sometimes reflexed, nervation never entirely glabrous. Indusium usually pubescent or pilose. Some Angul specimens are shortly hairy above.

Var. *procurrens*, Baker (sp. ?).

Root widely creeping with scattered fronds only 1—2 ft. long, oblong or lanceolate. Pinnæ soft close alternate 2—3" long only, those at base short and deflexed

* *Parasiticum* is apparently the oldest name, and the one which should be adopted under the international rules.

or not, pilose with long white hairs both sides, cleft about $\frac{3}{4}$ ths down into falcate oblong segments; veins 5—7 each side of costule, only 1 uniting. Rhachis villose. Stipes with linear-lanceolate finely pointed scales at the base.

Often gregariously covering the ground under partial shade in Purneah, and is I think distinct from *molle*! Not in fruit.

2. *N. unitum*, R. Br.*

Rhizome widely creeping. Stipes 1—1.5 ft. long, glabrous, black at base. Fronds about 1.5—2 ft. long with numerous very close pinnæ 3—5" long by 3—5" broad, cut down about one-third or a little more into triangular or ovate acute entire or subentire lobes, texture coriaceous, veins 4—8 each side of which lowest unites some distance below sinus and the next pair curving upwards sometimes unites with the excurrent vein; upper surface glabrous, under-surface generally very hairy. Sori medial on the veins, sometimes nearly coalescent and forming a continuous sinuous line round the pinna, indusium reniform, hairy.

A specimen named this in the *Cal. Herb.* from Sarguja, Wood, but it is poor and not in fruit and is possibly *aridum*. Abundant in tanks and places permanently wet in Bengal and probably in Purneah.

3. *N. pteroides*, J. Sm.

Resembles forms of *molle* and *unitum*. Rhizome wide-creeping. Stipes slender slightly scaly below up to 2 ft. Fronds 2—4 ft. long with larger pinnæ about 8" by 6" (up to 12" by 1", *Bedd.*), lobed one-third to half-way down into rounded-falcate or triangular lobes, hirtellous on the nerves beneath; veins 7—10, of which lowest and sometimes also the next pair unite in an intercostal vein running to the sinus. Rhachis and both surfaces nearly naked. Sori terminal on the veins forming a line all round the margin except at the sinuses, or sometimes only at the apex of the lobes (form *terminans*).

Balasore Hills, Orissa, *Blandford*!

4. *N. aridum*, Don.

A scarcely tufted fern, somewhat like *molle* but much more rigid and coriaceous, with narrower longer fronds usually 2—4 ft. and relatively narrower pinnæ which are only cut about one-fifth to one-third down into more or less triangular and acute lobules, usually 3—5 venules of each segment meeting one another. Sori usually closer, sometimes forming a continuous line each side of the vein half-way between vein and margin. Rhachis and lower surface pubescent or hairy, somewhat glabrescent with age.

Along streams. Ramnagar Hills, Champaran! Purneah, common! Wet places, Neerhat (Ranchi), elev. 3000 ft.! Fr. Oct.—Jan.

Fronds sometimes scattered on the creeping rhizome. Stipes dark or pale, 6—12" long, not scaly, slightly pubescent. Pinnæ tapering from base to apex, alternate median 3" by 3" (in middle) to 5" by 5", rarely more in our area but

* This is *N. unitum* according to *Beddome & Clarke*, i.e. *Polypodium unitum* (in their opinion) of *Linæus*. But *Christensen* says this plant equals *N. gongyloides* and that *N. cucullatum*, *Baker*, is the *P. unitum*, *L.* In *N. cucullatum* the sori are at the apex of the veins, lower pinnæ dwindle to auricles and 3—5 veins unite.

attaining 9" by 1" elsewhere, lower pinnæ distant and much reduced. The acuteness of the lobes is mainly due to the margin being recurved at the upper edges.

In a form collected in Sarguja by *Dr. Wood*, labelled *N. unium*, *R. Br.* (*Herb. Cal.*), the rhizome is very much creeping with the fronds arising 2—3" apart.

Var. α. pilosissimum.

Fronde 12—18" with villosely-tomentose rhachis and pubescent stipes, Pinnæ very close, touching one another, median about 3" by 3—4" (in middle), very truncate at base, cut about one-fourth way down, surface hairy and with papillose glands beneath, strigosely hairy towards the tips of the lobes on upper surface with several pairs of venules uniting.

Neterhat!

The tomentum and glands are yellow in my specimens. Rootstock widely creeping. Lower pinnæ reduced to auricles. Except that some of the pinnæ have the lower 3—6 veins uniting this might be a variety of *molle* (var. *aureum*, *Clarke?* but the lower pinnæ are not reduced in *aureum* and the pinnæ are not at all contracted at their base as they are in that variety).

Var. β. maximum.

A large fern of which the simply pinnate fronds sometimes reach 8½ ft. in length when clambering among bushes, but the pinnæ rarely over 10" long by 7—8" wide (in the middle), widest at base then nearly parallel-sided and finally tapering, pinnæ towards base of rhachis very distant and finally reduced to deltoid auricles 3" long only. Stipes naked, pale, grooved above, rhachis pale-brown, glabrous or puberulous. Pinnæ alt. and opposite cut about one-fourth way down into oblong rounded but shortly abruptly cuspidate lobes, which are connected below the cleft by a colourless membrane and finally a nervule, venules from each segment 10—12 each side, 1—2 lowest only really anastomosing with those of the next segment or intercostal vein. Costa of pinna above and veins and venules of the lobes beneath hirtellous, otherwise surface glabrous and somewhat shining. Sori on each of the lower 6—7 median and subterminal venules, indusia deciduous.

Purneah! Fr. Nov.—Dec.

There is little in common between this plant and var. *pilosissimum*, but without further study of both in the field I am unwilling to make either a separate species.

5. N. truncatum, Presl.

A rather stout tufted fern with short erect rhizome. Stipes grey naked or slightly pubescent. Fronds firm, up to 4 ft. long, rhachis pubescent above or glabrous. Pinnæ numerous, 7" by 7" (in my specimens, up to 11" by 1'6"), long-acuminate, sessile or subsessile and sometimes obtusely cuneate at base, cut down about half-way to costa into oblong truncate sometimes obscurely crenated lobes sometimes dotted beneath, hirtellous on the venation beneath, sometimes hairy on the costa above. Veins 9—10, of which 2—4 each side unite. Sori usually on the 4—5 lowest veins, median or nearer the costule, indusium reniform.

Angul Forests! Fr. March—April. There is also a specimen called *truncatum* in the *Cal. Herb.* collected by *Gamble* in Palamau, but it has not been received and I have been unable to compare it.

6. *N. moulmeinense*, Bedd. Syn. *Polypodium multilincatum*, Wall.*

A large fern with the simply pinnate fronds scattered on the creeping rhizome, 3—5½ ft. long, pinnæ subentire, crenulate or sharply falcately serrate, often with a large gland at the base, attaining 12" by 1·5", easily recognized by the strong parallel veins and the regular oblique venules, which are 10—20 each side uniting obliquely with an intermediate zigzag or nearly straight vein joining their apices.

Damp shady places, chiefly near rivers. Singbhum! Manbhum, Camp. Hazaribagh (Parasnath)! Kalahandi! Fr. Nov.—Jan.

Stipes 2 ft. or more long, not scaly, rhachis slender, pale, puberulous. Pinnæ mostly 1—1·3" broad in middle, scarcely tapering for half to three-quarters of their length, then caudate-acuminate, firm, with pale prominent costa beneath, shining and (in my specimens) minutely dotted, especially beneath, sometimes obscurely puberulous on the veins. Sori medial on the venules or nearer their apex, in a single row each side of the vein or costule. Indusiform reniform or rudimentary and evanescent.

7. *N. proliferum*, comb. nov. Syn. *Goniopteris prolifera*, Presl.; *Polypodium proliferum*, Roxb.

Fronds erect and tufted or creeping and clambering with long barren indefinitely growing simply pinnate fronds, erect barren fronds with lanceolate pinnatifid lobed or serrate apex, fertile fronds of definite growth and 1—2 ft. long, pinnæ 3—6" long by ·5—·75" wide. Often proliferous and pinnæ on the proliferous shoots gradually reduced to mere auricles towards the apex. Veinlets often wavy 6—10 each side of the veins meeting in an intermediate often very wavy vein. Sori medial on the venules, small round or oblong when young, usually becoming confluent in age, indusium 0.

Along river beds and ditches. Ranchil! Manbhum, Camp.! No doubt in many other districts. Abundant in Bengal and most parts of India near a perennial water supply. Fr. Nov.—Dec.

Rhizome stout, wide-creeping. Rhachis of barren fronds often rooting and bearing scaly bulbils from which new shoots spring. Pinnæ with bluntly lobed or crenate margins, sometimes deeply lobed at base, base truncate, rhachis and underside of pinnæ glabrous or slightly pubescent.

This is the only species of *Goniopteris* retained by *Beddome* in that genus. *Baker* and *Hooker* keep it in *Polypodium* where it was placed by *Roxburgh*. Although the habit and the sori are somewhat different from most of *Nephrodium* they seem to me insufficiently so to treat it differently from other species of *Goniopteris*.

2. LASTREA, Presl.

Characters of *Nephrodium* but none of the veins anastomosing. Fronds often very compound.

A. Fronds pinnate to 2-pinnate, nearly glabrous, at least above.

Sori glabrous:—

Barren and fertile fronds different, 2-pinnate or sub-2-pinnate.

Pinnæ up to 9". Sori ·08" diam. covering the fertile lobes. 1. *cochleata*.

Barren and fertile fronds similar, pinnate. Pinnæ up to 4·5".

Sori ·03" diam. not nearly covering surface. 2. *calcarata*.

B. Fronds 2—4-pinnate, hairy both sides. Sori hairy

3. *crenata*.

* But not *Wallich's Nephrodium multilincatum*.

1. **L. cochleata**, *Bedd. (F. S. I.)*. *Lastrea filix-mas*, *L.*; var. *cochleata*, *Bedd. (F. I. C.)*; *Nephrodium cochleatum*, *Don*.

A tufted large fern with dimorphic fronds, barren sub-2-pinnate or pinnate and pinnatisect reaching $3\frac{1}{2}$ ft. by 18", ovate or oblong-lanceolate or broadly-lanceolate; pinnæ 12—18 prs. close, lowest often 8—9" by 3" oblong-lanceolate, pinnules lobed or not, denticulate or serrate, with translucent clavate ends to the nervules, nearly glabrous. Fertile fronds narrowly lanceolate and smaller, 2-pinnate, thickly covered on the somewhat concave under-surface of the oblong pinnules with the brown or grey indusia of the large sori which are .08" diam., each of which sometimes occupies a separate rounded toothed lobule of the pinnule.

A common fern on shady banks, and the Indian plains representative of the Male Fern (*L. filix-mas*, *L.*). Purneah! Santal Parg! Ranchi and Palamau, common at 3000 ft.! Hazaribagh, ascending to top of Parasnath! Manbhum, Camp! Angul! Mayurbhanj! Fr. Sept.—Jan.

Rhizome woody very stout horizontal and ascending, thickly covered with the old leaf bases and with large brown shining scales. Stipes pale shining 6—12" in the barren, sometimes 2 ft. long in the fertile frond, base with brown fibrillæ and linear or lin.-oblong scales .2—4" long similar to those on rhizome. Rhachis terete, grooved above, firm, glabrous, or with a few fibrillæ and hairs which may also occur on the secondary rhachises esp. in the fertile frond; sec. rhachis in bar. fr. nearly always more or less winged by decurrent blade. Basal pinnæ spreading or somewhat reflexed in bar. fr., in fertile frond erect, pinna of fer. fr. 7—12 prs. (exc. subsidiary lobes), not exceeding 3—4"; pinnules of bar. fr. oblong or ovate-oblong attaining 1.5" by .5" when lobed, or usually about 1" by .25—3" when merely serrate; of fer. fr. rarely over .6" by .15" and often only .15" long and broad, lobules often spinulose serrate. The barren frond occasionally bears a few sori which are generally smaller than those of the fer. fr. Indusia persistent orbicular-nephroid with sinus quite closed, glabrous.

The rhizome does not appear to be used.

Var. *marginata*, *Hope*. Barren fronds deltoid completely 2-pinnate at base with sec. pinnæ cut four-fifths down into oblong serrate segments. Meghasani, elev. 3500 ft.!

2. **L. calcarata**, *Bedd.* Syn. *Nephrodium falcilobum*, *Hook.*

A tufted fern from 8" to 2 ft. high. Fronds lanceolate or oblong-lanc., pinnate with the pinnæ pinnatifid or pinnæ only lobed, in one variety (*falciloba*) with many reduced pinnæ or auricles on the stipes. Pinnæ 1—4.5" long by .2—7" wide, cut down two-thirds or more (or in small forms less), into oblique falcate linear-oblong segments, the upper basal one often considerably longer than the others and resembling the auricles. Rhachis pubescent or hairy and under-surface of frond glabrous or hairy. Veinlets 3—8, simple, sori .03" diam. medial with usually a well-developed orbicular (nephroid) indusium, becoming shrivelled with age, one medial on each veinlet or (in small forms) only a single line on each side of the costa of the pinna (*i.e.* only on one veinlet of each segment).

Near streams. Singbhum! Hazaribagh, Wood! Fr. April.

Caudex or rhizome small (in my specimens, stout, *Bedd.*), erect, with many fibrous roots. There are two varieties in our area:—

Var. *a. falciloba*, *Clarke*. A very pretty fern with fronds up to 2 ft., deeply pinnatifid and many erect auricles on the stipes, textures subroriaceous.

Var. β . *sericea*, *Bedd.*? A much smaller plant with much more hairy rhachis also hairy on the veins and venules beneath. Pinnæ less deeply lobed and lobes slightly falcate. Lowest pinnæ deflexed, auricles 0. It may be merely a young plant but is in fruit.

3. *L. crenata*, *Bedd.* Syn. *Polypodium crenatum*, *Forsk.*; *Nephrodium odoratum*, *Baker*; *Dryopteris crenata*, *Christ.*

A very pretty fern with glossy stipes 12–18" long with a tuft of lanceolate golden scales at the base. Frond 9–18" long, deltoid, 3–4-pinnate. Lowest pinnæ largest lanceolate-deltoid, 6–9" long by 3–4" wide at base. Pinnules lanceolate very crowded with ovate or oblong pinnatifid segments with blunt rounded lobes, texture softly herbaceous. Frond hairy or viscous villous both sides especially on the rhachides. Sori with large pale villous indusium.

Parasnath, among rocks, *J.D.H.*! Fr. Sept.—Oct.

3. POLYSTICHUM, *Roth.*

Usually very beautiful, generally terrestrial ferns. Fronds coriaceous, mostly pinnate, pinnæ usually stronger on the acroscopic side, ultimate teeth usually awned, venation pinnate simple with all veins free. Sori orbicular dorsal or rarely terminal on the veinlets, indusium peltate, seldom failing. Spores bilateral.

1. *P. aculeatum*, *Sw.*

A stout handsome tufted fern with the stipes very scaly and fibrillose throughout, the scales and fibrillæ extending more or less on to the frond. Fronds 2–3 ft., lanceolate, bipinnate or sub-bipinnate, coriaceous with numerous close lanceolate pinnæ, the lower about 5–6" in our form. Pinnules subrhomboid-oblong, unequal at the base, basispic margin excised, upper (acroscopic) more or less auricled, 5–6" long, spinulose crenate-serrate and with spinulose tip. Sori towards the apex of the lower veinlets.

Parasnath, *Clarke!* Fr. April.

The fern is very variable. The form described is nearly typical or near var. *lobatum*.

4. ASPIDIUM, *Swartz.*

Mostly fairly large ferns. Petiole not articulate on rhizome. Fronds very various, from simple to 3-pinnatifid, often membranaceous and flaccid with pinnæ frequently strongly developed on the basispic side, veins freely branched and much anastomosing with generally free included veinlets in the areoles. Sori roundish, on a rather prominent receptacle. Indusium orbicular, more rarely reniform or irregular or obsolete. Spores bilateral.

1. *A. cicutarium*, *Sw.* Syn. *Nephrodium cicutarium*, *Hk. & Baker.*

A tufted fern with the fronds rather membranous, often 2.5–3 ft. long and somewhat deltoid in outline, pinnatifid or pinnate below with the pinnæ deeply pinnatifid, rarely 2-pinnate or more compound. Sori .04–.06" diam. with a reniform or usually peltate indusium in a row

each side of the vein of the final lobe or segment, at the apex of the free venules or compital.

Shady banks in the forest. Common in Chota Nagpur. Singbhum! Paras-nath (Hazaribagh)! Ranchi! Palamau! Fr. Nov.—Jan.

Stipes under 1 ft., deep chestnut-brown, with few oblong scales or many close to the base; flattened. Main rhachis and primary partial rhachides beneath glabrous or nearly so. Free pinnæ usually 3—5 prs. sub-opposite. Final lobes rounded or if acute then again crenate.

Var. *coadunata*, Wall.

This has slightly thicker (but still thin) fronds which are pubescent above and on the nerves beneath, rhachis hairy. The common form in Singbhum!

NOTE.—*A. variolosum*, Wall., is recorded in *Bengal Pl.* from Ch. Nagpur. I consider the specimens so named are *A. cicutarium* with more pronounced reticulate venation. The fertile fronds of *A. variolosum* have narrower pinnæ and are unlike the barren fronds but the two species appear to pass into one another.

5. NEPHROLEPIS, Schott.

Rhizome short or widely creeping or climbing, sometimes with bulbils. Stipes not articulate to rhizome. Fronds clustered with indefinite apical growth, simply pinnate with sessile linear or oblong undivided pinnæ articulate on the rhachis and usually stronger on the acroscopic side; veins forked, free, their ends clavate and calcareous on the upper side (showing as white chalky dots). Sori distinct, orbicular, arising from the apex of the upper branch of a vein generally near the margin and furnished with a reniform or suborbicular extrorse indusium, appearing as a single row parallel to the margin or costa.

Not stoloniferous. Pinnæ 1.5—3" long. Sori sub-marginal

1. *exaltata*,

Stoloniferous. Pinnæ under 1.5" long. Sori sub-median

2. *cordifolia*.

1. *N. exaltata*, Schott.

A tufted fern with suberect rhizome and linear-oblong weak pinnate fronds up to 3 ft. long with firm slightly scaly pale-coloured stipes 4—8" long. Rhachis from densely fulvous hairy to nearly glabrous. Pinnæ mostly close 1.5—3" long by .25—4" broad, acute or subobtusate or lowest shorter broader and rounded at apex; base on the acroscopic side with an oblong auricle, on the basiscopic side with a smaller rounded one; margin entire or crenate or sub-serrate, glabrous both sides or very scaly when young or lower surface hairy. Sori in a line quite close to the margin with firm reniform (or orbicular but attached on one, the inner, side), .04" diam.

Bonai, *Grieve!* Very frequently cultivated in pots. Fr. May—July. *Grieve* described his specimen as climbing, but it appears to be *exaltata* (which is common in some of the Central Provinces' hills!) with rather more rambling fronds than usual.

Young unfolded fronds covered with dense dark subulate scales.

2. *N. cordifolia*, Presl.

A tufted fern developing long rooting stolons especially in wet places on which are produced stalked hairy and scaly brown bulbils or tubers up to .5" diam. or more. Fronds 1—2 ft. long, linear^o or linear-oblong

with a very slightly scaly or hairy stipes 1—4" long. Pinnæ very crowded, with the acroscopic auricle often overlapping the top of the rhachis and the base of the next pinna, attaining 1—1.3" long by .3—'6" broad but usually much smaller and the basal ones reduced to broadly oblong or orbicular superiorly lobed auricles, apex of pinnæ mostly rounded, margin entire or slightly crenate, base truncate or cordate, surfaces nearly glabrous, the cretaceous dots often conspicuous as small discs. Sori nearly equidistant from margin and midrib, .04"—.05" diam., indusium persistent, nephroid with broad sinus or attachment base.

On moist shady banks and hillsides. This occurs often in association with *N. exaltata* in the Central Province's mountains and will probably be found in the western mountains of our area. It is very frequently seen in cultivation in grass greenhouses and verandahs. Fr. April—July.

6. HUMATA, Cav.

(Includes *Leucostegia*, Presl.)

Ferns with creeping rhizome, growing usually on trees and rocks. Stipes scaly, articulate to the scaly rhizome. Frond coriaceous (*Humata*) or membranous (*Leucostegia*) 1—4-pinnate or -pinnatifid; veins simple or forked with free venules. Sori terminal marginal on the underside of the margin with a sub-orbicular or reniform thin or coriaceous indusium attached by a broad base but free at the sides and apex. Receptacle minute.

Scales slender. Frond 2—3-pinnate. Ultimate segments obovate, lobulate crenate or dentate.

1. *immersa*.

Scales broad rounded. Frond 3—4-pinnate. Ultimate segments lanceolate deeply cut into few short linear lobes

2. *pulchra*.

1. *H. immersa*, Diels. Syn. *Leucostegia immersa*, Hk.; *Davallia immersa*, Wall.; *Davallia multiflora*, Roxb. (*Beng. Pl.*).

A very pretty fern with the rhizome mostly underground, creeping, on the exposed parts covered with slender scales or fibrillæ. Fronds 2-pinnate and pinnatifid or 3-pinnate, ovate in outline, 4" by 2" to 9" by 4—5" with a polished glabrous erect pale brown stipes 6—8" long. Secondary pinnæ with slender stalks, in our specimens only pinnatifid or pinnatisect with the pinnules somewhat dimidiately obovate lobed and either (usually 3-) lobulate or coarsely crenate at the tips. Sori large, with the base of the semi-orbicular membranous indusium .06—'07" diam., impressed and hence clearly visible on the upper side, the sporangia when ripe usually projecting beyond the margin, usually 1—6 sori to a pinnule or segment and lower pinnules often barren.

Hazaribagh, repeatedly collected on the top of Parasnath 4000 ft. but nowhere else in our province. Fr. Sept.—Nov.

2. *H. pulchra*, Diels. Syn. *Leucostegia pulchra*, Bedd.; *Davallia pulchra*, Don; *Davallia chætophylla*, Wall.

A very beautiful fern with wide creeping rhizome clothed with broad rounded often peltately attached scales. Fronds glabrous very

delicately 3—4-pinnate or (from the rhachides being narrowly winged) -pinnatifid, ovate or sub-deltoid in outline, 5—15" long by 3·5—8" broad and with a slender naked stipes 4—8" long. Ultimate pinnules ovate or elliptic pinnatifidly cut into lanceolate segments with few short linear mostly very acute lobes. Sori mostly broader than long sub-marginal, ·02" diam.

On rocks and trees. Rare. Parasnath, J.D.H.! Fr. Sept.—Oct.

7. MICROLEPIA, Presl.

Rhizome creeping, hairy. Fronds scattered or 2-ranked along the rhizome, not articulate, 1—more pinnate, veins simple or pinnately forked with branches or venules free. Sori terminal on the dilated end of the venule which forms an evident receptacle often visible from the upper surface, marginal or intra-marginal. Indusium membranous, semi-cup-shaped, attached by base and sides. Sporangia very numerous.

Fronds simply pinnate, nearly glabrous
Fronds 2—3-pinnate, hairy both sides

1. *marginalis*.
2. *speluncæ*.

1. *M. marginalis*, Hance. Syn. *Davallia marginalis*, Baker.

Fronds simply pinnate and lobed, lanceolate or linear-lanceolate to broadly ovate-lanceolate (*Bedd.*), firm, 18—24" long by 6—12" broad (9—15", *Bedd.*), and with a grey scaberulous nearly glabrous stipes 8" or more long. Rhachis and costæ beneath closely pubescent. Lowest pinnæ reduced to 2—3 rounded toothed pinnules. Median pinnæ longest, attaining (in our specimens) 6—7" by 7—9" linear-lanceolate acuminate, shortly stalked, obliquely cuneate and much stronger on the acroscopic side of the base, lobed half-way down except on the serrate acuminate apex, lobes broadly oblong rounded rarely acute, crenate or dentate, each lobe with a pinnate or sub-dichotomously branched vein, the venules sometimes again divided in the larger lobes, fertile venules expanded at the tip into a receptacle visible and appearing brown from above. Sori solitary opposite the sinuses of the acuminate apex and intra-marginal, 2—5 sub-marginal on the lower lobes, ·06" diam., margin of indusium slightly crenate and sparsely hairy (densely villous in the type, our plant is probably var. *calvescens*, *Hook.*).

Mayurbhanj, elev. 3500 ft.! Fr. May—June.

2. *M. speluncæ*, Moore. Syn. *P. speluncæ*, L.; *M. strigosa*, Sw.; var. *flaccida*, R. Br. (sp.); *Davallia polypodioides*, Don; *M. Khasiyana*, Fen.

A large handsome fern 4—5 ft. from root to apex of fronds, caudex short erect with capillary scales. Stipes scaberulous with hard-based hairs, more or less glabrescent and glossy, 1—2 ft. long. Frond 2—3-pinnate and pinnatifid, rather flaccid, hairy both sides. Pinnæ longest about one-third from the base and attaining 18" with sec. pinnæ about 3", but often much smaller and then secondary pinnæ not again pinnate but only cut to the winged rhachis into broadly oblong lobulate and crenate lobes; lobes with long white hairs

beneath and more sparsely hairy above, broadly oblong rounded with a 2-chotomously branched vein, margin sometimes recurved. Sori few, .03" long and broad, often only 1—2 or up to 6 on a lobe close to the margin and usually at the sinus of a lobule or crenature.

Purneah! Fr. Dec.—Jan.

This is not at all typical *strigosa*, but I am not quite sure whether it is *Clarke's flaccida*. *M. strigosa* has a very characteristic densely substrigosely indumentum on rhachis and costæ. Our plant closely resembles the plate of *Davallia Khasiyana* in *Lowe's Ferns* (pl. 32) except that the margins of lobes are bluntly crenate rather than toothed. It also agrees with a specimen marked *Davallia proxima*, *Thw.*, at Kew! The fronds are more flaccid than in most of this group. *Clarke* (*F.N.L.*, p. 448) says that *Bentham* has apparently included under *Davallia speluncæ* the whole of *D. polypodioides* as well as *D. flaccida*, *R. Br.*, and he suspects that this is the course which ultimately pteridologists will take.

