

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

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LATE CONSERVATOR OF FORESTS, 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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WITH MAP AND INTRODUCTION

BY
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Late Conservator of Forests, Bihar and Orissa

PART III
CALYCIFLORÆ

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THE BOTANY OF BIHAR AND QRISSA

FAM. 52. MORINGACEÆ.

Trees with alternate 2—3-pinnate deciduous leaves with small leaflets stipules 0, but glands usually present at the base of the leaves and leaflets. Fls. m.s., zygomorphic, 2-sexual, white or red in many-fl. axillary panicles. Sepals, petals and stamens inserted on the margin of the disc which lines a cupular hypanthium, perigynous. Sepals petaloid reflexed narrow. Petals somewhat unequal, two upper erect, the others reflexed. Stamens in two whorls with somewhat unequal filaments, the episepalous ones more or less reduced to staminodes, anthers 1-celled, introrse. Ovary on a short gynophore, 1-celled, with 3 parietal placentæ and terminal style. Ovules numerous, 2-seriate on each placenta, pendulous anatropous with ventral raphe. Fruit pod-like, 3—6- angular and 3-valved, seeds along the centre line of each valve, separated by corky protuberances, 3-winged or wingless. Embryo straight with thick cotyledons, radicle superior, plumule with several leaf-rudiments, albumen 0.

1. MORINGA, *Juss.* (The only genus.)

1. *M. oleifera*, *Lamk.* Syn. *M. pterygosperma*, *Gaertn.* Munga ara, *M.*; Sojna, Sohajna, *H., Beng.*; Munagha, *Or.*; Horse-radish tree.

A small tree with elegant 3—4-pinnate leaves, pubescent or tomentose when young, and small elliptic or ovate leaflets 2—9" long, pale beneath. Panicles tomentose, branches 6—9" long. Fls. white, 1". Capsules pendulous, 9—18" long seeds 3-gonous, winged.

Wild in the valleys of the Ramnagar Hills, along river beds! Cultivated in all districts. Fl. Jan.—March. Fr. April—June. Decid. Dec.—Feb. or new leaves in January.

Bark grey, corky. Young parts tomentose. Two upper petals yellow spotted, lower larger, .75" long, oblanceolate, the lateral strongly reflexed.

The leaves, flowers and fruit are eaten as vegetables, and the tree is usually pollarded for the purpose of fodder. The pungent root is used as a vesicant and has the odour and flavour of horse-radish, for which it is used as a substitute. Distilled with water the root yields a very pungent essential oil, but it is rarely used as such in Hindu medicine, either decoctions of the root or the expressed juice being preferred. The seeds yield a fine fixed oil (*Ben*) which is used by perfumers for extracting the odours of flowers and by watch-makers as a lubricant (*vide Nadkarni*).

The tree grows readily from cuttings.

FAM. 53. PAPILIONACEÆ (Leguminosæ).

Trees, shrubs or herbs with simple, 1-foliolate or compound leaves and strongly zygomorphic flowers. Calyx equally, or usually unequally lobed, often 2-lipped and usually somewhat perigynous, in a few cases developed into a distinct elongate hypanthium. Petals 5, imbricate,

posterior (standard) exterior in bud, 2 lateral (wings) more or less declinate free or adhering to the keel, 2 lowest (anterior) usually more or less connate into one (keel) laterally compressed. Stamens 9 or 10 on the disc lining the very short or elongate hypanthium combined into an open or closed tube (monadelphous) or diadelphous (5+5+ or 9+1), very rarely (*Sophora*) free, alternate ones sometimes different. Ovary free, usually linear, 1-carpellary with simple style and stigma, usually with 2—many ovules on the ventral* suture, rarely sub-globose with only 1 ovule. Fruit (pod) usually follicular and 1-celled, sometimes indehiscent and sometimes septate and sometimes breaking up into one-seeded joints. Seeds albuminous or exalbuminous.

The germination of the Papilionaceæ is variable, from hypogeal to epigeal, but usually hypogeal with, however, the first leaves *simple and opposite* and thus simulating cotyledons. The shape of these is very different, from cordate and palm-nerved as in *Canavalia* and some *Phaseolus* to linear-lanceolate and pinn-nerved as in *Cajanus*.

§ Stamens monadelphous or diadelphous (1—57):—

† Stipellæ absent. † Mostly herbs or undershrubs. Pod usually dehiscent (cp. †††) (1 to 25):—

I. L. simple or digitately 3-foliolate (5-fol. in one species of *Crotalaria*). Leaflets entire, not gland-dotted (*Genistææ*) (cp. 31. *Flemingia*):—

Fls. small solitary axillary. Pod compressed, 1—2-seeded
Fls. on 2—more-flowered peduncles. Pod turgid

1. *Heylandia*.
2. *Crotalaria*.

II. Leaves pinnately 3-foliolate. Herbs with the sec. n. of lfts. excurrent as teeth. St. diadelphous (*Trifoliææ*).

a. Pod dehiscent, elongate

3. *Trigonella*.

b. Pod indehiscent.

Racemes slender. Pod sub-globose or very short

4. *Melilotus*.

Racemes not slender. Pod spiral or sickle-shaped

5. *Medicago*.

III. L. simple, pinnately 3—many-foliolate with entire leaflets (rarely toothed and then st. diadelphous). Pod not jointed (*Galegææ*):—

A. Anthers apiculate. Hairs fixed by centre (very few exceptions).

L. 3-foliolate, leaflets toothed

6. *Cyamopsis*.

L. 1—several-foliolate. Lfts. entire

7. *Indigofera*.

B. Anthers not apiculate. Hairs basifixed.

1. Leaves gland-dotted. Pod 1-seeded indehiscent

8. *Psoralea*.

2. Leaves not gland-dotted. Pod several-seeded, dehiscent:—

a. Erect or diffuse herbs or shrubs. Pod soon dehiscent:—

Lfts. 5—25, usually odd. Pod flattened

9. *Tephrosia*.

Lfts. 20—80, often even. Pod long slender septate.

10. *Sesbania*.

b. Climbing shrubs. Pod often woody and tardily dehiscent

11. *Millelittia*.

IV. Leaves even-pinnate with the rhachis ending in a tendril or bristle. Pod dehiscent, not jointed (*Viciææ*):—

A. Stamens 9. Slender climbing shrubs

12. *Abrus*.

* The term ventral is here used in the strict botanical sense, but as the ovary is declinate the suture is uppermost, or dorsal in the ordinary sense of the word, and faces the vexillum or standard.

† Minute in some *Galegææ*.

- B. Stamens 9+1. Herbs (in our area):—
1. Leaflets toothed. Style glabrous. Pod turgid 13. *Cicer*,
 2. Lfts. entire (exc. *Pisum*). Style usually hairy. Pod compressed (or turgid in the cultivated *Pea*):—
 - a. Staminal tube with oblique mouth:—
 - Ovules 3—many (or, if only 2, then beard annular) 14. *Vicia*.
 - Ovules only 2. Style longitudinally bearded 15. *Lens*.
 - b. Staminal tube truncate:—
 - Style broad upwards but margins not recurved 16. *Lathyrus*.
 - Style broad upwards with the margins recurved 17. *Pisum*.
- V. Leaves odd-pinnate (exc. *Zornia*, *Arachis*, *Smithia*), rarely only 1—3-foliolate. Pod jointed (joints 1-seeded, sometimes only 1—2). (*Hedysareæ*):—
1. Stamens 9+1:—
 - L. 3-foliolate. Ovule and joint 1 only 18. *Lespedeza*.
 - L. 1-foliolate. Spiny shrub. Joints few 19. *Alhagi*.
 2. Stamens monadelphous with dimorphous anthers:—
 - L. with 1—2 prs. of leaflets. Joints 2—6 20. *Zornia*.
 - L. 3-foliolate. Calyx-tube very long. Joints 1—2 21. *Stylosanthes*.
 - L. with 2 prs. of lfts. Calyx-tube very long 22. *Arachis*.
 3. Stamens 5+5:—
 - a. Joints folded inside the calyx 23. *Smithia*.
 - b. Joints several exerted:—
 - Calyx with two entire or sub-entire lips 24. *Æschynomene*.
 - Calyx teeth distinct 25. *Ormocarpum*.
- †† Stipellæ present (sometimes absent in *Cajanææ* and then leaves gland-dotted) (26 to 53).
- VI. (*Hedysareæ*, continued.) As above, but stipellæ present:—
Stamens 9+1. (Joints inconspicuous in some *Pseudarthria* and *Desmodium*):—
1. Ovary 1-ovuled. L. 1-foliolate. Raceme very lax 26. *Eleiotis*.
 2. Ovules several:—
 - a. Pod twisted up so that the joints are transverse to its axis 27. *Uraria*.
 - b. Pod not twisted up:—
 - i. Pod turgid, often terete 28. *Alysicarpus*.
 - ii. Pod flattened:—
 - Deciduous tree. Joints 1—5 large 29. *Ougeinia*.
 - Undershrub. Pod not septate, scarcely indented. (see *Desmodium*, sec.). *Pseudarthria*
 - Shrubs or herbs. Pod usually septate and indented 30. *Desmodium*.
- VII. Climbers, rarely erect or sub-erect with pinnately 3-foliolate (exc. *Flemingia*) leaves. Pod dehiscent, not jointed (*Phaseolææ*):—
- A. Leaves gland-dotted. Nodes of raceme not tumid (Sub-tribe *Cajanææ*):—
1. Ovules 1—2. L. 1—3-foliolate:—
 - a. Calyx not much accrescent:—
 - Erect or prostrate undershrubs. L. digitate or 1-foliolate. Fls. white or red. Pod turgid (cp. *Genistææ*) 31. *Flemingia*.
 - Erect. Pod compressed 32. *Eriosema*.
 - Erect or climbing. L. pinnately 3-fol. Pod turgid 33. *Rhynchosia*.
 - b. Calyx with very accrescent teeth. Climber 34. *Cylista*.
 2. Ovules 3 or more:—
 - a. Pod without channels between the seeds 35. *Dunbaria*.
 - b. Pod channelled between the seeds:—
 - Seed with a large grooved strophiole 36. *Atylosia*.
 - Seed estrophiolate 37. *Cajanus*.

B. Leaves not gland-dotted:—

1. Nodes of raceme not tumid. Style beardless (Sub-tribe *Glycineæ*):—

a. Stamens diadelphous. Stipules and bracts persistent:—

Style filiform. Calyx-teeth distinct 38. *Shuteria*.Style flattened upwards. Calyx truncate 39. *Dumasia*.

b. Stamens monadelphous. Stipules and bracts caducous:—

Anthers all fertile 40. *Glycine*.Alternate anthers abortive 41. *Teramnus*.

2. Nodes of raceme tumid. Style beardless:—

a. Petals equal in length (Sub-tribe *Galacticeæ*):—

i. Herbs. Stamens diadelphous:—

Two upper calyx-teeth distinct 42. *Grona*.Two upper calyx-teeth connate into one 43. *Galactia*.ii. Stamens 1—rarely 2-adelphous. Suffruticose. Upper lip of calyx projecting 44. *Canavalia*.

iii. Climbing shrubs. Upper lip of calyx not projecting:—

St. diadelphous. Pod 1-seeded (inc. *Spatholobus*) 45. *Butea*.St. monadelphous. Pod linear many-seeded 46. *Pueraria*.b. Petals very unequal (Sub-tribe *Erythrineæ*):—Climbers. Keel exceeding wings and standard 47. *Mucuna*.Trees or undershrub. Standard exceeding keel 48. *Erythrina*.3. Nodes of raceme usually tumid. Style bearded (Sub-tribe *Euphaseoleæ*):—

a. Stigma oblique:—

Keel spirally beaked 49. *Phaseolus*.Keel incurved. Style not flattened 50. *Vigna*.Keel not spiral. Style flattened upwards and circinate 51. *Pachyrhizus*.

b. Stigma terminal, not oblique:—

Petals equal 52. *Dolichos*.Petals unequal. Flowers large, blue 53. *Clitoria*.

††† Stipellæ rarely present. Woody plants. Pod indehiscent:—

VIII. Leaves pinnate. Pod flattened (*Dalbergiceæ*):—

1. Leaflets alternate:—

Flowers small, white or pink 54. *Dalbergia*.Flowers m.s., yellow 55. *Pterocarpus*.

2. Leaflets opposite:—

Pod rather thin and usually winged 56. *Derris*.Pod rather thick and woody, not winged 57. *Pongamia*.

§§ Stamens free:—

IX. Leaves odd-pinnate. Pod not jointed, moniliform. Erect shrubs (*Sophoreæ*) 58. *Sophora*.

1. HEYLANDIA, DC.

A single species with simple entire sub-sessile leaves, small flowers solitary in the axils, keel of corolla beaked, stamens monadelphous, ovary sessile 2-ovuled, pod short oblong flattened 1—2-seeded.

1. *H. latebrosa*, DC.

A prostrate herb with many dichotomously-branched slender stems 8—18" long and close-set alternate spreading obliquely ovate leaves

thinly villous. Flowers solitary subsessile .25" long, yellow or white with purple veins. Pod silky beaked .2—25".

Dry grassy places, not common. Fl., Fr. Sep.—Oct.

2. CROTALARIA, L.

Herbs or low shrubs or undershrubs with simple or 3-foliolate, very rarely 5-foliolate, stipulate or exstipulate, often pellucid punctate, entire leaves. Fls. racemose, sometimes also axillary, small or showy. Calyx teeth usually narrow, upper sometimes broader and connate. Corolla exserted or not, standard usually broad shortly clawed, keel petals connate into a conspicuously incurved beak. St. monadelphous, anthers dimorphous. Ovary linear, rarely only 2—usually many-ovuled; style long abruptly incurved with the keel, bearded upwards with minute oblique stigma. Pod very turgid without septa, seeds usually nearly as many as the ovules.

The distinction of terminal and leaf-opposed racemes is only relative; normally terminal racemes become leaf-opposed owing to the stronger growth of the axillary shoots.

I. Leaves simple. Mostly herbs under 3 ft. Corolla rarely (no. 6) exserted:—

A. Racemes becoming leaf-opposed (exc. sometimes 3), few-fld.

1. Stipules 0. Fls. under 6 in a raceme:—
 - a. Pod sub-globose. Peduncles slender 1. *biflora*.
 - b. Pod oblong:—
 - L. with long spreading hairs, base cordate 2. *trichophora*.
 - L. only silky, base not cordate, oblong, .7—1.5" 3. *prostrata*.
 - As in (3), but L. linear-oblong, .25—5" var. *levis*.
2. Stipules present, branches not winged:—
 - L. broadly elliptic, .15—1". Fls. .25" 4. *acicularis*.
 - L. ovate-lanc. or ovate oblong, 1—2". Fls. .5". Pod glabrous 5. *ferruginea*.
 - * L. ovate, 1—2.5". Pods hairy 6. *hirsuta*.
3. Stipules spreading and decurrent as large persistent wings on the branches 7. *alata*.

B. Racemes not becoming leaf-opposed:—

1. Racemes very short. Stipules 0:—
 - L. .2—7". Racemes .5—1" long. Fls. .1—12" 8. *pusilla*.
 - L. .5—75". Racemes capitate. Fls. .25" 9. *hirta*.
2. Racemes 6—9-fld., elongate. Stipules foliaceous 10. *mysorensis*.
3. Racemes elongate, usually many-fld. L. under 2" long. Stipules 0:—
 - Upper calyx-lobes connate high up. Pod not exserted 11. *linifolia*.
 - Calyx lobes nearly free. Pod much exserted 12. *albida*.
4. Racemes elongate. L. 2—6* long. Stipules minute:—
 - Calyx .75—1". Fls. yellow 13. *calycina*.
 - Calyx .3—5". Fls. blue 14. *sessiliflora*.

II. Leaves simple. Herbs over 4 ft. high, or undershrubs.

Corolla little or much exserted:—

- A. Bushy much branched undershrubs:—
 - L. rather broad, often rhomboid. Fls. blue and yellowish 15. *verrucosa*.
 - L. very short linear. Inflorescence glandular 16. *ramosissima*.
- B. Tall usually strict herbs or shrubs:—
 1. Herbaceous glabrous. Corolla much exserted. Pod glabrous 17. *sericea*.

2. Sub-woody silky. Cor. slightly exerted. Pod velvety:—

L. 2—4·5" linear or oblong

L. 6—12" linear-lanceolate acuminate

18. *juncea*.

19. *tetragona*.

III. Leaves trifoliolate:—

Suffruticose 3—5 ft. Lfts. 2—3"

Herbaceous, often diffuse:—

Lfts. 1—1·3". Pod ·5" oblong

Lfts. ·2—·7". Pod sub-globose

20. *striata*.

21. *orixensis*.

22. *medicaginea*.

IV. Leaves mostly 5-foliolate:—

Lfts. linear-oblong or oblanceolate

23. *quinquefolia*.

1. *C. biflora*, L.

A silky trailing herb with sometimes very numerous branches from 8—12" long from a woody root, small sessile oblique broadly ovate or sub-orbicular leaves ·25—·75" long, small flowers usually 2 together on long slender peduncles and comparatively large sub-globose pods.

Behar, *Kurz!*

2. *C. trichophora*, Baker.

A slender much branched diffuse herb covered with very long spreading slender villi, sometimes ·25" long. Leaves ·75—1·3" sessile with oblique sub-cordate base. Fls. very small, ·15" on filiform 1—2-flid. leaf-opposed peduncles. Pods ·3".

Behar, rare, *Kurz!*

3. *C. prostrata*, Roxb. Nanha jhunka, Katic jhunka, S.

A silky herb with spreading or long trailing slender branches from a perennial root, close oblong or ovate-oblong obtuse leaves ·5—1·5" long, glaucous beneath and densely silky, base oblique rounded but not cordate. Racemes on slender peduncles 2—4-flid. soon leaf-opposed attaining 3". Pod ·5—·7", glabrous, shortly stipitate, 16—20-seeded.

Very common on clay in open Sal forest, etc. Champaran! Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Sept.—Dec.

Stipules 0. Fls. ·2—·27", three lower calyx lobes linear acuminate shorter than the twisted keel, upper longer linear oblong connate half to three-fourths way up as long as standard.

Var. *levis*, Haines.

A small herb with numerous branches from a woody rootstock, small linear to oblong simple exstipulate strigosely-hairy leaves ·25—·5" long and slender terminal (leaf-opposed) racemes of 4—7 yellow flowers ·22—·25" long, the corolla only as long as the calyx or very slightly exerted. Pod as in type.

Neterhat 3000 ft. in open places. Fl., Fr. May—Dec.

Branches strigose. L. opaque. Petioles minute. Racemes 1—4", exceeding the branches, somewhat wavy. Bracts minute setaceous. Pedicels ·1—·2" slender. Calyx strigose ·2", upper teeth lanceolate acute sinus ·06", lower teeth rather narrower with sinus ·1" deep between them. Standard very slightly exerted emarginate ·18" broad with 2 small callosities at base.

Distrib. from United Provinces to the Shan Hills usually in the hills. May be distinguished from small specimens of *C. albida* in the absence of fruit by the opaque leaves.

4. C. acicularis, Ham.

A small procumbent much branched very hairy weed with a woody rootstock when old. Branches 4—10". L. broadly elliptic .15—.75" scarcely petioled, base oblique rounded. Racemes 1—2", 2—several-flowered, fls. .25". Pod small black .25—.3" oblong.

Open grassy places, often very conspicuous on cold mornings from the dew adhering to the hairs and giving it a grey or silvery look. Frequent. Chota Nagpur! Sambalpur! Fl., Fr. Nov.—Jan.

5. C. ferruginea, Grah.

Stems ascending 2—3 ft. branched more densely hairy. leaves oblong-ovate to oblong 1.5—1.75", stipules lanceolate, racemes pubescent lax 1—6-fl.; flowers .4—.5" long, calyx with teeth as long as corolla.

Chota Nagpur, elev. 2000 ft.—3000 ft.! Fl., Fr. Sept.—Nov.

Leaves pubescent rounded both ends. Stipules conspicuous spreading .2—.25". Racemes axillary and terminal, 2—5" long. Bracts .2". Bracteoles linear. Calyx 2-lipped often reddish, lower lobes oblong-lanceolate linear, standard with purplish veins. Pod .7—9" nearly glabrous, .3" broad, seeds about 25.

6. C. hirsuta, Willd.

An erect hairy herb 2—3 ft. high with broadly ovate simple leaves 2—2.3" long, very narrow stipules and terminal few-flowered racemes of yellow flowers .5" long with very long lanceolate calyx-teeth nearly as long as corolla.

Rather common in rocky jungles, Chota Nagpur! Fl., Fr. Aug.—Oct.

Hairs soft spreading. L. thin, with rounded base, mucronulate. Petiole hardly any. Stipules acicular-subulate spreading and reflexed .1—.14". Racemes ultimately leaf-opposed, usually under 2". Standard spotted brown. Pod .75—1" with spreading hairs, about 6—10-seeded.

7. C. alata, Ham. Marang jhunka, S.

Stems 1—3 ft. branched sub-erect softly hairy, winged. Leaves subsessile elliptic oblong or obovate 1—2.7", usually oblique-based, finely shortly silky beneath, scarcely punctulate. Petiole .15". Stipules decurrent. Racemes terminal and ultimately leaf-opposed. Racemes 3—4", few-flowered, with small petioled lanceo. bracts. Fls. .5—.6", calyx as long as corolla. Pod oblong 1.25—1.5" narrowed at base into a stalk, far exserted.

Frequent. Hills of Ramnagar! Chota Nagpur! Sambalpur!

Fl. Aug.—Nov. Fr. Sept.—Dec.

8. C. pusilla, Heyne.

A small plant 3—5" high with numerous usually spreading branches from the root and densely covered throughout with brown villous hairs. Leaves linear subsessile .25—.75". Sepals linear subulate .08" brown villous. Pod .2", the long brown hairs leaving small dots when rubbed off.

Bihar, Kurz! Fl., Fr. Sept.—Jan.

9. C. hirta, Willd.

A herb, scarcely sub-fruticose, somewhat resembling narrow-leaved forms of *C. mysorensis* but is a smaller plant in all its parts and more

diffuse. Branches densely clothed with short patent brown hairs. L. linear or linear-oblong without stipules, hairy. Fls. only 2—4 subcapitate with lanceolate foliaceous bracts. Calyx .25" with teeth all linear acuminate. Pod oblong .5"

Not common. Behar, *Kurz!* Savannahs, Singbhum, 2000 ft. Fl. March.

10. *C. mysorensis*, *Roth.*

A rather strict herb 3—4 ft. high covered with long spreading or erecto-patent hairs. Leaves sessile linear to oblong mostly about 2" long with erect foliaceous persistent stipules .3—.6" long. Flowers subsolitary or in few-fl'd. terminal racemes with lanceolate bracts .5—.6" long. Pod exserted 1—1.25" shortly stipitate in the deeply cut very hairy calyx.

Frequent in Chota Nagpur and the Santal Parganas! Fl. Aug.—Oct. Fr. Nov.—Jan.

The stipules which sometimes look like subsidiary leaves and in some Koderma plants are as large, are very characteristic. L. 2—3" pellucid-punctate. Lower sepals linear acuminate .5—.75" villous with brown hairs. Seeds 40—50 small black shining sharply hooked.

11. *C. linifolia*, *L.*

A herb 1—2 ft. high erect or with ascending branches, somewhat resembling the last in leaf but with black globose or oblong-ovoid pods only as long as the calyx and the marcescent corolla drying black.

Less common and more often in the open. Ranchi! Hazaribagh, *Wood!* Singbhum, *Clarke!* Fls. Sept.—Oct. Fr. Oct.—Nov.

Stems somewhat strigosely hairy. Leaves usually oblanceolate, sometimes linear but slightly wider upwards, 1—1.75", appressed silky beneath and with pellucid dashes. Racemes 3—6". Fls. .25", calyx hirsute, upper lip not deeply lobed, pod punctate, glabrous.

12. *C. albida*, *Heyne.*

A herb or undershrub with stems very many up to 3 ft. high from a woody rootstock, sparingly branched with fastigate appressed-hairy or silky branches, narrow leaves and yellow flowers .3—.5" with very shortly exserted corolla in terminal racemes with few or up to 25 flowers.

One of the commonest forest Crotalaris, very abundant on hard clay soil on hilly ground throughout Chota Nagpur! Angul! Probably occurring in all districts. Fls., Fr. Sept.—Jan.

Stems appressed pubescent above. L. linear-oblong, oblong or oblanceolate .8—3" by .25—.6" obtuse or rounded mucronate pubescent or laxly hairy above, glaucous and silky beneath, base narrowed to a very short petiole, copiously pellucid punctulate. Stipules 0 or minute subulate. Calyx very silky, two upper lobes oblong obtuse. Pod glabrous .5", slightly exserted, 6—8-seeded on pedicels .25" long.

13. *C. calycina*, *Schrank.* Mota bir-jhunka, *S.*

Herbaceous 1—3 ft. high with appressed brown-hairy branches and long lanceolate or linear leaves 3—5". Easily recognised by the pale-yellow corolla being shorter than the very large .75—1" long calyx which is shaggy with long brown hairs.

Frequent. Singbhum! Palamau! Hazaribagh! Santal P.! Probably in all districts. Fls. r.s. Fr. Oct.—Nov.

L. appressed brown-hairy beneath, very acute, closely pellucid-punctulate. Fls. axillary in the upper leaves and in terminal racemes with persistent linear-lanceolate bracts. Pod included, glabrous. Seeds pale yellow or white.

14. *C. sessiliflora*, L.

Will probably be found in Purneah as I have found it quite close to that district in Bengal. It is very like *C. calycina* but can be easily recognised by the blue corolla. Wet places. Fl. Sept.

15. *C. verrucosa*, L.

A much branched erect undershrub 3—4 ft. high with 4-ridged or -winged shortly silky branches, broadly rhomboid leaves and terminal leaf-opposed 3—7-fl. racemes 1·5—3" long of blue and yellowish flowers. Pod sessile 1" thinly silky.

Mals of Orissa! Fl. March—May. Fr. April—May.

L. only 1—2" in plants seen by me, 4—6" according to *F.B.I.*, obtuse, retuse or rounded, sometimes shallowly lobed wavy or crenate, glaucous, shortly silky both sides. Petiole short. Stipules large broad auriculate 2—4" shortly cuspidate, attached by a narrow base. Calyx 4". Standard 5" blue-veined, wings 5" long blue-veined and deep blue apically, keel pale 5". Bracts subulate 0·7". Seeds 12 or more.

16. *C. ramosissima*, Roxb. Harduli, Gond.

A densely branched small shrub 1·5—2 ft. high and as broad, stems, leaves and inflorescence densely silkily hirsute. Leaves 5—1" long linear. Flowers yellow tinged with red in very numerous few-flowered short racemes terminating all the branchlets. Pods 3" long, 1-seeded.

Quartzite rocks in open forest. Sambalpur! Fl. Oct.—Dec.

Usually grey or fulvous from the numerous hairs. L. with recurved margins, obtuse. Bracts and bracteoles ovate and with the calyx covered with a very viscid secretion which stains clothes brown and becomes a pest.

17. *C. sericea*, Retz. Sakasing, K.; Junka, Or.

A tall handsome bright green herb 3—5 ft. high with often hexagonal waxy stems oblanceolate to obovate leaves 3—6" long with persistent stipules and long terminal often paniced racemes of bright yellow flowers over 1" long with persistent spreading or reflexed lanceolate or ovate acuminate foliaceous bracts 3—5". Pod glabrous 1·5".

Frequent in grass under light shade and along streams. Throughout the province, but rarely outside the forest tracts! Fls. Sept.—Feb. Fr. Dec.—May. Biennial.

L. finely appressed silky beneath, sub-acute or obtuse, petiole short and stout, stipules variable in size. Racemes 8—12". Calyx 75".

18. *C. juncea*, L. Jiri, M. (jiri-bair, the fibre); Ji, Ho.; Son, S.; San, H.; Sun Hemp.

A strict shrub 4—6 ft. high with virgate grooved stems and branches and linear or linear-oblong leaves 2—4·5" long. Flowers 1" long, yellow in lax lateral and terminal racemes 6—12" long. Beaked sepals, pedicels and pods all softly closely pubescent or velvety. Corolla slightly exerted, standard 1" broad and long, veined red, silky without. Pod 1—1·4".

Apparently wild along streams in the Northern Champaran forests! Cultivated and sometimes apparently wild in Singbhum and the Ranchi scarps! Cultivated in most districts. Fl. Aug.—Jan. Fr. Dec.—Feb.

Yields the fibre known as Sun Hemp.

19. *C. tetragona*, Roxb.

A much stouter shrub than the last with angular pubescent branches, narrowly lanceolate very acute or acuminate leaves 6—12" long and lateral and terminal racemes of large lemon-yellow flowers with glabrous slightly exserted corolla. Pod 1·5—2" stout densely brown-velvety.

Grassy ravines, N. Champaran, rare! Probably also Purneah. Fl. July—Oct. Fr. Oct.—Jan.

20. *C. striata*, DC. Sakesing, K.; Son-jhunka, S.; Junjunka, Or.

An undershrub 3—5 ft. high with slender branches, long-petioled trifoliolate leaves and terminal and lateral elongate racemes 6—12" long. Fls. yellow 75" long, usually streaked with purple. Pods 1·5—2" by 25", 30—40-seeded, silky when young and more or less glabrescent.

Waste ground and along road-sides, throughout the province, locally abundant and sometimes cultivated for its fibre. Common in Orissa and the Mahanadi delta! Annual. Fl., Fr. Oct.—April.

Lfts. 1—2·5" broadly elliptic or obovate, with sparse appressed hairs beneath, base cuneate, tip rounded. Petiole 1—2".

Possibly an introduced plant. It is now very common near Calcutta and it is curious that Roxburgh makes no mention of it. Prain distinguishes between *C. Saltiana*, And. (our species), with obtuse obovate leaflets and *C. Brownei*, Bert., with oblong acute leaflets, which latter he says is cultivated and in some places naturalised in Bengal.

21. *C. orixensis*, Roxb.

Stems several diffuse from a perennial root, lfts. elliptic or obovate, 1—1·3" long. Racemes erect very long and slender with ovate lanceolate bracts 2" and yellow flowers 25—26" on slender pedicels 3—4" long. Pods very turgid 4" long with a long stipes.

Open waste ground and borders of fields. Behar, Kurz! Orissa, Prain. Fl., Fr. Aug.—Oct.

Branches and leaves beneath thinly hairy or strigose, lfts. sessile.

22. *C. medicaginea*, Lamk.

A diffuse herb or with slender erect branches 1 foot high with 3-foliolate leaves, linear-oblong or oblanceolate leaflets 4—7" with petioles shorter than the terminal leaflet, small, yellow fls. axillary and in terminal racemes and leaf-opposed racemes 1—2" long. Pod small obliquely-globose 12" diam. grooved and shortly beaked, thickly or thinly pubescent with 2 shining brown seeds.

Champaran! Palamau! Fl. r.s. Fr. Oct.—Nov.

Branches with appressed and spreading pubescence. Petioles up to 5". Lfts. rounded or emarginate at tip, silky beneath. Terminal racemes 2—15-fl. Calyx 1", upper teeth widely separate. Corolla 2" with very acute beak.

The more robust erect forms with many-fl. terminal racemes constitute the var. *luxurians* of the F.B.J., and the small prostrate forms with very few fls. the var. *herniarioides*.

23. C. quinquefolia,

An erect annual 2—4 ft. high with sulcate thinly silky branches, usually 5, rarely 3, linear or narrowly oblanceolate leaflets 2—4" long, silky beneath, and terminal racemes up to 6" long of rather large yellow flowers .5" long with linear-lanceolate reflexed bracts. Pod oblong glabrous 1.5—2" or 2.5" long and .75—1" broad, pedicelled.

Rare in our area. Bihar, in wet places! Bihar and Chota Nagpur (teste *Bengal Plants*). Fls., Fr. Nov.—Feb.

3. TRIGONELLA, L.

Herbs with pinnately 3-fol. leaves and adnate stipules. Fls. axillary or in axillary racemes, sometimes capitate, bracts minute or 0. Calyx teeth subequal. Stamens usually diadelphous or posterior filament sometimes connate to the middle, anthers uniform. Ovary many-ovuled. Pod often indehiscent, elongated, straight or falcate, sometimes beaked, not septate, many-seeded.

Erect. Fls. axillary. Pod beaked
Diffuse. Fls. racemose. Pod not beaked

1. *fœnum-græcum*.
2. *corniculata*.

1. T. fœnum-græcum, L. Methi, *Beng.*, *H.*; Fenugreek.

An erect strong-smelling herb 1—2 ft. with thinly hairy or subglabrous stems and oblong-oblanceolate denticulate obtuse or rounded leaflets .5—1.25" long. Petiole .3—5". Fls. pale sessile 1—2 together in the axils of the young leaves. Pod at first straight, often falcate with age, 3—4" or 2" with a long fine beak.

Cultivated in the gardens of Indians! Purneah, *Ham.*! Fl., Fr. Jan.—March.

The young plants are used as vegetables and the seeds in curries. The seeds are mucilaginous and various properties are ascribed to them; among others they are said to prevent baldness.

2. T. corniculata, L. Piring, *Beng.*

A diffuse herb with branches about 10" long, lfts. obovate .3—75" denticulate, petiole slender .25—5". Peduncles filiform .5—1" with several flowers .15—25", peduncles ending in a sharp point or awn. Pods .25—75" slightly curved, not beaked.

Rare. Bihar, *Kurz*! Cultivated in Tirhut, *Prain*.

4. MELILOTUS, Juss.

Herbs with toothed pinnately 3-foliolate leaflets and small flowers in long slender racemes. Standard and wings narrow, keel straight obtuse. St. diadelphous, anthers uniform. Ovary few-ovuled, style much incurved glabrous. Pod oblong exserted, indehiscent.

1. M. indica, All. Syn. *M. parviflora, Desf.*; *Trifolium indicum, L.*

A slender herb 1—1.5 ft. Lfts. obovate or oblanceolate .5" long glabrous. Fls. very small, .1" long, white in spiciform racemes 1.6—2.2" long. Pod scarcely longer than the calyx when 1-seeded, sometimes 2-seeded.

Chota Nagpur, Hazaribagh, *Clarke*! Fl., Fr. c.s.

2. M. alba, Lamk. Syn. *M. vulgaris*, Willd.

Herb 1—2 ft. high much more robust than the last, lfts. '1". Flowers white '2" in racemes 3—4" long or 4—6" in fruit. Pods '12".

Not uncommon in cultivated lands in the north. In fields of dhal, *Prain!* In lucern crops, *Ranchi!* Fl., Fr. Jan.—April.

5. MEDICAGO, L.

Herbs with pinnately 3-foliolate leaves and toothed leaflets. Corolla more or less exserted, standard and wings oblong, keel straight obtuse. St. diadelphous, anthers uniform. Ovary usually many-ovuled, style short, little incurved, stigma oblique. Pod usually spirally twisted, sometimes sickle-shaped or reniform with spiral tip, rarely only 1-seeded (*lupulina*).

- | | |
|---|-------------------------|
| A. Sub-erect perennials. Fls. racemose, purple. Pod unarmed.
Cultivated lucern | 1. <i>sativa</i> . |
| B. Diffuse annuals. Racemes very short or sub-capitate:—
Pod reniform, unarmed, 1-seeded | 2. <i>lupulina</i> . |
| Pod spiral, muricate, 2—more-seeded | 3. <i>denticulata</i> . |

1. M. sativa, L. Lucern, Alfalfa.

Stems slightly hairy 1—2 ft. high, lfts. narrow oblong with cuneate base to obovate-oblongate '5—1.25" with sharp teeth. Racemes stout 1.5—2.5" including the peduncle. Pod silky forming a complete loop or a double spiral, venose, no intramarginal nerve parallel to the suture.

Frequently cultivated by Europeans as fodder for horses. It may be repeatedly cut before flowering. In the damper districts it is apt to be attacked by fungus in the rains and is best grown as an annual.

2. M. lupulina, L. Black Medick.

A small procumbent branched herb with pubescent branches 3—6" long. Lfts. small obovate or cuneate-obcordate, '18—'35"; young very silky beneath, toothed, the sinus usually apiculate with a small triangular tooth. Fls. very small pale yellow in dense ovoid heads, oblong in fruit, on slender hairy peduncles much exceeding the petioles. Pod very small sub-globose reniform* with tip coiled, 1-seeded, with several strong raised concentric nerves and cross nervules, otherwise smooth, finally black.

Champan, Bettah, in fields! Fl., Fr. March.

3. M. denticulata, Willd. (*sensu F. B. I.*),† Toothed Medick.

A nearly glabrous herb with prostrate branches about 1 ft. long. Lfts. obovate or obcordate, sometimes retuse at the apex, '5" long, petiole slender, 1", stipules laciniate. Flowers very few, 2—5 only, umbelled, yellow, on a peduncle much shorter than the petioles. Calyx

* Baker (*F.B.I.*) describes the pod as minute linear sickle-shaped, which is, I think, a mistake. The Black Medick is found as far west as England, and my Indian specimens, though smaller, agree with the English ones.

†Our species is probably var. *apiculata*, but *M. apiculata*, Willd. (= *M. denticulata*, Willd., var.) does not agree with Gaertner's figure of *M. hispida* (Gaertner *de fructibus et seminibus plantarum*, 1788-91) to which it has been reduced by Urban, and I have not in this matter been able to follow that authority on *Medicago*.

·1", teeth as long as tube. Pod ·12—2" diam. sub-globose-spiral, muricate with strong nerves running parallel to margin, face reticulate, nervules meeting in intra-marginal one and with a nervule from each spine joining margin and the intra-marginal nerve.

Bihar, Kurz!

This species is also found in England, but is rare.

6. CYAMOPSIS, DC.

Erect herbs with laterally attached hairs as in *Indigofera* and pinnately 3-foliolate leaves with toothed leaflets. Stipules small. Stipellæ 0. Flowers in axillary close racemes with caducous bracts. Sepals connate into an oblique tube. Keel obtuse inappendiculate. Stamens 10 monadelphous with uniform anthers, connective apiculate. Ovary many-ovuled, stigma terminal capitate. Pod linear, subquadrangular, acuminate, septate. Seeds quadrate, compressed.

1. *C. tetragonoloba*, Taub. Syn. *C. psoralioides*, DC.; Guar, H.; Buru hahar, S.; The Cluster-bean.

Rather stout 2—3 ft. high with adpressed grey hairs. Lfts. 2—3" ovate acute inciso-dentate. Racemes short-peduncled, close. Fls. pinkish ·2". Pods clustered thick fleshy, 1·5—2·5" long, 8—12 seeded.

Cultivated occasionally in Santal Parganas and Manbhum!

The young pods are eaten.

7. INDIGOFERA, L. Indigo.

Herbs or shrubs more or less clothed with hairs which in most cases are forked, each fork appressed. Flowers in short or long axillary racemes, sometimes sub-capitate, usually reddish. Calyx small or minute, campanulate, teeth 5 sub-equal or lowest longest. Standard usually broad; keel straight, not beaked, each petal spurred near the base. St. diadelphous, alt. filaments sometimes longer and narrower, anthers uniform, apiculate. Ovary sessile, style short incurved, stigma capitate usually pedicellate. Pod usually linear or oblong, sometimes curved, in one species muricate.

I. Leaves simple. Herbs, usually small and prostrate:—

1. Fls. clustered. Pod muricate, 1-seeded

1. *echinata*.

2. Pod unarmed:—

L. linear. Pod globose, 1-seeded

2. *linifolia*.

L. ovate cordate. Pod oblong, 2-seeded

3. *cordifolia*

II. Leaves 3-foliolate. Herbs:—

1. Lfts. gland-dotted beneath. Pod short oblong

4. *glandulosa*.

2. Lfts. not gland-dotted. Pods linear, narrow:—

Racemes capitate sessile. Pods ·3—5"

5. *trifoliata*.

Racemes elongate. Pods ·7—9"

6. *trita*.

III. L. pinnate, or few only 3-foliolate:—

A. Flowers small, under ·25":—

1. Lfts. alternate.

Racemes sessile capitate. Lfts. 5—7

7. *enneaphylla*.

Racemes 1—4" long. Lfts. 5—9

8. *endecaphylla*.

2. Leaflets opposite. Fls. only 2—4, ped. slender

9. *pentaphylla*.

3. Lfts. opposite. Racemes elongate:—

a. Herbaceous, whole plant hirsute

10. *hirsuta*.

b. Shrubs. Hairs sparse appressed. (Dye Indigoes):—

* Pods slender glabrescent, over 6-seeded.

Lfts. 7—8 prs. Racemes 1·5—2·5"

Lfts. 3—6 prs. broad. Racemes 2—4". Pod acute.

Lfts. 3—6 prs. narrow. Pod stouter obtuse

** Pods sausage-shaped, under 5-seeded, sericeous

B. Flowers large, over 4" long.

Shrub. Lfts. 6—15 prs., 5—1·5". Sepals acuminate

Undershrub. Lfts. 2—6 prs., 5—6". Sep. acute

11. *arrecta*.

12. *tinctoria*.

13. *sumatrana*.

14. *articulata*.

15. *pulchella*.

16. *Hamiltonii*.

1. *I. echinata*, Willd.

A herb with many branches from the root 6—12" long with simple obovate leaves or orbicular-obovate leaves 5—75" long and small flowers in very short axillary racemes 7—1·5" long including the peduncle. Calyx somewhat hispidly hairy with long teeth. Pods 2—25" densely echinate on the two keels of the dorsal suture and somewhat hairy.

Ranchi, *Clarke!* Behar, *Kurz!*

2. *I. linifolia*, Retz.

A herb with prostrate two-edged or sub-4-angular grey pubescent slender stems 12—18" long and linear or linear-oblong apiculate leaves 3—1·2" long, strigulose both sides. Fls. small bright red in axillary bracteate racemes 15—1·1" long. Pods sub-globose silvery-silky 06" only.

Very common on banks and in grassy places in the open, chiefly in the dryer districts! Fls., Fr. Aug.—Jan.

L. subsessile. Stipules filiform. Bracts linear subulate, deciduous or persistent. Calyx tube very short with subulate setaceous teeth as long as the pod.

The roots are usually copiously covered with tubercles, so that the plant is probably useful as a soil fertiliser.

3. *I. cordifolia*, Heyne.

A small herb with many spreading rather wiry branches from the root, hoary with a dense white pubescence, leaves very small, only 2" (in my specimens), but attain 7", ovate cordate obtuse or acute subsessile. Fls. minute bright red clustered 4—8 together. Calyx densely hairy. Pod 2" pubescent 2- rarely 1-seeded.

On overgrazed pastures. Gayal Fl., Fr. Sept.—Dec.

Some states superficially resemble *Heylandia*.

4. *I. glandulosa*, Willd.

Erect 1·5—2 ft. high, branched. Branches pubescent. L. 3-foliolate with petioles 3—5" long and sub-digitate oblanceolate leaflets 5—1" long conspicuously gland dotted beneath and somewhat pubescent. Fls. in dense clusters shorter than the petiole, corolla 3" long much exerted from the pubescent calyx. Pods short oblong 2" turgid hairy and with four lines of fibrillæ.

In the western dryer districts. Behar, *Kurz!* Fl. Aug.—Sept. Fr. Sept.—Nov.

5. *I. trifoliata*, L.

A copiously branched weed with spreading branches 6—12" long thinly clothed with appressed bifurcate hairs. L. small with petioles

shorter or equalling the 3 digitate oblong to oblanceolate .25—1" long strigosely hairy leaflets. Fls. in sessile very numerous capitate racemes shorter than the petioles, in fruit conspicuous by the numerous clusters of slender .3—5" long 4—8-seeded pods.

Waste ground in Chota Nagpur, chiefly on the plateaux, frequent on firelines near Neterhat! Fl. r.s., Fr. Sept.—Oct.

6. *I. trita*, L. f.

Erect suffruticose slender 2—3 ft. with membranous 3-foliolate leaves, petiole .5—1.75", leaflets variable in size, .5—1.5", the lateral much smaller than the terminal, obovate or ell.-obovate, with rather dense appressed short hairs both sides. Fls. dark-red, at first close in racemes shorter than or much exceeding the leaves, short, then elongating to 1.3", 6—12 fld. Calyx white canescent. Pods somewhat reflexed .7—1" angular, hoary with appressed hairs, finely beaked, 6—10-seeded.

Not very common but wide-spread. Shahabad! Angul, Lacel! Fl., Fr. all the year round.

7. *I. enneaphylla*, L.

A herb, sometimes sub-woody at base, with numerous stems 8"—2 ft. long and small pinnate subsessile leaves .4—1.5" long with mostly 5—7 alternate (rarely up to 11) linear oblanceolate leaflets .2—8" long, the terminal usually largest, appressed hairy both sides, sometimes silvery beneath. Fls. small red clustered subsessile, heads dense sessile or shortly peduncled shorter than the leaf-rhachis. Ovary silky. Pod .12—1.7" oblong thinly silky 2-seeded.

Chota Nagpur, frequent in waste places! Monghyr! Fl., Fr. Aug.—Nov.

8. *I. endecaphylla*, Jacq.

In general appearance very like forms of *I. enneaphylla*, with many prostrate stems up to 2 ft. long. Leaf-rhachis usually .3—8" but in luxuriant plants up to 1.5", lfts. narrow oblong-oblanceolate 5—11, usually .15—5" long but attaining .9", strigose, mucronulate. Racemes longer than the leaves, many flowered, 1—2" or up to 3". Fls. .16—2" long. Pods .6—9" long with short slender beak, sometimes sub-four-angled.

Rare in our area. Behar, Kurz! Sirguja, Clarke! Fl., Fr. July—Jan.

Stipules scarious (as in *enneaphylla*). Bracts with setaceous tips, exceeding the buds, caducous. Calyx green, pilose. Corolla red, wings much shorter than the keel. Anthers greenish.

9. *I. pentaphylla*, L. Syn. *I. glabra*, L. (*Madras Flora*).

A rather variable diffuse often scraggy herb with numerous stems 8—15" long, hairy or sparsely hairy all over except the pods. L. membranous odd-pinnate with 7—3 leaflets, pairs opposite. Fls. small reddish or bright red usually 2—4 (rarely only one) in lax racemes with capillary peduncles .3—8" long. Pod slender straight turgid .7—1.2" tipped with the hardened style base.

Frequent in Chota Nagpur, chiefly in sandy soils! Lohardaga and Parasnath, Clarke! Fl., Fr. July—Dec.

Hairs for the most part simple. Lfts. elliptic or obovate, large and small, small often only .15", large .5—7", the larger ones often 3-nate. Pedicels very short. Calyx teeth three times the tube, silky. Standard .12—13".

10. *I. hirsuta*, L.

A suffruticose herb 2—4 ft. high, whole plant covered with spreading hairs or hairs adpressed on the leaves, hairs mostly simple (basifixed). L. 7—9-foliolate, stipules filiform 4—5", rhachis 2.5—3.5", lfts. opposite obovate or oblong, end one largest 1—2" with about 9 oblique sec. n. hairy both sides. Fls. pink in elongating racemes, 2—4" long in fruit. Conspicuous from the close strongly reflexed terete hairy and pubescent pods .5—7.5" long. Pedicels very short. Seeds about 5.

Common in Chota Nagpur in waste ground. Singbhum! Ranchi! Hazaribagh, Clarke! Palamau, Neterhat! Fl. rs. Fr. Aug.—Dec.

11. *I. arrecta*, Hochst. Java and Natal Indigo.

An erect deep-green rather strict but leafy undershrub 3—6 ft. high with angled and grooved thinly strigose stems, pinnate leaves 4—5" long with about 7 pairs and one odd leaflet and inconspicuous pink-red flowers in solitary axillary racemes 1.5" long, gradually elongating to 2—3" but only bearing pods near the base, which are straight and reflexed.

Cultivated in the indigo plantations and on the Ranchi plateau (for seed). Fls. Sept.—Oct. Fr. Nov.

Lfts. up to 17, median on the rhachis largest, .7—1.5", narrowly elliptic-oblong or oblanceolate thinly covered both sides with appressed short hairs, tip rounded or sub-acute mucronate, sec. n. 3—4 very faint. Stipules setaceous .17". Pedicels .03—07" erect. Bracts setaceous, very caducous, .03". Fls. .2" long. Calyx strigose, shallowly campanulate, cleft less than half way down into 5 sharply lanceolate teeth. Standard greenish, .2", brown-hairy as also is the keel which is prominently spurred. Wings pink. Free parts of filaments alternately rather longer and more slender than intermediate four. Pod with very sparse appressed hairs 1" long, about 8-seeded.

This is the indigo now generally grown in Bihar and Orissa. Most of the seed used in Behar and Tirhut now comes from Chota Nagpur or the United Provinces. When grown *in situ* the plants suffer from a disease called "wilt" and do not produce fertile seed (*Shillingford*).

12. *I. tinctoria*, L. Nil, H.; Sili bichi, S.; Wild indigo, or when cultivated, Ceylon Indigo.

A slender erect shrub 4—5 ft. high with weak sharply angled branches, odd-pinnate leaves, with two to four pairs of broadly elliptic or ell-ovate membranous lfts. .5—9" long and very slender axillary racemes of small red flowers .17" long. Pod straight or slightly curved (not seen in the Orissa plant) about 1" long pointed reflexed slender 10—12-seeded.

Wild in Orissa, Baruni Hill forest, under shade! Chota Nagpur, Wood, but almost certainly cultivated! Santal Parganas, Camp., probably cultivated! Bengal, J.D.H., without locality! Fl. Sept. Fr. Dec. Darbhanga and Purneah, cultivated specimens!

Branches with appressed hairs. Lfts. with rounded base and apex, usually nearly as broad as long but sometimes obovate or even oblanceolate and only .4—7.5" with white sub-strigose hairs beneath and more delicate hairs above, sec. n. very fine not visible above. Petiolules .05". Stipules setaceous .12". Stipellæ 0. Racemes at first equalling the leaves, elongating to 5" with very slender peduncles. Bracts setaceous .05". Pedicels about as long. Fls. .22" from tip of standard to tip of keel. Calyx hairy .12" equally 5-fid, teeth rather more than twice as long as tube, narrowly lanceolate acuminate. Standard sub-orbicular .17", keel spurred half-way up. Free parts of filaments 5 longer linear, 4 shorter lanceolate. Ovary

hairy, 6—7-ovuled in Orissa specimen, 10—12-ovuled in Bihar specimens and pod usually 10—12-seeded.

13. *I. sumatrana*, Gærtn. Syn. *I. tinctoria*, *F.B.I.* in part; Nil, *H.*; Bengal Indigo.

Scarcely more than a variety of the last. A somewhat stouter shrub, leaflets 9—15, longer than broad, obovate to narrowly elliptic .7—1" or sometimes 1.5 by .75". Racemes 3—6". Pods 1—1.25" stouter than in last, usually .1" broad and somewhat curved, obtuse, 8—10-seeded, usually reflexed. Standard 2".

Occasionally spontaneous in Tamarisk jungles and on river banks in Tirhut, *Praïn*. Purneah (see below)!

A form occurring as a wayside weed collected by me in Purneah has leaflets only .4—6" long and spreading shorter pods only .6—8" long with fewer seeds. It is probably a feral form.

14. *I. articulata*, Gouan. Syn. *I. cœrulea*, *Roxb.*; *I. argentea* var. *cœrulea* *F.B.I.*; Surat Indigo.

Very distinct from the two last. Branches sericeous. Leaf rhachis 2.5—3" with nearly always four pairs of obovate leaflets .75—1" long glabrous above. Racemes 1—2" elongating to 3" in fruit. Pods short and stout, somewhat like those of the wild *I. anil*, .3—4" long only, curved sausage shaped, densely hairy.

Patna, *Ham.*! Formerly cultivated in Behar. Fl., Fr. Oct., Jan., April.

15. *I. pulchella*, Roxb. Syn. *I. purpurascens*, *Roxb.*; *I. Jirahulia*, *Ham.*; *I. arborea*, *Praïn* (*Roxb.*?). Vern. Jirul, Jirahul, *Kharw.*; Hutar, Utar, *K.*; Dare Hutar, *S.*; Kilberi, *Ur.*; Giral, Gibri, *Or.*

A much branched shrub 4—10 fr. high with odd-pinnate leaves 3—8" long and 6—15 pairs of elliptic-oblong or oblong-obovate opp. and sub-opp. leaflets .5—2.2" long. Flowers pink or rose .5—6" long in numerous dense racemes which are axillary and from the axils of fallen leaves, with long boat-shaped acuminate, deciduous bracts covering the young buds. Calyx very oblique, often petaloid, broadly campanulate with lanceolate acuminate teeth. Pod straight slender 1—2" long, usually reflexed.

Common throughout the province but chiefly in hilly country. Fls. Nov.—March, chiefly in Feb., when it is more or less leafless in the dryer localities. Fr. Feb.—April.

Branches rarely quite glabrescent. Lfts. often emarginate, apiculate, appressed hairy both sides, rounded both ends. Calyx usually hairy. Standard ell.-oblong .5 by .3" neither clawed nor spurred, often with a white patch at the base.

There are two principal forms or varieties in our area:—

Var. *a.* ***purpurascens*, Roxb.** (sp.)=*I. Jirahulia*, *Ham.*

This is the common robust form with angled stems often quite hoary-hirsute when young but gradually becoming thinly appressed hairy or strigillose, the leaves somewhat sericeous and the inflorescence often with erecto-patent or spreading hairs. Lfts. not at all obovate, much firmer than in the next variety, often very large, up to 2.2" in exceptional cases. Bracts often far exceed the buds and end in long setaceous points. Standard with a white patch above claw at base (not recognisable in herbaria).

Roxburgh says that it is a native of the interior of the Peninsula, and I have found it in its best development on the hills and plateaux of the Central Provinces

and Chota Nagpur. (Wall. No. 5404 "e Loudon Gunti" is fairly typical, but Wall. 5404 "e Siupur" differs in being less hairy, leaflets smaller and the bracts without the long tip.)

Var. β . *pulchella* proper.

It is a native of damper localities, has more terete branches, is more green and far less hairy. Racemes less robust but more elongate often ultimately exceeding the leaves. Standard 4" relatively broader, without the white patch. Bracts without the long tip and therefore not exceeding the buds. Lfts. smaller, often somewhat obovate or ovate. Orissa!

NOTE.—All kinds of links connecting these two seem to be found (Gamble's No. 9270 from Orissa is one) and there is doubt as to the correct specific name of the group. *I. pulchella* was a Coromandel plant and *the type is not known*.* *I. arborea* adopted by Prain was a Srinagar (!) plant, and its description and figure moreover neither appear to me to belong to our common Indian forms. *I. elliptica* appears to be a glabrescent form, native of the eastern parts of Bengal. *I. purpurascens* is almost certainly the plant described above and is also Hamilton's *Jirahulia*, but against the adoption of this name is the objection to replacing such a well-established one as *pulchella* (which is contemporaneous) unless it can be shown to apply to a different plant.

16. *I. Hamiltonii*, Grah. in Wall. Cal. (No. 5465). Syn. *I. juncea*, Ham.

An undershrub with numerous diffuse strigillose branches from the root (never densely hairy), with odd-pinnate leaves 1—3.5" long with 2—4 prs. (sometimes only 1 pr. on new shoots after jungle fires), of orbicular or oval lfts. 5—6" long. Fls. red or deep pink 4—5" long in long peduncled racemes exceeding the leaves, with lanceolate concave caducous bracts 1". Calyx obliquely saucer-shaped membranous or petaloid with triangular or lanceolate puberulous and ciliate teeth.

On the higher plateaux of Chota Nagpur 3000—3500 ft. Fl. April—June. Fr. June—July.

Rhachis of leaf strigillose. Lfts. sometimes up to 6 pairs in unburnt specimens, thinly sericeous beneath, rounded or retuse sometimes apiculate. Calyx up to .15" long, posterior teeth rather shorter than anterior. Standard not clawed. Wings obliquely oblanceolate, slightly wider again at base with a callus and distinct claw, which is often nearly at right angles to the axis of the petal. Keel with curved claws and spurs about half way up. Ovules about 10. Pod (in Oudh specimens) 1—1.5" long, compressed and about 10-seeded.

I am doubtful whether this is always an undershrub. I have found a shrub on several occasions up to 5 ft. high with 5—13-foliolate leaves and small roundish leaflets which appears to me to be the unburnt form of this species, but inflorescence was not available.

8. PSORALEA, L.

Herbs or undershrubs with 1—3-foliolate leaves and repand or dentate gland-dotted leaflets. Stipules large, stipellæ 0. Fls. in spikes or racemes often sub-capitate, often 2—3 together in the axils of membranous bracts. Calyx campanulate. Keel incurved obtuse. Stamens 10 monadelphous or upper filament free, alternate free parts of filaments unequal. Ovary 1-ovuled. Pod ovate indehiscent.

* I have examined Kew, Calcutta, and the British Museum herbaria, and Mr. Craib informs me that the type is not in Edinburgh. It is unlikely therefore to be found.

1. **P. corylifolia**, DC. Babachi, *H.*; Barachi, *Beng.*; Bakuchi, *Or.*
The seeds have been asked for under the vernacular name of
"satbara."

A coarse herb 2 ft. high with sparsely hairy striate branches, simple broadly ovate repand-dentate long-petioled leaves about 3.5 by 2.5" and heads of small purple flowers on peduncles as long as or exceeding the leaves.

Occasional. Palamau, in the Sonc valley! Less common elsewhere. Fl., Fr. Nov.—Dec., annual.

L. strongly nerved, punctate beneath, base obtuse. Spikes .5—1". Peduncles 2—4". Fls. .25", calyx gland-dotted, anterior tooth half as long again as the others, wings exceeding the keel. Stamens with one filament free. Pod included densely gland-punctate and slightly hairy.

The seeds are laxative and stimulant. They yield a colourless essential oil.

9. TEPHROSIA, Pers.

Herbs, shrubs or usually undershrubs with odd pinnate leaves and opposite obliquely-parallel-nerved leaflets. Stipellæ small or 0. Fls. white or red usually in terminal or leaf-opposed racemes or sometimes also axillary. Calyx campanulate. Petals clawed, standard sub-orbicular, wings slightly adnate to the incurved keel petals. Stamens with vexillary filament connate above the base or free, anthers uniform. Ovary linear many ovuled, style incurved, often transversely flattened, glabrous or villous, with terminal often penicillate stigma. Pod linear compressed, not or slightly septate, dehiscent at both sutures. Seeds many, sometimes strophiolate.

I. Shrubs. Lfts. mostly over 1.3" long:—

Lfts. over 7 prs. Fls. white, .75—9"

Lfts. under 6 prs. Fls. red, 4—5"

1. *candida*.

2. *tinctoria*.

II. Undershrubs. Lfts. under 1.3". Style much flattened:—

A. Pods thinly appressed-hairy or glabrescent:—

1. Peduncles elongate with several nodes bearing 2—3 fls.

a. Style hairy above. Fls. over .4"

b. Style not hairy above. Fls. .2—3"

Erect bushy, densely sericeous. Fls. .3—35"

Diffuse, sericeous. Fls. .26—3"

Sub-erect, nearly glabrous. Fls. .26—25"

3. *maxima*.

4. *Hamiltonii*.

5a. *maritima*.

5. *purpurea*.

2. Peduncles with 1—3 fls. only, under .25". Stems villous, procumbent

6. *pumila*.

A. Pods with dense spreading hairs. Diffuse

7. *villosa*.

1. **T. candida**, DC.

A weak shrub 5—8 ft. high with sulcate grey sericeous branches, odd-pinnate leaves with 7 to 14 prs. of narrowly oblong leaflets 1—2" long which are grey-or white-silky beneath, and axillary and terminal elongate racemes 3—9" long of pure white (or reddish, *F.B.I.*) drooping flowers .75—1". Pod 3—4", brown, sericeous, slightly curved, 10—15-seeded.

Wild in the valleys of the Sameswar Hills! Cultivated on the Ranchi plateau and other places. Fl. Aug.—Oct. Fr. Nov.—Dec.

A pretty plant when in full flower. L. rhachis 4—7" long. Stipules .3" lanceolate erect with a setaceous tip. Lfts. somewhat narrowed each end, apiculate, with

many oblique sec. n. uniting in the marginal one. Petiolules .15". Racemes short-peduncled. Pedicels 3—5". Calyx rather oblique, .25—3" long anteriorly with triangular teeth as long as or shorter than the tube. Standard silky. Seeds smooth grey transversely oblong compressed .15—17" with white strophiole.

The plant is often grown on tea gardens, and at the Kanki Farm, as a green manure. It is also grown as an ornament.

2. *T. tinctoria*, Pers.

A much branched undershrub 3—3.5 ft. high with angular shaggily hirsute branches, sessile 3—5-foliolate leaves with oblong leaflets 1—3.5" long, densely grey silky-tomentose beneath, and axillary slender peduncles as long as the leaves with a short raceme of red flowers .5" long. Pod (unripe) 2—2.5" linear-oblong flattened thinly silky. Seeds 8—10.

Neterhat plateau, Seemah forest, elev. 3000 ft. Fl. Sept. Fr. Oct.—Nov.

L. rhachis .7—1", but sometimes a few simple obovate leaves on small lateral branches; petiole only 1". Lfts. increasing in size from base to apex of the rhachis, lowest about 1" and terminal 2—3.5", all with very numerous spreading secondary nerves up to the margin and forming a marginal nerve and intermediate reticulations. Stipules erect .2" lanceolate acuminate strongly nerved. Peduncles axillary, 1.2—3", with a close raceme 3—6" long hirsute closely bracteate, the bracts being furnished with stipules like those of the leaves. Pedicels only about as long as the bracts. Calyx campanulate silky-hirsute with 5 subequal setaceous teeth equal to or exceeding the tube. Corolla fugacious. Standard very silky-pubescent with green claw, retuse. Wings half as long, and keel a little longer than the wings. Fil. very slender. Ovary villous. Style shortly hairy and stigma minute penicillate.

This plant has hitherto been reported only from the Western Peninsula, Ceylon and Birma and some varieties have as many as 13 leaflets. It has axillary racemes notwithstanding that Baker in his Key to the Leguminosæ (*F.B.I.*, p. 57) distinguishes *Tephrosia* generically by its having leaf-opposed racemes.

3. *T. maxima*, Pers. Syn. *T. purpurea*, var. *maxima*, *F.B.I.*

Erect (often prostrate, Gamble) 2—2.5 ft. high, not bushy. Stems usually few sparsely villosely hairy. Leaves 2—3.5" with latticulate usually reflexed acuminate stipules and 5—8 prs. of obtuse leaflets with retuse apiculate tips. Corolla bright purple .5". Inflexed part of style villous. Pod nearly straight appressed pubescent or glabrescent, 2—2.5", 10—12-seeded.

Open ground, Puri! Fl., Fr. Aug.—Oct.

Lfts. 4—6.5" long thinly appressed villous beneath. Petiolules short but slender. Racemes terminal often 5" long with distant nodes. Bracts small lanceolate shorter than the pedicels. Standard silky. Seeds ell.-oblong not reniform.

4. *T. Hamiltonii*, Drummond. Syn. *T. purpurea*, *F.B.I.* in part; *T. sericea*, Ham. Vern. names the same as for *purpurea*.

A bushy undershrub about 2 ft. high with angled sericeous or villous branches, sometimes flexuous. Leaf rhachis 2—2.5". Stipules subulate setaceous 3—3.6" long. Lfts. 6—8 prs. oblanceolate to obovate closely sericeous beneath, .6—1.3" long, apex rounded straight or emarginate. Racemes terminal elongate with several nodes and often more than two flowers to a node. Bracts subulate shorter than the .1—1.4" long pedicels. Calyx sub-appressed-hairy broadly campanulate .12—1.8", teeth subequal subulate acuminate rather longer than tube.

Corolla .28—.38" broad not emarginate grey purple, pubescent outside. Pod 1.3—1.6" long slightly recurved above, with short appressed hairs, 6—7-seeded.

Common, often gregarious. Bihar and Chota Nagpur! Fl., Fr. Sept.—Dec.

This appears to be the *T. sericea* of Hamilton, but as that name is preoccupied I have adopted Mr. Drummond's name in the *Flora of Madras*.

5. *T. purpurea*, Pers. Sarphuka, H., Kharw.; Ban-nil, Beng.; Wild Indigo (of some Anglo-Indians).

Usually sub-erect with rounded glabrous or slightly hairy stems, filiform-subulate stipules, 5—7 prs. of oblong-cuneate glabrous or slightly appressed hairy leaflets with .75—1" long leaflets with rounded or slightly retuse mucronate apex. Fls. .25" long, purple in elongate lax racemes up to 5" long with three or more nodes, each bearing 1—3 fls. in the axils of seraceous bracts about as long as or shorter than the slender .1—1.6" long pedicels. (The bracts are usually ternate, being the bract proper and its two stipules.) Calyx .15—.16" long strigosely hirsute with narrow-lanceolate or subulate finely acuminate teeth exceeding the tube. Standard .15", broad, blade scarcely broader than long, scarcely emarginate. Style transversely flattened and glabrous above (as in the rest of this group). Pod 1.5" nearly straight erecto-patent appressed puberulous (glabrous in Willdenough's type), 6—10-seeded.

Waste ground, chiefly in sandy places. Common in Chota Nagpur! Fl., Fr. r.s. to c.s.

The branches are sometimes zig-zag.

Var. *a. maritima*.

Sub-erect or diffuse, branchlets angled more hairy or sericeous. Stipules subulate. Lfts. 5—8 prs. oblanceolate, finely sericeous beneath, .4—.55". Fls. .26—.3" in many pairs, fascicles or single in the short bracts. Calyx broadly campanulate, thinly downy, teeth broadly lanceolate or lanceolate. Standard .28" diam., blade broader than long, distinctly emarginate. Pods much as in the type but spreading and reflexed.

Orissa, near the sea! Fl., Fr. May.

This is perhaps as distinct a species as *T. Hamiltonii*, but without more specimens it appears undesirable to separate it. It unites *purpurea* and *Hamiltonii*.

6. *T. pumila*, Pers. Syn. *Galega diffusa*, Roxb.