8. ODONTOSORIA, Presl.

(Includes *Stenoloma*, *Fee.*).

Stipes often tufted, not articulate on the rhizome. Fronds very pinnately compound or decomposed with forked free veins. Sori terminal on the segments, on the tips of the venules but these are not expanded into an evident receptacle, the indusium forming together with the slightly modified opposed lobe of the frond a compressed cupular pouch only open at the top.

1. *O. chinensis*, *J. Sm.* Syn. *Stenoloma chinensis*, *Bedd.*; *Trichomanes chinensis*, *L.*; *Davallia tenuifolia*, *Sw.*, and *D. chinensis*, *Sw.*

A very beautiful and graceful fern with fronds tufted on the creeping rhizome which is covered with shining brown scales. Stipes glabrous shining brown 8—18" long, fronds (without stipes) 1—2 ft. long by 6—9" broad, ovate or lanc.-ovate or lanceolate in outline, 3-pinnate with pinnules cut into linear-obcuneate forked segments bearing 1—2 rarely confluent sori at their expanded tips. Pinnæ rather distant, alternate, ovate or lanceolate. Rhachis flattened and grooved above, that of the pinnules zigzag.

Banks of streams in the Saranda forests, Singbhum! Udeypur, *Prain's Collector!*
Fr. Feb.—May.

9. ASPLENIUM, L.

Ferns of various habit. Stipes not articulate to the rhizome, with 1 or 2 vascular bundles which unite above into a central more or less cylindrical or 4-gonous strand. Scales with thick-walled cells, the walls mostly coloured red-brown, the lumen colourless; usually the median cells are narrower and simulate a nerve. Frond undivided, pinnate, or more rarely 2—4-pinnate, pinnæ, or segments commonly more developed on the acroscopic side. Veins free. Sori straight, linear, attached laterally to the fertile vein on one side only (*cp. Diplazium*), indusium introrse. Spores bilateral.

A large genus which, even shorn of the allied genera *Athyrium*, *Diplazium*, *Anisogonium*, etc., numbers some 150—200 species, very badly represented in

our area. The character of the scales is not well marked in our species but is very distinctive in some and can be seen with an ordinary pocket lens. In other cases it can be seen if the scale is mounted in a little dilute glycerine on a slide.

1. **A. laciniatum**, *Don.* Var. *depauperata*, *Clarke.*

A small tufted fern 6—10" high. Fronds linear-oblong about 1—1.5" wide, pinnate with numerous alternate or subopposite rhomboid or semi-ovate stalked pinnæ rather irregularly lacinate less than half way down parallel to the flabellately arranged nervation, base much cut away on the basiscopic side. Stipes with linear scales, rhachis upwards glabrous or very sparingly scaly. Sori linear .1—2" long on many of the veins.

Parasnath, *J.D.H.* Fr. Oct.

10. ATHYRIUM, *Roth.*

Usually tufted ferns. Stipes not articulate on the rhizome, with 2 vascular bundles below uniting into a crescent-shaped bundle above. Scales of one layer of thin-walled cells. Frond 1—many pinnate, segments short, toothed. Veins free. Sori mostly solitary on a raised flat receptacle placed laterally on the fertile vein, short or elongate, more or less curved, sometimes hooked, indusium present and of same shape as sorus but sometimes evanescent or rudimentary, introrse, usually straddling over the fertile vein. Spores bilateral.

Straight oblong or linear-oblong sori often occur in some species together with curved ones or sometimes without curved ones; the sori then resemble those of *Asplenium*, to which genus it is in fact often united and is somewhat artificially separated. The walls of the scale-cells are sometimes of moderate thickness, but thin if compared with a good example of *Asplenium*.

Fronds 2—3-pinnate, or if 1-pinnate then pinnæ deeply pinnatifid. Sori .02—04" long

1. *felix-femina.*

Fronds 1-pinnate, pinnæ not lobed more than half-way down. Sori .1" long

2. *falcatum.*

1. **A. filix-femina**, *Roth.* Syn. *Asplenium filix-femina*, *Bernh.* Lady-fern.

A very beautiful finely-cut (except var. *parasnathensis*) tufted fern 1—4 ft. high. Stipes grooved, one-third to nearly as long as rest of frond with scattered linear membranous deciduous scales. Frond lanceolate narrowed both ends, membranous, green, 2—3-pinnate (sub-2-pinnate in var.) and pinnatifid, with soft rhachis appearing triangular or furrowed when dry. Pinnæ narrowly linear-oblong or linear-lanceolate, widest near the base, secondary pinnæ .25—1" long oblong or linear-oblong spreading at right-angles to rhachis, sessile or decurrent, pinnatifid or serrate (or pinnate in var. *pectinata*), margin toothed. Sori usually very small, shortly oblong (sometimes almost quadrate), only slightly curved, usually in two rows on the ultimate pinnules or lobes, .02—04 long.

Damp localities in the higher hills. Ranchi (Pitorea East Hill), Wood! Hazari-bagh, Parasnath! Fr. Sept.—Dec.

The following varieties occur in our area:—

Var. *α*. **pectinata**, *Clarke*. Syn. *A. pectinata*, *Wall.*

Very finely tripinnate and ultimate pinnae pinnatifid with very acute or sub-spinulose teeth. Rhachis slender but scarcely grooved when dry. Indusium very shortly oblong subsistent.

Ranchi and Parasnath.

Var. *β*. **parasnathensis**, *Clarke*.

Fronde 1-pinnate, sub-2-pinnate. Rhachis triangular when dry. Fronds reddish, 1.5 ft., narrow oblong, scarcely attenuate at base. Primary pinnae 1.5" long broadest at the base, sec. pinnae .25—3" acutely toothed, scarcely pinnatifid. Indusium short oblong, in two oblique rows, very persistent. Parasnath, *Clarke*.

2. **A. falcatum**, *Bedd.*; Syn. *Asplenium drepanophyllum*, *Baker*.

A tufted fern with linear-lanceolate 1-pinnate fronds narrowed to both ends 3—12" long by 1—3" broad; stipes up to 6" in the larger fronds. Pinnae .2—5" broad, median cut half-way down into broadly oblong rounded lobes usually with a distinctly larger basal lobe on the acroscopic side, lower pinnae sometimes more deeply cut, lobes entire or toothed. Stipes with many very slender scales near the base, rest of frond glabrous. Sori usually in one row each side of the costa of the pinna, about one to each lobe on its upper venule, oblong, about .1" long but sometimes very broad.

Ranchi, *Wood!* Palamau, 2000 ft., *Gamble!* Hazaribagh, 4000 ft. (Parasnath)! Fr. Sept.—Dec.

Pinnae spreading or deflexed. *Beddome* says that the sori are numerous on each side of the costa, at length confluent and covering the whole or nearly the whole under-surface. They are distinct in our specimens and have quite the shape of many *Asplenium*, in which genus it is often placed.

11. DIPLAZIUM, *Sw.*

(Including *Anisogonium*, *Presl.*)

Ferns of various habit. Stipes not articulate, with 2 vascular bundles which unite above into one peripheral semi-cylindric strand. Fronds simple to very compound. Nerves free or (section *Anisogonium*) some anastomosing. Sori dorsal straight linear as in *Asplenium*, but usually at least one (the basal acroscopic) veinlet in each lobe bears a sorus both sides; the other veinlets have a sorus on one side only or *nil.* Indusium usually coriaceous; in the twin sori both open outwards from the veinlet. Scales as in *Athyrium*.

1. **D. esculentum**, *Sw.* Syn. *Anisogonium esculentum*, *Presl.*; *Asplenium esculentum*, *Retz.*

A large fern with an erect stout caudex and a terminal tuft of mostly 2-pinnate fronds 3—5 ft. long, including the 1—2 ft.-long pale slightly scaly stipes which is more or less 4-angled and grooved. Scales dense near the rhizome lanceolate-acuminate, ciliolate with papillae. Barren fronds almost dimorphic, either simply pinnate with the pinnae 2—3.5" long or very broad and 2-pinnate (on same plant), with the pinnae 6—12" long alternate and rather distant, fertile fronds similar to the

second form, secondary pinnæ 1—4" long by .4—7" wide in middle, lobed $\frac{1}{4}$ — $\frac{1}{2}$ way down or only notched, basal lobes often much longer than others, margin crenate-serrate. Vein (one to each lobe) with 5—6 oblique veinlets, of which 2—3 meet in an included intermediate vein (much as in *Nephrodium*); occasionally also there is a little anastomosis near the edges of the lobes. Sori linear .05—12" long, one to each venule except the 1—2 terminal.

Frequent in marshy places. Purneah! Singbhum! Ranchi (3000 ft.)! Palamau, near rivers! Mayurbhanj, 3500 ft.! Fr. Dec.—Jan.

Fronds more or less puberulous and papillose beneath, sometimes pubescent on the costæ, slightly scented, the hairs apparently slightly glandular. The scales are moderately thin-walled as in *Athyrium* with lumen slightly coloured, all cells very narrow, but without any apparent midrib.

The young fronds are cooked and eaten.

12. BLECHNUM, L.

Rhizome usually erect. Stipes with 2 strong and several smaller vascular bundles; scales with thin-walled cells. Fronds tufted uniform or slightly dimorphic, simply pinnate or pinnatifid; veins in the barren fronds all simple free and parallel or uniting in a marginal vein only, or forked; in the fertile frond similar but with a transverse veinlet (sometimes very obscure) running parallel to and close to the costa and connecting up the veins usually just at their point of forking. Sori forming a continuous line each side of, close to the costa covering the connecting veinlet, with a continuous introrse indusium.

1. *B. orientale*, L.

A large fern with an erect stout caudex clothed with fibrillose dark brown scales. Fronds up to 4 or 5 ft. in length, simply pinnate. Pinnæ sessile entire linear with caudate tips, longer attaining 12—18" long by .5—9" wide, uppermost only with decurrent bases (making the top of the frond pinnatifid), others with base rounded on the basiscopic half-cuneate on the acroscopic side; veins very close parallel meeting and slightly upcurved in the margin, a few only forked. Sori forming a continuous line from the base nearly to apex of pinna.

Very common near streams. Purneah! Singbhum! Ranchi! Palamau, Wood! Mayurbhanj! Fr. all the year round.

The lowest pinnæ are reduced to small rounded auricles on the stipes.

13. GYMNOGRAMME, Desv.

(Includes *Neurogramme* part, Diels.)

Fronds various, not articulate to the rhizome, one—several-pinnate the under-surface more or less thickly hairy often with white waxy hairs (as in *Cheilanthes*), veins pinnate or forked or both, free, or with an occasional union. Sori linear occupying the whole length of the veins but leaving the ends free.

1. **G. calomelanos**, *Kaulf.* Syn. *Neurogramme calomelanos*, *Diels*; *Ceropteris calomelanos*, *Und.*

A pretty fern with 2-pinnate fronds 2—3 ft. long, lanceolar in outline with lanceolate pinnæ up to 3—4" long and narrow linear-lanc. pinnules cut at the base into small oblong lobes and crenate towards the apex. Under-side of fertile fronds white and mealy with intermixed black sporangia. Stipes dark shining chestnut with linear acuminate brown scales towards base. Veins close oblique, often twice forked. The sporangia have a golden annulus but appear black before bursting from the black spores.

Ditches and banks, Purneah (near Thakurganj)! Fr. Dec. One of the "Gold and Silver Ferns." This is a native of America, tropical West Africa on the islands, and has also been reported from Samoa! Its distribution is therefore remarkable, and it is remarkable that it should occur near Thakurganj with every appearance of being wild as, although it is sometimes cultivated, there are no signs of its being so in that locality (a small village without gardens). It has also been collected in a gully above Tista bridge near Pashok (*Herb. Lacaita*, 21.4.13).

14. **HEMIONITIS**, *L.*

Small ferns with erect or prostrate rhizome. Stipes not articulate. Frond simple or lobed, rarely pinnate, usually hairy, veins copiously anastomosing and forming numerous areoles with rarely a free veinlet in them, which when present is also soriferous. Sori continuous along the veins and copiously reticulate. Indusium 0.

1. **H. arifolia**, *Bedd.*

A small rufted fern with cordate ovate or hastate fronds; barren ones 2" by 1.5" to 6" by 3.5" with lobes rounded at the apex, fertile fronds often as broad as long, more hastate and with acute lobes, stipes of fertile frond 8—12" long, chestnut brown, fibrillose towards the base, young hairy all over, of barren frond only 2—4" long. Blade coriaceous, with thin long hairs beneath, venation obscure. Sporangia densely covering under-surface but following the reticulate veins, the costa of the lobes alone more or less bare.

Growing in the crevices of bare rocks. Ranchi (Horbap forest, etc.)! Puri, on Khandabolo Mnt.! Also Chilka Lake Islands, C. & N. Fr. Oct.—Jan.

15. **CHEILANTHES**, *Sw.* Silver-fern.

Usually small ferns with short erect or creeping scaly rhizome. Stipes not articulate, generally clustered. Frond 3—4-pinnate or pinnatifid, rarely only once pinnate and pinnatifid, more or less hairy or papillose, the hairs or papillæ often white-waxy and mealy, veins free. Sori terminal on the thickened ends of the veins, roundish or extending into a linear form and more or less confluent. Indusium 0, but the sori often more or less covered by the somewhat modified at length partially or wholly recurved margin of the frond. Spores roundish-tetrahedral.

Frond not covered with white papillæ beneath. Sori extending some distance from margin
Frond pure white with waxy papillæ beneath. Sori only forming a line round the margin

1. *tenuifolia*.
2. *farinosa*.

1. *C. tenuifolia*, Sw.

A small very pretty fern with shortly creeping scaly caudex; stipes more or less tufted deep brown or black, those of the fertile fronds much longer than of the barren. Barren fronds mostly 3–4" deltoid, 2–3-pinnate, pale beneath but not white-mealy, nearly glabrous, sparsely hairy above. Fertile fronds usually more elongate up to 12" or 18" long including the stipes, otherwise similar. Lowest one or two pairs of pinnæ longest, 2–4", with the lowest basispic secondary pinnæ often twice as long as the others and pointing backwards, ultimate pinnules with small elliptic lobes 1–2" long only, the larger crenate. Rhachis winged above. Sori submarginal on the crenatures, ultimately confluent, margin of the lobes more or less recurved.

On moist banks. Ranchi! Hazaribagh, *Gamble, Clarke!* Maubhum, *Camp!* Singhum! Frequent throughout Chota Nagpur. Puri (Barkuda I), *C. & N.;* Sambalpur, *Griff!* Fr. Sept.—Nov. *Beddome* calls it annual, but although it appears to curl up and die in the hot season, I think it is usually perennial.

2. *C. farinosa*, Kaulf.

A very pretty small tufted fern with more or less elongated black or chestnut glossy stipes, scaly when young. Frond (with the stipes which is usually about the same length as the blade) 4–20" long, smaller usually somewhat deltoid, larger usually lanceolar in outline, underside covered with a beautiful white indumentum of small waxy papillæ, usually 2-pinnate and pinnatifid. Lowest primary pinnæ longest, 2–4", with the lowest basispic secondary pinna two–three times longer than the others and generally pointing backwards, pinnatifid with oblong rounded lobes. Sori at first small globose in an almost continuous line close to the margin, finally confluent. Edge of frond thin and simulating an indusium, sometimes covering the sori.

Ravines and damp hillsides, very common in the hill districts. All districts of Chota Nagpur, ascending to top of Parasnath! Rajmahal Hills! Angul, *Chattarjee!* Fr. Sept.—Jan.

16. DORYOPTERIS, *J. Sm.*

Rhizome short or creeping, the black polished stipes clustered or scattered with diarch or triarch vascular bundles, scales with pronounced central band. Fronds often dimorphic, simple or pinnatifid, and the basispic side of segments more strongly developed; triangular ovate in outline. Veins copiously anastomosing without free included veinlets. Sori marginal as in *Pteris*.

1. *D. ludens*, *J. Sm.* Syn. *Pteris ludens*, *Wall.*

A small fern with creeping rhizome furnished with linear adpressed, white-margined brown scales. Stipes scattered, with sparse scales and sometimes pubescent at base and apex, that of barren frond 3–4", of fertile up to 12". Barren frond triangular-ovate simple entire with somewhat cordate or hastate base, 2–4" long and 1–2.5" broad, basal lobes sometimes sub-2-lobed. Fertile frond 4–6" each way, ivy-leaf shape or pinnatifid with the basal lobes furcate, the basispic fork

deflexed, other lateral lobes 2 only, lobes all linear or linear-lanceolate entire coriaceous, costæ black polished, other venation obscure.

Balasore Hills, *Blandford!* Fr. Feb. Common in Burmah.

17. ADIANTUM, L. Maidenhair.

Usually tufted ferns with black and polished inarticulate stipes, almost always with one half-cylindric vascular bundle. Fronds generally bright green and of delicate texture, simple to much pinnately compound with the final pinnules usually short broad and rounded with flabellate venation. Veins mostly simple or forked free. Sori marginal, globose to linear, at the ends of the veins, and often spreading on to the parenchyma, separate or confluent and covered by the recurved lobulate margin of the frond, on to which they extend.

Stipes naked. Pinnæ with slender petiolules half-orbicular or somewhat oblong, acroscopic margin entire or with rounded lobules

1. *lunulatum.*

Stipes pubescent or tomentose. Pinnæ sessile half-lanceolate or half-ovate, the acroscopic margin deeply lobed or lacinate

2. *caudatum.*

The well-known true Maidenhair fern (*A. capillus-veneris*) has been found by me on wet rocks in mountain ravines of the Central Provinces and might perhaps occur in our area.

1. *A. lunulatum*, *Burm.* Dodhari, *S.*

A tufted fern with slender fronds 6—15" long including the black polished nearly glabrous wiry stipes, alternate patent petioled semi-orbicular or elliptic-oblong simple pinnæ with straight basispic edge and curved lobulate acroscopic edge, .5—1.3" long, acroscopic base produced and rounded, nerves flabellate forked, sporangia on the recurved lobules or sometimes continuous margin. Stalks of the pinnæ filiform .1—.4" long, and rhachis black and polished like the stipes. Rhachis usually ends in a symmetrical flabellate pinna. Only in one case have I seen it produced into a flagellum as in the next species.

A common fern in shady hill forest. Santal Parg., *Gamble!* Throughout Chota Nagpur! Angul, *Chattarjee!* No doubt throughout the hilly districts. Fr. July—Jan.

A decoction of the root is given in throat affections by the Santals, *Campbell.*

2. *A. caudatum* L.

A small tufted fern with very fibrillose rhizome. Fronds linear or linear-oblong 6—16" long, including the wiry polished deep-brown stipes, up to the termination of the leafy portion, beyond which the rhachis is frequently extended into a long more or less bare flagellum of indefinite length often rooting at the tip. Pinnæ all quite free sessile or shortly petioled, more or less rhomboid or irregularly oblong in outline, nearly straight on the basispic side, more or less lobed or deeply lacinate on the acroscopic side and tip, flabellately nerved. Stalks of lower pinnæ up to .1", usually less, upper sessile. Rhachis and stipes more or less pubescent or tomentose. Sori at the ends of the segments, never forming a continuous line.

Damp hillsides and ravines, common. Ranchi! Palamau, Gamble! Singbhum! Manbhum, Camp! No doubt in all districts of Chota Nagpur and Santal Parganahs. Balasore Hills, Blandford! Puri (Barkuda), C. & N.; Angul, Chattarjee! Fr. July—Dec. It usually dries up in January.

18. ACTINIOPTERIS, Link.

A small tufted fern with suborbicular 2-chotomously flabellately divided fronds. Stipes inarticulate with one half-cylindric vascular bundle, not black or polished. Venation flabellate with a midrib to each main segment and very oblique sec. nerves. Sori linear on an intramarginal vein connecting the sec. nerve-endings; margin of the frond thin and simulating an indusium.

1. *A. radiata*, Link. *Actiniopteris dichotoma*, Bedd.

A very pretty little erect rather stiff fern resembling a miniature fan palm, 3—7" high. Fronds 1—1.5" diam. repeatedly 2-chotomously divided into linear segments with acutely toothed tips. Sori in a continuous line on the side margins, not on the toothed tips.

On dry hillsides, rare. Chota Nagpur (without locality), *Wood's List*. I have collected it at Nagpur but not in Chota Nagpur, nor can I find specimens from Chota Nagpur. Fr. Nov.

19. PTERIS, L.

Usually robust tufted ferns or sometimes fronds distant on a wide creeping rhizome. Stipes inarticulate, not polished black, with one vascular bundle throughout. Fronds sometimes simple but usually pinnate or pinnately-compound with the lowest pinna usually strongly developed below at base on the basiscopic side. Veins all free or (in section *Campteria*) the lowest veinlets uniting with those from the next costule and forming long arches along the costa. A slender submarginal vein also connects the nerve-endings in the fertile frond except sometimes in the sinuses and tips of the lobes. Sori linear situated on the above marginal vein and covered by the indusium-like margin of the frond. Spores orbicular tetrahedral.

1. Fronds tufted simply pinnate or lowest pinnae furcate or 2-pinnate on the basiscopic side only. Indusium single:—
 - A. All veins free, pinnae not pinnatifid, narrow:—
 1. Fronds simply pinnate with the pinnae many close undivided, upper linear 1. *longifolia*.
 2. Fronds with the lowest, or sometimes 2—3 lower, pinnae with an accessory pinna, upper pinnae unbranched (rarely all pinnae simple in *pellucida*):—
 - Frond 6—12". Pinnae up to .7" broad, sterile and sterile portions of fertile fronds acutely serrate 2. *cretica*.
 - Frond 12—18", pinnae often 1" and more broad, margin entire or crenate 3. *pellucida*.
 - B. Lowest vein from each costule, or at least some of them, anastomosing with that from the next costule. All pinnae deeply pinnatifid:—
 - Veinlets reaching the margin, lobes entire 4. *biawrita*.
 - Veinlets not reaching the margin, terminating in dots, margin of barren portion of frond or barren fronds crenate 5. *geminata* (p. 1257).

II. Fronds not tufted, 2—4 pinnate with many pinnae. Indusium double, one introrse, the other extrorse

5. *aquilina*.

1. *P. longifolia*, L.

A densely tufted fern with tip of rhizome and base of stipes densely clothed with linear acuminate brown or yellow scales. Stipes very short (in my specimens), 6—12" long according to *Beddome*. Frond simply pinnate, the rhachis somewhat scaly or hairy, clothed from base to tip with simple pinnae about 10—30 each side, which increase in length from the base upwards and end in a terminal pinna longer than all the others, lowest pinnae often ovate or oblong often mere auricles, upper linear, lower cordate truncate or auricled at the base, especially on the basiscopic side, uppermost 3—8" long by 2—3" broad. Sori in a continuous band down both sides of the fertile pinnae, with a well-marked pale indusium, annuli golden yellow.

Old walls, Purneah! *Prain* (*Beng. Pl.*) says "in all the provinces," but there is no specimen in the *Cal. Herb.* or *Kew* from any district within our area. Fr. Nov.—Dec.

2. *P. cretica*, L.

Stipes 6—12" long, erect, naked, or with lanceolate scales near the base, straw-coloured. Fronds (exc. stipes) 6—12" long, sub-2-pinnate, the lowest or lowest 2—3, rarely more, pairs of pinnae having one accessory secondary pinna near its base. Pinnae few. Primary pinnae or primary lobes of the double pinnae linear 3—8" long by 1/7—1/7" wide acute or obtuse, barren pinnae usually wider than the fertile, and as well as the barren portions of the fertile frond closely sharply serrate. Veins forked and simple, often very close together, diverging at a wide angle from the costa. Sori in a continuous band on the margins except near the base and apex, indusium distinct.

Balasure Hills, *Blandford*! A commonly cultivated fern. Fr. all the year.

3. *P. pellucida*, Pr.

A larger stouter plant than *P. cretica*. Stipes 1 ft. or more. Fronds 12—18" long, simply pinnate or occasionally lowest forked, pinnae usually in 3—6 sessile pairs, entire or serrate, upper slightly decurrent, lower often 8" by 1", surface glossy.

Singbhum! Santal Parg., *Gamble*! Fr. Dec.

Although of different appearance it is, as *Clarke* says, only a large *cretica* with pinnae often 1" broad and usually simple. *Baker* also says not satisfactorily distinguished from *cretica*. The young fronds are often digitate, the old barren ones sometimes superficially resemble *Nephrodium moulemeinense*.

4. *P. biaurita*, L. Syn. *Campteria biaurita*, *Bedd.*

A large handsome fern with fronds (including the stipes) 3—6 ft. long and up to 2—2.5 ft. broad, tufted on an erect caudex 6—12" high, simply pinnate and pinnatifid except at the base, the lowest pinna being bifurcate or with 2—3 descending secondary pinnae. Pinnae 8—14 prs. and a terminal one, all free, sessile or lowest petioled, deeply pinnatifid, longer 8—15" long by 1.5—2.5" wide, with close regular linear-oblong rounded segments gradually decreasing upwards and

finally ending in a linear entire tail 1—3" long. Secondary pinna of the lowest primary half to three-fourths as long as the primary and similar. Costules prominent, the lowest vein (rarely more) from each costule usually meeting the lowest from the next costule, and forming a low arch and giving off several veinlets towards the sinus. Occasionally the veins meet the sinus without meeting one another; other veinlets from the costules numerous, all bifurcate from their base and meeting the margin. Sori in a continuous line all round the segments, rarely interrupted at the tips or sinuses. Indusium prominent, double.

Near watercourses. Parnah! Frequent in the Saranda forests of Singbhum! Hazaribagh (on Parasnath)! Fr. Sept.—May.

Caudex stout. Stipes 1.5—3 ft. long, slightly scaly at the base, naked and polished straw-coloured above. The costæ have a small subulate process at the base of each costule on the upper side, which occurs in all my specimens though it does not appear to have been noted by *Beddome* or *Clarke*.

P. geminata, *Wall.* Syn. *Campteria Kleiniana*, *Presl.*

This is entered as from Chota Nagpur in *Bengal Plants*, and its characters are given in the key above. The only specimen is a plant from Parasnath which is to my mind merely *P. bicurva*. In addition to key characters *Beddome* says *Campteria Kleiniana* has sub-membranous fronds with falcate oblong segments, sterile ones broadly crenated, and the sori or indusium never reach the bases or apices of the segments. He gives the locality as Western mountains of the Madras Presidency.

5. P. aquilina, *L.* Syn. *Pteridium aquilinum*, *Kuhn*; Bracken.

A stout fern 2—6 ft. high with stout creeping rhizome and scattered fronds. Stipes 6—15" long, yellowish green except at the dark-coloured base, without scales, slightly pubescent when young. Frond deltoid to triangular, lanceolate in outline, 1—2 ft. wide, 2-pinnate or 3—4-pinnate below, pinnatifid at the tip, hairy beneath and on the costæ above, coriaceous. Pinnæ numerous with many pinnules. Ultimate pinnules or lobes 3—6" long (rarely more in our area) at base of the secondary or tertiary pinnæ, lanceolate or linear-lanceolate, sometimes falcate, veins close raised beneath, often twice forked. Indusium double, an inner extrorse and an outer firmer introrse.

On the highest mountains of the province (but not found on Parasnath). Neterhat Plateau, 3000 ft. and above! Mayurbhanj Mnts. 3500 ft. (Meghasani)! Fr. Dec.

Our plant has the pinnæ rather crowded and very hairy beneath. The genus *Pteridium* is perhaps rightly separated off from *Pteris*, but the name *Pteris aquilina* is one of the best known among ferns. Moreover the inner very thin indusium is said not to be always present; its edge is long-ciliate. In *Campteria* there appears to be a double indusium, but both are *outside* the receptacle and the outermost is continuous with the frond.

The habit of *P. aquilina* with its scattered fronds and many and much-divided pinnæ is quite different from our other species of *Pteris*.

20. DRYMOGLOSSUM, *Presl.*

Small epiphytic ferns with slender widely creeping rhizome. Fronds articulate with the rhizome, simple, dimorphic, the sterile short and broad, the fertile linear. Venation obscure, pinnately anastomosing, forming 3—4 series of areoles between costa and margin including

simple or forked free veinlets with clavate apices. Sori linear, confluent, scarcely immersed, more or less mixed with scales or stellate hairs, parallel to the costa or margin, sometimes at length covering the whole undersurface of the frond.

1. *D. piloselloides*, Presl.

A pretty little epiphyte with the filiform rhizome clothed with appressed narrow-rhomboid peltate lacinate scales. Barren fronds broadly ellipsoid, 7—1" long only, rounded both ends or base obtuse, young with stellate hairs; stipes 1" long only. Fertile frond linear with tapering base, 1.5—3" long by about 2—2.5" broad, tapering into a short slender stipes. Sori finally covering the whole under-surface except at base, mixed with stellate hairs.

On trees overhanging perennial streams in dense evergreen forest in the Duars! I have observed similar epiphytes in like places in Purneah and the Mals of Puri, but without fertile fronds. Fr. Jan.—Feb.

21. PLEOPELTIS, Humb. & Bonp.

Very often epiphytic with usually creeping rhizome. Stipes scattered or more rarely tufted, articulate on the rhizome. Fronds simple or more rarely divided, pinnæ when divided sometimes dimorphic. Veins often clavate at the ends, copiously anastomosing, forming irregular areoles with generally free included veinlets. Sori naked, usually round, sometimes oblong, generally on the back of united veinlets.

This genus is included in *Polypodium* by many botanists; *Polypodium* then would also include the genus *Goniophlebium*.

A. Fronds linear, more or less opaque, scattered:—

Fronds 3—10", nervation invisible

1. *linearis*.

Fronds 12—18", nervation visible

2. *simplex*.

B. Fronds lanceolate or oblong acuminate with winged stipes or subsessile, membranous, venation distinct.

3. *membranacea*.

C. Fronds lanceolate acute or obtuse, fleshy-coriaceous when fresh, venation visible but weak when dry

4. *punctata*.

1. *P. linearis*, Bedd. Syn. *Polypodium lineare*, Thunb.

A small epiphyte with creeping slender woody rhizome closely covered with lanceolate scales with thick-walled cells. Fronds scattered, linear, undivided, 3—10" long, very coriaceous so that the nervation is invisible when dry, base gradually narrowed into a stipes of indefinite length, but usually under 1", both sides glabrous when old, thinly hairy or scaly when young. Sori large orbicular or ellipsoid, in a single row half-way between margin and midrib, not sunk. Capsule pale with a red annulus and beautiful golden spores.

Closely adhering to rocks, often among mosses and hepaticæ. Ranchi, at Neterhat, 3000 ft. Fr. April—June.

Tip of frond often twisted in the hot season. Nerves closely reticulate with forked free veinlets in the areoles. Young sori with copious thin peltate scales.

2. *P. simplex*, Bedd. Syn. *Polypodium simplex*, Sw.

With regard to this fern *Beddome* states that it is very like *P. lineare* only the fronds are of thinner texture and much larger, up to 2 ft.

long by 1—2" broad, the veins more distinct, the sori always more or less deeply sunk and forming pustules on the upper side of the fronds, sometimes quite sunk in a cyst with visible margins.

A specimen from Parasnath called *P. simplex* in the *Cal. Herb.* (apparently the one from Chota Nagpur in *Beng. Pl.*) appears to be *P. lineare*, but the two are united by *Hooker & Clarke* according to *Beddome*. *Clarke* does not mention *simplex* in his *Ferns of Northern India*, though from his description of *lineare* he includes it. According to *Christensen*, *P. simplex* = *Polypodium excavatum*, *Bory*, and is var. β of *Polypodium lineare* in *Hooker & Baker's ferns*, i.e. the larger variety with fronds sometimes 18"—2 ft. long and 2" broad, texture thinner and veins more distinct. In our *P. lineare* the venation is very obscure.

3. *P. membranacea*, *Bedd.* Syn. *Polypodium membranaceum*, *Don.*

Rhizome short-creeping, the younger portion densely covered with dark grey lanceolate or ovate acuminate scales. Fronds scattered or almost tufted, sessile or with a winged stipes gradually passing into base of the frond, the latter lanceolate or oblong, 6" to 15" (in our area, sometimes much larger in the Central Provinces hills, etc.), acuminate, rather suddenly narrowed at base, membranous with the numerous subparallel veins or costules distinct, spreading at a wide angle from the costa and nearly reaching margin, which is entire, undulate or sinuate; veins between the costules very reticulate and the areoles including many free venules. Sori .06—'07" diam. only, rather scattered on the anastomosis.

Singbhum, Saranda forests above 1000 ft. on trees in ravines! Hazaribagh on Parasnath! Fr. Sept. Dries up in c.s.

4. *P. punctata*, *Bedd.* Syn. *Acrostichum punctatum*, *L.*; *Polypodium irioides*, *Hook.*

A Hart's-tongue-like fern with scarcely creeping rhizome with brownish ovate or lanc. scales. Fronds 9"—3 ft. long and 1—3" broad, base gradually tapering to a very short stipes, apex acute or obtuse, texture somewhat fleshy-coriaceous with the venation immersed when fresh, visible when dry, weak with numerous branched free veinlets in the areoles which have clavate apices. Sori compital, very small or m.s. and up to .05" diam., often confined to the upper half of the frond.

Purneah, *J.D.H.* & *T.T.*! Balasore Hills, *Blandford*! Very common on trees near Calcutta and probably in the adjacent parts of Orissa. Fr. May.

22. NIPHOBOLUS, *Kaulf.*

Usually rather small and mostly epiphytic ferns with widely creeping rarely short rhizome. Fronds simple entire, very rarely lobed, densely matted beneath with a thick stellate tomentum. Veins often obscured by the tomentum, pinnate from the costa with copiously anastomosing veinlets with frequently free included veinlets in the areoles; fertile fronds often contracted and venation less developed. Sori numerous, globose or elliptic, more or less immersed in the tomentum.

Fronds mostly dimorphous, fertile, longer under 9", sporangia

mixed with stalked stellate scales. Costules very obscure.

1. *adnascens*.

Fronds uniform, mostly over 9", sori not mixed with scales.

Costules distinct

2. *stigmatosus*.

1. *N. adnascens*, *Kaulf.* Syn. *Polypodium adnascens*, *Sw.*

A small fern with extensively creeping slender rhizome densely covered with imbricating narrow linear light-brown scales. Fronds scattered dimorphic, fleshy-coriaceous, covered beneath with a dense stellate silvery tomentum, upper surface with thinner tomentum or glabrous, green, obscurely showing the close oblique primary venation; barren fronds 1—3" only, oblanceolate or spatulate obtuse tapering into a short slender stipes. Fertile fronds up to 6" by 7" lanceolate or linear-lanceolate tapering into a slender stipes 1—1.5" long. Sori usually on the upper half of the frond only, dense, mixed with long-stalked stellate scales.

Closely clinging to the surface of mossy rocks and trees. Monghyr (near Jamalpur), *Cal. Herb.*! Ravines in Singbhum! Hazaribagh, on Parasnath, *Prain!* Angul! Fr. Sept.—March (probably all the year round).

Beddome says fertile fronds 6—8" long, costa subcarinate, costules sunk obscure, their areoles including 2—4 free veinlets with clavate apices, though they sometimes anastomose, sori deep sunk, arranged 5—6 in obliquely transverse series. Some Angul specimens have all linear fronds and none of the shorter form.

2. *N. stigmatosus*, *Bedd.* Syn. *Polypodium stigmatosum*, *Sw.*

Rootstock short or wide-creeping, stout, clothed especially round the base of stipes with very slender linear scales. Fronds sub-clustered 6—18" long (1.5—2 ft. in districts outside our area) by .7—1.7" wide, linear-lanceolate tapering both ends and decurrent on the short stipes, densely stellate tomentose beneath but distinctly showing the numerous parallel oblique costules. Sori very numerous and small occupying the whole space between the costules and immersed in the tomentum.

On trees. Parasnath, *Clarke!* Mayurbhanj Mnts. above 2500 ft. Fr. May—Sept.

Clarke says the tomentum is reddish-brown; in my specimens the dense sori gave a reddish-brown appearance to the fertile fronds beneath but the tomentum was grey.

23. DRYNARIA, *Bory.*

Epiphytic ferns with the fronds articulate to the caudex or rhizome and very dimorphic. Barren fronds broad-oval sessile with cordate base, concave or spoon-shaped, strongly nerved, poor in chlorophyll and their mesophyll soon dying. The normal or fertile fronds are stipitate and altogether resemble those of the *Pleopeltis* section of *polypodium*, i.e. the veins are copiously anastomosing forming quadrate or hexagonal areoles. Sori round or oval, small, numerous.

The barren fronds collect a great deal of humus in which adventitious roots from the plant find nutriment.

1. *D. quercifolia*, *Bory.* *Polypodium quercifolia*, *L.*; Garur, *Beng.*; Garur-panki, *Or.*

Rhizome creeping, short, with lanceolate-subulate cordate-based scales 2—5" long. Sterile fronds 3—12" by 7—8", glossy, pinnatifid or lobed, soon turning brown. Fertile 2—3 ft. long, pinnatifid with oblong acuminate entire segments 5—9" by 1—1.5", costules distinct,

veins very reticulate, sori on the anastomosis, small, in two series between and parallel to the costules.

On the branches of trees. Singbhum! Sambalpur, Griff.! Puri!

24. GYMNOPTERIS, Bernh.

Rhizome usually creeping and sometimes epiphytic. Stipes not articulate on rhizome. Frond simple or simply pinnate, often dimorphic; fertile fronds usually much contracted, if similar to the barren then often with the sori on a contracted apex. Veins copiously anastomosing with free veinlets in the areoles. Sori usually completely hiding the surface of the fertile frond and coalescent. Indusium 0.

The occasional presence of fronds similar to the barren ones but dotted all over with large distinct sori render the position of this genus, assigned to it by Diels, near to *Aspidium* very probable. It is distinguished from the *Polypodium*-series by the stipes not being articulate.

Fronds all simple
Fronds all pinnate

1. *variabilis*.
2. *costata*.

1. *G. variabilis*, Hook. Syn. *G. axillare*, Cav.

A very variable fern in the size of the fronds, always with a slender creeping rhizome of variable length, with blackish lanceolate acuminate scales.* Fronds in some forms reminding one of the *Hart's-tongue* fern, sometimes very small, always simple. Barren fronds 5" by 7" to 15" by 1.5", linear-lanceolate to oblong, rarely broadly lanceolate or ovate-lanceolate and up to 2" wide, base tapering into the 1-5"-long stipes which has sometimes a few scales near base. Veins usually raised and distinct, soon branched and forming many rectangular areoles with free included veinlets, of which the apices are marked by a pit on the upper surface, very rarely with scattered large sori below. Fertile fronds very narrowly linear (under 1" wide) with narrow incurved margins and the sori covering the whole under-surface.

Grows on rocks in shady places or sometimes creeping up trees. Singbhum, frequent! Ranchi 2-3000 ft.! Fr. Jan.—March.

Var. *axillaris*, Bedd. Syn. *G. axillare*, Cav.

This is a form with slender tortuous elongate nearly naked rhizome which ascends trees and is said also to differ by the more diaphanous fronds.

2. *G. costata*, Bedd. Syn. *Meniscium deltigerum*, Hook.; *Acrostichum costatum*, Wall.

Rhizome creeping, with subulate scales. Stipes up to 1.5 ft. long, fronds up to 2 ft. or more, pinnate, pinnæ up to 14" by 3", petioluled, acuminate with entire sinuate or crenate margin, veins very prominent and generally much raised, close together, areoles numerous, costal ones small or obsolete, empty, several excurrent veinlets from all the other areoles which are irregular, free or anastomosing.

*The scales are hyaline, but with very black cell-walls.

Mahuagarh, Santal Parganahs, Gamble (the specimen however not examined by me)! The description of the species from *Beddome*.

25. STENOCHLÆNA, J. Sm.

Rhizome stout or slender, scandent. Fronds simply pinnate with the pinnæ articulate on the rachis, fertile contracted and very narrow, veins as in *Blechnum* simple or forked, fine close and parallel, generally quite free to the margin and there entering a marginal vein, rarely some forking and the two forks again uniting, or more rarely two separate veins unite. Sori very many and spreading on to the parenchyma between the nerves, finally covering the whole underside of the frond except the costa and the often somewhat modified inrolled margin.

1. *S. palustris*, Mett. Syn. *Acrostichum scandens*, J. Sm.

A very tall scandent fern with large pinnate fronds 3—5 ft. long, the leaflets of which resemble those of the leaves of an *Oleandra*. Stipes not articulate, about 2 ft. long, pale brown, without scales. Lifts. about 20 each side alternate except at the top, mostly subequal, uppermost smallest, barren oblong or oblong lanceolate, acuminate, larger 7—9" long by 1·7—2" wide, base cuneate with short petiolule articulate on the smooth yellow-brown rachis, costa prominent with few pale irregular scales and with very close numerous spreading fine parallel simple nerves free to the margin where they unite in a marginal nerve; rarely a few nerves bifurcate and then again often uniting; marginal nerve stout with distant appressed spinulose teeth.

On tree-trunks in wet evergreen forest. Mals of Orissa! Monghyr, Ham.!

Rhizome rather slender, up to 3" diam., with tufts of roots and few pale small irregular scales, concolorous with the stipes. On either side of the costa of the barren pinnæ (and perhaps also in the fertile?) and close to it is a thick raised nerve (or slender ridge or wing according to *Beddome*), which appears to correspond with the similarly placed but slender nerve in *Blechnum*. A gland occurs near the base of the pinnæ on the acroscopic margin.

26. ACROSTICHUM, L.

Large ferns with stipes inarticulate on the stout erect rhizome. Fronds pinnate all similar and pinnæ similar to one another, distinct with strong costa, costules or principal veins not well marked but all veins very reticulate, forming numerous subquadrangular arcoles without free included veinlets. Sori densely covering the whole under-surface of the fertile pinnæ except sometimes towards the base and the costa. Indusium 0.

1. *A. aureum*, L.

A tall handsome very tough fern 3—6 ft. high with erect pinnate coriaceous fronds tufted on an erect caudex. Stipes 1—2 ft. glossy. Pinnæ suberect lower 6—10" long by 7—1" broad, linear-oblong, base shortly cuneate, tip rounded, the uppermost pinnæ fertile and a ruddy brown, venation very fine.

In the swamps of the Cuttack delta! Fr. April—June.

FAM. 3. PARKERIACEÆ.

Marsh or water ferns rooting in mud with simple, simply pinnate older often submersed leaves and pinnately divided aerial fertile leaves with narrower segments, venation mostly longitudinal, distantly anastomosing. Sporangia scattered dorsally on the veins, not united into sori, subsessile with a vertical annulus which is either complete, partial or obsolete. Indusium 0, but margin of frond recurved and meeting near the costa. Prothallia dicecious. Female with central axis of several layers of cells. Male smaller thinner and sub-spathulate with numerous antheridia on the margin.

1. CERATOPTERIS, *Brong.*

(The only genus.)

1. *C. thalictroides*, *Brong.*

A succulent tufted fern 6—15" high, the stipes with large air-cells. Barren fronds floating or erect, simple or slightly divided when young or 2—3 pinnatifid with broad oblong segments. Fertile arising later, 2—3-pinnate with linear succulent subtubular (from the recurved margins) segments.

Swamps, rice-fields, etc. Common in Chota Nagpur! Sambalpur, *Griff.* probably in all districts. Fr. c.s. Usually annual, but *Beddome* says if kept moist perennial.

It is sometimes cooked as a vegetable.

FAM. 4. GLEICHENIACEÆ.

Terrestrial ferns with usually unlimited growth and climbing, primary axis usually dichotomous, axes of higher orders attached pinnately, often proliferous from the axils of the forks, veins all free. Sori dorsal, terminal on or at the forks of the veins, small and consisting of few (2—8) sporangia. Sporangia sessile or very shortly stalked, with a transverse or oblique* annulus a little above the middle and dehiscence vertical. Spores radial or bilateral.

1. GLEICHENIA, *Sm.*

Rhizome widely creeping, fronds scattered, dichotomously branched, rarely simply pinnate.

1. *G. linearis*, *Bedd.* Syn. *G. dichotoma*, *Willd.*

A very handsome fern, widely spreading and sub-scandent with repeatedly dichotomous branches, the lateral of limited growth, the main axes of unlimited growth. Innovations densely covered with ferruginous or golden hairs. Fronds coriaceous, glaucous beneath. Pinnæ in divaricate pairs at the forks, the lower pairs short 2—4".

* The annulus of *Gleichenia* is always described as equatorial or transverse and sub-equatorial, but it is sometimes (in the same plant) very nearly vertical and may touch the short obpyramidal pedicel on one side,

the ultimate pairs sub-erect 6—10" long, pinnatifid or cut to the rhachis with broadly-linear lobes; median lobes 6—1.5" long, apex of lobes emarginate (in our specimens, "usually entire," *Beddome*). Veinlets usually three branched from the base, the centre one being again forked or pinnate. Sori under .05" diam., usually one only on the acroscopic branch of each veinlet, sometimes also one on another branch.

Not very common, but where it does occur sub-gregarious in large patches, usually in open forest on hill slopes of white clay-schists and in the vicinity of a stream. Purneah, in the plains, on river banks! also on the Nepal boundary! Singbhum, 1000 ft.! Mayurbhanj, 2500 ft.!

FAM. 5. SCHIZÆACEÆ.

Ferns of various habit (scandent in our species). Stipes with one collateral, concentric or almost radial bundle. Fertile segments almost always modified by the addition of small fertile lobes or different from the barren segments of the frond. Sporangia not combined into sori (although they may be very close, they are not on a common receptacle), 1-locular, dehiscing vertically, annulus a small close ring of special cells situated near the top (not encircling the sporangium). Spores numerous. Indusia 0 or sometimes represented by a bract-like outgrowth of the frond or by its recurved margin.

1. LYGODIUM, Sw.

Scandent ferns climbing by means of their twining rhachis, with a creeping rhizome and 1-seriate fronds, the older with a twining rhachis of unlimited growth. Primary pinnæ abbreviated and ending in a bud-like tip, with one pair of divaricate secondary pinnæ which are either dichotomous or pinnate or merely lobed. Sporangia spicately 2-seriate and dorsal on specially developed lobes of the fertile pinnules, one sporangium on each vein embraced by a bract-like indusium, the several indusia imbricate. Annulus very small, coronate.

A. Pinnules linear-oblong (palmate in young plants), margins acutely serrulate:—

Some or most of the fertile pinnules 4—6" long by 4—6" wide in middle (without the soriferous lobes). Soriferous lobes mostly close in a straight line rarely borne on lobules of the pinnule.

Fertile pinnules always under 3" long, mostly under 4" wide, usually forming an uneven line on lobules of the pinnule.

B. Pinnules mostly lanceolate with cordate base in barren, mostly broadly ovate in fertile pinnæ, rarely 1" long, margins minutely crenulate.

1. *flexuosum*.

2. *japonicum*.

3. *microphyllum*.

1. *L. flexuosum*, Sw. Syn. *L. pinnatifidum*, Sw.

A graceful climbing fern. Primary pinnæ abbreviated to a small knob with hairy apex and bearing a pair of 1—2-pinnate divaricate secondary pinnæ on well-grown fronds (pedately dichotomous on young fronds) 6—18" long. Ultimate pinnules shortly stalked, linear-oblong with or without a cordate or 2-lobed base, barren attaining 6—7" long

by '7—1" wide in the middle, serrulate, with many parallel forked veins, of which one veinlet enters each tooth, fertile rather narrower (excluding the sporangial lobes), pectinately lobed with the sporangial spikes which are '15—25" long.

Very common in the forests. Champaran! Bhagalpur, *Cal. Herb.*! Purneah! Santal Parg.! Monghyr, *Cal. Herb.*! All districts of Chota Nagpur! Angul! Doubtless, therefore, throughout the whole province. Fr. Aug.—Dec. The fronds are annual.

The leaves and rhachides are often sparsely hairy beneath.

2. *L. japonicum*, Sw.

A small form in which the secondary (divaricate) pinnæ are not more than 6" long in the mature plant, the pinnules never exceed 2" in length or the terminal 2.5" and the sporangial spikes stand on distinct lobes of the pinna; which is usually much more deeply lobed than in *flexuosum*.

Purneah, frequent!

This plant, although it at once strikes one as distinct in the field, is probably only a variety of *flexuosum* and is difficult to define. The fertile segments are often more finely cut and frequently hairy beneath, and sometimes each pinna is 3-pinnate and also pinnatifid—a very pretty form. In some Chinese specimens the barren portion of the lamina is almost absent.

3. *L. microphyllum*, R. Br.

A very graceful fern with twining fronds as in the last but more delicate. Main pinna ending in a tuft of golden hairs, lateral pinnæ 3—6" with a delicate zigzag rhachis, simply pinnate only and with more slender stalks to the pinnules. Pinnules broadly ovate to lanceolate-ovate, sometimes as broad as long, barren ones not exceeding 1" or terminal 1.5" and bifurcate, margin minutely crenulate, texture membranous, fertile orbicular or ovate '5—7" long. Stalks of pinnules '1—2", very slender.

Often festooning bushes and other creepers near the sides of streams in Purneah! Fr. Nov.—Dec.

FAM. 6. MARATTIACEÆ.

Usually very large ferns with erect rhizome or short stem, rarely with creeping rhizome. Leaves circinate in bud and covered when very young by the well-developed *stipules*, pinnately compound (rarely entire or palmate outside our area), stipes or base of pinnæ with a swollen articulation. Sori dorsal on a round or elongate receptacle, usually on the more or less parallel free veins but sometimes veins copiously anastomosing and sori on the anastomosis, either of more or less free 2-ranked sporangia or united into a chambered "synangium." Synangium hollow in the middle or opening by 2 valves, or by pores to each chamber. Sporangia if free opening introrsely by a slit. Indusium 0 or slight.

The *Marattiaceæ* have several peculiar anatomical characters different from true ferns. Moreover the sporangia proceed from a group of cells, and the arche-sporium (cell from which the spores collectively develop) is the hypodermal terminal cell of an axile row of the rudimentary sporangium (*Eusporangiate*). In the true

ferns (also in *Salviniaceæ* and *Marsiliaceæ*, *Leptosporangiate Filicineæ*) the sporangia are formed from a single epidermal cell and have a peculiarly shaped, usually tetrahedral archesporium. These characters are considered of so great importance by morphologists that the *Hydropteridæ* (including the *Salviniaceæ* and *Marsiliaceæ*) are usually placed next to the true ferns, while the *Marattiaceæ* and *Ophioglossaceæ* are placed subsequently.

1. ANGIOPTERIS, Hoffm.

Fronds very large 2-pinnate. Sporangia contiguous and angled by pressure but not united into a chambered synangium, in two parallel rows forming an ellipsoid oblong sorus. Veins simple or forked free.

1. *A. evecta*, Hoffm.

A magnificent fern, with a very stout short erect caudex or short thick stem sometimes 2 ft. high and huge 2-pinnate fronds 6—10 ft. long (in our area; attaining 20 ft. in hotter damper localities). Pinnæ 1—3 ft. long with swollen bases, pinnules subcoriaceous, glabrous shining, linear, 3—1" wide, crenulate, veins close parallel. Sori at the ends of the veins .04—.06" long of about 7—12 sporangia somewhat laterally compressed by one another and opening by a vertical chink.

Deep valleys along streams in Singbhum! One would expect to find this also in the mals of Orissa, but I do not recollect having seen it there. Fr. March—May.