Diffuse with many procumbent villosely hairy branches. Stipules setaceous. Rhachis villous with seven or more pairs of obtuse leaflets .45—.7" long densely sericeous beneath and less so above with rounded or emarginate apex. Fls. .2—.25", red, usually only about three towards the ends of slender peduncles. Calyx lobes setaceous-acuminate, twice as long as the tube, densely hairy. Standard sub-orbicular. Pod straight, nearly glabrous, 6—7-seeded.

Dry waste ground, Chota Nagpur! Fl. r.s. to c.s.

7. *T. villosa*, Pers. Syn. *Galega villosa*, Roxb.

Diffuse with flexuose somewhat hoary stems. Lfts. 6—8 prs., cuneate, somewhat emarginate. Stipules ensiform. Flowers in several prs. Pods much recurved, covered with white hairs, 5—6-seeded.

Behar, *Prain*.

I have seen no specimens from our area.

10. SESBANIA. *Pers.*

Herbs or shrubs or small soft-wooded trees, sometimes with small prickles. L. odd- or even-pinnate with very numerous narrow leaflets and narrow stipules. Fls. usually rather small, very large in *S. grandiflora*, in lax axillary racemes. Calyx teeth short sub-equal. Corolla exserted, petals long-clawed, keel petals obtuse, or in *S. grandiflora* sub-rostrate. Stamens 9 + 1 with uniform anthers. Ovary linear, stipitate, many-ovuled, style filiform, incurved, glabrous. Pod very long linear, septate, dehiscent, many-seeded.

- | | |
|---|-------------------------|
| I. Flowers very large, white or sometimes red | 1. <i>grandiflora</i> . |
| II. Flowers small or moderate-sized, under 1". | |
| A. Woody perennials without prickles | 2. <i>ægyptiaca</i> . |
| B. Annual, often tall, scarcely woody, sometimes prickly. | |
| Tall. Fls. .75". Pod pendulous | 3. <i>paludosa</i> . |
| Often dwarf. Fls. 4—5" long. Pod ascending | 4. <i>aculeata</i> . |
| Diffuse. Pod erect | 5. <i>uliginosa</i> . |

The roots of the *Sesbanias* are copiously covered with large root tubercles which should make them a good green manure. The cotyledons are large epigeal, the first leaf is simple obovate or sub-three-lobed.

1. *S. grandiflora*, Pers. Syn. *Agati grandiflora*, Desv.; *Agati*, Vern.; *Basna*, H.; *Buka*, Beng.

A small tree attaining 25 ft. high and nearly 2 ft. girth with straight stem and spreading branches. Leaves 6—12" long with 10—20 prs. of leaflets and an odd one. Lfts. linear-oblong about 1" long. Flowers very large 3—4" long white, or in one variety red, in lax 2—4-fl. racemes. Pods long slender curved, 12—18".

Often cultivated in gardens but rarely lives more than 3 years. It grows best on black-cotton soil. Fls., Fr. chiefly c.s.

The young leaves are eaten but they are said to be aperient. The juice of the flowers is said to improve the sight when squeezed into the eyes. It is also a popular remedy for catarrh.

2. *S. ægyptiaca*, Pers. *Jainti*, Beng.

A large shrub or small straight tree attaining 15 ft. in height with pinnate leaves 4—6" long ending in a point, 12—20 pairs of close-set linear oblong leaflets .75—1.2" long and yellow, or variegated with orange, red and deep purple, flowers .5—7" in very lax axillary racemes. Pod twisted 6—9" slender, thin, torulose.

Gardens and waste ground. Sometimes coming up as though wild. Fls. Oct.—Dec. Fr. Nov.—Jan.

Lfts. glabrous or sparsely appressed pubescent below. Flowers 2—10. Pedicels .2—4". Standard sometimes nearly black outside, .7" broad.

It germinates readily from seed and only lives about three years giving a light

shade, and may be used as a nurse to other plants, especially as it is copiously furnished with root tubercles.

The form with yellow flowers is considered the type, that with the standard dotted purple is sometimes called var. *picta* (Prain) and that with the deep purple or black standard var. *bicolor* (W. & A.).

3. *S. paludosa*, Prain. Syn. *S. aculeata*, var. *paludosa*, *F. B. I.*; Kathsola, *Beng.*

An erect annual 6—12 ft. high like a miniature tree, with a stout swollen tap root and lower part of stem swollen and pith-like, above green and shining. Leaves 6—12" long with 10—30 prs. of oblong slightly tapering leaflets 1" or more long, apiculate, thinly hairy beneath. Stipules caducous, semi-lanceolate. Flowers 1" yellow with standard purple-dotted. Pod linear pendulous 10—12 inches long, somewhat spiral, slightly moniliform.

In jheels and swamps. This probably occurs in Purneah and Santal Parganas, but was included formerly under *S. aculeata* in my notes. Central Bengal, *Bengal Plants.* Fl., Fr. r.s.

4. *S. aculeata*, Pers. Syn. *Æschynomene spinulosa*, *Roxb.*; Chaipijan, *K.*

An erect annual somewhat resembling the last on a smaller scale, reaching 4—5 ft. in height and muricate or with small weak prickles on the branches and leaf rhachis. Leaves 6—12" long with 20—40 prs. of linear leaflets 2—6" long, obtuse apiculate, glabrous. Stipules minute, caducous. Fls. 3—5" long. Pod ascending very slender 6—9" long, beaked, straight sub-moniliform.

In wet places, common in the rains, all districts! Fl., Fr. Aug.—Oct.

5. *S. uliginosa*, Roxb.

Of this species, also, no separate record has been kept and there are no specimens from our area, although I believe I have often observed it. The stems are diffuse. Lfts. 1—2". Fls. 2", sometimes clustered. Pods sub-erect, 2.5—3.5".

11. MILLETTIA, W. & A.

Trees or shrubs, often (in our area always) climbing, with odd-pinnate leaves. Stipellæ present or not. Flowers usually showy in axillary, often fascicled racemes, or racemes paniced and terminal. Calyx campanulate, lobes short or 0. Petals with long claws, standard broad. Stamens with vexillary filament free or connate only from the middle, anthers uniform. Ovary sessile linear few-ovuled. Style filiform incurved glabrous with capitate stigma. Pod linear or oblong, dehiscent or sub-indehiscent.

The species closely resemble those of the genus *Derris* in flower. The anthers in the latter genus are however versatile and stipellæ always absent.

Standard auricled. Pod flat, very tardily dehiscent

1. *auriculata*.

Standard not auricled. Pod torulose, dehiscent

2. *racemosa*.

1. *M. auriculata*, Baker. *Gaj, H.*; *Hehel, K., S.*; *Gurar, Kharw.*; *Arkawla, Or.*; *Gora, Ganj, Th.*

A large shrub, sub-erect or climbing, with leaves 1—2 ft. long and 3—4 prs. of strongly nerved leaflets thinly silky beneath. Fls. 4—5",

cream-coloured, fascicled on numerous racemes 4—9" long, which are often clustered on short stout axillary peduncles. Pod flat, but not thin, woody, tomentose, 4—6" by .75" with thickened sutures.

Throughout the whole province. In a semi-erect state often forming a dense undergrowth in many of the Sal forests in the valleys.

Fls. March—June. Fr. Jan.—March.

Innovations silky-tomentose. Lfts. obovate-oblong cuspidate 3—8" long, terminal largest, sec. n. 8—12, stipellæ minute. Racemes dense silky. Pod very late in dehiscing.

It is cut as a fodder. The root, like some other species of *Milletia*, is used to kill fish. It is also used for killing insects on cattle sores.

2. *M. racemosa*, Benth. Gaj (confused with the last), *H.*; Junginar, *Gond.*

A large climbing shrub with white bark on the branches; leaves about 1 foot long with 5—8 prs. of nearly glabrous lfts. Stipules large, filiform. Fls. cream or reddish .4—5" in copious racemes 10—18" long with very conspicuous villous setaceous subulate bracts .3—4" long. Pods 4—8" by .3—6" linear, torulose with 2—4 tapering segments, black and readily dehiscent when ripe.

Chota Nagpur, chiefly in rocky ravines above 1500 ft., not common! Rajmehal Hills, rare! Rocky ravines in Angul, frequent! Puri, *Gamble!* Sambalpur, Jhargati forest! Fl. May—July. Fr. Jan.—March. Deciduous April.

Old bark brown and uneven. Blaze pink and pale-yellow. Shoots tomentose. Lfts. oblong-obovate sometimes wavy shortly often obtusely cuspidate, brown-silky along the mid-rib beneath, end one largest 3—4" by 1.5—2". Petiole thinly silky. Stipellæ setaceous. Petals glabrous, standard orbicular-elliptic, wings spurred. Ovary 6-ovuled.

Uses as in last.

12. ABRUS, L.

Climbing shrubs with multi-jugate deciduous leaflets and rhachis ending in a point. Fls. small or m.s. pedicelled fascicled on the swollen nodes of axillary racemes or short axillary branchlets. Calyx campanulate with very short teeth. Standard ovate short-clawed slightly adnate to the staminal tube. Stamens 9 in a slit tube (place of upper vacant). Ovary sub-sessile, ovules several. Pod flat or turgid.

Pod flat, seeds compressed. Lfts. oblong

1. *pulchellus*.

Pod turgid, seeds round. L. linear or linear-oblong

2. *precatorius*.

1. *A. pulchellus*, Wall.

A pretty climber, leaves with rhachis 3.5—5.5" and oblong leaflets 8—15 prs., .5—1.2" by .25—5" or .6", apiculate, with appressed hairs beneath. Stipellæ minute subulate. Fls. pink .48" long, at first in short racemes but with the peduncle often attaining 6" in fruit. Pods often geminate at the nodes 2.5—3" long, thinly sericeous, about .44" broad. Seeds compressed ellipsoid .2" grey-black shining, in the hollows of a papery endocarp.

In the Northern Tract only. Champaran and Purneah! Fl. Aug.—Sept. Fr. Dec.—Jan.

2. **A. preicatorius**, L. Kawet, S.; Karjani, K.; Karjain, *Knarw.*; Gumchi, rati (the seeds), H.; Sonkach, Kunch, *Beng.*; Runj, Gunja, *Or.*; Indian Liquorice; Crabs' Eyes (the seeds).

A pretty twining slender shrub with same habit as last, leaves 2—3.5" long with 10—20 prs. of leaflets .3—7", glabrous or silky beneath. Fls. usually a pale pinkish white .3" in crowded racemes 1—3" long. Pods about 1.5" long turgid. Seeds polished, usually a brilliant scarlet with a black eye but sometimes white.

Hedges and waste lands on bushes. Common in the Central and Southern tracts! Purneah! Fl. Aug.—Sept. Fr. Jan.—March or even May.

Very pretty in ripe fruit when the pods open and disclose the seeds.

These seeds contain a poisonous albuminous substance; the active principle, *abrin*, has been isolated. Powdered and the powder boiled in milk it is said to be a powerful tonic, uncooked it is purgative and emetic and in large doses gives rise to symptoms like cholera. The powdered seed is also said to be used by chamars for poisoning cattle by hypodermic introduction with a needle (*sui*). The root is made use of in the same way as liquorice root. The juice of fresh leaves is said to remove the spots of leucoderma. Indian medical works give several other uses.

The seeds, rati, are used by Indian jewellers as a weight; each is said to constantly weigh 1.75 grs.

13. CICER, L.

Annual herbs with usually odd-pinnate leaves and toothed leaflets. Stipules sometimes coarsely toothed, conspicuous, stipellæ 0. Flowers solitary axillary. Calyx-tube oblique, teeth sub-equal lanceolate. Stamens 9+1. Style beardless. Pod sessile oblong turgid, usually conical at tip, style persistent. Seeds with a slender funicle.

1. **C. arietinum**, L. Bhut, S.; Chota but, Butkalai *Beng.*; Chana, H.; Moraijan, K.; Chicken-pea, Bengal gram, Horse gram.

A pretty herb about 1 ft. high, much branched and viscous hairy. Leaf rhachis 1—2" long with small toothed strongly-nerved leaflets .15—3" long. Fls. bluish-purple .27—3" long on slender peduncles. Pod oblong .75—1" long, 2-seeded.

A common cold-weather crop. Fl. Jan.—Feb.

It is largely eaten and horses and sheep are largely fed on it. It contains much oxalic acid. The liquid obtained from macerating the seeds is tonic and anti-bilious.

14. VICIA, L. Vetch.

Herbs, usually climbing by means of a twisted tendril into which the end of the leaf or leaf-rhachis is modified, rarely erect or diffuse and rhachis ending in a point. Leaves even-pinnate. Fls. often showy, sometimes very small, axillary or in axillary racemes. Calyx campanulate, often oblique, teeth unequal. Corolla exserted, wings adnate at the middle to the shorter keel and to the staminal tube. Stamens 9+1, mouth of sheath very oblique. Ovary 2—many-ovuled, style filiform or slightly flattened, usually pubescent or bearded. Pod compressed, continuous within.

(The genus is chiefly one of temperate climates.)

I. Climbing or diffuse slender herbs, Rhachis ending in a tendril.

A. Flowers few, very small, .25" or less.

Lfts. 6—8 prs., pods hairy, 2-seeded.

Lfts. 3—6 prs., pod glabrous, 3—8-seeded

B. Flowers .75", 1—2-axillary

1. *hirsuta*.2. *tetrasperma*.3. *sativa*.4. *faba*.

II. Stout, erect. Rhachis ending in a point or tendril

1. **V. hirsuta**, Koch. The common Tare, Hairy Tare.

A graceful delicate climber with very numerous branches and slender leaves ending in branched tendrils. Lfts. alt. or opposite, usually 9—11 in our area, about .3—7" long linear or somewhat broader upwards or linear-oblong. Fls. pale blue .12" long 1—6 but usually 4-flowered at the end of a slender peduncle. Style equally pubescent all round. Pod hairy oblong or rhomboid oblong .25"—.35" long, 2-seeded.

Fields, Bettiah! Champaran! Hazaribagh, Wood! Fl., Fr. Dec.—April.

2. **V. tetrasperma**, Moench. Syn. *V. gemella*, Crantz.; The Smooth Tare.

Habit similar but less graceful, leaflets usually 6—8 only, paired or not. Peduncles only 1—2-flowered. Fls. larger. Pod shortly stipitate glabrous 3—8-, usually 4-seeded.

Dinajpur district, on the edge of our area!

3. **V. sativa**, L. Ankari, Beng.; Rothi, Or.; Common Vetch.

A diffuse herb with angular stems, leaves hairy with rhachis ending in a short tendril, 4—6 prs. of obovate or oblong or linear-ligulate leaflets .5—1" long with truncate or retuse tip. Stipules semihastate often with a dark blotch, toothed or entire. Flowers .75" pale purple, solitary or paired, sub-sessile. Style bearded on the lower side near the tip. Pod linear 1.5—2" flat, 8—10-seeded. Seeds sub-globose.

Not common but fairly general, from Behar to Angul! Said to be self-sown. Fl., Fr. c.s.

It is a favourite fodder with cattle. Often cultivated outside our area.

The variety with leaflets all elliptic or ovate-oblong, the lower ones shorter and broader, is only known in cultivation.

Variety *angustifolia* has leaflets of upper leaves linear-lanceolate, lower ones obovate retuse or obcordate and more patent pods, and appears to be the form wild in temperate regions.4. **V. faba**, L. Field Bean, also Broad or Windsor Bean.

Stem stout erect 1—2 feet high. Rhachis ending in a point or short tendril, leaflets 2—3 prs., 1.5—3" long, elliptic-lanceolate. Flowers white 1" long.

Cultivated in Bettiah, etc.! Native of Persia and the Caspian region.

15. LENS, Gren. & Godr.

Annual herbs differing from *Cicer* chiefly by the rhachis ending in a tendril or point, rarely with a terminal leaflet, lfts. entire, fls. sometimes shortly racemose, wings more or less adnate to the keel and to the staminal tube, the style bearded longitudinally on the inner face and by the short funicles.

1. **L. esculenta**, Moench. Cicer Lens, Roxb.; Ervum Lens, F. B. I.; Masur, Masuri dal, H., Beng.; The Lentil.

With somewhat of the habit of *Cicer arietinum*, 1—2 ft. Branches angular. Leaflets from 4—6 prs., sub-opposite, pubescent, lanceolate. The short axillary peduncle bears usually 2 small white or pale blue flowers and ends in a bristle. Pod oblong rhomboidal glabrous with two round compressed grey seeds with minute spots.

Cultivated largely in Behar, occasionally in other districts.

It is a valuable food and is said to have the property of preventing constipation

16. LATHYRUS, L. Vetchling.

Scarcely differing from *Vicia* except that the staminal sheath is truncate and the style instead of being filiform is flattened upwards, always hairy beneath the stigma.

This is also chiefly a genus of the North Temperate zone.

1. **L. sativus**, L. Kansari, kesari, H.; Teora, Beng.; Chana, Or.

A very pretty little plant with winged stems. Leaves with 2 rarely 4 linear leaflets 1—2.5" long and rhachis ending in a tendril. Stipules lanceolate with a sharply lanceolate auricle, very variable in size, from .3" to nearly 1" including the auricles. Flowers solitary axillary bright blue .75". Pod dorsally 2-winged.

Sometimes cultivated as a second crop, but very general self-sown. Fl., Fr. Dec.—March.

It is largely eaten, but its continued use induces paralysis, *lathyrismus*, or hemiplegia, both in human beings and cattle. The toxic property has been traced to an alkaloid which is volatile and can be dissipated by heat. It should therefore be cooked at a high temperature.

2. **L. aphaca**, L.

An interesting little herb from the leaves being altogether reduced to tendrils at the base of which the large hastate ovate foliaceous stipules perform the function of leaflets. Fls. yellow, 1 rarely 2 axillary. Pods 1" sub-falcate, seed black, smooth, compressed.

Bihar and Chota Nagpur, but rare. In cultivated fields. A native of Europe including the British Isles.

17. PISUM, L. Pea.

The genus differs from *Vicia* chiefly in the truncate staminal tube and in the style, which is hard, inflexed dilated above but with margins bent back forming more or less of a channel beneath; bearded below the stigma.

1. **P. arvense**, L. Matar, H.; Batura, K.; The Field Pea.

Leaflets 2—3 prs. sharply toothed often smaller than the large auricled foliaceous stipules. Standard pale purple or white, wings and keel purple. Seeds brown, marbled or (teste *Praim*) grey or purple, mottled, angular.

Cultivated in Chota Nagpur!

2. *P. sativum*, L. Matar, H. ; The Garden Pea.

Closely resembling the last but flowers entirely white, seeds not angled, pale yellow or green.

Roxburgh says that this is the Patna or common white field pea, and the *Choota Mutur*, a small, round greenish variety of the common grey field pea. The former is cultivated extensively about Patna, and the other over every part of Bengal.

18. LESPEDEZA, Mich.

Shrubs or herbs with exstipellate 3-foliolate leaves. Flowers axillary or racemed. Calyx campanulate with narrow teeth. Corolla with broad standard. Stamens 9+1. Ovary only 1-ovuled with long slender incurved style and minute stigma. Pod of one small oblong compressed indehiscent reticulate joint.

Lfts. linear. Keel obtuse
Lfts. obovate. Keel incurved acute

1. *sericea*.
2. *macrostyla*.

1. *L. sericea*, Miq.

An undershrub with few long erect slender branches and close-set very shortly petioled leaves with linear-cuneate leaflets, in the axils of nearly all of which are abbreviated bracteolate racemes of 2—4 small white-purplish flowers 17—25" long. Pod .08—1" orbicular-oblong.

Bihar, *Kurz!* Neterhat, 3000 ft. Fl. r.s. Fr. Dec.—Jan.

Stems sulcate, thinly hairy. Lfts. .25—.7" long with truncate or emarginate apex and a bristle in the sinus, with close ascending parallel lateral nerves, sericeous beneath. Racemes rarely elongating to one inch, bracts filiform persistent.

2. *L. macrostyla*, Baker.

A much branched shrub 3—4 ft. high with silky or densely pubescent branches clothed with short-petioled 3-foliolate leaves. Lfts. small obovate. Fls. pink 4" long in fascicles or very short racemes in the axils of the leaves or of bracts. Pod thin .25—.3" long.

On the top of the Sameshwar Hills (2884 ft.). Fl., Fr. Nov.—Dec.

Shoots densely silky tomentose. L. rhachis (with petiole) .2—1" only. Stipules .1" brown nerved lanceolate or ovate acuminate. Lfts. .3—.8" appressed hairy or sericeous beneath, glabrescent above, tip rounded or mostly emarginate with the strong mid-rib produced into a seta; sec. n. about 7 not clearly distinguishable from the very reticulate raised intermediate and tertiaries. Petiolules very short. Fascicles with a very short rhachis so that the fls. are really shortly racemose. Pedicels .07" elongating to .2" in fruit. Fls. opening one at a time. Calyx campanulate with teeth rather longer than the tube, lower 3 setaceous, upper combined lanceolate. Standard obovate .3" with green central spot, claw 0. Wings slightly adherent to the up-curved acute keel. Ovary densely bearded above with long hairy style which breaks above the base leaving an awn on the fruit. Pod oblong acute flattened villous, venose.

Distrib.: Himalayas, Simla and Garhwal to the Khasia Hills.

19. ALHAGI, Desv.

A low thorny shrub with simple leaves and small flowers in short racemes with a thorn-tipped rhachis. Calyx teeth short. Corolla exerted, standard obovate, wings free, keel incurved obtuse. Stamens 9+1. Ovary many-ovuled with filiform incurved style and capitate

stigma. Pod linear, rather stout, indehiscent, septate and constricted between the seeds.

1. A. camelorum, Fisch. *A. maurorum, Desv.* Juwasa, *H.*

Thorns 2—1.5" long sometimes very slender. Leaves oblong mucronate obtuse drooping, 4—9" rigid glabrous. Flowers 3" red in racemes 1—1.5". Calyx glabrous 1". Pod 1" straight or curved, moniliform.

Dry waste ground, Gya; Ganges banks, down to Patna, *Kew Herb.* Near Monghyr, *Haml Mudden*

The thorns usually are derived from one out of a pair of axillary buds and frequently develop as small branches. L. sometimes slightly hairy, in up-country specimens often only 3", base sometimes narrowed.

20. ZORNIA, Gmel.

Small herbs with pinnate leaves with only 1—2 pairs of leaflets more or less punctate beneath and small flowers in elongate racemes furnished with pairs of large foliaceous bracts. Calyx minute, teeth unequal, upper connate. Corolla exerted with acute incurved keel. Stamens monadelphous with dimorphous anthers. Ovary several-ovuled with filiform incurved style and minute stigma. Pod of one-several small round flattened sometimes finely muricate joints.

1. Z. diphylla, Pers.

A small wiry herb 6—12" with comparatively long petioled 2-foliolate leaves with lanceolate leaflets 5—1" long and minute yellow flowers sessile between and hidden by the geminate peltately attached doubly-lanceolate bracts which are 3—4" long and gland dotted like the leaves.

Chota Nagpur, open grassy places, common. Fl. Fr. r.s.

Branchlets and minute petiolules pubescent. Stipules small peltately attached deciduous. Bracts long-ciliate. Joints of pod often only one, very reticulato-venose, slightly bristly.

21. STYLOSANTHES, Sw.

Undershrubs or sub-herbaceous with pinnately 3-foliolate leaves and stipules sometimes adnate to the petiole. Flowers small in short capitate spikes. The structure of the flowers is remarkable, the calyx-tube being relatively very long and slender and there is an epicalyx of ciliated bracteoles at its base which in fruit simulate a true calyx. Calyx membranous, upper teeth more or less connate, anterior longer. Petals inserted in the throat of the calyx-tube or hypanthium, wing petals free or united at the tip. Stamens monadelphous, dimorphous, alternately with linear and very short anthers. Ovary subsessile 2—3-ovuled. Pod with 1—2 compressed rugose joints.

1. S. mucronata, Willd.

A procumbent herb or undershrub with a woody rootstock and spreading tough silky-villous branches 8—12" long and small leaves with leaflets 3" long. Small yellow flowers 2" wide solitary in the axils of bracts which are arranged in short capitate spikes or are

axillary. Pod very small woody beaked 1- or sometimes 2-jointed and -seeded.

Sand dunes of the Orissa coast! Fl., Fr. Aug.—Sept.

Petiole and rhachis .23—3" adnate in its lower half to the connate cuspidate setose stipules. Lfts. rarely .5" slightly hairy and thinly silky, tip rounded or acute, mucronate; terminal with a minute but distinct petiolule above the rhachis, sec. n. about 4 oblique. Spikes .25—.5" sessile leaf-opposed, ultimately lateral and long-peduncled or at the end of a slender branch bearing 1—2 bract-leaves. Bracts various, lower petioled and stipulate like the leaves or lanceolate and pungent or reduced to the stipules which are persistent and striate. Calyx-tube .25" long, bracteoles .13" long.

22. ARACHIS, L. Ground Nut.

Herbs with even-pinnate leaves and usually only 2 pairs of leaflets. Stipules adnate to the petiole, stipellæ 0. Fls. yellow or white in a sessile axillary capitate spike, remarkable as in *Stylosanthes* by the very long slender hypanthium. Calyx-lobes 5, the 4 upper connate, the anterior free. Petals and stamens inserted on the throat of the hypanthium, keel incurved beaked. Stamens 9 or 10, monadelphous, 5 alternate anthers shorter and dorsifixed, others longer basifixed. Ovary 2—3-ovuled, raised after flowering by the elongating torus which finally becomes stalk-like and curves down towards the ground burying the fruit. Pod indehiscent with a thick reticulate pericarp.

1. *A. hypogea*, L. Chini-badam, mat-kalai, bilaiati-mung, Vern.

A small bushy plant. The well-known Earth-nut or Ground-nut.

Cultivated in all districts and becoming an increasingly important crop. Probably native of Brazil.

23. SMITHIA, Ait.

Herbs or undershrubs with even- rarely odd-pinnate leaves and usually small leaflets, rhachis ending in a bristle when even-pinnate. Stipules scarious, persistent, usually appendaged at the base. Flowers usually yellow, rarely bluish, in dense, more rarely lax, often unilateral racemes; bracts and bracteoles like the stipules. Calyx deeply 2-lipped, lips toothed or not. Corolla exerted, wings clawed and auricled. Stamens 5+5. Ovary many-ovuled, style filiform, stigma small. Pod of flattened or turgid 1-seeded joints folded together inside the calyx. Seeds reniform.

I. Flowers yellow. Calyx nerves parallel.

Flowers collected into heads with their supporting leaves

Flowers in peduncled heads, free of leaves

II. Flowers blue-white, calyx nerves reticulate

1. *conferta*.

2. *sensitiva*.

3. *ciliata*.

1. *S. conferta*, Sm. Syn. *S. geminiflora*, var. *conferta*, F. B. I.

A herb with numerous spreading branches 12—18" long with pinnate leaves .7—1.5" long, setose along the rhachis and midrib and margin of the linear-oblong leaflets, remarkable for the large persistent scarious stipules with long-tailed auricles. Fls. yellow clustered in the axils of the close-set terminal leaves of short lateral shoots, subsessile. Pod moniliform, the joints connected by the dorsal suture only.

Banks of rice fields, rivers, etc. Probably in all districts. Fl. Sept.—Oct. Fr. Oct.

Stems not bristly, much branched. Leaf rhachis with rigid setæ or bristles $\cdot 1''$ long, and ending in a bristle. Lfts. 5—9 prs., $\cdot 3$ — $\cdot 5''$ long, tip rounded or acute, mid-rib ending in a seta, lateral nerves very obscure. Fls. capitate, subsessile, 2—7 together, $\cdot 4''$ long; bracts and bracteoles resembling the calyx in texture. Bracteoles $\cdot 2''$ obovate obtuse bristly and ending in a long bristle. Calyx lips $\cdot 3''$ acute posterior slightly longer ovate or ell., scarious with numerous close parallel veins with a few bristles along mid-rib and apex. Corolla shortly exerted. Standard $\cdot 2''$ broad, broadly oblong but narrow at base. Wings and keel petals oblong subsessile, spurred. Disc annular. Ovary deeply jointed. Pod about 7-jointed $\cdot 3''$ long.

2. *S. sensitiva*, Ait.

A much branched procumbent elegant little plant with stems up to 1 or 2 ft. long. Leaves $\cdot 3$ — $\cdot 1''$ sensitive, rhachis bristly and ending in a bristle, lfts. 4—12 rarely up to 20 linear $\cdot 15$ — $\cdot 5''$ long ciliate or bristle-ciliate on the midrib below and less so on margins. Flowers 1—6 in a close peduncled raceme with short ascending pedicels, bright yellow. Calyx with acute entire lips with a few short deciduous bristles, nerves close parallel. Corolla with a brown band in the throat. Joints of pod 4—6, face to face when ripe and papillose, or with small acute warts.

Purneah! Santal Par., *Gamble!* Singbhum! Manbhum! Not nearly as common as the last. Fl., Fr. Oct.—Nov.

Peduncles slender $\cdot 5$ — $\cdot 1''$ usually longer than the leaves, racemes capitate $\cdot 3$ — $\cdot 4''$. Fruiting calyx with included pod $\cdot 25$ — $\cdot 27''$ with 2 bracteoles at base $\cdot 12''$ long.

3. *S. ciliata*, Royle.

A delicate species with diffuse branches 4—10" long. Leaves $\cdot 5$ — $\cdot 7''$ with 6—10 leaflets about $\cdot 3''$ long or less, linear, close, bristle-ciliate on the midrib and less so on margins, minutely punctate. Fls. in small peduncled heads with reticulate-venose long ciliate calyx $\cdot 2''$ long, upper lip truncate. Corolla bluish or bluish-white.

Frequent on the top of Parasnath! Fl., Fr. Sept.—Oct.

24. *ÆSCHYNOMENE*, L.

Erect herbs or undershrubs with pinnate leaves and very numerous close-set small linear leaflets. Flowers m.s. or small in sparse racemes with deeply 2-lipped calyx. Stamens 5+5, anthers uniform. Ovary stalked, linear, many-ovuled. Pod linear or linear-oblong stalked exerted, flat, articulate with several 1-seeded joints.

Stems slender. Fls. $\cdot 25$ — $\cdot 35''$

Stems swollen. Fls. $\cdot 75''$

1. *indica*.

2. *aspera*.

1. *Æ. indica*, L.

An erect slender suffruticose annual 2—3 ft. high with numerous slender terete branches more or less scabrid with small warts or papillæ, slender pinnate leaves $\cdot 75$ — $\cdot 3''$ long with close set minute leaflets $\cdot 1$ — $\cdot 15''$ long, small yellowish or white flowers in lax 1—4-fl. terminal racemes and linear-oblong 5—10-jointed pods 1— $\cdot 15''$ long.

In wet places in the rains. Very common, and probably in all districts. Fl., Fr. Sept.—Nov.

Papillæ on stem, branches, leaf rhachis and usually pods crowned with a delicate deciduous hair, upper parts also glandular. Lfts. linear-oblong 20—30 prs. uppermost usually alternate, 1-nerved, mucronulate. Stipules ciliate-toothed, lanceolate .2" including the large auricle, deciduous. Fls. .25—35" with a deciduous ovate toothed bract at base of pedicel and 2 oblong-lanceolate bracteoles at base of calyx, often gland-ciliate. Calyx membranous glabrous subequal .17—2". Standard obovate nearly equal to wings and obtuse keel. Free part of filaments longer than connate portion. Joints of pod smooth or papillose and sometimes (in a Ranchi specimen) verrucose opposite the seed. Lower suture indented. Stalk of pod often .3" long.

(The *F.B.I.* calls the racemes axillary, but in my specimens they are terminal on an axillary branchlet, which has often however only one leaf). (The leaflets are pellucid-dotted in boiled specimens.)

2. *Æ. aspera*, L. Shola, H. Beng.

A stout marsh herb with floating spongy stem, leaves 3—6" long with 50—100 leaflets and corymbose simple or branched racemes 1.5—3" long of yellow flowers .75" long. Pods 1.5—3" by .3" broad smooth or usually warted or muricate on the faces.

In tanks and jheels chiefly in the North East. Purneah! Ranchi, not common! Fl. July—Sept. Fr. Oct.—Nov.

Stems often as thick as the thumb. Stipules .3—35" lanceolate with large basal auricle. Lfts. linear 3—6". Inflorescence, calyx and corolla hairy.

This is the plant from which "Shola" or "Solar" hats are made. The stems are also tied together and used as rafts.

25. ORMOCARPUM, Beauv.

Shrubs with odd-pinnate leaves with persistent striated stipules and bracts. Flowers m.s. in lax racemes. Calyx not distinctly 2-lipped, with two upper teeth deltoid, anterior lobes longer narrow. Stamens monadelphous or 5+5, if monadelphous sheath split above. Ovary linear few-ovuled. Pod of few indehiscent turgid linear or oblong joints, naked or with stout gland-tipped trichomes.

1. *O. senoides*, DC.

A large shrub with weak sub-sarmentose branches, leaves about 3" long with 7—11 leaflets .5—1" long. Fls. .5" yellow in very short lax glandular pubescent racemes. Pods moniliform, muricate with stout trichomes having a capillary tip terminated by a viscid gland.

Baruni Hill Forest, Khurda! Fl. Aug.—Sept. Fr. Sept.—Oct.

Stems attain 4" girth. Innovations closely pubescent with gland or hair-tipped trichomes, branchlets thinly covered with their bases. L. rhachis 1.5—2.7" slender. Stipules lanceolar-setaceous .2" brown. Lfts. alt. oblong, rounded and somewhat retuse and apiculate at tip, rounded or obtuse at base, glabrous, glaucous beneath, sec. n. 4—5 obscure and soon branched. Petiolule .03" slender. Rhachis of raceme .2—1.2" slender bracteate, sometimes flexuous with small bracts at the angle. Pedicels very slender .3—4". Fls. with two ovate-lanceolate bracteoles at the base. Calyx 5-lobed about half-way down, .25" long, anterior lobe longer than the others, more or less gland-hairy. Standard broadly-ovate sharply reflexed on the claw purple-veined obtuse. Wings spurred. Keel petals obtuse connate above, with long slender claws. St. monadelphous. Disc shortly tubular. Ovary shortly stipitate, hairy. Ovules about 4. Style slender, stigma minute. Pod 2—3" long-stalked, and with a deciduous beak, both sutures equally indented, joints 2—4

narrowly elliptic, striate, the trichomes developing with the pod and much stronger than on the inflorescence.

26. ELEIOTIS, DC.

An annual herb with 1-foliolate leaves and small flowers in very lax axillary racemes. Calyx tube very short, teeth 5 sub-equal setaceous. Stamens 9+1. Ovary sub-sessile 1-ovuled with short, sometimes uncinuate style thickened at the base. Pod of one membranous exerted elliptic-lanceolate or boat-shaped joint.

1. *E. sororia*, DC.

Procumbent with long trailing slender 3-angled stems and orbicular leaves often emarginate both ends, .75—1.2" broad thinly hairy beneath, petioles slender, stipules scarious lanceolate nerved, stipellæ minute. Racemes 2—3" with spreading hairs and geminate usually opposite spreading filiform pedicels. Bracts elliptic nerved caducous. Fls. .08" long reddish. Pod .25" venose, sometimes purple streaked.

Dry sandy places, rare. Behar, Kurz! Fl., Fr. Sept.—Oct.

27. URARIA, Desv.

Herbs with perennial rootstock or undershrubs often with the habit of *Desmodium*. Leaves 1- to pinnately 9-foliolate. Flowers in short or very elongate racemes. Pedicels and setaceous lower calyx teeth hairy bristly or plumose. Stamens 9+1 often exerted from the keel. Pod of 2—8 small turgid 1-seeded indehiscent joints usually bent on one another so as to become more or less face to face when ripe.

- | | |
|--|----------------------------|
| I. Upper leaves with 5—9 narrow leaflets | 1. <i>picta</i> . |
| II. Upper leaves 3-foliolate, lower usually 1-foliolate. | |
| A. Racemes dense, plumose. | |
| Procumbent. Lfts. small orbicular | 2. <i>lagopodioides</i> . |
| Erect. Lfts. large ovate, base cordate | 3. <i>alopescuroides</i> . |
| B. Racemes lax elongate. | |
| Fls. .2". Pedicels .1—25". Pod puberulous | 4. <i>hamosa</i> . |
| Fls. .4". Pedicels .5—6". Pod hairy | 5. <i>pulchra</i> . |

1. *U. picta*, Desv.

An undershrub 2—4 ft. high with the upper leaves 5—9-foliolate and with linear leaflets 3.5—6" long usually with a pale or purple cloud along the centre. Fls. small red in dense terminal cylindrical racemes 3—4" long.

Waste ground and open forest. Chota Nagpur, frequent! Behar, Hope! Probably in all districts. Fl. Aug.—Sept. Fr. Oct.

Stems pubescent. L. very variable on the same plant; the first are small and suborbicular, these are succeeded by 3—5-foliolate linear leaves but often also by large simple oblong-lanceolate leaves upto 6" by 1.5". Bracts dry many-nerved long-acuminate ciliate. Pedicels with hooked hairs and sepals with long spreading ones. Joints of pod hard polished grey.

2. *U. lagopodioides*, Merr.

Suffruticose herb with prostrate and ascending branches about 12" long from a perennial woody stock. Leaves roundish or broadly oblong 1—2", 1- and 3-foliolate intermixed, sometimes all simple. Heads dense

1—2" long rarely 2.5" oblong, conspicuous from the plumose persistent calyx teeth. Pod with oblong finely pubescent joints .12" long.

Common in forest and waste ground. Chota Nagpur! Sambalpur!
Fl., Fr. Aug.—Oct.

3. *U. alopecuroides*, Wight. Syn. *U. repanda*, F. B. I

Erect with much larger ovate cordate leaflets, terminal on the 3-foliolate leaves 2.5—3.75" long, lateral smaller. Racemes 2—4" very dense, in bud conspicuous from the long awned bracts and afterwards by the plumed pedicels and calyx-teeth.

Frequent. Chota Nagpur! Behar, Kurz!
Fl. r.s.

4. *U. hamosa*, Wall. Salphani, Or.

An undershrub 3—5 ft. high with the habit of a *Desmodium* (and in some states apt to be confused with *D. laxiflorum* but hairs not appressed). Leaves simple and 3-foliolate, when 3-fol. then terminal much larger than the lateral, usually elliptic-ovate or oblong 2—6" by 1—3" pale beneath with many fine but prominent parallel sec. n., terminal leaflet 2—6" by 1—3". Flowers .3" long, pink or purple, 1—3-nate, mostly paired on slender pedicels .1—.25" long in long rather lax racemes 4—8" long, which are sometimes paniced. Calyx teeth slender hairy but not plumose in fruit. Pod 4—8-jointed, brown or slate-coloured, puberulous.

Throughout the area, frequent in the forests, esp. in valleys! Fls. Aug.—Oct. Fr. Oct.—Jan. Perennial.

Branches shortly pubescent, hairs of two kinds, straight, and shorter hooked or curved. Stipules erect 3—3.5" with setaceous tips. Lfts. sometimes only 1" long, rarely narrowly elliptic or ovate-lanceolate, base rounded or retuse, tip acute or obtuse, apiculate, appressed fulvous hairy on the nerves beneath. Sec. n. 10—18 in the terminal leaflet, reaching the margin, tertiaries scalariform, lateral lfts. usually less than half the terminal and elliptic. Stipellæ subulate-setaceous. Racemes brown glandular pubescent and hairy, when young closely covered with imbricating ovate or obovate orbicular long-cuspidate bracts, caducous before the flowers expand. Pedicels usually divaricate, curved in fruit. Calyx .1—1.2", teeth finely acuminate longer than the tube.

A decoction of the leaves is used with other drugs in cases of fever in Sambalpur (Mudaliar), cp. *U. lagopodioides* and *Desmodium gangeticum*.

5. *U. pulchra*, Haines, in *Kew Bulletin* 8 of 1921.

A *Desmodium*-like, somewhat diffuse, shrub 3—4 ft. high with fulvous hairy branches and 3-foliolate leaves, terminal leaflet rather larger than lateral, oblong, ell.-oblong or mostly somewhat obovate with rounded apex, 3—4.5" long, thinly yellow hairy beneath and pretty white, lilac or blue 1—2-nate flowers .4" long on very slender .5—6" long pedicels in long lax often paniced and glandular racemes 6—15" long. Pod 5—7-jointed glandular and hairy.

Sameshwar Hills, Champaran! Fl. Nov. Fr. Dec.

Hairs long and short as in *U. hamosa*. Stipules .3" subulate setaceous. Lfts. with rounded base and very rounded apex, shortly apiculate. Sec. n. reaching the margin 7—11 in terminal leaflet. Lateral leaflets more than half as long as terminal and much the same shape. Stipellæ setaceous. Calyx more or less

colour of corolla with 2 upper teeth nearly connate, with very few slender hairs and glabrescent. Keel 4" long.

28. ALYSICARPUS, Neck.

Herbs with usually 1-foliolate leaves and strongly-nerved dry calyx stipules and bracts. Fls. small in axillary racemes. Corolla included usually reddish. St. 2-adelphous. Ovary many-ovuled. Pod not or only slightly compressed, of several indehiscent 1-seeded joints. Seeds sub-orbicular or globose.

A. Calyx much longer than first joint of pod.

I. Fls. sessile. Tall, erect; spikes villous

1. *pubescens*.

II. Fls. pedicelled.

a. Diffuse. Pod distinctly 4-cornered

2. *tetragonolobus*.

b. Erect or diffuse. Joints of pod not angled in section.

1. Fls. in distant pairs. Pods not rugose. L. usually linear, never broadly elliptic or oblong

3. *bupleurifolius*.

2. Racemes often close. Pod rugose. L. rarely linear, often elliptic

4. *rugosus*.

B. Calyx not longer than first joint of pod (exc. sometimes in 5), leaves rarely linear.

I. Stems with spreading hairs.

Pod with globose joints.

5. *monilifer*.

Pod with compressed joints

7. *hamosus*.

II. Stems without spreading hairs.

Pod with cylindric joints, not constricted between

6. *vaginalis*.

1. *A. pubescens*, *Lam.*

Erect, up to 4 ft. high with linear 3-nerved hairy leaves 8—2" long, very short petioles, and dense villous spikes of flowers, the rhachis, bracts and calyx being all covered with dense soft hairs. Pod 3—4-jointed, deeply reticulated.

Western Behar, *Kurz!*

2. *A. tetragonolobus*, *Edgew.*

A small diffuse species with linear-oblong to ell.-oblong leaves 7—1.5" long appressed hairy beneath, the hairs leaving small dots or papillæ when they fall. Calyx densely villosely-ciliate, sepals acuminate. Pods several-jointed, much constricted between the joints, rugosely-ribbed with the ribs meeting in a longitudinal one on the faces so that the joints become sharply 4-angular in section.

Dryer parts of the province. Behar, *Kurz!* Fl. Oct. Fr. Dec.

Often a small plant only 3—4" but attains 12". The stems are hairy on one side with a line of appressed hairs. Some states resemble diffuse forms of *A. bupleurifolius*.

3. *A. bupleurifolius*, *DC.*

Erect slender 2—3 ft. high or small and diffuse with linear to linear-oblong leaves 1—2.5" or 3" long and very slender racemes 3—6" long of distant pairs of shortly pedicelled red flowers .25" long. Calyx .15—2", much longer than first joint of pod, ciliate at tip only or also at edges. Pod usually 2—4-jointed, joints with faint raised nerves not uniting in a facial longitudinal one and not angular in section.

Rather common. Fl. r.s. Fr. c.s.

The following forms occur:

Var. α *typica*.

Diffuse. L. linear acute glabrous.
Chota Nagpur and Santal P.!

Var. β *erecta*. (Syn. *A. longifolius* W. & A. in part.)

Erect. L. linear acute, with appressed hairs on midrib beneath. Pod 2—4-jointed 2—3" long, minutely puberulous or glabrescent.
High hills and *pats* of Chota Nagpur, elev. 2—3000 ft.!

Var. γ *gracilis*, *Baker* (Edgew. sp.).

L. oblong-lanceolate or oblong, sub-obtuse, 1—2" by .5". Calyx .2". Pod 1—2-jointed.
Hazaribagh, *Clarke*! Behar, *Kurz*!

Var. δ *intermedius*.

Diffuse, lower leaves sometimes elliptic, spikes less lax. Pod .35" with up to 6 joints.
Hazaribagh, *Clarke*!

4. *A. rugosus*, DC.

A diffuse or ascending very variable herb with broadly-elliptic, elliptic or oblong leaves .5—2" long, rarely more, with petiole .15—.25". Flowers pedicelled .25—.3" long with truncate or obtuse sepals, in dense or very dense, usually glabrous racemes. Pods turgid moniliform, included or slightly exserted, with 3—5 deeply transversely furrowed joints.

Widely distributed. Fl. r.s. Fr. c.s.

Var. α *typica*.

Stems attain 2 ft. in length. L. ell. or oblong glabrous or thinly hairy beneath. Spikes dense; bracts and sepals glabrous or somewhat hairy at the tips only, sometimes purplish, sepals obtuse about .28". The terminal spikes sometimes appear long and compound from the leaves dropping.

Purneah. Parasnath, *Clarke*!

Var. β *styracifolius*, *Baker*.

Diffuse 3—12". L. broadly elliptic pubescent beneath .5—7". Spikes short very dense or capitate, rachis and calyx villous, pedicels very short sepals acute.

Singbhum! Palāmau! Gaya, *Clarke*! Sahebganj, S.P.! Banks of Soane, J.D.H.

Var. γ *Heyneanus*, *Baker*.

Robust 3—4 ft. with stems and leaves pubescent, lower leaves oblong-obovate up to 2.3", petiole .3", racemes more lax, mostly 2—4" long.

Behar, *Kurz*!

5. *A. monilifer*, DC.

A small diffuse species with branches rarely exceeding 1 ft., leaves .2—.5" oblong or ell. often with cordate base, glabrous. Petiole .12—.2" hairy. Pod 3—6 or rarely 8-jointed .5—.7" long, globose joints minutely pubescent with curved hairs, calyx sometimes exceeding the first joint.

Hazaribagh, *Clarke*! Ranchi! Singbhum, common!

6. *A. vaginalis*, DC.

A diffuse or ascending variable species. Stems 6"—3 ft. with petioles relatively longer than in any of the preceding, and prominently septate pods not at all constricted at the joints .5—7" long.

Throughout Chota Nagpur, all districts, common! Behar, Kurz! Monghir, Ham. & Kurz! Puri! Probably throughout the province.

Both leaves and inflorescence variable. Prain calls all specimens with lax inflorescence "*vaginalis*" and with dense heads "*var. nummularifolius*." Baker places the distinction on the leaves, *var. nummularifolius* having small often rounded leaves. Ls. vary from elliptic and broadly elliptic to lanceolate, oblong or even linear-oblong .25—1.25", thinly hairy beneath, base cordate. Petioles slender up to .4", often as long as leaf. Very rarely some of the leaves are 3-foliolate (*var. heterophylla*).

7. *A. hamosus*, Edgew.

Whole plant hairy with ascending branches rarely exceeding 1 ft., leaves large .75—2" rotund or broadly elliptic. Pods compressed and often continuous within as in *Desmodium triquetrum*!

Behar!

29. OUGEINIA, Benth.

A tree with pinnately 3-foliolate stipellate leaves and rather small flowers mostly 3-nate in the axils of bracts in dense fascicled racemes from the leaf axils and the old wood. Corolla exserted, standard orbicular, wings spurred slightly adnate to the obtuse keel. Stamens 9+1. Ovary many-ovuled, style incurved, subulate, stigma capitate. Pod linear or linear-oblong of 2—5 flat, large oblong joints or joints obscure. Seeds 1—5 compressed reniform.

1. *O. dalbergioides*, Benth. Ruta, Panjan, K.; Rot, S.; Sandan, Panan, H.; Bandhan, Tinsa (Sambalpur); Pandan, Kharw.; Banjan, Or.

Usually a small and rather crooked tree in our area. Branches slender, grey. Lfts. often sub-tomentose beneath, terminal ovate, orbicular or obovate 3—6" long, obtuse, entire or crenate with 5—10 strong sec. n. Flowers often borne in great profusion, chiefly from the old wood, white or pink, on slender pedicels. Calyx campanulate with distinct teeth.

Throughout the area, from Bettiah! to Sambalpur! and Puri! Common in the hill regions. Fls. Feb.—April. Fr. May—June. Lfless. Feb.—April.

Bark finely closely streaked with blood-red on a white ground and exuding a red juice. Large pieces are prized for the patura or hubs of the sagar wheels, and the wood is in great request for agricultural implements. The leaves are largely used for fodder. It grows best in the most southernly forests and on red clayey loams. Roxburgh says that the pillars of Madajee Scindia's palace at Oojein are made of it. Gamble gives the average weight as about 52 lb.

29a. PSEUDARTHRIA, W. & A.

An undershrubs in all respects resembling a *Desmodium* except that the pod is neither jointed nor dehiscent but continuous within. Baker (*F. B. I.*, ii, 154) says that the sutures are not at all indented, but this is not correct, some pods being indented just like a *Desmodium*, so that either the species should be included in *Desmodium*, or some of

the sub-genera of that genus should be retained as genera. I have adopted the former course (see *Sect. IV of Desmodium*). *Pteroloma* is a connecting link between *Pseudarthria* and *Desmodium* proper.

30. DESMODIUM, Desv.

Shrubs or herbs with pinnately 1—3-foliolate stipellate (exc. in 14 and 15) leaves and usually small flowers 1—3-nate in racemes (rarely 1—4 axillary in species of *Dicerma* and *Sagotia*). Calyx with two upper teeth often sub-connate. Corolla exserted, standard broad, wings more or less adherent to the obtuse (or acute in section *Pteroloma*) keel which is sometimes spurred. Upper stamen entirely or partially free, alternate 4 of the sheath-stamens often shorter and sometimes (section *Sagotia*) without anthers. Ovary several-, rarely only 2—3-ovuled. Style incurved, stigma capitellate. Pod usually much compressed and of one-seeded indehiscent joints with one or both sutures indented, more rarely dehiscent along one suture or rarely pod continuous within and sutures little or not indented (sections *Pteroloma* and *Pseudarthria*).

(As noted under *Pseudarthria* it appears to be inconsistent to separate off that genus from *Desmodium* and not some others of the sub-genera.)

KEY TO SECTIONS AND SPECIES.

- | | |
|---|--|
| I. Flowers in heads or umbels. Joints of pod indehiscent.
Shrubs. | |
| A. <i>Section I. Phyllodium.</i> Flowers hidden by pairs of large foliaceous bracts. L. 3-foliolate | 1. <i>pulchellum.</i> |
| B. <i>Sec. II. Dendrolobium.</i> Bracts minute, deciduous. Branches 3-quetrons very hairy. Sec. n. 10—20 | 2. <i>cephalotes.</i> |
| Branches sub-terete, young silky. Sec. n. 7-10. | 3. <i>congestum.</i> |
| II. Flowers in elongate often paniced racemes. Pod indehiscent along the sutures. Erect or sub-erect (exc. No. 5). | |
| A. <i>Sec. III. Pteroloma.</i> L. 1-foliolate with broadly-winged petioles. Keel acute. Pod sometimes continuous within when ripe, sutures sometimes straight.
Erect pod very hairy | 4. <i>triquetrum.</i> |
| Prostrate. Pod sub-glabrous | 5. <i>pseudotriquetrum.</i> |
| B. <i>Sec. IV. Pseudarthria.</i> L. 3-foliolate, petiole not winged. Pods continuous within and sutures usually straight | 6. <i>viscidum.</i> |
| C. <i>Sec. V. Desmodium proper.</i> L. 1—3-fol. Pods with several joints (over 4), closed and indehiscent, sutures indented. | |
| 1. Leaves 3-foliolate. | |
| a. Joints of pod much longer than broad.
Bracts linear-subulate. Joints 3—4 times longer than broad | 7. <i>laxiflorum.</i> |
| Bracts lanceolate. Joints twice longer than broad, densely hairy | 8. <i>barbatum.</i> |
| b. Joints scarcely longer than broad.
Stipules large auricled. Fls. minute .1" | 9. <i>diffusum.</i> |
| Stipules subulate. Fls. over .2" | 10. <i>polycarpum.</i> |
| 2. Leaves 1-foliolate. Joints about as broad as long. Stems angled, hairs appressed. Leaves small, or if large, lanceolate-ovate
As in 11 but leaves large ovate.
Stems terete, hirsute. L. large deltoidly ovate | 11. <i>gangeticum.</i>
var. <i>ramnagari.</i>
12. <i>latifolium.</i> |

- III. Flowers small in short racemes or 1—4 axillary. Pods with only 1—2 joints, or, if more, separately dehiscent along the suture (exc. no. 15). Trailing herbs (exc. no. 13).
- A. *Sec. VI. Nicolsonia*. L. 1—3-foliolate. Racemes dense. Joints of pod 2, widely dehiscent 13. *brachystachyum*.
- B. *Sec. VII. Dicerma*. L. 3-foliolate, exstipellate. Pod 2-jointed, indehiscent. Bracts minute 14. *biarticulatum*.
- C. *Sec. VIII. Sagotia*. L. very small 3-foliolate, stipellate or not. Bracts large deciduous. Pod 2—5-jointed, dehiscent (exc. no. 15).
Fls. axillary, not racemed. Pod indehiscent 15. *triflorum*.
Fls. in very short lax racemes. Pods finally dehiscent 16. *parvifolium*.
- IV. *Sec. IX. Pleurolobium*. Shrubs or undershrubs with 3—1-foliolate leaves, large flowers in (often paniced) racemes. Pods dehiscent in a continuous line, indented but scarcely jointed.
Undershrub, side leaflets, if present, minute 17. *gyrans*.
Shrub. Side leaflets well developed 18. *gyroides*.

1. *D. pulchellum*, Benth. Bir kapi, S.

A shrub 3—5 ft. high with grey hairy branches, easily recognised by the inflorescence which far exceeds the leaves and bears double rows of pinnately 2-foliolate coriaceous foliaceous bracts, the rhachides of which end in a filiform point, and which bear in their axils fascicles of small white or yellowish flowers .25" long.

In the forests, in all districts, sometimes almost gregarious. Fl. Sept.—Nov. Fr. Jan.—Feb.

Lfts. three, shortly grey-hairy beneath and on the nerves above, end one ell.-or ovate-oblong 3—5" long, often sinuate; sec. n. 7—10 with parallel cross tertiaries. Lateral leaflets about half as large. Bracts orbicular strongly nerved. Joints of pod usually 2.

2. *D. cephalotes*, Wall. Syn. *Hedysarum cephalotes*, Roxb.; *Ramdataon*, Kharw.

A shrub 3—6 ft. high with distinctly 3-cornered, hairy branches, elliptic acuminate leaflets with 10—20 fine prominent silky parallel nerves and numerous yellow or reddish flowers in dense axillary short-peduncled umbels sometimes running out into racemes from reduction of the leaves. Pod silky 4—6-jointed .1—12" broad.

Rather common. N. tract, Purneah, etc. Chota Nagpur, in valleys, all districts! Sambalpur! Fl. Aug.—Oct. Fr. Nov.—Jan.

Angles of stem often shaggy. Lfts. 3—6" sometimes rather obovate, beautifully silky beneath when young, lateral half to three-fourths as long as terminal. Petiole 1—2". Umbels many-flowered with linear-oblong acute or acuminate bracts .1—12". Bracteoles linear or setaceous .12". Calyx-tube .12", anterior sepal long-acuminate .15—18". Standard 3".

Var. *congestum*, Prain. More glabrous and pods glabrescent. This may be a hybrid with the next species but is easily distinguished in our province by the numerous sec. n. and general appearance. Chota Nagpur!

3. *D. congestum*, Wall. Syn. *Hedysarum congestum*, Rottl.; *Hedysarum umbellatum*, Roxb.

A large shrub 15—20 ft. with terete or very young obtusely 3-gonous, adpressed-silky branches, 3-foliolate leaves, and oblong or oblong-lanceolate or lanceolate acuminate leaflets 3—4.5" glabrous beneath except

on principal and sec. n., which are fewer and less prominent than in *D. cephalotes*. Fls. in dense axillary short-peduncled umbels. Pods '7—1" deeply indented, joints 4—6 (mostly 5) slightly silky or glabrous.

Mals of Orissa! Fl. Sept.—Oct. (probably). Fr. Nov.—Dec.

A much larger shrub than *D. cephalotes*, branches never shaggy or acutely angled. Lfts. glabrous above, pale beneath, about 2½—3 times as long as broad, lateral about two-thirds or three-fourths as long as end one, sec. n. 6—8. Petiole '7—1". Lateral petiolules '07—1". Stipules '2—25" lanceolate striate with a fine setaceous tip. Bracts narrow-lanceolate acuminate. Calyx-tube '15", anterior sepal with the mid-rib excurrent in a long filiform tip.

The differences between this species and *D. cephalotes* are well shown in *Roxburgh's* unpublished drawings.

4. *D. triquetrum*, DC. Syn. *Pteroloma triquetrum*, *Benth.*; *Hedy-sarum alatum*, *Roxb.*

An erect undershrub 3—6 ft. high with obtusely 3-angled branches, 1-foliolate leaves with an oblong rather coriaceous leaflet 2—7" long, easily recognised by its short broadly-winged petiole, small blue or purple 1—3-nate fls. in axillary and terminal lax paniced racemes 4—8" long, succeeded by linear-oblong compressed ultimately 4—7-jointed pods '75—1.5" long. Seeds falling out through the open end of the pod after the fall of one or more of the joints.

Purneah, in grassy jungles! Khurda (Jaimangal Forest)! and Mals of Orissa! Fl. Aug.—Sept. Fr. Dec.—March.

A very distinct species attaining 6 ft. in damp localities. Branches sometimes 4-angled, angles villous glabrescent. Leaflet acute or acuminate, base rounded or subcordate. Winged petiole '7—1.3" long by '25—45" broad, 2-cuspidate at apex. Stipules '5" erect-lanceolate. Pedicels '2—25". Calyx 4-cleft, upper lobe broad acute. Pod appressed hairy dehiscing transversely at each joint but lower joints usually connected by the sutures, which are only slightly indented, seeds falling out through the transverse chink or at the end of the pod. Seeds free '07" compressed white or yellow.

This section might be restored as a distinct genus or included in *Pseudarthria* which the seeds and pods exactly resemble, but the next species seems to have the normal pods of *Desmodium*.

5. *D. pseudotriquetrum*, DC. Syn. *D. triquetrum*, *F. B. I.* in part.

A diffuse undershrub very similar to but smaller in all its parts than *D. triquetrum*, from which its habit at once distinguishes it. Pods '25" broad, glabrous or puberulous on the faces, hirsute on the sutures. The joints are closed when young.

Northern Bengal, *Prain*; probably Purneah.

6. *D. viscidum*, DC. Syn. *Pseudarthria viscida*, *W. & A.*

An undershrub with slender ascending pubescent branches 2—3 ft. long, pinnately 3-foliolate leaves with rhomboid leaflets often broader than long, and slender terminal racemes of small bright red flowers '15" long on slender 2-nate pedicels. Inflorescence and small oblong pods more or less glandular pubescent. Pods '6—8" long pubescent and with many short hooked hairs on the straight or somewhat indented sutures, 4—6-seeded, slightly depressed between the seeds when dry and sometimes breaking across at the joints.

Puri, Khurda forests! Fl. Nov.—Dec. Fr. Dec.

Branches somewhat angled. Hairs long and straight mixed with very short and often hooked ones. L. rhachis including petiole 1.25—2" pubescent. Terminal leaflet 1—2" (2—4" in some specimens outside our area), somewhat glaucous and thinly silky beneath and thinly hairy above. Lateral leaflets about half as large. Stipules .2" linear-setaceous, striate, hairy, .2". Stipellæ very small, setaceous. Racemes sometimes paniced, pedicels 2—3-nate, .1—2" long, reddish. Calyx .1", red, teeth acuminate.

7. *D. laxiflorum*, DC.

An undershrub 3—4 ft. high with rather thin twiggy angled branches clothed with adpressed short hairs. Leaves occasionally 1-foliolate mixed with the others. Lfts. ovate-lanceolate, elliptic or rhomboid acute, scarcely acuminate, terminal 3.5—6" by 1.5—3", lateral about half as long, adpressed hairy beneath, scabrid-puberulous above. Racemes paniced 6—12" long, lax. Fls. pretty, clustered on slender pedicels .15—37" long, the standard white, the lower lip deep purple. Pod slender 6—8-jointed, covered with minute tubercle-based hairs, scarcely constricted, joints much longer than broad, about .2 by .08".

Shady forests. Singbhum! Ranchi, Ichadag, elev. 2700 ft.! Manbhum, Campbell! Parasnath, T. Thomson! Rajmahal Hills, Kurz! Puri! Fl. Aug.—Sept. Fr. Dec.—Jan.

It is very apt to be mistaken for an *Uraria* in flower. Petiole slender pubescent 1.5—2". Stipules persistent .3" lanceolate setaceous. Sec. n. of leaflets 9—11 strong, parallel, joining a marginal one. Pedicels reflexed in fruit. Calyx white or pink, tube .05" hairy, teeth longer. Standard .2" diam., keel .2" long. In Puri the flowers are bright pink.

The elastic stamens are enclosed in the keel petals and wings, and shoot the pollen to a distance when these are depressed.

8. *D. confertum*, DC.

A shrub with thinly adpressed-hairy branches, 3-foliolate leaves with obovate terminal leaflet 2.5—3.5", remarkable for the fine raised reticulations beneath leaving only small pits between, and large flowers .4" long, in curved secund axillary and terminal paniced racemes. Very distinct in fruit from the densely plumose pods.

Harna River Bank, Sameswar Hills at low elevation! Fl. Nov.—Dec. Fr. Dec.—Feb.

A very distinct species in leaf, flower and fruit. Petiole about equalling the rhachis above the lateral leaflets .5—1.3". Lfts. silky beneath, obtuse, apiculate, lateral ell.-oblong about three-fourths the end one, sec. n. 4—5 oblique strong, margin thickened beneath. Racemes 3—4", rhachis pubescent. Bracts .25" lanceolate. Pedicels .2". Calyx campanulate .15—17", teeth 2 upper connate nearly to top, 3 lower lanceolate as long as tube. Standard obovate .4" by .3". Ovary densely villous 4-ovuled. Joints of pod .3"—4" long, 3—4, longer than broad, concealed by the long hairs when young.

This is essentially a Himalayan species.

9. *D. diffusum*, DC.

A stout herb much branched from the base with 2—3 ft. high, somewhat diffuse, sulcate and angled hairy stems, 3-foliolate leaves with very large oblong auricled and cuspidate stipules and many-nerved leaflets. Flowers very minute bluish in terminal paniced racemes in the axils of 3-nate small lanceolate bracts. Pod 5—6-jointed, joints sub-circular with minute hooked hairs.

Open ground. Singbhum, *Clarke!* Hazaribagh, *Wood!* Behar, *Kurz!* Santal P. Fl., Fr. Sept.—Dec.

Lfts. ovate or ell.-oblong rounded both ends 2—3" long, slightly hispidulous and with sparse adpressed hairs above, thinly sericeous and pubescent beneath. Sec. n. strong parallel about 8—10. Stipellæ large, exceeding the hairy petiolules. Fls. 2—3-nate.

A noticeable species from the large stipules and persistent bracts.

10. *D. polycarpum*, DC. Baephol, S.; Salpani, Krishnupani, Or.

An undershrub with an extensively creeping rootstock sending up numerous erect or ascending stems 1—2 ft. or sometimes 3—4 ft. high. Branches hairy. L. 3-foliolate with obovate or broadly ell.-oblong leaflets usually about 2" by 1". Flowers bright purple geminate or clustered in dense or rather lax terminal often paniced racemes 1—4" long, conspicuous in bud by the closely imbricating concave lanceolate striate bracts .25" long which have a sub-aristate tip. Pods .5—8" long by .12", brown, hairy, close and erect, 5—7-jointed.

Common, often forming an undergrowth in damp rather open forests, frequent in Sal forest throughout the province! Fl. Sept.—Oct. Fr. Nov.—Dec.

Hairs on stems appressed (see var.). Lfts. membranous, or sub-coriaceous, pale and thinly silky beneath, rounded both ends or somewhat retuse, mucronulate, 1—3", side ones half to three-fourths as long as end one, sec. n. straight fine curving at the margin 5—7. Petiole as long or shorter than the side leaflets, angled, hairy. Stipules subulate setaceous .2". Inflorescence often glandular, hairy. Fls. .2—25" on slender pedicels .15—25" spreading or somewhat deflexed in flower, ascending or erect in fruit. Calyx .08—1", 2 upper teeth combined except at tip, 3 lower narrower acuminate, longer than tube. Joints of pod not much longer than broad, lower suture indented about one-fourth width of pod.

Var. **trichocaulon**. *D. trichocaulon*, DC.

Branches with spreading hairs. Racemes laxer 2.5—6", glandular. Fls. .25—3". Calyx 1" reddish thinly hairy, lobes ovate longer than tube, sinus gibbous. Standard .25" broad obovate emarginate.

Hills of Chota Nagpur 3000 ft. and over, Ranchi (Ichadag)! Palamau (Adar and Neterhat)! Parasnath, *Prain!*

This plant is also said to be used medicinally in Bonai, but the different species of *Uraria* and *Desmodium* are much confused by the non-botanist.

11. *D. gangeticum*, DC. Tandi Bhidi Janetet', S.; Salpani, Beng.

Herbaceous or shrubby with somewhat angled stems, lanceolate oblong or narrowly-ovate, 1-foliolate leaves rather shortly petioled, gradually narrowed to an acute point and with rounded base, grey silky or nearly glabrous and glaucous beneath and very small flowers .12—.2" in ascending lax elongate slender axillary and terminal usually paniced racemes 6—12" long. Pod curved .5—9", 6—8-jointed, indented about half-way down on the lower suture, upper suture slightly indented, usually with minute hooked hairs on the faces.

Throughout the whole province, common in one form or another in both forest and waste land! Fl., Fr. most of the year, but chiefly May—Jan.