Easily recognized by the large stipules at the base of the swollen articulate stipes.

FAM. 7. OPHIOGLOSSACEÆ.

Usually small perennial ferns with short sometimes tuberous, erect rarely creeping rhizomes. Fronds not circinate in veneration, sheathing, exstipulate. Barren fronds or their barren segments simple linear to broad and cordate, or sometimes palmate or repeatedly dichotomous or pinnately compound. Fertile segments usually similarly divided to the sterile part of the frond but much contracted and modified, usually above the sterile segments (rarely small fertile spiciform leaf-segments arise from the base of the spreading part, but not in our area). Sporangia confined to the side nerves of the fertile segments, sunk in the tissue or free, spherical, opening transversely or longitudinally without an annulus. They are formed from a group of superficial cells and have a several-layered wall. Archesporium the hypodermal terminal cell of the axile row of the young sporangium. Spores all similar, orbicular-tetrahedral. Prothallus (as far as known) long-lived, monœcious, subterranean and tuberous.

A. Sporangia opening transversely:—

1. Sporangia 2-ranked on the lateral nerves of a slender spiciform fertile leaf-segment and sunk in its tissue. Sterile leaf-segment usually simple and entire, reticulately veined 1. *Ophioglossum*.
2. Sporangia on the margins of the usually pinnately divided fertile segment, 2-ranked on each segment, globose and not sunk in the tissue. Veins not reticulate 2. *Botrychium*.

B. Sporangia with vertical dehiscence:

Sporangia in small clusters on short simple or branched rhachides which arise on all sides of the fertile segment. Sterile part of the frond palmately pinnate with curved dichotomously branched free sub-parallel veins

3. *Helminthostachys*.

1. OPHIOGLOSSUM, L. Adder's Tongue.

Small terrestrial ferns or larger and epiphytic. Terrestrial forms with a simple undivided linear to broadly cordate barren segment of the single frond, epiphytic forms with a dichotomously divided or palmately lobed barren segment. Sporangia situated laterally in two rows on the edges of a very narrow linear spike-like stalked spiciform segment of the frond, in the lamina of which they are sunk and open by a transverse fissure reaching the axis of the spike (sporangiophore). The sporangiophore arises at the base of the barren lamina (in our species) and is erect, or it may arise on the lamina above the base, or even there may be several sporangiophores from the stipes and lower part of the lamina (not in our area). Venation reticulate.

A. Barren part of frond usually over 2" placed half-way up or more:

Barren segment of frond broadly ovate cordate, with a short stalk above junction with fertile portion, membranous

1. *reticulatum*.

Fronde with barren segment 2—4" ovate or ovate-oblong not stipitate or cordate, somewhat coriaceous. Spike stout with short peduncle

vulgatum

(pp. 1267,
1268.)

B. Frond with barren segment 2" or less, placed near base, not stipitate. Peduncle and spike very slender

2. *nudicaule*.1. *O. reticulatum*, L. Syn. *O. vulgatum* according to D'Almeida.

Whole plant 6—12" high with a short narrow erect rootstock. Sterile frond sub-coriaceous when fresh, membranous when dry, ovate or broadly ovate, 1.5—3" by 1.1—2.5", cordate and the base below the sinus produced into an obtuse often sheathing stalk (of same texture as frond) up to .5" long to the junction of the fertile segment; point of branching of the two segments one-third to less than half whole height of plant from the ground. Sporangial spike 1—2" on a slender stalk. Venation of barren segment reticulate with a more or less distinct central vein but no midrib.

Under dense shade. Ranchi (Ichadagh), 2500 ft. | Hazaribagh (Parasnath), 3500 ft. | Fr. Aug.—Dec.

Prof. J. F. D'Almeida (*Journal of Indian Botany*, December, 1922) gives reasons for uniting *O. reticulatum* with *O. vulgatum*, L. Compared with my English specimens of *O. vulgatum* the two appear to be very distinct, but apparently numerous intermediate forms occur.

2. *O. nudicaule*, L. Syn. *O. parvifolium*, Hook. & Grev.

A very small fern only 1—4" high with a short erect somewhat tuberous rootstock and frequently 2—3 fronds. Barren segment of frond placed one-third the way up or from quite near the base, linear lanceolate or ovate, acute or subobtusely, sessile and tapering at the base, .5—2" long (.5—1" long only, *Bedd.*) by .25—'6" wide, texture rather

thin, venation mostly reticulate with hexagonal areoles but not very distinct. Sporangial spike 4—7" long, slender (only .07" or less wide), and on a long slender peduncle greatly exceeding the barren segment.

Manbhum, Campbell!

This is called *O. vulgatum* in the *Cal. Herb.* and appears to have been accepted as such by *Prof. D'Almeida (loc. cit.)*, but agrees better with the species called *nudicaule* in the *Kew Herb.* which is *Baker's nudicaule*. It differs from *O. vulgatum* in the very long slender peduncle, much longer than the stem below the frond, in the thinner texture of the frond, more slender spike and more tuberous rootstock, but possibly it is not distinct.

2. BOTRYCHIUM, Sw.

Erect terrestrial ferns with small tuberous rootstock, fronds 2-forked with the barren portion of the frond foliaceous, usually primarily 2-chotomously divided and 2—3-pinnatifidly compound, rarely simply pinnate, venation flabellate free. Fertile fork of frond stipitate from the base of the barren portion, consisting of a panicle-like soriferous receptacle branched similarly to the barren but without obvious lamina, covered on the segments with small globose coriaceous capsules or sporangia which dehisce transversely.

1. *B. daucifolium*, Wall.

A handsome plant 1.5—2 ft. high. Barren half of frond deltoid about 1 ft. diam.; primary divisions of blade 2-chotomous or main rhachis straight and then appearing as primary pinnæ; primary segments or pinnæ pinnate and pinnatifid below, pinnatifid above (in our plant, sometimes 2-pinnate), lower pinnæ much the largest; ultimate segments oblong crenate-serrulate (in our plant; sometimes lanceolate-oblong and "finely toothed," *Beddome*). Panicle 3—4.5" long, 3-pinnate, on a stipes 6" long and exceeding the barren part of the frond.

In evergreen forest close to our area (Jalpaiguri district)! Fr. Nov.—Dec.

3. HELMINTHOSTACHYS, Kaulf.

Fertile frond bifurcate, with a barren foliaceous portion and a sporiiferous panicle. Barren portion primarily 3-chotomous or with one pair of pinnæ, each division pinnately subdigitately or pedately divided, veins forked from a central costa with free parallel branches. Fertile portion a stipitate distichous spiciform panicle, consisting of numerous close verticillate pedicellate tufts of sporangia terminated by a crest-like appendage. Sporangia fleshy-coriaceous sessile, globose, inverse, bursting extrorsely and longitudinally from the base upwards, valves hemispherical.

1. *H. zeylanica*, Hk.

Plant about 12—18" high, looking superficially like an aroid (without the panicle). Rhizome thick fleshy creeping. Stipes 7—12". Barren fork of frond 4—6" diam., primarily 3-partite, with the segments sessile or shortly stalked and again forked or pinnatifid, ultimate segments oblong or linear-oblong 2.5—4" long by .5—1" wide, acute obtuse or acuminate, denticulate or serrulate, nerves numerous close parallel

forked. Fertile part of frond .25—.3" diam., shorter than or exceeding the barren, its peduncle about as long as the dense spiciform portion or spike sometimes 5" with peduncle only 3". Sporangia globose .04—.05" diam.

Among moist bamboo clumps, Bengal, *Wall.* Bihar, *Beng. Pl.*, but I can find no specimens from Bihar. Fr. Aug.

Order HYDROPTERIDEÆ. *Water-ferns.*

FAM. 8. SALVINIACEÆ.

Small or delicate, mostly annual, aquatics floating on the surface of the water with a dorsiventral stem with two or more rows of leaves, sometimes verticillate, on the dorsal face, and modified filamentous root-like leaves or true roots on the ventral face. Leaves folded lengthwise in veneration. Sorus one in each unilocular thin-walled sporocarp or indusium, which is composed of two layers of cells. Spores of two kinds, macrospores and microspores, those in the sporocarp all of one kind, but macrosporangia and microsporangia in the same cluster on metamorphosed leaf-segments. Microspores giving rise to a rudimentary prothallus which emerges from the spore through a 3-cleft orifice and forming antheridia. Fem. prothallus well-developed, emerging and bearing several archegonia.

Leaves very small, 2-ranked, deeply 2-lobed. Roots present . . . 1. *Azolla*.
 Leaves in numerous alternating 3-merous whorls, 2 aerial and one ventral root-like submerged in each whorl. Aerial leaves in 4, submerged in 2 alternating series on the stem. No true roots 2. *Salvinia*.

1. AZOLLA, *Schreb.*

Small annual floating herbs with much dichotomously branched stems, closely covered with minute fleshy imbricating leaves. L. alternating in two series, deeply 2-lobed, lobes unequally developed, upper floating with a peculiar recess on its inner side which contains *Nostoc* filaments, lower lobes submerged. Roots solitary or in tufts. Sorus or sporocarp a 1-celled capsule, wall or indusium 2 cells thick, capsules 2 or 4 together on the lower lobe of the first leaf of a lateral shoot, containing either microsporangia or macrosporangia. Microsporangia on a stalk of 2 cell-rows radiating from a slender columella, containing numerous spores aggregated into "masulæ" covered by a hyaline cuticle. Macrosporangia with a single spore, the episporium variously developed and furnished with swimming-bladders.

1. *A. pinnata*, *R. Br.* Syn. *Salvinia imbricata*, *Roxb.*

A small pretty floating aquatic, usually reddish especially towards the end of the rainy season, with very small imbricate rhomboid obtuse upper leaf-lobes. Roots solitary. Sori paired. Masulæ without glochidia. Macrospores with 9 swimming-bladders.

Common in the r.s. and then disappearing! Probably in all districts.

The repeated dichotomous branching with the stronger branches alternately

to right and left results in a more or less deltoid form to the whole plant which attains about 1—1.5" diam. at the base. The upper leaf-lobes are sometimes somewhat oblong, obtuse, papillose; lower membranous, of but one layer of cells. The roots have a distinct membranous root cap.

2. SALVINIA, L.

Small floating aquatics. Leaves in numerous 3-merous alternating whorls consisting of two normal aerial dorsal leaves and the third ventral, submerged root-like, forming on the stem 4 rows of aerial leaves and two rows of submerged leaves. True roots absent. Aerial leaves with well-developed simple sessile or short-petioled lamina sometimes resting on the surface; submerged longer, without lamina, divided to the base into filiform segments. Sorus or sporocarp a 1-celled capsule, paired or clustered at the base of the submerged leaves, its wall formed of an indusium of 2 cell-layers as in *Azolla*. Microsporangium with numerous microspores, on a slender stalk of one row of cells radiating from a columella projecting into the cavity of the sporocarp, spores not grouped into "masulæ." In the female sporocarp are several short-stalked macrosporangia each with one macrospore, episporium developing a 3-rayed cleft through which the prothallium projects on germination.

L. horizontal oblong, not crowded

1. *natans*.

L. more or less erect, folded and crowded

2. *cucullata*.

1. *S. natans*, Hoffm.

A small floating plant with horizontally spreading oblong leaves 3—5" long and about half as broad, rounded or slightly cordate at base, upper side with about 12—20 pinnately arranged rows of hairs or bristles in tufts, under-side thinly matted like the stem with shining pellucid brown hairs. Sporocarps 4—8 in a cluster with regularly hexagonal wall cells.

Backwaters in the warmer districts, frequent in Purneah! Santal Parg.! Probably in Orissa.

2. *S. cucullata*, Roxb.

A small tufted aquatic with sessile leaves broader than long, erect or suberect and very congested on the rhizome, margins incurved so that the leaf becomes funnel-shaped, 5—7" wide, flabellately nerved, upper surface closely papillose, undersurface nearly naked. The sporocarps have not been seen.

Very abundant in the rainy season, often closely covering the surface of backwaters and carried down by the rivers. Purneah! Singbhum! Probably all districts.

FAM. 9. MARSILIACEÆ.

Creeping marsh plants, rarely floating, with a dorsiventral stem and erect subsolitary or 2-ranked leaves with a 4-partite blade of 4 obovate leaflets (setaceous and without blade in *Pilularia*, which does not occur in India), ventral side with a row of roots. Leaves circinate in

vernation. Spores of two kinds, macrospores and microspores, contained in the same 2--more-celled coriaceous oblong or globose sporangium. Male prothallus enclosed in the spore until the development of the antherozoids. Fem. prothallus a few-celled tissue sometimes almost reduced to a single archegonium never separating from the spore.

In the *Salviniaceæ* the sporocarps appear to be a special development of the indusium. In the *Marsiliaceæ* the sporocarps are of much more complicated structure, sometimes exceedingly hard, several-celled and filled with parenchyma. It appears to be a metamorphosed segment of the leaf, and it is borne on the ventral side of the petiole of ordinary foliage leaves on a long stalk, which runs along the dorsal edge of the capsule and gives off lateral veins which branch dichotomously and run to the ventral edge.

1. MARSILIA, L.

Small herbs with a slender creeping rhizome terminating in a 3-sided apical cell giving rise to 2 dorsal rows of leaves and a ventral row of roots (adventitious roots are also sometimes developed). Mature leaves 4-foliolate; in very young plants there is a cotyledonary leaf followed by simple primordial leaves and sometimes floating leaves. Sporocarps bean-shaped, bilaterally symmetrical, many-celled, finally 2-valved, pedicelled. Pedicels branching from the petiole of the leaf or from its base, solitary, or several from one petiole (*cp. Ophioglossum*), adnate to the base of the sporocarp and forming a raphe (not always apparent) which usually ends in a tooth and often bears a second lower tooth; its vascular bundle running along the dorsal edge of the sporocarp gives off lateral nerves into both valves which fork and run to the opposite suture. Mature sporocarps with very firm shell consisting of 5 layers. Innermost a cartilaginous band passing round the sutures and from which spring opposite the nerve-forks on both sides the sori. On the valves opening in water this tissue swells up, becomes extruded, and finally rupturing one end, is seen to bear the sori pinnately arranged along it, each enclosed in a hyaline membrane. Each sporangium with few macrospores and many microspores.

So far as the herbarium material goes there appears to be but one species of *Marsilia* in our area. *M. quadrifoliata* L., certainly does not occur and probably does not occur anywhere south of the Himalayas. In the following key (from *Sadebeck*), however, I have given the character for some other Indian species which may possibly occur:

- | | |
|--|------------------------------------|
| I. Several (2—5) sporocarps at the base of the petiole. L. without interstitial strips of sclerenchymatous cells:— | |
| A. Pedicels arising far from the base of the petiole, connate for about half their length | (<i>quadrifoliata</i>). |
| B. Pedicels arising at the base of the petiole, free or very shortly connate with one another:— | |
| 1. Sporocarps strigosely hairy or glabrescent, often ribbed, usually margined. L. lobulate | 1. <i>minuta</i> (<i>erosa</i>). |
| L. entire, larger, sporocarps usually 2, sometimes 1. | var. <i>major</i> . |
| 2. Sporocarps hirsute with erect hairs. Pedicels shorter than the sporocarps:— | |
| Sporocarp distinctly ribbed | <i>brachypus</i> . |
| Sporocarps not ribbed | <i>gracilentia</i> . |
| II. Sporocarps always solitary. L. with interstitial strips of sclerenchyma cells. Pedicels $2\frac{1}{2}$ —6 times as long as sporocarp | <i>coromandeliana</i> . |

1. *M. minuta*, L. Syn. *M. erosa*, Willd. (including also *M. quadrifoliata* of Bengal Plants).

A slender very variable herb with a widely creeping much branched slender rhizome, the growing tip hairy. Leaves very variable in size, erose or entire, leaflets with many obliquely anastomosing nerves meeting in the marginal nerve and without bands of sclerenchymatous cells between, outer surface in veneration hirsute. Sporocarps 1" long or more usually 12—18" long, ellipsoid, on pedicels as long to twice as long as themselves, somewhat compressed and often with a marginal ridge, strigosely hairy but glabrescent, nerves (not visible externally) running without anastomosis to the opposite suture. Sori very numerous. Pedicels usually paired, sometimes more numerous, quite free from the petiole and nearly so from one another.

In wet places throughout the province. Fr. Nov.—Jan.

The following extreme forms occur, connected by many intermediates:

Var. *α. minuta* proper. Syn. *M. erosa*, Willd.

A very small form with leaflets sometimes only 12—2" long and broad or up to 35", cuneately obovate on petioles 1—2" long, margin irregularly coarsely toothed or lobulate. Capsules usually very numerous, several or in the same plant rarely solitary at the base of each petiole, pedicels half as long again to twice as long as the capsule, ascending. Capsule usually margined, sometimes also ribbed, upper tooth longer.

Common, Singbhum and other districts of Chota Nagpur!

Var. *β. major*. Syn. *M. quadrifoliata* (Beng. Pl. non L.).

A very robust form, leaflets 1" long and broad, entire, on petioles 6—10" long. Sporocarps usually paired at the base of the petioles and often absent, sometimes solitary 12—18" long, rarely margined, not ribbed. Pedicels mostly decurved and ascending, 2" long.

Also common, usually in running water!

This closely resembles the African *M. diffusa*, Lepr. Should the pedicels be shorter than the capsules and the latter be furnished with erect instead of strigose hairs, it would be *M. gracilentia*, A. Br.

EQUISETALES.

FAM. 10. EQUISETACEÆ.

Stem symmetrical erect or scrambling from a perennial creeping rootstock, jointed, sulcate, hollow except at the septa and with air canals beneath the grooves. Leaves reduced to the teeth of a foliar sheath arising from one internode and embracing the next, the teeth corresponding with the ridges. Branches 0 or whorled, springing from inside the base of the foliar-sheath and alternating with the teeth. Sporangia 5—10 on the under-surface of the sporophylls, which correspond in position and origin to the leaves and become modified into the peltate scales of a terminal cone, either on the summit of ordinary or of special cone-bearing stems. Sporangia opening by a slit towards the stalk of the sporophyll. Spores of one kind, developed

from a hypodermal archesporium as in the ferns, with several coats which split into spiral hygroscopic bands (elaters), the function of which appears to be to keep groups of spores (which develop functionally one-sexual prothalla) together. Prothallium well-developed, flat and pluricellular.

1. **EQUISETUM**, L. Horse-tail.

Characters of the family. Only one genus.

Scrambling or subscandent. Branches sparse, weak. Cones subsessile, rounded or apiculate

Erect. Branches dense. Cones shortly peduncled, obtuse

1. *debile*
2. *diffusum*.

1. **E. debile**, Roxb.

Stems lax scrambling and often attaining 10 ft. among bushes. Branches long slender few, often only 2—3 in a whorl. Internodes 1·5—4" long. Leaf teeth ·07—·12" long, subulate-acuminate, black with scarious margin, very variable in number from 8—9 to many more on luxuriant plants. Conc or spike ·3—·7" long, sessile in the funnel-shaped tip of the branch until mature then very shortly stalked; tip rounded or apiculate. Peltate sporophylls orbicular or oblong about ·05" diam. pale with a black centre. Sporangia oblong yellow.

Along shady streams. Singbhum, not uncommon! Manbhum, Camp! Ranchi, ascending to 3000 ft. at Neterhat! Fr. Sept.—Oct.

2. **E. diffusum**, Don.

Erect, 1—2 ft. high and easily distinguished by above characters. Found in the Jalpaiguri district and possibly occurs in Purneah.

LYCOPODIALES.

FAM. 11. LYCOPODIACEÆ.

Stems usually rigid prostrate and creeping, more rarely erect, sometimes from a creeping rootstock or corm, roots usually arising singly along the creeping stems or in erect ones sometimes growing down through the fundamental tissue and emerging at a lower point in a tuft, branching mostly dichotomous. Leaves very numerous small simple with a simple vascular bundle or nerveless, closely clothing stems and branches, verticillate or spiral, more or less imbricate. Sporangia formed singly at the base of the leaves or of the more or less leaf-like scales of a terminal or axillary cone, usually transversely elongate and reniform, originating in a group of superficial cells, finally 2-valved. Spores of one kind with three radiating lines and opening by three valves.

Prothallium (where known) usually very well developed and exhibiting various types, sometimes tuberous. That of some tropical species (including *L. phlegmaria*) is exceedingly interesting. It is more or less ribband-shaped, irregularly monopodially branched with radiating tuberosities, living during the wet season as a saprophyte in the bark of trees and forming bulbils which persist over the

dry season. The inner tissues abound in oil and starch and also harbour an endophytic fungus. The sexual organs are developed on short thick branchlets, archegonia and comparatively numerous antheridia on the same prothallium.

1. LYCOPODIUM, L. Club-moss.

Characters of the family. (There is only one other genus of the family native of Australia and New Zealand to which the above characters do not altogether apply. *Psilotum* is now included in a separate family and does not occur in our area.)

I., Epiphytic. Branching entirely 2-chotomous with few forks.

Stems densely clothed with leaves to the base:—

A., Sporophylls not forming a distinct flower or club, or if club evident (some *squarrosa*), then sporophylls closely resembling the leaves:—

L. oblong obtuse. Sporophylls resembling them

1. *Hamiltonii*.

L. lanceolate subulate. Sporophylls smaller

2. *squarrosum*.

B. Sporophylls forming distinct slender flowers in double pairs, usually 3—4" long but only .05" diam.

3. *phlegmaria*.

II. Terrestrial. Branching primarily monopodial. Sporophylls strongly differentiated from the leaves:—

Flowers or clubs short and broad sporophylls toothed

4. *cernuum*.

1. *L. Hamiltonii*, Spring.

A terrestrial or epiphytic caespitose, erect suberect or pendulous rigid club-moss 2—4" high (in our area; sometimes attains 12"), 2—4 times dichotomously forked, .4—1" diam. with the spreading firm leaves. Leaves .2—3" or sometimes even .5" long on lower part of stem, subcoriaceous flattened, oblong or elliptic-oblong obtuse or rounded at tip, dense, glossy, with distinct midrib, often wrinkled when dry. Sporophylls like the barren leaves, not forming a cone or club. Capsules .04—05" diam.

Top of Parasnath, J.D.H.! Fr. May—Sept.

2. *L. squarrosum*, Forst.

A rigid epiphyte with roots at the basal end only, 2-chotomously branched with subequal branches, whole diameter (with the leaves) .6—1". Stems clothed to the base with leaves of which the lower are perpendicular to the stem, upper suberect. Barren leaves lanceolate-subulate, .4—6" long, coriaceous, midrib visible beneath. Fertile leaves mostly smaller relatively broader at base and then rather suddenly contracted, sometimes forming a flower or cone 1" long, at other times scarcely differentiated. Capsule broadly reniform, pale, .05" broad.

Mayurbhanj, Meghasani, elev. 3500 ft. on trees! Also Tarai and Duars and therefore probably Purneah. Fr. May—June.

The plant growing wild had scarcely differentiated cones; taken and cultivated in a verandah the cones became well-marked the following year. It might therefore be included in section *Selago* or *Subselago*.

Pendulous, 1—2 ft. long, 2—3-times forked only with long branches and branchlets often upcurved at the tips. Leaves crowded moderately firm, dark green with distinct midrib. Sporophylls usually much smaller than barren leaves erectopotent .17—25" long.

3. *L. phlegmaria*, L.

A pendulous epiphyte usually over 1 ft. long forked 3—4-times. Leaves lanceolate or ovate-lanceolate with rounded or subcordate base, often ternate, coriaceous, shining, spreading, lower .4—.5" long. Flowers or clubs sharply differentiated, mostly in double pairs at the ends of the branchlets, very slender, 3—4" long and only .04—.05" diam., sporophylls ovate wrinkled scarcely exceeding the sporangia.

Nepal, Tarai and Duars close to our area! Fr. April.

4. *L. cernuum*, L.

A very pretty club-moss with stems at first erect like a miniature tree, finally falling over and widely diffuse but rooting at base only and not creeping, base of stem unbranched and almost bare of leaves, branching primarily monopodial, only the lateral and younger branches distinctly dichotomous. Leaves setaceous, spreading and upcurved and somewhat decurrent on the branchlets, rather soft, .1—.15" long. Sporophylls forming a distinct flower or cone which is short, .2" long and .06" diam., clavate, cernuous at the ends of the branches. Sporophylls lanceolate from a rhomboid base, toothed, pale, or shortly strongly ciliate, acuminate, paler than the leaves, much exceeding the small pale unequally valved sporocarp which is .015" long.

On river banks, sometimes sub-gregarious. Neterhat, 2—3000 ft. Fr. May—June.

Old plants extend several feet.

FAM. 12. SELAGINELLACEÆ.

(Excluding Isoetæ.)

Erect or more often prostrate herbs with copious sub-monopodial or dichotomous branching in one plane. Leaves very small simple entire with a single vascular bundle, usually terminating in a point or delicate awn, very often ventral leaves larger and distichous (appearing lateral) and dorsal leaves smaller and unilateral, more rarely uniform and imbricate all round the stem, upper side with a minute or microscopic ligule. Sporophylls forming a quadrangular terminal spike or flower, usually similar to one another but often differing in shape to the sterile leaves. Sporangia arising between the ligule and base of the sporophylls of two kinds, macrosporangia with usually 4 (2, 4 or 8) macrospores, larger and 2—4-valved, and microsporangia which contain microspores, smaller and usually 2-valved.

The development of the sporangia and spores is much the same as in the *Lycopodiaceæ*. The spores are usually echinate. The macrospores develop a small-celled meniscus-shaped tissue in the apical region which never leaves the spore, but becomes exposed by a 3-rayed aperture on the spore and develops one or more archegonia and is the rudimentary prothallium. The cavity of the spore becomes filled with a large-celled tissue which may be homologous to the endosperm of *Gymnosperms*. The microspores produce a very rudimentary 1-celled prothallium and a simple antheridium.

1. SELAGINELLA, *Spring.*

(The only genus.)

- I. Leaves all similar, imbricate all round the stem
- II. Leaves ventral and dorsal dissimilar, in two planes:—
- A. Sporophylls all similar to one another:—
1. Small fugacious species, branched from the base:—
Sporophylls like the larger leaves. Stem decumbent
Sporophylls not like the leaves. Stem ascending . . .
 2. Persistent, trailing, and rooting along the stem, 2—3-pinnate from near the base (or suberect in forms of *plumosa*). Leaves entire:—
L. oblong obtuse or subacute, flaccid, nearly equilateral, base not imbricate over stem, eciliate . . .
L. oblong-lanceolate, acute, firmer, acroscopic side larger and imbricate over ventral side of stem, base ciliate
 3. Persistent with stems erect rigid and unbranched below:—
a. Sporophylls cuspidately acuminate, much exceeding capsules:—
i. Frond not curling up (or slightly curling in drought in *caulescens*), surfaces nearly concolorous:—
L. with white closely ciliolate margins, dorsal cuspidate . . .
L. glabrous or with few cilia, dorsal acute . . .
ii. Frond markedly curling especially in drought, deep green above, very pale or white beneath.
 - b. Sporophylls orbicular, scarcely exceeding the capsules
- B. Sporophylls of two kinds like the leaves. Small fugacious species:—
Stem decumbent and rooting at intervals . . .
Stem erect or ascending, rooting only at base

1. *rupestris*.2. *exigua*.3. *flaccida*.4. *semicordata*.5. *plumosa*.6. *caulescens*.7. *pentagona*.8. *bryopteris*.9. *fulcrata*.10. *promiflora*.11. *tenera*.1. *S. rupestris*, *Spring.*

A small *Lycopodium*-like plant with densely cæspitose decumbent and ascending mostly monopodially branched stems only a few inches high or attaining 6—12" in length, with distant usually pinnately arranged branches. Leaves all round the stem, similar to one another, close, erect or ascending, linear or subulate, 1—2" long without the long hair-tip, margins minutely ciliolate. Spikes or flowers scarcely differentiated, sessile, 5—1" long by .04" diam., sporophylls rigid, ovate-lanceolate, acute, much imbricated, acutely keeled.

On rocks, higher mountains of Chota Nagpur above 3000 ft. Parasnath! Fr. Nov.

In our plant the base of the leaves is bearded. The plant becomes closely curled up in the cold season.

2. *S. exigua*, *Spring.*

A very small plant with densely tufted slender stems 1.5—2" long, decumbent with roots from the lower half only; branches closely pinnate, lower compound. Leaves in two planes, crowded on the branches, laxer on the main stems, membranous, pale green, .06—1" long, those of the upper plane somewhat smaller, obliquely ovate,

acute, subcordate and shortly ciliate on the acroscopic edge at the base, those of upper plane cuspidate. Sporophylls altogether like the leaves, or slightly larger (*not* smaller as in most *Selaginella*), and those of the upper and lower plane scarcely different, ovate, acute keeled, the flower axis about .08—.1" long only. Sporocarps pale yellow, .02" diam.

Ranchi, Hundrughagh, *Prain* (the specimen called *proniflora*)! It is probably much more common on damp rocks than would appear from the single collection. The Hundrughagh waterfall, however, is a very special locality. Somewhat like *proniflora* before the latter flowers (although the dorsal leaves are much smaller than the ventral in *proniflora*). Unless looked at closely the flowers of *exigua* are not at all evident; in *proniflora* they are very evident.

3. *S. flaccida*, *Spring*.

Stems suberect 6"—1 ft. long with roots only near the base and copious pinnately arranged short erecto-patent copiously compound branches down to the base. Distinctly dorsiventral. Leaves membranous (but not nearly so thin as in *exigua* and *proniflora*), ventral larger, often contiguous on the branches, ovate-oblong, acute, base subequal, neither ciliate nor imbricated over the stem, .08" long, dorsal leaves more than half as long, rather oblique, strongly cuspidate. Flowers copious slender .5—1" long, with lanceolate cuspidate erecto-patent sporophylls .06" long.

Koderma, Hazaribagh on wet banks! Fl. Nov.—Dec.

4. *S. semicordata*, *Spring*. Syn. *Lycopodium semicordatum*, *Wall.* (No. 126 part).

A slender procumbent plant often 1 ft. long copiously pinnately branched; stem pale bisulcate above, main branches short rather remote, flaccid, somewhat pyramidal. Lower leaves spreading or rather ascending oblong or oblong-lanceolate, .08—12" long, obtuse or subacute, paler green or less firm in texture than in *plumosum*, nearly equal-sided, the acroscopic side not dilated at the base nor imbricate over the stem, ciliate, midrib distinct. Dorsal leaves one-third to one-half as long, much imbricate, falcate or obliquely broadly oblong, suddenly cuspidate or awned. Spikes square .25—.5" long with ovate suddenly acute or sub-cuspidate strongly keeled bracts.

Rajmahal Hills, *Wall.*! Fl. Aug.

Wallich's No. 126 contains two or three species. I take the left-hand plant on the sheet bearing his full ticket to be the type. *Spring*, however, appears to have taken a different sheet.

5. *S. plumosa*, *Baker*. Syn. *Lycopodium plumosum*, *L.*

Stem pale trailing .6"—1 ft. long, often forked low down, copiously pinnately branched, faces generally flat, roots extending to upper nodes. Larger leaves contiguous on the branches, spreading or rather ascending, bright green, firmer than in *semicordata*, oblong- to ovate-lanceolate acute, .08—12" long, produced on the acroscopic side of the distinct midrib and imbricated over the (lower face of) rhachis, ciliate on both sides at the base; smaller (dorsal) leaves half as long,

ovate, cuspidate, much imbricated. Spikes square, .2—5" long, bracts ovate-lanceolate acute or subcuspidate, strongly keeled.

The above is mainly *Baker's* account of *S. plumosa* to which species form *tetragonostachya*, *Wall.*, a dwarf suberect form, is assigned. This is not very easy to separate from some specimens included in *caulescens*.

Monghyr Hills, *Ham.* (forma *tetragonostachya*). Fl. Sept.

Spring quotes the above plant under his "*chrysocaulos*" but surely in error, as *chrysocaulos* belongs to the section with unilateral spikes and dimorphic bracts.

Baker describes the bracts as acute. They are lanceolate and cuspidate in *Hamilton's* plant, .07" long.

6. *S. caulescens*, *Spring*.

A pretty plant with erect stem 6—12" high simple rigid and with distant leaves below, deltoid and pinnately decomposed above. Pinnæ close deltoid with copious subflabellately compound lower pinnules and contiguous ascending final branchlets .25—1" long, .12" broad, liable to curl up in drought. Ventral leaves crowded ovate or broadly lanceolate falcate acute .05—1" long, firm, bright green, rather unequal-sided, with fine microscopically serrulate white margins broadly rounded at base and slightly imbricated over (ventral side of) the stem, nerves usually 2; dorsal leaves one-fourth to one-half as long, ovate, with oblique semicordate base, cuspidate, much imbricated. Flowers (or spikes) 4-angled .2—5" long, sporophylls ovate cuspidate or aristately acuminate.

Hills of Chota Nagpur, frequent in shady forest, all districts!

The common Chota Nagpur plant does not always quite agree with *caulescens* in the following particulars and there may be two species here. Chiefly the leaves in many specimens are not 2-nerved*; whereas *Baker* describes them as shortly ciliate on the basal upper edge ours are minutely white ciliolate all round but in this respect agreeing better with *Spring's* account; dorsal leaves often half as long as ventral, but described by *Baker* as one-fourth to one-third as long only. The female capsules are sessile tetrahedral with 4 large macrospores.

7. *S. pentagona*, *Spring*.

Stems at first erect, simple and with sparse leaves below, elongate and sometimes falling over and rooting at the end, unequally pentagonously striate, pinnately branched and lower pinnæ decomposed deltoid, final branchlets contiguous inclined forward .25—1" long. Lower cauline leaves rigid, remote decurrent and sub-2-auricled, those on main branches contiguous, ascending, ovate-lanceolate oblique or somewhat falcate, acute, .08—12" long, not or obscurely ciliate, broadly rounded and much imbricate over the stem at the base; dorsal leaves one-fifth to one-third as long, oblong-lanceolate, acute, contiguous. Flowers 4-angled, short, with ovate-lanceolate strongly keeled sporophylls.

Parasnath, *fide Baker*.

The fronds are much more elongate than in *caulescens* and more or less narrowly lanceolate in outline.

* The 1-nerved specimens might belong to the erect variety of *plumosa*. I had no opportunity of comparing them with this.

8. *S. bryopteris*, Baker. Syn. *S. tamariscina*, Spring; *Lycopodium bryopteris*, L.; *L. circinale*, L., & *Herb. Ham.*

Erect or suberect with well developed scaly stems, whole plant 6—12", stem often half to two-thirds as long. Frond deltoid or decomposed, deep green above, pale or silvery beneath, readily curling up on dry or hot days. Primary and secondary branching pinnate, ultimate divisions between pinnate and flabellate. Larger leaves much imbricate, ascending, ovate, cuspidate, .04—.06" long or attaining .1" on the stem (including the cusp), upper leaves nearly as long, oblique ovate with fine arista or cusp often as long as the blade. Spikes or fls. short square, .04" diam. with ovate cuspidately acuminate strongly keeled bracts or sporophylls.

Bihar, *Ham.*! Dry forests, Singbhum! Kaimur Hills, *Levinge*! Fl. c.s.
A distinct easily recognizable species.

9. *S. fulcrata*, Spring.

Erect or suberect, 8—15" high, primarily monopodially branched, with the main branches opposite or subopposite and main stem simple below with very distant appressed leaves, younger branches subdichotomous with wavy pubescent rhachis. Ventral leaves oblong .08" long, subobtuse, often revolute at both margins nearly equal-sided; dorsal leaves dimidiate-oblong, the inner margin being straight and contiguous to that of the opposite row, .03—.04" long. Flower .2" long, 4-angled, sporophylls .05" long, and slightly concave orbicular; sporocarps .02—.03" long, broad, transversely oblong slightly reniform with a minute attachment point in sinus, nearly as long as the short sporophylls.

Sameshwar Hills! and Bettiah forests, Champaran! Fl. Dec.

A very pretty and distinct species. The rhachis is sometimes only pubescent at the bases of the leaves. Final branchlets .25—.5" long only on a somewhat zigzag rhachis. Dorsal leaves neither acute nor cuspidate.

10. *S. proniflora*, Bak. Syn. *Lycopodium imbricatum*, Roxb.

Very slender decumbent and rooting at intervals, 2—4" long, often forked at the base, copiously pinnately branched with simple or only slightly compound oblique branches. Leaves membranous, rather distant except below tips of branches, ventral spreading ovate acute .07—.08" long, pale green, unequal-sided, ciliate, with cordate base and much imbricated over the stem on the upper side at the base; dorsal about half as long, cordate-ovate, acute and with a hair-tip (not cuspidate, Baker). Flowers .25—.75" long with sporophylls in two planes as the leaves, but twisted so that the larger sporophylls are in the plane of the smaller leaves, larger dorsal erecto-patent much imbricated oblong-lanceolate, nearly equalling the ventral leaves, ventral paler, pointing more forward, shorter, ovate, cuspidate, strongly ciliate.

Very common on wet banks, rocks, etc., in the forests, sometimes forming a mat over which the *S. caulescens* grows like a fairy forest! Fl. Nov. and disappears in the dry season.

11. *S. tenera*, Spring.

Stems .5—1" long, erect from the base or decumbent below and ascending, copiously pinnate with the flaccid erecto-patent branches much compound. Ventral leaves ascending and nearly contiguous on the branchlets, lax and squarrose on main stem, oblong-rhomboid, subacute, .08—.12" long, very membranous, unequal-sided, broadly rounded and a little imbricate over the stem on the upper side at the base, serrulate; dorsal leaves very small, lanceolate, cuspidate. Flowers short with the position of the sporophylls reversed as in *proniflora*, larger lanceolate rhomboid or upper ovate, smaller ovate cuspidate.

Barkuda Island (Chilka Lake), C. & N.

DIVISION—GYMNOSPERMÆ.

(See Introduction. This Division and the Pteridophyta should logically be placed before the Dicotyledons, which were dealt with first as being in our area the most important.)

FAM. 1. CYCADACEÆ.

Shrubs or small trees, with a thick simple (rarely forking) stem and terminal crown of leaves, or stemless with leaves arising from a tuberous simple or branched rootstock. Leaves in alternate series of short coriaceous scales and of palm-like pinnate (rarely 2—3-pinnate) leaves with membranous or coriaceous leaflets. Flowers dioecious; males in one or more terminal cones formed of numerous fleshy flat or variously peltate scales bearing on their underside crowded 1-celled anthers; females of flat carpellary leaves (carpophylls) crowded round the apex of the stem (in *Cycas*) or of flat or thickened variously peltate scales arranged in cones. Ovules large, sessile, orthotropous, either numerous and erect in notches on either margin of the carpophyll or solitary and inverted on either side of the peltate scales. Seeds large, drupaceous, with more or less fleshy external and crustaceous or bony internal coat. Albumen copious with one or more embryo sacs. Embryo usually one by abortion, slender, radicle superior attached to the crumpled suspensory cord. Cotyledons 2.

1. CYCAS, L.

Shrubs or trees with a simple or rarely branched cylindrical trunk clothed with the woody bases of the petioles. Leaves in terminal crowns, linear-oblong, pinnate, leaflets linear entire, 1-nerved, involute in vernation, lower often reduced to spines. Male cones apparently terminal (finally thrust aside by growth of stems), peduncled; scales cuneate, closely imbricate, apex often long-acuminate upcurved, anthers in groups of 3—5. Carpophylls numerous, crowded round apex of the stem, densely woolly, appressed at first into an apparently terminal cone, then spreading (and stem continuing its growth through them), elongate, flattened, dilated above into an entire, crenate or pectinate blade. Ovules 2—10, in notches on the margins of the lower part of the carpophyll, distant, alternate or opposite, nearly erect. Seeds ellipsoid or globose.

Cycadean stems can easily be distinguished from those of the palms with which they are sometimes confused, but in no way allied, by the petiole-scars being arranged in bands, the bands with large scars being those of the large foliage leaves, the small scars those of the alternating scale leaves.

1. Sides of leaflets flat (or margins only recurved in *pectinata*):—

A. Blade of carpophylls lanceolate, not very deeply pectinate:—

Male sporophylls ending in an upcurved spine. Blade of fem. lanceolate, toothed or shortly pectinate, teeth sometimes spinous

1. *circinalis*.

- Male sporophylls shortly acuminate. Blade of female a long simple acumen without teeth 2. *Rumphii*.
 B. Blade of carpophylls orbicular, long-acuminate and deeply pectinate. Male sporophylls deltoid and much thickened with a long abrupt subulate acumen 3. *pectinata*.
 II. Sides of leaflets revolute. Blade of carpophylls deeply softly pectinate nearly to midrib 4. *revoluta*.
 Only 1 and 3 are wild in our area.

1. *C. circinalis*, L. Var. *orixensis*. Oruguna, Or.

Trunks mostly 6—15 ft. high. Leaves 5—9 ft. long, petiole 1·5—2 ft. long, laterally spinous to near the base, leaflets 8—12" by about ·25—·5" at the widest part, subfalcate, acuminate, margins flat. Male cones about 7" (where seen by me, but unripe; they are said to attain 18"), scales 1·3—1·5" to base of the upcurved tip, which is densely tomentose and armed with a sharp 1—3-fid upcurved spine up to ·7" long, lower part of scale beneath densely covered with pollen-sacs. Female cone (young) about 6" diam. globose with over 50 carpophylls (usually said to be only 6—12 in *circinalis*), about 6—10" long including the stalk, brown-tomentose; blade 1·5—2·2" lanceolate long-acuminate, margin subulate pectinate, with teeth ·2—·4" long spinose tipped, subulate spine or acumen ·7—1" long. Ovules 3—5, in recesses below the blade, mostly alternate. Seeds ovoid, pale reddish-yellow, 1" long.

Wild in the hill forests of the Mals of Puri, especially on the tops of ridges with heavy rainfall! extending to Angul, in open forest, where it is less common! Fl. July—Aug. Some old carpophylls with the fruits fallen were found by me in April; these were no larger than those recorded above.

The spinous character of the antheriferous scales is nowhere mentioned as far as I can ascertain. The lower ones are simply spinous-tipped, the median also spinose-serrate below the often 2-spinose tip. The carpophylls also are not spinous-toothed in the Kew Herbarium, the teeth are lanceolate ·2" or less.

The stalk or basal portion is obtuse and the anthers are confined to this portion, which is 4—6" wide at the top, flattened with a median ridge on upper side; from the widest portion the scale is thickened and curved upwards and crenate or spinous as described above.

2. *C. Rumphii*, Miq.

Usually about 4—15 ft. in gardens, often branched. L. 3—6 ft., 1fts. 9—15" by ·5—·7". Carpophylls with ovate to ovate-lanceolate blade, densely villous, teeth small. Seeds 2—3" long.

Sometimes cultivated in gardens. Native of Tenasserim, Malacca, etc.

The carpophylls are described in *F.B.I.* as with an ovate-rhomboid blade spinous-toothed above entire below; where I have seen them the blade is a long simple acumen above the linear-oblong fertile portion. Male sporophylls thickened and obliquely truncate at the apex with a short upcurved not spinescent acumen.

3. *C. pectinata*, Griff. Kunth, *Th.*

A small tree 4—10 ft. high with a crown of somewhat recurved leaves 4—5 ft. long. Leaflets narrow-linear 6—10" by ·25—·3" wide, subfalcate, tapering into a minute spine, margin slightly reflexed (in my specimens), rhachis and leaflets beneath more or less brown-pilose with deciduous hairs, especially on midrib. Male cone 18" long and 6" diam., somewhat ovoid cylindrical, antheriferous scales 1·5" long, 1" broad, deltoid-clavate with much thickened apex and an abrupt ascending

subulate acumen 1.5" long. Carpophylls 6", densely tawny-villous all over, stalk about equal in length to the broadly orbicular, long-acuminate blade which is about 3" diam., deeply cut into strong subulate spinous teeth .75" long, and with 1—2 spinous teeth at broad base of acumen. Ovules 4—6. Seeds about 1.5" long, ovoid.

Along the high banks of ravines in the Sameshwar Hills, Champaran! Fl. Nov.—Dec.

Petiole laterally spinescent. The pith and other soft tissues are full of starch and yield a sago.

4. *C. revoluta*, *Thunb.*

A cultivated species about 6 ft. high with leaves 2—6 ft. long. Petiole thick, quadrangular. Leaflets narrow under .2" wide with their margins revolute. Carpophylls 4—9" long, blade somewhat obovate, lacinate into villous segments nearly to centre, stalk longer than blade with 4—6 ovules.

In gardens only. Native of China and south-eastern Asia.

Male cones 1 ft. long, sporophylls about 1" truncate and umbonate, covered with pollen sacs to the base. Carpophylls densely tomentose 1.5—2.5" broad, the blade somewhat obovate-oblong each ending in a short sharp spine. Seed 1" by .7".

FAM. 2. CONIFERÆ.

Trees or shrubs, wood of tracheides with bordered pits, without true vessels (no pores), resin-canals frequent. Leaves rigid, linear or subulate rarely with broad blade, solitary, or fascicled in membranous sheaths. Flowers monœcious or diœcious. Males catkin-like, deciduous, of many 1—more-celled anthers (scales of the so-called catkins). Fem. of 1 or more sessile naked orthotropous or anatropous ovules seated on or at the base of sporophylls which are usually arranged in more or less perfect cones (and are then called cone-scales), rarely ovule solitary and sometimes terminal, cone scales where present either spiral or decussate in the cone, sometimes with subsidiary placental scales which outgrow the cone-scale proper (see *Pinus*). Fruit of the more or less accrescent cones, rarely a solitary seed with its fleshy coats. Seeds often winged, with thick or thin testa. Embryo axile. Cotyledons 2 or more, albumen copious.

There are so few Coniferæ in our area that I have treated them as a single family. They are more properly an Order or even a Class.

A. Fem. cone with numerous spirally arranged scales. Ovules 2, inverted:—

L. acicular in membranous sheaths

1. *Pinus*.

B. Fem. cone with 6—12 decussate scales. Ovules 2—many on each scale, erect:—

L. small scale-like imbricate:—

Cones usually oblong, scales usually thin oblong. Seeds 2 to each scale

2. *Thuja*.

Cones globose, scales usually thick clavate. Seeds more than 2 to each scale, winged

3. *Cupressus*.

1. PINUS.

Richly monopodially branched trees with simple acicular leaves, one or more on abbreviated shoots in the axils of membranous scale-leaves, when more than one appearing clustered. Male flowers ("catkins") clustered at the base of leafy shoots of the same year, each surrounded at the base by an involucre of 3—6 scale-like bracts and composed of numerous sessile anthers, imbricate in many rows with crest-like sub-orbicular connectives. Female fls. subterminal or lateral, consisting of numerous spirally imbricate sporophylls (open carpels, cone-scales), at the base of which develops the seminiferous scale (ovuliferous scale or placental scale), bearing 2 inverted ovules at the base. The seminiferous scale soon outgrows the cone-scale proper and becomes more or less thickened and woody on the exposed surface. Fruit a woody cone maturing at the end of the second or sometimes third season. Seeds usually winged, cotyledons 3—18.

1. *P. longifolia*, Roxb. Chil, Chit, H.; Dhup, Th.; Long-leaved Pine.

A large tree with symmetrically whorled branches high up the trunk forming a rounded crown. Leaves in clusters of 3 in a membranous sheath, 9—15" long, slender, nearly triquetrous, sheath 5—1" long, greyish-brown fimbriate. Male flowers (catkins) 5" long. Fem. cones solitary or in whorls of 3—5, 4—8" long and 3—5" diam., scales with thick pyramidal pointed and somewhat recurved beak. Seed 3" long with thin membranous wing rather longer than the seed.

Forms gregarious forest on sandstone on some of the Sameshwar Hills, Champaran! Frequent in cultivation in Purneah! Also in Ranchi! Male fl. appear Jan., pollen ripens Feb.—April. The female flower is pollinated at this time and is about 7—1" long by the end of the Oct. and the cone reaches full size in June—July of the following year. They commence opening in the hot weather of the third season (whole time about 27 months).*

It attains 7.5 ft. girth in the Sameshwar Hills. Bark 1—2" thick, outer in large plates. Wood weighs 40—50 lb. per cubic ft. It is fairly durable and has been much cut out for building and other purposes. It is used in some match factories (not in our area) and for the production of resin and turpentine.

2. THUJA, L.

Trees or shrubs with flattened branchlets and small decussate green scale-like acute leaves bearing stomata on the back, those on leading shoots appressed or spreading, rounded or keeled on back; on lateral branches one series usually much laterally compressed; imbricate or nearly so. Fls. monœcious, minute, solitary, the two sexes usually on different branchlets. Male ovoid with 4—6 decussate filaments enlarged into suborbicular peltate connectives bearing on their inner face 2—4 subglobose anther-cells. Fem. usually oblong (subglobose in our species, which belongs to the somewhat abnormal section *Biota*) or somewhat pyriform with 6—12 oblong decussate scales, some or all bearing seminiferous scales with 2 erect ovules at their base. Fruit an ovoid-oblong (subglobose in *orientalis*) cone with the scales usually thin and coriaceous

* *Indian Forest Memoirs*, vol. i, Part I.

(thick and angular in sect. *Biota* and in *Cupressus*), those in the middle usually alone fertile. Seeds winged (exc. in sect. *Biota*).

1. **T. orientalis**, L. Sara. Vern. (The common name for *Thuja* and *Cupressus*.)

A small tree with branchlets often in somewhat vertical planes. Older scale-leaves brown, clothing the older branchlets, about '1" oblong or ovate with cuspidate tip, on the youngest branchlets green and 4-ranked, imbricate, those on the flatter faces rhomboid, on the narrower faces oblong-ovate and rather blunt. Cones subglobose or compressed pyriform on short lateral scaly branchlets, '4" long. Scales usually 6 only, in decussate pairs, thick, umbonate, the umbo developing from the enlarged seminiferous scale to which the thin bract proper is adnate beneath. Two outer scales each with two erect ovules, 2 next each with 2—1 ovules, 2 innermost barren. Ovules somewhat 3-gonous. Seeds 2—3 only, brown ovoid or elongate-ovoid, '15" long, 3-angled or subalate.

The most commonly planted conifer in our area. Fl. March. Seed ripens November the same year.

3. **CUPRESSUS**, L. Cypress.

Trees with the bark usually separating into long shred-like scales, wood often fragrant, branchlets slender, 4-angled. Leaves scale-like ovate with slender spreading or appressed tips, thickened rounded and often glandular on back, opposite and decussate. Fls. minute monœcious, the two sexes on separate branchlets, male oblong of many decussate stamens with broadly ovate blades or connectives bearing 2—6 globose pendulose anther-cells. Fem. oblong or sub-globose, with 6—10 thick decussate scales. Ovules numerous, bottle-shaped, several-seriate at the base of the seminiferous scale. Fruit a nearly globose cone maturing the second year, scales (seminiferous) abruptly dilated and flattened at apex bearing the unenlarged flower-scale as a short central more or less thickened mucro or boss. Seeds many in many rows, acutely angled or compressed with thin lateral wings.

Several species of *Cupressus* have been introduced into gardens, especially in the Northern Area and on the plateaux chiefly *C. torulosa* and *C. sempervirens*.

FAM. 3. GNETACEÆ.

Woody plants without resin-canals, with vessels in the secondary wood and with simple, large or scale-like, opposite leaves. Fls. dicecious, monœcious or 2-sexual, with a simple tubular or 2—4-merous perianth. Male with 2—8 stamens or pollen-sacs. Female with flask-shaped perianth and erect orthotropous ovules with 1 or 2 integuments. Seeds as in the Coniferæ. Embryo always with 2 cotyledons.