Very variable, diffuse or sub-erect, depauperated specimens have leaves only .5—1.5" (var. *maculatum*, *F.B.I.*), luxuriant forest plants have stems 3—4 ft. and leaves 3—6" long, upper surface glabrescent or somewhat scabrous or with few adpressed hairs, sec. n. 7—8 or up to 10 in the largest leaves rather strong beneath and reaching margin, often with intermediate shorter ones. Petiole .5—1"

in the larger leaves, one-third to half as long as the leaves in the smaller ones. Stipules erect striate subulate with setaceous tips. Fls. purple or white, 2—several-nate, pedicels .1—1.5". Bracts subulate, minute or as long as pedicel. Calyx .08", teeth as long as tube lanceolate or deltoid. Pods spreading.

Var. *maculatum*, Baker. (*D. maculatum* DC.) Stem under 1 foot. Leaflet often only 1" or less, roundish or oblong with cordate base. Frequent!

Var. *ramnagari*, Haines.

Very robust with erect angled hairy stems and broadly ovate leaves 3—6", densely hoary-sericeous beneath. Bracts setaceous .15". Pods more erect, less curved, constrictions reaching from the lower to the straight upper suture.

Ramnagar! Fr. Dec., flower not seen. It looks at first very different from the type and may be specifically distinct.

D. gangeticum is regarded in Hindu medicine as febrifuge and anti-catarrhal. It forms an ingredient of the compound decoction called "dasamula kvatha" which consists of ten drugs (S.M.M.).

12. *D. latifolium*, DC. Kursopani, Or.

An erect shrub 3—6 ft. high with densely hirsute terete branches, broadly ovate leaves of one softly-hairy membranous or coriaceous obtuse leaflet 3—6" by 1.5—3.5" with straight or cordate very broad base. Fls. purple .16—2" in numerous axillary and terminal often paniced, dense very narrow racemes 2—7" long, or panicles up to 18" Pods 3—6-jointed, joints slightly longer than broad, about .13" long, pubescent and villous.

Frequent under shade. All districts! Fl., Fr. Aug.—Jan.

This species may best be distinguished from var. *ramnagari* of the last by its spreading hairs and more deltoidly ovate leaves with a very obtuse or rounded apex. Lft. often repand, sometimes only 2" in dry places. Sec. n. 6—8 of which one is basal. Stipules lanceolate with setaceous tip. Short hairs sometimes hooked as in the last species.

13. *D. brachystachyum*, Grah.

A herbaceous undershrub 1—2 ft. high with thinly appressed-hairy somewhat angular stems and mostly 1-foliolate leaves with the elliptic-oblong leaflet reflexed on the petiole, 1—1.7" long, sericeous beneath and slightly so above, rounded or somewhat retuse. Fls. deep purple in axillary and terminal very short dense racemes .5—1" long with the pedicels sharply deflexed after flowering and calyces white-villous. Pod short of 1—3 joints only, widely dehiscent when ripe, and slightly hairy.

Usually under light cover in open jungles. Gaya! Singbhum, esp. Porahat! Hazaribagh, Clarke! Bonai, common undershrub, Cooper! Fl. Sept.—Oct. Fr. Dec.

Petiole .5—.7". Stipules .2", stipellæ setaceous. Petiolule hairy curved, thus reflexing the leaflet which has a rounded or retuse base. Bracts ovate acuminate persistent .2" and pedicels not quite as long. Calyx teeth nearly as long as corolla. Standard .12" diam. Joints of pod .1" by .06". Seed shining yellow peppered red.

14. *D. biarticulatum*, Benth.

A small procumbent undershrub with spreading stems about a foot long from a long woody rootstock, small digitately 3-foliolate leaves with small leaflets .2—.4" long, grey silky beneath, small reddish flowers in short often branched terminal racemes and 2-jointed densely appressed-hairy pods with both sutures equally indented.

Sands of the Orissa sea-coast! Fl., Fr. Aug.—Sept.

Branches with adpressed hairs, often clothed below with the brown striate 2-fid .1" stipules. Petiole .1—12". Lfts. oblong or obovate-oblong, rounded or somewhat retuse, sec. n. 4—5 faint not reaching the margin, minutely reticulate between, petiolules very minute hairy. Stipellæ 0. Racemes .5—1.25". Bracts .05—07" subulate, striate, exceeding the short pedicels. Fls. mostly 2-nate, .2", 2-bracteolate. Calyx .1" tubular, sericeous, two upper teeth connate except at tip, 3 lower broadly lanceolate equally or slightly exceeding the tube, acute. Standard obovate. Wings and keel long-clawed. Joints of pod broadly ellipsoid .22" by 1.8".

15. *D. triflorum*, DC.

A very slender procumbent and long-trailing herb, often rooting at the nodes. Stems with fine spreading hairs. Leaves very small 3-foliolate with obovate truncate or emarginate leaflets .12—5" long with a few adpressed hairs beneath. Fls. minute, white or pink, not racemed, 1—4 together in the axils of the terminal leaves of small lateral branchlets, flowering pedicels .25—3" long. Pods curved 3—5-jointed on filiform pedicels up to .5", joints hairy or nearly glabrous reticulate-veined, rather longer than broad.

Pastures and banks, very common. Fl., Fr. Aug.—Jan. and perhaps throughout the year.

Much resembles a small *trefoil*. Stipules conspicuous persistent .1" long lanceolate. Calyx .12" clothed with long silky hairs with very long teeth. The pod in this species does not seem to open.

16. *D. parvifolium*, DC.

A prostrate copiously-branched wiry herb with small or minute 1—3-foliolate leaves and oblong orbicular or elliptic leaflets under .5" sparsely appressed-hairy beneath and with excurrent mid-rib, slender petiole with long loose villi towards apex and glandular hairy lax racemes of pale violet flowers nearly .25" long on capillary pedicels .3". St. 9+1, alternate, 4 without anthers. Pod 2—4-jointed, joints dehiscent not separating.

Neterhat plateau, near streams 3000 ft. Fl. April—Oct. Fr. May—Nov.

Stems hairy above sometimes trailing for 2 ft. Petiole about as long as the leaflets. Stipules lanceolate brown, striate, as long as or shorter than the petiole. Leaflets dimorphous: in one form crowded and only about .1" and often orbicular, in the other up to .5" and elliptic. Stipellæ absent or most minute. Racemes very numerous, often short on small lateral shoots, .7—2" long, 2—14-fld., fls. 1—2-nate on a zigzag rachis, buds with large imbricate deciduous boat-shaped or broadly ovate amplexicaul cuspidate bracts .12" long. Calyx .15" beaked in bud with the long-hairy linear sericeous teeth, two upper teeth connate for about one-fourth the total length of the calyx. Standard orbicular .25" broad, retuse, claw cuneate. Wings and keel shorter partly connate, keel petals spurred. Ovary thinly pilose. Ovules about 4. Joints of pod rarely 5, .12" by .1" puberulous, young glandular.

17. *D. gyrans*, DC. Gora Chand, Beng. The Telegraph Plant.

A sub-herbaceous perennial 3—4 ft. high, branches green glabrous. Leaves with an oblong or oblong-lanceolate terminal leaflet 3—4" long and 0, 1 or 2 small very narrow side leaflets .5—1" long. Fls. rather large in axillary and terminal racemes 2—6" long, the large bracts concealing the flower buds and forming a terminal club. Pod 1—1.5" shortly pubescent slightly indented, continuously dehiscent along the ventral suture.

In the damper forests and on moist banks. Champaran and Purneah, in the open! Gaya! Chota Nagpur, frequent! Probably also in other forest tracts. Fl. Aug.—Nov. Fr. Oct.—Dec.

Lfts. nearly glabrous, sometimes flushed with white, base and apex rounded, sec. n. distinct but fine, tertiaries very inconspicuous. Stipules .5" setaceous from a broad base. Terminal raceme often branched. Fls. 4—5".

The small side leaflets move by little jerks in damp warm weather.

18. D. gyroides, DC. Jatang sing, M.

A shrub 6—20 ft. high with softly hairy branches. Lfts. 1—3 often drooping, end one obovate rounded attaining 3.25 by 1.75", side ones rarely 1.5" long. Fls. .5" deep purple in short axillary and terminal racemes 1—2" long, with large deciduous bracts as in the last.

Along river banks and in shady ravines. Champaran! Purneah! Singbhum, especially on the Porahat plateau! Common along streams at Neterhat (Ranchi and Palamau)! Fl. Aug.—Nov. Fr. Oct.—Jan.

Lfts. appressed hairy both sides, sec. n. 6—8 and tertiaries distinct. Terminal raceme often branched rarely elongating to 4". Bracts ovate .35". Pod 1.25—2" hairy, 6—10-seeded, lower suture indented, dehiscent as in the last.

31. FLEMINGIA, Roxb.

Shrubs or undershrubs or herbs with perennial rootstocks, digitately 3-foliolate or simple 1-foliolate leaves, gland-dotted beneath. Fls. rather small or m.s. in minute cymes or in racemes or panicles, sometimes with large conduplicate bracts. Calyx-teeth narrow. Corolla cream or yellow or red-veined. Stamens 9+1. Ovary sub-sessile 2-ovuled. Pods oval very inflated, without septa, containing two rounded estrophiolate seeds, funicle attached to centre of seed.

I. Leaves simple or 1-foliolate.

A. Fls. in small cymes each hidden by a large conduplicate persistent bract

Leaves broadly ovate

L. lanceolate. Petiole under .3" thick

L. lanceolate. Petiole over .3" slender

1. *chappar.*

2. *bracteata.*

3. *strobilifera.*

B. Fls. in small cymes on the rhachis of panicles with caducous small lanceolate bracts

4. *paniculata.*

II. Leaves 3-foliolate. Inflorescence racemose.

A. Erect or prostrate strict shrubs with lanceolate leaflets and 6—20 sec. n. (exc. sometimes in 7).

Erect. Leaflets with 12—20 sec. n. Racemes 2—4"

Erect. Lft. with 6—10 sec. n. Racemes 1"

Prostrate. Sec n. sometimes few

5. *stricta.*

6. *angustifolia.*

7. *prostrata.*

B. Erect branched shrubs with elliptic leaflets under 6 sec. n.

Leaf glands evanescent. Racemes 2—5"

Leaf glands black persistent. Racemes 1—2.5"

8. *semialata.*

9. *congesta.*

C. Erect stemless. Leaflets large and broadly elliptic

10. *nana.*

III. Leaves 3-foliolate. Inflorescence capitate

11. *involutata.*

1. F. chappar, Ham. Ulu, K., S.; Galphuli, Kharw.; Rani dantkatta, Or.

An erect shrub 5—10 ft. high with pubescent branches, strongly-nerved orbicular-ovate cordate cuspidate leaves and axillary racemes of secund 2-seriate large folded bracts enclosing the small cymes of white flowers.

Not recorded from Northern area. Central and Southern areas, frequent in the forests, often forming a dense undergrowth. Chota Nagpur, all districts! Santal Parganahs, common! Rairakhol! Athmalik! Sambalpur, rather local! Mayurbhanj! Angul! The bracts are well developed in October but it does not actually flower until Jan.—March. Fr. April—May when the bracts are brown and dry. Deciduous April and renews leaves May and June.

Leaves 2—4" each way, distinctly dotted and thinly silky in age beneath. Petioles .75—1.25" thickened both ends. Bracts .75—1" by 1.25—1.5" broad when unfolded, cordate emarginate. Fls. .3—5" opening singly in succession and then becoming visible between the parted margins of the bract, few in an umbel.

The wood is used for tooth-brushes.

2. *F. bracteata*, Wight. Syn. *F. strobilifera*, var. *bracteata*, *F. B. I.*

A shrub 1—3 ft. high with shaggily pubescent sharply angled branches, lanceolate or oblong-lanceolate acuminate leaves 3—7" by 1—2.5" with sub-cordate base and very short stout petioles under .3" and mostly terminal paniced racemes 2—5" long of large folded deeply cordate bracts .7—8" long which are softly hairy and (when unfolded) are over 1" broad, usually all slightly emarginate and sometimes the lowest obscurely cuspidate. Pods .3—4" thinly pubescent.

Frequent in the forests and usually in dryer places than *strobilifera*. Champaran! Chota Nagpur, all districts! Angul! Narsingpur! Kalahandi! Probably in all districts. Fl. Jan.—April. Fr. Oct.—Nov.

Leaves sometimes with very few glands beneath, base 3-nerved. Petiole usually only .2—25" densely pubescent. Stipules sub-persistent linear-setaceous or subulate with a filiform tip .5—1". Racemes usually with a zigzag rhachis. Fla. .25" pinkish.

Roots sometimes given for epilepsy.

3. *F. strobilifera*, R. Br.

A bushy shrub 5—8 ft. high with appressed-silky terete or slightly angular branches, lanceolate or ovate-lanc. sub-acuminate leaves 3—6" by 1—3" with rounded base and slender petioles, and numerous axillary and terminal racemes 2—3.5" long of folded membranous cordate bracts enclosing short few-flowered cymes .5" long of small white or purple flowers .25—3" long.

Frequent in shady ravines Singbhum and Porahat forests esp. at 2000 ft. Manbhum, Ball! Palamau, Neterhat 2500 ft. Fl. Feb.—March. Fr. Mar.—April but the conspicuous bracteate inflorescence appears in December or earlier.

L. hairy on the 10—13 strong straight sec. n. beneath. Petiole slender .5—8". Stipules very caducous, small. Bracts (unfolded) ovate cordate rounded, apiculate or shortly acuminate, usually about 1" broad and .6—9" long, puberulous. Calyx .15—2" pubescent and hairy and glandular, teeth linear-lanceolate acuminate, lowest rather longer than others 2—3 times as long as tube. Pods .3—32" pubescent.

Var. *nudiflora*, Haines. A very remarkable variety in which the bracts are open, or both open and folded, but caducous before the flowers expand. It is apt to be mistaken for *F. paniculata* after the bracts fall.

Saitba forest, Singbhum!

4. *F. paniculata*, Wall. Rani dantkatta, Salpini, Or.

A large shrub 4—12 ft. high with terete thinly pubescent or hairy branches, rather large ovate cordate and cuspidate membranous leaves or upper ovate-lanceolate. Stipules caducous. Fls. reddish in short rather dense axillary and terminal densely hairy panicles, bracts dry ovate to lanceolate .2—2.5" strongly nerved, caducous.

Damp Forests. Singbhum and Porahat, not uncommon! Santal P.! Angul, common in the damper forests! Sambalpur, attains 12 ft. in the Tablai-Deogaon forest! Fl. Feb.—March.

Leaves 4—6.5" long, rarely base nearly straight and oblique, glabrescent beneath except for the hairy nerves, glands inconspicuous, base 5—7-nerved, sec. n. 5—7 fine but prominent and tertiaries often sub-parallel. Petiole thickened each end .75—1.5" very hairy. Fls. usually fascicled on racemes 1—3" long, which are sometimes subsolitary in the axils but usually clustered and paniced, the panicles when terminal attaining rarely 6". Calyx-teeth long linear-acuminate nearly as long as the corolla which is generally pink. Pods .5", hairy.

5. *F. stricta*, Roxb. Also called Salpani in *Orya*.

A tall strict scarcely shrubby species 6—8 ft. high with large 3-foliolate leaves, lfts. lanceolate or elliptic acuminate mostly 6—11" in length with a 1—3-nerved base and 12—20 fine strong parallel sec. n. above the base. Stipules 2—3" long lanceolate caducous. Fls. purplish, veined .25—.35" long in very dense erect axillary 1—2-nate racemes 2.5—4" long conspicuous in bud by the densely imbricating brown linear-lanceolate bracts which overtop the buds and the very large basal bracts of the raceme which attain 1.2" and are often embraced by the yet longer stipules.

In the damper forests usually under dense shade. N. Champaran! Ranchi! Singbhum! Puri! Angul, common! Narsingpur! Sambalpur (Katabaga forest)! Probably therefore throughout the whole province where the forest conditions still exist. Fl. Jan.—March. Fr. April.

Branches 3-quetrous. Lfts. hairy on the nerves beneath, lateral basal nerves never much stronger than the secondary nerves. Petiole 3-quetrous, often narrowly winged, 5—6" long. Lower calyx tooth equalling or exceeding the corolla. Pod hairy .38—.5".

6. *F. angustifolia*, Roxb.

An erect undershrub 2—4 or 6 ft. high with tomentose obtusely 3-angled branches, 3-foliolate leaves and lanceolate leaflets 5—6.5" long. Fls. in dense axillary and sub-terminal sometimes clustered sub-spicate racemes about 1" long with sub-persistent dry villous bracts and very slender densely villous calyx lobes.

Ramnagar Forests, N. Champaran! Fl. Aug. Fr. Sept.—Dec.

Scarcely more than an erect form of *F. prostrata*, but if united with it then species nos. 8 and 9 should be united. Similar specimens were collected at Dehra Dun and North Oudh and included in *F. congesta* in the *Cgl. Herb.* which it certainly is not. *Roxburgh's* type (not now existent) came from Hardwar, which is close to Dehra Dun.

Petioles 1—2" 4-ridged below, widely channelled above roughly 3-angled as in last. Sec. n. 6 or more reach the margin, tertiaries strong raised, hairy (hairs not appressed as in *F. congesta*).

7. *F. prostrata*, Roxb. Syn. *F. congesta* var. *semialata*, *F. B. I.* in part.

A diffuse slightly branched undershrub with a woody rootstock, brown-tomentose angular branchlets, 3-foliolate leaves with angular not-winged petioles and narrowly lanceolate leaflets 2—4.5" long. Fls. in dense sub-spicate axillary racemes about 1" long with sub-persistent dry bracts and very slender densely villous calyx-lobes as long as or exceeding the corolla and pod.

Frequent in the forests. N. Champaran! Singbhum! Ranchi! Manbhum, common in the rather dry forests of Gobindpur sub-division!

Fl. Aug.—Oct. Fr. Oct.—Dec.

Branches 6"—2 ft. densely tomentose when young. Lfts. brown-hairy or pubescent beneath and thinly so above, lateral basal nerves short, sec. n. (of end leaflet) 4—7 reaching the margin. Petioles 3-angled 1—2" hairy tomentose. Stipules lanceolate or subulate acuminate 2—4".

8. *F. semialata*, Roxb. Syn. *F. congesta*, var. *semialata*, *F. B. I.* Birbut, S.; Galphuli, Birja.

An erect shrub 4—6 ft. or attaining 9 ft., bushy with densely pubescent or closely villous glabrescent branches, 3-foliolate leaves with narrowly winged petiole, lfts. rhomboidly lanceolate or elliptic glabrescent except on the nerves beneath and the glands disappearing with age. Fls. 3—4" long in copious axillary 2—4-nate or branched villous racemes which elongate and become longer than the petioles and are often sub-panicled at the top of the branches.

Very common in moist forests throughout the province, attaining its best development at elevations of 2—3000 ft.!

Fls. Aug.—Jan. Fr. Oct.—Feb. Perennial, new shoots come out April or May.

Trunk attains 9" girth in Chota Nagpur with red blaze. Young shoots densely silky. Petiole 1.5—4". Lfts. usually 4—5.5" but sometimes attain 8.5" by 4.5" acute or acuminate, base narrowed sub-cordate. Racemes 2—5". Bracts dry .25". Calyx densely sericeous or villous, teeth 2—3 times as long as tube, lowest as long as corolla. Standard green with red stripes, wings pink, keel reddish. Pod 4" tomentose. Seeds 2 black shining, raphe basal not very large.

9. *F. congesta*, Roxb. *F. congesta*, *F. B. I.*, part only.

Resembling *F. semi-alata* but a smaller and less bushy plant, leaves very similar but petiole angled not winged or only with a narrow ridge-like wing, blade glabrescent between the nerves or slightly pubescent, glands small black numerous and persistent and similar glands on the calyx and young pod. Racemes always very short 1—2.5" not as long as the petioles.

Not common. Bettiah, *Hieronymus*! Kalahandi!

Possibly only a variety of the last and is so like it in leaf that it may be much commoner than would appear from the above distribution. The nervation of both species is the same and very different from *F. angustifolia*, i.e. on the midrib there are about 5—6 slender oblique sec. n. which reach the margin and the tertiaries are fine and not prominent.

10. *F. nana*, Roxb.

A dwarf undershrub 1 ft. high with a very short brown tomentose stem springing annually from a woody rootstock; very large, rarely small, 3-foliolate leaves with long winged petioles and congested sometimes paniced racemes of small reddish flowers appearing before the leaves.

In damp forests. In most if not all districts of the Central and Southern tracts! Fls. March—April. Fr. April—May. The leaves do not usually appear until the rains and they last until the succeeding February.

Lfts. broadly-elliptic or rhomboid 5—7" long and often 5" broad, not acuminate, lateral very oblique. Petiole sometimes 10" long. Petiolules tomentose .25". Racemes 3—4" densely pubescent, bracts caducous. Corolla .25", lowest sepal as long. Pods 3—5". The inflorescence leaves a deep orange stain on the hand, especially in fruit, from the numerous red glands.

11. F. involucrata, Bth.

A strict undershrub 4—5 ft. high with pubescent branches, very shortly petioled 3-foliolate leaves with short narrowly-elliptic or elliptic leaflets and purple flowers about .5" long in dense hairy heads surrounded by strongly-nerved oblong acuminate bracts.

Grassy places in the forest. N. Champan!

Fl. Oct.—Dec. Fr. Dec.—Feb. Dies down to the root after fruiting.

A very distinct species with petioles only .2—8" long, leaflets 1.5—3.5", pubescent beneath not 3-nerved, sec. n. 10—12. Heads very villous, with permanent dry brown striate bracts .7—8" long.

32. ERIOSEMA, DC.

Shrubs or herbs, usually erect with 1—3-foliolate leaves. Flowers axillary 1—2 or racemed. Calyx-teeth 5 as long as tube. Corolla exsert, standard auricled, longer than the wings and slightly beaked keel. Stamens 2-adelphous. Ovary sessile 2-ovuled, style glabrous. Pod oblong turgid 1—2-seeded. Seeds oblique, funicle attached to the extremity of the linear hilum.

1. E. chinense, Vogel.

An erect very sparingly branched undershrub 1.5—3 ft. high covered with long hairs. L. 1-foliolate linear, very slightly tapering, 1—3" long, silky beneath, with mid-rib and margins pilose. Stipules persistent filiform hairy .25". Flowers 1—2 axillary yellow .2" long in nearly all the leaf axils. Pod .5" clothed with long brown hairs, persistent with recurved valves after ripening.

In grassy forests, frequent in Chota Nagpur, ascending to 3000 ft.!

Fl. Aug.—Sept. Fr. Oct.—Nov.

The rootstock is said to be tuberous. The plant reminds one much of a *Crotalaria*.

33. RHYNCHOSLA, Lour.

Twining or sub-erect herbs or shrubs with pinnately 3-foliolate leaves gland-dotted beneath, with or without stipellæ. Stipules and bracts caducous. Flowers small or m.s., axillary and usually racemed. Calyx rarely somewhat accrescent (in *R. rufescens*, but never simulating a papilionaceous corolla, as in *Cylista*), tube short, teeth usually exceeding it, upper often more or less connate. Corolla included or exserted. Stamens 9+1. Ovary sub-sessile, 1—2-ovuled, style long, incurved, stigma capitate. Pod round or oblong, compressed or turgid, not or rarely septate. Funicle inserted in the centre of the seed which is reniform or sub-globose and with a small peltate or large divided, strophiole.

A. Calyx-teeth, at least the lower, subulate or acuminate.

Suffruticose climber, lfts. rhomboid, 2—3"

Erect undershrub 2—4 ft. high, heterophyllous

Slender twiner, lfts. under 1.7". Racemes lax

Slender twiner, lfts. under 1". Racemes capitate

B. Calyx-lobes broadly oblong, corolla included

1. *bracteata*.

2. *cana*.

3. *minima*.

4. *aurea*.

5. *rufescens*.

1. *R. bracteata*, Bth.

A suffruticose climber distinctly woody below, bearing a very strong resemblance to *Atylosia crassa*, with downy or grey-tomentose branches, rather large strongly-nerved leaflets, yellow flowers .5—'6" long, not paired, in very numerous often sub-panicled peduncled racemes usually longer than the leaves. Pod .75—1.3" compressed obovoid- or oblanceolate-oblong glandular-pubescent and velvety, 2-seeded (neither septate nor peltately glandular as in *Atylosia crassa*).

Angul Fl. Feb.—March. Fr. March—April.

Branches grooved. Lfts. attain 3" by 3" rhomboid cuspidate pubescent beneath and less so above, nervation strong. Stipules lanceolate .1—'15". Racemes often 5", with glandular pubescence,* and deciduous ovate acuminate bracts exceeding the buds which are pubescent (not varnished as in *A. crassa*). Calyx densely glandular, campanulate tube .2", lower sepal long-acuminate .25", upper two connate into a 2-toothed lip. Standard .3" diam. 2-auricled. Seeds .2" shining.

2. *R. cana*, DC.

A sub-herbaceous undershrub erect about 4 ft. high villous and glandular-hairy, leaflets of two kinds, rhomboid obovate or oblong 1—2.5", and small lanceolate-acuminate or linear. Fls. small yellow or reddish .3" (tip of standard to tip of keel) on 1—2-fld. short axillary peduncles, corolla twice as long as calyx. Pod .4—'5" oblong somewhat flattened neither septate nor lineate, sometimes slightly depressed between the seeds, minutely puberulous glabrescent.

Durgapur range, Angul, on sandstone, frequent! Gyra, Thoms. and Anders. Fl. Fr. Dec.—March.

Very variable, the broad large-leaved form and the small linear-leaved form would be taken for different species but occasionally plants occur with both kinds of leaflets. Very glandular with stalked glands above, but the gland-hairs tend to disappear in some plants. Branches often whippy at the ends. Petiole .3—'1". Lateral leaflets smaller than end one which is often 3 times as long as broad more or less hairy beneath, with stalked glands in small form. Peduncles .1—'75". Pedicels .1". Calyx 2-lipped, upper 2-lobed, lower with 3 subulate hairy teeth about twice as long as tube. Standard longer than wings and keel yellow streaked with red. Seed resembling that of *R. rufescens* and with a large divided strophiole.

3. *R. minima*, DC.

A very slender trailing or twining herb with angled puberulous stems, leaflets orbicular- or ovate-rhomboid mostly under 2" long. Racemes laxly 3—8-fld. Fls. yellow .3" long, calyx minutely silky, teeth subulate-acuminate, corolla about twice as long as the upper teeth. Pod .5—'7" long, flattened, oblong-ob lanceolate, slightly curved, pubescent (glabrescent, *F. B. I.*). Seeds brown mottled black, .12—'14" long.

Open jungles. Rajmehal Hills, Kurz! Koderma, Palamau, frequent! Fl. Sept. Fr. Nov.

Var. *laxiflora*, Baker.

Our specimens all belong to this variety which has ovate-lanceolate leaflets with deltoid base and are 1—2" rarely 2.5" long, the type being rounded at apex and rarely attaining 1". They are not however glabrous (as described in *F. B. I.*) but minutely hispidulous. Stipules linear-lanceolate persistent. Racemes very lax, attaining 5.5". Strophiole minute, peltate.

* Baker in *F. B. I.* states that the pubescence is not glandular.

4. *Rhynchosia aurea*, D.C. Var. *capitata* is a small species only once recorded by Kurz from Behar. It is a slender twiner with small broadly rhomboid leaflets about .7—1" each way, very easily recognised by its flowers being aggregated in capitate racemes and by its square or orbicular membranous villous pods .35—4" diam. closely striate with transverse raised lines.

5. *R. rufescens*, DC.

A scarcely woody rusty-pubescent often glandular-hairy climber with slender whip-like branches, rhomboid or ovate scarcely acuminate leaflets 1—2.5" and very numerous lax few-flowered racemes of smallish yellow flowers, the corolla included in the large deeply 5-fid calyx which has broadly oblong segments .3" in flower attaining .5" in fruit. Pod beaked sub-quadrate oblong. Seed 1 subglobose mottled, with a large grooved strophiole.

Forests. Singbhum! Koderma, Hazaribagh, among rocks, frequent! Haripur forest, Puri! Durgapur Range, Angul! Fl., Fr. Dec.—March.

Stems sometimes woody below, gland-pubescent above. Leaflets sub-equal much reduced in size on the upper branches, terminal usually rhomboid-lanceolate, both sides pubescent, base 3-nerved, sec. n. 2—3, looped and with raised reticulations, glands very minute. Petiole 1—3". Racemes 1.5—3" long, laxly 3—5-fl. Standard sub-orbicular .32" broad with 2 small inflexed auricles above the claw, wings spurred oblanceolate. Ovary silky 1-ovuled, slender style swollen in middle.

34. CYLISTA, Ait.

A twining shrub closely allied to *Rhynchosia*. Fls. in axillary sometimes paniced racemes with lanceolate acuminate caducous bracts, differing from *Rhynchosia* in the excessive development of the persistent calyx, the lobes of which are at first sub-petaloid both in form and texture but become scarious. Anterior sepal boat-shaped, largest resembling the keel petals of a corolla, enlarging to 1 inch or more in fruit, upper two connate in an emarginate lip and the lateral shortest very obtuse. Ovary 1—3-ovuled* and pod small oblong keeled somewhat oblique, glandular, enclosed in the calyx. Seed not or very slightly strophiolate.

1. *C. scariosa*, Ait.

A somewhat extensive but scarcely woody climber with densely pubescent stems and petioles. Lfts. softly shortly hairy above pubescent beneath especially on the nerves, terminal rhomboid about 5.5" by 4.5" acuminate, base rounded on the petiolule. Fls. in very numerous sometimes branched racemes, yellowish and red. Calyx .5" and enlarging to over 1", two posterior sepals resembling the standard of a corolla, the true corolla concealed within the calyx.

Angul, in the forests, especially climbing over undergrowth near open ravines! Athmalik! Fl. Nov., also Feb.—March (perhaps Nov.—March?).

Lfts. microscopically gland-dotted beneath, dull, and rugose above; primary nerves 3, sec. n. about 4 on each side of mid-rib, tertiaries strong transverse and reticulate, lateral leaflets ovate, much broader below mid-rib, acuminate, larger about 4.5 by 3". Stipellæ small setaceous or acicular, .2—2.5". Pod .4" pubescent and glandular.

* Wrongly described as 1-ovuled in all works consulted.

The Angul plant differs rather from type in the leaflets being glabrescent between the nervules and in the more slender racemes which attain 6" in length.

Dunbaria circinalis, Baker, was found in the Jalpaiguri district, not in our area. The genus has been included by mistake in the Key.

36. ATYLOSIA, W. & A.

Erect or twining herbs or shrubs with pinnately or sub-digitately 3-foliolate leaves gland-dotted beneath, often exstipellate. Fls. small or m.s., axillary or racemed. Calyx-teeth distinct. Keel of corolla not beaked. Stamens 9+1. Ovary sessile with terete incurved glabrous or pubescent but not bearded style, and simple or capitate stigma. Pod linear or oblong, somewhat flattened, thick septate and with depressed lines between the seeds which have a conspicuous divided strophiole.

- | | |
|---|--------------------------|
| A. Erect shrub 3—6 ft. high. Pod minutely velvety | 1. <i>cajanifolia</i> . |
| B. Twiners or suberect with twining branches. | |
| Suffruticose. Lfts. 2—4". Fls. .7" | 2. <i>crassa</i> . |
| Herbaceous. Lfts. ovate 1—2". Fls. .5—6" | 3. <i>platycarpa</i> . |
| Herbaceous. Lfts. ell.-oblong .5—1.5". Fls. .3" | 4. <i>scarabæoides</i> . |

1. *A. cajanifolia*, Haines (Jour. As. Soc. xv, 7). Ban Arhar, Or.

An erect shrub 3—6 ft. very like *Cajanus indicus* in general appearance. Stems minutely pubescent angled by three decurrent lines from the nodes. Lfts. sub-digitate rhomboidly lanceolate very acute 3-nerved, lower 1.5—3", uppermost often only .5". Fls. dull yellow about .5" long, 1—4 usually 2 on short or long axillary peduncles longer than the leaves. Pod 1—1.3" by .4" deeply grooved 4—6-seeded, minutely velvety.

Forests of Southern range, Puri! Fl. Nov.—Dec. Fr. March—April. Sub-deciduous in the hot season.

Petiole .5—1.5". Lfts. pale, minutely pubescent, or sub-tomentose beneath, very acute, exstipellate, margin thickened, sec. n. about 4, tertiaries reticulate. Peduncles .8—1.8" long. Pedicels .3" long. Calyx .15—1.9", teeth triangular. Corolla .42—4.5". Standard purple brown veined at the back, corolla sometimes marcescent. Seeds .17" black shining with large strophiole.

2. *A. crassa*, Prain. Bir rambara, K.; Bir malhan, S.

A suffruticose climber with downy or tawny-tomentose stems, rather large strongly-nerved leaflets, yellow marcescent flowers .7" long in pedicelled pairs on short axillary and paniced racemes. Pod 1—1.8" by .4—6" with strong oblique furrows. Seeds 3—6.

Bettiah Forests, Champaran! Central tract, not unfrequent in the damper valleys; Porahat! Palamau! Manbhumi! Ranchi ghats! Southern tract: Singbhum! Angul (Labangi)! Puri (Kahuri)! Fl. Jan.—March. Fr. March—April.

Branches grooved. Lfts. attain 4" by 3.75", terminal usually rhomboid, rugose above, yellow- or brown-pubescent, sec. n. 2—3 above the 3—5-nerved base and with strong cross nervules. Petiole 1—4". Racemes 1—4" usually paniced with large deciduous concave oblong paralleled-nerved bracts .5—7.5" long. Calyx .3", lobes $\frac{1}{2}$ — $\frac{3}{4}$ ths as long as tube, upper two combined into one obtuse or emarginate. Standard and wings auricled. Ovary yellow-glandular, margins pubescent. Seeds .25". Strophiole large.

3. *A. platycarpa*, *Bth.*

A slender annual twiner with hairy stems, broadly ovate acute or acuminate leaflets 1—1.5 rarely 2" long, fls. .5—'6" long subsolitary on axillary slender peduncles, pods oblong 1.2—1.5" by .5—'6" compressed 4—5-seeded lineate not deeply furrowed, with deciduous spreading hairs.

Rare. On rocks in the Horhap Forest, Ranchi! Behar, *Kurz!* Fl. Aug. Fr. Oct.—Nov.

Rhachis of end leaflet about .5". Lfts. hairy with 3 slender basal nerves. Peduncles 1—2-flid. .5—1.3". Calyx narrow .4—'5" with long setaceous teeth, very hairy.

4. *A. scarabæoides*, *Benth.* Gaisani, K.; Bir horec', S.; Ban Kulthia, Or.

A copiously branched pubescent grey-green herb with flexuose ends to the branches or more usually with slender twining branches, small strongly-nerved leaflets, terminal elliptic- or obovate-oblong .5—1.5" or usually only 1" long, smallish yellow or reddish flowers .3" long, the corolla not much exceeding the densely grey-silky calyx. Pods small oblong very hairy or silky .75—1" long, about 5-seeded.

Very common in somewhat open forest on clay, soils, throughout the Central and Southern areas! I have not noted it from the Northern area but it probably occurs. Fl. Aug.—Dec. Fr. Oct.—April.

Stems pubescent. Lfts. with 3 primary nerves tomentose when young; the glands in some specimens almost evanescent; lateral somewhat smaller and somewhat oblique. Petiole usually shorter than the terminal leaflet which has a rounded apex. Stipels 0. Peduncles .25—'75" slender 1— few-flowered. Seeds under .2", grey-brown, oblong rounded.

The seeds are eaten but chiefly by children. *Campbell* says that the plant is given for diarrhoea in cattle.

37. CAJANUS, DC.

An erect shrub with m.s. racemed flowers. The genus differs from *Atylosia* in the non-strophiolate seeds. The ovary is sub-sessile and the depressions between the seeds oblique.

1. *C. indicus*, *Spreng.* Arhi, Arhar, K., H.; Pigeon Pea, Dal.

An erect shrub 4—8 ft. high with slender grey-silky grooved branches, hairy oblong-lanceolate leaflets 1.5—2.5" long whitish beneath and yellow flowers .75" long in axillary racemes and terminal panicles. Filaments alternately longer and shorter. Pod 2—3" long, silky, often with dark purple spots. Seeds 3—4 globose and the size of a small pea, pale brown.

Cultivated throughout the province, often on a large scale. Fl. r.s. Fr. c.s. but depending on the time of sowing. Perennial but usually grown as an annual.

Probably a native of Africa.

The dal is highly esteemed and said to be easily digested but it is regarded as heating and apt to produce costiveness. The tender leaves are chewed in cases of aphthæ and spongy gums (*Nadharni*). Lac has sometimes been grown upon it.

The first pair of leaves are opposite lanceolate gland-dotted beneath and stipulate. They are apt to be mistaken for cotyledons.

38. SHUTERIA, W. & A.

Climbers with 3-foliolate stipellate leaves and conspicuous persistent bracts and bracteoles. Fls. small or m.s., racemose. Calyx tube gibbous, teeth shorter. Standard not spurred, exceeding the spurred wings and united keel petals. Stamens $\bar{9}+1$. Ovary sub-sessile or stipitate, many-ovuled, style incurved filiform, beardless. Pod flat linear usually recurved.

1. *S. densiflora*, Benth.

A slender twiner with pubescent stems, very slender petioles membranous nearly glabrous ovate or rhomboid leaflets mostly 1—2.5" long with very rounded or emarginate apex and small white and purple flowers in dense axillary fascicled racemes with brown striate bracts clothing the rhachis. Pod at first strap-shaped thin 1—1.2" long, finally dehiscent with spirally wound valves brown glabrous, 6—8-seeded.

Singbhum, in the damper valleys, rare! Ranchi and Palamau, in valleys at about 3000 ft.! Fl. Dec.—Feb. Fr. Feb.—April.

Leaflets rather pale beneath, and one attaining 3" by 2", apiculate, base rhomboid, sec. n. very fine, rhachis very slender, stipellæ small setaceous. Racemes .75—1.75" long sessile with hairy rhachis, pedicels mostly geminate .12", bracteoles lanceolate as long as calyx, .12—2" long. Standard .3".

39. DUMASIA, DC.

Slender climbers with the habit of *Shuteria* but bracts and stipules small and inconspicuous. Calyx-tube cylindrical with oblique subtruncate mouth, base gibbous. Petals sub-equal, standard spurred. Wings and keel adherent with small limb and long claws. Ovary linear sub-stipitate, few-ovuled, style flattened upwards. Pod linear falcate, torulose.

1. *D. villosa*, DC.

A very slender twiner with thinly hairy stems. Lfts. membranous broadly ovate-oblong, terminal with sub-rhomboid or triangular base and rounded or obtuse apex. Flowers pale yellow .6" long in very slender racemes 1.5—3" long, standard reflexed and deeply emarginate spurred above the long cuneate claw. Ovary sericeous, ovules 3—4. Pod 1—1.5" long velvety or sub-glabrous.

Chota Nagpur. Ravines near Neterbat, elev. 3000 ft.! Parasnath! Fl. Oct.

Lfts. pale glaucous beneath and with short appressed hairs in our specimens var. *leiocarpa*), 1.5—2.5", terminal larger than lateral, lateral with rounded or truncate base, all apiculate, rhachis slender, 1.5—2.2" above the thickened petiole and .5" between the leaflets. Stipules erect linear-setaceous .1", stipellæ minute. Bracts and bracteoles minute. Calyx .3—35" long. Pod in type velvety, in var. *leiocarpa* nearly glabrous. The type has not been found in our area.

40. GLYCINE, L.

Twining or sub-erect herbs with 3—7-foliolate stipellate leaves and blue or red flowers in axillary racemes. Corolla little-exserted, petals sub-equal, standard not distinctly spurred. Stamens monadelphous. Ovary many-ovuled, style short beardless. Pod linear or oblong, flat or rather turgid, few-seeded.

1. **G. hispida**, Maxim. Syn. *Glycine Soja*, F. B. I.; *Dolichos Soja*, Roxb.; *Ram kurthi*, H.; *Cari kalai*, Beng.; *Hende disum horec'*, S.; *The Soy Bean*.

Suberect or trailing about 1—2 ft. high looking like a *Phaseolus* with very hirsute stems, petioles and inflorescence. Lfts. ovate or oblong-lanceolate or lanceolate about 3" long, more or less hairy both sides, petiole very long, often 5—6". Fls. 2" pale blue (or reddish, F. B. I.), in sessile very short and hirsute racemes not exceeding 1.5", pedicels very short, calyx about .15" densely hairy. Pods oblong narrowed at the base, 1—1.5" long, straight or slightly curved, hairy. Seeds 2 (—3) deep brown or black compressed ellipsoid .35—.38" long with hilum .1" long.

Occasionally cultivated, Purneah and S.P.! Manbhum. Fr. Oct., May.

41. TERAMNUS, Sw.

Slender twiners with 3-foliolate minutely stipellate leaves. Fls. in very slender racemes, corolla little exerted, petals subequal, standard not spurred. Stamens monadelphous or diadelphous with the 4 alternate anthers small or abortive. Pod linear with a short upcurved beak (persistent style), seeds several.

1. **T. labialis**, Spreng.

A very slender twiner with glabrescent branches. Lfts. very variable in size, sometimes only .6—1.3", at others 1—3" long, elliptic or ovate or terminal somewhat obovate, thinly appressed-hairy beneath, sec. n. 3—4, petiole shorter than or equalling the terminal leaflet. Racemes very slender 1.5—5" with distant clustered or solitary flowers in the axils of small subulate bracts. Fls. about 2" long, calyx densely covered with adpressed white or tawny hairs, corolla pink purple or white. Ovary hispid. Pod narrow linear straight or slightly curved 1.5—2.2" long thinly appressed hairy. Seeds red when fresh, black when dry, oblong, .12" long, about 10.

Widely distributed. Bihar, J.D.H.! Shahabad plains, J.D.H.! Gya, Clarke! Palamau! Manbhum! Monghyr, Madden. Fl. July—Sept. Fr. Oct.—Dec.

42. GRONA, Lour.

Twining herbs with stipellate, sometimes very narrow, 1-foliolate leaves and deciduous bracts and stipules. Fls. racemed, nodes of raceme slightly swollen. Calyx campanulate with narrow teeth, two upper shorter but not connate. Petals exerted, nearly equally long, standard and wings spurred. Stamens 9+1, anthers uniform. Style beardless. Pod linear compressed or turgid, septate.

1. **G. Grahmi**, Benth.

A slender twiner with linear or lanceolate-oblong leaves attaining 7.5" in length. Flowers reddish in distant pairs rarely some solitary, mostly geminate in short racemes. Pod compressed 2—2.3" long densely hairy; seeds with a small strophiole, orbicular.

Ranchi, Biru, Rev. Cardew! Manbhun, Campbell! Bonai, frequent! Fl. Aug. Fr. Sept.

Leaflet hispid on the thickened marginal nerve and with deciduous hispid hairs beneath finally glabrescent and glaucous, sec. n. very numerous and nervules reticulate; petiole .5—7" long, hairy, stipellæ acicular. Fls. 4" long racemes usually one to three together, 1—3" long. Lower calyx teeth much exceeding the tube, linear.

43. GALACTIA, P. Br.

Slender twiners with 3-foliolate stipellate leaves. Flowers racemed with the nodes of the raceme somewhat tumid. Calyx teeth linear or lanceolate, the two upper entirely connate into one. Corolla little exerted. St. 9+1. Style beardless. Pod linear flattened, sometimes curved, sub-separate. Seeds without strophiole.

1. *G. tenuiflora*, W. & A.

A slender climber with small elliptic leaflets 4—1.5" long, shortly silky and finely reticulate beneath. Fls. 3" in very few-fl. elongate and very slender racemes. Pods curved 1.2—1.5" flat sericeous, seeds about 8.

Behar, Kurz! The only record.

Kurz's specimen belongs to variety *villosa* of Baker (F.B.I.) = *Galactia villosa*, W. & A., which is distinguished by the leaflets being densely villous beneath and larger (attaining 3.5" according to the *Madras Flora*), mucronate, sec. n. 7—8.

44. CANAVALIA, DC.

Large suffruticose twiners or prostrate herbs with stipellate 3-foliolate leaves and rather large flowers in racemes with tumid nodes. Calyx 2-lipped, upper lip entire or with 2 rounded lobes, lower 3-toothed. Standard larger or shorter than the wings and incurved obtuse keel. Stamens monadelphous, or posterior free at base. Ovary many-ovuled, style beardless. Pod large linear or linear-oblong, somewhat compressed with the upper suture strongly 2-ribbed. Seeds large sub-compressed with linear hilum, enclosed in a thin papery endocarp.

On germination the large oblong fleshy cotyledons are somewhat epigeal, the first leaves are simple, opposite, deeply cordate and palminerved, with erect oblong interpetiolar stipules.

I. Lfts. ovate or oval, very few obovate, glabrous or nearly so.

Lfts. ovate acute or acuminate with obtusely cuneate base.

Seeds 1", pink or red, compressed

1. *ensiformis*.

Lfts. oval or broadly-ovate, often obtuse, base rounded.

Seeds .7", scarcely compressed, brown

2. *virosa*.

II. Lfts. orbicular-obovate, rounded or retuse, often with white silky hairs

3. *lineata*.

1. *C. ensiformis*, DC. Syn. *Dolichos ensiformis*, L.; *Canavalia gladiata*, DC.; Tihon, K., S.; Makhan Sim, Beng.; The Sword Bean.

A climbing perennial with green glabrous stems, terminal leaflet 4—6" long glabrous ovate usually shortly acuminate and with obtusely cuneate not rounded base. Fls. large white or pink. Calyx glabrous .55—6" long, standard broadly oblong 1.3" long and 1.4" broad, wings 1.4", long-clawed, slightly adnate to keel. Ovary slender silky below,

swollen below the style. Ovules 10 or more. Pod usually 8—10" long by 1·3" broad. Seeds bright rose-pink ·8—·9" long, rather strongly compressed.

Apparently wild along river valleys in the Angul jungles and cultivated in all districts! Fl. Aug.—Dec. Seed ripens March—April.

In cultivation the plant is somewhat variable, but chiefly in the length of the pod and number of the seeds; the measurements above given are chiefly those of the wild or feral Angul plant, the pod of which has a distinct curvature (in opposite direction) each end. The seed is always pink when ripe, though *Roxburgh* refers to a grey variety in Silhet.

The seed and the sliced fruit are eaten.

The plant is usually grown as an annual, as the natives say that the subsequent crops of seed are more or less poisonous! This is interesting in view of the next species being reputed poisonous. The seed germinates in June. The interpetiolar stipules of the first leaves are ·6" long, oblong, sometimes 2-fid. The regular stipules are mere points.

2. *C. virosa*, W. & A. Syn. *C. ensiformis* var. *virosa*, F. B. I.; *Dolichos virosus*, Roxb.; Kath-sim, Kala-sim, Beng.; Mohrhaha, Bahara, Or.

A climbing perennial with usually reddish and tougher stems than in the last. Terminal leaflet 1·5—4" long rarely 5·5", broadly elliptic-oblong or broadly-ovate with a rounded tip and short cusp or obtuse, rarely acute or sub-acuminate, base rounded; usually with few scattered hispid hairs beneath and petiolules hairy. Flowers lilac-purple 1·2" long usually reflexed in shorter but closer-flowered raceme than the last, calyx puberulous ·55", standard sometimes 1·2" broad not as long, with two strong calli above the claw. Wings 1" adnate to keel at base, wavy. Ovary silky tapering into the style. Ovules about 10. Pod attaining 7" by 1·5" but often much smaller (4—5") nearly straight, brownish when ripe. Seeds 4—8 ellipsoid or somewhat ovoid ·6—·7" long and much less compressed than in *ensiformis*, marbled with light and darker brown, hilum ·5" long.

In hedges and scrub forest, especially near the sides of ravines, common in the Southern Area but not elsewhere. Purneah! Puri! Angul! Fl. Aug.—Dec. Fr. ripens March and newly germinated seedlings may be found in April. These are very hairy.

The interpetiolar stipules of the first leaves are oblanceolate, 4—5" long.

The character of obovate leaflets so often given to distinguish this species from the last is quite useless; it very rarely has obovate leaflets. The very distinct seeds on the other hand have not been usually noticed. In the forest the very frequently red stems and venation at once distinguish it.

The seeds are reputed poisonous, but the young pods are sometimes eaten.

3. *C. lineata*, DC. Syn. *C. obtusifolia*, F. B. I.

A prostrate plant with long stems several feet long (but not climbing) which at least when quite young are clothed with white silky hairs. Lfts. silky when very young, glabrescent, orbicular-obovate or orbicular, rounded or retuse, terminal 2—4" long and broad. Fls. pink much as in *virosa* but in fewer fld. racemes which exceed the leaves. Pod straight 3—4" long by 1" broad, 4—6-seeded.

Sandy sea-shores from Balasore southwards! Fl. Oct.—Nov. Apparently dying down after fruiting in March. New shoots in May.

The stipules are somewhat better developed in this species, broadly ovate but very small.

The plant roots at the nodes and tends to bind the sand.

45. BUTEA, Roxb.

Trees, sub-erect shrubs or large woody climbers with pinnately 3-foliolate stipellate leaves. Flowers large or rather small fascicled on the tumid nodes of racemes or panicles. Calyx campanulate, teeth short or lanceolate. Petals sub-equal or unequal, keel incurved and acute or straight and obtuse. Stamens 9+1. Ovary 2-ovuled, style beardless. Pod much compressed oblong, the base sometimes sub-samaroid and the apex dehiscent round the terminal seed, sometimes seed more central and pod sub-indehiscent.

- | | |
|---|------------------------|
| A. Flowers very large, red. Keel incurved, acute. | |
| Tree. Lower calyx-teeth deltoid | 1. <i>frondosa</i> . |
| Large climber. Lower calyx-teeth lanceolate | 2. <i>superba</i> . |
| B. Flowers not very large, keel little-curved, sub-obtuse. | |
| Sub-erect shrub | 3. <i>minor</i> . |
| C. Flowers rather small, cream-coloured. Keel straight, obtuse. | |
| Large woody climber | 4. <i>parviflora</i> . |

1. *B. frondosa*, Roxb. Morud, K.; Murup', S.; Dhak, H.; Paras, Palas, Beng.; Porasu, Polas, Or.

A small or m.s. tree with usually crooked trunk and black nodose branchlets. Leaves rarely 1-foliolate. Lfts. coriaceous 4—8" long and broad, with a markedly greyish appearance when seen from a distance, grey tomentose or pubescent beneath, shining above, terminal obovate rounded at apex, or emarginate lateral oblique and considerably smaller. Flowers scarlet and orange 1.5—2" long, borne in great profusion on the usually leafless branches. Calyx velvety black, campanulate, coriaceous, upper lip sub-emarginate, lower with three deltoid teeth. Pod about 6" long, velvety brown. Seed oval compressed brown, 1.5" long.

Very common in the Central and Southern areas exc. Puri, and often gregarious in cultivated and waste lands esp. in Palamau and Hazaribagh. In the Northern area it becomes scarce in Purneah except towards the Morung but it is found sub-gregariously in some grass lands of Northern Champaran. Fl. Feb.—April, at least the upper part of the tree being leafless at the time. Fr. May—July.

On blazing the trees a red juice issues which hardens into a red astringent gum used in diarrhoea and in the indigo-beating vats. It is said to increase the outturn of indigo by 30—40 per cent. The trees are bled in May and June and the gum realises Rs. 6/- to Rs. 15/- per maund. The leaves are used for fodder and manure. The root bark gives a fibre and the flowers a yellow dye. It is one of the principal trees for lac cultivation. It grows easily from seed and succeeds best on cotton soil.

2. *B. superba*, Roxb. Morud, K.; Nari-murup, S.; Dorang, Kharw.; Noi Palas, Palsa-Noi, Or.; Budel, budhla, Gond.

A very large woody climber with the leaflets usually attaining 12—18" and sometimes 20" in young plants, sub-rugose and dull above, green and thinly (or young densely) hairy especially on the nerves beneath, terminal usually sub-rhomboid with obtuse apex. Flowers 1.75—2.5" long, gorgeous orange scarlet borne in great profusion along the leafless

branches on racemes often 12" long. Calyx broadly campanulate, lower teeth lanceolate. Pod about 5"—6".

Common in the hill forests of the Central and Southern areas in all the districts! Fl. March—April. Fr. June—July. Leafless Feb.—May.

It climbs from left to right with a trunk attaining 2—3 ft. girth. Bark rich brown, tardily flaking and hence generally smooth, the red juice as in *B. frondosa* contained in tubes between the bast fibres in the cortex; wood normal *without concentric rings*, with numerous med. rays, scattered large pores often sub-divided and other smaller ones. The spaces between the raised nerves beneath are minutely areolate with depressed nervules and the areoles are pale and glabrous, the appearance is therefore different to the leaflets of *Butea parviflora* which are sometimes confused with this. The fruit is very similar but can be distinguished by the character of the persistent calyx.

Roxburgh remarks that "the colours of the flowers are so vivid that my best painter has not been able, with his utmost skill, to imitate their brightness. When in flower, I do not think the vegetable world offers a more gaudy show."

3. *B. minor*, *Ham.* (*Wall. Cat.* 5439) inc. *B. pellita*, *H. f.* (*Kew. Bull.* 1908).

A large shrub with several long sub-sarmentose weak stems, not climbing. Stems without, or with very scanty, red juice, densely velvety with a close spreading indumentum, densely yellow-sericeous towards the inflorescence. Terminal leaflet 12—16" broadly elliptic, with rounded not rhomboid base and acute rounded or emarginate apex, lateral similar but smaller and usually obliquely oblong, above sparsely hairy, beneath densely grey hairy-pubescent on the nerves but glabrescent between them with age. Fls. red 9" long in dense racemes which are usually paniced at the ends of the stems, both calyx and corolla densely yellow-sericeous. Pod sub-sessile oblong wider upwards 2—3" by 1.25—1.4" tomentosely hairy with the basal thin portion very short or almost absent.

Sameswar Hills, N. Champaran 2000 ft., on sides of ravines! Fl. Sept.—Oct. Fr. Nov.—Jan. The whole plant dies back to the rootstock after fruiting.

A very interesting plant, never, where I have seen it, a climber. Lfts. with venation as in the other species with usually several sec. n. near the base. Petiole 6—8". Stipules often persistent as semi-orbicular auricles 1" broad. Rhachis of panicle angular. Pedicels .5—7". Calyx .3" with very short teeth. Style hairy.

Eastern Himalayan specimens differ in some respects, especially in the more sericeous less hirsute tomentum, rather larger flowers and longer base to the pod. Our plant more resembles *B. pellita* but is close to *Hamilton's* type and collected near the same region, so that it is the Eastern form, not the Western, which requires renaming if the two are distinct. The description of *B. minor* in *Kew. Bull.*, 1908, appears to have been drawn up from the Eastern form, not from *Hamilton's* Nepal plant.

4. *B. parviflora*, *Roxb.* Syn. *Spatholobus Roxburghii*, *Benth.*; *Bandu*, *Bandan*, *K.*; *Cihut*, *S.*; *Bibri*, *Kharw.*; *Maula*, *H.*; *Ram Borla*, *Th.*; *Murdha*, *Or.* (When in leaf only it is often called by names applicable to *Butea superba*.)

A gigantic climber with the trunk attaining 3 ft. girth or more. Leaflets 5—10" long, scarcely coriaceous, shortly densely silky or (var. *denudatus*, *Baker*) glabrescent beneath, terminal elliptic, sub-rhomboid or somewhat obovate, shortly cuspidate, sec. n. 8-10 strong and tertiaries scalariform. Fls. cream-coloured or white .35" long. Pod 3—4" long, ferruginous-tomentose, sometimes constricted below the seed, base narrowed suddenly to a stipes .5" long.

Throughout the whole area but only common in the moister forests! Fl. Aug.—Dec. Fr. Feb.—March. Evergreen.

Bark smooth grey, wood with deep red concentric bast bands. The length and character of the leaf rachis between the lateral and terminal leaflets is extremely variable, sometimes only 3" long and stout, at other times slender and 1.5" long. Panicles tomentose, pedicels under .1". Calyx narrowly campanulate (by this character the inflorescence can be distinguished from *B. superba* in fruit), pale tomentose, lower teeth sometimes exceeding the tube, linear-lanceolate.

The seeds give an oil used for cooking and anointing. The bark gives a fibre. The red gum resembles that of *B. frondosa* and lac is sometimes collected both from this and the large-flowered *Buteas*.

46. PUERARIA, DC.

Large woody climbers or twining herbs with stipellate 3-foliolate leaves, leaflets sometimes lobed. Flowers large or small fascicled on the tumid nodes of long often paniced racemes. Two upper calyx teeth connate. Corolla far exserted, standard spurred or not at base, clawed, about equalling the wings and keel. Stamens monadelphous or distinctly diadelphous, anthers uniform. Ovary not or scarcely stipitate, many-ovuled, style filiform incurved beardless, stigma capitate. Pod linear, more or less compressed, sometimes constricted between seeds.

Large woody climber flowering when leafless
Slender climber flowering with the leaves

1. *tuberosa*.
2. *phaseoloides*.

1. ***P. tuberosa*, DC.** Jan Tshira or Chirra, S.; Pathal Kohnra, *Kharw.*; Pathal, Badra, *Gond.*; Ban Kumra, *H.*; Shimia batraji, *Beng.* (teste *Beng. Pl.*); Handiphuta, Kataka, Buinka Karkaru, *Or.*; Marda tunga, *Khond.*

A very large woody climber flowering when leafless and then very handsome. Lfts. large 6—12" roundish or, more usually, the terminal one rhomboid longer than broad and the lateral very obliquely ovate, easily recognised from other similar woody climbers in the province by being permanently appressed white silky beneath and with scattered thinner appressed hairs also above, the stipellæ are also lanceolate-subulate 2—3" long on the young leaves though they become more inconspicuous with age. Fls. blue-purple ternate on the nodes of racemes 6—18" long. Calyx 3" purple or green, silky. Standard orbicular, clawed, often white, 5" long, slightly spurred or not, sides often revolute and apex emarginate. Stamens usually diadelphous 9+1. Pod 2—3" long, hairy.

Central and Southern area, chiefly on the sides of rocky streams. Hazaribagh, *Meebold!* Parasnath! Manbhum, *Camp!* Ranchi! Palamau! Puri! Angul! Sambalpur! Kalahandi, *Cooper!* Fl. Feb.—April. Fr. May—June. The leaves drop December in February and are renewed in May.

Tubers usually several, attached to the base of the stem by stout lateral roots and again ending in roots. They thus remind one of the Yams and are probably morphologically roots, the shape is usually globose-oblong. Stems attain 2 ft. girth. Bark brown, fibrous, peeling off in strips, sometimes twisted. Wood rather soft without bast rings, with many very large pores with distinct walls, sometimes divided, med. rays inconspicuous. Near the pith are sometimes patches of tissue with red juice, but the outer bark has no red juice. Wings of corolla 5" long, falcately oblong with spur above base, obtuse; keel petals free, long-clawed,

spurred. Ovary silky, about 10-ovuled, style puberulous. Vexillary stamen rarely slightly connate. Young pod densely brown bearded on the sutures and densely appressed hairy on the faces.

The tubers sometimes attain an enormous size. *Campbell* mentions one from the Gobindpur sub-division nearly 2 ft. long and 2.5 ft. in circumference. They are sometimes cut up, boiled and eaten in Palamau, but their use as food seems to be far from general. In most districts they are used medicinally. *Campbell* states in Manbhum for renal complaints and to kill fish. In some districts eaten in particular conditions of the bowels, in other districts no use appears to be made of them.

2. *P. phaseoloides*, *Benth.* Syn. *Dolichos phaseoloides*, *Roxb.*

Rather a strong twiner but not at all woody. Stems with reflexed hairs, leaflets 3—4" closely appressed-hairy beneath, less so above. Fls. 5" long blue (yellow according to an Indian collector) in axillary racemes 3—6" long or about as long as the leaves, rachis strigosely hairy. Pods numerous straight linear 2—3" by 15" only, somewhat compressed, clothed with stiff appressed hairs, 10—14-seeded.

Jungles of northern Purneah! Fl. Sept. Fr. Oct.—Dec. Perennial.

Terminal leaflet broadly rhomboid sometimes as broad as long rarely 5", obtuse or acute, sometimes shallowly lobed, sec. n. 6, of which 1 basal. Petiole densely hairy, 1—1.5". Stipules basifixed triangular, 1.5" long. Stipellæ subulate. Racemes sometimes 2-nate. Pedicels very short, recurved in fruit, so that the pods are strongly reflexed.* Seeds black, oblong, subterete, rough, not shining, with very hard testa and short hilum.

The pods and seeds are more those of a *Phaseolus* than a *Pueraria*.

47. MUCUNA, *Adams.*

Twining shrubs or herbs with pinnately 3-foliolate minutely stipellate leaves. Flowers usually large and usually purple (in our area), mostly fascicled on the tumid nodes of racemes which are axillary or lateral on the old branches or stems. Calyx widely campanulate, anterior lobe longest, upper two connate. Corolla much exserted, petals very unequal, the standard being much shorter than the wings which again are shorter than or equal to the keel, standard auricled at the base. Stamens dimorphous, the longer with basifixed anthers, the shorter with ovate dorsifixed bearded anthers. Ovary and style densely hairy. Ovules 2—many. Pod usually covered with fine irritating pungent bristles. Seeds transversely oblong with short hilum or orbicular with linear hilum.

- | | | |
|---|--|------------------------|
| I. Flowers 1" or more long. | | |
| A. Pod oblong with plaited faces. | | |
| Lfts. lanceolate. Pod oblong, winged down the sutures | | 1. <i>imbricata</i> . |
| Lfts. ovate. Pod elliptic or rhomboid, 2—2.5" | | 2. <i>monosperma</i> . |
| B. Pod linear, faces not plaited. | | |
| 1. Leaves silky beneath. Fls. purple. | | 3. <i>prurita</i> . |
| Pod grey with close bristles | | var. <i>utilis</i> . |
| Pod black with velvety persistent tomentum | | |
| 2. Leaves glabrescent. | | |
| Fls. white. Pod as in last variety. | | var. <i>nivea</i> . |
| Fls. few, purple. Pod velvety, glabrescent | | var. <i>capitata</i> . |
| II. Flowers about .8" or less | | 4. <i>minima</i> . |

* In our specimens, but sometimes the pods are erect. In the closely allied genus *Phaseolus* the position of the pods has sometimes been used to differentiate species!

1. *M. imbricata*, DC. Marang atkir, itikar or etka, K., S.

A large climber with slender sparsely hairy or yellow-setose branches, lanceolate or ovate-lanceolate or elliptic usually acuminate leaflets 4—6" long sparsely shortly yellow hairy beneath, dull purple flowers in pendulous long peduncled racemes 4—6" long and pods about 5" by 2", easily recognised by the two wings on each suture and the obliquely plaited faces. Seeds 2—4, large, flat, with a circumferential hilum.

In the damper forests, N. Champaran! Ravines in Singbhum and Santal Parganas! Parasnath (Hazaribagh)! Angul! Fl. Aug.—Oct. Fr. Dec.—Feb., but pods remain long on the plant and were found on Parasnath in May.

Petiole and leaf-rhachis slender, together about 3—5" long. Petiolules stouter, .25". Stipellæ minute, setaceous. Peduncles usually 6—12" long. Flowers about 8—10, 2—2.25" long. Bristles on the plaits ferruginous and style persistent as a hard slender beak.

2. *M. monosperma*, DC. Sarni, Bai-donka, Or.

A large climber with sometimes worted glabrescent branches, ovate broadly ovate or (terminal) sometimes elliptic leaflets, very dark green with red nerves and scanty ferruginous hairs, mostly about 4" long and shortly suddenly cuspidate. Fls. large purple in short-peduncled short racemes about 3—4" long only. Pods sub-globose when young, afterwards ovoid or ellipsoid or rhomboid, 2.5" long, 1-seeded.

Damp forests. Mals of Orissa! Fl. Nov.—Dec. Fr. Feb.—April.

Petiole and leaf-rhachis together 4—6" long. Stipellæ minute, setaceous. Peduncles usually about 1" only and racemes few-flowered. Flowers about 2" long. Pod very bristly when young with slender hardened style-base. The young pod is not winged on the sutures, but some specimens at Kew show the wings in old pods.

3. *M. prurita*, Hook. Syn. *M. pruriens*, F. B. I. (not of DC., teste Gamble); Kivach, H., whence the English name Cowage; Alkusi, Atkir, Etka, K., S.; Bai Khujani, Or.

A slender climber, leaflets appressed hairy beneath, lateral exceeding the terminal semi-cordate ovate 3—6" long with 6—7 rather strong lateral nerves, terminal rhomboid. Flowers purple, 1.25—1.5" long in rather dense drooping short-peduncled racemes 6—12" long. Pod turgid linear with the ends curved in opposite directions, 2—4" long, densely clothed with brown or grey intensely irritating bristles. Seeds about 6 in a papery endocarp, black and shining.

In dry jungles, very common along riverain forests, throughout the whole area. Fl. Sept.—Nov. Fr. Jan.—April.

Stems sulcate and densely clothed with rigid hairs or with few appressed hairs. Petiole sometimes 10" long.

Various medicinal virtues are ascribed to the plant, some probably imaginary. Campbell states that the root is given for delirium in fever and that a paste made from the powdered root is applied for dropsy. The hairs of the pod are anthelmintic and were at one time included in the *British Pharmacopœia*. Both the root and seeds are included in the Hindu *Materia Medica*. An intoxicating liquor, "khasuna," is prepared from the plant in Palamau. The young pods are eaten as a vegetable after removal of the hairs.

The following are possibly only cultivated varieties of *M. prurita*; they do not occur wild in our area:

α. *M. utilis*, Wall. Alkushi, Beng.; Kursar, Mal Pah.

It scarcely differs from *M. prurita* except in the black velvety pod. "In badly grown plants the racemes are often short and few-flid.

Cultivated in Chota Nagpur," Prain.

β. *M. nivea*, DC. Khamach, Beng.

It differs in the leaflets being glabrescent beneath and in the white flowers.

Cultivated in Chota Nagpur, Wood.

γ. *M. capitata*, W. & A. Kursar, Mal Pah.; Kuswa, Kharw.

Branches glabrescent. Lfts. usually smaller than in *prurita*, 2.5—4" long, thinly appressed hairy beneath, sub-equal, petiole often shorter than the leaflet. Racemes in short peduncled few-flowered. Pod purple 5—6", bristles at first dense subsequently few and deep brown or blackish, when dry marked with faint oblique grooves.

Palamau! Rajmahal Hills!

As the pod may sometimes be described as black and velvety, this may be the same as *utilis*.

4. *M. minima*, Haines (Jour. As. Soc., xv, 7).

A very slender climber with sulcate thinly hairy stems, leaves with the petiole only 2—3" long, terminal leaflet broadly elliptic or obovate 1—1.5", lateral leaflets exceeding the terminal, very gibbous. Flowers only .75—8" long in a few-flowered axillary cluster. Pod not seen.

Forest near Larasara, Sambalpur!

Fl. February.

Leaflets sericeous beneath and less so above, apex rounded, sec. n. 3—4. Petiole 1—1.5". Stipellæ filiform. Pedicels .15". Calyx .35"—.4" densely sericeous, lowest tooth lanceolate about as long as the tube. Keel .75". Standard .5", nearly glabrous, wings slightly shorter than the keel, narrow. Upper part of filament of stamens with dorsifixed anthers dilated, free part of posterior filaments very long. Ovary linear and style densely hairy. Ovary 2-ovuled.

48. ERYTHRINA, L.

Trees with prickly branches or (*E. resupinata*) an undershrub with pinnately 3-foliolate leaves and gland-like stipellæ. Fls. red, showy, with spathaceous or two-lipped calyx and very unequal petals, the standard much exerted and exceeding the wings and keel. Upper stamen nearly free or connate with the others half-way up. Ovary stipitate many-ovuled. Pod linear turgid, septate usually more or less torulose.

I. Trees.

A. Calyx oblique spathaceous and splitting.

Calyx split to base, tip 5-toothed

Calyx split half-way down, apex entire

B. Calyx not spathaceous but two lipped.

Lfts. broadly ovate or rhomboid

Lfts. elliptic, much longer than broad

II. Undershrub. Calyx 2-lipped

1. *indica*.

2. *stricta*.

3. *suberosa*.

4. *ovalifolia*.

5. *resupinata*.

1. *E. indica*, Lamk. Marar, S.; Pharar, Kharw.; Palita-mundar, Beng.; Hadbad, Ghatw.; Pharad, Pangra, H.; Indian Coral Tree.

A prickly tree with the prickles small and black. Shoots at first densely tomentose but leaves quickly glabrescent, leaflets 3—6", broadly deltoid

or base of terminal sometimes rounded or subrhomboid. Racemes very elongate usually 6" excluding the peduncle which is about 4" long. Flowers brilliant scarlet. Calyx split spathaceous with very oblique mouth, persistent and ultimately recurved, 5-toothed at the narrow tip. Pods many, 6—10" long, beaked, somewhat curved, narrowed into a seedless base and a stout stipes .75—1" long, torulose, 6—12-seeded, somewhat stellate-pubescent.

Often planted. Rare in Purneah, *Ham.*; Ranchi! Palamau! Khandpara and Banki! Common in Khurda, where it is perhaps wild! Fl. March—April. Fr. April—July. Deciduous up to the time of flowering.

Bark smooth and greenish after the papery exfoliations, branchlets less stout than in the next. Stipellæ short swollen reflexed finally hard, sec. n. 4—5, of which one from the base. Standard about four times as long as the wings. Fruiting pedicels stout about .6". Seeds .6—7" dark purple.

The wood is little used but *Gamble* says it is fairly durable although light and soft. "Wt. about 19 lbs. only." The bark is used as a collyrium in ophthalmia. The tree is very ornamental and grows easily from cuttings and is used in some parts of India for supporting the Black Pepper (*Roxb.*).

2. *E. stricta*, *Roxb.*

A large or mod.-sized tree with the stout branchlets very closely beset with sharp yellow prickles .15—2" long. Lfts. hairy beneath when young, glabrescent, 3—6" long and broad, broadly deltoid, base often rhomboid or rounded. Racemes under 3" long on peduncles the same length. Flowers crimson, 1.8—2" long. Calyx split, spathaceous, pubescent .4", not toothed at the tip. Pod not at all torulose (in our specimens), slightly curved, 4—6.5" long by .7" wide, with a slender stipes .5—1.3" long and persistent spathaceous calyx; often beaked with the slender style. Seeds .4—5", oblong.

Orissa. Chandka, Puri, *Gamble*! Sometimes planted! Fl. Jan.—Feb. Deciduous up to the time of flowering.

A much larger tree than the last. Bark pale smooth greenish after the papery exfoliations as in the last. Standard about .4" wide but if unfolded .75" wide and lanceolate.

3. *E. suberosa*, *Roxb.* (inc. *E. sublobata*, *Roxb.*). Piri, *K.*; Buru Marar, *S.*; Pharar, *Kharw.*; Paldua, *Chaldua*, *Or.*; *Baldia*, *Gond.*

A small very prickly tree with thick corky bark and leaves covered with white-brown tomentum beneath (exc. var. *glabrescens*). Fls. scarlet in sub-capitate racemes. Calyx persistent turbinate 2-lipped. Pod scarcely torulose (torulose *F. B. I.*), much as in *E. stricta*, narrowly spindle-shaped, 4—6" long including the slender stipes, about .4" wide in the middle. Seeds 2—3 only.

In hilly districts throughout the province! Fl. March—May. Fr. April—June. Leafless upto June.

Rarely attains 5 ft. girth. Bark deeply furrowed, blaze thick yellowish. Prickles usually straw-coloured. Shoots densely tomentose. Terminal leaflet 6—9" broad, not as long, base usually rhomboid or sub-cuneate, sec. n. 5—6, one from base. Petiole 6—7" tomentose. Racemes 1.5—3" long (excluding the peduncle). Standard 3—4-times as long as broad and twice the keel.

Var. *sublobata*, *Roxb.* Leaflets lobed or lobulate, very tomentose beneath. Monghyr! Hazaribagh! Parasnath!

Var. **glabrescens**. Lfts. almost glabrescent beneath. It may be distinguished from *E. stricta* by the areoles (between the reticulations) less conspicuous and not white. Champaran Hills!

The bark yields a good cordage fibre of a pale straw colour. The wood, ash, and bark are used for dyeing, and the bark is also used in medicine.

4. *E. ovalifolia*, Roxb. Hari-kekra, Beng.

A mod.-sized much branched tree with scattered pale-coloured prickles which often extend even on to the leaves and leaflets. Easily recognised, distinguished from any of the preceding by the elliptic or ovate-elliptic leaflets. Flowers crimson, mostly 3-nate on the rachis of the raceme. Calyx pubescent, often irregularly splitting. Standard twice the keel, broadly obcordate with a long claw. Pod about 6", torulose at least on one side, 6—8-seeded.

Puri! Perhaps only planted. Fl. Feb. also May. I have seen new shoots in September but it probably renews its leaves also at the end of the hot season like the others.

Bark pale brown thick and fluted or somewhat cracked. Prickles sometimes with black tips, very sharp and more slender than in the others. Lfts. 4—6" long, rounded at tip, very pale beneath and minutely reticulate, glabrescent, sec. n. 6—8 of which one from base.

5. *E. resupinata*, Roxb.

An undershrub with shoots a few inches high, dying down annually, leaflets about 2.5" long and broad, roundish or terminal rhomboid, lateral smaller, sometimes ovate or ovate-lanceolate, obtuse, tomentose or pubescent beneath, glabrescent? Petioles and nerves usually somewhat prickly. Racemes about 4—6", short-peduncled, often appearing before the leaves. Fls. bright scarlet. Calyx 2-lipped. Standard elliptic or exceeding the small obovate nearly colourless wings. Pod not seen.

Higher plateau of Chota Nagpur. Neterhat, 3000 ft.! Parasnath! Fl. March—April. It occurs in Oudh and will very likely occur in Champaran.

49. PHASEOLUS, L.

Prostrate, sub-erect or twining herbs with 3-foliolate stipellate leaves and conspicuous stipules sometimes peltately attached. Fls. fasciated on the swollen nodes of axillary racemes. Calyx campanulate with the two upper teeth connate or not. Keel of corolla spirally beaked. Stamens 9+1. Ovary sessile, many-ovuled, style twisted with the keel, conspicuously bearded on the inner face (or, owing to torsion, on the side) below the very oblique stigma. Pod linear, rarely oblong, sub-terete or compressed, with usually thin septa between the seeds.

I. Stipules not produced at their base. Fls. rarely yellow.

Pod over 3" broad, curved, 2—4-seeded.

A. Pod oblong. Fls. whitish or yellowish green

1. *lunatus*.

B. Pod linear. Fls. medium-sized.

Bracteoles large, exceeding the calyx. Fls. lilac to white

2. *vulgaris*.

Bracteoles shorter than the calyx. Fls. scarlet, rarely pinkish

3. *multiflora*.

II. Stipules produced below the base (peltate). Fls. yellow. Pod under 3" broad.

A. Pods glabrous or puberulous, terete or sub-compressed, straight.

1. Pods terete, seeds rounded at ends.

Stipules oblong. Lfts. shortly lobed

Stipules lanceolate. Lfts. deeply lobed

4. *trilobus*.

5. *aconitifolius*.

2. Pods sub-compressed. Seeds truncate at the ends.

Lfts. usually repand, scarcely lobed

6. *calcaratus*.

B. Pods hirsute, sub-compressed.

1. Wild. Stems twining and pods distinctly septate

7. *sublobatus*.

2. Cultivated. Stems sub-erect or shortly twining. Pods sometimes not septate. Septa sometimes evanescent.

a. Pods erect or sub-erect (*mungo*).

Sub-scandent, seeds black

Diffuse. Seeds black with grey spots

8. *mungo*.

(9.) *Roxburghii*.

b. Pods spreading or reflexed (*radiatus*).

Seeds green, pods patent

10. *radiatus*.

Seeds yellow, pods reflexed

(11.) *aurea*.

Seeds black, pods patent

(12.) *grandis*.

NOTE.—The above key is mainly after *Prain in Bengal Plants*, but he defines two species, viz. *mungo* and *radiatus*, and treats the others (shown in brackets) as varieties of these two. I look upon all of the species 8—12, as varieties derived from *sublobatus*. The position of the pod is not a satisfactory character. *Gamble (Madras Flora)* adds "seeds black" in the definition of *P. mungo* and "seeds green" in that of *P. radiatus*. This would reduce *P. grandis* to a variety of *mungo*, whereas *Prain* considers it a variety of *radiatus*!

Baker in F. B. I. reduces *P. radiatus* to a variety of *P. mungo*.

1. *P. lunatus*, L. Rangoon Bean, Sugar or Lima Bean.

Twining with pubescent but often glabrescent stems. Lfts. 2—4" long, nearly glabrous, terminal tapering-rhomboid. Racemes usually short, 1—3.5", hairy. Fls. hairy, 17—25", usually 3 to a node. Pod 2—2.5" long by .6—7" broad, somewhat curved, shortly beaked, glabrous, seeds 2—4 large, usually white, sometimes purple.

Occasionally cultivated, chiefly in Orissa. Fl. Aug.

It is said to be injurious to cattle, owing to prussic acid, which, however, is dissipated in cooking.

2. *P. vulgaris*, L. French Bean, Haricot Bean.

Glabrous or nearly so, twining or low and suberect (var. *nanus*). Lfts. thinly hairy, terminal rhomboid with rounded sides and slightly tapering tip, 2.5—3.5" long. Racemes 1.5—7", axillary very lax. Fls. pale-coloured, slender-pedicelled, in pairs on the not much thickened nodes, easily recognised by the very conspicuous large nerved bracteoles embracing the flower and exceeding the calyx, ultimately spreading, .3" long. Pods about 3—5" by .4", beaked.

Often cultivated in European gardens.

Roxburgh says the bracts (bracteoles) are shorter than the calyx, evidently following *Willdenough*, who made this mistake.

3. *P. multiflorus*, Willd. The Scarlet Runner.

Stem twining. Flowers geminate, scarlet, in many-flowered racemes as long as the leaves, the two bracteoles appressed to and shorter than the calyx. Pods long pendulous.

Occasional in European gardens. A native of Mexico.

4. *P. trilobus*, Ait. Mugani, Rakhal-kalai, *H.*

Stems trailing 1—2 ft. long, glabrous or hairy. Lfts. very variable in size usually shorter than their petioles, nearly always lobed, lobes usually three shallow and rounded, in the wild plant sometimes deeply lobed, but lobes broad obtuse or rounded and sub-spathulate. Stipules oblong or ovate-oblong, very large, 3—5", attached above their base. Stipellæ small, but spreading and foliaceous. Racemes capitate or spiciform, long-peduncled. Fls. about 2—2.5" long. Bracteoles ovate. Pods narrowly linear about 2" long, only about 1—1.2" broad, glabrous, sometimes curved. Seeds 6—12, grey, small oblong with rounded ends, lineolate.

Apparently wild. Behar, *Hope!* Manbhum! Puri, *Hooper!* Fls. chiefly r.s. The seeds are gathered and eaten by the poor. Cattle eat the plant.

5. *P. aconitifolius*, Jacq. Moth, *H.*; Bir-moch, *S.*; Mung, *K.*

Stems numerous, trailing for several feet, often very hairy. Lfts. always deeply lobed and the lobes often again lobed, lobes linear or lanceolate and acute, somewhat hairy. Petioles longer than the leaflets. Stipules sharply lanceolate, 2" rarely 3", and stipellæ linear or subulate. Racemes usually capitate, flowers 2" or less, but standard 2.5" broad. Bracteoles linear-setaceous, far exceeding the minute calyx. Pods 1—2" long, 1.5—1.7" broad. Seeds often 7—8.

Doubtfully wild, often cultivated. *Campbell* says that it is wild in dry situations in Manbhum, and the Santal name supports this. Santal Parganas, *Wood!* Cultivated in Ranchi, Singbhum, etc.! Fl. chiefly Sept.—Oct. Fr. Oct.—Nov.

The grain is eaten and the plant used for fodder.

6. *P. calcaratus*, Roxb. Sutri, *H.*; Bir Mung, *S.*

A slender twiner. Stems with spreading hairs. Leaves long-petioled. Lfts. 2—4", terminal rhomboid-ovate repandly 2-lobed or wavy each side, rarely some lanceolate and entire, both sides hairy. Stipules large peltately oblong, 4—5", hairy and ciliate, 12-nerved above. Racemes 2.5" elongating to 1" with peduncle 1—3". Pod never with long hairs, hirtellous or puberulous.

Wild in Sal forests in Singbhum! Abundant in a wild state in high dry jungle lands. Manbhum. *Campbell!* Lohardaga, *Clarke!* Palamau forests! Kodcrma forest! Santal Parganas, *Kurz, Wood!*

Fl. Aug.—Sept. Fr. Sept.—Nov.

Lfts. often softly hairy both sides, broad-ovate or rhomboid or upper quite narrow, always some wavy or lobulate, larger 4" by 3" rarely up to 5". Peduncles 2—4". Fls. yellow, 3.2" broad. Bracteoles setaceous. Pod 1.75", 9—12-seeded, seeds brown, not shining, small .08" or less, truncate both ends.

The seeds are eaten.

Very closely allied to *P. sublobatus*, but probably distinct, the very small short appressed hairs on the pods very constant in character. But it is doubtfully *Roxburgh's* plant which has quite glabrous pods. *Roxburgh* states that the *carina* has a remarkable long horn on the right side (when looking at the back of the keel). My specimens are unfortunately not in a state to determine this.

7. *P. sublobatus*, Roxb. Ghora Mung, *Beng.*

A twiner with branches and petioles brown-hairy, 3-foliolate leaves with leaflets sparsely setosely hairy on nerves beneath and rather

more so and also hispidulous above, terminal mostly ovate lanceolate with a rounded lobe each side, lateral often sub-lobed. Racemes often on leafless slender branches. Fls. capitate sub-sessile or pedicelled. Pods spreading terete (or compressed in *Herb.*) with rather rigid ascending hairs, about 12-seeded. Seeds terete '1—'12" dark grey with longitudinal wavy lines. Stipules large oblong '2—'45".

Wild in the forests. Palamau ascending to 3000 ft.! Ranchi! Parasnath, 4000 ft. *Clarke!* Fl. Sept. Fr. Oct.—Nov. Annual.

Var. α **typical**. Very slender. Lfts. 2—3". Petiole 1.25—1.75". Stipules 2—3" sparsely ciliate. Stipellæ 2" setaceous exceeding the petiolule. Peduncles 4—7" strigosely hairy. Racemes 2" few-fl'd. Bracts oblong-lanceolate. Pods 1—3" thinly septate. Neterhat 2500—3000 ft.! Parasnath!

Var. β **robusta**. Stoutier and more densely hairy. Lfts. 3—4". Petiole 1.5—2". Stipules 3—4.5" strongly 8-nerved and strongly ciliate. Racemes up to 8". Peduncles 3—6". Pods 1.5—2" to 1.8". Palamau and Ranchi forests!

This last comes very close to the cultivated *P. radiatus*, L., esp. var. *grandis*, which, however, has got perfectly smooth seeds.

8. *P. mungo*, L. Urid, mashkalai, tikari-kalai, *Vern.*; Ramra, *Kol.*

A cultivated diffuse or shortly scandent herb with often twisted stems with spreading or reflexed hairs sometimes glabrescent. Lfts. ovate lanceolate or ovate sometimes slightly lobed. Stipules 6—12-nerved '3—5" oblong, often hairy and sometimes ciliate. Pod 1—1.3" rarely more, erect or ascending, hairy. Seeds 4—6 black or black mottled grey, smooth.

Chota Nagpur, commonly cultivated! Santal Parg., *Kurz!* Probably throughout the province. A cold weather crop.

Both this and *P. radiatus*, L. are probably cultivated forms of the indigenous *P. sublobatus*. The flowers are a purer yellow than in *P. radiatus*.

(9.) Var. **Roxburgii**, *Prain* Syn. *P. radiatus*, *Roxb.* (in *F. I.*); Mash Kalai, *Beng.* is the suberect or diffuse form with seeds (f. *Prain*) grey only. I am inclined to think the colour rather variable. I have seen brown seeds in forms with erect pods. Indeed all the characters seem very variable.

Roxburgh describes it as diffuse and hairy. Lfts. elliptic. Stipules lanceolate. Horn of the keel very long. Pods straight hairy terete nearly erect 2" long, very hairy. Seeds small, 4—6, black with grey spots.

He states that it is the most esteemed of all the Leguminæ. Cattle eat the straw of this variety and it is considered very nourishing.

10. *P. radiatus*, L. Syn. *P. Mungo* var. *radiatus*, *F. B. I.*; Mung, *H., Beng.*

A cultivated plant rarely more than a foot high. Stems with spreading hairs or hairs somewhat reflexed. Lfts. sparsely setosely hairy, variable in size according to cultivation, usually 1—3". Stipules 3", 5—7-nerved usually ciliate. Racemes under 5" usually 3" but occasionally sub-panicled. Pods 1.5—2.5" by 2—2.2" spreading or reflexed, hairy when young with hairs inclined forwards but usually glabrescent. Seeds smooth.

Cult. apparently throughout the province.

Var. α **typica**. (*P. mungo*, *Roxb.*). "Pods spreading, seeds green." *Prain*. Balasore! Burdwan! A common field crop.

- (11.) Var. β **aurea** (*P. aureus*, Roxb.). "Pods reflexed, seeds yellow," Prain.
 (12.) Var. γ **grandis** (*P. Max*, Roxb.). Krishna Mung, Beng.; Mash-Kalai; Urid, H. "Pods longer, spreading. Seeds black," Prain.

The last is very close to *P. sublobatus* var. *robusta* (q. v.), but the wild plant is a good climber and seeds not so smooth. One specimen has the leaflets somewhat lobed. Baker is probably more logical in reducing *P. radiatus* to a variety of *P. mungo* (q. v.)

50. VIGNA, Savi.

A genus only separable from *Phaseolus* by the keel petals, which² are not spirally twisted, though often incurved.

Even this character often fails in *V. vexillata*, which I only retain in *Vigna* instead of *Phaseolus* for uniformity with other floras.

The stigma is sometimes large and capitate, situated on the inner face and with the minute horn-like appendage often more dorsal than in *Phaseolus*.

- | | |
|---|-----------------------|
| I. Keel with an incurved beak. Pods hairy, at least when young. | |
| Standard 1.25" diam. Pod with short brown hairs | 1. <i>vexillata</i> . |
| Standard 8" diam. Pod densely pubescent and hairy | 2. <i>pilosa</i> . |
| II. Keel scarcely beaked. Pod glabrous. | |
| Cultivated, twining or sub-erect | 3. <i>catjang</i> . |

1. *V. vexillata*, Benth. Syn. *Phaseolus vexillatus*, L.; Serwang, Bir Ghangra, S.

A slender twiner with tuberous roots and scabrid stems. Lfts. narrowly lanceolate, rarely ovate-lanceolate, usually about 6.5" by 1.75", often flushed white near the mid-rib, scabrellous above and on the ribs beneath, base rounded. Fls. large pale-purple in few-fl. heads on very long peduncles, vertically compressed with keel sometimes spirally curved. Pods narrowly linear straight, 3—4" long by .2" broad, with sparse short brown hairs, 15—20-seeded.

Frequent in the forests of Chota Nagpur, edges of fire-lines, etc. Singbhum, chiefly on the Porahat ghats! Hazaribagh! Ranchi! Manbhum, Camp! Fl. July—Oct.

Petiole 2—3" long. Peduncles 6—9" long, the raceme very short and often only 2—3-flowered with very short pedicels. Pod glabrescent.

The roots as well as the beans are eaten by the Kols and Santals.

2. *V. pilosa*, Baker. Syn. *Dolichos pilosus*, Roxb.

A twiner with hairy stems. Terminal leaflet lanceolate acuminate about 7" by 3", shortly hairy both sides, base 3-nerved; lateral rather shorter sub-falcate with very oblique base. Peduncles not longer than the 1"—1.75" long raceme. Flowers pale purple .7" long with standard .8" broad. Pod 4—5.5" long, slightly compressed, nearly straight, about .3" wide, beaked, densely pubescent and hairy, about 10—12-seeded. Seeds oblong, shining black .2" long.

Singbhum, Songra forest, near streams! Fl. Oct.—Nov. Fr. March. Perennial. Hairs appressed or in young parts spreading and of two lengths. Stipules narrowly lanceolate basifixed .15". Petioles of larger leaves 3—3.5" long much thickened below, pubescent, 2-margined above. Lfts. paler beneath. Calyx-tube .17" slightly gibbous covered with small appressed brown hairs, lower tooth

lanceolate as long as tube, upper lip extremely short, notched. Wings with very slender claw and basal spur as well as a short hooked spur below the rounded apex, keel with an incurved not at all spiral beak. Pedicels .1".

3. **V. catjang**, *Endl.* Syn. *Dolichos Catiang* and *D. sinensis*, *L.*; Barbati, *Beng.*; Badbadi, *Kharw.*; Lobia, Ransi, *H.*; Ghangra, *S.*; Rambara, *M.*; Galjaramba, *Ho.*; Bodi, Rewas, *Uran.*

Erect with long trailing branches or twining. Stems striate hispidulous or glabrous. Terminal leaflet rhomboid 2.75" and nearly as broad, nearly glabrous or attaining 5" and sub-hastately 3-lobed and lanceolate, the side lobes, if present, very rounded, base always very obtuse, glabrous and rather shining beneath and faintly puberulous above; lateral leaflets about as long as terminal, very unequal-sided. Flowers mostly geminate at the nodes, nearly 1", pale-yellow with purple wings or tinged purple, in the twining form often quite 1" with pale blue and white corolla. Standard .75—1" diam. sub-orbicular with 2 ridges and 2 small callosities above the claw. Keel carinate. Pod long linear sometimes 1—2 ft. and .3" broad with 15—23 seeds. Seeds usually white .3" subterete.

Cultivated in all the districts either with other crops or trained on trees and trellises or as a separate field crop.

Fl. chiefly Sept.—Nov. Fr. Oct.—Dec. or later.

Petiole 3—5" long grooved and often sub-alate above, rhachis of terminal leaflet often over 1", similar. Stipules .5—9" long, oblong acuminate attached near the base but with a broad lanceolate often curved auricle, rarely (in the twiner) only .3" and spurred. Stipellæ small ovate or tumid or oblong. Peduncles striate shorter than or much longer than the petiole. Racemes very short .5—1" hispid. Calyx .3" long with campanulate tube about as long as the subequal narrow-lanceolate teeth, sometimes tuberculate or transversely rugose.

Var. **typica**. Pods erect about 5", 6—12-seeded, expanded or sub-truncate at the tip, seedless both ends. Ramba, Bodi, *Vern.*

Var. **sinensis**, *Willd.* (sp.) Pods very long, 1—2 ft., pendulous, 15—23-seeded, torulose, usually twining. Galjaramba, *Ho.*, Daonbodi, *H.*

The whole pod is eaten cooked.

Pachyrhizus angulatus, *Rich.* (Syn. *Dolichos bulbosus*, *L.*; Sankalu, *Beng.*), is a robust climber which is fairly widely cultivated in the moister regions but has so far not been seen by me in our area though it is very probably cultivated in Orissa. The genus differs from *Pueraria* in the style being flattened upwards and being bearded within below the stigma, and from *Phaseolus* in the keel not being at all spiral. The plant has large tuberous roots which are caten, sharply angled or very acutely sub-lobed leaflets, and long racemes of handsome blue flowers. The pod is compressed about 5—10" long, much depressed between the 8—12 round flattened seeds. *Roxburgh* says it is cultivated throughout the Malay Islands for its roots, which resemble a turnip in taste.

52. DOLICHOS, *L.*

Twining, more rarely sub-erect, herbs with stipellate 3-foliolate leaves and small sub-persistent bracts, bracteoles and stipules. Fls. small or m.s., axillary or racemed, much as in *Vigna*, but the incurved keel not at all twisted and stigma terminal without a dorsal process. In many species, too, the style is hairy all round the stigma instead of being bearded on the inner face. Pod flat, linear or oblong or sub-oblong and wider in middle or upwards, curved, usually tipped with the style. Seeds

not or somewhat flattened, sometimes with a thickened and sub-persistent funicle.

Style thickened upwards, bearded on the inner face	1. <i>lablab</i> .
Style slender, hairy all round the stigma.	
Root tuberous. Flowers on a slender bracteate peduncle	2. <i>falcatus</i> .
Root annual. Flowers 1—3 axillary	3. <i>biflorus</i> .

1. *D. lablab*, L. Inc. *D. lignosus*, *Roxb.*, not of *Linnaeus*; *Sim*, *Sirmi*, *K.*; *Malhan*, *Malal*, *S.*; *Shim*, *Beng*.

A rather powerful climber, or in some forms dwarf and sub-erect with sarmentose branches. Lfts. pubescent both sides, but especially on the nerves beneath, terminal 2—4", rarely 6", long and broad, broadly ovate or deltoid, shortly acuminate, base strongly 3- or 5-nerved. Flowers red, purple or white in racemes which are axillary 3—6" long or terminal and attaining 9" excluding the peduncle. Nodes tumid with 1—4 flowers .75" long. Calyx campanulate, .25", subequally toothed, standard .6—'75" broad, keel rostrate. St. diadelphous. Style bearded down the inner face. Pod white to purple and usually shining, sub-lunate-oblong or wider above the middle, 2—3" long, tipped with the sharply bent style. Seeds with their axis at right angles to sutures about .5" long, rarely (in variety) with long axis parallel to suture, and then pod loses its normal shape and is longer. The sutures have a characteristic crisped or crenulate appearance.

Cultivated in all districts and one of the commonest climbers near the houses of the natives. The dwarf variety is less cultivated than in the Central Provinces. Fl. Oct.—Jan. Fr. c.s.

Stems pubescent or puberulous. Petioles 2—6". Stipules lanceolate .15—'2" long. Stipellæ variable in shape usually as long as the petiolule. Pedicels under .1". Bracteoles appressed to calyx, oblong, ciliate, .06".

Var. *lignosus*, *Roxb. sp.*, has longer linear-oblong pods less curved (see above). The racemes long and erect. It is the form usually grown as a dwarf and kept for the seeds, which are eaten.

In the usual short-podded form the bean is usually eaten before the seeds ripen.

2. *D. falcatus*, Klein. *D. falcatus*, *Willd.* (*F. I.*)

A slender climber with rather small 3-foliolate leaves and simple and 3-lobed leaflets sometimes with a pale patch in the centre. Fls. yellow (or blue-purple, *Roxb.*), .5", in a very slender usually short lax few-fl. raceme or solitary on a slender bracteate peduncle. Pod pale, flat, curved, 2—3" by .4", with 5—8 somewhat kidney-shaped seeds .3" long.

Hill forests of Puril Fl. Fr. Nov.—Dec.

Root a fusiform tuber. Branches with fine spreading hairs. Lfts. 1—1.5" or a few up to 2.3" with few short fine adpressed hairs both sides. Peti. slender 1—2". Stipules lanceolate .1" reflexed. Calyx .17". Funicle very broad.

Roxburgh's drawing marked *Dolichos trilobus* 289 (*Cal. Herb.*) is this.

3. *D. biflorus*, L. *Hore*, *M.*; *Hoe*, *Ho.*; *Horec'*, *S.*; *Kurti*, *Kulti*, *H.*; *Kulthia*, *Or.*; *The Horse-gram*.

A sub-erect villous herb with sub-scandent branches or, in the wild form, twining and less hairy. Lfts. .75—1.75" long lanceolate to ovate-lanc. or ovate-oblong, hairy both sides and often reflexed. Fls. very pale yellow with a crimson spot on the standard, 1—4 together axillary,

·45" long. Pod curved, very slightly so in the wild form, linear or broadly-linear, 1—1·7" long, thinly appressed-villous or sub-glabrescent. Seeds 4—6, reniform, grey.

One of the commonest field-crops in Chota Nagpur and frequently cultivated also in all other districts. Fl. Sept.—Nov. Fr. Oct.—Dec.

This appears to be an indigenous plant in India but not perhaps in our area. The calyx-teeth are very long and setaceous, about three-fourths as long as the flower.

Easily grown and eaten largely by the aborigines but is inferior, and in the more cultivated districts is used chiefly for cattle food. The straw is also used as fodder.

The orbicular-cordate cotyledons are long persistent.

53. CLITORIA, L.

Twining herbs (in our area) with pinnately 3—7-foliolate leaves and persistent striate stipules. Flowers large showy, axillary or paired on the rachis of axillary racemes. The genus differs from the allied genera in the standard far exceeding the wings and keel. Stamens diadelphous. Ovary stipitate. Style incurved, flattened, bearded along the inside below the capitate, not oblique stigma. Pod linear, flattened or turgid.

1. *C. ternatea*, L. Aparjita, Beng. The Mussel-shell Creeper.

A very beautiful slender twiner with pinnately- (mostly) 5-foliolate leaves, elliptic leaflets 1—2" long and azure blue, more rarely pure white, flowers 1·5—2" solitary on axillary peduncles with large foliaceous persistent bracteoles and the spoon-shaped standard expanding under the wings. Pod flat linear about 3·5" long.

Very common in gardens and as an escape. Fl. chiefly in the r.s. Fr. Nov.—Dec.

54. DALBERGIA, L.f.

Trees or shrubs, sometimes scandent. Leaves pinnate with alternate exstipellate leaflets. Fls. rather small in axillary or terminal panicles. Corolla usually only shortly exerted, wings oblong as long as the broad standard, keel obtuse with the petals joined at the tip. Stamens 9 or 10 monadelphous or 5+5 diadelphous, rarely 9+1. Ovary stipitate, few-ovuled. Style short, stigma capitate. Pod thin flat, usually oblong and veined opposite the seeds, indehiscent. Seeds 1—4.

The pods usually remain long on the tree. The seeds germinate within it after the pericarp has become so softened by the first monsoon rains that the radicle can penetrate it.

Root suckers are very common in the genus.

I. St. monadelphous in a sheath split above, rarely the tenth stamen casually free.

A. Trees. Leaflets large roundish.

Lfts. 3—5 cuspidate. Corolla yellowish.

Lfts. 5—7 obtuse or emarginate. Fls. white.

B. Shrubs, ultimately climbing. Fls. white.

Lfts. 5, sec. n. 2—4. Fls. ·2—·25"

Lfts. 5—7, sec. n. many. Fls. ·3"

Lfts. over 20

1. *sissoo*.

2. *latifolia*.

3. *candenatensis*.

4. *rubiginosa*.

5. *tamarindifolia*.

II. St. diadelphous 5+5, sheath split above and below.

- | | |
|---|-------------------------|
| A. Climbing shrub. Lfts. 11—13. Fls. purplish .25" | .6. <i>volubilis</i> . |
| B. Erect trees. | |
| Lfts. .5—1.5". Fls. .3" standard oblong | 7. <i>paniculata</i> . |
| Lfts. .75—2.5". Fls. .3—5" standard orbicular | 8. <i>lanceolaria</i> . |
| C. Erect or climbing, thorny. Lfts. 7—9. Fls. .12" | 9. <i>spinosa</i> . |

1. **D. sissoo**, *Roxb.* Shisham, *H.*; Sissu, *Nep.*

A large handsome tree, lfts. 3—5 usually 5, broadly ell., ovate or obovate or orbicular, cuspidate or acuminate, 1—3" long. Fls. small yellowish, sub-sessile, secund on the branches of dense, densely pubescent axillary panicles 2—3" long. Stamens 9. Ovary long-stipitate pubescent with very short style. Pod strap-shaped with cuneate base 1—3", 1—3- rarely 4-seeded.

Indigenous along rivers in Northern Champaran and the Mechi river in Northern Purneah, but the rest of the northern area seems just outside its natural distribution. It is however commonly planted throughout the province, especially in the northern districts! Fl. with the new leaves March—April. Pods ripen in the next c.s. and usually remain on the tree until it again flowers, and the seeds germinate in June—July. Partially deciduous Dec. March.

Attains 6—12 ft. girth with grey or pale brown thick bark exfoliating in narrow longitudinal strips. Shoots pubescent. Corolla twice the calyx or less, standard orbicular long-clawed.

A beautiful timber and yielding one of the handsomest furniture woods. The transverse strength is very great: *Gamble* gives the value of P as 700—900. It forms the best of wooden wheels and one of the best for all implements requiring strength and elasticity. "Its weight varies from 42—52 lbs." (*Gamble*). It grows very quickly when young. Planted trees in the compound of the manager of the Bettiah Raj actually showed a girth of 8 ft. in 20 years (if the age furnished by the manager was correct) and the average of seven 3-year-old *Sissoo* was 6" girth per annum.* For sowing an absolutely clean seed-bed is required and thus natural reproduction only takes place as a rule in new river silt. It is an excellent fuel and makes a splendid charcoal but its light cover renders it a poor avenue tree. It requires a light soil.

2. **D. latifolia**, *Roxb.* Setisar, *Th.*; Kiri, *K.*; Satsayer, Mahle, *S.*; Pahari-Sissu, Sitsal, *H.*; Blackwood, Rosewood.

Usually a small tree except in the south of our area. Leaves odd-pinnate with 5—7 very unequal-sized leaflets on the same rachis, lfts. sub-orbicular with round or emarginate tip, glabrous 1—4" long, petiole .25—4" long, pale beneath. Fls. pure white in very numerous lax panicles 2—4" long axillary and from the leaf scars. Pods 1.5—3.5" by .75" stipitate, 1—3- rarely 4-seeded.

Northern area, in the Sameswar Hills! Not uncommon as a small tree especially on cool aspects in the Southern and Central area. Often a large tree in the Southern area. Fl. Sept. when the tree is in full leaf. Fr. Jan.—Feb.

Attains 7.5 ft. girth in the Jacobo Block, Angul! Over 3 ft. in the Rajmahal Hills! Bark light-coloured, blaze green then pale yellow. Pedicels and calyx .12—17". Corolla twice as long. The pods sometimes constricted at the sutures between the seeds.

This is as valuable a wood as the true *Sissu*, indeed it appears to me to be a more handsome furniture wood and it is in as great demand for gun-carriages and other articles requiring great strength, but in our area it is too scarce to supply a large demand and it should be artificially propagated in Angul. *Gamble* gives the value of P as between 822 and 1052! and the weight as 50—70 lbs.

* Vide Report on the Forests of Rajpur-Soherin, 1904, by H. H. Haines.

The reproduction under shade in the Baghmunda forest of Angul in good soil is excellent. The growth of trees raised by me from seed in Chaibassa was on an average of 32 ft. in height and 18" girth in 16 years, but the locality is entirely unfavourable.

3. *D. candenatensis*, Prain. Syn. *D. monosperma*, Dalz.; *D. torta*, Grah.

A climbing shrub frequently with very lenticellate branchlets spirally coiled, round supports. Leaves small, leaflets usually 5 obovate rounded at tip or emarginate 8—1·8" long with sec. n. 2—4 only very fine scarcely distinguishable from the reticulate nervules. Fls. white 2—2·5" long in short simple or branched racemes, 7—1·5" long axillary and on lateral abbreviated branchlets. St. 9—10 monadelphous. Ovary linear stipitate 1—2-ovuled. Pod flat, rather thick, sub-lunate, 9 by 4", rarely 2-seeded and larger.

Tidal forests of the Mahanadi delta! Fl. May.

Leaf rhachis 8—2". Lfts. with sparse short adpressed hairs beneath; petiolules 0·2—1". Rhachis of racemes rusty pubescent. Calyx green with short rounded or obtuse teeth. Petals with claws longer than the calyx. Standard ovate slightly auricled.

4. *D. rubiginosa*, Roxb. Kanchanai, Or.

A dwarf bushy or scandent shrub with rusty pubescent shoots, small odd-pinnate leaves with 5—7 ell. or oblong, somewhat obovate leaflets 5—2·5", and white or cream coloured flowers 3" in short axillary simple or paniced racemes 5—1·5" long. St. 10 monadelphous with sheath split above. Ovary linear long-stipitate 2—3-ovuled. Pod 1·3" very thin, but opaque and venous.

Frequent in Angul and Puri districts! often in rocky places when it becomes bushy. Fl. April—June. Fr. April—June.

L. rhachis with short petiole 1—2·5" pubescent. Lfts. subsessile increasing in size from the base of the rhachis upwards, coriaceous polished above, finely sericeous partly or wholly glabrescent beneath, finely closely nerved, tip rounded rarely sub-acute. Rhachis of racemes densely rusty hirsute with 2 rows of minute sub-second bracts. Fls. sometimes subsolitary usually close but not fascicled. Calyx 1·2—2" campanulate rusty-pubescent, lobes oblong-rounded, two upper broader and shorter than the 3 lower. Standard retuse long-clawed and with two fleshy callosities. Wings oblong auricled. Keel petals connate above, all long-clawed. Filaments free above. Sheath open at base then connate anteriorly.

5. *D. tamarindifolia*, Roxb.

A large shrub scrambling or climbing by means of its recurved peduncles, singularly resembling a climbing Tamarind. Branchlets and leaf rhachis fulvous pubescent. L. 4—7" with 12—20 prs. of oblong leaflets 3—8" long, appressed fulvous-hairy beneath and less so or glabrescent above. Fls. white 2·5" in dense brown-pubescent shortly paniced racemes 5—2" long mostly from the leaf scars and on the new shoots. Pod linear oblong thin glabrous long-stipitate 1·5—3" long.

Ravines in the northern Rajmahal Hills, S.P.! Mayurbhanj, near streams above 2500 ft! Fl. Feb—March. Fr. April—May. Partially deciduous in Feb.

Lfts. sub-sessile with oblique base somewhat gibbous on the upper edge, apex rounded or retuse. Calyx 1·2", lobes obtuse, ovate. Pet. long-clawed. Ovules 2—3. Pod 1—3-seeded.

My specimens were not in flower.

6. *D. volubilis*, Roxb. Nari siris, K., S.; Kalibeti, Nubari, Or.

A sarmentose and scandent shrub with long green branches, 7—13-foliolate leaves and pale purple or pale blue flowers in ample terminal panicles. Stamens in two bundles of 5 each. Pods oblong, 2—3.5" long by .6—.75" broad, veined opposite the seed.

N. Champaran, common! Throughout the Central and Southern areas, along ravines and nalas! Fl. Feb.—March. Fr. May—June.

Attains 2 ft. girth in the Santal Parganas. Stem fluted. Wood with very large pores but without concentric bast rings. Leaves 3—10" long. Lfts. broadly oblong or obovate attaining 3.25" by 1.5" but usually only .75"—1.75" on flowering branches, very obtuse or emarginate, apiculate, nearly glabrous, petiolule .66". Inflorescence appressed pubescent or rusty tomentose with lateral branches 3—5" long. Fls. .25—3" pedicelled dense. Calyx tube campanulate, upper two teeth sub-orbicular, lower narrower acute. Seeds 1—2 light brown, .32" ellipsoid slightly reniform.

7. *D. paniculata*, Roxb. Sojania-pati-tinia, Barahbakla, Or.; Dhobin, Gond., H.; Sathpardia, Gond.?

A usually straight tall tree. Leaves with 7—15 alternate leaflets, .5—1.5" (rarely 1.75"), smaller orbicular or oval, larger oblong-elliptic or at end of rachis somewhat obovate, beneath pale glaucous, minutely reticulate with somewhat raised nervules and nearly glabrous, above with sparse short appressed hairs. Fls. .28—3" pinkish or bluish-white in dense very numerous mostly lateral panicles 2—3" long. Standard oblong with claw about one-third its length not of different texture and not thickened above it, two small lateral auricles sometimes present at base of blade. Pods 2—3" by .5—.62" tapering both ends, at base into a slender pedicel .2—.5" long. Seeds 1—3, brown smooth ellipsoid but sub-reniform at base.

In the Southern Tract only. Puri! Angul, common in cotton soil towards Kharada! Athmallik! Very common and grows to a large size in most of the Orissa States, Cooper! Fl. July with the leaves. Fr. Nov.—Jan.

Bark nearly white. Blaze as in next, from which it is sometimes difficult to distinguish in leaf. The tall straight habit is not invariable. The alternating bands of xylem and phloem serve to distinguish the stem and larger branches when cut. Lfts. with emarginate apex and usually rounded base, smaller than in the next. Calyx densely hairy, lower teeth subulate, upper linear-oblong sub-acute. The pod usually has a sharp terminal wedge with straight sides, whereas the terminal wedge in those of *D. lanceolaria* has often rounded sides and a blunt mucro.

The wood falls to pieces when sawn owing to the rings of phloem.

8. *D. lanceolaria*, L.f. Koiad, Kiachalom, K.; Chapot-siris, S.; Hardi, Kharw.; Lipsi (in Manbhurn, teste *Grieve*); Chakundia, Sujanipati, Or.

A mod.-sized tree with leaves reaching a foot in length with 9—12 (or fewer on the smaller leaves) oblong, elliptic or obovate-oblong leaflets attaining 2.5" by 1.5" but often much smaller on the lower leaves of a branch, with about 12 very fine sec. n. and with thin scattered short hairs beneath, or on both surfaces when young. Fls. .3—5" pink or purple or nearly white, sometimes tinged blue from a distance in dense or lax numerous lateral or terminal fulvous-pubescent panicles 2—4" long. Upper calyx lobes rounded or obtuse. Standard sub-orbicular

above and sharply geniculate on the hardened subulate claw, usually white-margined and with green central callus; two small auricles at the base. Pod 2—4" by .5—.75", narrowed both ends, often sinuate between the 1—3 seeds with a stipes .3—.5" long.

Throughout the whole area, except perhaps in the north-east! Nowhere very common, usually in valleys or shady sides of hills and along streams. Fl. April—May when the tree is quite bare of leaves or with the young leaves. Fr. Sept.—Jan.

Bark white or grey nearly smooth, peeling off in oblong or irregular flakes. Blaze pale yellowish-white very soon darkening. Innovations yellow-silky. Stipules linear-oblong caducous. Lfts. with sometimes emarginate apex, base rounded, obtuse or sub-acute.

Var. α **lanceolaria** proper. Panicles and racemes lax. Fls. nearly .5". Calyx hairy with anterior lobe half to three-fourths the tube.

Var. β . Fls. secund in very dense racemes in panicles as dense as in last species. Fls. .3" only. Calyx densely hairy with anterior lobe as long as the tube. Santal Parganas!

A young forest of suckers springs up around this tree after the roots have been injured by trampling.

9. **D. spinosa**, Roxb.

A large woody climber or sub-erect, frequently with long sharp thorns bearing leaves and flowers, leaflets 5—9 usually 9, broadly elliptic or obovate .4—.7" long glabrous. Fls. very small in lax lateral racemes 1—1.5" long rarely shortly paniced. St. diadelphous in two sets of 5 each. Pod somewhat kidney-shaped .8—1" long, 1-seeded rarely 2-seeded and then somewhat longer.

Tidal forests of the Mahanadi delta. Fl. April—May. Fr. July—Oct.

Attains 1 foot girth with rough bark. Branchlets sometimes circinate, glabrous. Fls. .12" long. Bracteoles caducous. Calyx glabrous campanulate about half the corolla, upper lobes rounded, lowest larger lanceolate. Standard obcordate much exceeding the wings and keel. Ovary and pod stipitate.

55. PTEROCARPUS, L.

Large trees with alternate coriaceous exstipellate leaflets. Fls. yellow articulate on the pedicels, in paniced racemes with minute caducous bracts and bracteoles. Calyx turbinate, curved in bud, teeth short. Petals with long claws, standard and wings crisped. Stamens 5+5 or monadelphous with the sheath slit above only, or upper stamen free, anthers versatile. Ovary stipitate 2-ovuled. Pod orbicular with a broad wing, the apex displaced to near the base. Seed nearly always solitary.

1. **P. marsupium**, Roxb. Hid, K.; Murga, S.; Piasal, Bijasal, Paisar, H.; Bia, Kharw.

A handsome tree attaining large (7—10 ft.) girth. Leaves with 5—7 oblong or elliptic leaflets 3—5" long with rounded or obtuse or retuse ends, glaucous beneath; sec. nerves close parallel, over 12 each side. Fls. .5" in dense flowered racemes on terminal panicles 6—10" long and broad. Pod 1—1.75" diam. with stipes .2" long.

Not recorded from the Northern area. Common in the Central and Southern areas and apparently in all districts except in the plains. Very common in Patna

and Kalahandi States (Cooper). It thrives best on slopes near the nalas in the hills esp. on north aspects. Common on quartzite in Sambalpur.

Fl. Oct. Fr. Dec.—Jan. Nearly evergreen, leaves renewed May—June.

Bark cinereous, rather rough. Blaze grey-streaked, then pink and finely lined, with exudation of red juice (Kino).

Var. **acuminata**, Prain. Lfts. ovate, acute or acuminate. Pods larger than in the type.

Rajmahal Hills, Prain! It appears to be very rare.

P. marsupium is one of the best trees for planking in the province and it deserves to be largely planted. The supply is not at present adequate. The wood is largely used for furniture, implements, wheels, etc. As a pole it has not much value and should therefore always be allowed to reach timber size. The liquid gum Kino takes about a fortnight to harden. (A note on its preparation is given in *The Indian Forester* for August, 1899). It is a valuable medicine in diarrhoea. The leaves are used for buffalo fodder and trees have been seen actually felled for this purpose of giving a meal or two to buffaloes in the so-called protected forests of the Santal Parganas! "The average weight is 55 lbs." *Gamble*.

Trees raised by me from seed at Chaibassa showed after 16 years an average height of 32 ft. and girth 17.4", but the locality is not favourable. Stools of Bija may be detected in the forest by their blackening from the exuding sap which is very rich in tannin.

56. DERRIS, Lour.

Trees or, always in our area, climbing shrubs. Leaves odd-pinnate with opposite leaflets, usually exstipulate exstipellate. Fls. small, solitary or usually fascicled on the rhachis on the branches of axillary or terminal racemes or panicles, bracts and bractcoles small and usually caducous. Calyx campanulate sub-truncate or with short teeth. Corolla exerted. Standard broad, not auricled, wings often spurred above the long claw, somewhat adnate to the keel. Stamens usually monadelphous, but with upper filament free at base, rarely quite free, anthers versatile. Ovary sessile or shortly stipitate, few-ovuled. Pod usually thin, indehiscent, winged on one or both sutures, sometimes very narrowly. Seeds 1—few, reniform or orbicular.

Derris is in many respects closely allied to *Millettia* and except for the greater adhesion of the wings and keel the flowers are very similar.

- | | |
|--|------------------------|
| A. Fls. in clusters on the rhachis of simple or paniced racemes. | |
| Lfts. 1—2 prs. Racemes 1—4" not paniced | 1. <i>uliginosa</i> . |
| Lfts. 4—5 prs. oblanceolate. Racemes 1—4" paniced | 2. <i>cuneifolia</i> . |
| Lfts. 3—6 prs. lanceolate. Racemes 6—10" | 3. <i>scandens</i> . |
| B. Fls. not in racemes or clusters, copiously paniced. | |
| Lfts. 4—6 prs. oblong or ovate-oblong | 4. <i>laxiflora</i> . |

1. *D. uliginosa*, Benth. *Kctia*, Or.

A large climbing shrub with brown branches marked with prominent white lenticels, leaves only 3—5-foliolate, leaflets ovate to oblong 1.5—3", or those on the 3-foliolate leaves sometimes 5" by 2.5". Fls. 4" long, white, 2—3-nate on a rhachis 5—7" long, which is occasionally branched and bears 1—2 leaves. Pod orbicular, 1—1.3" diam., with a very narrow wing on the upper suture.

Near the sea from Cuttack tidal forests! to Puri (near the Chilka Lake)!
Fl., Fr. April—June.

L. rhachis together with comparatively long petiole 3—6". Lfts. glabrous, base rounded, sec. n. 6—9 very fine, reticulate within the margin, nervules reticulate. Petiolule .2". Calyx campanulate nearly glabrous, teeth very short.

2. *D. cuneifolia*, Benth.

A large woody climber, the branches often tuberculate with the raised lenticels. Leaves large, 9—11-, rarely only 7-foliolate, with oblanceolate, oblong-obovate or narrowly elliptic glabrous leaflets which attain 7.5 by 3", but may only be 1.5 by .75" at the base of the rhachis. Racemes short lateral often appearing before the leaves. Fls. .4". Pod 2—3" by .5—6", sessile, venose, thin, flat, narrowly winged on the upper, very narrowly or scarcely winged on the lower suture, 1—3-seeded.

Bettiah Forests, N. Champaran! Santal Parganas, ravines near Banjhi! It also occurs in the Moring Forest of Nepal close to Purneah! Fl. April—May before or with the new leaves. Fr. Nov.—Jan. Deciduous.

Branches often long and whippy. Lfts. slightly ferruginous-pubescent when very young, soon glabrous, base rounded, tip tapering or not, sec. n. 8—10 slender finely reticulate between. Petiolules .25" blackish in mature leaves. Racemes 1—4" copiously paniced. Calyx .12" broadly campanulate glabrous except the densely pubescent rim.

3. *D. scandens*, Benth.

A large climbing shrub with brown lenticellate branchlets, and odd-pinnate leaves with 7—11 narrowly oblong, or few obovate-oblong or lanceolate leaflets .7—3" long coriaceous shining and glabrous. Fls. .3" white or pink in clusters along the brown-pubescent rhachis of long racemes usually far exceeding the leaves. Pods narrow 1.3" and 1-seeded to 3—4" and 3—4-seeded, .4" wide with a very narrow wing down the upper sutures.

Orissa, wild; Cuttack! Puri! Often cultivated in gardens. Fl. July—Sept. Fr. Sept.—Feb.

Stems attain 9" girth with very large pores and rings of bast in the wood. L. rhachis very slender 1—4" (longer in some eastern specimens). Lfts. occasionally somewhat shortly sericeous beneath, usually somewhat tapering to an obtuse tip, sec. n. about 8 very slender and scarcely longer than the intermediate, finely reticulate between. Petiolules .1—1.5" slender pubescent. Racemes 3"—1 foot. Pedicels slender .2". Calyx subentire .1" sericeous. Pod sometimes repand on the lower or both sutures.

4. *D. laxiflora*, Haines.

A large woody climber with minutely rusty pubescent branchlets, 9—13-foliolate leaves with oblong or slightly ovate-oblong, rarely terminal somewhat obovate, leaflets 1—2.5" long, rusty pubescent beneath, and very thinly finely sericeous above. Flowers solitary, .35" long in axillary and terminal lanceolar rusty tomentose panicles 4—10" long. Ovary rusty-villous and young pod linear somewhat rusty pubescent. Pod oblong flat 2 by .7" narrowly winged on both sutures, sessile, 1-seeded.

Ramnagar Hills, N. Champaran! Fl. Aug.—Sept. Fr. Nov.—Dec.

The flowers were over in my specimens but remains were found in spiders' webs, the fruits mostly young. L. rhachis with petiole 2.5—6" rusty pubescent. Lfts. sub-coriaceous with rounded often oblique base and shortly rather suddenly tapering acute or obtuse tip, midrib very pubescent beneath, sec. n. 5—7 not

strong, nervules obscure below very minutely reticulate above. Petiolules $\cdot 1''$. Branches of panicle erecto-patent short 2—3". Bracts small persistent subulate. Pedicels $\cdot 2''$. Calyx $\cdot 07''$ long oblique truncate broader than long.

In leaf this plant resembles *D. scandens* except for the indumentum and fewer sec. n. but it differs wholly in panicle and fruit. It is most closely allied to *D. ferruginea* and *D. polystachya*, Bth., but the leaves of the latter are wholly glabrous and even the small-leaved forms of *D. ferruginea* have obovate leaflets and strong sec. n. The panicle of *D. ferruginea* has usually very long branches and fasciated flowers, moreover the young pod is much broader and very densely ferruginous hirsute. The inflorescence of *D. polystachya* resembles that of *D. ferruginea*.

57. PONGAMIA, Vent.

A tree with odd-pinnate leaves and opposite leaflets. Floral characters of *Derris*. Ovary sub-sessile 2-ovuled. Differs in the oblong pod, which is woody and not at all winged.

1. **P. glabra**, Vent. Karanj, H., K.; Kuruinj, S.; Darkaranja, Beng.; Kiramal, H.

Sometimes a large tree or sometimes, on the sea-coast, flowering as a shrub. Leaves 8—14" long with 5—7 shining oblong or ovate cuspidate leaflets 2—5" or sometimes up to 8" long. Flowers lilac, those near the coast of a deeper colour than inland, 2—4-nate in simple peduncled axillary racemes on pedicels $\cdot 25$ — $\cdot 6''$ long. Calyx brown, corolla $\cdot 5''$, standard silky. Pod woody glabrous 1-seeded, 1.5—2" long and $\cdot 15$ — $\cdot 2''$ thick, with a short decurved point.

Indigenous throughout the greater part of the province along streams, and in the coastal forests. It is also found wild and of large girth (up to 5 ft.) on the top of the Bhainsgot Hill (Puri)! Abundant along rivers in Athmallik and other of the Orissa States. Largely planted in all districts. It is possibly not indigenous in the Northern Area. Fl. May—June. Fr. Dec.—Jan. Deciduous in May but renews its leaves the same month.

Bark smooth thin grey. Blaze shows chlorophyll under the outer bark, then thin yellow.

The pods are very largely collected for the valuable oil expressed from the seeds, which is largely used for burning and for the cure of skin diseases. It is also used in rheumatism.

A wonderful tree for adapting itself to diverse conditions, growing well with its roots in salt water, or fresh water, or exposed to the hot dry winds of Gaya and Chota Nagpur when planted along road-sides.

58. SOPHORA, L.

Trees or (in our area) shrubs with odd-pinnate leaves and showy yellow or purple, racemed or paniced flowers. Calyx oblique broadly campanulate with very short teeth. Standard broad, petals long-clawed. Stamens all free, or only obscurely connate at the very base, anthers versatile. Ovary stipitate, many-ovuled. Pod moniliform, indehiscent or dehiscent, joints turgid, sometimes winged.

1. **S. Bakeri**, Clarke. Bara Jirhul, H.; Moola Bodi, Birja.

A shrub 4—5 ft. high with tomentose shoots and leaves 5—8" long with about 7 prs. sub-opposite oblong silky leaflets, 1—1.25", or up to 2" long by $\cdot 75''$ broad. Fls. purple in leaf-opposed racemes 4—6" long. Pod 3—4" moniliform, beaked, dehiscent, hairy.

Higher mountains and ridges in Singbhum! Ranchi and Palamanu, ascending to the tops of the pats, common at Neterhat 3000 ft.! Purasnath! Fl. May—June. Fr. Oct.—March.

Lfts. subsessile, mucronate glabrescent above. Calyx purple pubescent 3—4" long, two upper teeth connate rounded. Standard 5" with inflexed margins, deep-purple, notched. Wings narrow-oblong. Keel rather shorter, purple-veined, auricled. Stamens 9 very loosely cohering. Ovary and pod stipitate.

FAM. 54. CÆSALPINIACEÆ (Leguminosæ).

Trees or shrubs, rarely herbs. Leaves 1—2-pinnate, but sometimes leaflets only 2 and sometimes these two combined, thus simulating a simple palm-nerved leaf (usually 2-lobed); sometimes sensitive (showing sleep movements). Flowers large or small, zygomorphic or sub-regular, usually racemose. Calyx sometimes spathaceous, generally 5-merous and perigynous with a short or elongate tube (hypanthium), sepals imbricate or valvate. Petals 5, more rarely fewer or 0, free, imbricate, posterior innermost in bud and often different. Stamens normally 10, but some often reduced to staminodes or altogether abortive, inserted on the hypanthium, rarely connate. Ovary free or somewhat adnate on one side to the hypanthium, as in the Papilionaceæ, but more frequently indehiscent and samaroid in fruit and never breaking up into one-seeded joints.

The germination is generally epigeal or sub-epigeal, i.e., with the somewhat fleshy cotyledons elevated on a very short hypocotyl or hypocotyl suppressed.

I. Leaves 1-pinnate or simple (of two connate leaflets).

A. Hypanthium very short.

Petals 5. L. several-foliolate

Petals 0. L. 6-foliolate

Petals 0. Leaflets 2 only

Petals 5. Leaflets usually combined into one

1. *Cassia*.
2. *Ceratonia*.
3. *Hardwickia*.
4. *Bauhinia*.

B. Hypanthium elongate.

1. Petals 5—3.

Leaflets two usually combined into one leaf

Leaflets several. St. 9+1 (diadelphous)

Leaflets many. St. 3

4. *Bauhinia*.
5. *Amherstia*.
6. *Tamarindus*.
7. *Saraca*.

2. Petals 0. Calyx petaloid. Lfts. several

II. Leaves 2-pinnate.

A. Sepals valvate. Fls. 2-sexual.

1. Unarmed trees with distinct rhachis to leaves.

Sepals petaloid, unequal, 4 upper connate

Sepals subequal, green

8. *Colvillea*.
9. *Poinciana*.
10. *Parkinsonia*.

2. Thorny small tree with very abbreviated rhachis

B. Sepals sub-imbricate. Fls. polygamous.

Tree with copious branched thorns

11. *Gleditschia*.

C. Sepals imbricate. Fls. 2-sexual.

1. Ovary adnate at base to hypanthium.

Seed enclosed in the wing-like endocarp of the dehiscent pod

12. *Schizolobium*.

2. Ovary quite free from hypanthium.

a. Pod broadly winged, indehiscent.

Unarmed tree. Hypanthium shallow

Prickly climber. Hypanthium deep

13. *Peltophorum*.
14. *Mezoneuron*.

b. Pod not or scarcely winged, dehiscent or not.

Erect or climbing, often prickly

15. *Cæsalpinia*.

I. CASSIA, L.

Trees, shrubs or sometimes herbs with even-pinnate leaves and few or many leaflets. Flowers in axillary racemes and terminal panicles, rarely in axillary pairs. Calyx-tube very short. Petals subequal, usually somewhat zygomorphous. Stamens 10, frequently unequal or some reduced to staminodes, anthers dehiscing by a short slit or terminal pore. Ovary linear, many ovuled. Pod variable in shape, septate, dehiscent or not.

A large genus with many species found in gardens not here referred to. Many possess purgative properties. Senna Tea is the leaves of two species of *Cassia*.

A. Trees, shrubs or herbs with broad obtuse sepals and large or mod.-sized leaflets.

I. Trees. Stamens 10 antheriferous, 2-3 lower anthers different from the others. Pods indehiscent.

1. Fls. in lax pendulous racemes, very large yellow

2. Fls. in erect corymbose racemes, red or pink.

a. Thorny. Lfts. oval 1-2" glabrescent. Fls. 1.5-2"

b. Unarmed. Lfts. oblong or lanceolate-oblong. Lfts. 2-3", Fls. 1.5-2.5"

Lfts. 8-1.5" pubescent. Fls. 1"

II. Stamens 10, 6-7 only antheriferous (exc. *glauca*), 2-3 lower larger, 3-4 posterior reduced to staminodes. Pod dehiscent.

1. Tree. Leaves without glands

2. Shrubs or herbs. Rhachis or petiole with glands.

a. Rhachis usually with several glands between the leaflets.

Large shrub. All anthers perfect and subequal

Large shrub. Stipules large semi-cordate.

Lfts. 8-12 prs.

Undershrub. Lfts. 3 prs. Glands 1-2 only

b. Gland only on top of petiole.

Lfts. 3-5 prs. more or less ovate

Lfts. 6-12 prs. not at all ovate

B. Undershrubs or herbs with narrow acute sepals and (exc. *absus*) numerous very small sub-falcate leaflets.

1. Lfts. mod.-sized only 2 prs.

2. Lfts. small and many.

a. Petiole with a large sessile gland. Stamens 10 (-9)

Lfts. 20-40 prs. 3-6" long

Lfts. 40-70 prs. 1.5-2" long

b. Petiole with a long stipitate gland.

Stamens 5. Fls. very small, under .2"

Stamens 10. Fls. over .2"

1. *fistula*.

2. *javanica*.

3. *nodosa*.

4. *marginata*,

5. *siamea*.

6. *glauca*.

7. *auriculata*.

8. *tora*.

9. *occidentalis*.

10. *sophera*.

11. *absus*.

12. *Eeschenautiliana*.

13. *mimosoides*.

14. *pumila*.

15. *Kleinii*.

1. *C. fistula*, L. Hari, K., Mirju-baha, Nuruc', and the pod Bandar-lari, S.; Danbar, Dhanrach, *Kharw.*; Sonarki, *Uran*; Sundaraj, Amaltas, H.; Sonari, Or.; The Indian Laburnum (but the true Laburnum is one of the Papilionaceæ).

A small or m.s. tree, very handsome in flower, with large, closely veined ovate, ovate-lanceolate or ovate-oblong acuminate or acute leaflets 2-7" long. Flowers 1.5-2.5" diam., light bright yellow in long pendulous racemes, succeeded by long cylindrical drooping pods 1-2 ft. long and 1" diam.

In all districts wild and planted. Indifferent as to soil and aspect, but never at all gregarious. Frequent on the Khurda laterite! Fl. May--Aug., but the pods may be found on the tree nearly all the year round and fall about April. Deciduous March--April.

Bark smooth pale or white. Blaze rather hard, red-brown slightly streaked. Lfts. 4--8 prs. with close strong sec. n. Racemes 1--2 ft. Pedicels long. Pods ultimately black, indehiscent with the flat transverse seeds embedded in flesh which is eaten by jackals, bears, etc.

The wood is hard, strong and heavy (about 60 lbs.) and much in demand for carts and agricultural implements. It is largely used for house posts for which it is well adapted as the tree does not grow to the size of large timber. It also gives a good firewood and charcoal, but the chief use of the tree lately has been for tanning bark, and in 1917--18 considerable leases were given out for its collection from the reserves, while Re. 1/- per maund was paid for it in the Orissa States. It is said to be a good mixture with "tarwad." As the tree coppices readily and the poles are in demand, the sale of the bark for tanning is not as wasteful as it might seem. The flowers are eaten. Decoctions of the leaves and fruit are used as laxatives and the pulp round the seeds is the *Cassia pulpa* of the Brit. Pharmacopœia. It is made into a sherbert in Chota Nagpur. The seedlings at first are very slow growing. Gamble gives rate of growth as 9 rings per inch of radius.

2. *C. javanica*, L. Syn. *C. bacillus*, Gærtn. (F.I.).

A small tree with grey or brown bark, often thorny. Branches numerous spreading often flexuous with bifarious leaves about a foot long bearing 10--16 pairs of oval leaflets 1--2" long with very obtuse rounded or emarginate sometimes apiculate tip. Very handsome in flower with bright rose or pink flowers, 1.5--2" diam. in elongating bracteate corymbs 4--6" broad. Pod like that of *C. fistula*, 18--24" long, flesh dry not pulpy.

Common in gardens! Fl. chiefly in the hot season.

Youngest branches and leaf rhachis thinly tomentose. Stipules lunate caducous, lower horn lanceolate, upper horn broader rounded or emarginate. Lfts. often few near the raceme, somewhat pubescent when young. Racemes terminal and axillary, bracts lanceolate stipulate (cordate Roxb.). Sepals ovate, reddish.

Following the usual custom I take Roxb.'s *C. bacillus* to be the Linnean *C. javanica*, but the description of the latter in the *Species Plantarum* might as well be one of the following, and it is given as a native of India, whereas our species is a native of Java and the Malay Peninsula.

3. *C. nodosa*, Ham.

A small tree with spreading and weeping branches and bifarious leaves about a foot long (9--15") with 11--14 pairs of oblong or somewhat lanceolate oblong leaflets 2--3" long, but sometimes much smaller towards the base of the rhachis, chiefly distinguishable from the last by being somewhat narrowed and obtuse, acute, or very shortly acuminate at the tip. Equally handsome in flower, with pink or rose flowers 1.5--2.5" diam. in elongate bracteate corymbs which are usually lateral on branchlets other than the new ones. Pod similar.

Often cultivated in our area (e.g. Ranchi)! Fl. most of the rainy season. It is a native of India.