The three genera of the *Gnetaceæ* are so different, and as only *Gnetum* is likely to be found either wild or in cultivation, the family has been very shortly dealt with. The significance of the so-called perianth is doubtful. It may be an integument of the nature of an arillus or it may represent an ovary open at the top.

1. GNETUM. L.

Climbing shrubs with opposite broad penninerved leaves on thickened nodes. Fls. minute monoecious or dioecious, crowded in the axils of annular cupular bracts on solitary or paniced spikes, mixed with dense cellular hyaline hairs. M. perianth clavate in bud, the apparently single stamen with 2 pollen-sacs breaking through it on a long filament or column and opening by two terminal valves (two anthers with transverse apical dehiscence according to some). Fem. perianth thick flask-shaped, integument of ovule double, inner with a long neck projecting beyond the outer and with a fimbriate mouth or 3 filiform teeth, outer with 3 minute obtuse teeth or entire. Ovule 1 erect. Fruit drupe-like, the seed enclosed in the fleshy accrescent perianth.

Not easily recognized as a *Gymnosperm*. The ovule simulates a 1-ovuled ovary, with style and stigma represented by the loose integument with its long narrow neck and fimbriate mouth. The perianth and the integuments are easily separable from the nucellus.

1. *G. scandens*, Roxb. Milgandi, K.; Galio, Or.; Mirig-lendi (Bonai).

An immense dichotomously branched, woody climber with elliptic oblong or ovate entire glabrous leaves 3—8" by 2—4" shortly acuminate base rounded or very obtuse, sec. n. 6—10 each side of stout midrib and with many intermediate nerves. Petiole 3—75" long. Fls. monoecious (dioecious, *F.B.I.*) in rings among dense cellular hairs, females usually above two rows of males, in the axils of the peculiar annular bracts of the spikes and wholly enclosed by these when young. Spikes 1—3" long, peduncled, in 3-chotomous panicles. Fem. ovoid. Seed (.25" only in my specimens ovoid but unripe and) said to attain 1—1.5" and to become orange-coloured and stipitate while the fruiting spikes are said to attain sometimes 10" in length.

In the more evergreen forests, Mountain valleys in Singbhum! Bonai, Cooper! Mayurbhanj, 3000 ft.! Puri, in the Mals! Fl. April—May.

The fruit is eaten according to the Kols, but I have not seen it.

APPENDIX I.

LIST OF SPECIES FROM BIHAR AND ORISSA FOUND IN THE WALLICHIAN HERBARIUM AT KEW.

The families and genera are arranged in the order adopted in the *Flora*, and the specific names given in the **first column** are also those of the *Flora*, so that the authority has not been repeated. After the specific name is given the Wallichian number. Next the name given on Wallich's or Hamilton's tickets are, where these differ from the name adopted, added in italics. This is the more necessary as one Wallichian number includes specimens from many localities, and also sometimes different species. Moreover Hamilton's names have an interest in themselves. They are usually "*noms de plume*" embodying the supposed genus and some obvious character (e.g. *Echites pubescens*) or the vernacular name in the locality where collected (e.g. *Nerium coraia*). The bulk of the specimens from our area are of Hamilton's collection; those of 1820 especially are Wallich's own collection. The precise locality has fortunately usually been given as well as the date, but many of the small villages are difficult to locate, and the construction of an itinerary has had to be relied upon to fix those villages which fall within the limits of our area. Prain's *Life of Buchanan Hamilton* has also been found useful. The place Nathpur, so often occurring on tickets, is in Bhagalpur, not far from the Kosi river and close to the place marked Pratabganjghat on the map attached to this work. From this place Hamilton appears to have made excursions during 1810 not only into the surrounding country, but often extending across the Nepal frontier. Hence the plants collected at Siupur, Sukranagar and other places bearing similar dates to those from Nathpur but which are apparently across the frontier have had to be deleted from the list. Even some of the plants labelled Nathpur itself, although included, were possibly collected outside British territory, perhaps on short day excursions. Such is *Anaphalis araneosa*. There is a place Chainpur in Shahabad, but the Chainpur Hills are now found to be the Chainpur Hills near the Arun River in Southern Nepal, not those near Chainpur in Shahabad. There is also a Chainpur in Bhagalpur and not far from Nathpur. Although Hamilton surveyed Shahabad practically no specimens of his are found from that district, and he did not go there till the rainy season of 1913 (*vide Prain in Life of Buchanan Hamilton*). Koemore, again, does not refer to the Kaimur Hills of Shahabad, but apparently to a place in Goalpara. Kumarganj is in Bhagalpur, just south of the Ganges and not far from Monghyr. Dariyapur is in Gaya; Maghada is the old name for Bihar and Puraniya for Purneah. Saefganj is in Purneah. Bihar refers to the town (not district) of that name in Patna. Kalkapur is in Bhagalpur, Sheikpura in the Santal Parganahs, Kisanganj in Purneah, bhimnagar in the

north of Bhagalpur not far from the frontier, Paingti in the Santal Parganahs, Bangsi in Patna, Barh in Patna, Arval in Patna, Risikhund in Monghyr, Manihari is on the Ganges on the Purneah side of a crossing from the Santal Parganahs. Paturghata is in northern Bhagalpur on the south side of the Ganges. Nawada is in the south of Gaya, Burhisimar in the Santal Parganahs, Dumraon in Shahabad, Thakurganj in Purneah, Ratanganj in Bhagalpur, Banka in Gaya. The few other places mentioned are either on the map attached or in the Maldah, Jalpaiguri and other districts near our boundary and only concern species already mentioned in the *Flora*.

FAM. 1. RANUNCULACEÆ.

Nigella sativa, No. 4712 *N. indica*, Kumarganj.

FAM. 2. DILLENACEÆ.

Dillenia pentagyna, No. 949, Monghyr.

FAM. 4. ANONACEÆ.

Uvaria Hamiltoni, No. 6485, *U. grandiflora*, Monghyr 26 May 1810.

Polyalthia longifolia, No. 6442 *Guateria longifolia*, Patna.

P. cerasioides, No. 6436 *Guateria cerasioides*, Monghyr 27 April 1811, fl. and fr.

P. suberosa, No. 6437 *Guateria suberosa*, Monghyr 13 Oct. 1811.

Milium velutina, No. 6441 *Guateria velutina*, Monghyr 27 April 1811, fl.

Saccopetalum tomentosum, No. 6472 *Uvaria Chandana*, Monghyr 3 May 1811.

FAM. 5. MENISPERMACEÆ.

Cissampelos pareira, No. 4979 *C. convolvulacea* and *C. septemnervia*, Rajmahal and Monghyr 20 July, 10 Sept. and 7 Aug.

Tinospora cordifolia, No. 4955 *Cocculus cordifolia*, Monghyr 3 May 1811, fl.

Cocculus hirsutus, No. 4957 *C. villosus*, Monghyr 30 April 1811, fl. and fr.

FAM. 7. NYMPHÆACEÆ.

Nelumbium speciosum, No. 7259, Patna.

FAM. 10. CRUCIFERÆ.

Eruca sativa, No. 4800, Patna 6 April. Pods up to 1·2" long including the 2—3" long beak.

FAM. 11. CAPPARIDACEÆ.

Cleome viscosa, No. 6968 *Polanisia viscosa*, Monghyr 19 June 1811, fl.

Capparis sepiaria, No. 6993, Patna and Monghyr, 26 April 1812 and 27 April 1811.

FAM. 14. FLACOURTIACEÆ.

- Flacourtia ramontchi** var. **occidentalis**, No. 6675 *F. sapida*, Sukanagar.
F. cataphracta, No. 6674, Monghyr 5 May 1811, fl.
Casearia graveolens, No. 7195 *Samyda glabra*, Monghyr 4 June 1811.

FAM. 16. POLYGALACEÆ.

- Polygala chinensis**, No. 4170 *b* and *d* *P. telephioides*, Monghyr and Nathpur 4 Aug. and 13 June. Wing petals falcate or hatchet-shaped in fruit and glabrous. Capsule margined and ciliate only on margin.
P. erioptera, No. 4170 *c* and *b* *P. quinqueflora* and *P. senduaris*, Monghyr and Patna 14 Aug. and 25 March. Wing petals elliptic, never falcate but sometimes contracted and somewhat oblique at base in fruit, '15—'18" long. Capsule margined, oblong ellipsoid and obliquely notched, mostly pubescent.

FAM. 17. CARYOPHYLLACEÆ.

- Dianthus chinensis**, No. 656 *D. glaucus*, Patna 29 March. Doubtless cultivated.
Polycarpon Læffingiae, No. 6962 *Hapalosia Læffingiae*, Monghyr.

FAM. 18. PORTULACACEÆ.

- Portulaca tuberosa**, No. 6844 *P. cristata*, Monghyr 24 June 1811.
P. oleracea, No. 6841 *P. levis*, Monghyr 11 May 1811.
P. quadrifida, No. 6943 *P. meridiana*, Patna 18 Aug. 1812.

FAM. 19. AIZOACEÆ.

- Mollugo stricta**, No. 650 *M. pentaphylla*, Monghyr 23 May, fl. fr. Capsule globose oblong.
M. spergula, No. 653 *Pharmaceum rigidum*, Patna. Leaves linear-lanceolate.
Trianthema monogyna, No. 6837 *T. obcordata*, Patna and Monghyr 2 May 1812 and 6 June 1811.
T. pentandra, L., No. 6838 *T. govindia*, Monghyr 1 June 1811. *Vide* p. 1307.

FAM. 20. ELATINACEÆ.

- Bergia ammanoides**, No. 655 and 655 *b* *Dulachera ammanoides* and *Leihea verticillata*, Monghyr 29 May, etc.

FAM. 21. TAMARICACEÆ.

- Tamarix dioica**, No. 1241, Ganges near Rajmahal Aug. 1820.

FAM. 23. GUTTIFERACEÆ.

- Garcinia oowa**, No. 4863, Monghyr 27 April 1811.
Mesua ferrea, No. 4835, Nathpur.

FAM. 26. MALVACEÆ.

- Malva verticillata**, No. 1894 *M. rotundifolia*, Patna 12 April 1812, fl., fr.
Sida glutinosa, No. 1874 *S. olans*, Nathpur.
S. cordifolia, No. 1849, Nathpur 2 Oct. 1811.
S. spinosa, No. 1872 *S. boriaria*, Monghyr 15 May 1811.
S. rhombifolia, No. 1862 *S. rhomboidea*, 24 Aug. 1811.
Abutilon indicum, No. 1858 *Sida populifolia*, Monghyr Aug. 1820, fr.
Urena lobata, No. 1929, Nathpur 24 Sept. 1810.
U. sinuata, No. 1932 Monghyr, 30 Sept. 1811.
Hibiscus pungens, No. 1919 *Bamia magnifica*, Rajmahal 1820.
H. solandra, No. 1876 *H. albus*, Monghyr 30 Sept. 1811.
H. cannabinus, No. 1898, Monghyr 13 Oct. 1811.
H. hirtus, No. 1904 *H. phœniceus*, Monghyr 15 May 1811. The gland on mid-rib beneath is mostly absent in this specimen.
H. syriacus, No. 1891, Patna. No doubt cultivated.
H. mutabilis, No. 1907, Patna 20 April 1812. No doubt cultivated.
H. vitifolius, No. 1899, Patna.
Althæa chinensis, No. 2689, Patna. Cultivated.
Gossypium arboreum var. **neglecta**, No. 1880 *G. viridescens*, Nathpur 18 Sept. Ditto dated 14 Oct. is the same hybridized (according to Watt) with *nanking*.

FAM. 27. STERCULIACEÆ.

- Sterculia colorata**, No. 1119 *S. rubicunda*, Monghyr, fl. 5 April 1911, leaf 20 July 1911.
Helicteres isora, No. 1179, Monghyr.
Pentapetes phœnicea, No. 1157, Monghyr 6 Sept. 1911, fl. and fr. Leaves up to 7" by 8" at the base. Capsule subglobose-oblong 5".

FAM. 28. TILIACEÆ.

- Triumfetta neglecta**, No. 1075 *T. pentandra*, Monghyr 22 Sept. 1810.
T. rhomboidea, No. 1075 (part) *T. angulata*, Nathpur 28 Sept. 1810.
Corchorus acutangulus, No. 1096 *C. fuscus*, Nathpur 24 Sept. 1810.
Grewia hirsuta, No. 1091, Monghyr 20 July 1811, fl.
G. tiliæfolia, No. 1094, Dumka, leaves only, Monghyr 17 May 1811, fl.
G. Hainesiana, No. 1089 *G. asiatica*, Patna, 5 May, fr.
G. araria, No. 6308, Monghyr. This requires further examination. It appears to be a hybrid of *G. Rothii* and *G. elastica* form *elato-stemoides*.

FAM. 29. EUPHORBIACEÆ.

- Chrozophora prostrata**, No. 7716 *C. plicatum*, Patna 31 March 1812.
Trewia nudiflora, No. 7837 *Rottlera indica*, Monghyr.
Acalypha indica, No. 7779, Monghyr 16 July 1811 and Bhagalpur 30 Oct. 1811.
Tragia involucrata, No. 7791, Monghyr 4 Aug. 1820.

- Claoxylon mercurialis**, No. 7790 *Tragia mercurialis*, Monghyr Aug. 1820.
- Bridelia montana** var. **Hamiltoniana**, No. 7882 *B. Hamiltoniana*, Monghyr 3 Sept. 1811.
- B. stipularis**, No. 7879 *Cluytia scandens*, Rajmahal Aug. 1820.
- Sapium sebiferum**, No. 7972 Patna.
- Phyllanthus urinaria**, No. 7893, Monghyr 4 June 1811.
- P. niruri**, No. 7895, Monghyr 16 May and 17 June, 1811.
- P. simplex**, No. 7899, Monghyr 4 June 1811.
- P. debilis**, No. 7892, Monghyr 5 July 1811.
- Sauropus quadrangularis**, No. 7892 (same sheet) *Phyllanthus myrtellus*, Monghyr 5 July 1811.
- Glochidion multiloculare**, No. 7864 *Bradleia multilocularis*, Monghyr 23 June 1811 and Rajmahal 7 Aug. 1820.
- Putranjiva Roxburghii**, No. 6814, Monghyr 17 Aug. 1820 and Patna 5 April 1812.
- Euphorbia thymifolia**, No. 7710 *E. granulata*, Patna 4 May 1812.
- E. granulata**, No. 7710 (same sheet), Monghyr 6 June 1811, but specimens confused and the tickets special to each uncertain.

FAM. 23. ZYGOPHYLLACEÆ.

- Tribulus terrestris**, No. 1191, Monghyr Aug. 1810.
- Ditto, No. 6854, Bhagalpur 3 Nov. 1810, fr.

FAM. 34. GERANIACEÆ.

- Biophytum sensitivum**, No. 4343 *Oxalis sensitiva*, Monghyr 24 Aug. 1811.
- B. apodiscias**, No. 4344 *Oxalis debilis*, Monghyr 7 July 1811.

FAM. 25. BALSAMINACEÆ.

- Impatiens balsamina**, No. 4732 *I. laxa*, Nathpur 17 July 1810.

FAM. 36. RUTACEÆ.

- Limonia acidissima**, No. 6364, Monghyr 3 May 1811, fl.
- Glycosmis pentaphylla**, No. 6374, Monghyr 10 May 1811, fl.
- Murraya exotica**, No. 6368, Patna (no doubt from a garden) and Monghyr, probably indigenous, 10 May 1811.
- Citrus medica**, No. 6387, Patna 31 March 1812. No doubt cultivated.
- C. aurantium**, No. 6390, Gaya, leaves only. Cultivated.
- Feronia elephantum**, No. 6380, Monghyr 5 May 1811, fl.

FAM. 37. SIMARUBACEÆ.

- Ailanthus excelsa**, Nawada and Patna, 20 Dec. 1811, fl., and 13 April 1812, fr.

FAM. 39. BURSERACEÆ.

- Bursera serrata**, No. 8492 *Icica indica*, Rajmahal Aug. 1820.

FAM. 42. OLACACEÆ.

- Olex scandens**, No. 6774, Rajmahal.
Ditto, No. 6778 *O. bador*, Monghyr. From this it would appear that *bador* is the vernacular name also in Monghyr.

FAM. 44. CELASTRACEÆ.

- Celastrus paniculata**, No. 4301 *C. malcanei*, Nathpur 8 April 1810.
Hippocratea indica, No. 4210, Monghyr 17 May 1811, fl.

FAM. 46. RHAMNACEÆ.

- Zizyphus jujuba** var. *fruticosa*, No. 4245 *Z. mauritiana*, Dariyapur
22 Oct. 1811.
Z. Cœnopia, No. 4246 *Z. napeca*, Rajmahal 7 Aug. 1920, fl.

FAM. 47. AMPELIDACEÆ.

- Vitis tomentosa**, No. 6004 *V. obtusifolia*, Monghyr, 29 July 1811, fl.
V. auriculata, No. 6031, Rajmahal ripae gangis, Aug. 1820, leaf only.
Leea aspera, No. 6829 *L. herbacea*, e silvis Maghada.

FAM. 49. SAPINDACEÆ.

- Cardiospermum halicacabum**, No. 8030, Monghyr 28 Aug. 1811, fl., fr.
Sapindus emarginatus, No. 8039, Behar 5 Jan. 1812, fl.

FAM. 51. ANACARDIACEÆ.

- Semecarpus anacardium**, No. 986 *Anacardium latifolium*, Monghyr
11 June 1811.

FAM. 52. MORINGACEÆ.

- Moringa oleifera**, No. 5814 *Moringa sylvestris*, Patna (no doubt
cultivated) 1812.

FAM. 53. PAPILIONACEÆ.

- Crotalaria prostrata**, No. 5388 *C. obliqua*, Monghyr 9 Oct. 1811.
C. hirsuta, No. 5413, Monghyr 6 Sept. 1811, with lanceolate-ovate
leaves.
C. medicaginea, No. 5434, Monghyr 26 Sept. 1811.
Trigonella foenum-græcum, Puraniya 6 Feb. 1810.
Melilotus alba, No. 5942, Puraniya 5 Feb. 1810. Lfts. sharply dentate,
1". Racemes 3-4". Fls. 15".
Medicago lupulina, No. 5944, Sæfganj, 13 Feb. 1810.
M. sativa, No. 5945, Patna 22 April 1812.
Cyanopsis psoralioides, No. 5920 *Trigonella goalia*, Monghyr 9 Oct.
1811.
Indigofera enneaphylla, No. 5444, Monghyr 24 June 1811.
I. trifoliata, No. 5448 *I. canescens*, Nathpur 23 Aug. 1810.
I. hirsuta, No. 5450, Nathpur 12 Sept. 1810.

- I. articulata**, No. 5460 *I. caerulea*, Patna 9 April 1812.
Psoralea corylifolia, No. 5351, Gour 19 Nov. 1809.
Tephrosia Hamiltonii, No. 5642 *Galega sericea*, Monghyr.
Millettia auriculata, No. 5892 *Pongamia macrophylla*, Monghyr.
Abrus precatorius, No. 5818 *Dolichos precatorius*, Nathpur 21 Sept. 1810.
Vicia hirsuta, No. 5955 *Ervum hirsutum*, Sæfganj 15 Feb. 1810, fl., fr.
Lens esculenta, No. 5954 *Ervum lens*, Puraniya 5 Feb. 1810, fr.
Alhagi camelorum, No. 5760 *A. maurorum*, Monghyr 17 June 1811, fl.
Zornia diphylla, No. 5660 *Hedysarum diphyllum*, Monghyr 6 Sept. 1811.
Smithia sensitiva, No. 5668, Nathpur 10 Sept. 1810.
Alysicarpus bupleurifolius, No. 5761, Nathpur 1 Oct. 1810. Probably var. *erecta*. In young bud only. L. with yellow flusii and appressed needle-shaped hairs on the nerves beneath.
Ditto var. *typica*, with few fine needle hairs, No. 5762 *A. ludens*, Nathpur 12 Sept. 1810.
A. monilifer, No. 5769 *Hedysarum moniliferum*, Monghyr 3 Sept. 1811, fl., fr.
A. vaginalis, No. 5771 *Hedysarum rubibarna*, Monghyr, bud 6 Sept. 1811.
Ditto No. 5772 *Hedysarum vaginale*, Nathpur 1 Sept. 1810, fl.
Desmodium gangeticum, No. 5689 *Hedysarum gangeticum*, Monghyr 26 Sept. 1811.
Ditto var. *maculatum*, No. 5690 *Hedysarum maculatum*, Nathpur 11 April 1810.
Desmodium triflorum, No. 5734, Patna and Monghyr 25 March 1812 and 22 April 1811.
Ditto, ditto, Nathpur 2 Oct. 1810.
Flemingia semialata, No. 5746 *F. bhottea*, Nathpur 17 May 1810.
Rhynchosia minima, No. 5496 *R. prostrata*, Sukaraghar; no date and locality uncertain.
Atylosia scarabæoides, No. 5590 *Cajanus scarabæoides*, Nathpur and Monghyr 30 Aug. 1810 and 16 Sept. 1811.
A. crassa, No. 5553 *Dolichos crassus*, Kalkapur 13 Dec. 1810.
Butea frondosa, No. 5569, Puraniya 6 Feb. 1810, fl.
B. superba, No. 5438, Monghyr 18 April 1811, fl.
Erythrina suberosa, No. 5964 *E. tomentosa*, Monghyr 20 July 1811.
Phaseolus trilobus, No. 5589, Monghyr 6 Sept. 1811.
P. radiatus var. *typica*, No. 5589 *P. mungo*, Nathpur 30 May 1810.
P. radiatus var. *grandis*, No. 5606 *P. max*, Bhagalpur 5 Nov. 1810.
P. calcaratus, No. 5598 *P. sublobatus*, Sibganj 21 Nov. 1809.
P. mungo var. **Wightianus** (*F.B.I.* ii, p. 203), No. 5605 *P. subvolubilis*, Monghyr 5 Oct. 1811. The *F.B.I.* describes it as "stems elongated slender flexuose finely hairy, the hairs short and grey, leaflets thinner." It is not mentioned in *Beng. Pl.* and I have not been able to examine it.
Vigna catjang, No. 5549 *Dolichos catjang*, Bhagalpur 5 Nov. 1810. Pods linear, seeds black square. Monghyr 14 Aug. 1811, young fruit.

- Ditto var. *sinensis*, No. 5550 *Dolichos sinensis*, Monghyr 5 Oct. 1811.
Pod linear 15".
- Dolichos lablab** var. **lignosus**, No. 5537, Pirganj 9 Jan. 1809.
- Pterocarpus marsupium**, No. 5842 *P. vijaya*, Siupur April.
- Derris scandens**, No. 5905 *Pongamia coriacea*, Monghyr 29 July 1811.
- Pongamia glabra**, Patna.

FAM. 54. CÆSALPINIACEÆ.

- Cassia absus**, No. 5314, Monghyr 26 Sept. 1811, fl., fr.
- C. mimosoides**, No. 5321 *C. amœna*, Maldah 17 Jan. 1808.
- C. pumila**, No. 5227, Monghyr 16 Sept. 1811, fr.
- C. glauca**, No. 5311 *C. frondosa*, Gaya.
- Bauhinia racemosa**, No. 5789, Monghyr 10 May 1811.
- B. tomentosa**, No. 5790, Patna, 28 April 1812.
- B. variegata**, Monihari 20 Feb. 1810, fl.
- Cæsalpinia digyna**, No. 5839 *C. oleosperma*, Bhagalpur 3 Nov. 1810.

FAM. 55. MIMOSACEÆ.

- Leucaena glauca**, No. 5239 *Acacia caronja*, Patna 14 March 1812.
- Mimosa angustosiliqua**, *Gamble* (type), No. 5289 *M. rubicaulis*, Bagdwar 14 Jan. 1809. The name was subsequently altered by *Gamble* to *M. Barberi*.
- Dichrostachys cinerea**, No. 5231 *Desmanthus cinerea*, Patna 23 April 1812.
- Acacia catechu** proper, Monghyr 26 June 1811, fl., and Rajmahal Aug. 1820.
- A. torta**, No. 5249 *A. arar*, Monghyr 10 May 1811.
- A. lenticularis**, Rajmahal, Jan. 1811.
- Albizzia odoratissima**, No. 5234 *Acacia biluara*, Monghyr 3 May 1811, fl.
- A. lebbek**, No. 5265 *Acacia sirissa*, Monghyr 27 April 1811, fl., fr.

FAM. 56. ROSACEÆ.

- Rosa semperflorens**, No. 685 *R. indica*, Nathpur 17 July 1810. Cultivated.
- R. involucrata**, No. 696, Nakeswari 16 Feb. 1809.
- Eriobotrya japonica**, No. 666, Gya 7 Dec. 1811, fl. Cultivated.

FAM. 57. SAXIFRAGACEÆ.

- Vahlia viscosa**, No. 7188, Sheikhpura 1 Jan. 1811.

FAM. 62. COMBRETACEÆ.

- Terminalia chebula**, No. 3967, Monghyr.
- T. tomentosa**, No. 3978 *Chuncoa tomentosa*, Monghyr 23 June 1811 and Rajmahal Aug. 1820.
- T. arjuna**, No. 3979 *Chuncoa glabra*, Monghyr 4 June 1811.

FAM. 63. MYRTACEÆ.

Eugenia jambolana, No. 3560 *Sisygium jambolanum*, Monghyr 3 May 1811.

FAM. 65. MELASTOMACEÆ.

Osbeckia chinensis, No. 4067 *O. angustifolia*, Nathpur 21 Sept. 1810, fl.
O. rostrata, No. 4057 *O. tenuifolia*, Ramjunga 22 Nov. 1808.

FAM. 66. LYTHRACEÆ.

Lagerstroemia flos-reginæ, No. 2114 *L. reginæ*, Patna. Probably cultivated.

L. parviflora, No. 2119, Rajmahal 7 Aug. 1820, fr.

Ammannia baccifera, No. 2098 *A. vesicatoria*, Monghyr 5 Oct. 1811 and *A. prostrata*, Patna 27 March 1812.