Young branches downy. Leaf rhachis pubescent when young. Stipules .5--8" lunate with both horns cuspidate. Lfts. puberulous beneath, base slightly unequal, sec. n. about 14. Bracts subsistent reddish ovate-lanceolate acuminate .3". Fls. very sweet-scented. Pedicels red 1.5--2" long. Sepals red .2". St. anterior 3 long declinate with a bulbous swelling on the yellow filament and fertile

hairy anthers, 4 shorter arched with spurs opening by pores, nearly glabrous. Three apparently unfertile shorter with incurved filaments. Ovary hairy

4. *C. marginata*, Roxb. Syn. *C. Roxburghii*, DC. ; *C. javanica*, F.C.N.

A low tree with long spreading and weeping branches, tomentose branchlets and bifarious leaves 6—10" long with 8—20 prs. of oblong unequal-sided leaflets 8—1.5" long with rounded or emarginate and apiculate tip. Easily distinguished from the preceding two by the young leaves being densely yellow pubescent and the old ones silky below minutely pubescent above. Fls. deep rose-red only about 1" diam. in axillary and terminal corymbose racemes on the current year's shoots. Pod 8—12" long, often curved, flesh spongy.

Cultivated only in our area (e.g. *Dumka*)! Fl. Nov.—Dec. Native of India.

5. *C. siamea*, Lamk. Sometimes called *Siris* in Chota Nagpur and *Chakundi* in Orissa, neither name properly belonging to it.

A mod.-sized tree with leaves 6—12" long, 6—14 prs. of oblong leaflets 1.5—2.5" long and numerous very large erect or inclined panicles of bright yellow flowers. Pods flat 6—9" long, many-seeded.

Not indigenous but very commonly planted and self-sown. Fl. Sept.—Dec. Evergreen.

Lfts. emarginate with a small bristle from sinus. Panicle composed of numerous corymbose racemes.

A very rapid grower attaining 20 ft. in 2—3 yrs. in Singhum, but short-lived, and very little else will grow in its vicinity. The heart-wood is deep-brown but useless.

6. *C. glauca*, Lamk.

A handsome shrub or small tree. Leaves with 4—6 prs. of ovate glaucous leaflets 1.5—4" long, usually with glands between the leaflets. Flowers bright yellow in axillary corymbs with reflexed bracts. Stamens 10 with anthers similar but two lower filaments longer. Pod flat and thin 6—8" long.

Frequent in gardens! *Campbell* gives *Manbhūm* as a locality with the *Santali* name of *Bheda-dereng* and says that the root is given in epilepsy. The plant was, no doubt, only cultivated.

7. *C. auriculata*, L. *Tarwad*, *Vern.*

A much-branched handsome shrub 3—10 ft. high with hairy twigs and leaves, 8—12 prs. of elliptic obtuse mucronate hairy leaflets 6—1" long, and large yellow flowers in subterminal corymbs. Easily recognised by the large broad foliaceous obliquely cordate stipules on the younger leaves. Pods 3—5" long by .7" broad, flat, obtuse each end. Seeds 6—10.

It is not indigenous in our area but has been recently sown in several divisions on account of the scarcity of good tanning material during the war. In the Central Provinces it flowered Oct.—Jan. and fruited Jan.—March and was partial to cotton soil.

Fresh *tarwad* bark contains over 20 per cent. of tannin. Mr. Fraymouth, Director, Esociet Tannin Research Factory, *Maihar*, said before the Tannin Conference at *Dehra Dun* in 1917 that the leather-making properties of this bark are quite exceptional, and "I doubt if any other tan-stuff can be found to provide a complete substitute for *tarwad*."

I found the plant very easily grown from seed at Nagpur and it attained 4—5 ft. and flowered in the first year, on cotton soil.

8. **C. tora**, L. Inc. *C. obtusifolia*, L. Syn. *Senna toroides*, Roxb.; Jomaikau, K.; Bheda-deren, chakoara, S.; Chekor, Kharw.; Chakunda, H.

An erect herb 1—5 ft. high with 3 prs. of obovate obtuse rounded or retuse leaflets, the pairs increasing in size from the base of the rachis upwards. Fls. 5" diam. axillary paired or solitary. Pods sub-terete or 4-angled very slender, falcate, 6—12" long, incompletely septate with numerous brown oblong seeds 12" long.

Very common and sub-gregarious in waste ground in the rains, but also found in forest glades where it attains 5 ft. in height! Fl. Sept.—Oct. Fr. Nov.—Dec. Annual.

Lfts. 1—2.5" long, glabrous or thinly villous with a linear gland between the lowest or two lower pairs, sub-sessile or shortly petioluled, odour usually fœtid. Stipules setaceous. Fls. usually two on a very short peduncle but one often abortive.

- Var. **obtusifolia**, Syn. *Senna toroides*, Roxb.

Roxburgh describes this as a more robust plant than *C. tora* with a single subulate gland only. Fls. larger, one always abortive and with little or no smell.

In our area at least the plants pass into one another, the large robust form in the Betlah forest having two glands, and I have actually grown plants with leaves fœtid and glaucous beneath and only bearing one gland except on the lowest one or two leaves, which had two. Such plants may also be discovered in the wild state.

The young leaves (Chakaoda ara, K.) and the pods are eaten. Both leaves and seeds contain chrysophanic acid and therefore constitute a valuable remedy in ringworm and itch. The leaves are gently aperient (*Nadkarni*).

9. **C. occidentalis**, L. Kaiu, K.; Kasondi, H.; Kalakashunda, Beng. Sometimes called *Negro Coffee* in English from the roasted and ground seeds having been used as a substitute for coffee.

An erect stout herb, or suffruticose, 2—4 ft. high with leaves 6—12" long with about 4—5 prs. of ovate or ovate-oblong or ovate-lanceolate lfts. 1.5—4" long. Flowers yellow .5—.75" diam. rarely sub-solitary, usually in axillary and terminal racemes, sometimes paniced. Pod 4—5" long, flattened, slightly falcate, septate between the numerous seeds.

A very common weed on waste ground during the rains. Fl. Sept.—Nov. Fr. Dec.—Jan. Annual.

Whole plant fœtid. Stems often grooved. Petiole with a large tumid gland above its base. Lfts. sometimes lanceolate and acuminate. Stipules semi-ovate acuminate caducous. Axillary racemes very short, terminal many-flowered.

The leaves, roots and seeds are purgative and are said to be useful in cough and whooping-cough. The plant is also used for skin diseases in the same way as the last.

10. **C. sophera**, L. Bas-ki-kasunda, H.

A shrub 4—7 ft. high, stouter than the last, and the leaves with 6—12 prs. of lanceolate or narrow-lanceolate finely acute or acuminate leaflets mostly 1—3" long. Fls. 1—1.5" diam. in short axillary and terminal panicles. Pod sub-terete or terete 2.5—3", straight or very slightly curved. Seeds very many compressed.

All districts but not nearly as common as *C. occidentalis* and usually in hedges near villages. Fl. Aug.—Dec. Fr. Nov.—Dec., but also found in flower and fruit sometimes March and April.

This also has a single gland just above the petiole, but it is subulate, not tumid.

The properties and uses are practically the same as in the last two and an infusion of the bark or powdered seeds is said to be good for diabetes. An infusion of the leaves is given in rheumatic fever and as an anthelmintic and as an injection in gonorrhœa (*Nadkarni*).

11. *C. absus*, L.

An erect viscous-hairy herb 9—18" high with only two prs. of ovate or rhombic-ovate leaflets 6—9" long and terminal racemes of small yellow or red flowers with only 4 stamens, all perfect. Pod flat hairy 1—1.5" long, seeds black shining.

Chota Nagpur! Frequent. Probably in all districts. In somewhat open stony jungles and waste ground. Fl., Fr. Aug.—Oct.

Petiole 1—2". Stipules acicular hairy. Racemes 1—2" long.

12. *C. Leschenaultiana*, DC.

A slender erect but stouter plant than *C. mimosoides* with slender branches and leaf rhachis clothed with straight spreading hairs. Leaves 1.5—4" long with distinct petiole bearing a sessile gland. Leaflets 20—40 prs., 3—6" long. Flowers on long pedicels, two or more, rarely solitary on a very short extra-axillary peduncle clothed with pairs of stipule-like bracts. Sepals subulate, sub-aristate acuminate. Stamens 10 perfect or only 8—9, 4 anthers usually larger 1.6—2" long. Pod 1—2" long, linear-oblong, flat, hairy, about 15-seeded.

Purneah! Ranchi and Palamau, elev. 3000 ft. in damp places! Fl. Aug.—Sept. Fr. Oct.

Stipules lanceolate-acuminate with sub-oblique or semi-cordate many nerved base. Lfts. linear sub-falcate sub-aristulate. Buds ovoid long-beaked with the tips of the sepals. Sepals subulate, .45" long, hairy. Petals shorter. Seeds small pale-brown shining, oblong with oblique base.

13. *C. mimosoides*, L. Syn. *Senna tenella*, Roxb., also *S. sensitiva*, Roxb.? Or-kondro, S.

A slender erect or somewhat diffuse undershrub with many slender branches and leaf rhachides clothed with erect somewhat curled hairs. Leaves 2—3.5" with a very short petiole bearing a sessile gland. Leaflets very small and many, 50—70 prs., .16" long. Fls. solitary, rarely two, with very slender pedicels arising from a pair of extra-axillary bracts. Sepals .3" slender tapering both ends. Petals shorter. Stamens 10 perfect, 4—5 anthers distinctly larger than the others, the longer ones .12—.14". Pod 1—2", 15—25-seeded.

Usually in grass lands. Frequent in Chota Nagpur. Fl., Fr. r.s.

Stipules .3" subulate with a filiform tip and a very broad sometimes sub-cordate base, strongly-nerved. Leaflets sensitive, closing up in the sleep position so that the leaf is only .045" wide, sub-falcate, mucronate. Bracts rarely two pairs on the very abbreviated sessile raceme; pair of bracteoles near top of pedicel about half as long as the sepals. Buds with appressed hairs, ovoid, beaked with the tips of the sepals.

14. *C. pumila*, Lamk. Ot-kondro, S.

A diffuse or prostrate herb with many stems 8—15" long, pubescent or sub-villous with curled hairs. Leaves very variable, 6—1·7" in smaller, 1—3·5" in the larger forms, with hairy rhachis, a long stipitate gland on the short petiole and sometimes one or more on the rhachis. Lfts. 6—25 prs. (sometimes on same plant), rapidly decreasing in size from the base to apex of rhachis, lower 2" long in the smaller, 5—6" long in the larger forms, hairy or glabrous excepting the hispid margin, midrib produced into a short awn. Fls. very small, shortly pedicelled, 1—3 on a short bracteate extra-axillary peduncle. Sep. 12—15", narrow, subaristate, 3 outer hairy on back, petals 1—12". Anthers 5 about as long as filament. Pod flat, thinly villous or glabrescent, 8—12" with thickened sutures, 8—11-seeded.

Frequent in waste ground and pastures. Behar, *Prain!* Chota Nagpur! Santal Parganas, *Gamble, Kurz!* Fl., Fr. Sept.—Oct.

Stipules narrowly lanceolate, spinose tipped. Lfts. sub-falcate. Bracts on peduncle geminate subulate and two small bracteoles at apex of pedicels. Ovary densely villous.

15. *C. Kleinii*, W. & A.

Habit of *C. pumila* and indistinguishable without flowers. Leaflets more often nearly glabrous and nearly always over 1" long. Fls. much larger on a longer peduncle which often attains 7—8" in fruit. Sep. 2", three usually broadly-lanceolate, petals 2", anthers 10, 2—3-times as long as filament. Ovary usually only villous on the margins, style longer and less curved. Pod nearly straight erect or ascending 1·5—1·9" long, about 12-seeded.

Rare. Western Behar, *Bengal Plants.*

This may be merely a large-flowered variety of *C. pumila* in which the 10 stamens are correlated with the larger flowers, or (more probably) *C. pumila* is a variety of this species.

***Ceratonia siliqua*, L.** Carob Tree; Locust; St. John's Bean.

A small or m.s. tree with a dense evergreen crown and even-pinnate leaves with usually 3 pairs of coriaceous elliptic rounded or retuse leaflets. Flowers small, polygamo-dioecious, in short spikes from the axils of fallen leaves with very small deciduous bracts and bracteoles. Hypanthium saucer-shaped with 5 small teeth, filled with a broadly peltate disc. Petals 0. Stamens 5. Ovary shortly stipitate, ovules many, stigma peltate. Pod linear-oblong, thickly coriaceous, indehiscent with thickened sutures and full of a sweet nutritious pulp, which is eaten raw, and forms in some of the Mediterranean countries an important cattle food.

The tree was grown some years ago in Hazaribagh and in Puri but I believe has not thrived. I have however no recent accounts of it.

3. HARDWICKIA, Roxb.

A tree with paripinnate leaves of only two palmately-nerved leaflets. Flowers very small numerous in paniced racemes. Calyx-tube very small, disc sub-basal. Sepals 5, rarely 4, oblong, imbricate, petaloid. Corolla 0. Stamens twice as many as sepals, alternate longer, anthers versatile. Ovary sessile, 2-ovuled. Pod samaroid, dry, apically dehiscent. Seed 1, apical, exalbuminous.

Germination epigeal but cotyledons usually raised but a short distance above the ground. Cotyledons rather fleshy, obtuse-oblong, nearly 1" long, base with two small auricles indistinctly 3—4-nerved.

1. *H. binata*, Roxb. Anjan, *H.*, *Kharu*.

A large and beautiful tree with drooping branchlets and glaucous foliage, the small leaves resembling those of a *Bauhinia* but with the two leaflets quite distinct, sessile, about 1—2" long, obliquely rhomboid or ovate obtuse 4—5-nerved. Fls. whitish in axillary and terminal panicles. Pod samaroid linear-oblong 2—3".

On sandstone in the Kymore Hills, formerly abundant and attaining 120 ft. in height (vide *Hooker*, Himalayan Journals); Palaman, near the Sone! Gregarious in patches. Fl. July—Aug. Fr. Feb.—March. Evergreen or nearly so; new shoots in April.

Attains 7—8 ft. girth but the forests not having been reserved large trees are now rarely found, though coppice shoots are frequent. Bark rough dark grey.

The wood is very hard and heavy, deep red and sometimes nearly black in colour. *Gamble* gives the weight as from 60 to 84 lbs. This extreme weight militates against its more extensive use for sleepers and construction. It is used for cart wheels and implements. The young trees are extensively lopped and mutilated for fodder and for the fibre of the bark. Although found on the Kymore sandstones it was common and easily grown on trap in the Central Provinces. The tree has to be sown *in situ* for artificial propagation.

Some useful sylvicultural notes by *L. S. Osmaston* will be found in the *Indian Forester* for June and July, 1909.

4. BAUHINIA, L.

Trees or shrubs, sometimes climbing by means of circinate tendrils, with two leaflets as in *Hardwickia* but usually connate into a broad palmately-nerved 2-lobed, rarely entire, simple leaf with rounded or cordate base and mid-rib (rachis) ending in a bristle. Flowers usually large or m.s., rarely small, in simple or paniced sometimes corymbose racemes, rarely only 2—3 axillary. Hypanthium usually thickened and tubular or turbinate, calyx lobed or spathaceous. Corolla with clawed petals somewhat zygomorphic, the posterior usually different from the others or sub-regular. Stamens normally 10, often reduced, occasionally only 1—3 perfect, anthers versatile. Ovary stipitate, stipes free or adnate to the side of the hypanthium. Pod linear to oblong, coriaceous or woody, dehiscent, rarely indehiscent, several or many-seeded. Seeds compressed, aluminous.

The germination in those species examined is sub-epigeal, the orbicular oblong sessile rather fleshy cotyledons turning green but lying close to the earth.

A. Erect trees or shrubs.

1. Fertile stamens 10. Calyx with short tube and spathaceous 5-toothed limb.

a. Small trees. Fls. rather small, not showy.

L. mostly under 2". Racemes simple with short pedicels 1. *racemosa*.

L. mostly over 2". Racemes sub-corymbose, lower pedicels long, far exceeding the bracts 2. *malabarica*.

b. Shrubs with showy white or yellow flowers.

Fls. 1—3 axillary usually yellow 3. *tomentosa*.

Fls. in short racemes, pure white 4. *acuminata*.

II. Fertile stamens 3—5. Calyx tube elongate (exc. in *B. retusa*).

a. Leaves deeply lobed. Flowers large.

Fl. buds not angled. L. deciduous when flowering

5. *variegata*.

Fl. buds sharply angled. Fls. with leaves

6. *purpurea*.

b. Leaves scarcely lobed. Fls. small white

7. *retusa*.

B. Large climbers. Fertile stamens 3—5.

L. with rounded lobes. Fls. over 2" diam.

8. *Vahlîi*.

L. with acute or acuminate lobes. Fls. very small

9. *anguina*.

1. ***B. racemosa***, Lamk. Kaimu, K.; Katmouli, Kathul, Kharw.; Ghatouli, Ur.; Ambalota, Or.; Kathal, Or. (fide Cooper).

A small tree with pubescent branches, small leaves broader than long, tomentose or pubescent especially on the nerves beneath and small whitish flowers in simple, not corymbose, tomentose racemes 2—3.5" long. Calyx spathaceous, petals linear oblanceolate. Pod 4—7" rarely 10" long, thick, sometimes slightly torulose, septate, not beaked or with very short beak under .2".

Central and Southern tracts. Usually in the dryer mixed forests! Manbhum! Hazaribagh! Ranchi, on the Ghats! Palamau, Betlah forest, frequent! S.P.! Athmallik! Puri, Baruni Hill! Angul, towards Khatada! Sambalpur! Cooper says common in the Orissa States. Fl. April—June. Fr. Nov.—Feb., but persisting till April. Evergreen.

Bark dark rough grey with dark-pink blaze. Leaves 1—1.5" by 1.5—2.5" pale glaucous beneath, lobed one-third way down, lobes obtuse, base shallow-cordate 7—9-nerved. Bracts linear-subulate about as long as pedicels. Corolla scarcely exsert, anthers densely villous. Seeds .12".

The pod is variable. A very thick form occurs on sandstone and conglomerate but there is also a falcate less turgid variety. The wood is only used for fuel. The bark yields a fibre.

2. ***B. malabarica***, Roxb. Laba, K.; Jhinjit, S.; Koinar, Turia; Sahul, Th.; Koteli, Or.; Ampti, H.

A small tree attaining 4 ft. girth with a bushy crown and dark green leaves 1—4" diam. broader than long, glabrescent and grey beneath. Fls. sub-regular whitish on slender pedicels in tomentose sub-corymbose racemes 2—3" long which are mostly in a corymbose panicle. Pod 7—12" by about .75" flattened, mostly curved, rostrate.

Usually a tree of moist localities and in the dryer districts loving the vicinity of streams. Throughout the whole province. Bettiah Forests, Champaran! Santal P.! Singbhum, on northern slopes and along valleys, frequent! Manbhum! Hazaribagh (Parásnath, etc.)! Puri! Angul! Sambalpur, frequent! Fl. Sept.—Nov. Fr. Jan.—March. Evergreen.

Bark light brown-grey nearly smooth or with linear-oblong flakes when old. Blaze hard pinkish red and pink turning red, or bright deep crimson in old trees. Shoots pubescent or tomentose. L. lobed one-eighth to one-quarter way down, sometimes permanently minutely pubescent beneath, base cordate, 7—11-nerved, petiole 1—2" usually black at the thickened tip. Calyx .25—5", limb shortly 5-lobed, petals slightly exsert, oblong-spathulate. Pod usually described as reticulato-venose, but this only appears when dry.

The wood is only used for fuel. The leaves have a pleasantly acid taste which may be used to discriminate this species from the last when only foliage is available and there is any doubt.

3. ***B. tomentosa***, L.

A handsome shrub with young parts tomentose, 7—9-nerved leaves 2—3" long, rather broader than long, lobed less than half way down

into two obtuse lobes, laxly pubescent beneath. Fls. yellow or white, shortly bluntly beaked in bud, in axillary or leaf-opposed peduncled pairs with linear bracts and bracteoles. Calyx spathaceous .5", corolla 2". Pod brown 4—5" long by .5".

Frequently cultivated in gardens! Wood cites Tamar, 500—1000 ft., as a locality, without remark. Fl. July—Aug. Fr. Jan.—Feb.

4. B. acuminata, L. Ahalad, S.

A large shrub 6—15 ft. high with shoots curly pubescent, not tomentose, 7—11-nerved leaves often small 1.5—2.5 but in favourable situations attaining nearly 6" long and broad with petiole 1.5", lobed over one-third to half way down into two acute or acuminate lobes, sparsely pubescent beneath. Flowers pure white well characterised by the long-beaked buds and long acuminate or beaked spathaceous calyx. Pod 4—5" by .7" beaked, widest above and tapering downwards, about 7-seeded.

Wild in the Santal Parganas, in cool places on Trap rock on the north side of Kandeshari Pahar! Wild on the Baruni Hill, Khurda! Very frequently cultivated in gardens; Fl. May—Aug. Fr. Jan.—April. Nearly evergreen.

The flowers are in short racemes 1—3" long with a pure white corolla 2.5—3" diam. The buds have beaks .5" long.

5. B. variegata, L. Buj, Juruju, Burunga, K.; Jantai, M.; Jhinjir, S.; Kachnar, H.; Kandol, *Bhumij.*; Lalkangchan (the red), Vagangkangchan (the white), *Beng.*

A small or m.s. tree with 13—15-nerved leaves 2.5—6" by 3—6.5", lobed about one-fourth to one-third the way down into rounded lobes, grey-glaucous and pubescent especially on the nerves beneath. Flowers large pure white or pink or purple with one petal variegated yellow, in short racemes mostly from leafless axils, flower buds terete. Pod 6—12" by .75—1" flat, dehiscent.

Naturally a tree of dry rocky hills and very beautiful in the forest. Chota Nagpur, all districts! Santal Parganas, Rajmahal Hills, occasional! Probably in all the hill districts of the Central and Southern Areas. Often cultivated in gardens and will sometimes flower in its second year as a shrub. Fl. Feb.—March, the upper part of the tree being more or less leafless at the time. Fr. April—May.

Bark grey longitudinally cracked, blaze pale pink or flesh-coloured darkening on exposure. Primary nerves sometimes only 11. Petiole .5—1.75" pubescent stout. Calyx spathaceous, tube 1—1.25", limb broad ovate. Petals obovate 2—2.5" long. Perfect stamens usually 5 without staminodes. Pod very venose when dry and mature, papillose when young, stipes 1" long.

The wood is only used for fuel. The bark yields a fibre and is both eaten and used medicinally, *Campbell*. The flowers and flower-buds are sometimes eaten. *Nadkarni* says that the bark is astringent, tonic and alterative, and a decoction is useful in diarrhoea. The flowers are laxative. The dried buds are also useful in diarrhoea and worms, and a decoction of the root is an anti-fat remedy.

6. B. purpurea, L. Koilara, *Th.*; Sing-ara, *M.*; Sing-a, *Ho.*; Sinhara, *S.*; Koinar, *Kharw.*; Kundrau, *Mal P.*; Sona, *H.*; Deva-kanchan, *Beng.*

A m.s. tree but not infrequently flowering as a shrub, with 9—11-nerved very deeply lobed often oblong leaves 5—7" long, lobes with usually angular tips. Fls. large purple in terminal paniced racemes

with *acutely 5-angled* flower-buds. Pod 6—12" by .75—1" narrow below, nearly always somewhat broadening upwards, flat, dehiscent when ripe with thin coriaceous twisted valves.

Frequent in all districts, especially in valleys and often grown in the villages. Fl. Sept.—Dec. Fr. Jan.—March.

Twigs glabrous. Bark ashy or dark brown, blaze with or without a pink outer layer, then pale yellow rapidly darkening, then nearly white but centre (on wood) again yellowish. Twigs glabrous. Leaves split from one-third of the way down often to near the base, glabrous or minutely puberulous on the nerves beneath, green, scarcely glaucous and much more membranous than in *B. variegata*. As in other *Bauhinias* very small leaves are sometimes present on same shoot with others. Petiole 1—1.5". Calyx spathaceous, limb .75", the turbinate tube .25—3" only. Petals oblanceolate 1.25—2" long, often variegated, long-clawed. Stamens 3—2 perfect and staminodes filamentous.

The bark gives a fibre. The leaves are eaten as vegetables (a:, ara, K.). The tree is frost hardy.

Var. a **triandra**, Roxb. (sp.).

A smaller-flowered form with pink flowers with a dark crimson centre. The leaves are also broader with a broader sinus, petals cuneate obtuse.

On limestone, Naga Untari (Palamau)! Fl. Nov.—Dec.

This is probably Roxburgh's *B. triandra*.

7. B. retusa, Ham. Laba, K.; Birnju, Bunju, Jhinjit, S.; Kaamaun, Katmauli, Kharw.; Tewa, Ur.; Kanla, H.; Choari, Or.; Panki, Khond.

A m.s. tree with entire or only slightly emarginate 7—11-nerved leaves 4—7", rather broader than long with a cordate or straight base. Flowers only 1" diam. zygomorphic, white with the three upper petals purple-mottled, in corymbose racemes arranged in ample terminal panicles. Pods straight, sub-oblong but rather broader upwards, 5—7" by 1.25—1.75" thin and deep red till ripe.

Hill districts of the Central and Southern tracts. Especially common on northern slopes in Chota Nagpur! Common in Angul, Mayurbhanj and Sambalpur in valleys and on quartzite hills. Fl. Sept.—Dec. Fr. Feb.—March. Evergreen.

Bark dark grey-brown, blaze very pale pink. L. green beneath easily distinguished by the entire or scarcely divided apex. Calyx-tube scarcely any. Petals subrhomboid above the long claws. Stamens 3.

The bark yields a fibre and gum, the latter used in sweetsmeats. Campbell says that the leaves have a bitter disagreeable taste. The tree is frost hardy. The stem above the cotyledons is remarkably long and slender up to the first pair of foliage leaves which are opposite!

8. B. Vahlia, W. & A. Maulan, Th.; Maholan, Kharw.; Maljan, Mahul, H.; Jom-lar, Lamak' lar, S.; Sialpatta, Or.

An immense climber with villosely tomentose shoots and young parts, simple circinate tendrils mostly leaf-opposed, deeply 2-lobed deeply cordate leaves from 2" to 18" diam. and corymbs of large white or cream-coloured flowers. Pod woody 6—12" by 1.5—2", flat, velvety.

Throughout the province but especially on the hills and in stony ravines. Fl. April—June. Fr. Dec.—March. Sub-deciduous and renews its leaves in May.

The stem attains 2—4 ft. girth, often deeply fluted with nearly smooth brown bark. Leaves with rounded lobes more or less pubescent or hairy and with a very

stout point from the sinus. Corymbs often paniced, villously tomentose. Petals 1—1.5" densely villous on the back.

One of the most destructive climbers in the province but fortunately of considerable value. The bark yields a strong fibre (chop, K.; lamaklar, S.) used for ropes. The leaves are used as plates (kalu, K) and cups (pu, K). The pods are known as lama in Kol, in Santal the small-seeded variety being *cihri lamak*, and the large-seeded variety *dhalka lamak*. These pods are opened by means of heat which, to avoid carriage of the husks, is often applied inside the forest and is a fruitful source of forest fires. The seeds are an important article of food. The bark contains a quantity of tannin, but the mucilage makes its extraction difficult.

9. *B. anguina*, Roxb.

A woody cirrhose climber with peculiar compressed stems alternately convex and concave on the flexures. Branchlets very smooth terete. L. densely tomentose when young, adult thin glabrous 2—5" with two very long acuminate lobes or lobes short, and on old plants leaves often quite entire rounded and cuspidate. Fls. very small white .2—.25" diam. racemed in lax terminal pubescent panicles. Pod 1—1.8" long ellipsoid 1—2-seeded glabrous.

Ramnagar Hills, N. Champaran! Fl. Oct. Fr. Feb.—March.

Tendrils persistent simple or with two very symmetrically opposed coils. L. 7—11-nerved often as broad as long. Racemes long and slender. Calyx 5-toothed. Pet. obovate. St. 3. Ovary glabrous, stipitate.

5. AMHERSTIA, Wall.

Amherstia nobilis, Wall., is a well-known garden tree in the more humid parts (e.g. Cuttack). It has a broad dark green but low crown of large even pinnate leaves and long acuminate leaflets. The flowers are very large and showy in long pendulous racemes on long pedicels which have a pair of bright scarlet bracteoles at their apex. Sepals 4. Petals only 3 developed, the upper very broad 2" long and broad scarlet and yellow with a long tube, lateral wing-like narrower. Fl. May—June.

6. TAMARINDUS, L. Tamarind.

1. *T. indica*, L. Jojo, K.; Jojos, S.; Amlī, Inli, H.; Tetul, Tentuli, Beng., Or.; Tetar, Kharw.

A very large and very handsome tree with even-pinnate leaves with 10—20 prs. of small close linear oblong leaflets about .5" long and small red and yellow flowers in lax racemes. Calyx-tube turbinate, sepals lanceolate, imbricate, two lowest connate. Corolla with only the three upper petals developed, two lower reduced to filamentous scales. Stamens only 3 developed, monadelphous below, the sheath bearing 3—4 bristles (staminodes), anthers large versatile. Ovary stipitate, stipes adnate to hypanthium. Pod curved linear, somewhat compressed thick with thin crustaceous epicarp and thick pulpy mesocarp, indehiscent.

Commonly grown in villages and sometimes found in the forest on old deserted village sites. Naturalised among granite rocks near Kuru, etc., and it would probably become so elsewhere but it suffers much from fires. Fl. usually April—June (but also seen in flower in October). Fr. Dec.—Feb. Evergreen. Supposed to be native of Africa.

It is easily grown from seed. The young plants have persistent linear-lanceolate stipules .5" long, pubescent shoots and leaflets .75" long.

The tamarind must be of exceedingly ancient introduction and it has two Sanskrit names, Tintidi and Amlika. The ripe fruit is regarded in native practice as refrigerant, digestive, carminative and laxative and useful in intoxication caused by alcohol or datura (*Materia Medica of the Hindus*). Hamilton speaks of the tree being very large and abundant among the ruins of Gaur.

7. SARACA, L.

Trees with even-pinnate glabrous coriaceous leaves. Inflorescence showy with coloured bracts and calyx, flowers in sessile corymbose lateral panicles. Hypanthium long cylindrical, sepals on the terminal disc, 4, oblong, resembling a zygomorphic corolla, the true corolla absent. Stamens 3—8 with long coloured filaments and versatile anthers. Ovary long-stipitate, many-ovuled. Pod flat dehiscent, coriaceous. Seeds exalbuminous.

1. *S. indica*, L. Husangid-ba, Usangid-ba, K.; Asoka, Beng.

A strikingly beautiful tree when in flower, with dense corymbs 3—4" broad of a brilliant orange-scarlet, each flower with scarlet exerted stamens. The flowers are well set off by the dark-green leaves of 3—6 pairs of large oblong or oblong-lanceolate acute or acuminate leaflets which attain 9" by 2.5".

Along streams in the Ramnagar Hills, Champaran! Valleys of Singbhum especially in the ravines of Porahat! Bolah Reserve, Keonjhar, Grieve! Mayurbhanj, elev. 3000 ft. along streams! Arang Reserve, Angul! Southern Range, Puri, frequent! Fl. March—April. Fr. Sept. and seeds germinate in Dec. Evergreen. New leaves in purple drooping clusters appear at intervals.

Rarely exceeding 30 ft. with a low dense crown. Leaves sub-sessile, leaflets on some leaves only 2—3" long and lanceolate. Corymbs often sub-terminal on short special branchlets together with a single leaf, bracts sub-persistent ascending short ovate-acuminate, ciliate, and bracteoles similar, coloured. Sepals .25—5", tube 1—1.3". Pod 6—8" by 1—1.6" slightly oblique both ends.

The tree is often cultivated. Roxburgh says "when in full blossom, I do not think the whole vegetable kingdom affords a more beautiful object." In my opinion, however, it requires to be seen in nature, along some woodland stream, to appear at its best.

8. COLVILLEA, Boj.

1. *C. racemosa*, Boj.

An ornamental tree occasionally seen in gardens, introduced from Madagascar (teste Taubert). It grows to a moderate size and has handsome 2-pinnate leaves with very small linear leaflets, bears large drooping dense sub-paniculate racemes of bright orange flowers in September. Rhachis of racemes thickened. Bracts coloured caducous. Hypanthium very short bulged, with 5 sepals, 4 more or less connate, the fifth and lowest free. Uppermost petal very broad, lowest narrow. Stamens 10 free declinate villous below. Ovary sub-sessile free. Pod elongate straight turgid dehiscent with several seeds.

9. POINCIANA, L.

Trees with ample 2-pinnate leaves and numerous small leaflets. Stipules small or well-developed. Flowers showy, orange or scarlet in terminal corymbs. Hypanthium very short. Sepals 5, large sub-equal. Petals 5 with the uppermost different from the others. Stamens 10 free declinate villous at base. Ovary sessile many-ovuled. Stigma truncate

ciliolate. Pod woody flat straight or curved finally dehiscent. Seeds transverse, oblong.

The *Flora of Madras* has abandoned the well-known name *Poinciana* on the grounds that the species (*Poinciana pulcherrima*) for which it was originally established by *Linnaeus* has since been transferred to *Cæsalpinia* (vide *Kew Bulletin*, 1920). It appears to be open to doubt whether this necessitates a change in the genus *Poinciana* as since modified and amplified and no confusion can possibly arise by retaining the old name.

1. **P. regia**, *Boj.* Syn. *Delonix regia*, *Raf.*; Gul Mohur (often corrupted in English to Gold-mohur), *Vern.*; Flamboyant, *Fr.*

A beautiful and well-known tree with feathery 2-pinnate leaves. When not in flower distinguishable from the many other trees with feathery 2-pinnate foliage by the pectinate stipules with finely linear segments. Petals 2" long or more, orbicular with a very long claw, the 5th lined with red and orange. Pod 1—2 ft. long. The narrow oblong seeds have a bony testa and often take two years to germinate.

Common in Indian gardens. Fl. April—June.

2. **P. elata**, *L.* Syn. *Delonix elata*, *Gamble.* The yellow Gul-mohur.

A mod.-sized tree with larger leaflets and orange flowers. Bracts small simple. Pod only 6—8".

It is planted more in southern India and is rare in our area. Its native country is doubtful. *Roxburgh* says that it is native in Coromandel.

Fl. April—May.

10. PARKINSONIA, *L.*

Trees or shrubs with sharp thorns which represent the abbreviated axis of a 2-pinnate leaf, pinnæ 2—4 relatively very long, with compressed rhachis and numerous very small leaflets. Stipules converted into prickles. Flowers yellow in lax axillary racemes. Calyx-tube short, sepals equal coriaceous. Petals 5, the uppermost broader than the rest. Stamens 10. Ovary shortly stipitate, with many ovules. Pod linear, unevenly turgid, indehiscent or tardily dehiscent. Seeds linear oblong, parallel with the axis.

1. **P. aculeata**, *L.* Bilaiti-kikar, *H.*

A small tree with 2—6 pinnæ on the shortened main axis and stipulary thorns recurved or absent. Lfts. numerous linear-oblong '25" or less or obsolete. Pod 1—few-seeded, acuminate or beaked, dry, moniliform, 3—6" long, tardily dehiscent. Seeds brown '3".

Apparently naturalised (from America) in various parts of the province on waste ground. Banks of the Sone, Palamau! On cotton soil, S.P.! Frequent on cotton soil, Balasore!

The seed germinates in July. The cotyledons are foliaceous oblong rounded '8". The first leaves are pinnate with the stipules reduced to small deciduous points.

11. GLEDITSCHIA, *L.*

Trees with the axillary branchlets often converted into branched thorns. Leaves abruptly pinnate or bipinnate, sometimes in the same

species. Lfts. rather small. Flowers greenish in often paniced spikes, polygamous. Calyx with 3—5 sepals. Petals 3—5 without claws, imbricate. Stamens 6—10 free. Ovary in herm. fl. free with 2—many ovules, short style, stigma terminal pubescent above. Pod short or long compressed, indehiscent or tardily 2-valved. Seeds often surrounded by pulp.

1. **G. sinensis**, Lamk. Syn. *G. horrida*, Willd.; Dozakh, Vern.; The Honey-locust.

A tree armed with formidable thorns, leaflets ovate-elliptic obtuse. Pod elongate compressed.

Either this or the next are often seen planted on railway platforms.

2. **G. macracantha**, Desf. Syn. *G. ferox*, Desf.? Vern. as above.

Similar in habit. Leaflets lanceolate rigid, about 2" long crenate-dentate. Pod very pulpy within.

Both species are native of China. *G. sinensis* has been introduced into Europe and whether the Indian tree is the same requires further examinations.

12. **SCHIZOLOBIUM**, Vog.

1. **Schizolobium excelsum**, Vog.

A tree rather frequent in the town of Ranchi, introduced from Brazil, and there known as *Bacurubu*. It is readily recognised by its tall slender stem with smooth bark bearing a crown of large rather feathery 2-pinnate leaves and large paniced racemes of yellow flowers in April. Hypanthium turbinate oblique with 5 sub-equal oblong-ovate sepals, calyx and ovary with black hairs. Petals long-clawed oval-rotund .5—7" long with wavy margin. Stamens 10 declinate, uniform. Ovary stipitate with the stipes partly fused on the upper side to the hypanthium. Pod compressed obovate, dehiscent. Seed 1 enclosed in the wing-like endocarp which separates from the epicarp.

13. **PELTOPHORUM**, Vogel.

Tall trees with evenly bipinnate leaves and showy yellow flowers in axillary and terminal paniced racemes. Flower as in *Mezoneuron* but hypanthium shallow and stigma broadly peltate. Pod compressed, indehiscent, thinner and winged towards both sutures. Seeds 1—3.

1. **P. ferrugineum**, Benth. Syn. *Cæsalpinia inermis*, Roxb.

A large handsome dark-foliaged tree with rusty tomentose shoots and rusty panicles of showy yellow flowers. Pod oblong, about 3.5 by 1" with the wing each side equal. Seeds usually 3, brown oblong .4" long.

Now frequently planted, thrives well especially in the Central Area and is often seen on railway platforms. Fl. r.s. Fr. Dec. Native of the Eastern Peninsula and Ceylon.

Leaves 6" to 1 ft. long, pinnae 16—20, 3—6" long. Lfts. 20—30, close oblong, .5—75". Pod closely longitudinally veined.

14. **MEZONEURON**, Desf.

Differs from *Cæsalpinia*, to which it is very closely allied, chiefly by the flat indehiscent pod broadly winged down the upper suture, also in a less degree by its very oblique and deep hypanthium with

the very cucullate lowest sepal. The floral bracts are nearly or completely suppressed.

1. *M. cucullatum*, W. & A. Baganaha, *Th.*; Baghin janum, *S.*; Kokobotur, *K.*

A large woody glabrous shrub, scrambling or widely scandent by the numerous small black sharp prickles on branches and leaves. Leaves ample 2-pinnate with deep green shining ovate leaflets 1—3.5" long. Flowers bright yellow or orange articulate on their pedicels in numerous paniced racemes, often from the old wood. Pod 2—4" long, 1-seeded.

Northern Area, Champaran to Purneah! Central Area, in valleys, Singbhum, especially in the Saranda forests! Dalbhum, *Gamble!* Santal Parganas, along streams! Fl. Sept.—Feb. Fr. Feb.

Stems with large conical or oblong bosses tipped by a prickle, sometimes one foot in girth. Leaf rhachis 6—12". Pinnæ distant 2—5 prs. Lfts. 3—5 prs. ovate to narrow elliptic. Two anterior sepals and anterior petal produced into a slipper receiving the base of the anterior filaments. Ant. pet. fleshy purple folded, deeply 2-lobed, others and usually also calyx, pedicles and rhachis yellow. Stamens 5 longer and 5 shorter but one very long and one very short, inclined, anthers bright crimson.

15. CÆSALPINIA, L.

Trees or shrubs often scandent and usually armed with numerous prickles and with large abruptly 2-pinnate leaves and usually showy yellow or red flowers in axillary racemes, more rarely racemes terminal and paniced. Bracts present, at least when young. Calyx-lobes imbricate, the lowest much the largest and cucullate, tube very short. Petals spreading (or erecto-patent in *C. coriaria*), usually orbicular and clawed, the posterior smallest. Stamens 10 free declinate, filaments often woolly. Ovary few-ovuled. Pod various in form, dehiscent or not, not winged (a rudimentary wing is sometimes present).

I. Trees or shrubs, not scandent. Not indigenous.

A. Unarmed tree. Flowers small whitish 1. *coriaria*.

B. Prickly, at least on young stems. Flowers showy.

Tree, prickles very few. Pinnæ and leaflets 10—15 prs. 2. *sappan*.

Large shrub. Pinnæ 6—9 prs. 3. *pulcherrima*.

II. Scandent prickly shrubs.

A. Petals broad. Pods unarmed.

a. Lfts. 2—3 prs. on each pinna 4. *nuga*.

b. Lfts. 6—12 prs. on each pinna.

Lfts. .25—3". Pod thick, sub-fleshy 5. *digyna*.

Lfts. .5—1". Pod dry 6. *sepiaria*.

B. Petals narrow. Pod echinate 7. *crista*.

1. *C. coriaria*, Willd. Divi-divi, American Sumach.

A small or m.s. tree with a dense low spreading crown and pretty 2-pinnate leaves with very numerous close-set leaflets .12—3" long. Pinnæ 13—17, 1—2" long. Fls. small whitish sweet-scented paniced. Pods spirally twisted.

Introduced from Central America and often cultivated for ornament, e.g. Chaibassa, Santal Parganas and Koderma! Fl. May—June. Fr. Aug. Evergreen.

It was originally introduced for tanning purposes but does not seem to be used in the province. The seed germinates well in about a week after sowing but it is

probably not worth growing on a large scale, other more easily accessible materials being as rich in tannin as the pods of Divi-divi.

2. C. sappan, L. Bakam, Beng.; Patang, H.

A small tree with small and few or sometimes no prickles. Pinnæ 8—12 prs. Leaflets close sessile .5—·75" oblong oblique or falcate, 10—20 prs. Fls. yellow, the racemes paniced. Pod 3—4" by 1·5" wider and truncate at apex which is prominently beaked, polished, indehiscent. Seeds 3—4.

Planted at Ranchi and Hazaribagh! Fl. r.s.

The wood yields a red dye not, I believe, now used in the province. It is allied to the Logwood (*Hæmatoxylon campechianum*) of Central America, but the dye is Brasilin and in Logwood Hæmatoxylin. Before the advent of the aniline dyes *sappan* is said to have been much used as a dye for cotton fabrics. It is a powerful astringent (*Nadharni*).

3. C. pulcherrima, Swartz. Krishnacharan, Gultorah, Vern.; Peacock flower; Barbadoes Pride. Syn. *Poinciana pulcherrima, L.*

A handsome much-branched shrub, but getting straggly and untidy when old. Upper branches often without thorns. Leaf rhachis smooth glossy 7—11" long with 6—9 prs. of pinnæ. Lfts. on median pinnæ about 8—10 prs., median about .7" long, glabrous, broadly oblong, emarginate and apiculate. Flowers scarlet or yellow in elongate axillary and terminal racemes 6—12" long or more in fruit. Pedicels 1—1·5" long articulate above. Petals, four sub-equal transversely oblong above the long claw .7", the fifth with its claw longer and blade smaller and much crisped. Filaments declinate 2" long, 5 longer than the others.

Very common in Indian gardens and sometimes running wild. Seeds sown in the r.s. will flower in the following c.s. and h.s.

The yellow variety is sometimes called var. *lutea*.

4. C. nuga, Ait. Syn. *C. paniculata, Roxb.*

A large prickly climber with prickles on the branches, at the base of the pinnæ and along the rhachis of the leaves above. Pinnæ 3 prs. Lfts. usually only 2 prs. on each pinna or one pair and an odd, elliptic- or ovate-lanceolate, shortly obtusely acuminate or acute, .7—1·5" rarely 2" long, coriaceous with very indistinct venation. Fls. yellow, fragrant in paniced racemes; calyx about .3" and petals not much exerted, filaments densely woolly below. Pod compressed woody, obliquely broadly elliptic sharply cuspidate, about 2" long only without the cusp and short stipes and 1·2—1·4" broad with one, very rarely two, large brown flattened ellipsoid seed.

Tidal Forests of Orissa! Fl. Jan.—April. Fr. May.

In the Himalayan Journals *Sir J. D. Hooker*, speaking of that part of the Grand Trunk Road not far from Parasnath, writes: "On the way I found the *C. paniculata*, a magnificent climber, festooning the trees with its dark glossy foliage and gorgeous racemes of orange blossoms." There is a doubt as to what this passage refers but I believe it to have been *Mezoneuron cucullata*, which in foliage much resembles *C. nuga*. It could scarcely have been *C. nuga*.

5. C. digyna, Rottl. Umul-kuchi, Beng.; Hainsa, Th.; Gilo, Or.; Tari, Or.? *Tari* appears to be the trade name of the pods. *Heri* in Assam.

A large much branched scrambling shrub copiously armed with recurved prickles. Leaf rhachis 5—8" or up to 11" long, with geminate prickles at each pair of pinnæ, minutely pubescent or fulvous hairy. Pinnæ 8—10 or up to 12 prs., .75—2.5" long, swollen at base. Lfts. 7—10 or up to 12 prs. on the median pinnæ, .25—4" rarely .5" long, close oblong. Fls. bright pale yellow .7" diam. in copious supra-axillary glabrescent racemes 3—8" long, pedicels slender spreading, .7—1.25" with very oblique persistent spreading truncate calyx-tube, sepals lanceolate .2" and anterior .4", soon deciduous. Petals orbicular, posterior smaller reflexed. Pod 1—2" long, oblong thick fleshy shortly stipitate crowned by the long style, 1—4-seeded. Fruiting pedicels slender.

In the damper districts. Champaran, near streams in the Ramnagar Hills; Purneah and the northern Santal Parganas! Mayurbhanj! Bonai, Cooper! Puri, but not abundant! Angul, fairly common in places! Narsingpur! Fl. July—Oct. Fr. Feb.—April. Evergreen.

Usually very dense. Branches shining, lower prickles .5" straight and sharp, upper .1—2" recurved and those on leaf rhachis small. Lfts. pale beneath with rounded tip and sub-cordate oblique base, minutely appressed hairy beneath and puberulous above, becoming nearly glabrous with age. Racemes often curved, glabrescent, bracts almost obsolete. Filaments far exerted woolly below. Calyx glabrous. The young pod shows signs of a wing. Seeds roundish smooth dark brown .4—5" diam., with very hard testa.

The pods are said to contain as much tannin as the American Sumach and leases have been asked for. The plant is, however, far more abundant towards Assam and Burmah.

Seed obtained from Burmah, sown in July, germinated at Sambalpur after 25 days (*Mudaliar*).

6. *C. sepiaria*, Roxb. Uri, Relu, Kando, H.; Gilo, Or.

An extensive shrub rambling or climbing by means of the recurved prickles on the stems and leaf rhachis. Branchlets and leaf rhachides and panicle rusty pubescent or sub-tomentose. Leaf rhachis about 12" long with geminate prickles between as well as at base of pinnæ. Pinnæ 5—10 prs., usually 1—2" apart, 3—5" long. Lfts. 6—12 prs., .5—1" long or some only .3" long, broadly oblong, close, rounded or retuse both ends, puberulous both sides or nearly glabrous above. Fls. showy bright sulphur yellow .75—9" diam. in long simple racemes 6—12" long which are terminal or in a vertical supra-axillary series of which the uppermost is the oldest. Pod oblong dry compressed 3—3.5" long tipped with the straight hardened style which is .5—7.5" long. Fruiting pedicels stout, woody.

Occasional. Gangpur, near the Brahmini river! Ranchi, planted not far from the Mahadeo Temple and occasional in gardens and hedges! Fl. Dec.—May. Fr. old ripe pods have been found by me both in September and June and unripe ones in February. I am not sure to which flowering months they relate as they remain long on the plant.

Branchlets sometimes 5-angled. Stipules semi-sagittate caducous. Young racemes with deciduous lanceolate recurved bracts .3" long. The small petal usually with red lines. Lower part of filaments densely woolly. Pod very tardily dehiscent.

7. *C. crista*, L. Syn. *C. Bonducella*, Fleming; Bagni, S.; Katkaranj, H.; Nata, Beng.; The Fever-nut.

An extensive climbing or scrambling shrub covered with short

straight prickles, those on the leaf-rhachis reflexed. Branchlets fulvous-hairy. Leaves ample with large persistent compound or pinnatifid foliaceous stipules. Pinnæ 6—8 prs. and leaflets about 8 prs. oblong or ovate-oblong .5—1" by .5". Fls. pale yellow .5 by .75" diam. in simple usually supra-axillary very elongate racemes, the lower flowers only fertile. Young pods softly echinate, old broad-oblong prickly, 2—3" long, dehiscent, 1—2-seeded.

Usually in hedges in the open. Champaran! Gayal Ranchi! Santal P., frequent! Puri! Sambalpur! Fl. Aug.—Oct. Fr. Dec.—April. Evergreen.

Lfts. not contiguous, slightly downy beneath, with obtuse mucronate tip. Bracts long linear reflexed over the buds .6—75" long, deciduous. The small erect petal marked with orange. Seeds large round grey .75" diam. with an exceedingly hard testa.

The seeds, Putikaranja in Sanskrit and Natakaranja in Bengali, are said to resemble in properties those of *Pongamia* (Dutt). The seeds and the root bark are largely used as antiperiodic and febrifuge in fevers. *Roxburgh* says the seed is a powerful tonic; *Nadkarni* that the powdered seed acts as a tonic in dyspepsia, and that the same smoked in a hucqua is said to cure colic; other uses are also given in *Indian Plants and Drugs* by that author.

I have found the seed germinates more quickly if the testa is rasped. The germination is hypogeal.

FAM. 55. MIMOSACEÆ (Leguminosæ).

Trees or shrubs, rarely (*Mimosa pudica*) undershrubs, with 2-pinnate leaves (rarely main pinnæ digitate). Pinnæ and leaflets sometimes reduced to one pair or (in some exotic *Acaciæ*) absent and the rhachis developed as a phyllode. Flowers small regular, collected into spikes or heads with usually prominent stamens but small perianth. Calyx tubular or campanulate, truncate or valvately toothed or lobed, sometimes minute. Petals valvate, free or more or less connate into a tubular or funnel-shaped corolla (gamopetalous) hypogynous or perigynous. Stamens as many or twice as many as the petals or numerous, hypogynous to perigynous, free or monadelphous sometime adnate to the base of the corolla. Ovary 1-carpellary free from the hypanthium, 2—many-ovuled. Fruit a dehiscent or indehiscent dry or sub-succulent pod, very rarely breaking up inside the sutures into one-seeded joints.

Germination in those species examined by me is epigeal in most, but sometimes hypogeal as in *Entada*. The first true leaves are often at once bi-pinnate.

I. Stamens definite, usually 10 (*Mimosæ*).

A. Flowers spicate. Anthers apiculate with a small gland in bud.

Large climber with tendrils and immense pods 1. *Entada*.

Unarmed tree with ample leaves 2. *Adenanthera*.

Small thorny tree. Fls. polygamous, similar 3. *Prosopis*.

Small thorny tree. Fls. dissimilar, spikes parti-coloured 4. *Dichrostachys*.

B. Flowers in globose or oblong ovoid heads.

1. Anthers apiculate glandular. Pinnæ only 2 5. *Xylia*.

2. Anthers not gland-tipped. Pinnæ several.

a. St. monadelphous. Sepals imbricate 6. *Parkia*.

b. St. free. Sepals valvate.

Unarmed. Pod not jointed 7. *Leucæna*.

Prickly. Pod breaking into joints when ripe 8. *Mimosa*.

II. Stamens indefinite (*Acaciæ*).

A. Stamens free.

Usually spiny or prickly trees or shrubs 9. *Acacia*.

B. Stamens monadelphous. Usually unarmed trees.

Pod thin flat

10. *Albizzia*.

Pod circinate, dry. Sometimes prickly trees

11. *Pithecolobium*.

Pod straight, flattish, rather succulent

12. *Enterolobium*.

1. ENTADA, *Adans.* (*Pusaetha*, *L.*)

Woody, sometimes immense, climbers with 2-pinnate leaves, uppermost pinnæ (or all in the seedling) sometimes converted into tendrils, leaflets often large and few-paired. Stipules small, bristle-like. Flowers 5-merous small in slender single or fascicled spikes which are often paniced towards the ends of the leafless branches. Calyx campanulate, very shortly toothed. Petals free or slightly connate. St. 10 free, exserted. Ovary sub-sessile with many ovules. Pod compressed, in our species very large and woody, with thickened sutures and breaking up within them into large 1-seeded joints. Endocarp enclosing the seed and separating from the epicarp. Seeds large compressed exalbuminous.

1. *E. scandens*, *Benth.* Syn. *Pusaetha scandens*, *L.*; Karu, *K.*; Kari, *Kharw.*; Bidhanta, *S.*; Gila, Gilo, *Beng., Or.*; Osta, *Arsi, Or.* (*teste Cooper*); Saruni, *Vern.*

An immense woody climber with the 2-pinnate leaves usually ending in a point or two-fid tendril, pinnæ only two pairs often ending in an abortive leaflet. Lfts. 2—4 prs., terminal leaflet 2—3" long, others shorter towards the base of pinnæ. Spikes of green or cream-coloured fls. 4—9" long, pubescent, often extra-axillary. Pod the largest of the family in India, often 2 ft. long, large chestnut-coloured seeds discoid 1.5—2" diam.

Throughout the area, but not common except in the damper high forests. Purneah! Santal! P. Singbhum, valleys! Patamau, Haslett! Mayurbhanj, elev. 3000 ft.! Puri Mals, common! Fl. April. Fr. March—May of the following year. Deciduous March—April.

Attains 3—4 ft. girth, stems often with cork-screw-like flanges. Bark brown, blaze red or pink and very fibrous in old stems, wood without the large pores usually common in climbers. Lfts narrow-elliptic to obovate, with many fine sec. n., apex emarginate even when shortly acuminate, above glossy. Calyx .12". Corolla lobes valvate .17", oblong-lanceolate acute. Bracts minute linear.

The powdered seed mixed with ghee is eaten as an anodyne during parturition. The seeds are often worked up into small boxes and ornaments.

The germination is hypogeal, and the seedling concentrates all its energy in quickly getting up through the bushes to the light so that all the leaves are entirely converted into slender tendrils, the rhachis ending in a mucron. These tendrils gyrate very fast, describing many complete circles in the course of the day.

2. ADENANTHERA, *L.*

1. *A. pavonina*, *L.* Ranjan, Rakto-kanchan, *Beng.*

A large handsome tree but sometimes flowering as a shrub is sometimes found in gardens, as at Dumka and Ranchi. It has ample 2-pinnate leaves with 8—12 distant pinnæ, each with 12 or more alternate oblong leaflets .75—1.25" long. The flowers look somewhat like those of *Entada*, being small and yellowish in axillary and paniced spiciform racemes 2—6" long, each with 10 free stamens as long as the corolla. Pod 6—9" by .5" falcate, with about 10 bright scarlet, rarely yellow-brown seeds, each of which are said to weigh 4 grains, and are used as weights and ornaments.

3. PROSOPIS, L.

Trees usually with axillary or paired thorns or stipulary and scattered prickles, rarely unarmed, with evenly 2-pinnate leaves of a few pairs of pinnæ and many narrow coriaceous leaflets, glands often present on the rhachis. Fls. small, in narrow spikes or spiciform racemes without bracts and bracteoles. Calyx campanulate with short teeth. Petals 5 ligulate connate to the middle or later free. Stamens 10 free, slightly exerted, anthers with an apical gland. A raised disc sometimes present. Ovary stipitate, many-ovuled. Pod flat or turgid with a thick spongy mesocarp, septate, often torulose. Seeds ovoid, compressed.

1. *P. spicigera*, L. Jhand, H.; Shami, Beng.

A small thorny tree with rather glaucous foliage. Leaves with 2 prs. of pinnæ only, each with 7—10 prs. of ligulate leaflets .25—·5" long with an ascending cusp. Spikes 2—3". Corolla under 1". Pod straight cylindrical torulose, 4—8" long with 10—15 seeds.

A specimen in the Calcutta Herbarium is described as from "Bihar" but it is very rare there and probably only in the driest parts. In districts where the tree is abundant the pods form a valuable food for cattle, camels and goats.

4. DICHROSTACHYS, DC.

Small trees or shrubs with the branchlets often ending in thorns. L. 2-pinnate with several pinnæ and many small or minute ligulate leaflets, stipules present, stipellæ 0. Spikes parti-coloured with dimorphous minute flowers, the upper yellow and 2-sexual, the lower pink and neuter bearing long filiform staminodes. Calyx minute. Corolla oblong with 5 ligulate petals connate towards the base. Stamens free, 10, anthers gland-tipped. Ovary many-ovuled. Pod narrow compressed becoming spiral or irregularly bent and depressed between the seeds, not septate.

1. *D. cinerea*, W. & A. Vurtuli, H.

A large branched shrub or small tree looking like an *Acacia* when not in flower. Twigs mostly ending in a thorn. Easily recognised by its pretty tassel-like stalked heads of flowers, the lower 1—2" with staminodes .5" long being a bright rose colour, the upper usually shorter portion yellow with the stamens more shortly exerted and antheriferous. Pods curled and twisted 3—4" long in clusters.

Only found on black cotton soil in the extreme south of the province! Puri! In flower or fruit most of the year round. Seed has been collected October and November.

Bark grey. The habit is very characteristic, the numerous branches being armed with short lateral and terminal straight thorns and the leaves on the thorns and small nodose tubercles which are covered with what are apparently the bases of persistent stipules. L. rhachis only 1.5—3" long pubescent with 3—12 prs. short pinnæ and numerous leaflets only .05—·1" long. Seeds 6—10.

5. XYLIA, Benth.

Tree with 2-pinnate leaves; pinnæ only one pair with large leaflets. Flowers small tubular-campanulate sessile in dense globose peduncled heads, often imperfect and 1-sexual, peduncles mostly from the axils

of fallen leaves, and clustered on the new shoots before the leaves develop, often paired from the axils of caducous linear scales. Calyx with 5 lanceolate lobes. Petals 5 valvate. Stamens 9—10 free, exerted, with slender filaments, anthers apiculate and tipped with a caducous gland. Ovary sessile or reduced to a fulvous hairy pistillode. Ovules many. Pod large woody scarcely septate, seeds oblong compressed.

1. **X. xylocarpa**, *Taub.* Syn. *X. dolabriformis*, *Benth.*; *Inga xylocarpa*, *D.C.*; Kongra, *Or.*; Suria, *H.*; Tangen, *Khond* (Kalahandi).

Usually a small tree in our province but attains 6 ft. girth in places, with brown tomentose thick branchlets. Petiole together with main rachis 2—5", sec. rachides 4—13" with normally 5—6 prs. of leaflets, rarely 2—3 or 7 prs. on some leaves, basal usually ovate upper oblong, length 2—8" with 7—12 fine oblique sec. n. Glands 4—5 on rachis, between the upper leaflets. Peduncles 1—2". Heads .5—.75 diam. (without the stamens). Corolla one and a half times as long as the calyx. Pods flat woody somewhat shoe-shaped, 6" long and 2" broad towards base and about 1.25" broad towards apex, the gibbous base contracted upward to the stipes. Seeds brown broad-oblong .5—6" about 10, in depressions of the valves.

Frequent and often kept as standards in the Puri forests! Mayurbhanj, up to 1000 ft., attaining large size! Kalahandi! Narsingpur, attains 6 ft. girth in the high valley of Nayagarh! Fl. April—May when leafless. Fr. Feb.—April.

It is the well-known Pyingado or Iron-wood of Burmah but the small trees as usually found do not appear to be of much value.

6. **PARKIA**, *R. Br.*

Large handsome trees with ample 2-pinnate leaves often with glands on the petiole, and very many small leaflets. Flowers in dense heads on long peduncles, each flower narrow-tubular subtended by a narrow bract with a clavate or spoon-shaped tip. Stamens 10 exerted, connate below, anthers eglandular. Ovary stipitate. Pod large flat narrow many-seeded.

1. **P. biglandulosa**, *W. & A.* The Drum-stick tree.

A very handsome tree with large feathery leaves 12—20" long, petiole with 2 glands. Heads of flowers with an offensive smell on long rusty peduncles 6" long, deep brown in bud and constricted about one-third way up. Fls. about .5" long.

Often planted, e.g. in forest compound at Chaibassa. Fl. Feb. The trees at Chaibassa averaged 54.5 ft. in height and girth 43.9" in 15 years. They are therefore remarkably quick-growing.

7. **LEUCÆNA**, *Benth.*

Trees, or flowering as large shrubs. L. 2-pinnate. Flowers in dense globose heads which are often fascicled or paniced. Stamens 10 free much exerted without gland-tips. Ovary stipitate. Pod flat coriaceous many-seeded.

1. **L. glauca**, *Benth.*

A large shrub or small tree. L. with 4—8 prs. of pinnae each with 10—15 prs. of linear glaucous lfts. .3—5" long. Fls. white in heads

1" diam. Petals twice the calyx-tube. Pods about 6", very numerous, with flat transverse ovate seeds.

Commonly planted and often self-sown in moist situations. Fl. May—Aug.

8. MIMOSA, L.

More or less prickly shrubs or undershrubs with digitate-pinnate or 2-pinnate leaves and numerous small, more or less sensitive leaflets, stipules and stipellæ small. Fls. very small in dense globose heads, mostly 4-merous. Calyx campanulate, teeth small. Stamens as many or twice as many as the petals, much exserted. Pod flat dry, breaking up into 1-seeded joints which separate from the continuous slender sutures.

- | | |
|--|------------------------|
| A. Pinnæ digitate. Stamens as many as petals | 1. <i>pudica</i> . |
| B. Pinnæ pinnately arranged. Stamens diplostemonous. | |
| 1. Leaves much over 1" long. | |
| Pinnæ 8—12 prs., lfts. 16—20 prs. .2—3" long | 2. <i>himalayana</i> . |
| Pinnæ 4—6 prs., lfts. 10—15 prs. .4—7" long | 3. <i>rubicaulis</i> . |
| Pinnæ 5—7 prs., lfts. 7—8 prs. Pod sutures aculeate | 4. <i>Prainiana</i> . |
| 2. Leaves under 1" long. | |
| Pinnæ 3—5 prs. Pod very prickly | 5. <i>hamata</i> . |

The Indian species of *Mimosa* have been revised by Gamble in *Kew Bulletin* No. 1, 1920. In this species usually hitherto known as *M. rubicaulis* and *M. hamata* have been split up. My collections and those at Kew only show the new *M. himalayana* from our area but these are so few that I have added the typical *M. rubicaulis* and *M. Prainiana* to the Key in case they should hereafter be found, and also shown *M. hamata* for comparison.

1. *M. pudica*, L. Lajalu, lajwati, H.; Kajak, Beng.; Lajkuri, Or.; The Sensitive Plant.

A well-known small undershrub with weakly-prickly stems and compound spreading long-petioled leaves, with 4 digitately arranged pinnæ 1—2.3" long, leaflets linear .3—4" rarely .5" long, stipules pectinately ciliate. Peduncles 1—2 axillary with pretty pink heads of flowers. Bracteoles to the male flowers minute subulate or 0, to the hermaphrodite flowers stiff subulate pectinate. Fls. .03" long without the stamens which are about 4-times as long. St. 4. Pod with weak prickles on the sutures.

Common in the damper districts in open places, waysides, etc., or in partial shade. In the dryer districts is chiefly confined to damp sandy ground. It occurs inside the Lachmidungri forest near streams in Sambalpur and is thoroughly naturalised. Originally from tropical America (Brazil). Fl., Fr. r.s. and c.s., also found in fruit in Puri in March.

On the irritability of the Sensitive Plant see Sachs, *Physiology of Plants*, English edition, p. 644.

2. *M. himalayana*, Gamble. Syn. *M. rubicaulis*, F. B. I. (in part); Shiah-kanta, H.; Kundaru, K.; Segaj-anum, S.; Khirkichi-kanta, Or.

An erect or sub-erect very prickly weak shrub 6—10 ft. high with many stems. Branches angular, densely tomentosely pubescent when young, with close scattered slightly curved prickles. Leaf rhachis 4.5—8" very prickly, with 8—12 prs. of pinnæ .7—1.5" long. Lfts. 16—20 prs. or only 10 on the basal pinnæ .15—27" oblong. Fls. pink, in heads

about .5" diam. on peduncles .7—1" long which are 2—4-nate, axillary and in long thyrsiform racemes in the axils of undeveloped leaves with filiform stipules .2—25" long. Pod linear-oblong curved (or straight, *teste Gamble*), 2—3" long, 4—10-jointed and -seeded, glabrous with attenuate base and apiculate apex tipped by the long style. Sutures slightly aculeate or unarmed.

Very common in low jungles, forest glades and sometimes in hedges. Purneah, abundant! Soane River, Bihar (with aculeate pods), *J. D. H.* Chota Nagpur, frequent! This, or one of the forms of the *M. rubicaulis*, *F. B. I.*, occurs throughout the area, but whether the Khirkichi-kanta of Puri, Angul and Sambalpur is *M. himalayana* remains to be ascertained, as it was merely noted by me as *M. rubicaulis* (*sensu F. B. I.*). Fl. r.s. to Oct. Fr. Jan.—April.

Lfts. with obtuse or subacute mucronate tip and semi-rectangular base, hairy beneath, mid-rib nearer the upper margin, sec. n. faint, about 5, looping. Bracteoles among the flowers minute clavate pubescent. Calyx campanulate, 1 mm. long, glabrous. Corolla funnel-shaped, 2.5 mm. long, lobes 4 oblong as long as the tube. St. 8, long-exsert. Ovary glabrous.

In Angul "Khirkichi" is said to be used for gunpowder charcoal. In Manbhum the powdered root is given for vomiting arising from weakness, *Campbell*.