FAM. 67. ONAGRACEÆ.

Jussiaea repens, No. 6331, Patna 24 April 1812, fl., fr.

J. suffruticosa (*J. erecta* var. *exaltata* of Ridley?), No. 6333 *J. ventilignum*, Monghyr 13 Oct. 1811.

FAM. 71. CUCURBITACEÆ.

Trichosanthes cucumerina, No. 6691 *T. pilosa*, Monghyr 14 Aug. 1811.

Bryonopsis laciniosa, No. 6699 *Bryonia laciniosa*, Monghyr 28 Aug. 1811.

Cucumis melo, No. 6738, Monghyr and Nathpur, 29 May 1811 and 4 July 1810.

Momordica charantia, No. 6745 *M. muricata*, Kaliganj 26 Feb. 1809, Patna 16 April 1812 and Patna 1 May 1812.

Luffa ægyptiaca, No. 6751 *L. pentandra*, Monghyr.

Ditto (*Luffa cylindrica*, Roem cited in *Cogniaux Monograph*), No. 6757 *L. satpatia*, Nathpur 27 Aug. 1810, and *L. parvula*, Puraniya 8 Feb. 1810.

FAM. 74. UMBELLIFERÆ.

Carum Roxburghianum, No. 571 *Apium involucreatum*, Kisorganj.

Ænanthe stolonifera, No. 585, Nathpur 25 April 1810.

FAM. 77. RUBIACEÆ.

Anthocephalus cadamba, No. 6088 *Nauclea cadamba*, Patna.

Mitragyna parvifolia, No. 6093, Monghyr.

Morinda tinctoria, No. 8421 *M. coreia*, Nathpur 28 May 1810 and Monghyr 20 May 1811.

Ixora coccinea, No. 6120 *I. bondhuca*, Nathpur 17 July 1810. Cultivated.

Ixora undulata, No. 6129, Monghyr 10 May 1811, fl.

Pavetta indica var. *tomentosa*, No. 6173 *P. tomentosa*, Monghyr.

- Dentella repens**, No. 6206, Patna 4 May 1812 and Monghyr 7 July 1811.
Oldenlandia gracilis, No. 843 *Hedyotis gracilis*, Bhinnagar 12 March 1810.
O. paniculata, No. 875 *Hedyotis racemosa*, Monghyr 24 June 1811.
O. crystallina, No. 6200 *Hedyotis pumila*, Monghyr 9 Oct. 1811.
O. brachiata, No. 6203 *Hedyotis angustifolia*, Patna 3 Sept. 1818.
Spermacoce stricta, No. 822 *S. torta*, Monghyr 24 Aug. 1811, fl.

FAM. 78. COMPOSITÆ.

- Vernonia divergens**, No. 3032 *V. aspera*, Rajmahal Hills 10 Jan. 1811.
Erigeron asteroides, No. 3052, Monghyr 24 April 1811.
Grangea maderaspatana, No. 3235, Patna 12 March 1812.
Blumea glomerata, No. 3076 *Conyza purpurea*, Rajmahal Hills 7 Jan. 1810.
B. laciniata, No. 3085 *Conyza sonchifolia*, Patna 5 April 1812.
B. virens var. *muralis*, No. 3078 *Conyza muralis*, Paingti 15 Jan. 1811.
Sphaeranthus indicus, No. 3178 *S. hirtus*, Patna 12 March 1812.
Anaphalis araneosa, No. 2939 *Gnaphalium decurrens*, Nathpur 27 June 1810. *Vide* p. 1309.
Gnaphalium luteo-album, No. 2953, Arval 13 Feb. 1812.
G. indicum, No. 2954, Patna 3 April 1812 and Bangsi 12 Jan. 1812.
G. pulvinatum, No. 2955 *G. prostratum*, Patna 25 March 1812.
Vicoa vestita, No. 2962 *Inula vestita*, Patna 22 March 1812.
Pulicaria foliolosa, No. 3281 *Conyza foliolosa*, Patna 22 March 1812.
P. crispa, No. 2963 *Inula quadrifida*, Bar 27 Oct. 1811.
Xanthium strumarium, No. 3181 *X. orientale*, Patna 22 March 1812.
Blainvillea latifolia, No. 3204 *Verbesina dichotoma*, Monghyr 29 Aug. 1811.
Spilanthes acmella, No. 3185, Patna 5 May 1812.
Bidens decomposita, No. 3189, Monghyr 30 Sept. 1811.
Tricholepis stictophyllum, No. 2915 *Cnicus angustifolius*, Sukanagar 22 April 1810.
Cichorium intybus, No. 3241 *C. casnia*, Patna 18 March 1812. Cultivated.
Crepis acaulis, No. 3264 *Prenanthes glabra*, Kaligunj 26 Feb. 1809.
Lactuca Heyneana, No. 3258 *Hieracium schimda*, Patna 25 March 1812. *Vide* p. 1309.
Sonchus oleraceus, No. 3252, Patna 12 March 1812 and Kumarganj 22 Feb. 1811.

FAM. 80. CAMPANULACEÆ.

- Lobelia trigona**, No. 1309 *L. zeylanica*, Nathpur 23 Sept. 1810.

FAM. 83. MYRSINACEÆ.

- Embelia robusta**, No. 2301 *E. canescens*, Patna and Gongachara. The Patna specimen not found.

FAM. 84. SAPOTACEÆ.

- Mimusops hexandra**, No. 4148, Monghyr Aug. 1820, leaf only.

FAM. 85. EBENACEÆ.

- Diospyros montana**, No. 4115 and **D. cordifolia**, No. 4116, not found.
D. embryopteris, No. 4123, Patna 1 April 1812.
D. tomentosa, No. 4133 *D. exsculptus*, Sambalpur 17 Nov. 1810 and Monghyr 3 May 1811.

FAM. 87. OLEACEÆ.

- Jasminum pubescens**, No. 2852 *J. hirsutum*, Monghyr 14 June 1811.
 Ditto, No. 2874 *J. congestum*, Patna 16 April 1812.
J. arborescens, No. 2856, Monghyr 1 April 1811.
 Ditto, No. 2877 *J. punctatum*, Patna 16 April 1812.
J. sambac, No. 2869 *J. quadrifolium*, Patna 1 May 1812, also No. 2879 *J. quinqueflorum*, Patna June 1812. No doubt cultivated.
 Ditto, No. 2880 *J. pubescens*, Monghyr 11 June 1811. Probably cultivated.
J. humile, No. 2887 *J. revolutum*, Patna 6 May 1812. Doubtless cultivated.

FAM. 89. APOCYNACEÆ.

- Carissa paucinervia** var. *gangetica*, No. 1678 *C. diffusa*, Monghyr 1 April 1811.
Vinca pusila, No. 1638 *V. parviflora*, Monghyr 9 Aug. 1811.
Holarrhena antidysenterica, No. 1673 *Echites pubescens*, Monghyr 27 April 1811.
 Ditto, No. 1672, Rajmahal Aug. 1820.
Wrightia tomentosa, No. 1615 *Nerium coraia*, Monghyr 12 April and 18 April 1811.
W. tinctoria, No. 4261 *W. Hamiltoniana*, Gaya 7 Dec. 1811. No doubt wild.
Aganosma caryophyllata, No. 1651 *Echites caryophyllata*, Monghyr 20 July 1811 and 15 Aug. 1820 (Risikund).
Ichnocarpus frutescens, No. 1674, Bhagalpur 4 Nov. 1810.

FAM. 90. ASCLEPIADACEÆ.

- Gymnema tingens**, No. 8190, Monghyr 28 June 1811.
Telosma pallida, No. 8181 *Pergularia viridis*, Monghyr 16 July 1811.
T. minor, No. 8182 *Pergularia odoratissima*, Patna 20 April 1812.
Vide p. 1309.

FAM. 91. LOGANIACEÆ.

- Mitreola oldenlandioides**, No. 4350, Sukanagar 11 Oct. 1810.

FAM. 92. GENTIANACEÆ.

- Exacum tetragonum**, No. 4356, Nathpur 24 Sept. 1810 and Rajmahal Aug. 1820.
Erythræa Roxburghii, No. 4397 *Chironia centurioides*, Monghyr 13 April 1811.

FAM. 95. BORAGINACEÆ.

- Cordia Rothii**, No. 895 *C. reticulata*, Monghyr 21 April 1811.
C. myxa, No. 889, Puraniya.
Coldenia procumbens, No. 942, Monghyr 7 July 1811.
Heliotropium indicum, No. 913, Monghyr. Not found.
H. strigosum var. **brevifolia**, No. 914 *H. revolutum*, Monghyr 23 May 1811.
H. ovalifolium, No. 2089, Monghyr 23 May 1811, fl., fr.
H. supinum var. **malabaricum**, No. 7014 *H. malabaricum*, Patna March 1812.
Trichodesma indicum, No. 932, Rajmahal 7 Aug. 1820.

FAM. 96. CONVULVACEÆ.

- Evolvulus alsinoides**, No. 1317, Monghyr Aug. 1820.
Argyrea cymosa, No. 2257 *Convolvulus glomeratus*, Ganges ad Paturghatta, Aug. 1820.
A. cuneata, No. 1366 *Convolvulus cuneatus*, Patna 17 May 1812, Cultivated? *Vide* p. 1310.
Calonyction muricatum, No. 2249 *Convolvulus muricatus*, Monghyr 13 Oct. 1811.
Ipomoea eriocarpa, No. 1399 *Convolvulus patulus*, Bhagalpur 3 Nov. 1810.
I. pes-tigridis, the entire-leaved form, No. 2250 *Convolvulus capitellatus*, Monghyr 5 Oct. 1811.
I. reptans, No. 1422 *Convolvulus palustris*, Patna 16 May 1812.
I. obscura, No. 1383 *Convolvulus trigonus*, Monghyr 27 April 1811 and Bolahat 8 Nov. 1809.
I. hederacea, No. 1373 *Convolvulus hederaceus*, Patna 21 April 1812 and Nathpur 14 Oct. 1810.
Hewittia bicolor, No. 1410 *Convolvulus bicolor*, Manihari.
Convolvulus paniculatus, No. 1396 *C. parviflorus*, Dumraon 26 Nov. 1812.
C. pluricaulis, No. 1316 *Evolvulus ferrugineus*, Bhagalpur 2 Nov. 1810.
Erycibe paniculata, No. 1330, Monghyr Aug. 1820.
Nos. 2251, 2252, 2253 and 1386, which according to the catalogue concern our province, have not been found.

FAM. 97. SOLANACEÆ.

- Physalis minima** var. **indica**, No. 2634 *P. angulata*, Nathpur 18 Aug. 1810.
Withania somnifera, No. 2635 *Physalis flexuosa*, Monghyr 21 June 1811.
Solanum xanthocarpum, No. 2612 *S. Jacquini*, Monghyr 22 April 1811.
S. verbascifolium, No. 2616, Nathpur 4 July 1810.
S. torvum, No. 2627 *S. siturium*, Nathpur 27 June 1810.
S. melongena, No. 2628 *S. ovigerum*, Patna 6 April 1812.

FAM. 98. SCROPHULARIACEÆ.

- Linaria ramosissima*, No. 3911 *L. cymbalaria*, Patna 22 March 1812.
Sutera glandulosa, No. 3941 *Buchnera incisa*, Tikari 5 Feb. 1812.
Herpestis moniera, No. 3900 *Capraria bramia*, Patna 1 April 1812.
Mimulus gracilis, No. 3918 *M. striatus*, Rajmahal Aug. 1820.
Dopatrium junceum, No. 3892 *D. lobelioides*, Monghyr 16 Sept. 1811
 and Rajmahal Aug. 1820.
Lindenbergia urticæfolia, No. 3923 *Stemodia ruderalis*, Rajmahal 4 Jan.
 1810.
Limnophila heterophylla, No. 3905 *Ambulia heterophylla*, Nathpur
 16 Aug. 1811.
L. racemosa, No. 3907 *Ambulia fatua*, Kalkapur 13 Dec. 1810.
Vandellia crustacea, No. 3961 *Torenia alba*, Nathpur 23 Sept. 1810.
V. scabra, No. 3945 *Torenia globosa*, Nathpur 23 Sept. 1810.
V. erecta, No. 3947 *Torenia erecta*, Monghyr 29 May 1911.
V. multiflora, No. 3943 *Torenia trichotoma*, Monghyr 30 Sept. 1811.
V. veronicæfolia, No. 3857 *Gratiola oppositifolia*, Nathpur 30 Aug.
 1810.
V. verbenæfolia, No. 3858 *Gratiola verbenæfolia* and *G. bancala*,
 Monghyr Sept. 1811 and Patna 2 Sept. 1812.
 Ditto No. 3951 *Torenia angustifolia*, *Vandellia angustifolia*, Benth.,
 Nathpur 10 Aug. 1810.
Veronica anagallis, No. 406 *V. amplexicaulis*, Behar 9 Jan. 1812.
Centranthera humifusa, No. 3883, Nathpur 12 Sept. 1810.
Striga euphrasioides, No. 3868 *Buchnera euphrasioides*, Nathpur 23
 July 1810.
 Ditto, No. 3872 *Buchnera bifida* and *B. denticulata*, Nathpur 21 Sept.
 1810 and Monghyr 13 Sept. 1811.

FAM. 99. OROBANCHACEÆ.

- Orobanche ægyptiaca*, No. 3966 *O. indica*, Patna 18 March 1812.

FAM. 100. LENTIBULARIACEÆ.

- Utricularia bifida*, No. 1498 *U. lutea*, Monghyr 4 June 1811.

FAM. 102. BIGNONIACEÆ.

- Stereospermum suaveolens*, No. 6507 *Bignonia quadrilocularis*, Nawada
 20 Dec. 1811. Leaf only.

FAM. 103. PEDALIACEÆ.

- Sesamum indicum*, No. 6408, Nathpur and Monghyr.

FAM. 104. ACANTHACEÆ.

- Hygrophila polysperma*, No. 2483 *Justicia polysperma*, Patna 26 March
 1812.
Asteracantha longifolia, No. 2505 *Barleria longifolia*, Monghyr 30
 Sept. 1811.
Ruellia prostrata, No. 2384 *R. repens*, Monghyr 14 May 1811.

- Dyschoriste depressa**, No. 2396 *Ruellia nagchana*, Patna 19 March 1812.
Petalidium barlerioides, No. 2389 *Ruellia barlerioides*, Monghyr 5 April 1811.
Daedalacanthus purpurascens, No. 2492 *Eranthemum purpurascens*, Manihari 18 Feb. 1810 and Monghyr 9 Nov. 1811.
Barleria cristata, No. 2507 *Barleria ciliata*, Patna 19 April 1812.
 Ditto var. **dichotoma**, No. 2509 *B. dichotoma*, Nathpur 14 Oct. 1812 and Patna 29 April 1812.
Lepidagathis purpuricaulis, No. 2366 *Ruellia tenuis*, Burhi-simar 8 March 1811.
L. trinervis, No. 2500 *Barleria trinervis*, Saseram 6 Jan. 1813, fr.
Rungia parviflora, No. 2459 *Justicia pectinata*, Monghyr 20 May 1811.
R. repens, No. 2459 *Justicia repens*, Monghyr 26 Sept. 1811 and Rajmahal 1820.
Justicia betonica, No. 2423, Monghyr 30 Sept. 1811.
J. gendarussa, No. 2342, Patna 25 March 1812.
J. peploides, No. 2441 *J. procumbens*, Ganges and Bhagalpur Aug. 1820, and Monghyr 24 June 1811 and Sibganj 21 Nov. 1809.
J. quinqueangularis, No. 2443, Rajmahal 7 Aug. 1820.
J. diffusa, No. 2444, Monghyr 15 Aug. 1820.
Ecbolium Linneanum, No. 2432 *Justicia ecbolium*, Patturghata 1820.
Craptophyllum pictum, No. 2438 *Justicia picta*, Patna 6 May.
Peristrophe bicalyculata, No. 2457 *Justicia bicalyculata*, Patna 16 April 1812.
Dicliptera Roxburgiana, No. 466 *Justicia chinensis*, Manihari 17 Feb. 1810. This is Nees's type.
Andrographis paniculata, No. 2454 *Justicia paniculata*, Sibganj 21 Nov. 1809.
Phlogacanthus thyrsoflorus, No. 2430 *Justicia thyrsoflora*, e sylvis Magadha. But only the specimen from *Hort. Bot. Cal.* is found.
Blepharis boerhaavifolia, No. 2513, Dumraon 26 Nov. 1812.
B. molluginifolia, No. 2514, Monghyr 9 Oct. 1811.

FAM. 105. VERBENACEÆ.

- Lippia nodiflora**, No. 1824 *Verbena nodiflora*, Monghyr 15 May 1811.
Stachytarpheta indica, No. 2656 *Verbena indica*, Monghyr. The Monghyr specimen is not found, but others under the same number are *Stachytarpheta*.
Verbena officinalis, No. 1825, Rajmahal Aug. 1820.
Vitex negundo, No. 1744, Rajmahal 7 Aug. 1820.
V. trifolia, No. 1743, Patna 22 April 1812.
V. peduncularis, No. 1752, *V. morava*, Monghyr 27 April 1811.
Premna scandens, No. 1774, Nathpur 9 June 1812.
 No. 1768, said to be *P. barbata*, from Rajmahal is not found.
Clerodendron infortunatum, No. 1799 *C. dentatum* (the leaves are toothed), Rajmahal 1820.
Caryopteris Wallichiana, No. 1812 *Clerodendron glumasta*, Patna.
Holmskioldia sanguinea, No. 2087 *Hortingia coccinea*, Rajmahal 10 Jan. 1811, and Patna 20 April 1812.

FAM. 106. LABIATEÆ.

- Ocimum gratissimum**, No. 2720, Monghyr 13 Oct. 1811 and Nathpur 27 June 1810.
O. basilicum, No. 2713, Nathpur 10 Sept. 1810 and Patna 21 April 1812.
O. sanctum, No. 2716, Monghyr 19 July 1811, "ram tulsi."
Orthosiphon rubicundus, No. 2721 *Ocimum rigidum*, Nathpur 6 June 1810.
O. pallidus, (also) No. 2721 *Ocimum bantulasia*, Monghyr 6 Sept. 1811.
Acrocephalus capitatus, No. 1563, Monghyr 9 Oct. 1811.
Coleus amboinicus, No. 2730 *C. aromaticus*, Patna 20 April 1812.
Elsholtzia blanda, No. 1550 *Aphanochilus blanda*, Rajmahal 27 Nov.
Mentha sp., No. 1536 *M. pudina*, Nathpur 22 July 1810.
Salvia plebeja, No. 2149 *S. brachiata*, Sæfganj 15 Feb. 1810 and Kumarganj 20 Feb. 1811.
S. coccinea, No. 2150 *S. gandhara* Patna 24 April 1812. An American species.
Meriandra bengalensis, No. 1526 *Salvia stellata*, Patna 26 April 1812. *Vide p.* 1310.
Leonurus sibiricus, No. 2071, Patna 12 March 1812.
Leucas mollissima, No. 2059 *Phlomis sp.*, Rajmahal 7 Aug. 1820.
Ditto, No. 2525 *L. Hamiltoniana*, Monghyr 13 Sept. 1811.
L. procumbens (? the whorls are 6—7-fid), No. 2063 *Phlomis decemdentata*, Bolahat 8 Nov. 1809 and Patgong 25 March 1809.
Leucas cephalotes, No. 2043, Monghyr 24 Aug. 1811 and Patna 3 April 1812.

FAM. 107. NYCTAGINACEÆ.

- Boerhaavia repanda**, No. 6769, Monghyr 13 Sept. 1811.
B. diffusa, No. 6770, Monghyr 24 April 1811 and Patna 6 May 1812.

FAM. 108. AMARANTACEÆ.

- Deeringia baccata**, No. 6888 *D. celosioides*, Monghyr 14 June 1811.
Celosia argentea, No. 6916, Nathpur 11 Oct. 1810 and Monghyr.
Ditto, No. 6817 *C. margaritacea*, Monghyr 24 July 1811.
Allmania nodiflora var. *angustifolia*, No. 6890 *Celosia angustifolia*, Nathpur, 27 June 1810.
Amarantus tenuifolius, No. 6893, Patna 23 April 1812.
A. gangeticus, No. 6896. Nathpur, etc., 13 May 1810.
A. blitum var. *oleracea*, No. 6899 *A. oleraceus*, Sibganj 23 Nov. 1809.
A. viridis, No. 6901 *A. polystachyus*, Patna 20 March 1812 and Monghyr 5 May 1811.
A. paniculatus, No. 6903 *A. amardano*, Bhagalpur 2 Nov. 1813. Seeds large white.
Pupalia atropurpurea, No. 6933 *P. berua*, Monghyr 24 Aug. 1811 and *P. scandens*, Sibganj 19 Nov. 1809.
P. lappacea, No. 6934 *P. berua*, Monghyr 3 Sept. 1811.
Ærua lanata, No. 6909, Monghyr 14 June 1811.
Ærua scandens, No. 6911, 14 June 1811. Leaves short, 1" ovate.

Achyranthes aspera, No. 6924, Patna 20 March 1812. L. tomentose obovate.

Alternanthera sessilis, No. 6921 *A. triandra*, Monghyr 20 May 1811.

FAM. 109. CHENOPODIACEÆ.

Chenopodium album, No. 6952, Puraniya 8 Feb. 1810. L. large and cut.

Ditto, No. 6955 *C. purpurascens*, Puraniya 9 Feb. 1810.

C. album? (probably the top of a large plant of *C. album*, with narrowly linear leaves), No. 6957 *C. chandune*, Patna 20 April 1812.

C. murale, No. 6953 *C. gandhium*, Nathpur 13 May 1810. *Vide* p. 1311.

Beta vulgaris, No. 6949 *B. benghalensis*, Patna 12 April 1812.

Spinacia oleracea, No. 6949 *S. tetrandra*, Puraniya 8 Feb. 1810. L. sharply palmately lobed.

Basella rubra, No. 6960 *B. alba* and *B. cordifolia*, Kumarganj, Thakurganj and Patna.

FAM. 111. POLYGONACEÆ.

Polygonum plebejum, No. 1691, *P. aviculare*, Monghyr 8 June 1811.

FAM. 113. ARISTOLOCHIACEÆ.

Aristolochia indica, No. 2704, Nathpur 25 Sept. 1810.

FAM. 115. LAURACEÆ.

Litsæa sebifera, No. 2554 *Tetranthera apetala*, Monghyr.

FAM. 119. LORANTHACEÆ.

Loranthus longiflorus, No. 499 *L. bicolor*, Nathpur 18 Sept. 1810.

FAM. 120. SANTALACEÆ.

Santalum album, No. 4034 *S. myrtifolium*, Monghyr 6 Sept. 1811 and Bhagalpur 1 Nov. 1810. Probably cultivated.

FAM. 122. ULMACEÆ.

Trema orientalis, No. 3689 *Celtis orientalis*, Dumka 29 Nov. 1810.

T. politoria, No. 3693, Dumka.

FAM. 125. MORACEÆ.

Morus indica, No. 4647 *M. indica minor*, Patna 1 April 1812.

M. lævigata var. **viridis**, No. 4650 *M. viridis*, Patna 31 March 1812.

Ficus infectoria, No. 4520 *F. tsiela*, Nathpur 30 May 1810.

F. Arnottiana, No. 4485 *F. populifolia*, Monghyr 3 Sept. 1811.

F. bengalensis, No. 4560 *F. varenga*, Nakeswari 18 Feb. 1809.

F. tomentosa, No. 4497 *F. asimuaia*, Monghyr Aug. 1820.

F. cunia, No. 4531, Rajmahal 1820.

F. carica, No. 4506, Patna 8 May 1812. Cultivated.

F. palmata, No. 4507 *F. caricoides*, Patna and Gaya. Cultivated.

FAM. 129. ALISMACEÆ.

- Alisma oligococcum**, No. 4996 *A. apetalus*, Ratanganj 8 Nov. 1810.
Sagittaria guayenensis, No. 4995 *Alisma pubescens*, Nathpur 17 Aug. 1810.
Butomopsis lanceolata, No. 4999 *Butomus lanceolatus*, Nathpur 23 Sept. 1810.

FAM. 130. NAIADACEÆ.

- Aponogeton monostachyon**, No. 5167, Monghyr 23 Sept. 1811 and Ratanganj 8 Nov. 1810.
Potamogeton pectinatus, No. 5179 *P. marinus*, Patna 23 March 1812.
P. pusillus, No. 5180, Patna 22 March 1812.

FAM. 131. HYDROCHARITACEÆ.

- Vallisneria spiralis**, No. 5045, Patna 23 March 1812.

FAM. 132. ARACEÆ.

- Scindapsus officinalis**, No. 4436 *Pothos officinalis*, Monghyr 19 June 1811.

FAM. 138. CYPERACEÆ.

(The determinations are entirely those of *C. B. Clarke* or synonyms of the same.)

- Cyperus pumilus** var. **punctata**, No. 3312, Monghyr 13 Sept. 1811.
C. pumilus and **C. globosus** var. **stricta**, also No. 3312, Nathpur 12 Sept. 1810.
C. compressus, No. 3314, Nathpur 16 Aug. 1810.
C. sanguinolentus, No. 3319 *C. foveolatus*, Nathpur 12 Sept. 1810.
C. platystylis, No. 3337, Pirganj 10 Jan. 1809.
C. difformis, No. 3363 *C. haspan*, Monghyr 30 Sept. 1811.
C. haspan, No. 3369 *C. graminifolius*, Nathpur 12 July 1810.
C. flavidus, No. 3369 (same number), Monghyr 30 Sept. 1811.
C. cuspidatus, No. 3376, Monghyr 22 Aug. 1811 (var. *angustifolia*) and Nathpur 16 Aug. 1810.
C. aristatus, No. 3376 (same number), Monghyr 13 Sept. 1811.
C. iria, No. 3360 *C. luteus*, Monghyr 13 Oct. 1811, Patna 25 July 1812 and Nathpur 16 Aug. 1810.
C. niveus, No. 3377, Monghyr Aug. 1820.
C. leucocephalus, No. 3445 (mixed with *Kyllinga*), Monghyr 29 July 1811.
C. distans, No. 3366, Monghyr Aug. 1820.
C. eleusinoides, No. 3347, Monghyr prope Risikhund Aug. 1820.
C. corymbosus, No. 3351, Monghyr 19 Sept. 1811.
C. pilosus, No. 3336, Nathpur 18 Sept. 1810.
 Ditto, No. 3355 *C. barungia*, Nathpur 23 Aug. 1810.
C. exaltatus, No. 3328, Rajmahal Aug. 1820 and Monghyr 13 Sept. 1811.