9. ACACIA, Willd.

Erect or climbing, usually armed trees or shrubs with either 2-pinnate leaves or the leaves transformed into green variously shaped phyllodes. Leaflets when present usually small. Stipules sometimes transformed into spines, stipellæ 0. Flowers small in heads or spikes, usually 5-merous, sometimes polygamous, each subtended by a bract. Calyx campanulate, toothed. Corolla free from the calyx-tube, more or less gamopetalous. Stamens many, free or connate with one another and to corolla at the base only. Pod usually flat and dry, sometimes moniliform and turgid but never breaking into joints, usually dehiscent.

The germination in species examined is epigeal, the cotyledons rather fleshy, sessile or shortly petioled, ovate to oblong. There is a curious disc-like growth in some cases separating the hypocotyledonary axis from the root. The stipules are from the first often converted into spines.

§. Leaves not converted into phyllodes.

I. Flowers in globose heads.

A. Armature stipular in origin and therefore usually geminate, spines straight.

1. Heads axillary, yellow or orange.

Shrubby. Pinnæ 4—8 prs. Pod 2—3", turgid .
Arboreous. Pinnæ 3—9 prs., .5—2" long. Pod moniliform

Pinnæ 4—6 prs., up to .5" long only. Pod even
Pinnæ 7—14 prs., .5—1.5" long, tomentose

2. Heads paniced, nearly white .

B. Armature not stipular. Usually of scattered curved prickles.

[Heads 1—7-nate appearing paniced (exc. *concinna*) from the leaves in the axils of which they arise being undeveloped at the time of flowering.]

1. Small erect tree.

Pinnæ 16—20 prs. extending almost to base of rhachis. Lfts. .25—5" long .

2. Climbers or scrambling woody shrubs, rarely sub-erect.

a. Pod thin.

Pinnæ 8—20 prs. Lfts. .2—35" long linear

1. *Farneesiana*.

2. *arabica*.

3. *eburnea*.

4. *tomentosa*.

5. *leucophlœa*.

6. *Donaldi*.

7. *pennata*.

- | | |
|--|-----------------------------|
| Pinnæ 8—20 prs. Lfts. .15—.2" long linear | 8. <i>canescens</i> . |
| Pinnæ 12—20 prs. Lfts. .25—.3" oblong, hairy | 9. <i>torta</i> . |
| Pinnæ 6—8 prs. Lfts. .3—.7" linear-oblong | 10. <i>cæsia</i> . |
| b. Pod thick. | |
| Pinnæ 3—6 prs. Lfts. .4—.6" | 11. <i>concinna</i> . |
| II. Trees. Flowers in spikes. Spines usually stipular, short and curved. | |
| A. Lfts. under .5" long. | |
| Pinnæ 7—24 prs. Bark very dark | 12. <i>catechu</i> . |
| Pinnæ 10—20 prs. Bark very light | 13. <i>suma</i> . |
| Pinnæ 3—5 prs. | 14. <i>ferruginea</i> . |
| B. Lfts. .75—1.5" long | 15. <i>lenticularis</i> . |
| §. Leaves converted into phyllodes (introduced species). | |
| Phyllodes 4—7" long. Pod spiral | 16. <i>auriculæformis</i> . |

1. A. Farneesiana, Willd. Dei-babul, Bilaiti-babul, Gand-babul, H.; Gabur, S.; Kapur, Or.; Guyababla, Beng.

A shrub or small tree 12—20 ft. with 4—8 prs. of short pinnæ; and 10—20 prs. of minute crowded leaflets .07—.15" long. The branches bear small usually slender stipular spines .12—.7" long. Heads of deep orange deliciously fragrant flowers .6" diam. on peduncles 1—1.5", usually clustered on abbreviated shoots from the axils of fallen leaves, also axillary. Pod 2—3" long, brown, turgid, .5—.6" thick, curved, not dehiscent. Seeds dark-brown, more or less oval, .25" scarcely compressed.

Cultivated in gardens throughout the province and often self-sown. It is a native of the West Indies. Fl. chiefly Sept.—Feb. Fruits may be found most of the year, ripen April and fall in the monsoon.

Branchlets often zigzag, lenticellate. Leaf rhachis with short petiole pubescent, often ending in a spine, a gland often present above the petiole, pinnæ .5—1" rarely 1.5" long.

If pruned it makes a very beautiful garden shrub covered with innumerable yellow fragrant heads which under the misnomer of "Cassia flowers" are used in perfumery. The roots have a smell of garlic and with the pods are said to be rich in tannin.

Cotyledons oblong.

2. A. arabica, Willd. Babla, Babur, Gabla (*teste Draper*), K., S.; Babul, Kikar, H.; Bambur (in Sambalpur).

A tree attaining 4.5 ft. girth, but often flowering as a shrub, with long straight white (stipular) spines .25—.2" long on the branches. Leaves with 3—6 (seldom up to 9) prs. of pinnæ .5—.2" long, each with 10—20 prs. of leaflets .12—.25" long. Leaf rhachis with a cup-shaped gland at the base of the lowest and generally also of the uppermost pair of pinnæ. Heads of yellow flowers .5" diam. on short axillary slender fasciated peduncles with two bracts a little above the middle. Pod indehiscent whitish tomentose 3—9" long, deeply constricted between the seeds.

The distribution is peculiar and appears to depend mainly on soil and the absence of competing species. Purneah! Dryer tracts of Behar and Tirhut, on alluvium! Other districts of the Central and Northern tracts mainly on spoil banks and railway embankments, where also it is sometimes planted. Santal Parganas, on Cotton soil! Southern Tract, common in Khendpara and Banki on Cotton soil and in parts of Puri! Sambalpur, rare, and chiefly on Cotton soil! It appears to avoid Metamorphic rocks and is absent from all the more fully stocked forest areas. Fl. Aug.—Dec. Fr. Jan.—April. Evergreen.

Bark deep brown or black deeply cracked, blaze very hard, deep brown then pink.

The wood is good and durable and valuable for agricultural implements. The bark is very largely used for tannin in upper India but Babul-tanned bark is less suitable for further finishing in Europe than the so-called half-tans (e.g. tarwad). The seedling is very impatient of grass and other competition and it requires to be raised on clear soil in even-aged crops. In my experience it does not coppice, and in his paper read before the Tannin Conference *Mr. Fireman* says that "in general it does not coppice well," but other foresters speak of its coppicing. The tree produces the Indian Gum Arabic. The true Gum Arabic (*nilotica*) has not the white tomentum on the pods and the very moniliform pods have oblique joints. Drainage is said to be one of the essentials of its silviculture, yet it appears to thrive on badly drained cotton soil.

The cotyledons are ovate and very obtuse with the base somewhat auricled and bevelled. The roots like the last have an alliaceous odour. The pods are largely eaten by goats and the seed which passes is the best for germinating.

3. *A. pseudeburnea*, Drummond (in *Kew Herb.*). Syn. *A. eburnea*, Willd. (in part). (Parker considers this to be *A. Campbellii*, Arn.).

A shrub or small tree with long straight dark-brown spines which become white on the older branches. Leaves small 1—1.5" with hairy rhachis ending in a spine or point and 4—6 rarely 8 prs. of small pinnæ about .5" long with 6—12 prs. of rigidly coriaceous greyish-green leaflets .08—12" long. Peduncles about 1" very slender grey-downy with connate bracts about the middle. Heads .3—4" diam, corolla pale yellow (always?). Pod 3—6" long, thin, flat, straight, glabrous and shining.

Behar, Kurz! There is only one specimen from Behar, and a very poor one in fruit. The species apparently just enters the province from Oudh and the North-West. Fl. Nov.—Jan.

Bark dark grey or reddish-brown. Spines .25—2", slender in our specimen. Branchlets hairy. Rhachis with a large gland between the uppermost pinnæ and (fide *Duthie*) between each of the two lowest pairs. Sec. rhachides also often ending in spines. Lfts. oblong about .1" long mucronulate. Pod .25" broad.

This tree appears distinct from the South Indian true *A. eburnea* in the larger number of pinnæ, more slender spines, and the yellow not purple corolla. But it is to be noted that *Roxburgh's* figure in *Pl. Coramand.* shows the leaves of *Mimosa eburnea* with 4—8 prs. of pinnæ .25—5" long and corolla purple!

4. *A. tomentosa*, Willd.

A small tree with the twigs, leaves and spines covered with grey tomentum. Leaves 2—3.5" long with several glands on the rhachis and 7—14 prs. of pinnæ .5—1.5" long, each pinna with 15—30 prs. of oblong pubescent leaflets .1—1.5" long. Stipular spines straight grey reaching 3" in length on the branches and stems. Heads .5" diam. on stout peduncles 1—1.5" long with median bracts. Pods curved yellow-brown or reddish 4—5" long by .4", flattened, slightly depressed between the seeds, pedicelled. Seeds 6—10, pale grey compressed oval .3" long.

On cotton soil. Puri, Southern Range! Fl. May—June. Fr. April.

5. *A. leucophloea*, Willd. Goira, Gohira, Or.; Gulura, Reimja (Sambalpur).

Usually a small tree but attaining 6 ft. girth with white smooth-barked branches, sometimes unarmed. Twigs and leaves tomentose.

Leaves small, 1—3"* long with 6—12 prs. of pinnæ .7—1.5" long each with 15—30 prs. of crowded leaflets .12—.3" long. Flower-heads small .2—.25" diam., nearly white, numerous in large terminal tomentose panicles, bracts on peduncles median. Pods long linear curved, panicled, 4—8" by .2—.3" tomentose.

Southern parts of the province only, chiefly on cotton soil not on metamorphic rocks. From Balasore and Cuttack to Sambalpur! Not frequent in the better forests, where the seedlings get suppressed, though old trees may sometimes be seen. Fl. Aug.—Oct. Fr. Dec.

Lower parts of large trunks with very rough rugose bark which may turn nearly black, the upper part remaining white. Blaze light red slightly white-streaked. Rhachis with a gland sometimes at each pair of pinnæ. Seeds 8—12.

"Seasons well and takes a fine polish, strong and tough, but often eaten by insects. An excellent fuel for locomotives," *Brandis*. It does not seem to be much used in this province. A fibre is obtained from the bark by steeping for several days and beating it. *Gamble* gives weight as about 55 lbs.

6. A. Donaldi, *Haines (Indian Forester, Feb., 1917)*; Gar Khair, Burkeli, Or.

A small tree up to 2.5 ft. girth, very rarely sub-scandent. Branches with usually 5 lines of minute prickles, twigs finely pubescent, usually armed with short recurved prickles but stipular spines absent or rudimentary. Leaf-rhachis 3—10" (usually 4—5.5") with very short swollen petiole and a flattish or rudimentary gland on rhachis immediately above it and between each of the 3—4 upper pinnæ, rhachis with very small weak prickles on the lower rounded surface. Pinnæ 10—27 (usually 16—20) prs. .3—.5" apart and extending down the rhachis to within half an inch of base of petiole, median 1.5—2" long with 25—40 rarely 50 prs. of linear leaflets .25—.5" by .03—.05". Pods green to pale yellow and whitish-brown, ultimately grey, rather turgid when unripe, up to .25" thick, base attenuate, but pedicel, if any, not exceeding .2".

Sambalpur, especially on the quartzites and shales of the Boropahar Range! Fl. July—Aug. Fr. Nov.—Jan.

Bark light-coloured, blaze slightly pink-streaked or pink in older trees. Foliage often fascicled, sparsely rigidly ciliolate, rhachis pubescent above, lfts. mucronate, base obtusely semi-sagittate or -hastate with oblique costa, under surface pale with microscopic hairs. Stipules .12—.16", fugacious. Heads white or cream coloured about .5" diam. on peduncles .58—8" long usually 3-nate in the axils of bracts. These are really very young leaves and develop later so that the fructiferous peduncles become axillary. Calyx .14" almost glabrous 5-nerved with acute lobes. Corolla quite free from calyx, glabrous, length (measured from base of flower) .17—.19". Stamens very shortly connate at extreme base and also adnate to base of corolla. Ovary sericeous with long stipes .08" long.

The pods and seeds occur under two forms: (a) length 3—5" by .8—1" with about 6 oblong brown seeds; (b) length 5—6" by .8" with rounder darker seeds.

The germination is only sub-epigeal, the cotyledons are thick, oblong, and there is no hypocotyl but a thickening at the base of the cotyledons, a pair of 2-pinnate leaves and a stem between them arise immediately from the cotyledonary axis. The first leaves, which end in a point, bear two prs. of pinnæ and normal erect stipules.

The seeds are much punctured by one of the Bruchidæ, identified at the Forest Research Institute as a species of *Caryoborus*.

* I have no field notes on the dimensions of the leaves, and I suspect that the measurements given, taken from Herbarium material, are as usual too small, as these are usually associated with the inflorescence.

7. **A. pennata**, Willd. Syn. Kundaru, K.; Kondro-janum, S.; Arar, Kharw.; Dontari, Nali Konti, Or.

A large woody climber. Branches usually more or less 5-angled with lines of small prickles on the angles which sometimes persist even on the rounded stems. Leaves like those of *A. canescens* but pinnæ usually fewer, leaflets rarely 60 prs. less sensitive and more usually spreading, .2—35" and "broader,"* green, glabrous or only ciliolate on the margins. Rhachis often more aculeate. Inflorescence (in my specimens) smaller, under 6" long, peduncles thinly pubescent or nearly glabrous. Bracts subtending the flowers very small without the dilated tip which usually occurs in *A. canescens*. Flowers as in *A. canescens* var. *albida*. Pod .75—1" broad.

Behar, Soan River, J. D. H.! Sikkim Tarai, and therefore probably all through the Northern Areal Fl. r.s., Fr. c.s.

In Behar specimens the median leaflets are .17—3" long, with mid-rib nearer upper edge at base but nearly central at tip, the base is rounded rectangular with about 4 small nerves. Pods variable but always purple when young, 5—7" by .7—1.3", suddenly obtusely acuminate or acute.

8. **A. canescens**, Grah. Syn. *A. pennata* var. *canescens*, F. B. I.; Kundaru, K.; Kondro-janum, S.; Arar, Kharw.; Dontari, Nali Konti, Or.

A large woody climber. Branches usually more or less 5-angled with 5 lines of small prickles even when old. Shoots and twigs grey-or fulvous-tomentose. Leaf rhachis without or with only very few prickles 3—8", with a large gland between the very short swollen petiole and the pinnæ, a gland also between 2—3 of the uppermost pinnæ, rhachis permanently pubescent or glabrescent with 8—20 prs. of pinnæ the lowest of which is usually from 1.5—2" distant from base of petiole. Pinnæ .25—5" apart, 1.5—3" long with 40—80 prs. of very small linear leaflets .15—2" long permanently hoary beneath. Pod thin flat dry with strong sutures 4—6.5" by about .7", deep brown or purple, margins sometimes sinuate.

In all districts, chiefly near nalas in the dryer ones. Purneah (or Sikkim Tarai)! Soane River, Shahabad and Plains of Bihar, J. D. H.! Gaya! Singbhum! Gangpur! Hazaribagh! Santal P.! Puri (var. *fulva*), ascending to the tops of the hills at Rajim! Fl. May—Aug., sometimes earlier in wet seasons. Fr. ripens following April.

Bark light-coloured. Blaze crimson (this may possibly be *pennata*). Lfts. with rounded apex or (in var. *fulva*) acute. Construction of inflorescence as in the last. Peduncles often 4-nate and with 1—2 linear deciduous bracts. Calyx .08—09" long. Corolla (from base of flower) .1—12". Seeds up to 12 black, oblong, .4—5" long by .3".

There are two varieties, perhaps as distinct from one another as they are from *pennata*. Indeed I only keep *A. canescens* distinct from *A. pennata* to be in uniformity with the *Flora of Madras*.

* But I cannot follow altogether the distinctions between these two species given in the *Flora of Madras*. One of these is that the leaflets of *canescens* are always acute, yet some specimens named at Kew have not only obtuse but rounded tips to the leaflets. The leaflets in *pennata* are said to be linear-oblong and those in *canescens* linear, but the proportionate breadth seems to me the same.

Var. **albida**. Lfts. with rounded apex, glabrescent or nearly so, costa nearly central at apex. Flower quite glabrous or ovary minutely sericeous, calyx with a delicate median nerve to each sepal.

Var. **fulva**. Shoots densely rusty tomentose, indumentum more permanent, leaflets very acute with costa close to upper margin. Calyx minutely pubescent, not nerved. Ovary sericeous.

Mals of Puri only.

9. **A. torta**, *Craib* (*Kew Bulletin*, No. 9 of 1915). Syn. *A. cæsia*, *W. & A.*, *A. Intsia* var. *cæsia*, *F. B. I.* (As pointed out in my *Descriptive List of Trees, etc., Central Provinces*, this is not the *Mimosa cæsia* of Linnæus, and *Mr. Craib* has renamed it in *Kew Bulletin*, 1915, No. 9.). Same vernacular names as for *A. canescens* and *A. pennata*, also *Dontari*, *Konti*, *Or.*; *Dater*, *Khond* (?).

A large scrambler or climber with the stems very often channelled or 5-angled. Branches with 5 lines of prickles, young tomentose. Leaf rhachis densely pubescent or tomentose, 6–10" long with small recurved prickles and a depressed or conical gland at base, pinnæ 12–20 prs. 3–4" long ((some only 2" or reaching 5"), pubescent .4–.5" apart, lfts. oblong 30–45 prs. rigidly spreading (except in sleep) .25–.31" by .1–.15", always somewhat pubescent beneath. Heads white, copiously panicked. Pods flat dry with strong sutures, 3–5.5" by .6–1" light brown, usually cuneate both ends, with a rusty tomentum when young.

Central and Southern areas, probably in all districts. Behar, *T. T.*! *Monghyr*, *Ham.*! *Gaya*! *Santal P.*! *Chota Nagpur*, all districts! *Mayurbhanj*! *Narsingpur*! *Angul* to *Sambalpur*! I am doubtful whether it occurs in *Puri*, where the next species has been collected. Fl. May–Sept. Fr. Jan.–March. Evergreen.

Trunk attains 2.5 ft. girth with rough bark, brown blaze, on younger stems bark light-grey nearly smooth and blaze slightly pink. Wood light-brown or reddish, structure normal, falsely ringed with soft tissue in which the pores are.

NOTE.—The leaf rhachis includes that part of it usually termed the "petiole" below the pinnæ and down to the true thickened petiole.

10. **A. cæsia**, *Willd.* Syn. *A. Intsia*, *F. B. I.* Same vernacular names as for *A. torta*.

A large climbing shrub with stout 5-angled stems with minute prickles. Twigs sometimes circinate. Shoots pubescent or tomentose with sharp recurved prickles. Leaf rhachis 4–8" long pubescent, sometimes glabrescent, aculeate, with a large linear-oblong swollen gland at the base often with free conical apex, and a large gland just below 3–4 of the uppermost pinnæ. Pinnæ 6–8 prs., 1.5–3.5" long, rhachis at first closely pubescent or pilose, afterwards thinly so, .5–1" apart with a distinct short petiolule and two setaceous stipellæ above the petiolule (these are present in *A. torta*, but are more minute and hidden by the indumentum). Lfts. 8–15 prs. usually shining (often steel-blue in herbarium), obliquely oblong, sessile, mucronate, smaller .3", larger (on the same plant) .7" long by .27" wide, with a few fine hairs beneath when young but glabrescent. Panicles axillary and terminal, very narrow and lax up to 18" long with the future leaves very minute and bract-like, heads 5–7-nate, red in bud, .5–.6" diam. Fls. white with tip of calyx and corolla often red. Bracts between flowers oblong-spathulate acute ciliate. Calyx .08" (or .1" in fresh

specimens), length to tip of corolla $\cdot 1$ — $\cdot 12$ ". Stamens $\cdot 25$ — $\cdot 27$ " long. Pod thin with thickened sutures, dark brown, $4\cdot 5$ — 6 " long by $\cdot 8$ — $\cdot 1$ " broad, base rounded or cuncate, stipes $\cdot 2$ — $\cdot 25$ ". Seeds $\cdot 4$ ", dark polished brown, oval, flat.

Southern Area only, in extreme south. Puri! Angul! Fl. Sept.—Oct. Fr. April. Renews leaves as in other species at time of flowering or immediately after flowering.

I have had to describe these species at great length on account of the confusion existing in works as to their distinctive characters.

11. *A. concinna*, DC. Syn. *A. rugata*, Ham.; Ban-ritha, Beng.

A large very prickly scrambling shrub with pale-grey twigs copiously armed with hooked prickles. Leaf rhachis 3 — $5\cdot 5$ " long pubescent with 3 — 6 prs. rarely up to 8 prs. of pinnæ, of which the median are about $2\cdot 5$ " long with 9 — 15 prs. of leaflets $\cdot 4$ — $\cdot 6$ " long and $\cdot 2$ " broad. Flower-heads appearing with the more or less developed leaves, not paniced but 2 — 4 -nate in the leaf axils and below them (scale axils), cream-coloured or pink, $\cdot 4$ — $\cdot 5$ " diam. Pods thick and fleshy, depressed between the seeds and margin often constricted, but finally dehiscent, $2\cdot 5$ — 4 " long by $\cdot 7$ — $\cdot 1$ " broad, beaked.

Throughout the area but not common. Ramnagar Hills! Purneah! Valleys in Singbhum! Puri! Angul! Fl. April—June. Fr. ripens following March. New leaves in March—April. In Purneah a sub-arboreous specimen was found.

Branchlets often nearly white. Shoots pubescent. Pinnæ $\cdot 5$ — $\cdot 1$ " apart. Length of flower to tip of corolla $\cdot 11$ — $\cdot 13$ ". Calyx $\cdot 087$ ", minutely thinly pubescent. Ovary usually glabrous or nearly so in our area.

Var. *rugata*, F. B. I., is distinguished by the larger leaflets and pods and villous ovary. The *Flora of Madras* keeps *rugata*, Ham., as a distinct species from *concinna*. I am unable to accept the validity of the distinctive characters given as my specimens have pinnæ only 3 — 6 prs. and an all-but glabrous ovary. The young pods in the Ramnagar specimen have very minute scattered thin hairs and the ovary may therefore have been pubescent; the leaflets are, however, those of *concinna* and the pod is only $\cdot 7$ " broad.

The pod is saponaceous and used for washing.

12. *A. catechu*, Willd. Khair, H., S.; Khoiru, Or.

A small tree with black bark, branches slender armed with geminate (stipulary) hooked spines. Pinnæ 7 — 24 prs. with their rhachis from $\cdot 5$ " (on very small leaves) to $1\cdot 5$ " long, pubescent or hairy, with 6 — 35 but mostly 12 — 20 prs. of sessile ciliate leaflets $\cdot 1$ — $\cdot 2$ " long. Fls. small white or pale yellow, crowded in pubescent spikes 2 — $3\cdot 5$ " long, axillary on the young shoots. Fls. $\cdot 08$ — $\cdot 1$ " long excluding stamens, the corolla one-and-a-half to usually two times as long as the calyx, both pubescent or petals densely hairy, greenish with membranous margins. Ovary glabrous stipitate. Pods 2 — 5 " by $\cdot 6$ — $\cdot 8$ " often irregularly constricted, 4 — 7 -rarely only 2 -seeded, obtuse mucronate or beaked, base contracted into a pedicel and pubescent, above glabrescent, dehiscent.

Central and Southern Tract, usually in dry forest! Gaya! Palamau, common, and often found mixed with the Sal both on clay and sandstone! Hazaribagh, esp. on sandstone and often mixed with Sal! Manbhum! S. Parg., especially on cotton soil! Athmallik! Narsingpur! Angul! In all the Orissa States, Cooper.

Bark peeling off in thin vertical strips, blaze very hard vandyke-brown, then deep pink, twigs pubescent. Main rhachis 2 — 6 " rarely 8 " with a gland below the pinnæ and one between the uppermost 1 — 6 pinnæ. Peduncles sometimes paired

·5". Stamens in 5 bundles at base of corolla with long glabrous or very sparsely hairy filaments.

A valuable wood, strong and very durable, largely used as house posts. The wood yields, by boiling the chips, the well-known Kath used for chewing with Betel and in medicine, and Catechu, used for tanning. These have for long been manufactured in Palamau, Manbhūm and Hazaribagh. Kath is a valuable astringent.

The open Khair forests are largely a result of treatment by man, and where cattle and fires are kept out the Khair tends to die out, as it neither seeds nor coppices under shade—a point which has sometimes been lost sight of. The weight of the wood as given by *Gamble* is about 50—60 lbs.

The cotyledons are orbicular-oblong ·25" long with auricled-cordate base. The first stipules are erect and normal, the first leaves with only two pinnae.

Var. *a catechuoides*, *Wall. sq.*

A straighter tree than *A. catechu* and chiefly distinguished by the puberulous not pubescent rhachis and glabrous calyx and corolla.

It is more a tree of river-beds where it occurs in the sub-Himalayan tract in northern Purneah! This may also be the tree of Bettiah and Ramnagar, but the Khair of that district was not examined by me.

13. *A. suma*, *Ham.* San-kanta, *Beng.*

A tree much resembling *A. catechu* but with white bark, more flexuose branches and with the corolla not much exceeding the calyx.

Manbhūm, Raganathpur, *Clarke!* Balugaon, Puri! *Gamble* says common in Orissa, but he probably refers to Orissa in its wider sense. Patna and Kalahandi, *Grieve.* Fl. Aug. Fr. Dec.

Branchlets and petioles grey-pubescent. Leaves 4—10" long with a large gland above base of petiole. Pinnae 10—20 prs., leaflets 20—50 prs. generally ciliate. Flower usually under ·08" but the relative length of calyx and corolla is variable. In nearly all the specimens I have seen the calyx is not much more than half as long as the corolla, in some three-fourth or two thirds. Pods 2—5" by ·75" pubescent when young.

The wood is said to be similar in its properties and uses to that of *A. catechu*.

14. *A. ferruginea*, *DC.* Safed Khair, *H.*; Kanta Chira, *Or.*

A fairly straight tree 2—4 ft. girth. Branchlets pubescent with small stipulary prickles 1—·15" slightly curved. Leaf rhachis 1·5—2·5" with 3—5 prs. stalked pinnae each with 10—18 prs. lfts. Lfts. ·25—·35 glaucous, almost white when dry. Pod about 4" up to 6·5" long by ·8", 4—6-seeded, upper suture margined. Spikes 3—4".

This is also a rare tree in our area, only found by me in the Bolong Forest, Angul! It will probably also be found in Kalahandi and the Khondmals. Fl. Mar.—April. Fr. Nov.—Jan.

Bark grey, cracking into oblong pieces. Blaze light crimson or in old trees deep crimson, with thin white lines. As the tree is nearly bare of leaves at the time of flowering the spikes appear panicked.

15. *A. lenticularis*, *Ham.* Khairi, *Ur.*; Kolsa-kanta, *H.*; Balu Tentul, *Mal. P.*; Kanta Siris, *S.*

A pretty tree, 20—40 ft. high, at first sight much resembling an *Albizia* or *Siris*, with bright green foliage and large leaflets. Pinnae 2—4, more rarely 5 prs., 3—5" long. Lfts. 7—12 prs. oblong or obovate-oblong sub-sessile glabrous or nearly so ·75—1·5" by ·6". Fls. pure white in stout dense spikes 4—5" by ·75" with hairy rhachis. Pod flat straight 5—9" by 1—1·5".

Hill forests, central and southern tracts. Hazaribagh, frequent, esp. on quartzite, on clay schists near the Damuda! Palamau, Kumandi reserve and Adhe, on banks of streams! Ranchi Ghats, common! Common about Neterhat, 3000 ft.! Porahat, Kundrugutu forests! Rajmahal Hills, not common! Kalahandi, Grieve. Fls. May—June. The pods seem to ripen about Oct. and Dec., but remain on the trees often till following April. Evergreen.

Attains 7.5 ft. girth in Palamau. Old bark brown-grey or dark-grey with oblong flakes and blaze deep crimson. The old trees are nearly unarmed or with straight slightly recurved stipulary compressed spines. Leaf rachis 5—7" glabrous or slightly hairy with a gland below the pinnæ. Lfts. margined with rounded apex and oblique base, mid-rib nearly median. Calyx slightly hairy, teeth nearly as long as tube. Petals greenish, twice the calyx.

Frost-hardy and ornamental, but the timber is said to be attacked by white ants, though very hard and strong.

16. *A. auriculæformis*, A. Cumm. (Benth. in *Hook. Lond. Journ.*, i, p. 377.)

A rather tall straight tree with smooth white bark, sometimes taken for a Eucalyptus. Glabrous and glaucous with slightly angular branchlets. The place of leaves is taken by large laterally compressed falcate-oblong phyllodes 4—7" long and .5—1.5" broad, narrowed both ends with 4—6 principal sub-parallel nerves sometimes confluent near the base and finer parallel intermediate occasionally anastomosing. Flowers small white in slender axillary spikes 1.5—2.5" long, calyx broadly campanulate .02" long minutely toothed, petals spreading as long as the calyx. Pod hard, almost woody, much twisted in an irregular spire with the outer edge often sinuate as in some *Pithecolobium*.

Frequently planted as in Bankipur! Fl., Fr. at various times of the year.

Native of N. Australia and Queensland.

A few other Australian phyllodineous *Acacias* are sometimes met with in gardens, but the above is the only common one. All transitions occur between phyllodes and true leaves and the seedlings of phyllodineous *Acacias* have usually normal leaves.

10. ALBIZZIA, Duraz.

Unarmed trees with 2-pinnate leaves. Flowers in globose heads rarely subtended by bracts on 1—5-nate peduncles which are either axillary or in the axils of rudimentary leaves which ultimately develop, rarely truly paniced and in the axils of small or large bracts. Calyx tubular or campanulate, teeth usually small. Corolla gamopetalous usually exerted and with 5 petals. Stamens many more or less connate., Ovary sessile or shortly stipitate, many-ovuled. Pod linear or linear-oblong, flat, straight, thin, indehiscent or tardily dehiscent. Seeds exalbuminous, compressed.

- | | |
|---|--------------------------|
| A. Pinnæ 1—2 prs. only. Lfts. 2—5" long | 1. <i>lucida</i> . |
| B. Pinnæ 2—6 prs. Lfts. mostly over .75". | |
| Pinnæ 3—6 prs. Lfts. 1—2.3". Fls. sessile | 2. <i>procera</i> . |
| Pinnæ 2—4 prs. Lfts. .75—2.25". Heads axillary. Fls. pedicelled | 3. <i>lebbek</i> . |
| Pinnæ 2—5 prs. Lfts. .6—1.3". Heads paniced. Fls. sessile | 4. <i>odoratissima</i> . |
| C. Pinnæ mostly over 6 prs. Lfts. all under .75". | |
| Pinnæ 3—10 prs. Lfts. .5—75". Fls. pedicelled | 5. <i>Thomsoni</i> . |
| Pinnæ 6—15 prs. Lfts. .1—25", costa median | 6. <i>amara</i> . |
| Pinnæ 12—20 prs. Lfts. .15—35", costa submarginal | 7. <i>stipulata</i> . |

1. **A. lucida**, *Benth.* Gobraha, *Th.*

A large or (in our area) m.s. or small tree. Leaves with 1—2 prs. of pinnæ only, rhachis with a gland near the base, glabrous. Rhachis of pinnæ 2—5" with 2—4 prs. of leaflets and a gland below all except the lowest pair. Leaflets elliptic-oblong acuminate dark green and shining, paler beneath, 2—5" long by 1—1.5" broad, penninerved and reticulate, young thinly pubescent. Heads small, peduncles slender, .3—7" long, 1—4-nate in short axillary pubescent glabrescent panicles 2—3" long. Flowers sessile, calyx with short lobes, corolla exerted to about twice the length of the calyx. Pod brown thin shining 5—9" long by .8—1.3".

Beriah and Ramnagar forests, near streams! Probably also in Purneah. Fl. April—May. Fr. March—April. Evergreen.

Bark light, nearly smooth. Blaze yellow and white.

The wood is said by the Tharus to be very strong and to be used for carts.

2. **A. procera**, *Benth.* Kare, *Th.*; Pandrai, *K.*; Safed Siris, *H.*; Garso, Kerso, *Kharw.*; Tentra, *Or.*

A large tall tree with characteristic greenish-white or white bark (except on very old trunks). Leaves with 3—6 prs. of pinnæ. Pinnæ with a gland below the upper 1—3 prs. of leaflets or not. Lfts. 5—11 prs. broadly oblong or rhomboid-oblong 1—2.3" by .5—1.2", much broader on the forward (acroscopic) side of the costa than on the basis-copic side, the costa being nearer to the lower edge except at the apex. Heads 1—4-nate copiously paniced, bracts caducous. Exserted part of corolla 1—1.5 times length of calyx. Pod 4—8" by .5—1", thin strap-shaped, young often red.

In damp ground, along watercourses, etc., in all districts. Also occasionally planted but only attaining perfection in the forests near streams. Fl. Aug.—Sept. Fr. Dec.—May. In May and June it may be nearly or quite leafless for a very short time. There may be a second flush of new leaves in August growing through the panicle.

Attains 7—8 ft. girth. Blaze red. Youngest leaves silvery hairy, quickly glabrescent. Panicles nearly glabrous, large or only 3—4". Calyx .1—1.2" glabrous, teeth unequal. Corolla greenish white, nearly .25" (measured from base of flower) and lobes about one-third as long. Fil. white, anthers yellowish, staminal-tube exceeding the corolla.

The timber is good. Carts are made from it in Champaran, it is used also for building, rice-pounders, etc. It is a good fuel. *Gamble* gives the weight at about 40—50 lbs. It grows very rapidly.

3. **A. lebbek**, *Benth.* Syn. *Acacia Lebbek*, *Willd.*; *A. Sirissa*, *Roxb.*; Siris, *H., Beng.*; Shirson, *Or.*; East Indian Walnut.

A large or m.s. tree usually noticeable when leafless from the numerous pendulous straw-coloured pods. Leaves with 2—4 rarely 5 pairs of pinnæ, rhachis with a gland below the uppermost pair of pinnæ and at the base. Pinnæ with a gland below the 2—5 upper prs. of leaflets. Lfts. 6—8 prs. rarely up to 13 prs., oblong .75—2.25" by .35—1" rarely twice as long as broad, rounded glabrescent, drying green, costa not less than one-third diam. of lft. from and parallel to its upper edge. Peduncles stout 2—4" long, 1—3 together in the axils of the leaves of the young shoots, rarely sub-paniced from the late development of these. Flowers with distinct pedicels which attain

·2" long. Corolla exserted to twice length of calyx. Pods linear-oblong 6—12" by 1—2" broad.

Everywhere planted, very commonly along roadsides. Apparently wild in the Sameshwar Hills but rare! *Hamilton* speaks of a *Sirish* in Purneah allied to *Lebbek*, if not it. Apparently wild on the Damuda ghats, the Kuru ghats, in the hills above Ader (Ranchi), below Korgi and Adhe (Palamau), all in Chota Nagpur! Apparently wild along streams near Nakchi and Lohamunda (Athmallik)! Also in the Tikapara forest, near the Mahanadi and at Baghmunda, Angul! And in the Mals of Puri! Fl. April—June. Fr. ripens January and remains on the tree till the following March or April. Leafless during the hot season.

Bark rather rough and rugose, cinereous. Blaze deep crimson or red. Shoots, young leaves and inflorescence densely (often yellow-) tomentose. Stipules ·17" linear deciduous, 2 minute stipellæ above the thickened petiolule of the pinnæ when young. Lft. with 4—5-nerved base. Fls. scented, with a pedicel ·1—12" long. Calyx ·12" pubescent. Corolla tubular-ventricose, often ·3" measured from base of flower, slightly hairy above with lobes nearly ·12".

Var. *rostrata*, Haines. Bark rough even on branches. Pod with a very long sharp beak. Wild below Korgi and Adhe, Palamau, near hill streams.

Var. *pubescens*, Haines. Tomentose, leaflets more or less permanently hairy and more narrowly oblong and up to 13 prs.

It is practically indistinguishable from the next species without flowers and fruit, and as the flower pedicels are also shorter than the type it is probably a hybrid.

Palamau near Daltonganj, probably of nursery origin.

The wood of *A. lebbek* is not much used in the province. *Gamble* says that it seasons, works and polishes and is fairly durable. The weight is given as about 50 lbs. It is very fast growing, but as an avenue tree its leafless condition and the dismal rattle of its pods in the hot weather make it very inferior.

4. *A. odoratissima*, Benth. Gobraha, *Th.*; Kiachalom, *K.*; Jang Siris, *S.*; Sirish, *Tinia*, *Or.*

A large or small tree, some forms graceful with drooping foliage. Leaves with 2—5 pairs of pinnæ, main rhachis with glands as in *lebbek* or glands abortive. Pinnæ with rhachis 3—10" long, a gland between the upper 1—2 prs. of leaflets rarely absent. Lfts. 6—24 prs. (on same individual), oblong to narrowly oblong and sometimes sub-falcate ·6—1·3" by ·25—·5", mostly under 1" and twice to three times as long as broad, usually drying grey, finely appressed silky both sides, costa about one-fourth diam. of lft. from the upper margin. Peduncles ·75—1·25" long, 1—3 together in usually ample terminal panicles.* Flowers sessile. Corolla exserted to 4—5-times the length of the calyx. Pods purplish-green to brown or red when quite ripe 5·5—12" long by about 1" rarely 1·25" broad.

In all districts! Chiefly in valleys. Fl. May—June. Fr. Nov.—Feb. Evergreen. The new leaves usually following the flowering, or with the flowers.

Bark grey or sand-coloured, blaze thick deep crimson. Shoots and panicle densely pubescent or tomentose. Leaf rhachis pubescent, lfts. pale beneath, silky or nearly glabrous except the margins and mid-rib, basal-nerves 5—6. Calyx campanulate, ·05—·06", pubescent, scarcely toothed. Corolla hairy all over, funnel-shaped with tube exserted and lobes one-third to as long as tube, whitish. Filaments ·6—·7" long.

* The panicle is always described as terminal and ample, but sometimes the bracts are replaced by young leaves and the inflorescence then assumes the form of that of *A. lebbek*. The two trees sometimes, I believe, hybridise (*cp.* var. *lebbekifolia* in C.P. list).

The wood is used for much the same purposes as *A. lebbek* and is said to be durable. *Gamble* gives the weight as about 50 lbs. and says that it works and polishes well. It is sometimes lopped for fodder.

5. *A. Thomsoni*, Brandis. Sailari, Gondi.

A large and handsome tree with the young parts tawny or golden tomentose and old twigs dark grey densely appressed-hairy. Pinnæ 3—10 pairs 2—6" long. Lfts. 5—10 on the first leaves, up to 25 prs. on later leaves, very unequal sided, base and lower side forming a right angle, ultimately glabrous both sides but rhachis villous, larger .5—75" by .25". Peduncles appearing to be corymbose from the old branchlets but the young shoot bearing the inflorescence ultimately proliferous. Heads .7—9" diam. (with st.) sub-corymbose on slender peduncles .7—1.6" greenish-yellow. Fls. .17" with slender pedicels .1" long. Pods red 6—8" by .6—1" beaked, 6—8-seeded.

Angul; Tulka, Labangi, and Burkundi Forests! Fl. March while leafless. Fr. Nov.—Jan. The new leaves appear at the ends of the new shoots which bear the inflorescence during or just after flowering, rarely some peduncles also axillary in the new leaves.

Attains 6—7 ft. girth. Bark grey, smooth, slightly cracked below. Blaze dark crimson. Main rhachis with 1—2 glands between the uppermost pinnæ and a very large one on petiole. Lfts. pale beneath, sometimes slightly falcate, tip rounded and mucronate. Petiolule very short villose. Fls. fragrant. Calyx .08" pubescent, teeth very small obtuse. Petals greenish .12" pubescent, exserted and free to a distance as long as the calyx, narrow ell.-oblong subacute. Fil. .4—5" long connate into a short tube at the base, white glabrous with greenish-yellow anthers. Ovary shortly stipitate, glabrous, or both it and young pod densely golden hirsute. (These last are diseased).

Var. *galbana*, Haines.

It is remarkable that *Brandis* particularly states that the flowers are not scented and that the anthers are pink. He even says that these characters differentiate it from *A. odoratissima* and the *Flora of Madras* also quotes them. I have confirmed the observation in the Central Provinces, but our tree has scented flowers and greenish-yellow anthers! *Prairie* in the *Calcutta Herbarium* writes—"A. odoratissima var. *mollis* = *A. Thomsoni*, which is not a good species." But the cover really contains a mixture of *A. odoratissima* with *A. Thomsoni* and this no doubt led to confusion. On no occasion on which I have seen *A. Thomsoni* in the forest have I for a moment confused it with *A. odoratissima* and it is an excellent species. The tree with scented flowers and yellow anthers I therefore consider as a variety of *Thomsoni*. The form, leaflets, time of flowering, character of inflorescence, pedicelled flowers and pod serve to distinguish it at every stage from *A. odoratissima*. The flowers are usually so high that I have always had to collect them by shooting down a branch; those of *odoratissima* can usually be reached from the ground.

6. *A. amara*, Boivin.

A small or m.s. tree with smooth greenish bark and the innovations softly yellow tomentose. Leaves with main rhachis 2—4" long and 6—15 prs. of pinnæ 1—3" long with numerous (15—25 prs.) close-set linear leaflets under .25" long with the costa nearly central. Fls. .14—15" long (without st.) yellow, fragrant, in heads .3—5" diam. (.3" without the stamens), peduncles .7—1" long rather slender, closely yellow hairy, 1—4-nate in the axils of scales and of the new leaves or appearing shortly paniced owing to late appearance of these. Pedicels short. Corolla exserted to two to three times length of the calyx which

is sub-entire, petals lanceolate about half as long as tube. Pod 4—6" by 7—1" pubescent.

Fl. March—May.

The wood is strong.

Prain gives Orissa as a locality but I can find no specimens from our area either at Kew or Calcutta. The nearest locality where I have collected the tree was in *Rajpur* in the Central Provinces!

7. *A. stipulata*, Boiv. Syn. *A. marginata*, *Merr.*; *Kare, Th.*; *Kala Siris, H.*; *Japud, K.*; *Chapot, Kera-serom, S.*; *Ghora-lenja, Or.*

A large handsome tree with feathery foliage. Pinnæ 12—20 prs. usually about 14 prs., 3—5" long with hairy pubescent rhachis and about 30—40 prs. of semi-lanceolate leaflets 15—35" long with the costa close to the forward margin, young pubescent, mature pubescent at base, margin and costa. Stipules large caducous. Fls. (with stamens) 1—1.25" long on 1—5-nate peduncles often in the axils of stipuliform bracts in panicles 4—8" long. Pods 3.5—6" long by 6—8" broad, dehiscent.

In the damper forests, usually near streams or ravines. Not common. Champaran to Purneah, frequent! Valleys in Singbhum! S.P., rare! Athmallik, near rivers! Angul!

Fl. May—June. Fr. Oct.—April. Evergreen or nearly so, new leaves Feb.—March.

Attaining 8 ft. girth with a smooth pale grey bark with characteristic transverse furrows, but some forms when old have a rough bark below. Blaze crimson. Nearly all parts densely pubescent. Leaves about one foot long, sometimes likened to the Gul Mohur, whitish beneath. The large cordate stipules are very conspicuous on the new shoots but so far from being persistent (as sometimes described) they are very caducous in our area. Fl. cream-coloured or white, sessile, the tubular-funnel-shaped calyx 1½" long and the corolla twice as long or more, pubescent.

The wood is not used in the province but in some parts of India it is said to be used for building and for wheels. It was tried for tea-boxes in the Duars but there was no subsequent demand for it while I was in that district, though, under the name of "Sau," it was extensively planted both there and in Chota Nagpur among the tea, the growth of which it is supposed to improve. It is lopped for cattle fodder.

11. PITHECOLOBIUM, *Mart.*

Closely allied to *Albizzia* but sometimes spinescent. It differs chiefly in the compressed pod being circinate or spirally twisted, coriaceous or fleshy and dehiscent, and the seeds often arillate or embedded in pulp.

1. *P. dulce*, Benth. Syn. *Inga dulcis*, *Willd.*

A pretty tree with small stipular spines persistent on the trunk. Leaves with only one pair of pinnæ and these pinnæ with only one pair of small oblique leaflets 1—2" long. Heads white 5" diam. in narrow panicles. Seeds 6—8 shiny black in a white pulpy aril.

It is often cultivated and deserves to be more so but I have not found it succeed on the Ranchi plateau and it is sensitive to frost. It is a native of Mexico. If repeatedly cut back it forms a good hedge and the pods serve as a cattle fodder.

Fl. Jan.—Feb. Fr. April—June.

12. ENTEROLOBIUM, *Mart.*

Differs from *Albizzia* in the somewhat thickened fleshy pod which is more or less septate within. It is indehiscent.

1. **E. saman**, *Prain*. Syn. *Pithecolobium Saman*, *Benth.*; The Rain Tree.

A large or m.s. tree with rather short trunk but large spreading crown, often forked from the base. Handsome when in flower from the numerous rose-coloured heads of flowers with long stamens against the dark-green leaflets.

Very commonly planted in stations in every district. Native of tropical America. Fl. May—June. Fr. March—April. Evergreen.

Bark dark grey. Shoots and rhachis pubescent. Leaf rhachis with often a gland between one to all the pairs of pinnae, no gland at base. Pinnae 3—7 prs., lowest with 2—3 prs. of leaflets only, larger with 8—10 prs. Lfts. usually 1—2" long by .5—1", rhomboid with the costa diagonal, somewhat hairy beneath, esp. on the nerves. Peduncles 1—3-nate, 2—3" long, axillary, or appearing racemed from arising in the axils of very young leaves. Fls. distinctly pedicelled with a bract on the pedicel. Calyx .25". Corolla-tube rather longer, lobes .12". Filaments very long pink. Pod 5—9" fleshy with firm sutures.

A very easily grown tree of remarkably quick growth. The fuel is said to be useless (*Mackenzie, Fuel and Bamboo Plantations, Ind. For.*, 1917), but this may be due to the difficulty in splitting it. The tree is often much damaged by wind. The pods are sweet and are eaten by cattle.

The name is said to be derived from the multitudes of Cicadas which feed on the tree in the West Indies squirting out slender streams of fluid. The leaves give a good example of sleep movements. *Mr. Maries*, formerly of Darbhanga, found that this tree has the property of rendering *reh* soils fertile. I believe there has been no confirmation of this theory and possibly the efflorescence reappeared after the dense shade of the trees was removed.

FAM. 56. ROSACEÆ.

Herbs, shrubs or trees with stipulate alternate simple or variously compound leaves. Flowers regular, usually 2-sexual. Sepals imbricate in bud, sometimes an epicalyx present. Floral axis more or less hollowed out into a cupular or flask-shaped receptacle (hypanthium) lined above or entirely by the disc and bearing the sepals, petals and usually numerous, rarely definite, stamens. Carpels 1 to many, free or more or less adnate to the sides of the hypanthium, often entirely enclosed within it and when also connate forming with the latter a more or less syncarpous ovary. Ovules 1—2. Fruit very variable, sometimes of achenes free on the receptacle or nutlets sunk within it or sometimes forming with the fleshy swollen accrescent hypanthium a several-celled berry or pome.

I. Carpels free, not enclosed in the hypanthium.

A. Carpel 1. Ovules 2, pendulous. Trees or shrubs.

Calyx 5-lobed. Petals large

1. *Prunus*.

Calyx 5-toothed. Petals minute, sometimes sepaliiform

2. *Pygeum*.

B. Carpels many, exposed in fruit.

1. Ovules 2 collateral, pendulous.

Usually prickly shrubs

3. *Rubus*.

2. Ovule solitary, ascending. Herbs.

- Ripe carpels seated on the fleshy accrescent receptacle
- Ripe carpels seated on a dry receptacle
- II. Carpels many 1-ovuled free at the bottom of a flask-shaped hypanthium, styles free or connate above
- III. Carpels definite 2-ovuled, enclosed in the hypanthium and adnate to its walls, more or less connate with one another to form a syncarpous ovary. Fruit a berry or pome.
- Flowers panicled
- Flowers fascicled or corymbose
4. *Fragaria*.
5. *Potentilla*.
6. *Rosa*.
7. *Eriobotrya*.
8. *Pyrus*.

1. PRUNUS, L.

Trees or shrubs with simple entire or toothed, often gland-serrate, leaves with frequently 2 glands on the petiole. Fls. solitary fascicled corymbose or racemose. Sepal 5 deciduous in fruit. Petals conspicuous. Stamens perigynous. Carpel 1 with terminal style and 2 collateral pendulous ovules. Fruit a drupe, stone often 2-valved, 1-, rarely 2-seeded.

- A. Leaves conduplicate in bud, lanceolate.
- Fls. peduncled appearing before the leaves
- Fls. sessile, appearing with new leaves
- B. Leaves convolute in bud, ovate acuminate
1. *amygdalus*.
2. *persica*.
3. *armeniaca*.

1. *P. amygdalus*, *Baill.*, is the Almond.
3. *P. armeniaca*, *Benth. & Hook. f.*, is the Apricot. Neither appear to thrive in our area.
2. *P. persica*, *Benth. & Hook. f.* The Peach.

A small tree with oblong-lanceolate or oblong-oblancoolate leaves 4-6" long finely serrate or doubly-serrate, short petioles and with fimbriate stipules. Flowers sessile on the branchlets, pink. Fruit velvety.

¶Succeeds well on the Ranchi plateau.

The variety with a smooth shiny fruit is the *Nectarine*.

Plums and Cherries are species of *Prunus* and have no connection with the Jujube or Ber commonly called "*plums*" by Anglo-Indians.

2. PYGEUM, *Gærtn.*

Evergreen trees or shrubs with entire or toothed leaves, sometimes a pair of flat circular glands at the base of the blade. Stipules minute caducous. Flowers small racemose. Sepals minute 5-6. Petals 5-6, like the sepals or very small and villous. Stamens 10-40, often in series of 10. Carpel 1 with 2 collateral pendulous ovules, sometimes abortive. Fruit a transversely ellipsoid somewhat didymous drupe with scanty flesh, cotyledons hemispheric, fleshy, albumen 0.

- Leaves entire. Stamens over 30
- Leaves toothed. Stamens 10-15
1. *acuminatum*.
2. *lucidum*.

1. *P. acuminatum*, *Colebr.*

A small evergreen tree with coriaceous elliptic or oblong acute or shortly acuminate leaves 4-6" by 1.5-3", yellowish-green flowers in racemes 2-5" long and transversely ellipsoid-oblong drupes .75" diam.

Along streams in the moist shady hill valleys of the Saranda forests! Very rare, but would probably also be found in the Mayurbhanj mountains. Fl. Aug. Fr. April—June.

Twigs brown with white lenticels. Leaves shining, some ovate, base rounded or shortly acute, mid-rib very prominent and sec. n. 6—8 strong beneath, arched, and looping some way from margin, cross tertiary faint; glands present or not (on the same tree). Petiole .5" grooved above. Rhachis of raceme pubescent. Pedicels .25". Calyx .12" diam, pubescent. Fr. .5" on the shorter diameter, sometimes with a slight median vertical furrow, endocarp thin woody, testa papery veined.

2. P. Andersoni, *Hook. f.* Syn. *P. lucidum*, *Anders.* (*Beng. Pl.*)*

A rigid shrub or small tree somewhat resembling a *Symplocos*, quite glabrous except the margins of the petals. Leaves coriaceous oblong or oblong-lanceolate obtusely acuminate, 1.5—3.5" with rounded sub-acute or obtuse base and crenate-serrate margins, sec. n. 8—12, faint, nearly straight, bifurcate. Petiole .3". Racemes 1" dense-fl'd. Pedicels very short. Hypanthium hemispheric, glabrous, sepals broadly ovate obtuse, petals twice as long, elliptic with densely ciliate margins. Stamens 10—15 with transversely oblong 2-celled anthers.

An interesting and very rare plant first collected by *Anderson* on Parasnath elev. 4300 ft. from a solitary tree on the northern side of the Central Peak. Since that collected several times, but only from the same locality and perhaps the same tree.

The tree has also been found at Mahendragiri, Ganjam, elev. 4500 ft. by *Gamble* and *Fischer*.

Fl. and renews its leaves in November. Fruit not seen.

3. RUBUS, L. Raspberry.

Rambling prickly shrubs, rarely creeping herbs. Leaves simple or lobed or compound, stipules free or adnate to the petiole. Flowers in terminal and axillary panicles, rarely solitary. Sepals persistent. Petals 5. Stamens many, inserted on the margin of the hypanthium or broad calyx-tube. Carpels many on a convex receptacle, style sub-terminal. Ovules 2 collateral, pendulous. Fruit of many 1-seeded drupels on the dry or spongy raised receptacle.

Leaves palmately 5—7-lobed

1. *moluccanus*.

Leaves pinnately 3-foliolate

2. *ellipticus*.

1. R. moluccanus, L. Syn. *vide* note.**

A shrub, easily recognisable as a Raspberry, with sarmentose prickly branches 3—5 ft. long, broadly ovate or sub-orbicular cordate lobed leaves with small prickles on the 5—7 strong primary nerves beneath and very dense axillary and terminal panicles of white rather inconspicuous flowers .5" diam. Fruit variable in size, scarlet fleshy.

Along the Pendra Valley, below Neterhat, elev. 3000 ft. Fl. Aug.—Oct. Fr. Sept.—Oct. Evergreen.

* The name *P. lucidum* was published without description in *Anderson's* paper on the Flora of Behar and the mountain Parasnath.

** This is apparently *R. rugosus*, *Sm.*, if the species is subdivided as is done in the *Flora of Madras*, but the bracts are rather variable though usually pectinate or lacinate chiefly at apex. It cannot be variety *Thwaitesii*, which is described as having black fruit!

A very variable plant of which only the local form is here described. Branches tomentose. Leaves mostly 6 by 5.5" with rounded dentate lobe hoary-tomentose between the nerves and hairy on the nerves. Panicles usually only 2—2.5" long with lacinate stipules and bracts. Sepals acuminate reflexed in flower, erect 5—6" long after flowering. Petals distant obovate 2" long.

The fruit is insipid.

2. *R. ellipticus*, *Smith*.

A large sarmentose shrub with branches 15 ft. long, long-hirsute with spreading red sub-setose hairs and with a silky-tomentose underlayer. Leaves pinnately 3-foliolate, petiole and rhachis hairy like the twigs. Lfts. usually elliptic 2—4" long with an appressed hoary tomentum between the hairy nerves beneath and often small prickles along the mid-rib. Panicles small many-flowered with short pedicels and setaceous bracts. Flowers 3—5" diam. with obovate petals exceeding the calyx. Fruit a yellow raspberry 6" diam., very sweet.

Sameswar Hills, Champaran, elev. 2500 ft. Meghasani, Mayurbhanj, near rivers, elev. 3500 ft. Fl. Feb.—March. Fr. April—May. Evergreen.

The leaflets are usually rounded or obtuse at the apex, the Mayurbhanj form has them gradually acute, margin very sharply toothed, sec. n. 8—12 strong, often bifurcate near margin, tertiaries scalariform. Petiole 1—3". Stipules setaceous. Sepals acuminate. Carpels silky.

The fruit is good eating.

4. *FRAGARIA*, *L.* Strawberry.

Perennial stoloniferous herbs with digitately 3—5-foliolate leaves and stipules adnate to the petiole. Flowers white or yellow, often polygamous. Calyx with an epicalyx of 5 bracteoles, sepals 5 valvate. Petals 5. Stamens many persistent. Carpels many on a convex receptacle, styles ventral, ovule 1 ascending. Fruit of numerous achenes separately sunk in the very swollen fleshy receptacle.

1. *F. indica*, *Andr.* Yellow-flowered Strawberry.

A delicate procumbent herb with long rooting stolons. Leaves about 2" diam. Leaflets obovate-cuneate with large lanceolate teeth which are sometimes again toothed, 7—1.5" long, thinly sericeous. Peduncles axillary, long and slender, only bearing 1 flower each which is yellow and about 5" diam. with calyx (including the epicalyx) exceeding the corolla. Fruit red.

Damp shady places, Purneah! Fl., Fr. Nov.—Jan.

Rootstock rather stout. Petioles very slender thinly villous. Stipules foliaceous toothed. Bracteoles of the epicalyx exceeding the sepals and sub-lobed or with 2—3 coarse teeth. Fruit sometimes very succulent but insipid, sometimes spongy.

2. *F. elatior*, *Ehrh.*

The cultivated strawberry, whose origin is probably *F. vesca*, *L.* (*Hooker f.*), succeeds fairly well on the Ranchi plateau. Fl. Feb.

5. *POTENTILLA*, *L.*

Perennial herbs, rarely shrubs, with compound leaves, stipules adnate to the petiole. Flowers usually yellow, sometimes white or red, sometimes unisexual or dioecious. Calyx 5- rarely 4-sepalous with an epicalyx

of as many bracteoles, valvate. Petals as many. Stamens many, rarely definite. Carpels many, rarely definite, on a small receptacle which remains dry and does not become succulent in fruit, style ventral or terminal. Ovule 1 pendulous. Fruit of numerous achenes on the dry receptacle.

A. Flowers in sub-corymbose cymes.

Diffuse. Radical leaves digitately 3—5-foliolate

1. *Kleiniana*.

Erect. Radical leaves pinnately 5—9-foliolate

2. *Leschenaultiana*.

B. Flowers solitary axillary.

Sub-erect or diffuse. Leaves pinnately 5—9-foliolate

3. *supina*.

1. *P. Kleiniana*, W. & A.

A diffuse sub-erect annual or perennial herb with weak stems often 18" long. Radical leaves long petioled digitately 3—5-foliolate, lfts. elliptic obovate 7—2" thinly hairy. Cauline leaves smaller and with shorter petioles upwards, 3—5-foliolate, obovate-cuneate, deeply-serrate. Fls. 3" diam., yellow in corymbs 2—6" diam. Receptacle glabrous somewhat swollen or fleshy in fruit. Achenes 1 mm. long, oblique, keeled and with wavy ridges, glabrous or nearly so.

Highest hills of Ranchi and Palaman in grass near streams, Neterhat! Fl. April—June (perhaps all the r.s.).

Petioles laxly pilose, leaflets deeply sharply serrate except at the cuneiform base, with strong very oblique nerves, hairy. Leaves below the inflorescence sessile. Stipules 3—4". Sep. oblong—lanceolate, bracteoles of epicalyx rather shorter than sepals sometimes bifid. Pet. obovate 15". St. about 20.

Distrib. Himalayas and Khasia hills and mountains of Burma, S. India and Ceylon.

2. *P. Leschenaultiana*, Ser. Var. *biharensis*, Haines.

An erect villous herb with woody rootstock, long-petioled pinnate radical leaves with 5—9 alt. orbicular broadly-elliptic or obovate leaflets 7—1.8" long with a subsidiary leaflet between or at the base of several of the leaflets, cauline leaves pinnate, 3-foliolate or uppermost simple. Fls. yellow 4—5" diam. in lax often corymbose cymes about 2" diam. Achenes glabrous obliquely ovoid somewhat compressed with a dorsal rib and lineolate faces, on a conical sparsely villose receptacle.

Mountains of Chôta Nagpur near streams. Neterhat 3000 ft. Fl., Fr. May—July.

Radical leaves with petiole 6—8" long, leaflets villous beneath strongly nerved, a nerve running into each of the large strong mucronulate teeth. Stipules large, foliaceous. Pedicels slender. Sep. ovate 15". Bracteoles lanceolate nearly as long. Pet. obovate slightly retuse.

Distrib. (of type) North-West Himalaya and Nilghiri Hills.

3. *P. supina*, L.

An annual herb 3—4" and sub-erect, or with stems up to 1 foot very numerous and spreading from the root, hairy and leafy. Radical leaves (with petiole) 2—3" flaccid, often absent when flowering, pinnate, with 5—7 rarely 9 obovate opp. and alt. lobulate leaflets 2—5", lower cauline similar to the radical leaflets long-petioled, upper cauline with 3—5 leaflets short-petioled and lfts. usually small and obtuse

about 3-lobulate or incised-serrate. Fls. small yellow .25" diam., solitary axillary never corymbose, but often crowded on the repeatedly branched stems with much reduced leaves.

Northern tract, in damp places, Bettiah to Purneah (Malda, *C. B. Clarke!*). Fl., Fr. c.s., also Feb.—April. Near Sahibganj, *Kurz!* Fl. May. Banks of Sone, *Anderson*. Leaflets not always distinct.

6. ROSA, L. Rose.

Erect, sarmentose, or climbing usually prickly shrubs with pinnate leaves and serrate leaflets, stipules adnate to the petiole. Flowers terminal, solitary or corymbose. Hypanthium ovoid or pitcher-shaped with a contracted mouth bearing the foliaceous or sub-foliaceous sepals which are imbricate in bud. Petals normally 5, large. Stamens many inserted on the thickened disc at the throat of the hypanthium. Carpels many, rarely few at the base of the hypanthium, free, but their styles sometimes connate above, stigmas thickened, ovule 1 (rarely 2) pendulous. Fruit of dry coriaceous or bony indehiscent carpels (achenes) enclosed in the fleshy hypanthium which is often lined with hairs.

A concise and admirable summary of the roses usually cultivated in India is given in Brandis's *Forest Flora of North-West and Central India*. This is reproduced with some modifications in the *F.B.I.* The following appears to be the only rose indigenous in our area.

1. *R. involucrata*, *Roxb.* Jangli Gulab, *H.*; Koya, *Vern.* (Bihar, teste *Ham.*).

A pretty shrub, sometimes subscaudent with arching branches. Pinnate leaves with 5—11, usually 7—9, small elliptic-lanceolate or elliptic-oblong lfts. .25—1.25" long, finely sharply serrate. Flowers 2" diam. pure white solitary or in short corymbs.

Northern Tract, said to be common along the rivers. Purneah! In the Central and Southern tracts it is rare, but found along the larger rivers in the forest tracts. Singbhum! Daspalla! *Buch.-Ham.* says that it was common in the "higher parts of the swamps of Purneah" (*Puraniya, vide unpublished MS.*). Fl. March—April.

Young parts and inflorescence tomentosely villous, gradually glabrescent. Leaves 2—4" long only, lfts. shining, stipules with very narrow segments. Styles distinct, ending in a discoid mass of stigmas. Fruit globose, tomentose (not seen by me), the sepals deciduous.

7. ERIOBOTRYA, *Lindl.*

Trees with simple coriaceous leaves and white flowers in dense panicles. Sepals small persistent on the turbinate or clavate hypanthium. Petals 5 contorted or imbricate, obovate or orbicular. Ovary 2—5-celled with styles connate and woolly below. Ovules two in each cell, basal, ascending. Fruit baccate with very thin endocarp and large angled seeds with very thick cotyledons.

1. *E. japonica*, *Lindl.* Loquat, Japanese Medlar.

A small tree with stout branchlets, leaves beneath and inflorescence densely woolly. Leaves large, 6—12" long, sub-sessile, lanceolate or oblanceolate acuminate, dentate or serrate with 15—20 strong sec. n.

Flowers .5" diam. in dense stout panicles 3—6" long. Fruit ovoid yellow succulent 1—1.5" long, 1—5-seeded.

A native of Japan, frequently cultivated and succeeding well on the Ranchi plateau and in the Northern Area. Fl. Sept.—Oct. Fr. March—April.

An excellent fruit.

Pyrus communis, L. The common Pear is cultivated on the Ranchi plateau but yields a fruit only fit for cooking.

FAM. 57. SAXIFRAGACEÆ.

Trees, shrubs or herbs with alt. or opp. nearly always simple leaves stipules sometimes adnate, always exstipulate when opposite. Flowers regular. Sepals imbricate or valvate usually on a distinct hypanthium which varies much as in the Rosaceæ, from which family the alternate leaved genera are separated chiefly by habit, by the definite stamens equal to or double the number of the petals, ovary of 2—5, commonly 2, free or connate carpels but usually united below and often forming a 1-celled ovary below, and by the numerous ovules and seeds. Placentation in 1-celled ovaries is parietal or the placentæ are pendulous, in 2—more-celled ovaries axile. The opposite-leaved genera often have numerous stamens.

Our only representative (indigenous) genus is not at all typical. To the family also belongs the *Hydrangea*, which is often cultivated.

1. VAHLIA, Thunb.

Herbs with opposite entire exstipulate leaves, but sometimes with a stipular line. Flowers axillary, usually paired. Sepals 5 superior persistent. Petals 5 and st. 5, epigynous. Ovary inferior 1-celled with 2 pendulous placentæ and many ovules, styles 2. Capsule dehiscing apically between the styles. Seeds numerous, minute, ellipsoid, smooth.

Peduncles .3—7", 2-fld. Filaments without basal scale . 1. *oldenlandioides*.
Flowers sub-sessile. Filaments with a minute basal scale 2. *viscosa*.

1. *V. oldenlandioides*, Roxb.

A small plant very like an *Oldenlandia*, usually erect or diffuse, much branched about 6" high, shortly sparsely pubescent all over and also glandular above. Leaves .5—2", subsessile, linear to linear ovate. Peduncles 2-fld. in all the axils, .3—7" long. Fls. white (or yellow?) with 5 small erect triangular sepals, petals about .17" long, obovate. Capsule sub-globose .12" diam.

In fields. Behar, Kurzi Puri! Fl., Fr. c.s.

2. *V. viscosa*, Roxb.

Densely branched from the root with stems up to 10" and even more densely flowered than the last, glandular-pubescent. Leaves .5—1" long sub-sessile, ovate to lanceolate, narrowed both ends. The flowers are sub-sessile (peduncles up to .1") and the filaments have a minute hairy scale at the base which is absent in the last.

Dry rice-fields. Fl. Feb. On grounds of distribution probably occurring in our area.

There are frequently axillary branches congested in the leaf axils which makes the resemblance of this genus to the *Rubiaceæ* the more striking.

FAM. 58. CRASSULACEÆ.

Herbs, rarely undershrubs, usually with simple (exc. *Bryophyllum* and *Kalanchoe*) alternate or opposite fleshy exstipulate leaves and regular racemose, cymose or paniced flowers. Sepals and petals usually 4—5, free or gamophyllous. Stamens hypogynous or epipetalous, as many as or twice the petals. Carpels as many as petals, rarely only 3, free or connate below, narrowed upwards into distinct styles. Hypogynous glands or scales sometimes present at the base of each. Ovules on the edges of the carpels, usually many. Fruit follicular; seeds albuminous with terete embryo and short cotyledons.

Calyx with long inflated tube and 4 short lobes
Calyx 4-partite

1. *Bryophyllum*.
2. *Kalanchoe*.

1. BRYOPHYLLUM, *Salis*.

Erect perennial herbs with opposite simple or 3-partite crenate leaves. Flowers large drooping, in panicles with opposite spreading branches. Calyx large inflated, shortly 4-lobed. Corolla gamopetalous with short 4-fid limb. Stamens 8, 2-seriate, inserted on middle of the corolla tube. Hypogynous scales 4. Carpels 4, free or connate at base, ovules very many. Follicles 4, many-seeded.

1. *B. calycinum*, *Salis*. Kop-pata, *Beng.*; Life-plant.

A glabrous fleshy herb with simple or 3-foliolate (at base) leaves, oblong or elliptic crenate or very coarsely crenate leaflets 2—6" long and flowering stems 1—3 ft. high bearing a panicle of pale greenish and purple flowers with inflated campanulate calyx '8—1'5" long with 4 deltoid lobes. Corolla nearly included, sub-globose at base and constricted in middle, tip reddish purple. Follicles included in the persistent perianth.

Frequent in Orissa in rocky waste ground on the edges of streams! Very commonly cultivated and sometimes spreading as an escape. Fl. Dec.—Feb.

The plant is remarkable by the facility with which it produces buds and young plants from the leaf-crenatures when these are laid on damp ground. Young plants will even form in the botanical drying press and sometimes grow an inch in length before dying.

2. KALANCHOE, *Adans*.

Erect stout usually fleshy perennial herbs with opposite leaves, or the upper alternate, lower or all sometimes pinnate or pinnatifid or 3-foliolate. Flowers large usually yellow with calyx deeply divided and corolla with a spreading limb above the gamopetalous flask-shaped tube, much exceeding the calyx. Stamens 8, 2-seriate, adnate to

corolla-tube. Scales 4. Carpels 4, rarely 5, adnate to base of corolla. Ovules many. Follicles 4.

Leaves simple obovate-elliptic, crenate .

1. *heterophylla*.

Leaves, or some of them, deeply pinnatifid

2. *laciniata*.

1. **K. heterophylla**, *Prair.* Syn. *K. floribunda*, var. *glabra*, *F. B. I.*; *Cotyledon heterophylla*, *Roxb.*

About 1—3 ft. high when in flower, with opposite fleshy ovate-oblong, or upper elliptic, leaves 2—3" long which are crenate or (fide *Roxburgh*) slightly laciniate. Fls. clear yellow (white or pale-pink, *C. B. Clarke*) in compound corymbose glabrous cymes with numerous small lanceolate bracts 1/2" long. Sepals oblong acute. Corolla-tube 3—4" long, lobes 2—25" lanceolate.

Parasnath, elev. 4000 ft., *J. D. H.* Fl. April.

The young plants have sometimes ternate leaves. Petiole short.

2. **K. laciniata**, *DC.*

Sometimes almost woody below 1—3 ft. high when in flower with the lower and sometimes all the leaves pinnatifid with very narrow usually entire lobes or (at least in cultivation) 2—3-pinnatifid. Fls. bright yellow 1" diam. in paniced cymes, sepals lanceolate, glabrous or pubescent.

Patna, *C. B. Clarke*. But it is so commonly cultivated and so easily spreads that I think this was probably not indigenous.

FAM. 59. DROSERACEÆ.

Small herbs usually with whorled radical leaves and cauline leaves alternate or 0, copiously covered with long glandular hairs secreting fluids by means of which they catch and digest minute insects, sometimes diaphanous and glabrous and then with automatically closing laminae. Flowers small regular axillary or on slender scapes. Calyx 4—8-partite or sepals free. Petals and stamens as many as the sepals, hypogynous or very slightly perigynous. Ovary nearly free 1—3-celled with 5—3 styles. Ovules many on parietal placentæ equal in number to the styles. Capsule membranous 5—3-valved, many-seeded. Seeds many with fleshy albumen, embryo cylindric or minute.

Leaves glandular, cauline 0 or alternate

1. *Drosera*.

Cauline leaves whorled vesicular glabrous

2. *Aldrovanda*.

(*Aldrovanda* has been found in salt pans south of Calcutta close to but not within our area. It is not further dealt with.)

1. **DROSERA**, *L.* Sundew.

Small green or red herbs usually found in wet places with small rosettes of radical leaves or with erect or decumbent leafy stems with alternate leaves which are usually circinate in veneration. Stipules 0 or adnate to petiole. Sepals persistent. Petals white or rose, marcescent. Stamens hypogynous or slightly perigynous. Ovary 1-celled with

2—5 styles. Fruit loculicidally 2—5-valved. Seeds many obovoid ellipsoid.

Leaves forming a close rosette, stem 0
Stem elongate with linear leaves
Stem with lunate peltate leaves

1. *Burmanni*.
2. *indica*.
3. *peltata*.

1. **D. *Burmanni***, *Vahl*. Mukha-jali, *H*.

A pretty little plant with a very close compact rosette of obovate or obcuneate leaves .25—.4" covered with (usually scarlet) gland-hairs. Scape erect 3—8" high, sometimes forked. Flowers rose-pink or white secund in a helicoid cyme, usually only one or few opening at a time. Pedicels erect in fruit. Calyx reddish covered with short papillæ.

Locally abundant, especially in Purneah! Also found in Chota Nagpur! Generally on damp sandy ground where water has stood during the monsoon but sometimes (in Purneah) on rather high ground. Fl. Nov.—April.

The stipules in *F.B.I.* are said to equal half the petiole. Those in my specimens are as long as or exceeding the petiole, shortly adnate and intrapetiolar with long fimbriæ.

2. **D. *indica***, *L.* Linear-leaved Sundew.

A slender little plant with sub-erect or decumbent weak stems a few inches long with linear leaves 1—2" long covered with long gland-tipped hairs. Flowers larger than in the last .5" diam. with long pedicels .3" long in helicoid cymes 2—4" which are usually lateral on the stem (not radical but probably terminal, the branching being cymose). Pedicels spreading in fruit. Sepals lanceolate .15—.2" thinly gland-hairy.

Frequent in wet ground near tanks and river-beds. Chota Nagpur, common! Puri! Probably in all districts, ascending to top of Parasnath. Fl. Sept.—Jan.

3. **D. *peltata***, *Sm.*, is said to occur throughout India, but I have seen no specimens from our area. It is a hill plant and might be found at Neterhat.

FAM. 60. HALORRHAGIDACEÆ.

Small terrestrial herbs (excluding South American genera) or aquatics with opposite or whorled, or upper alternate, simple or (in aquatic species) pectinately-pinnatisect exstipulate leaves. Flowers reduced, solitary or clustered axillary or by reduction of the leaves running out into spikes, 1—2-sexual. Calyx lobes 4 or 0. Sepals and petals 4 or 0 superior. Stamens 8, 4 or reduced to 1, epigynous. Ovary 4-, 2- or 1-celled with a like number of simple or fimbriate styles. Ovules 4 altogether, pendulous. Fruit small dry or drupaceous, indehiscent or separating into its carpels.

Stamens 4. Leaves submersed whorled often pinnatisect
Stamen 1. Submersed leaves entire opposite, floating pseudo-whorled

1. *Myriophyllum*.
2. *Callitriche*.

[*Callitriche* is shown here in the place allotted to it in the genera *Plantarum*. It has, however, already been dealt with next to the *Euphorbiaceæ*. It has 1-sexual flowers, and whether the ovary is superior or inferior it is not possible to say.]

1. MYRIOPHYLLUM, L.

Slender aquatic herbs with the submerged leaves whorled or rarely upper alternate, submerged ones usually finely cut into capillary segments, exserted ones toothed, rarely all simple and toothed or entire. Fls. inconspicuous axillary or in spikes appearing above the water, 1—2-sexual. Sepals 4, rarely 2 or 0 on a short tube in the male, hypanthium longer and 4-furrowed in herm. fl. or fem. fl. Petals 2—4 concave, sessile. St. 2, 4 or 8 in male, sometimes 0 in female. Ovary inferior 4- rarely 2-celled. Fruit 4-furrowed sometimes separating into 4 or 2 cocci. Seeds albuminous with central terete embryo.

Flowers white or pink with much fimbriate stigmas, carpels with acute dorsal ridges

1. *tuberculatum*.

Flowers white, stigmas slightly fimbriate, carpels rounded on back

2. *indicum*.1. *M. tuberculatum*, Roxb.

A submerged aquatic with lower leaves 1—1.5" long cut into filiform segments and somewhat leafy spikes of minute flowers 3—5" long, often lateral as well as terminal, floral leaves simple linear-oblongate toothed .25—5" long. Upper fls. male, lower female, but sometimes hermaphrodite fls. also present. Petals white, stamens 4 with yellow anthers. Stigmas pink very fimbriate. The plant in fruit is easily recognised from the 4 radiating sharply angled tuberculate carpels, the whole fruit about .1" long and broad.

Probably generally distributed. Fl., Fr. Sept.—Dec.

2. *M. indicum*, Willd.

Habit of preceding except that the plant is much more flaccid and leaf segments more capillary so that the plant collapses into a tassel when taken from the water. Floral leaves usually very short .1—2" long, rarely .3" long narrow lanceolate toothed. Spikes dense at the top. Fls. .04" long. Fruits .08" diam. 4-lobed, the lobes with rounded angles, not or scarcely tubercled.

Bengal, *J. D. H.* Herb. Ham. (without locality, possibly Purneah)! There are no good specimens from our area though it almost certainly occurs, especially in Orissa.

Fl., Fr. July—Sept.

FAM. 61. RHIZOPHORACEÆ.

Trees or shrubs, often littoral and furnished with pneumatophores (sometimes called blind root-suckers) and aerial roots, generally glabrous with opposite entire simple coriaceous leaves and interpetiolar deciduous stipules which enclose the terminal bud and leave prominent scars. Flowers regular, 2-sexual, often coriaceous, on 1—many fld. axillary peduncles. Calyx superior or half-superior on a cupular or campanulate hypanthium, 4—14-lobed or -sepalous. Petals as many, often 2-fid and laciniate. Stamens twice as many,

rarely indefinite, perigynous or epigynous. Disc usually lining the hypanthium above the ovary which is inferior or free, 2—5. rarely 1-celled. Ovules 2 pendulous in each cell or pendulous from a central placenta in 1-celled ovaries, style 1. Fruit usually a coriaceous 1-seeded berry (tardily dehiscent in *Weihea*). Seed usually albuminous but albumen quickly absorbed by the growing embryo, rarely arillate. Embryo usually without a period of rest but germinating on the tree, in other cases minute. Cotyledons either fused or distinct, sometimes 3—4.

The Mangroves are usually distinctly xerophytic, the salt water being a physiologically dry environment, and the leaves often bear water-tissue below the epidermis. The pneumatophores as well as the stilt-roots and aerial roots have numerous large lenticels and air-conducting tissue to supply oxygen to the submerged parts.

In aerial germination the cotyledons at first enlarge in some cases but this growth is quickly superseded by that of the hypocotyledonary axis or tigellus which may attain 1—3 ft. in length while still on the tree. On falling it plunges deep into the soft mud either bearing with it the cotyledons (*Bruguiera*) or separating circumscissilely from the fused cotyledonary body.

Dots in the leaves are due to cystoliths of Calcium Oxalate.

- | | |
|--|------------------------|
| I. Flower epigynous, the ovary completely adnate to the hypanthium (before pollination). Fruit indehiscent. | |
| A. Hypanthium flask-shaped, not or scarcely produced into a limb above the ovary. Calyx girding the fruit, 4—6-sepalous. | |
| 1. Sepals 4. Petals entire. Anthers many-locellate . | 1. <i>Rhizophora</i> . |
| 2. Sepals 5—6. Petals lobed or cut. Anthers 4-celled. | 2. <i>Ceriops</i> . |
| Stamens 10—12. Ovary 3—4-celled | 3. <i>Kandelia</i> . |
| Stamens indefinite. Ovary 1-celled . | |
| B. Hypanthium spherical or tubular produced above ovary. Calyx above the fruit, 5—14-sepalous. | |
| Sepals 8—14. Petals embracing the stamens | 4. <i>Bruguiera</i> . |
| Sepals 5—8. Petals not embracing the stamens . | 5. <i>Carallia</i> . |
| II. Flower perigynous, the ovary free in the hypanthium | 6. <i>Weihea</i> . |

1. RHIZOPHORA, L. Mangrove.

Evergreen trees or large shrubs with little main trunk and numerous stout usually arched adventitious roots. Leaves coriaceous mucronate or apiculate. Fls. rather large, coriaceous, on axillary few flowered bracteate cymes. Sepals 4. Petals 4 entire. Stamens subsessile with many-celled anthers inserted on the fleshy margin of the hypanthium. Ovary 2-celled produced beyond the adnate hypanthium as a cone, stigma 2-fid. Ovules 2 in each cell. Fruit ovoid girt with the persistent sepals. Albumen present before germination. Cotyledons fused and acting as a continual absorber of nutriment for the largely elongating hypocotyl which ultimately grows far beyond the fruit and is club-shaped. The upper end with the small plumule finally detaches itself circumscissilely from the cotyledonary mass and drops into the mud.

True specialised pneumatophores are generally absent, their function being assumed by the upper part of the stilt-roots which is copiously supplied with lenticels and air tissue.

- | | |
|--|------------------------|
| Cymes long-peduncled 3—5 flowered . | 1. <i>mucronata</i> . |
| Cymes very shortly peduncled with 2 subsessile flowers | 2. <i>candelaria</i> . |

1. *R. mucronata*, Lamk. Rai, *Or.*; The Common Mangrove.

A handsome small tree standing on stilt roots, with elliptic or broadly elliptic coriaceous leaves 4—6" long cuneate both ends and tipped with a short blunt awn, brown or black dotted beneath and also microscopically pale-punctulate. Flowers in long-peduncled few-fl'd. cymes, very coriaceous, 4—7" long. Fruit brown at time of germination 1.5—2", obpyriform.

Orissa, tidal swamps of the Mahanadi delta! Fl. Dec. also April—June. Evergreen.

Bark smooth. Blaze pink. Branchlets closely marked with leaf and stipular scars, leaf buds subterete slender 1.5—2.5". Petioles .6—1.5". Peduncles on the young branches, usually only 3-flowered, 1—1.5" long. Fls. yellowish, pedicelled, cyme branches and pedicels each with two terminal bractcoles united by their bases. Calyx split $\frac{1}{2}$ ths to the base of flower, sepals broad-lanceolate. Petals fleshy woolly on the inner face. Anthers leathery apiculate with an oblong-lanceolate basi-fixed ligule covering the locellæ.

Fruit with the reflexed sepals 4—5" long, the germinating tigellus and radicle reaching one foot or more before dropping.

One year old seedlings (communicated by *Mr. C. G. Rogers*) are 3—4 ft. long with the lower part 6" diam. warted with large lenticels and 3—4 pairs of narrow elliptic leaflets. I have a note of numerous slender erect pneumatophores in this species.

The bark is largely used for tanning.

2. *R. candelaria*, DC. Syn. *R. conjugata*, *F. B. I.* (not of *Linn.*); Rai, *Or.*

A tree very similar in general appearance to the last but distinguished in the forest by its narrower leaves which are often subacuminate. Peduncles very short and stout bearing two sub-sessile flowers only. Fruit narrower, the 4 reflexed sepals oblong 4—5" long.

Orissa, tidal forests of the Mahanadi delta! *Mr. Rogers* points out that in Burmah and elsewhere this tree is usually found in less deep water than *R. mucronata* in association with the *Bruguieras* and has therefore less stilted roots. Fl., Fr. April—June and perhaps at other times.

Petiole .5—1", often rather shorter and stouter and the sec. n. more distinct than in *R. mucronata*. Peduncles mostly from the axils of fallen leaves 2—3.5" long, bractcoles forming a cup receiving the base of the .5" long flower. Petals thin, glabrous.

Bark used for tanning as in the case of *R. mucronata*. The one-year seedling has elliptic-lanceolate leaves and the lower part is far less warted or nearly smooth as compared with *R. mucronata*.

(The unfortunate change of name appears necessary, vide *Kew Bulletin*, 1920, p. 51.)

2. CERIOPS, Arn.

Small trees or shrubs with ovate or obovate leaves and small flowers in axillary peduncled heads with bracts and bractcoles at their base. Sepals 5—6, petals 5—6. Stamens in two whorls, diplostemonous, filaments inserted between the lobes of a crenate disc. Ovary with free top only, growing up in fruit far beyond the calyx-tube which girds its base, 3-celled, cells 2-ovuled. Fruit 1-celled and -seeded. Germination as in *Rhizophora*.

1. *C. Roxburghiana*, Arn. Goran, Beng.; Gartah, Or.

A tall shrub or a small tree with many upright branches, coriaceous obovate rounded leaves mostly 2—3" and small greenish-white sessile flowers in short-peduncled heads. Flowers each with a brown-edged bract and 2 bracteoles at base. Sepals 4—6. Petals 4—6 shorter oblong puberulous or pubescent with white fimbriate margins. Stamens 8—10 (10—12, *F. B. I.*) inserted outside the crenate disc. Fruit 5—6" girt by the calyx about one-third from base.

Orissa, tidal forests of the Mahanadi delta! Fl., Fr. April—May.

With numerous pneumatophores. Blaze white, turning brown. Leaf buds compressed linear 1". Leaves sometimes up to 4" by 2", base cuneate on the 4—1" long petiole. Peduncles 1—3". Sepals 2" thick fleshy lanceolate acute 3-angular. Petals conduplicate embracing the inner whorl of stamens. Ovary at first with free top only, ultimately growing up conically far beyond the calyx tube as in *Kandelia*. Germinating embryo 4—5" before dropping, often curved, seedling leaves narrowly obovate.

3. KANDELIA, W. & A.

A small tree with oblong coriaceous leaves and moderate-sized white flowers in long-peduncled cymes. Fls. sheathed at base by connate bracts. Hypanthium turbinate produced above the ovary and with an annular disc within. Sepals 5—6 linear. Petals 2-fid with multifid lobes. Stamens numerous. Ovary 1-celled, conical tip growing out in fruit beyond the calyx. Ovules usually 5 abortive and 1 fertile on a central column. Fruit 1-celled and -seeded.

The germination is said to be as in *Rhizophora* but I have not examined it. The germinating seedling may attain 1 foot in length before falling. The first stem is bifurcate (always?).

1. *K. Rheedii*, W. & A. Rasunia, Or.; Gorla, Beng.

A small spreading tree with thick twigs, leaves 4—5" long rounded at the apex and white flowers with white linear sepals 5—6" long. Petals caducous. Fruit 1" long, a double cone girt by the calyx at their common base.

Orissa, tidal forests of the Mahanadi delta, usually fringing the creeks and leaning over the water! Fl., Fr. all the year round. Evergreen.

Leaf buds flat linear with stipules 1". Leaves tapering into the 3—7" long petiole, microscopically dotted beneath, sec. n. not visible. Peduncles 1—1.7" long, usually once bifurcate and each branch with 2 pedicelled flowers, sometimes twice branched. Hypanthium turbinate-campanulate, sepals finally reflexed.

4. BRUGUIERA, Lam.

Large or small trees with coriaceous leaves and rather large coriaceous flowers on 1—many-fld. peduncles. Sepals and petals 8—14 on the obconic, campanulate or ellipsoid hypanthium. Petals oblong 2-lobed with a bristle in the sinus, lobes sometimes fimbriate. Stamens twice the petals, embraced by them and springing elastically forward when ripe, filaments slender, anthers linear, mucronate. Ovary 2—4-celled inferior. Style slender, stigma minute, 2—4-lobed. Fruit girt by the calyx, 1-seeded.

The germination is said to be as in *Rhizophora* but it is only superficially so. There are 3—4 cotyledons, sub-connate while in the seed with absorbing tips in the gelatinous albumen. On protrusion of the radicle the style and its base is thrown aside as a cap, and when ripe for falling the whole embryo including the linear-oblong cotyledons falls. The latter *not* remaining behind and circumscissilely breaking off as in *Rhizophora*.

The *Bruguieras* are found in shallower water than the *Rhizophores* and often develop a large trunk.

Leaves elliptic, petioles over 1". Flowers solitary 1. *gymnorhiza*.
L. narrowly-elliptic, petiole under 1". Fls. 2—3 2. *caryophylloides*.

1. **B. conjugata**, Merr., inc. *B. eriopetala*, W. & A. Syn. *B. gymnorhiza*, Lamk.; *Rhizophora conjugata*, L., non *F. B. L.*, Kekra, Rasinia, Or.

A small straight tree with elliptic, or sometimes somewhat elliptic-obovate, shortly acuminate leaves 3·5—5" with petioles 1—2·5" long, large solitary campanulate flowers 1—1·3" soon reflexed with the tube rather shorter than the 10—12 linear-subulate sepals. Petals 2-lobed ·55" with a long bristle from the sinus and 0—3 shorter ones near the end of each lobe.

Orissa, tidal forests of the Mahanadi delta! Fl. April—June and perhaps at other times. Evergreen.

Bark grey, nearly smooth; blaze bright crimson. Stipules about 2—2·5" long, buds subterete. Brown dots on the leaf absent or very few. Sepals rarely 14, tube usually ridged.

I have united *B. eriopetala* with this species. Mr. Rogers agrees with me that it at most is no more than a variety.

α *conjugata* proper. Petals villous on the margins at the base nearly glabrous above with 2—4 bristles on each lobe.

β *eriopetala*, W. & A. sp. (*Wight Ill.*, i, p. 210). Petals densely villous along the whole margin with 0—1 bristle on each lobe. Intermediates may, however, occur with petals sparingly fringed throughout and more than 1 bristle on a lobe.

Occurs in same localities as the type.

The tigellus and radicle are much shorter than in the *Rhizophores*, being only about 6" long when the leafy shoot emerges. Mr. Rogers states that it is found in somewhat shallower water (in Burma).

2. **B. caryophylloides**, Blume. Kekra, Karika, Or.

A small erect tree with narrowly elliptic or lanceolate-obovate leaves 3—4·5" cuneate or shortly acuminate at apex and narrowed at base into a petiole ·75—1" long. Flowers whitish 2—3 pedicelled on a short axillary peduncle, with ellipsoid-obconic tube ·15—·2" long and erect or spreading sepals ·15" long which soon become reflexed and enlarged to ·3" and the tube to ·4". Young embryo very early penetrating the top of the fruit which is at first below the top of the calyx-tube.

Orissa, tidal forests of the Mahanadi delta! Fl. April—June. Evergreen.

Leaf buds compressed at base, very acuminate, leaves microscopically dotted beneath, sec. n. not visible (when fresh), stipules 1·5". Peduncles ·3" with two rather membranous deciduous bracts at the top ·15" long. Pedicels shorter than peduncle. Sepals and white petals 8, petals shorter than calyx, apex fimbriate. St. about 16. Fruiting calyx ·4" somewhat urceolate crowned by the spreading or reflexed sepals.

Young embryo slender, not more than 4—5" long while on the tree.

5. CARALLIA, *Roxb.*

Trees or shrubs with entire or serrulate leaves and small greenish or white flowers sessile in short dense 3-chotomous cymes. Hypanthium minutely bracteate at the base and produced above the ovary with 5—8 sepals and a crenulate disc. Petals and stamens inserted on the margin of disc; petals clawed, orbicular or quadrate, small, 2-fid or entire. Filaments slender. Ovary 3—4-celled, style with 3—4-lobed stigma. Fruit small globose coriaceous, crowned by the calyx.

Leaves entire. Petals white
Leaves serrulate. Petals yellow

1. *integerrima*.
2. *lucida*.

1. *C. integerrima*, *DC.* Jur, K.; Kierpa, *Beng.*; Manj, *Or.*

A small tree with shining leathery oblong, elliptic or obovate shortly suddenly obtuse or obtusely acuminate leaves 3—6.5" long and stout dense 2—3-chotomous cymes 1—2" long of small greenish flowers with inconspicuous white erose petals. Fruit .25" diam.

Purneah! Singbhum, frequent along the banks of streams and dry nalas! Santal Par.! Athmallik! Angull! Sambalpur, along streams! Fl. Dec.—April. Fr. r.s.

Attains 5 ft. girth but no great height. Bark smooth grey, blaze hard red. Aerial roots sometimes present. Twigs somewhat 4-angled. L. sometimes 8" by 3", base often cuneate or attenuate, crystal-cells visible as dots, sec. n. close oblique, anastomosing within margin. Peti. 3—5". L.-buds linear-lanc. .5—.75" acuminate, enclosed by the caducous stipules. Peduncle .5—.75". Fls. obconic .17". Pet. 6—8, 2-fid and lacerate.

Wood hard and red, said to be good and useful for furniture, cabinets and veneering. *Gamble* gives weight as 46 lbs.

2. *C. lucida*, *Roxb.*

A specimen collected by me in Purneah with serrulate leaves exactly matching *C. lanceifolia*. *Roxb.*, may be this. It is young with acuminate leaves, without flowers. Possibly a seedling of *C. integerrima*? Have these serrulate leaves?

6. WEIHEA, *Spreng.*

Trees or shrubs with oblong entire or obtusely serrate leaves. Flowers on 1—more-fid. peduncles with connate bracts enclosing the buds. Calyx 4—5-fid patent, on a campanulate hypanthium with a low slightly lobed disc, under the margins of which the clawed spatulate fimbriate-lacerate petals are inserted. Stamens 16—30 inserted on the margin of the perigynous disc with slender filaments and oblong anthers. Ovary 2—4-celled with filiform style, stigma with 2—4 lobes. Ovules 2 in each cell. Fruit globose fleshy but tardily septicidally dehiscing into 2—4 valves, 2—4-celled each with 1—2 seeds. Seeds arillate, ovoid, subtrigonal with straight embryo and elliptic cotyledons.

1. *W. ceylanica*, *Baill.*

An erect much-branched shrub 3—4 ft. with lenticellate brown twigs and very coriaceous opaque oblong or ovate-lanceolate leaves 2.5—3.5" long shining above with obtuse tip and rounded or sub-obtuse base. Sec. n. 5—7 very slender. Petiole .2" pubescent. Stipules interpetiolar oblong obtuse erect or recurved .15" long, pubescent. Fls.

solitary or geminate axillary shortly pedicelled, globose buds enclosed in 2 orbicular bracts which are nearly glabrous except at base and ciliate margins. Sepals 5 thick valvate densely silky ovate acute, shortly bearded within near the apex. Pet. 5 broadly ovate or quadrate pectinate nearly to the middle. St. 30 with very short filaments (in bud) and oblong 2-celled anthers with cells on the inner face. Ovary conical villose, style with 3 short stigmas.

Rocky margins of the Chilka Lake! Flower buds Dec.—Jan.

My specimens from which above description is taken are in very young bud; it is therefore not possible to give the measurements of the parts of the flower. The following details are from specimens outside the province; ours may possibly be a new species; it is 5-merous.

L. often acuminate, petiole up to .3". Fls. usually tetramerous. Sepals oblong acuminate .2—25", spreading persistent. Petals cuneate. Anthers cordate. Ovary 3-celled. Fr. (f. *F. B. I.*) globose spongy. The plant in young bud looks very like one of the *Celastraceæ*, but the stipules at once give it away.

All specimens in the *Cal. Herb.* are from S. India and Ceylon.

FAM. 62. COMBRETACEÆ.

Trees or shrubs sometimes scandent, with opp. or sub-opposite, more rarely quite alternate simple exstipulate leaves often with small peltate scales beneath or dots due to cystoliths. Fls. generally small, sometimes polygamous, usually sessile in spikes, heads or in racemes. Hypanthium completely enclosing the ovary and often prolonged above it into a very narrow tube or beak carrying a wider tubular or campanulate 4—6-lobed "calyx-tube". Petals between the lobes, or often 0. Stamens 2-seriate, twice as many as the calyx-lobes or one series reduced or absent. Ovary completely inferior, 1-celled with few pendulous ovules. Style simple. Fruit 1-seeded, generally indehiscent, sometimes 2—5-winged or -angled. Seed exalbuminous, cotyledons usually large and convolute, sometimes three.

Germination appears always to be epigeal, the expanded cotyledons large and broad, often somewhat truncate at the tip and palminerved, petioled.

Characteristic nervation of *Combretaceæ* is penninerved with a number of rather strong sec. n. curved up with the margin and less strong or weak numerous obliquely scalariform tertiaries.

I. Fls. racemose or spicate. Staminodes not present.

A. Petals 0.

1. Trees. Sepals deciduous.

Fls. spiked or racemed. Fr. usually drupaceous

Fls. capitate. Fruit small dry

2. Large diffuse shrub. Calyx accrescent

1. *Terminalia*.

2. *Anogeissus*.

3. *Calycopteris*.

B. Petals 4—5 (exc. *Combretum apetalum*).

1. Littoral shrub with alternate leaves

2. Terrestrial usually climbing shrubs.

Beak of hypanthium short or under .5"

Beak of hypanthium very long. Flowers showy

4. *Lumnitzera*.

5. *Combretum*.

6. *Quisqualis*.

7. *Gyrocarpus*.*

II. Fls. cymose. Staminodes present as glands

* Now transferred to Family Hernandiaceæ.

1. TERMINALIA, *L.* Myrabolan.

Large trees with sub-opposite, opposite or alternate leaves sometimes clustered at the ends of the twigs and often bearing large glands on the petiole or base of the blade. Fls. small greenish in the axils of caducous bracts in simple or paniced spikes, 4—6-merous. Hypanthium not beaked above the ovary, bearing a campanulate limb or calyx-tube with a hairy lobed disc. St. diplostemonous inserted outside the disc. Ovules 2—3. Fruit drupaceous or dry, endocarp 4—5-angled, or pericarp produced into wings.

- I. Fruit drupaceous, not winged.
- A. Leaves alt. and clustered at the ends of the twigs.
Spikes simple.
Petioles very short. Fr. glabrous, compressed 1. *catappa*.
Pericles 1". Fr. tomentose globose or pyriform 2. *belerica*.
- B. Leaves not clustered at the ends of the twigs. Spikes
paniced 3. *chebula*.
- II. Fruit with 5 (—4) sub-equal wings. Spikes paniced.
- Bark pale. Leaves glabrous 4. *arjuna*.
Bark dark, rough. L. usually hairy or tomentose beneath 5. *tomentosa*.

1. *T. catappa*, *L.* Deshi-badam, Bangla-badam, *Vern.*; Almond Tree.

A very large and handsome tree with wide-spreading crown and buttressed trunk. Bark cracked like that of *T. tomentosa* but less deeply furrowed. Leaves clustered towards the ends of the branchlets 6—10", obovate with a narrowly cordate base. Spikes solitary axillary. Fruit ellipsoid slightly compressed with a very thick hard and fibrous endocarp 1.7" long, within which is a small almond hardly worth the trouble of extraction.

Very commonly planted but only thrives in the more humid districts. Fl. March—May with the new leaves which turn a beautiful crimson colour in Jan. and Feb. and then drop.

2. *T. belerica*, *Roxb.* Lupung, *K.*; Lopong, *S.*; Behra, Bahera, *H.*; Bohera, *Beng.*; The Beleric Myrabolan.

A large tree with straight and tall trunk, broadly elliptic and obovate leaves 3—8" long clustered at the ends of the branchlets (alt. and distant on some growing twigs), petioles 1—2.5" long, and greenish-white or yellow flowers 2—2.5" diam. in solitary axillary or extra-axillary spikes 3—6" long. Fruit .75" diam. grey-tomentose, sub-globose or pyriform showing only faint furrows when dry.

Throughout the whole area, chiefly in mixed forest in the north, general in Sal forest in the Central Area, nearly always in valleys. Fl. March—May. Fr. Jan.—Feb. Deciduous Feb.—March, the new foliage being often copper-coloured.

Bark dark grey, blaze yellow. Leaves with rounded or obtusely-cuspidate apex and cuneate base, only very young with a little pubescence, usually dotted above, sec. n. 6—9 rather irregular, very minutely reticulate between on lower surface. Inflorescence pubescent, sometimes from axils of caducous bracts below leaves. Calyx-tube cupular, densely villous inside, sepals small triangular.

The fruits are used in tanning but have now but little market value. The kernels are eaten but are said to produce vertigo if many are taken. They are largely eaten however by monkeys, and many animals eat the fruits. The tree yields a gum which is eaten by the Santals. As a constituent of "*triphala*" or the three

myrabolans, they are used in very numerous diseases by Hindu physicians, especially in hoarseness and cough. There is no distinct heartwood and the timber is little used except for temporary huts. The growth is fairly quick. Two trees sown by me attained 21.9" girth in 16 years and a height of 36 ft. *Gamble* says that it is moderate to rapid, 3 to 7 rings per inch of radius, and that the wood is used in some parts for house-building after steeping in water.

3. *T. chebula*, Retz. Rola, K., S.; Hadra, *Uran*; Hara, Hara-taki (the fruit), *Beng.*; Kasa-phal (Mayurbhanj); Harida, *Or.*; The Chebulic Myrabolan.

A small or m.s. tree with a rounded crown, usually sub-opposite ovate or elliptic leaves 4—7.5" by 2—4" and whitish flowers in spikes from the upper new leaf axils and forming small terminal panicles. Drupe ellipsoid 1—1.25" long glabrous, 5-ribbed when dry due to the 5-ribbed endocarp.

Throughout the whole province, especially common on the low hills and plateaux and ascending to the highest points. It appears to favour clay soils. Fl. April—May with the new leaves. Fr. Nov.—Feb. Decid. Feb.—March.

Trunk usually short and crooked, bark grey or dark-grey, in old trees cracked and flaking, blaze thick hard, deep grey-brown on the outside then yellow or sometimes an intermediate reddish zone. Young shoots and leaves usually beautifully silvery-silky, adult nearly or quite glabrous, acute or obtuse with a rounded rarely acute base and 7—9 prominent oblique slightly arched sec. n., nervules very finely reticulate as in other species. Petiole .5—1" with usually 2 glands near the top. Spikes 2—3.5", pubescent or tomentose. Bracts linear as long as the buds, caducous. Fls. very densely white-villous within. Stone 5-angled, very thick with gum vessels in the walls and convolute cotyledons.

There are several varieties or forms, chiefly dependent on the amount of pubescence. In one the hypanthium is densely villous, in another glabrous; the villous one is far the commoner. In Mayurbhanj a form occurs with the leaves nearly glabrous from the first, while on Parasnath a form occurs with the leaves shaggy beneath and the drupes only .75" long.

It is the best of the Myrabolans for tanning, and the best quality is considered to be those "nuts" (so called in the trade) with a bright orange colour (this has, however, been denied); they are best collected off the ground as soon as they fall.

The tree is a great light demander, at least for good fruit-bearing, though the seed germinates best in shade. It is frost-hardy and coppices well. The growth is rather slow, but .7" girth increment p.a. has been recorded in Singbhum. The fruit is largely eaten by animals, especially Chital. *Hari-taki* is the chief Myrabolan in Hindu medicine and is highly prized as an alterative and tonic.

4. *T. arjuna*, W. & A. Kowa, Gara Hatana, K.; Kahua, S.; Kahua, *Kharw.*; Arjun, *H.*

A large tree with pale greenish or grey bark, long inclined branches with opp. or sub-opp. oblong leaves 2—3-times as long as broad, but smaller ones at bases of shoots elliptic, sub-sessile, soon glabrous. Flowers .2" diam., white, in shortly paniced spikes. Fruit 1—1.5" long, wings less than .5" wide, usually premorse above, with ascending striations.

Common along nalas where it sometimes attains an immense size in the Central and Southern areas. Not noted from the Northern area and not very common in the Santal P., also rare or absent in Puri, Balasore and Cuttack. It thus chiefly occupies the valleys of the dryer hilly districts. Fl. May—July. Fr. March—April. Evergreen or nearly so, renewing its leaves at the time of flowering.

Attains 12 ft. girth and 100 ft. in height with smooth bark or slightly flaking on old trees and deep red or crimson blaze distinctly zoned. Leaves with 2 glands

near the base or on the very short petiole which is under $\cdot 5''$, margin entire or crenate but nerves not excurrent as teeth.

Seedlings have often toothed and usually linear-lanceolate glabrous leaves and there are often 3 cotyledons which are very broadly cuneate, $\cdot 7$ — $1\cdot 8''$ diam. at apex, with slender $\cdot 5$ — $\cdot 7''$ long petioles. Two trees which were sown by me attained in 16 years an average height of 38.5 ft. and girth 34.2". The timber a good deal resembles that of *T. tomentosa* and is used for building and agricultural implements, but the chief use of the tree latterly has been for the bark, which is good for tanning and can be removed, *i.e.* the outer bark, which is the best, without damaging the tree.

Gamble gives the weight of the wood as 52—69 lbs.

The bark is also used in native practice as a tonic and astringent and is said to be useful in heart diseases, contusions and ulcers.

5. *T. tomentosa*, W. & A. Hatana, atana, K., S.; Asana, Th.; Saj, Asan, Sain, H.

A large tree with dark cinereous rough bark, deeply cracked into oblong segments, opp. or sub-opp. elliptic or ell.-ovate or, in some varieties, oblong leaves 5—9" long, entire or nerves excurrent as teeth, subsessile or petioled with distinct tertiary nerves, under-surface permanently pubescent or with a close felted tomentum or in one variety glabrescent. Two large glands beneath or on the petiole. Flowers and panicles much as in *T. arjuna* but panicles often larger. Fruit 1.5—2" long or sometimes attaining 3" by 2.5", wings over $\cdot 5''$ broad with horizontal striations.

Throughout the whole area and perhaps the commonest tree. It is partial to the more humid valleys and only there attains its best development, but appears as a small tree on the hills and plateaux. Fls. May—June. Fr. Feb.—March. Decid. March—May.

As might be expected in so widely distributed and common a tree, there are several forms or varieties:

Var. α nepalensis. Ujar-ki-Asan, Th. Leaves large, usually oblong, 8—11" long, with a very close short tomentum beneath whence the under-surface appears white or grey. Sec. n. over 20 with oblique scalariform tertiaries. Inflorescence tomentose or closely shortly pubescent, bracts linear-subulate. Fls. $\cdot 16$ — $\cdot 17''$ diam. Hypanthium tomentose slightly longer than broad, calyx outside thinly pubescent or almost glabrous at tips, sepals triangular mucronulate, inside with long villi and large lobed disc densely villous-hirsute.

Lower hills and valleys of the Northern Area, entering Nepal. The sawyers say that the wood is lighter coloured and superior to that of the ordinary Saj. Whether this is the same tree as var. *coriacea*, *Clarke*, of the Coromandel Coast I am unable to say without further specimens.

Var. β typica, Clarke. The Central India Saj. Leaves usually more or less elliptic-oblong or ovate, often serrate esp. when young, hairy beneath esp. on the nerves. Sec. n. usually fewer than 20. Inflorescence with a looser longer indumentum but flowers $\cdot 18$ — $\cdot 19''$ diam. with the sepals inside far more shortly villous, deltoid; hypanthium broader than long, densely pubescent; calyx outside pubescent or hairy. Disc much as in last.

The Common Saj or Hatana of Chota Nagpur and the Central Provinces. The fruit is often very large and always glabrous.

There are other forms, including one which is very nearly glabrous in the Santal Parganas, and there are also what appear to be hybrids between this species and *T. arjuna*. The seedlings of *T. tomentosa* are usually toothed and hairy.

The tree is very easily grown from seed and appears to prefer a clayey loam. It is more patient of water-logging than most trees. In coppicing it throws out far too many shoots from the top of the stump which are apt to remain weak unless thinned out. In unfavourable localities seedlings may apparently take some twenty years to form a stem and this is frequently a sympodium. Seed sown by me in Singbhum grew on an average 30 ft. in height and 20·9" girth in 16 years and were thus much slower than the *Arjun*.

The timber of *T. tomentosa* is very useful and has been largely cut for sleepers (which are, however, far inferior to Sal), as well as being one of the principal trees used as poles in native houses. It is also an excellent fuel. *Gamble* gives the weight as about 52 to 70 lbs. It is the tree pollarded throughout Chota Nagpur for feeding the Tusser Silk-worm. The bark appears inferior for tanning to the last. The young ovaries are attacked by a cynips, so that panicles of galls are very common on the tree, which are sometimes mistaken for fruits.

2. ANOGEISSUS, Wall.

Trees or shrubs with opp. or sub-opp. and alternate entire usually dotted petioled leaves and small greenish flowers in globose axillary peduncled heads. Ovary inferior and hypanthium produced above it into a beak and then into a campanulate 5-lobed "calyx-tube." Petals 0. St. 10 in two series adnate to the campanulate tube outside the crenate hairy disc. Ovules 2 pendulous. Fr. small indehiscent compressed, 2-winged, beaked, in densely packed heads. Germination epigeal but hypocotyl very short, cotyledons transversely oblong sub-reniform, petioled, convolute in the seed.

Bark smooth pale. Leaves broadly elliptic, obtuse both ends 1. *latifolia*.
Bark dark. Leaves elliptic acute, one or both ends 2. *acuminata*.

1. **A. latifolia**, Wall. Hesel, K., S.; Dhaunta, *Kharu.*; Dhaura, H.; Bhanji, *Th.*

A straight large or m.s. tree with whitish bark and alt. to opposite usually broadly elliptic leaves 2—4" long rounded or obtuse at both ends, in most cases glabrous with age. Peduncles usually shortly racemed or 2—3-nate. Fruit (excluding beak) about as long as broad rarely ·25", beak equalling or shorter than the diam. of the fruit, at length deciduous.

In the Northern Area chiefly on dry ridges in the west, absent from the eastern districts. In the Central Area very common, forming a large proportion of the growing stock on the dryer hills and also frequent in second growth, also common in the Southern Area except on the coast. Fl. June—Sept. Fr. Dec.—Jan., rarely up to the end of March. Deciduous Feb.—April. Leaves turn red or brown in December.

Bark smooth, shed in thin roundish flakes, blaze first a chlorophyll layer, then brown-pink, inside (on wood) pale brown. Leaves sometimes sub-orbicular or emarginate, rarely acute, with 8—14 distinct sec. n. curved before reaching the margin, pellucid dots visible with a lens from above but often not from beneath. Petiole ·25—·75". Heads (without st.) 3" diam. Wings of fruit entire or angled but not jagged.

Var. **tomentosa**, Haines (*F. C. N.*). Twigs and leaves, especially beneath, persistently tomentose (but not smaller as in *Clarke's* variety

villosa). Fruits slightly puberulous above, only about as broad as long and beak as long.

Manbhumi, Palamau, and west of Hazaribagh!

The tree is a very useful one and is especially in request by the agriculturist for posts, implements and carts. Axles are manufactured out of large trees as well as from poles. In the Monghyr market it commands the best price of all woods as fuel. It is very strong, tough and elastic, but the values given for P in *Gamble's Manual* vary from 752 to 1220. *Troup* includes it only in his fourth class in which P=700—800. Weight 56—68 lbs. (*Gamble*).

The twig, bark and leaves have assumed considerable importance during the war for tanning purposes. According to *Mr. Fraymouth* the September shoots are better than those produced in other months. A scheme for pollarding has been proposed to yield several flushes of shoots and leaves in the year. Several notes on reproduction are given in *Mr. Tireman's* paper before the Tannin Conference. I have germinated seed fairly easily on heaps of rubble, and in the forest natural clearances caused by land-slips and with some lateral shade are often thickly covered with seedlings. The cotyledons are 5—6" diam. with petioles 2—4" and the young seedlings are very hairy. Trees raised in Chaibassa from seed had an average height of 30 ft. 10" and girth 18·9". *Gamble* gives 7 rings per inch of radius for the growth and more details are given in the paper cited. The young trees coppice fairly well in the hot season. *Mr. Makins* has recorded 5-year-old coppice 16 ft. high and 9" girth. It is fairly frost-hardy.

2. *A. acuminata*, Wall. Gara-hesel, Parsia, K.; Chakwa, Beng.; Phansi, Or.

A large and beautiful tree with slender drooping branches but often flowering as a small tree. *Leaves* 75—2·25" long, mostly sub-opposite, narrowly elliptic or elliptic or elliptic-oblong, acute one or both ends and apiculate, base nearly always cuneate, beneath densely sericeous when young more or less glabrescent with age and old leaves glabrous above, sec. n. 5—8 or up to 12 on the longer leaves, fine and distinct. Peduncles mostly solitary from the leaf scars and axils. Hypanthium above and beak densely pubescent, calyx-tube glabrous without. Fruit 13—18" long and 24—28" broad with upper part pubescent and beak much shorter than diameter, wings often lobed or irregularly cut and angled or toothed.

Central and Southern areas, along rivers and streams. Singbhum, not uncommon and attaining 8 ft. girth in Saranda! Athmallik! Mayurbhanj! Puril to Sambalpur! Frequent along the Mahanadi. Fl. March—April. Fr. April—May. Evergreen or nearly so, renewing its leaves at the time of flowering or fruiting at which time the old ones are also shed.

Attains 8 ft. girth with nearly black cracked bark and red blaze. Young parts densely sericeous or tomentose. Leaves often rounded at the tip but apiculate and with cuneate base, rarely base obtuse and only in some leaves, dots appearing translucent and due to crystal-cells are numerous. Peduncles usually solitary but in one form clustered and branched; they sometimes appear paniced by arising on leafless twigs.

The wood is used for cart axles and ploughs and some native state that it is superior to that of *A. latifolia*. *Gamble* states that it is inferior to that tree and that it warps and cracks in seasoning; he gives the weight as about 50 lbs.

3. CALYOPTERIS, Lamk.

A shrub with opp. entire leaves with minute scales beneath and greenish flowers in dense axillary and paniced spikes or racemes. Flowers with a tendency to zygomorphy, the style being always declinate towards

the posterior sepal. Hypanthium 5-angled expanded above the ovary into a campanulate "calyx-tube" without a disc, villous both inside and out with 5 large sepals and 10 stamens in two series. Petals 0. Ovules 3—5 on long funicles. Fruit crowned by the greatly enlarged wing-like sepals. Cotyledons convolute.

1. **C. floribunda**, Lamk. Sil, Or. (also Achindi and Atundi, through confusion with *Combretum*); Kukaranji, Gondi.

A large sarmentose or climbing shrub attaining 18" girth with rusty villous shoots, opposite ovate or elliptic acuminate leaves 2.5—5" long copiously covered with minute peltate scales beneath, densely tomentose when young and pubescent rarely quite glabrescent when old. Flowers villous in dense bracteate spikes or sometimes with short pedicels, .26" long in flower with sepals .15—.17" long, spikes in large terminal panicles. Calyx rapidly enlarges after flowering with membranous sepals .5—1" long crowning the 5-ribbed indehiscent 1-celled fruit which is villous and .3" long.

In the Southern tract only. Mals of Puril Angul, common! Narsingpur, common! Fls. March—April. Fr. May.

Leaves with rounded base and about 9 sec. n. curved up within the margin and with not very strong scalariform tertiary, usually permanently pubescent on the nerves beneath. Petiole .1—2".

It is curious that no work which I have seen makes mention of the very characteristic scales, which resemble those of a *Combretum*.

4. **LUMNITZERA**, Willd.

Large shrubs or small trees growing in salt marshes, with alternate coriaceous sessile entire or crenate obovate leaves and narrow flowers in spikes or racemes with small bracts, and two bracteoles adnate to the hypanthium. Hypanthium narrow tubular, solid for some distance above the ovary and then produced as a funnel-shaped calyx-tube with small sepals. Petals 5 inserted in the throat of the calyx-tube. Stamens 10, or the anti-petalous ones failing. Ovary 1-celled with simple style sometimes adnate to one side of the calyx-tube. Ovules 2—5 pendulous. Fruit woody, crowned by the calyx-tube. Radicle long, only partly enfolded by the convolute cotyledons.

1. **L. racemosa**, Willd. Tunda, Or.

A small tree with rough bark and small obovate or oblanceolate entire or crenate fleshy leaves 1.5—2" long. Flowers small white .25" diam. in mostly axillary spikes.

Tidal forests of the Mahanadi delta! Fl. April—May. Fr. May—June.

Leaves with a long cuneate base and rounded or emarginate apex, venation obscure. Hypanthium and calyx together .3" long, lobes small rounded minutely ciliolate. Petals entire .12" ell.-obovate. Fruit .5" (in May and not quite ripe) bottle-shaped, clasped at the base by the two oblong-spathulate bracteoles, striate.

5. **COMBRETUM**, L.

Usually large sarmentose shrubs (*C. nanum* is a dwarf shrub) with opp. or sub-opp., more rarely alternate, entire leaves, often with small

peltate scales beneath. Flowers small white or greenish in our species (showy in some exotics) in spikes or racemes which are usually paniced, sometimes with large white petaloid bracts, polygamous. Hypanthium constricted above the ovary, expanding into a tubular or urceolate "calyx-tube" above it, and sometimes with an intermediate very narrow tube or beak, sepals small 4—5, petals as many or 0, stamens twice as many, 2-seriate. Disc usually lining the calyx-tube with villous margins within the stamens. Ovary with 2—5 pendulous ovules. Fruit with 4—5 angles or wings, dry. Seed one, with flat or plicate rarely convolute cotyledons.

A. Flowers 5-merous. Fruit 5-winged

1. *decandrum*.

B. Fls. 4-merous. Frt. 4-winged.

Large sarmentose shrub or climbing shrub

2. *ovalifolium*.

Undershrub

3. *nanum*.

NOTE.—*C. extensum*, Roxb., is quoted in *Bengal Plants* from Chota Nagpur. The supposed specimen, collected by Dr. Wood, is in the Calcutta Herbarium and is merely *Terminalia chebula*.

1. *C. decandrum*, Roxb. Phalandu, K.; Aten, S.; Rateng, Kharw.; Atundi, Kala-Achindi, Or.

A large bush or scrambling climber or twining from left to right, sometimes covering the highest trees and conspicuous from the large white bracts on the inflorescence. Leaves coriaceous oblong shortly suddenly acuminate 3—5" long rarely 7" by 3", shining above, glabrous or somewhat appressed hairy or with tufts of hairs in the axils of the strong sec. n. beneath. Spikes rusty villous 5—1" rarely 2" long in large axillary and terminal panicles. Fls. 5-merous with urceolate calyx-tube 17" diam. densely villous-pubescent. Frt. oblong or elliptic 1—1.25" long.

Very common throughout the province, especially along nalas but also forming dense low masses in scrub jungle, as in Gaya. Fls. Nov.—Feb. Fr. April—June. The leaves on the panicle turn white or cream-coloured in November while the flower buds are unopened. Evergreen.

Sometimes forming a dense bush in the open with brown bark. Innovations densely rusty-villous. Leaves sometimes somewhat obovate-oblong, sec. n. 6—8, tertiaries subscalariform, those on the panicle similar except as to colour and texture, bracts on the spikes becoming linear upwards, villous. Sepals sub-aristate, acuminate, petals ovate acuminate hairy, not much longer.

2. *C. ovalifolium*, Roxb. Atundi, Or.

A large climbing shrub with elliptic or oval, not at all oblong, leaves 2.5—4.5" long, apex rounded or with a very short obtuse cusp. Spikes 5—1.5" rarely 2", often racemose on a common rhachis and frequently by the fall of the leaves appearing copiously paniced. There are no white foliaceous bracts on the panicle. Fruit 4-winged only, often a beautiful claret colour when ripe, .75—9" by .6—7", shining, with numerous close horizontal striæ.

Chota Nagpur, rare (Palamanu, Rajkot)! Puri, fairly frequent! Angul! Palamanu! Fls. Feb.—April as the leaves are dropping. Fr. May. Deciduous for a short time, renewing leaves in May, often a beautiful dark red before falling.

Very young leaves have a dense villous tomentum near mid-rib and lower sec. n., mature with a rounded or shortly cuneate sometimes unequal base, sec. n. 6—8. The under surface of the leaves shows under a lens numerous minute discs evidently

corresponding to the scales so evident in some species but in this case scarcely differentiated from the rest of the leaf surface. Petiole .4—7". Fls. usually dense towards the end three-fourths of short lateral branches of panicles 2—2.5" long which arise in the axils of falling or fallen leaves, and are pubescent. Petals rather shorter than the 4 triangular acute sepals and narrowly obovate with sometimes retuse apex. Disc densely hairy. There are two forms:

α. Hypanthium below the calyx-tube .14" long and pubescent.

β. Hypanthium below the calyx-tube .09—1" long glabrous and varnished.

In both forms it is slightly narrowed upwards and 4-angled.

Var. Cooperi, Haines.

This is a remarkable plant but too fragmentary to describe. The leaves are exactly those of *C. decandrum* except that it has the scales characteristic of but more pronounced than in *C. ovalifolium* and one of the lower leaves has also the shape of the latter species. The plant is in fruit with pubescent axillary panicles 3—4.5" long. Fruits all 4-winged but *oblong* 1.8—1.9" long by .75—.8" with red colour and texture of *C. ovalifolium* and minute scales between the wings as in that species.

The plant is described as a climber and might very well pass as a hybrid between *C. decandrum* and *C. ovalifolium*. Kalahandi, *Cooper!*

3. C. nanum, Ham. Phirtol-rel, Andaika, K.

An undershrub with woody rootstock, and numerous erect stems or branches 1—2 ft. high, opp. or alternate leaves which are orbicular or obovate or lanceolate 2—4" long and are at first bright red and again turn brilliant red in December and January. Petiole .5". Flowers white in rather dense racemes 4—8" long. Hypanthium obconic. Petals far exceeding the sepals. Fruit 1—1.5", a pretty pink or crimson, 4-winged.

Burnt jungles and fire-lines more especially on the plateaux. Throughout Chota Nagpur! Gaya (on the ghats and hills)! Fl. with the new shoots March—May. Fr. April—Aug. Deciduous Jan.—Feb. and in unprotected forest usually burnt down by the jungle fires.

6. QUISQUALIS, L.

Quisqualis is chiefly distinguishable from *Combretum* by the hypanthium produced into a very much longer slender tube above the ovary and the style partly adnate to the tube, funicles long with their papillose inner sides almost connate. Flowers showy.

1. Q. indica, L.

A large handsome climber with elliptic-oblong shortly acuminate leaves 3—4" long, petiole .3—4" at first, persistent and often transformed into recurved spines after the fall of the leaf and by which the plant is assisted in climbing. Flowers showy in terminal racemes with bracts .3—4", hypanthium about 3" long, petals .8—1" at first white then changing to red and crimson. The flowers are beautifully scented of an evening.

Very common in gardens. Indigenous in the Malay Peninsula, Philippines and western tropical Africa.

The genus *Gyrocarpus* is transferred to Hernandiaceæ.

FAM. 63. MYRTACEÆ.

Trees or shrubs with opposite, very rarely alternate, exstipulate, simple entire, usually evergreen and shortly petioled leaves which with the young stems and parts of the flower and fruit are usually copiously supplied with lysigenous oil glands. Flowers 2-sexual regular perigynous or epigynous, the hypanthium adnate with the ovary and often produced into a tube (calyx-tube) above it. Sepals 4—5 imbricate usually persistent. Petals rarely 0, inserted on, or on the margin of the epigynous disc, or disc lining the hypanthium. Stamens usually numerous and many-seriate inserted with the petals, filaments free or variously connate, anthers small with longitudinal dehiscence, usually dorsifixed. Ovary syncarpous 2—many-celled with axile placentation, rarely 1-celled and placentation basal. Ovules usually numerous anatropous or campylotropous, sometimes only 2 or 1. Fruit various, baccate, drupaceous or opening by as many valves as there are cells. Seeds usually 1—few, exalbuminous, embryo straight or curved.

Germination usually hypogeal.

The venation of the Myrtaceæ is like that of the Combretaceæ or more usually the sec. n. loop continuously within the margin or join an even intramarginal nerve.

The Lecythidaceæ (including *Careya* and *Barringtonia*) are included in the *F. B. I.* and many other works in this family.

- | | |
|---|-------------------------|
| I. Fruit baccate. | |
| A. Cotyledons thick and fleshy. Sep. 4. Seeds 1—few | 1. <i>Eugenia</i> . |
| B. Embryo horse-shoe shaped. Cotyledons small with comparatively large hypocotyl. | |
| Fls. axillary solitary. Sepals free in bud | 2. <i>Myrtus</i> . |
| Flowers paniculate cymose | 3. <i>Pimenta</i> . |
| Peduncles axillary 1—3-fld. Calyx entire in bud irregularly splitting in flower | 4. <i>Psidium</i> . |
| II. Fruit dry, loculicidally splitting at top. | |
| Fls. capitate or umbelled. Petals calyptrate | 5. <i>Eucalyptus</i> . |
| Fls. in axillary spikes. Petals 5 spreading. St. in bundles opposite the petals | 6. <i>Melaleuca</i> . |
| Fls. in proliferous spikes. Stamens free | 7. <i>Callistemon</i> . |

1. EUGENIA, L.

Trees or shrubs with often quadrangular branches and usually opposite glabrous gland-dotted leaves. Flowers sometimes solitary axillary but usually in 3-choromous cymes. Hypanthium often produced into a calyx-tube above the ovary which is truncate or with 4—5 sepals. Petals 4 rarely 5, sometimes calyptrate. Stamens with small versatile anthers often with a gland at the tip. Ovary 2-rarely 3-celled, style simple. Ovules many in each cell but only 1—few developing. Embryo thick with short axis and large fleshy cotyledons. Germination hypogeal.

- I. Flowers cymose. Hypanthium produced beyond the ovary as a calyx-tube.
- A. Stamens not inserted on a thickened disc. Petals usually calyptrate (*Syzygium*).
1. Secondary nerves and intermediate very fine close and numerous.

- a. Branches of panicle rounded in section.
 L. oblong or ell.-oblong over 4" not glaucous, glands conspicuous. Berry oblong or ellipsoid
 L. ell. or lanceolate mostly under 4", glands obscure. Berry pisiform
 L. narrowly oblong or lanceolate. Berry dry oblong or ovoid. Often shrubby, glands very conspicuous
- b. Branches of panicle square in section.
 Branches of panicle sharply 4-angled. L. of *Jambolana* not glaucous, glands more evident, surface often shining
 Branches of panicle obtusely 4-angled. L. broadly ell. to ell.-oblong 2.5—5" dull and very glaucous
2. Sec. n. 8—15 distinct and raised beneath
- B. Stamens inserted on a thickened disc; Petals not usually calyptrate. Flowers often large (*Jambosa*).
1. Angles of twigs decurrent into a sac above the nodes.
 Large indigenous tree. Petals sometimes calyptrate
2. Angles of twigs not saccate at the extremities.
 Small cultivated trees.
 Flowers 2—3" diam. Fruit globose
 Fls. 1.5" diam. Fruit shining turbinate
- II. Flowers solitary or sub-racemose. Hypanthium not produced into a tube above the ovary (*Eugenia* proper).
 Shrub
1. *E. jambolana*, Lamk. Jamun, Jam, H.; Kala Jamb, Beng.; Jamkuli, Or.; Kuda, K.; So-kod, S.; Jambun, Ur.

1. *jambolana*.
 2. *caryophyllifolia*.
 3. *Heyneana*.
 4. *fruticosa*.
 5. *glaucissima*.
 6. *operculata*.
 7. *lanceifolia*.
 8. *jambos*.
 9. *javanica*.
 10. *bracteata*.

A large tree everywhere glabrous with oblong or elliptic-oblong acute or acuminate shining leaves mostly 4" or more long, with very numerous close spreading sec. n. and intermediate nearly as strong. Fls. white sessile mostly in threes in 3-chotomous panicles with terete branches. Hypanthium turbinate 1—2" long, sepals 0 rarely small. Petals calyptrate. Berry ellipsoid or oblong, often curved.

Very common throughout the area, wild or cultivated. The wild tree occurs chiefly along rivers and nalas. Fl. May—June. Fr. June—July. Evergreen and renews leaves about the time of flowering though the inflorescence usually appears on the previous years' twigs.

Attains 8 ft. girth or more in sheltered ravines, with grey-brown or nearly black often pitted bark more or less cracked when old. The trunk is nearly always single. Blaze thick, deep red or brown. Wood reddish-brown to reddish-grey.

Seed nearly always solitary with thick rounded fleshy cotyledons closely appressed on their inner faces. Seedling stems sharply 4-angled with linear or lanceolate leaves 4—1.5" long in their first year, alternate or opposite, without the close fine nervation of the adult.

Timber good and has latterly been much used for sleepers. It is also used for building and for well-curbs, agricultural implements and carts. It is a very good heating fuel. Weight 40—50 lbs. The fruit is eaten and a preparation is given as a stomachic, as a remedy in enlarged spleen and in chronic diarrhoea. The bark is also used for diarrhoea and dysentery and the seed in diabetes. It is a very good avenue tree except in very dry situations.

The following species, nos. 2—5, should in my opinion be all treated as varieties of *E. jambolana* or all treated alike as species. It is usual to treat *E. fruticosa* and *E. Heyneana* only as species. The two hill trees *E. caryophyllifolia* and *E. glaucissima* can be distinguished in the forest without any difficulty whatever, whereas

it is sometimes very difficult to discriminate between *E. fruticosa* and *E. jambolana* without inflorescence. In the herbarium they are always recognised by the inflorescence.

2. *E. caryophyllifolia*, Lamk. Syn. *E. jambolana* var. *caryophyllifolia*, F. B. I.; Buru-kuda, K.; Bir-kod, S.

A small or m.s. tree with pale branchlets, eli. or lanceolate or ovate lanceolate acuminate leaves mostly under 4" long, the glands very small and inconspicuous. Fls. white sessile but often sub-pedicelled with much contracted base, usually clustered at the ends of the branches of short 3-chotomous or irregularly branched panicles with terete branches. Bracts among the flowers caducous linear-subulate. Hypanthium turbinate .1—15". Sepals small rounded. Petals calyptrate. Berry pisiform.

Hills of Chota Nagpur, very common. Fl. May. Fr. June. Nearly leafless at the time of flowering; the young leaves then all come out together generally of a brilliant red colour.

3. *E. Heyneana*, Wall. Gara-kuda, K.; Chuduk' Kod, S.; Katjaman, Kharw.

A shrub or small bushy tree 8—20 ft. high with narrowly oblong-elliptic or lanceolate acuminate leaves 3—5" by .5—1" and lateral cymes of capitate white flowers from the old twigs. Berry .5" oblong crowned by the calyx-tube.

Along streams. Champaran! Common in Chota Nagpur! Frequent in the Southern Area and probably in all districts except perhaps on the coast. Fl. May—June. Fr. July—Aug.

Leaves have glands more evident than in *E. jambolana* and the cymes are usually longer-peduncled, 2—3" long with brachiate branches. Fls. sub-sessile usually several in a head, sepals small.

A form collected by me on the Mabanadi in Angul has linear-lanceolate leaves only 1—2" long. The presence of the calyx-tube on the fruit is not a specific distinction; it occurs even in the cultivated forms of *Jambolana*.

The fruit is sometimes said to be eaten.

4. *E. fruticosa*, Roxb. Bhalu Jamun, Or.

A large tree* but usually branched low or from the base with leaves closely resembling those of *E. jambolana* often long acuminate very distinctly glandular, shining or not. Fls. as in *jambolana* in short panicles but with sharply 4-angled branches. Bracts among the flowers minute very caducous. Hypanthium turbinate or broadly campanulate. Sepals 0. Petals calyptrate or *sometimes expanding*. Fruits globose .25—3" diam.

Mountains of Mayurbhanj 2500—3500 ft. Fl. May—June. Fr. July. Ev. Renews leaves from February onwards.

Bark pale grey, in young trees with chlorophyll, dark grey or with pale patches and somewhat cracked in old trees. Blaze brown as in *Jambolana*. L. usually narrow ell. and acuminate with dots conspicuous beneath when dry, 3—5.5". Petioles .5—9", divaricate. Fls. usually very small, .1" only, but in Mayurbhanj specimens .15 by .2" with raised glands inside and out. St. .2" long. Fruits (in Maymyo specimens) globose .3—3.5" diam.

* It is described as a shrub by *Roxburgh*, but all the specimens in the Calcutta Botanic Garden have grown into trees. There are several other cases of Chittagong plants being found in Orissa (see Introduction).

5. *E. glaucissima*, Haines.

A small tree with broadly elliptic to ell. oblong long-acuminate leaves 2.5—5", rarely attaining 7" and oblong lanceolate, very glaucous and not shining, with very conspicuous pellucid dots. Fls. white sessile ternate or clustered at the ends of the short branches of rather irregular panicles with 4 sided but not sharply 4-angled branches. Bracts among the flowers caducous minute obtuse or acute oblong or triangular. Hypanthium obconic then saucer-shaped .15" long and broad. Sepals 0. Pet. calyptrate. Berry sub-globose (excluding the short truncate tube) or broadly ellipsoid, glands in the pericarp large and numerous.

Hills of Chota Nagpur 2000—3000 ft.! Fl. May. Fr. June. Evergreen.

Bark pale. Blaze rather hard, light red in young, deep red in old trees. Petiole .5—7". Cymes from previous years' leafless axils stout, .5—1.5" with few branches.

Regarded as a variety it is not clear whether this is most nearly allied to *E. jambolana* or to *E. fruticosa*.

6. *E. operculata*, Roxb. Topa, K.; Totonopak', S.; Paiman, H.; Bodara, Th.; Satiam, Bawal, Or.; Pui Jamla, Gond.; Dumkol (Gaya).

A low tree with broadly elliptic or obovate and rounded leaves 5—7.5", more rarely oblong-oblancoate or ovate and acuminate, sec. n. rather irregular 7—12. Fls. white sessile ternate in brachiate panicles 3—6" long mostly from old leaf scars. Berry glabrous .25—3" (—5", *F. B. I.*).

Widely distributed in the damper forests but not common except in the north. All along the northern boundary esp. in Purneah in open grassy jungle tracts! Valleys in Singbhum, Hazaribagh, Manbhum and Santal P., especially in grassy glades! Rauchi ghats, near streams! and the cool tops of the highest mountains, e.g. Parasnath and Meghasani! Gaya, at foot of ghats! Angul! Sambalpur! Fls. April—May. Fr. June—July. The leaves turn red before falling.