- C. rotundus**, No. 3329 *C. carmutha*, Patna 16 July 1812.
 Ditto, No. 3353 *C. mothi*, Patna 24 April 1812.
 Ditto, No. 3373, Monghyr Aug. 1820. A very robust form (var. "80-flora").
 Ditto, No. 3322, Nathpur 17 Aug. 1810.
Cyperus digitatus, No. 3438 *Mariscus*, Nathpur 12 Aug. 1810.
Pycneus sanguinolentus, No. 3319 *Cyperus foveatus*, Nathpur 12 Sept. 1810.
P. pumilus, No. 3312, Monghyr 13 Sept. and Nathpur 12 Sept. 1810 (part).
P. globosus var. *stricta*, C.B.C., No. 3312 (part). Nathpur 12 Sept. 1810. (part).
Juncellus pygmæus, No. 3325 *Cyperus musarius*, Patna 24 March 1812.
J. inundatus, No. 3359 *Cyperus gonus*, Nathpur 10 Sept. 1810. *Vide* p. 1311.
Kyllinga triceps, No. 3445, Monghyr 4 Aug. 1811.
K. monocephala, No. 3443, Monghyr 4 Aug. 1811.
K. brevifolia, No. 3443 (same number), Nathpur 30 Aug. 1810.
Mariscus tenuifolius, No. 3432, Monghyr Aug. 1820.
M. compactus, No. 3439, Nathpur 10 Sept. 1810.
M. paniceus, No. 3435 *M. sumatrensis*, Monghyr 10 Sept. 1811. *Vide* p. 1311.
Eleocharis fistulosa, No. 3453 *Scirpus spiralis*, Nathpur 23 Aug. 1810.
E. plantaginea, No. 3454, Monghyr 26 Sept. 1811.
Fimbristylis quinquangularis, No. 3499 *Scirpus satbundius*, Monghyr 23 Sept. 1811.
F. monostachya, No. 3491 *Cyperus indicus*, Nathpur 10 July 1810.
F. squarrosa, No. 3479 *Scirpus aristatus*, Patna 12 May 1812.
F. æstivalis, No. 3479, part of same number and date as *F. squarrosa*.
F. æstivalis, No. 3517 *Scirpus saharantha*, Patna 17 July 1812 (part).
F. dichotoma, No. 3517, same number and date as last.
 Ditto, No. 3511 *Scirpus nildurba*, Monghyr 6 June 1811.
F. tenera var. *verrucænox*, No. 3514 *Scirpus surada*, Monghyr 28 Aug. 1811.
F. junciformis, No. 3520 *Scirpus obtusifolius*, Monghyr 22 June 1811.
Bulbostylis barbata, No. 3497 *Scirpus tristachyeos*, Monghyr 9 Aug. 1811.
Scirpus squarrosus, No. 3477 *Scirpus capillaris*, Monghyr 24 Aug., and *S. squarrosus*, Monghyr 16 Sept. 1811.
S. supinus, No. 3461 *S. lateralis*, Nathpur 12 Sept. 1811.
S. mucronatus, No. 3467, Rissikhund 15 Aug.
S. maritimus, No. 3504 and 3505 (apparently from Gorakhpur district?).
 Ditto, var. *affinis*, No. 3463 *S. balua*, Monghyr 6 June 1811.
S. grossus, No. 3470, Nathpur 10 Sept. 1810.
S. erectus, No. 3462 *S. ternatus*, Nathpur 12 Sept. 1810. *Vide* p. 1312.
S. corymbosus, No. 3472 *S. gonda*, Patna 17 July 1812. *Vide* p. 1312.
Scleria lithosperma, No. 3417, Rajmahal Aug. 1820.
Carex speciosa, No. 3391 *Carex concolor*, Rajmahal 8 Aug. 1820.

FAM. 139. GRAMINEÆ.

- Eragrostis viscosa**, No. 5008 *Poa tilphulia*, Patna 26 April 1812.
E. interrupta var. **Kœnigii**, No. 3850, Patna 15 May 1812.
E. major, No. 3828 *Poa subsecunda* and *Poa elegans*, Monghyr 14 Aug. 1811, Patna 16 April 1812 and Bhagalpur 4 Nov. 1810.
E. pilosa, No. 3829 *Poa phulia*, Patna 27 April 1812.
 Ditto, No. 5012 *Poa phuleia*, Patna 27 April 1812.
E. nigra, No. 3842 *Poa amabilis*, Nathpur 23 Aug. 1810. *Vide* p. 1312.
E. brachyphylla, No. 3827 *E. bifaria*, Monghyr 4 Aug. 1811.
Elytrophorus articulatus, No. 3825, Banka 15 Nov. 1811.
Cynodon dactylon, No. 3803, Monghyr 4 Aug. 1820.
Eleusine indica, No. 3816, Rajmahal Aug. 1820 and Monghyr 6 June 1811.
E. ægyptiaca, No. 3818 *Cynosurus cavara*, Patna 16 May 1812 and Monghyr 28 Aug. 1811.
Leptochloa filiformis, No. 3804 *Aira filiformis*, Sibganj 21 Nov. 1809.
 Ditto, No. 3805 *Festuca tenuis*, Monghyr 26 Sept. 1811 and Patna 24 April 1812.
Sporobolus coromandelianus, No. 3764 *Milium rurea*, Patna 25 July 1812.
S. tremulus, No. 3770 *Agrostis phuldubba*, Patna 26 July 1812.
S. Wallichii, No. 3769, Rajmahal 7 Aug. 1820. Catalogue also says Monghyr, but this is not found.
Aristida adscensionis, No. 3786 *A. depressa*, Monghyr 19 Sept. 1811.
A. funiculata, No. 3787, *A. setacea*, Monghyr.

FAM. 140. ERIOCAULACEÆ.

- Eriocaulon truncatum**, No. 6076, Monghyr 28 June 1811.

FAM. 143. COMMELINACEÆ.

- Ancilema vaginatum**, No. 5209 *Ancilema filiformis*, Nathpur 30 Aug. 1810.
A. nudiflorum, No. 5260 *A. diandra*, Nathpur? (tickets conflicting).

FAM. 145. LILIACEÆ.

- Smilax prolifera**, No. 5124 (part), Puraniya 2 Feb. 1810.
S. macrophylla, No. 5124, Rajmahal 7 Aug. 1820.
Asparagus racemosus, No. 5154 *A. volubilis*, Monghyr 9 Aug. 1811 and Rajmahal 7 Aug. 1820.
Urginea indica, No. 5062 *Scilla candria*, Monghyr 10 May 1811.
Chlorophytum arundinaceum, No. 5056 *Phalangium alatum*, Monghyr Aug. 1820.

FAM. 148. PONTEDERIACEÆ.

- Monocharia vaginalis**, No. 5095 *P. racemosa*, Nathpur 23 Aug. 1810 and *P. alba*, Monghyr 5 Oct. 1811.
 Ditto, No. 5096 *Pontederia vaginalis*, Nathpur 10 Aug. 1810. This is var. *plantaginea* with few-fl. lax spikes.

FAM. 152. DIOSCOREACEÆ.

- Dioscorea pentaphylla**, No. 5098, Monghyr 30 Sept. 1811.
D. spinosa, No. 5103 *D. aculeata*, Nathpur 21 Sept. 1810 (also Monghyr according to catalogue, but the specimen not found).
Vide p. 1313.
D. bulbifera, No. 5106 *D. versicolor*, Monghyr.
D. alata, No. 5107 *D. japonica*, Monghyr 19 Sept. 1811 and Nathpur 14 Oct. 1812.

FAM. 156. ZINGIBERACEÆ.

- Zingiber rubens?**, No. 6566 *Z. ligulatum*, Nathpur 22 July 1810.
Z. capitatum, No. 6560, Rajmahal Aug. 1820.

FAM. 159. ORCHIDACEÆ.

- Habenaria plantaginea**, No. 7053 *Gymnadenia plantaginea*, Monghyr 10 Sept. 1811.
H. longifolia, No. 7060 *Gymnadenia longifolia*, Nathpur 10 Sept. 1810.
-

APPENDIX II.

ADDITAMENTA.

FAM. 19. AIZOACEÆ (p. 50).

2. TRIANTHEMA, L.

- Flowers solitary. Style 1. L. usually obovate
Flowers clustered. Styles 2. L. not obovate
1. *monogyna*.
 2. *pentandra*.

2. *T. pentandra*, L. Syn. *T. gobvindia*, Ham.

A herb diffusely branched from the roots. Leaves elliptic or oblong-lanceolate 5—1.5", rounded or obtuse, papillose; petiole 2—3", dilated at the base. Flowers in axillary sessile clusters. Stamens 5. Capsule 1" oblong mitriform above and 2-valvular, circumsciss at base below the valves, each valve with a 2-lobed divergent beak. Seeds 2 dull-black closely lineolate-channelled, one at the base of each cell, the apex also closely adnate to a seed in each beak.

Monghyr, Ham. Fl., Fr. May—June.

FAM. 39. BURSERACEÆ (p. 178).

4. COMMIPHORA.

- Unarmed. L. 3—7-foliolate, 1fts. entire. Disc with short free margin
Armed. L. 3—1-foliolate, 1fts. finely serrulate. Disc erect cupular
1. *caudata*.
 2. *Roxburghii*.

2. *C. Roxburghii*, Engl., var. *serratifolia*, Haines. Syn. *Balsamodendron Roxburghii*, Arn.; *Amyris commiphora*, Roxb.; *Amyris serratifolia*, Rottler MS.

A small tree with almost white outer bark peeling off in very thin flakes and disclosing a green under-surface. Branchlets mostly ending in thorns. Leaves 1-foliolate (in our specimen), sometimes 3-foliolate with the lateral leaflets much smaller than terminal and in our specimens mostly visible as two stipel-like or glandular processes. Terminal (or only leaflet) lanceolar-elliptic acuminate, finely serrate, 1—2" long, petioles slender. Flowers (according to *Roxburgh*) small red, sub-sessile on small axillary-tubercles on the leafless twigs. Drupe about .25" diam. red.

Collected from a mound on the banks of the Ganges at Mayagunj, Bhagalpur, where several were growing together, D. Mookharjee! Fl. h.s.

Specimens were received through the kindness of the Director of Agriculture (Mr. Dobbs) and Mr. Mookharjee, but the flowers have dropped off and only a few bear leaves. The plant was identified at the Calcutta herbarium as *Balsamodendron Roxburghii*, and agrees well with the equally poor material of this species at Kew.

As regards the name, *Commiphora Roxburghii* Engl. is the correct name of *Commiphora Mukul* (*Balsamodendron Roxburghii*, Stocks, 1847, *Balsamodendron mukul*, Hook.f., 1849. See also Engler in *Nat. Pflanz. Fam.*, III, iv, p. 253). But if regarded as a distinct species, this leaves *Balsamodendron Roxburghii* of the F. B. I. without a published specific name except the tautonym *Commiphora commiphora*. Rather than rename the plant on the very scanty material that exists of it, and with regard to the view expressed in the F.B.I. that it may be identical with *Balsamodendron mukul*, I have treated it as a variety of that species.

FAM. 49. SAPINDACEÆ (p. 222).

7. SAPINDUS, L.

Fls. large. Sepals ovate tomentose, disc hairy. Fruit more or less hairy or glabrescent
 Fls. small. Sepals orbicular glabrous and petaloid. Disc glabrous. Frt. glabrous

Spp. 1 and 2
 (p. 223).
 3. *Mukorossi*.

3. *S. Mukorossi*, Gærtn. Ritha, H., Beng.

A handsome tree with young shoots tomentose. Leaves crowded towards the ends of the branches 6—18" long, leaflets 10—16 lanceolate acuminate or obtuse, 2—6" by .75—2", glabrous. Fls. 1" white or purple in terminal and lateral pyramidal panicles which are tomentose only when young. Petals 5, with a woolly scale on each side at the top of the claw. Ovary 3-quetrous, glabrous.

Cultivated at several places in Bhagalpur and in the Dharbhanga Raj gardens. D. Mookharjee. Occasionally cultivated in Chota Nagpur! Fl. May—June. Fr. Sept.—Dec. Renews leaves in April. Native of China and Japan.

Leaflets with numerous close secondary nerves. Sep. and petals ciliate. St. 8, rarely 6. Fruit of usually only one sub-globose smooth yellow drupel .75—1" diam.

The fruit is used for soap.

FAM. 78. COMPOSITÆ (p. 499).

Add to key on p. 476:—

Herm. fls. mostly fertile with divided styles 15. *Gnaphalium*.
 Herm. fls. all sterile, their styles obtuse subcapitate or slightly 2-cleft 15*. *Anaphalis*.

Add after *Gnaphalium*:—(499).

15*. ANAPHALIS, DC.

Erect cottony or woolly herbs with alternate simple leaves. Heads small corymbose, disciform, heterogamous or sometimes unisexual. If heterogamous female flowers outermost, numerous filiform 2—4-toothed. Herm. fls. usually sterile, tubular with subcampanulate 5-fid limb. Involucral bracts scarious, inner with a petaloid limb, outer shorter, outermost woolly. Receptacle naked. Anther bases sagittate with connate caudate auricles. Style of herm. fl. filiform, obtuse, subcapitate or 2-cleft. Achenes very small, oblong, pappus hairs of fem. 1-seriate, slender, scabrid, free and caducous, of herm. fl. often thickened at the tips.

1. **A. araneosa**, DC. Syn. *Gnaphalium decurrens*, Wall. Cat. 2939.

Erect 2 ft. high, cottony with decurrent linear leaves 2—3" long, white woolly beneath and a terminal close capitate panicle of white heads.

Bhagalpur (Nathpur), Ham.! Fl. June—July.

This may be from over the Nepalese frontier (see p. 1286), as it is normally a hill plant. Clarke does not quote this specimen in his *Compositæ Indicæ*.

51. **LACTUCA**, L. (p. 520).

A. Flowering stems corymbosely or paniculately branched:—

Peduncles ebracteate. Outer invol. bracts distinct, much smaller than the inner

1. *polycephala*.

Peduncles bracteate. Outer invol. bracts gradually passing into the inner. Cultivated only

2. *scariola*.

B. Flowering stems slender spiciform or sub-racemiform with heads solitary or fascicled on the rhachis

3. *Heyneana*.

3. **L. Heyneana**, DC.

A tall glabrous annual or biennial with stem hollow below and leaves mostly radical 6—12" very irregularly runcinate-pinnatifid; cauline few, half-amplexicaul auricled. Inflorescence as in *Launea* with heads in distant spiked or racemose fascicles on the slender branches. Fruit 1" long, oblanceolar suddenly contracted to a short beak, black, muricate; pappus silvery persistent 2" long, flexuous, silvery.

Patna, Ham.! Fl., Fr. h.s.

Leaves membranous narrowed at the base, with fine spinulose firmer teeth. Heads 5", rarely shortly peduncled, bracteolate. Inner invol. bracts in fruit with thickened ribs.

FAM. 90. **ASCLEPIADACEÆ** (p. 584).

16. **TELOSMA**, Coville.

Pollinia elongate. Cor.-lobes 3—5". L. glabrous or pubescent on the nerves beneath

1. *pallida*.

Pollinia globosely obovoid. Cor.-lobes 2". L. and petioles hairy

2. *minor*.

2. **T. minor**, Craib. Syn. *Pergularia minor*, Andr.; *Pergularia odoratissima*, Wight.

A twiner with ovate-oblong, orbicular or ovate deeply cordate suddenly acuminate leaves, 2.5—3" long, shortly hairy, and with hairy petioles 1—1.5" long. Flowers 5" long (including the often suberect lobes) in umbellate cymes 1.3—2" diam. "very fragrant," yellow or green. Sepals linear-oblong hairy 3" about equalling the corolla tube. Corolla-lobes mostly erect 2—2.5", oblong; tube pubescent above within; coronal scales double, inner with a long subulate point but very variable (J.D.H.). Follicles lanceolate 3" long by .75" diam. Seeds .3" long, broadly ovate.

Patna, Ham.! (Wall. No. 8182). Fl. April—May.

FAM. 96. CONVULVULACEÆ (pp. 615, 617).

5. ARGYREIA, *Lowr.*

Stems twining. Leaves more or less ovate Spp. 1—5.

Shrubby, branches sometimes twining. Leaves more or less obovate 6. *cuneata*.

6. *A. cuneata*, *Ker.* Syn. *Lettsomia cuneata*, *Roxb.*; *Convolvulus cuneatus*, *Willd.*

Suberect and shrubby 2—5 ft. with twining branches (*vide C. B. Clarke*) or (according to *Roxburgh*) altogether scandent, but it is easily distinguished from all the others by the leaves never being ovate but lanceolate-obovate, obovate or obcuneate and often emarginate or obtuse and mucronate. L. 1·5—3" or sometimes 4" long, villous beneath. Peduncles numerous axillary mostly 3-fld., ·25—1·5" long. Corolla large deep bright purple, tubular funnel-shaped, hairy without. Sepals ·2", ovate, subobtus. Corolla 2" diam. Filaments broad, hairy at the base. Fruit ovoid or oblong nearly dry, the septa evanescent so that it appears 1-celled, yellow-brown, shining. Seeds 1—4.

Patna, *Ham.*! Perhaps cultivated only, as it is native of the Deccan. Fl. h.s.

FAM. 106. LABIATÆ.

Insert in Key after I. B. 2. b. i. (p. 762):—

Anther-cells very unequal or solitary on a long connective 17. *Salvia*,
Anther-cells equal distant, pendulous from a very long connective 17*. *Meriandra*.

17*. MERIANDRA, *Benth.*

Hoary or woolly shrubs with opposite coriaceous crenulate and rugulose leaves. Flowers small in many dense-fld. whorls in terminal or paniced spikes. Calyx ovoid with concave upper lip and 2-fld lower lip, throat naked. Corolla with short tube and equally 4-fld limb, lobes flat, upper entire or 2-fld. Stamens short stout, 2 lower fertile erect with anther-cells separated by the long connective, stipitate, pendulous; upper stamens imperfect. Nutlets obovoid, smooth, brown.

1. *M. bengalensis*, *Benth.* Syn. *Salvia bengalensis*, *Roxb.*

A shrub with smell of sage with tomentose shoots and lanceolate-oblong leaves, larger 5" by 1·7", smaller upwards, appearing almost punctate beneath from the close raised tomentose reticulation, sub-obtuse. Bracts inconspicuous in fruit and shorter than the whorl. Whorls ·3" diam. in fl., ·75" in fruit, close dense in terminal spikes 2—5" long. Fls. white.

Patna *Ham.*! Native of Abyssinia.

FAM. 109. CHENOPODIACEÆ (p. 807).

1. CHENOPODIUM, L.

- L. glaucous or mealy beneath, entire at base, upper entire. Spikes simple 1. *album*.
 L. bright green beneath, rather shining, sharply and unequally toothed. Spikes with spreading branches. Fls. cymose 1*. *murale*.

1*. *C. murale*, L.

Rather foetid, 6—18" high, branches decumbent. Leaves rather shining bright green rhombic-ovate or deltoid-ovate acute, base cuncate, upper narrower serrate. Spikes short densely paniced 5—75" long. Sepals slightly keeled almost covering the utricle, narrowly scarious. Seed sharply keeled, horizontal, dotted.

Nathpur, Ham.! Fl., Fr. May.

The Nathpur specimen has been identified with *C. murale* by *Hooker* and the description is of true *C. murale*, in which the flowers are said to be in lax or dense axillary divaricate cymes, but those of the Nathpur specimen do not appear to be more cymose than in *C. album*.

FAM. 138. CYPERACEÆ.

3. JUNCELLUS, Griseb. (p. 949).

- Spkts. in a single dense compound head . 1. *pygmaeus*.
 Spkts. in loose spikes in a compound umbel 2. *inundatus*.

2. *J. inundatus*, C. B. Clarke.

Rather stout 1—3 ft. high with the stem 3-quetrous at the top. Leaves often as long as the stem 25—3" broad. Bracts 3—5 foliaceous, 8—18" long. Umbel compound, rays 3—6, very unequal. Spikelets in open spikes 1—2" long. Glumes broad-ovate obtuse, 5—7-nerved. Nut over half as long as the glume.

Nathpur, Ham.! Fl. Sept.

5. MARISCUS, Vahl.

Insert in Key (p. 951):—

Stolons slender:—

- Spkts. small 1-fld., broad-lanceolate recurved and 3-gonous in fruit 1*. *panicus*.
 Spkts. 2-fld., narrow-lanceolate and suberect in fruit 2. *tenuifolius*.

1*. *M. panicus*, Vahl., var. *Roxburghiana*, Clarke (in *F. B. I.*). Syn. *Cyperus umbellatus* var. *panicea*, Clarke (in *Journ. Linn. Soc.* xx).

A slender glabrous sedge up to 2 ft. high with long slender stolons clothed with lanceolate striate rich brown scales. Leaves often as long as stem. Umbel simple, bracts 5—7, leaf-like. Rays of umbel up to 2" unequal. Spikes solitary cylindric dense ebracteate. Spkts. 2" long, 1-fld.; 2 lowest glumes empty, persistent, 3rd glume nut-bearing, ovate, deciduous, its upper margins broad scarious, 4th rudimentary.

Fruiting spkt. broad-lanceolate, 3-gonous more or less recurved. Nut oblong trigonous, black, two-thirds length of glume.

Monghyr, *Ham.* Fl., Fr. Sept.—Oct.
The description is after *Clarke*.

10. SCIRPUS, L.

Add to Key (p. 968):—

In the bracket opposite I. and after *supinus*, "clusters on rays of a lateral umbel in *corymbosus*."

After I. A. 2.:—

Spkts. angular, gls. carinate	3. <i>supinus</i> .
Spkts. terete, gls. convex	3*. <i>erectus</i> .

In place of B. i.:—

1. Bristles 0. Stem terete:—

Stems septate when dry. Clusters simple near base. Spkts. 3—5"	4. <i>articulatus</i> .
--	-------------------------

Stems not septate. Clusters on rays of a lateral umbel. Spkts. 25—3"	4*. <i>corymbosus</i> .
--	-------------------------

3*. S. erectus, Poir. Syn. *S. debilis, Pursh.*

A sedge 6—12" high or more with terete stems and generally resembling *S. supinus*. Spikelets in a single lateral head, terete. Glumes ovate concave incurved, bristles 5—6, rarely 0, style 2—3-fid. Nut broadly obovoid plano-convex obtuse, slightly transversely wavy, black.

Nathpur, *Ham.* Fl. Sept.

4*. S. corymbosus, Heyne.

A stout sedge with a horizontal rhizome and terete leafless stems 3 ft. high and 25" diam. at the base. Spikelets 25—3" long, rusty, clustered on the rays of a lateral simple or compound umbel, glumes ovate acute mucronate, glabrous, faintly striate, bristles 0.

Patna, *Ham.* Fl. July—Aug.

Rays of umbel short or sometimes attaining 5". Lowest bract 5—4" suberect, scarcely looking like a continuation of the stem as in preceding species. Nut obovoid 3-gonous scarcely half as long as glume, black, smooth or with faint transverse lines.

FAM. 139. GRAMINEÆ.

10. ERAGROSTIS, Beauv.

Add to Key (p. 999):—

Annual. Spkts. 5—12-fid. Empty gls. unequal, i very minute hyaline nerveless. Grain ellipsoid	13. <i>pilosa</i> .
Perennial. Spkts. 3—9-fid. Empty gls. subequal acuminate strongly 1-nerved. Grain truncate both ends	13*. <i>nigra</i> .

13*. E. nigra, Nees.

An erect stout or slender perennial 6"—3 ft. high. Leaves with mouth of sheath bearded. Panicle large open lax-fid., oblong to ovate, rachis

glabrous at the nodes, branches many in whorls or fascicles. Spikelets olive-grey .15—.17" long, linear to oblong 3—9-fld. Gls. i and ii sub-equal membranous acuminate strongly 1-nerved with keel scabrid, flg. gls. ovate acute about .06" long, palea obtuse denticulate persistent. Grain very short truncate each end.

Nathpur, *Ham.* Fl. Aug.

FAM. 152. DIOSCOREACEÆ.

1. DIOSCOREA, L. (p. 1165).

The following species could be placed first in the Key as it differs from all the rest in the straight sharp spines on the roots and base of stem. It is probably only cultivated in our area. The description is mainly from the *F.B.I.*

1*. *D. spinosa*, *Roxb.* (*F. B. I.*, vi, p. 90). Syn. *D. aculeata*, *Roxb.*†

Tubers very large. Base of stem with long woody rigid fibres bearing straight sharp spines up to .7" long. Leaves simple, orbicular deeply cordate, attaining 8" diam., acuminate or cuspidate, with 5—7 basal nerves, glabrous or tomentose and somewhat resembling those of *anguina*. M. fls. .12" diam. often in very dense cymes, sessile or shortly pedicelled in long simple or nearly simple axillary spikes 6—18" long. Bracteoles very broad. Stamens 6, anthers large, pistillode large oblong. Fem. raceme rather short, sepals broadly oblong or orbicular. Capsule 1" diam. broadly obcordate.

Nathpur, *Ham.* Monghyr, *Ham.* Probably cultivated.

† *Burkill* in the *Straits Settlements Gardens Bulletin*, iii, 15 April, 1924, states that the proper name for this species is *D. esculenta* and that *Roxburgh's D. fasciculata* is also this species.

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