Bark rather rough, blaze red. Twigs 4-angular. Leaves usually 2.5—3.5" wide or, in one form occurring in Chota Nagpur, 1.75—2" wide only, dots small. Petiole .5—7.5". Hypanthium obconic .15—1.8" long and broad. Sepals 4, transversely oblong, glandular. A large gland also on connective.

The fruit is eaten for rheumatism and an extract of the root boiled down to the consistency of gur is rubbed on the joints for the same disease while the leaves are used in dry fomentations. The tree is seldom straight and the wood usually used only for agricultural implements. Weight 45—50 lbs.

7. *E. lanceefolia*, Roxb. Syn. *E. Wallichii*, var. *lanceefolia*, *F. B. I.*

A large tree with smooth nearly white bark, twigs 4-angular above the nodes with distichous oblong or lanceolate acuminate glabrous leaves 3—7" long, shining above, and white flowers in lateral corymbose cymes 1.5—2.5" long and broad. Berries narrow oblong crowned with the calyx. The most characteristic feature of the species, however, is the way in which the two pairs of internodal ridges unite and form two prominent sacs above or at each node.

Mayurbhanj, Simlipahar Range, elev. 3000 ft. in dark valleys! Fl. Nov.—Jan. Fr. Feb. Evergreen.

Large trees are much buttressed below, blaze hard with chlorophyll, then dark red. Leaves translucent-dotted seen from beneath and with minute yellow glands,

acumen often very slender, base rounded, obtuse or acute, sec. n. about 12 scarcely stronger than intermediate, others fine and reticulate. Petiole 3—5". Cymes corymbose, axillary, 1.5—2.5". Hypanthium .2", turbinate, sepals broad, semi-orbicular. Petals usually calyptrate. St. 4—5" long. Berry .4" oblong, contracted into a neck below the persistent calyx.

The distribution of this fine tree outside our area is from the Duars to Assam and Chittagong. *Roxburgh* says of it, "I am inclined to consider this one of the most elegant and most useful species of this genus."

8. *E. jambos*, L. Syn. *Jambosa vulgaris*, DC.; Gulab-jamun, H.; The Rose-apple.

A small tree with lanceolate leaves 5—8" long narrowed into a short petiole, sec. n. rather distant joined by a prominent looping intra-marginal one. Easily recognised by its very large handsome flowers about 3—4" diam. (with the long stamens) and which are in short terminal racemose cymes with pairs of flowers (trichotomous cymes with the central axis not at once terminating in a flower). Sepals rounded. Fruit globose white 1—2" with 1—2 grey seeds loose in the large cavity of the succulent pericarp.

Very commonly cultivated and semi-wild in the village jungles of Purneah, also cultivated in Santal Parganas, Balasore, etc., but does not succeed well in the dryer districts. Fl. March—April and fruits in the r.s.

The fruit has a sweetish rose-water flavour and is very indifferent eating.

9. *E. javanica*, Lamk. Syn. *E. alba*, Roxb.; Jamrul, Beng.

A small tree with oblong acuminate sub-sessile or very shortly petioled leaves 5—10" long with a narrowly cordate or sub-cordate base and conspicuous nervation. Flowers not nearly so handsome as in the last, about 1.5" diam. or 2.2" with the stamens, in lateral and terminal short cymes and often from the old branches and trunk. Staminal receptacle somewhat pulvinate with a yellow colour. Fruit turbinate almost flat above rather a pearly or pinkish white crowned by the fleshy inflexed sepals, very watery and flavourless.

Cultivated only in the southern moister districts, e.g. Cuttack. Fl. April. Fr. May. Native of Malacca.

10. *E. bracteata*, Roxb. Sagarabatua, Unchana, Or.

A pretty myrtle-like shrub 2—4 ft. high with leaves 1.5—3" very faintly nerved (until dried). Flowers 4—7" diam., white, usually solitary extra-axillary but often appearing terminal (being crowded on the new shoots with undeveloped leaves). Berries red or ultimately black globose 1—2-seeded about 3—4" diam. crowned by the 4-leaved calyx.

Very common on sandy ground in Orissa near the coast from Cuttack southwards and often in the laterite scrub jungle! Fl., Fr. all the year round.

Twigs brown. Innovations brown-hairy as well as the inflorescence. L. lanceolate, oblanceolate, elliptic or rhomboid usually contracted at the base, apex obtuse subacute or acuminate, copiously gland-dotted. Petiole 1—2". Pedicels .3". Calyx with a circular brownish pubescent disc. Sepals 4 oblong obtuse .15" long somewhat pubescent esp. on edges.

The ripe fruit is eaten.

2. MYRTUS, L.

Myrtus differs chiefly from *Eugenia* in the horseshoe-shaped embryo, small cotyledons and comparatively large hypocotyl. The petals expand. Carpels 2—3 forming a wholly or almost wholly (septa not quite reaching the apex of the ovary) 2—3-celled ovary, with axile placentation.

1. *M. communis*, L. The Common Myrtle.

A shrub with small ovate to lanceolate leaves 1—1.5" long, very sweet smelling, white flowers about .75" diam. solitary axillary on slender peduncles succeeded by ellipsoid berries which finally turn black and are crowned by the 4—5-partite calyx.

Often planted in gardens. Indigenous from the Mediterranean to North West Himalayas.

3. PIMENTA, Lindl. Allspice.

1. *P. officinalis*, Berg.

A small bushy evergreen tree 20—30 ft. high with aromatic narrow-oblong leaves with many sec. n. and terminal and axillary 3-chotomous paniculate cymes of rather small white flowers. Sepals and petals 4. Ovary 2-celled with 1—2 pendulous ovules in each cell. Fruit somewhat like a pepper-corn when dry, 2-seeded. Native of the West Indies; sometimes found in the gardens of Indians. The unripe berries dried in the sun yield the *Otium Pimentæ*.

4. PSIDIUM, L. The Guava.

1. *P. guayava*, L. Syn. *P. pyriferum* and *P. pomiferum*, Willd.; Amrud, H.; Piyar, Beng.

A large shrub or small tree with opposite entire ell-oblong leaves 4—6", pubescent beneath and with 15—20 sec. n. Peduncles axillary with 1—3 pretty white flowers 1—1.5" diam. Ovary usually 4—5-celled with many ovules. The well-known fruit with many very hard seeds. Embryo horseshoe-shaped.

Almost or quite naturalised in the village jungles of Purneah! Native of tropical America. Fl. h.s. Fr. r.s. and c.s.

5. EUCALYPTUS, L'Heritier.

Trees, often gigantic in their native forests, sometimes flowering when quite small, secreting an aromatic gum or resin. Leaves coriaceous, at first often opposite sessile and horizontal (for 3—5 yrs. in *E. globulus*), in older trees they hang obliquely or vertically, are petioled and of a different shape, studded with oil glands and frequently glaucous. Flowers small in heads or umbels rarely solitary axillary. Hypanthium continuous with the pedicel and often usually produced beyond the ovary as a truncate "calyx-tube" without sepals. Petals entirely fused into a calyptra. Stamens numerous. Ovary 3—6-celled with numerous axile ovules. Fruit usually hard and woody dehiscing loculicidally at the top. Seeds numerous.

A very large Australian and Tasmanian genus, the species of which are variously known as Gum-trees, Stringy-barks, Ironbarks etc. *E. amygdalina* attains 480 ft., the highest tree in the world. *E. marginata* is the Jarrah wood largely imported for sleepers. Some species have proved very useful in Italy, Algeria and other places for drying up swamps and lessening mosquitoes and in California, on the other hand, for planting up areas subject to periodic droughts. *E. globulus* and others have succeeded well in the Madras Presidency.

The following species have been tried in this province, viz. *globulus*, *citriodora*, *tereticornis*, *rostrata*, *crebra*, and a few others. All these and others have been sown at Neterhat but only the first two germinated well. The species best suited to Bihar and Orissa have yet to be ascertained; so far I have only seen *globulus*, *citriodora* (a deliciously fragrant species) and *tereticornis* which have attained young pole stage. The following descriptions are chiefly compiled from *Mueller's Eucalyptographia*.

- | | |
|---|--|
| I. Anthers mostly broader than long, usually reniform, opening by divergent upwards confluent slits. Umbels generally solitary | 1. <i>amygdalina</i> . |
| II. Anthers not or scarcely longer than broad, usually roundish, slits longitudinal. Umbels mostly paniculate | 2. <i>crebra</i> . |
| III. Anthers distinctly longer than broad, ovate to narrow oblong, slits longitudinal almost parallel. Umbels or fls. solitary. | |
| A. Flowers paniculate. Lid hemispherical | 3. <i>maculata</i>
(<i>citriodora</i>). |
| B. Umbels solitary. | |
| 1. Umbels peduncled, several-fld.
Lid longer than tube with acute beak | 4. <i>rostrata</i> . |
| Lid longer than tube with sub-terete obtuse beak | 5. <i>tereticornis</i> . |
| 2. Umbels sessile, 1-fld. Fruit angular and warty | 6. <i>globulus</i> . |

1. *E. amygdalina*, *Labill.* The Giant Eucalypt. Probably the tallest tree in the world. Stems when growing freely are smooth and almost white. L. rather short-petioled, mostly alternate, narrow- or falcate-lanceolate, usually attenuate into acute oblique base, somewhat shiny. Umbels usually several-fld. short peduncled. Calyx attenuate into a thin pedicel. Ripe fruits small, semi-ovate.

2. *E. crebra*, *F. v. Mueller*. A very sweet-smelling species with dark rugged bark and slender drooping branchlets. L. alt. short-petioled, linear or falcate-lanceolate, rather thin, dull-green, very translucent-dotted. Filaments almost white. Fruit slightly attenuate at base. Germinated at Neterhat.

3. *E. maculata*, *Hooker*. Syn. *E. citriodora*, *Hook.* in *Mitch. Journ. Trop. Aust.* A tall handsome tree (or, *loc. cit.*, a bush) with smooth somewhat shining whitish or reddish-grey bark mottled with the remains of the older bark. Seedlings rough with red-brown hair. Leaves scarcely shining. Branchlets slightly angular. Leaves shining or not, alt., linear-lanc. often somewhat falcate, sec. n. crowded, rather spreading, prominent with marginal nerve very close to edge, oil-dots not very evident to sight. Fls. in short panicles, sometimes 2—3-nate on the panicle or solitary, pedicels shorter than calyx, calyx-tube short, lid double, inner transparent shining outer hemispheric pointed. Anthers oval-clavate. Fr. globose or sub-clavate, rim narrow, valves 2—4.

Mueller states that *E. citriodora* can only be distinguished from *E. maculata* as a variety differing in the exquisite lemon scent of its leaves and frequently finer-veined. The tree called *E. citriodora* thrives in Ranchi.

4. *E. rostrata*, *Schlecht.* The Red Gum.

A tall tree with smooth ashy grey or white bark and slender branches. L. alt. lanceolate-falcate, sec. n. crowded rather faint, dots scanty or obscure. Umbels lateral or supra-axillary, solitary on slender peduncles 4—14-fld. Calyx-tube semi-globose, lid longer with sub-hemispheric base then sharply beaked. Fruit sub-globose.

The timber is extraordinarily durable but less quick-growing than *E. globulus*. The tree will live in swampy land in Australia.

5. *E. tereticornis*, Smith.

Closely allied to last. Leaves with more prominent sec. n. Umbels short-peduncled 4—8-fld. Lid often much elongated in a gradually tapering cone. Top of fruit more protruding.

The seedlings have opposite almost oval leaves. Timber excellent.

6. *E. globulus*, Labille. The Blue Gum.

A tall tree with smooth greyish- or bluish-white bark (except where persistent at base) with robust 4-angular branchlets. L. on old trees alt. (in seedlings opposite sessile cordate or cordate-ovate), lanceolar-falcate, thick, sec. n. oblique not crowded, marginal rather distant from edge, dots inconspicuous. Fls. large axillary solitary rarely 2—3-nate, sessile, short and broad. Calyx glaucous, lid depressed hemispheric, warty-glandular, sharply umbonate, rarely as long as the obverse-pyramidal warty tube. Anths. oblong oval. Fruit rather large, hemispheric or obverse-pyramidal with broad rim and depressed or convex crown.

The young foliage is often very glaucous.

6. MELALEUCA, L.**1. *M. leucadendron*, L. Cajeput Oil Tree.**

A m.s. usually tall and straight tree with almost white or ashy bark peeling off in large papery flakes, branches pendulous and somewhat willowy with lanceolate, somewhat oblique coriaceous aromatic leaves 2—5" long, tapering both ends and with 3—12 longitudinal nerves and short petiole. Flowers yellowish-white odourless in erect axillary spikes which are often proliferous. Calyx 15" long. Corolla 3" diam. Stamens numerous in 5 bundles opposite the petals. Ovary 3-celled with many ovules on peltate placentæ. Capsule loculicidally dehiscent at the apex, subglobose, 2" diam.

Frequent in gardens. Native of the Malay Peninsula to Australia. Sometimes confused with *Eucalyptus* and *Acacia*.

7. CALLISTEMON, R. Br.

Australian Bottle-brush Trees. Trees or large shrubs, often with willowy foliage and often bright red or crimson small flowers conspicuous by being close together and sessile in a proliferous spike, the small dry fruits remaining for a long time clustered round the branches far below the terminal leaves. Hypanthium more or less globose or urceolate with deciduous dry sepals and caducous petals. Stamens very long usually brightly coloured, free. Ovary 3—4-celled, pubescent on the top which is depressed round the style. Ovules numerous on peltate placentæ. Capsule opening by loculicidal small slits at the top.

1. *C. linearis*, DC., with numerous bottle-brush-like tufts of brilliant crimson flowers and

2. *C. salignus*, Sweet, with small white flowers are both beautiful shrubs or small trees flowering in the hot weather and very common in gardens.

The last has a very hard wood.

FAM. 64. LECYTHIDACEÆ.

Trees (an undershrub in one of our species) with the characters of Myrtaceæ but without oil glands in the leaves and flowers, the leaves alternate and usually clustered towards the ends of the branchlets, often

toothed and usually without an intramarginal nerve or loops. Flowers usually large 4—6-merous, rarely 2—3-merous. Fruit a berry or fibrous or in exotic genera woody and opening by a stoppel.

The flowers of some of this family which are found in Calcutta gardens are exceedingly showy and interesting; such are *Napoleona imperialis* and *Couroupita guianensis*. In the latter tree that part of the hypanthium bearing the androecium grows out sideways and then curves over the top of the flower so that an insect to get at the nectaries has to squeeze itself in between the two staminal (or staminodal in the case of some species) surfaces. To this family also belong the Brazil nut.

Flowers large in short spikes. Fruit baccate, many-seeded 1. *Careya*.
Fls. m.s. in pendulous racemes. Frt. angular 1-seeded 2. *Barringtonia*.

1. CAREYA, Roxb.

Trees or (*C. herbacea*) an undershrub with large leaves usually toothed and very large spicate or racemose flowers in few-fl'd. spikes or racemes. Hypanthium slightly produced beyond the ovary with 4 imbricate deciduous sepals. Petals 4 large white or pink. Stamens numerous, the outermost or innermost or both reduced to filiform staminodes, more or less connate at the base. Disc annular intrastaminal. Ovary 4—5-celled. Ovules numerous axile. Style long filiform. Fruit a large globose berry with numerous seeds.

1. *C. arborea*, Roxb. Kumb, Kumbi, H., Beng.; Asanda, K.

A small or m.s. tree with large obovate or obovate-oblong leaves clustered at the ends of the branchlets and large white and pink flowers in dense spikes succeeded by large globose green fruits 2.5—3" diam. crowned with the calyx-tube.

Throughout the province but chiefly in the moister regions and only found in the valleys of the Central Area. Fl. March or April—May. Fr. July. Deciduous Feb. to the time of flowering, old leaves often red or purple.

Attains 6 ft. girth in Angul where the largest trees are found, but no great height. Bark thick dark brown, rather smooth with exfoliating scales, blaze very thick red and fibrous. Leaves 6—15" long, glabrous, slightly crenate-denticulate, sec. n. 10—12 not very strong. Flowers with large bracts and bracteoles, sessile or scarcely pedicelled. Sepals ovate obtuse. Petals 1.75" cream or white. Filaments pink, very numerous. Ovary usually 4-celled.

Wood only used for fuel and agricultural implements. Brandis says weight variable but average about 50 lbs. The bark gives a fibre suitable for rough ropes. Campbell says that the fruit is eaten but I have not found this. The root is used to kill fish in Gangpur. Except in the grass lands of a damp district like Purneah (where the thick bark makes it tolerably fire resisting) the tree only thrives in shady forests, and though handsome there seldom looks well in a garden.

2. *C. herbacea*, Roxb.

An interesting little undershrub like a very dwarf "Kumbi" sending up annually from a woody rootstock reddish shoots with alternate glabrous obovate or oblanceolate serrulate leaves 3—4" long at time of flowering, ultimately 6—8" long, and large flowers 2.5" diam. with a disagreeable odour.

In open grass lands of Champaran! New shoots appear beginning of March and at once flower, but this is partly dependent on the time of firing the grass and they may appear up to May and June, or as early as January.

Leaves rounded at tip, vary attenuate at base into the short rather wider petiole. Flowers often sub-solitary. Bracteoles adnate to base of hypanthium. Sepals broadly-oblong .5" long. Petals oblong whitish or purple. Filaments pink below. Fruit (ripe?) 1.5" topped by the oblong rounded sepals .4" long.

2. BARRINGTONIA, *Forst.*

Trees with entire or toothed leaves mostly clustered towards the ends of the branches and large or m.s. flowers in terminal or lateral spikes or racemes with small deciduous bracts. Hypanthium ovoid or turbinate, calyx-tube hardly any, sepals 2—4 rarely 5 imbricate or valvate. Petals 4—5. Stamens connate at the base and tube also adnate to base of petals, anthers short versatile or sub-basal. Disc annular within the stamens. Ovary 2—4-celled with 2—8 ovules in each cell. Fruit pyramidal, ovoid or oblong, sometimes 4-angular, hard and fibrous when ripe, indehiscent, with one seed only. Embryo a thick fleshy hypocotyl with rudimentary cotyledons.

1. *B. acutangula*, Gaertn. Hinjal, Hijal, *Beng., Or.*; Ijar, *Th.*; Dundi, *K.*; Ingan, *Kharw.*; Hinjor, *S.*; Hyal or Hyar, *H.* (teste *Buch.-Ham.*).

A small or m.s. tree with obovate or oblanceolate denticulate leaves attaining 9" by 4" but usually much smaller, narrowed into the .3—5" petiole. Flowers with pale pink very caducous petals but conspicuous from their bright red stamens and from being arranged in long drooping racemes often 2 ft. long. Fruit oblong quadrangular truncate about 1" long.

Usually on banks of streams but equally common both in the flooded parts and higher lands of Purneah and other swampy parts of Bihar. Singbhum! Manbhum! Gangpur! Athmallik! Puri! Angul! Sambalpur, along the Mahanadi! Rajmahal Hills (no doubt along streams) *Kurz!* Kalahandi! Fl. May. Fr. Sept. Evergreen or nearly so, renewing leaves March—April.

Sometimes attaining 5 ft. girth but always with short trunk. Bark thick dark grey distinctly furrowed on old trees, blaze pink with cheesy cut. Leaves usually 3—5" with about 10 sec. n. and very reticulate intermediate venation, rather pale beneath. Racemes lax, pedicels .2—3". Hypanthium acutely 4-angled obpyramidal. Sepals .1" denticulate. Petals 2".

"Wood pale or reddish brown, tough and strong. Wt. about 40—50 lbs. Used for boat-building, wells, carts, rice-pounders and by cabinet-makers." *Brandis.*

FAM. 65. MELASTOMACEÆ.

Herbs or shrubs, rarely small trees, with opposite or whorled entire, rarely serrulate, exstipulate leaves which are usually 3—7-nerved from or from near the base (exc. in *Memecyleæ*), the nerves extending nearly to the apex. Flowers small or often very showy regular or somewhat irregular in the andrœcium, 2-sexual. Hypanthium usually united by vertical walls to the ovary, sometimes wholly adnate, rarely nearly free, bearing 3—6 sepals or truncate. Petals as many as sepals, contorted in bud. St. as many or more than the petals and inserted with them on the margin of the hypanthium, filaments bent inwards in bud, alternate stamens sometimes different or rudimentary, anthers opening by

terminal pores, rarely by slits, connective often appendaged at the base. Ovary 3—6- usually 4—5-celled or (in *Memecylon*) 1-celled, style simple. Ovules very many except in *Memecyleæ*, axile in the *Melastomeæ*, free central in *Memecyleæ*. Fruit baccate or capsular, opening by pores in the top or sometimes irregularly breaking up. Seeds minute and numerous (exc. *Memecylon*), albumen 0, cotyledons usually short.

I. Sub-family *Melastomeæ*. Ovary 3—6-celled. Ovules very many on axile radiating placentæ. Seeds very many. Anthers opening by a pore.

A. Flowers 4—5- rarely 6—7-merous, not spicate.

Stamens all similar

1. *Osbeckia*.

Stamens dimorphous

2. *Melastoma*.

B. Flowers 3-merous, in scorpioid spikes

3. *Sonerila*.

II. Sub-family *Memecyleæ*. Ovary 1-celled, ovules about 9 on a free short central placenta. Berry 1-seeded. Anthers opening by pores or short slits. Stamens 8 similar

4. *Memecylon*.

1. OSBECKIA, L.

Shrubs or herbs with usually 4-angled branches and frequently strigose hispid or with stellately-hairy or setose scales. Leaves opp. or ternate. Fls. terminal capitate or paniced, more rarely solitary, 4—5-merous. Hypanthium with stellate hairs or pectinate scales. Stamens equal or subequal and similar with oblong anthers which may be more or less beaked, connective not produced at the base, slightly swollen or with 2 tubercles. Ovary setose at the apex with very numerous ovules on placentæ radiating from the axis. Capsule opening by 4—5 pores at the top. Seeds curved through half a circle, covered with minute elevated points.

A genus of very pretty herbs or shrubs most of them suitable for a garden.

I. Perianth 4-merous.

A. Anthers not or scarcely beaked.

Hairs spreading. Fls. capitate with an involucre of leaves

1. *truncata*.

Hairs appressed. Fls. 1—3 not capitate

2. *zeylanica*.

Var. *non-rostrata*.

B. Anthers distinctly beaked.

Hyp. not necked. Herb under 2 ft. Fls. capitate

3. *chinensis*.

Hyp. long-necked in fruit. Herb 3—5 ft. Fls. paniced

4. *rostrata*.

II. Perianth 5-merous (rarely 4-merous in *nutans*).

Small wiry shrub 2—3 ft. Fls. cernuous 1" diam.

5. *nutans*.

Shrubby 4—5 ft. Fls. not cernuous 1.5" diam.

6. *nepalensis*.

1. *O. truncata*, Don.

An erect herb slender 4—12" high with spreading hairs on the 4-angled stem, elliptic or ovate sparsely hairy leaves .5—1.3" and very small usually 4-merous pale purple flowers capitate at the ends of the stem or branches. Hypanthium .1—1.5", 8-ribbed and stellately pilose. Sepals 4 very small .05" or less triangular and cuspidate persistent alternating with branched hairs which are as long. Anthers not beaked. Fruit .15—2" with the hairs persistent.

In wet places, not nearly as common as *O. chinensis*. Ranchi! Manbhum, Camp! Gaya, below the ghats (Pathra forest)! Angul, *Chattarjœe*! Fl. r.s. Fr. Nov.

Easily recognised in flower by the very small petals not exceeding $\cdot 1$ — $\cdot 15$ ". Lower leaves shortly petioled, upper sessile. Inflorescence supported by 3—4 large leaves.

Var. Kurzii. Plant scarcely 2" with very small leaves and flowers and ribs on fruit absent.

Parasnath 4200 ft., Kurz!

2. *O. zeylanica*, Willd. Var. non-rostrata.

A very small herb 2—3" high with the stems strigosely hispid on the angles, small elliptic or oblong leaves $\cdot 3$ — $\cdot 4$ " thinly strigose above with stout hairs ending in a capillary tip, a continuous row of especially stout adpressed hairs near the margin. Fls. mauve $\cdot 5$ " diam., not capitate, few, usually about 1—3 at or towards the ends of the branches on pedicels $\cdot 05$ — $\cdot 07$ " long. Hypanthium 8-ribbed setose. Sepals lanceolate $\cdot 15$ " spreading with long-stalked stellate hairs between. Anthers 8 scarcely beaked. Fruit ovoid setose.

Sands of the Orissa coast, Puri! Chilka Lake (called *O. truncata* in *Herb. Cal.*), Alcock! Fl. March.

This differs from the type essentially in the anthers not being beaked. A specimen of *O. zeylanica*, however, collected by C. E. C. Fischer in the Anaimalai Hills has only short beaks. The other characters in which it differs such as the very small leaves and few flowers are no doubt the immediate result of its habitat.

3. *O. chinensis*, L.

An erect herb 6" to 2 ft. high with linear linear-lanceolate or oblong leaves 3—5-nerved appressed-hairy both sides and usually 4-merous mauve-coloured flowers about 1" diam. capitate at the top of the branches. Hypanthium urceolate not ridged, glabrous except for stellate bristles between the sepals, or with a few hairy stipitate scales, often shining in fruit. Anthers with a long beak.

Common in wet places all over the Northern and Central Tract, especially on the mountains! Chota Nagpur, common usually on damp clay soil in grass! Angul, Chattarjee! Fls. Aug.—Nov.

Stems 4-angled, sparsely strigosely hairy. L. 1— $2\cdot 5$ " rarely more, margin often obscurely serrulate. Sepals lanceolate glabrous ciliate. Fruit glabrous, $\cdot 15$ — 2 " wide with apical bristles.

Var. parasnathensis. Erect, 2 ft., leaves oblong 2" with sub-cordate base. Fruit often $\cdot 25$ ".

Parasnath!

4. *O. rostrata*, Don.

A stout herb 3—5 ft. high, scarcely branched, with opposite or ternate ascending distant leaves $3\cdot 5$ — 7 " long with 5—7 principal nerves and numerous distinct obliquely scalariform secondary nerves. Petioles $\cdot 2$ — 4 ". Flowers in oblong or pyramidal terminal panicles 4— 7 " long at the top of the stem, purple, with petals $\cdot 5$ — 7 " long. Hypanthium glabrous or thinly setose $\cdot 3$ " long, ovoid oblong with a neck (bottle-shaped), glabrous or setose $\cdot 4$ — $\cdot 5$ " long in fruit.

Fl. Aug.—Sept. Fr. Oct.—Dec.

The following two very distinct varieties occur in the province:—

Var. pulchella, Benth.

Stems glabrous 4-angled or -winged. L. oblong or oblong-lanceolate

acute or sub-acuminate up to 2.5" broad, glabrous beneath between the nerves, hispid above. Fruits .5". Seeds small white with lines of minute dots.

Purneah, in wet ground and swamps!

Var. *sexangulata*, Haines.

Stems strigosely hirsute with bulbous-based hairs, 6-angled. L. lanceolate or narrowly-lanceolate up to 1.3" broad setosely hairy on both surfaces. Petiole densely strigose. Fruit .3—4". Seeds very small orange yellow conchoidly granulate.

Chota Nagpur 3000 ft. in wet places!

The type has 4-angular stems, glabrous or with patent hairs, and corymbose flowers.

5. *O. nutans*, Wall.

A pretty little much-branched wiry shrub 2—3 ft. high with narrowly lanceolate 3-nerved leaves 1—1.8" long glabrous and sometimes golden between the strigose nerves beneath, glabrous and beautifully lineolate above when dry. Flowers 4—5-merous, pale rose-coloured, about 1" diam. on cernuous pedicels 1—2 together on short axillary and terminal peduncles. Hypanthium glabrous, globose, .2—2.5" diam. Sep. .3" lanceolate, ciliate at base and with pectinate scales between. Free part of ovary and fruit densely strigosely hairy.

Sub-montane tract, along rivers, N. Champaran! Fl. Oct.—Dec. Fr. Nov.—Jan. Branches strigose. Petiole mostly under .1".

C. B. Clarke says (*F.B.I.*, p. 516) that "there is no recorded instance of a normally 5-fid *Osbeckia* producing 4-fid flowers"; this, however, was the case with the first specimens of *O. nutans* collected by me.

6. *O. nepalensis*, Hook.

A branched shrub 4—5 ft. somewhat resembling *Melastoma malabathricum* when not in flower but the leaves softly hairy on both surfaces. Flowers in corymbose panicles white (or mauve-purple, *F. B. I.*), 1.5" diam. Hypanthium with large flat permanent scales pectinate with white bristles and a ring of the same round the top, truncate in fruit. Sepals broad lanceolate .4" ciliate. Fruit campanulate (not bottle-shaped) or urceolate, free top short opening by 5 terminal pores densely strigose and with a 5-crenate ciliate crown.

N. Champaran, Bettiah and Ramnagar! N. Purneah, in open grassy jungles! Fl. Oct.—Dec. Fr. Nov.—Dec.

Stems acutely 4-angled strigose. L. lanceolate acuminate subsessile, larger 5.5" by 1.7", principal nerves 3 and 1—2 weaker ones each side.

2. MELASTOMA, L.

Strigose or villose shrubs with 3—7-nerved leaves and 5- (rarely 6—7-) merous flowers. Hypanthium with simple hairs or scales. Sepals deciduous. Stamens twice as many as the petals, alternate ones longer with purple anthers and connective produced at base terminating in two lobes, the intermediate shorter ones with yellow anthers not produced but with two tubercles in front. Ovary as in *Osbeckia*. Fruit baccate or coriaceous, bursting irregularly. Seeds as in *Osbeckia*.

1. *M. malabathricum*, L. Dantgigiri, *Th.*; Gongai, *Or.*; Phutki, *H.*

A beautiful very bushy shrub 4—5 ft. or sometimes 7 ft. high with 4-angled branches densely strigosely-scaly twigs and 3—7-basal-nerved, rough, broadly lanceolate, oblong-lanceolate or elliptic leaves 3—4" long. Fls. bright mauve-purple 1—1.5" diam. in clusters of 1—5 at the ends of the twigs with conspicuous yellow stamens. In fruit the hypanthium becomes rather brittle and breaks usually transversely, while the placentæ become very fleshy and purple.

Throughout the area, but especially common in the Northern area north of the Ganges. In the Central and Southern area restricted to the more shady valleys and water courses. Fl. March—May. Fr. Nov.—Dec. Evergreen.

Leaves strigose with stout scabrid hairs beneath and somewhat similar hairs adnate their whole length to the epidermis above. Petiole 3—5". The hairs (so usually described) on the hypanthium and other parts are rather scales, consisting of very numerous cells and sometimes minutely toothed and with a mid-rib.

The mass of sweetish fleshy placentæ and seeds is eaten and stains the teeth purple.

3. SONERILLA, Roxb.

Small herbs, sometimes woody at the base, sometimes stemless. Leaves in a pair sometimes unequal, 3—5-nerved, entire or serrulate. Fls. in racemes or scorpioid spikes with campanulate or a long-funnel-shaped hypanthium and 3 short sepals, 3 petals and 3 stamens (rarely 6), anthers without appendage to connective. Ovary 3-celled, apex glabrous. Fruit a capsule usually 3-gonous and 6-ribbed opening at the top by 3 valves. Seeds very many smooth or minutely tuberculate or punctate, raphe simple or running out into a lateral appendage, sometimes overtopping the seed.

1. *S. tenera*, Royle.

A delicate little plant 2—8" high with often pink stems more or less pubescent and gland-hairy. Leaves membranous ovoid, elliptic or rhomboid 3—5-nerved, larger 1.25" by .75", sometimes obscurely toothed narrowed into the short petiole, sometimes with long sparse hairs above. Racemes or spikes 1—2", only about one flower opening at a time. Fls. .3" long. Sepals broad ovate short cuspidate. Petals pink, clawed, broad-oblong, suddenly acute. Ovary with very thin wall slightly adherent to the hypanthium which is sparsely gland-hairy.

Frequent on moist banks in the hills of Chota Nagpur. Singbhum! Hazaribagh, ascending to top of Parasnath! Neterhat! Fl., Fr. Oct.—Nov.

4. MEMECYLON, L.

Shrubs or trees with short-petioled or sessile coriaceous glabrous leaves which are usually penninerved. Flowers in small lateral, rarely terminal, cymes or umbels, often clothing the branches from the axils of fallen leaves. Hypanthium campanulate, sepals 4 short or 0. Petals 4 usually blue or white. St. 8 similar with short anthers opening by slits in front, connective with an empty spur or horn behind. Ovary inferior 1-celled enclosed in the hypanthium and with an 8-rayed disc

at the top, style filiform, ovules 6—12 on a free central placenta. Fruit baccate but only 1-seeded. Seed large with convolute cotyledons.

1. *M. edule*, Roxb. Var. *ovata*, Clarke. Niras, Or.

A very beautiful shrub or small tree with ovate acuminate leaves 3 by 1·8" to 5·5" by 2·8" with rounded base and very obscure sec. nervation. Flowers bright blue ·25" diam. very numerous in clustered compound umbellate cymes exceeding 1" long from the old leaf axils. Hypan. pink, shortly tubular-campanulate then spreading and saucer-shaped with 4 shallow rounded sepals, disc beautifully veined with 8 radiating lines united by a marginal one. Pet. 4 blue fugacious broadly ovate. St. blue. Berry ·3—·4" diam., blue or dark-purple.

Along rocky ravines and on the tops of high rocky hills in Orissa. Baruni and Kahuri hills and ravines in Southern range, Poril Ravines in Angul! Rarely also in scrub jungles! Fl. April—June. Fr. June—July. Evergreen.

Attains 2 ft. girth with closely regularly fluted corky bark and hard deep-brown then pale brown blaze, in young trees thin pink and dirty white. L. rarely only 2·5", acute or obtusely acuminate, with minute black dots beneath, sec. n. 6—9 (fairly distinct in Angul specimens). Petiole ·25—·4". Cymes (only 3" long in some Khurda plants) 1-many from a node with 4-angled peduncles ·25—·4" long. Fl. buds white very acute.

The berries are eaten.

FAM. 66. LYTHRACEÆ.

Trees, shrubs or herbs, often with 4-angled branches. L. entire, usually opposite sometimes whorled or alternate, exstipulate, sometimes dotted. Fls. from minute to very large, 2-sexual, regular or somewhat zygomorphous (distinctly in *Woodfordia*) perigynous with the hypanthium growing up around but free from the ovary (exc. *Punica*) though often adherent and accrescent in fruit, generally 3—6-merous. Sepals 3—6, valvate, sometimes with an epicalyx of smaller intermediate sepals (or bracts?). Petals as many as the sepals or 0. St. definite or indefinite perigynous, inserted in the hypanthium or on its throat. Ovary 2—6-celled with long simple style and usually capitate stigma. Ovules very many on large axile, rarely parietal placentæ. Fruit membranous, coriaceous or capsular, sometimes 1-celled by absorption of the septa. Seeds many exalbuminous, sometimes winged. Embryo straight (exc. *Sonneratia* and *Punica*).

In the *Nat. Pflanz. Fam.* *Sonneratia* (under the name *Blatti*) is placed in a separate family (*Blattiaceæ*) and *Punica* is placed in another family consisting of the single genus. The last is the most natural arrangement, but as *Punica* is not indigenous in our area it suffices to include it here.

I. Lythraceæ. Flower perigynous. Ovary cells in one whorl.

A. Trees or shrubs. Flowers often large.

- | | |
|--|--------------------------|
| 1. Flowers distinctly zygomorphous, hypanthium coloured | 1. <i>Woodfordia</i> . |
| 2. Flowers regular. | |
| a. Ovary not adnate at base with hypanthium, 2—6-celled, placentation axile. | |
| Flowers 4-merous | 2. <i>Lawsonia</i> . |
| Fls. 3- or 6-merous, rarely perianth 7—9-merous. | |
| St. α | 3. <i>Lagerstrœmia</i> . |

b. Ovary more or less adnate at base to hypanthium,
10- or more-celled

B. Herbs with small or minute flowers sometimes apetalous
II. Punicaceæ. Flowers epigynous. Ovary multi-cellular in
two whorls

4. *Sonneratia*.
5. *Ammannia*.
6. *Punica*.

1. WOODFORDIA, *Salisb.*

A shrub, a single species characterised generally by the cymose tubular flowers which are distinctly zygomorphic with a curved coloured hypanthium somewhat dilated above with oblique mouth, 6 greenish tooth-like sepals, 6 very small scarlet petals and an epicalyx of 6 scales. Stamens 12 inserted below the middle of the hypanthium declinate and of two different lengths in any one flower (fls. trimorphic as in *Lythrum salicaria*, cp. *Darwin's Different Forms of Flowers*). Ovary free oblong 2-celled with filiform style. Fruit dry with thin walls irregularly breaking. Seeds very many, narrowly cuneate-obovate, smooth.

1. *W. fruticosa*, *Kurz.* Syn. *W. floribunda*, *Salisb.*; *Lythrum fruticosum*, *L.*; *Icha*, *K. & S.*; *Phuldawai*, *Dhai-phul*, *Kharw.*; *Dadki dhatuli*, *dhauri*, *Vern.*

A much-branched beautiful shrub when in flower with sessile or sub-sessile linear-lanceolate acuminate distichous leaves 2.5—4" long, silvery, finely pubescent and dotted beneath, and brilliant scarlet flowers .5—.75" long in fascicled cymes axillary and from the old wood, often completely covering the branches.

A very common shrub except in the plains, chiefly on clay soils in open and second-growth forest, sometimes gregarious. Fls. Jan.—April. Fr. April—May. Nearly leafless end of Feb. and in March when the flower is at its best, leaves often not renewed till end of May in dry localities.

The germination is epigeal but the seedlings most minute with cotyledons the size of a pin's head. I have germinated and grown the plant very successfully by sowing it in heaps of brick rubble which is kept damp.

The flowers yield a dye which is yellow or pink. *Paranjpe* states that it is the dye so familiar during the Holi. Both the flowers and leaves yield a large percentage of tannin. The dried flowers are given with "dhai" in dysentery. On account of the tannin also the powdered flower is sprinkled over unhealthy sores and ulcers. It is a favourite flower among the Kols who wear it in their hair and often mention it in their songs.

2. LAWSONIA, *L.*

A large shrub or small tree with terete often thorny branches, glabrous. Leaves opposite. Flowers rather small in terminal paniced cymes. Hypanthium short cupular. Sepals 4 ovate. Petals 4 obovate, wrinkled. Stamens 4 or 8. Ovary 4-celled or 4-celled at base with many ovules on axile placentæ. Fruit dry coriaceous exserted from the hypanthium, globose, irregularly breaking up and finally 1-celled. Seeds many angular, smooth.

1. *L. inermis*, *L.* Syn. *L. alba*, *Lamk.*; *Mehndi*, *H.*; *Benjati*, *Or.*; *Henna*.

A small tree 20 ft. high or large shrub with branches often ending

in thorns, lanceolate or narrow-rhomboid small leaves .9—1.5" very shortly petioled with few rather inconspicuous sec. n. Fls. .25" diam. very fragrant, cream-coloured. Fruit red when young, ultimately dry and seated on the hypanthium with the persistent small sepals, depressed globose, .25—3" diam. crowned with the style.

Not uncommon in hedges. Ranchi! Palamau! Gaya! Sambalpur! Fl. Oct.—Nov. Fr. Nov.

Yields the Henna dye.

3. LAGERSTRÆMIA, L.

Trees or shrubs with opp. or sub-opp. distichous entire leaves and usually showy flowers in axillary and terminal panicles. Sepals and petals 6—9 on the margin of the cupular or tubular hypanthium; petals very long-clawed, wrinkled, crisped or crose. Stamens very many, inserted near the base of the hypanthium and more or less hypogynous, with long often-curved and barren filaments. Ovary 3—6-celled. Capsule 3—6-valved and -celled, girt by the persistent calyx. Seeds winged at the apex, flat, erect.

Hypanthium strongly ribbed. Fls. large, mauve	1. <i>flos-reginæ</i> .
Hyp. not ribbed. Fls. 1.5—2" diam., colours various	2. <i>indica</i> .
Hyp. not ribbed. Fls. .5" diam., white	3. <i>parviflora</i> .

1. *L. flos-reginæ*, Retz. Kwiri, *M.*; Gara Sekre, *Ho.*; Jarul, *Beng.*; Patoli, *Or.*

A large or m.s. tree but often flowering when only 20 ft. high. Leaves elliptic to lanceolate 4—8" long, glabrous, with rounded base and 6—12 sec. n. Petiole very short. Flowers 2—3" diam. mauve-purple in long narrowly-pyramidal panicles sometimes a foot long. Hypanthium semi-spherical with alternate strong broader and narrower ribs sometimes slightly produced as teeth beyond its margin (rudimentary epicalyx). Capsule septifragally 5—6-valved, woody, 1—1.5" diam. subglobose.

Along the larger rivers and muddy side-nalas in Singbhum! Gangpur! Bonai, Bonaigarh, rare, *Cooper!* Banks of Mahanadi, Angul! Cuttack and Balasore, near the canals, indigenous? Puri (Jaganathprachad Forest), *Haslett!* Often planted and a very handsome tree when covered with its large panicles.

Fl. end of April—June. The capsules remain on the tree till the following flowering season. Evergreen.

Bark nearly smooth, peeling off in flakes, grey. Although an important timber tree in Assam it occurs too sparingly in this province to be of much value.

2. *L. indica*, L. Farash, Telinga-china, *H.*; Crepe Plant or Crepe Myrtle.

A very beautiful shrub attaining 15 ft. with elliptic or oblong sessile glabrous leaves acute or sub-obtuse about 1—3" long and very numerous panicles of white, lilac or rose-coloured flowers 1—1.5" diam. Hypanthium not ribbed, with triangular sepals and long-clawed petals. Fruit sub-globose .3" diam.

Very common in gardens. Fl. May—July. Deciduous in c.s. Native of China.

3. *L. parviflora*, Roxb. Asidh, Th.; Sekre, K., S.; Sidha, Beng.; Lendia, Senha, Gond.

A tall tree or sometimes a small tree or shrub, with narrowly elliptic or oblong or ovate-lanceolate acute or acuminate distichous leaves 2—3·5" and delicate white flowers in 3-chotomous panicles with petals ·25" long. Hypanthium cupular smooth, woody in fruit and embracing the capsule which is ·75—1" long ellipsoid and polished, 3-, sometimes 4-valved.

Throughout the whole province, attaining its largest size in the sub-Himalayan districts and again in Angul and the better forests of the Orissa States, small in the dryer Chota Nagpur forests and, indeed, frequent in scrub jungles. Fl. April—May. Fr. Dec.—Jan. Decid. Feb.—March and flowers on the new shoots.

Attains 6—8 ft. girth with grey or reddish smooth bark, stripping off in long narrow flakes in old trees, blaze light brown. Young branches often 4-winged. Foliage with a grey or glaucous appearance, the young leaves hoary beneath with a very fine tomentum, old coriaceous, glabrous or shortly pubescent beneath with 6—10 sec. n. Cyme branches and pedicels very slender often 2—5-nate, bracts linear. St. few long and many short.

Var. *majuscula*, Clarke. Leaves glabrous larger, sometimes 4—5" by 2", fruit larger, sometimes exceeding 1·5 by 1".

The small tree of Chota Nagpur appears mainly to belong to this variety which seems to be a form of dry uplands.

It is one of the poles most in demand for house-posts and other timber for native buildings. It is also much used for agricultural implements. The fuel, including charcoal, is good. Gamble gives the weight as 53 lbs. The gum is said to be edible.

4. SONNERATIA, L. f.

Glabrous trees of salt-water marshes with coriaceous leaves and large axillary solitary or terminal ternate flowers. Hypanthium thick cupular or campanulate with 4—8 lanceolate sepals and as many narrow or 0 petals. Stamens many perigynous near mouth of hypanthium. Ovary adnate below to hypanthium or nearly free, 10—15- or 20-celled with very many axile ascending ovules. Fruit 10—15-celled, baccate embraced by the persistent calyx. Seeds very many curved, angular, with convolute cotyledons.

Petals 0. Stigma very large mushroom-shaped
Petals 6. Stigma capitate

1. *apetala*.
2. *acida*.

1. *S. apetala*, Ham. Keora, Kerua, Or.

A large tree with pale bark and numerous conical pneumatophores. Leaves oblong or narrow-elliptic, often oblique, 3—4" long, glaucous both sides and with the sec. n. not visible. Flowers both lateral and terminal 1—1·25" diam. with the numerous stamens, sepals broadly lanceolate 4 or sometimes 5. Petals 0. The flower is at once recognisable by the long style with its remarkable mushroom-shaped stigma. Fruit ·5—·75", broader than long.

Common in the tidal forests of the Mahanadi delta! Fl. Feb.—May.

Often 4 ft. girth with grey-green bark on young stems, blaze with chlorophyll then white and brown, bark of old trees dark-grey and rough below, blaze hard

dark crimson. Pneumatophores with exfoliating bark. Leaves attenuate at base into a 2—25" petiole.

The wood is not much used but is said to be used in the Sunderbans for plank-ing and for fuel. The fruit boiled till it is soft is cut in half and is used as a fish bait.

Gamble says that the bark is black! He gives the weight of the wood as about 40 lbs.

2. *S. acida*, L. Ora, Beng.

A small tree about 20—25 ft. with broadly obovate or sub-orbicular more rarely oblong leaves 2.5—3.5" long, pale beneath, sec. n. fine but distinct, about 10, base narrowed into the very short petiole. Fls. over 2" diam. with large calyx 1.3" long (including the hypanthium). Petals linear, 6. Capsule globose much depressed often 2" broad.

Tidal forests of the Mahanadi delta! Fl. June—July. Fr. Aug.

Bark white and blaze white but rather darker on the wood. Pneumatophores corky. Inflorescence articulate.

The above is somewhat doubtful. The tree was not in flower and the flower is described from a Bombay specimen. As the species occurs in the Gangetic delta there is, however, considerable probability of its occurring in Orissa.

5. AMMANNIA, L.

Small annual herbs growing in wet places, with branches frequently 4-angular. L. opposite or upper alternate, rarely whorled, entire. Flowers small or minute axillary solitary and sessile or in spikes or small axillary cymes, bracteoles 2 sometimes minute. Hypanthium tubular or campanulate with 4—5 rarely 3 small sepals and sometimes small intermediate folds or teeth (epicalyx). Petals 5—1 or 0, inserted between the sepals, a small annular disc rarely present inside the petals. St. 3—8 rarely 2, inserted usually near the middle of the hypanthium. Ovary free, 3—5-celled or by absorption of the septa 1-celled. Ovules very many axile. Capsule thin-walled 2—4-valved or more or less irregularly dehiscent or circumsciss. Seeds many minute, usually rounded on the back and concave or flat with a low rim on the face, rarely angled.

The genus is sometimes divided into three: *Rotala*, *Ammannia* and *Nesaea*. In the first two the central axis with placentæ is not continuous with the style and in *Nesaea* it is. In *Rotala* the capsule opens by valves and in the last two it is said to rupture irregularly or circumscissilely, but in some species of *Ammannia* the valves are nearly regular.

I. Flowers solitary in the axils of leaves or bracts. Capsule valvular.

A. Flowers distinctly spicate, spikes peduncled terminal.

Fls. pink.

L. small orbicular. Hyp. campanulate. Pet. twice sep. 1. *rotundifolia*.

L. ell. or ovate. Hyp. tubular. Pet. smaller 2. *temis*.

B. Fls. axillary or spikes axillary, not peduncled.

1. Hypanthium tubular. Ovary and capsule oblong.

Stems ascending. L. obovate, margined 5—7" 3. *indica*.

Stems prostrate. L. linear 2—3". Sepals 5 4. *dentelloides*.

2. Hypanthium campanulate. Ovary usually 3-lobed.

Capsule as broad as long.

a. Procumbent caespitose herb. L. linear under 3".

Sep. 4

5. *pygmaea*.

b. Ascending or erect herbs. L. oblong or lanceolate over .3".

Fls. mostly 4-merous. Epicalyx 0, petals yellow . 6. *densiflora*.

Fls. 5-merous. Epicalyx conspicuous. Petals pink or 0 . 7. *pentandra*.

II. Flowers cymose or clustered axillary.

A. Clusters or cymes sub-sessile.

L. tapering at base

8. *baccifera*.

L. rounded or cordate at base .

9. *salicifolia*.

B. Cymes distinctly peduncled.

Capsule much exceeding hypanthium .4" long

10. *senegalensis*.

Capsule hardly exceeding hypanthium, .05" long

11. *multiflora*.

1. *A. rotundifolia*, Ham. Sim-sindur, S.

A very pretty little herb forming carpets of magenta or pink when in full flower with very numerous erect branches 3—6" high from a creeping stem. Leaves sessile orbicular or broadly elliptic rounded each end .2—.5" long. Fls. in the axils of small foliaceous bracts in dense terminal often 3-nate spikes. Hypanthium campanulate. Petals conspicuous twice as long as the sepals. Capsule 4-valved ellipsoid. Seeds ellipsoid peltate.

Common in wet places especially by the marshy sides of streams, gregarious. In all districts, ascending to the tops of the mountains! Fl., Fr. Jan.—May.

The flowers are dimorphic in respect to the length of stamens and style (*teste* C. B. Clarke).

2. *A. tenuis*, Clarke. Syn. *Amelctia tenuis*, R. Wight.

A little plant resembling *A. rotundifolia* but far more delicate and less showy. Leaves .1—.25" elliptic or ovate, often acute. Spikes on very slender peduncles with oblong or lanceolate bracts, hypanthium narrowly funnel-shaped or tubular with acute lanceolate sepals and with large bracteoles at the base about three-fourths its length. Petals lanceolate-obovate only slightly exceeding the sepals. Capsule 2-valved.

Behar, Kurz! J. D. H.! Fl., Fr. Oct.—Dec.

3. *A. indica*, DC. Syn. *A. peplodes*, Spr., *Rotala indica*, Kœhne.

An erect succulent herb 5—12" with decumbent often rooting base and quadrangular stems and branches. Leaves often close, elliptic-obovate or elliptic with attenuate base, sessile, .3—.7", distinctly margined, tip rounded or obtuse, sec. n. 4—6 rather prominent beneath. Fls. very pale pink narrowly campanulate, solitary axillary on very short spiciform axillary branches with reduced narrow-oblong leaves (or bracts), base of bract also often pinkish. Bracteoles linear setaceous .1" long, *i.e.* about as long as the flower. Sepals lanceolate acuminate 4 exceeding the very minute petals, or petals 0. Ovary oblong. Capsule ellipsoid or oblong about as long as hypanthium, 2-valved. Seeds "narrow oblong sub-falcate, pink," Clarke.

Rice fields and wet places, common. Singbhum! Ranchi! Parasnath, Prain! Bettiah, Hieronymus! Angul, Chattarjeel! Probably in all districts. Fl., Fr. Oct.—Dec. or up to Feb. in moister situations.

4. *A. dentelloides*, Kurz.

A small procumbent weed with stems 2—4" long and opposite linear leaves 2—3" long. Fls. axillary. Hypanthium tubular-campanulate 5-ribbed with 5 triangular sepals minutely thinly puberulous. Petals minute. Capsule ellipsoid 2-valved.

Found in the Sikkim Tarai and probably Purneah. A note in the *Calcutta Herbarium* also says Parasnath, Kurz, but I can find no Parasnath specimens.

N.B.—Kœhne, in *Das Pflanzenreich*, states that this is a Scropulariaceæ. cp. *Microcarpæa muscosa*.

5. *A. pygmæa*, Kurz.

A very small and slender but cæspitose weed 1—3" high or decumbent branches up to 5", with linear leaves 1—25" long and most minute flowers in their axils. Bracteoles shorter than the flower filiform or as long as the 02"—long campanulate hypanthium. Sepals 4 rarely 5. Petals 0. Stamens 2 rarely 3—4. Capsule broadly ellipsoid before dehiscence then about as broad as long, 2-valved or 3-valved. Seeds concave white, brown or black.

Frequent on damp ground and sometimes inside the forest. Ranchi! Singbhum! Parasnath, Clarke! Manbhum, Ball! Santal P., Kurz!

It sometimes forms green mats in the damp beds of nalas. Fl., Fr. Nov.—Jan.

6. *A. densiflora*, Roth. Syn. *Rotala densiflora*, Kœhne.

General habit of *A. peploides*, 6—16" high. Leaves oblong or oblong-lanceolate sub-amplexicaul with cordate base decurrent as four wings on the stems, branches, and spikes, cauline 5—1", upper smaller with more acute base and passing into bracts, tip rounded, scarcely tapering, sec. n. distinct. Fls. on the short spiciform axillary branches but these sometimes elongate as in *A. pentandra*, bracts 1—2", scarcely tapering, pink at the base. Fls. solitary 05—06" long, pink, with yellow tubular-campanulate hypanthium and minute bracteoles only one-third as long; sepals 4, very rarely 5 (3—6 Kœhne), pink, very broadly ovate then suddenly acute, petals 0—4 (3—6 Kœhne), but usually 1, yellow. Stamens inserted below middle of tube. Ovary 3-lobed microscopically trabeculate, style short but half as long as ovary or longer. Capsule nearly as broad as long.

Wet ground, Purneah! Fl., Fr. Dec.

Perhaps only a variety of the next, the length of the style being a bad character.

7. *A. pentandra*, Roxb. Syn. *Rotala leptopetala*, Kœhne, and *R. densiflora*, Kœhne?

An erect weed 4—15" high, in robust specimens pyramidal with very numerous spreading branches. Lower leaves oblong or lanceolate acute from a broad sessile sometimes cordate or truncate (sub-cuneate or contracted, Kœhne) base, 5—13" long, smaller upwards and becoming bractiform with a sessile flower in every axil, sec. n. obscure. bases decurrent as angles or wings but branches less alate than in the last species. Floriferous branches often elongate (and when at the same time the main cauline leaves drop the plant looks different and is

apparently the *Rotala illecebroides*, *Kœhne*). Bracteoles acicular as long as or nearly as long as the flower. Fls. pink 1" long with broadly campanulate hypanthium. Buds depressed acutely 5-angled, sepals usually 5 broadly triangular, often finely acuminate, intermediate teeth (epicalyx) distinct spreading acicular. Petals usually present pink elliptic-oblong above the claw, obtuse or retuse, twice the sepals. Disc often prominent annular and 5 stamens from inside the disc when present. Ovary prominently 3-lobed, sub-globose style scarcely longer than stigma, capsule globose, 3-valved.

Wet ground, especially on clay soils, very common throughout the province. Often turning red when the ground dries up. Fl., Fr. July—Jan.

8. *A. baccifera*, L. Syn. *A. vesicatoria*, Roxb.

Erect, stout for the genus, 6"—2 ft. high with square stems and opposite leaves below, often alternate above, lower narrowly elliptic-lanceolate tapering both ends, attaining 3" by 6" but often only 3" on depauperated plants, successively smaller upwards. Flowers minute green pedicelled, in few-fl. or dense axillary usually umbelliform cymes under 2" long, turning red in fruit. Buds 4- or 8-angled often like two equal pyramids placed base to base with the four corners somewhat subulate-mucronate (intermediate folds or epicalyx). Hypanth. broadly campanulate or obconic with 4, rarely 5, broadly triangular sepals, petals 0 (or small, *Clarke*), stamens 4 with very short filaments. Capsule depressed-globose exceeding the calyx and red in fruit, circumsciss, 1-celled.

In rice fields and wet places throughout the province. Fl., Fr. r.s. and c.s. A plant from a marsh in Porahat was 3 ft. high, with very few-fl. cymes, but it was young and old cymes become more and more congested until, as *Clarke* says, they appear as knots on the branches. *Roxburgh* says that the leaves are exceedingly acrid and are largely employed as a vesicant.

9. *A. salicifolia*, Monti, is scarcely more than a variety of *A. baccifera* distinguished by the leaves not tapering at the base but rounded or sub-cordate. They sometimes attain 3" in length.

Behar, *J. D. H.*

10. *A. senegalensis*, Lamk.

An erect weed 6"—2 ft. high with sharply 4-angled branches. Larger leaves attain 1—2", linear-oblong or linear-lanceolate from a broad sub-hastate base. Fls. in axillary peduncled cymes which attain 5—7" in length but are shorter than the subtending leaves. Hyp. tubular-campanulate with green ribs, sepals 4 broadly triangular and intermediate ribs sometimes excurrent as teeth (epicalyx). St. 6—8. Fruit globose. 1" diam.

Purneah, *Kurz!* Upper Gangetic Plain (and therefore probably extending throughout the Northern area), *Duthiel!* Fl., Fr. r.s. and c.s.

11. *A. multiflora*, Roxb.

An erect weed 6"—2 ft. high with numerous erecto-patent sharply 4-angled branches. Leaves linear or linear-oblong from a very broad sub-hastate or auricled base, larger sometimes 1—1.5". Flowers in

compound peduncled cymes usually longer than the subtending leaves. Hyp. campanulate or tubular campanulate with 8 green ribs; longer than the 4 broadly triangular mucronulate sepals. Petals very minute red or 0. St. 4, 6, or 8 with slender filaments exceeding the sepals. Fruit globose minute .05" diam.

Very common in wet places in all districts. Fl., Fr. r.s. and c.s. This is perhaps scarcely more than a finely branched variety of the last with smaller fruits but its appearance is different in the numerous slender cymes overtopping their leaves and becoming racemed.

6. *PUNICA*, L. Pomegranate.

1. *P. granatum*, L. Anar, H.; Dalim, Beng.

A large shrub or small tree with terete, or when young, 4-angled often thorny branches and opposite, sub-opp. or clustered oblong or obovate obtuse entire leaves with a distinct or obscure intramarginal nerve. Flowers large 1—5-nate terminating the shoots, with a thick fleshy, at first spherical, finally flask-shaped hypanthium produced considerably beyond the ovary and bearing above (in the neck) a thickened disc. Sepals 5—7 persistent. Petals 5—7 inserted between the sepals, obovate, imbricate in bud and crumpled. Stamens very many covering the whole of the disc, anthers versatile introrse. Ovary inferior adnate wholly or for the most part to the hypanthium, many-celled, the cells in 1—3 concentric more or less superposed whorls, style long, stigma capitate. Ovules very numerous anatropous, in some cells axile, in others parietal. Fruit a globose berry with coriaceous epicarp and crowned by the calyx, many-celled and -seeded. Seeds angular, cotyledons convolute.

Very commonly cultivated in gardens. In this province chiefly for its scarlet or orange-red flowers which are about 2" diam.

Fl. April—May. Fr. July—Sept.

The bark and rind of the fruit are used for tanning. The edible pulp is formed from the outer layers of the testa of the seed.

FAM. 67. ONAGRACEÆ.

Herbs, rarely undershrubs, sometimes aquatic. Leaves opposite or upper alternate, more rarely all alternate, simple (submersed leaves in *Trapa* are pinnatipartite), exstipulate. Flowers regular and typically 4-merous or sometimes sub-regular, often large or m.s. or showy, axillary, spiked or racemed. Hypanthium entirely enclosing the ovary (exc. in *Trapa*) with 2—5, usually 4 valvate sepals. Petals alternate with the sepals, rarely 0. Stamens as many or twice as many as the sepals, epigynous, on the mouth of the hypanthium. Ovary adnate to the hypanthium 1—6-, usually 4-celled, style simple with capitate or 2—4-lobed stigma. Ovules 1—many in each cell axile, pendulous or half-ascending. Fruit usually capsular, sometimes indehiscent, 1—many-seeded. Seeds with little or no albumen.

- I. Hypanthium more or less produced above the inferior ovary. Ovules and seeds many in each cell. Terrestrial or aquatic.
 Fls. 4—6-merous, diplostemonous 1. *Jussiaea*.
 Fls. 3—5-merous, isostemonous 2. *Ludwigia*.
- II. Hypanthium cupular calyciform only enclosing the lower part of the ovary, with no free tube above. Ovule 1 in each cell. Floating aquatic herb 3. *Trapa*.
- N. B.—*Trapa* sometimes forms the type of a separate family, the Hydrocaryaceæ.

The Samydaceæ are in the *Genera Plantarum* placed after the Onagraceæ. The family has already been described with the Flacourtiaceæ.

1. JUSSIÆA, L. (*Jussieua*, *Auct. plur.*)*

Herbs or undershrubs growing in wet places, sometimes floating with modified air-roots. Leaves alternate mostly entire. Fls. yellow or white, solitary axillary or sub-racemose. Hypanthium elongate but very slightly produced above the ovary with 4—6 acute persistent sepals. Petals white or yellow. Stamens twice the number of sepals, one whorl sometimes smaller, epigynous. Ovary 4—5-celled with very short style and 4—5-lobed stigma. Ovules many axile 1—several-seriate in each cell. Capsule linear 4—5-celled, 8—10-ribbed, opening from above septidally, or the valves separating from the ribs or breaking irregularly between the ribs. Seeds many, sometimes dimorphous and enclosed in a corky fissile endocarp.

- A. Creeping or floating. Leaves obovate 1. *repens*.
 B. Erect. Leaves lanceolate acute.
 Usually pubescent. Sep. broad. Seeds all similar 2. *suffruticosa*.
 Glabrous. Sepals narrow. Lower seeds different from the upper and 1-seriate 3. *fissendocarpa*.

1. *J. repens*, L. Kcsara-dam, Beng.

Creeping on the margins of tanks and with long stems floating out on the water by means of white air-roots 5—1.5" long. Leaves obovate or oblanceolate 5—3" long narrowed into a long petiole. Flowers pretty, white, 1—1.5" diam. with the veins at the base of the petals yellowish. Petals 5—6 obovate, long- or short-peduncled. Capsule 5—1.5" rather woody. Seeds smooth reticulate 1-seriate each enclosed in a corky segment of the endocarp ("with a white corky testa" *Clarke*).

Common on tanks. Chota Nagpur! Santal Parganas! Purneah! Angul, Lacel Fl., Fr. c.s.

2. *J. suffruticosa*, L. Dak'ichak', S.

An erect herb, scarcely an undershrub, suffruticose, 2—4 ft. high usually (always?) hairy and with decurrent raised lines. Leaves linear or lanceolate, rarely ovate-lanceolate, pubescent or hairy, sub-sessile or

* Since this sheet was sent to press *Ridley* has written a paper on "The Indo-Malayan Species of *Jussiaea*" in the *Journal of Botany*, September, 1921. He splits up *J. suffruticosa*, *nobis*, into *J. erecta*, L., and *J. villosa*, Lamk., and states that *J. fissendocarpa* is the real *J. suffruticosa* (though he does not give all the characters). I find it difficult to determine from this paper whether one Angul specimen (collected by *Chattarjee* is *Ridley's J. erecta* var. *exaltata* or *J. villosa*, Lamk.

very shortly petioled. Hypanthium subsessile or tapering into a very short pedicel, pubescent, sepals ovate or broadly elliptic and acuminate, .2—·3". Petals yellow .25—·5" long. Capsule 1—2" tapering at base, pubescent (or finally glabrous, *teste Clarke*), thin, and breaking up between the ribs. Seeds rounded, brown or reddish, finally grooved.

Common in wet places, sides of tanks, etc., throughout the province! Fl., Fr. c.s.

Raimann suggests that the seeds are each formed of two coalescent ovules of which one is barren.

3. *J. fissendocarpa*, *Haines* (*Journ. As. Soc. Beng.*, xv, 1919, No. 7).

A very tough much-branched undershrub 3—4' ft. high, stems glabrous with raised decurrent lines from the leaf-bases or sub-alate. Leaves lanceolate or linear lanceolate subsessile acute. Flowers sessile from all the upper axils. Sepals lanceolate .08—·1". Petals shorter. Stamens with 4 smaller or absent. Hypanthium 4-ribbed. Capsule slender minutely pubescent .6—·85" long terete 4-celled. Seeds in upper part of capsule minute ellipsoid sub-compressed, pale brown, .07 mm. with a prominent raphe (or white and half the size), several-seriate, in lower part of capsule 1-seriate, each enclosed in a 2-valved corky prismatic portion of the endocarp and larger.

Watery places, Purneah! Fl. Nov.—Dec. Fr. Dec.—Jan.

Upper leaves about 1" (the lower fallen in my specimens), not tapering to a slender base as in *Ludwigia parviflora* and *L. prostrata*, nearly glabrous. I have seen very few flowers and the size of the petals may vary.

2. LUDWIGIA, L.

Habit of *Jussieuia* but perianth 3—5-merous, petals small inserted below the margin of the epigynous disc and stamens as many only. Ovules in two or more vertical rows in each cell. Capsule opening by terminal pores or breaking up irregularly along the sides. Seeds obovoid smooth.

Capsule inflated, seeds many-seriate in each cell	1. <i>parviflora</i> .
Capsule very slender. Seeds in one row in each cell	2. <i>prostrata</i> .

1. *L. parviflora*, *Roxb.*

A herb 8—18" high usually erect, glabrous, with lanceolate, linear-lanc. or linear-oblong. leaves 1.5—3" long always tapering at the base into a short petiole. Fls. very shortly pedicelled small yellow usually 4-merous. Capsule very short oblong or linear-oblong .3—·4" long, glabrous, seeds many-seriate not separately distinguishable through the capsule walls.

Gaya, near Grand Trunk Road! Chota Nagpur, *Prain*! Manbhum, common in ricefields, *Clarke*, *Milne*! *Kurz* says common in wet places in Western Bengal; his specimens are, however, small and diffuse.

Fl. Oct.—Nov. Fr. Nov.—Dec.

2. *L. prostrata*, *Roxb.*

Somewhat like the preceding but more diffuse prostrate or ascending with the lower branches longer than the stem spreading flat on the

ground and rooting, generally reddish. Leaves thin glabrous lanceolate or ell.-lanceolate with very fine sec. n., narrowed at base into a slender petiole. Sep. .07" narrow-lanceolate acute. Petals lanceolate longer than the calyx (*Roxb.*) yellow. Capsules much more slender than in last, .8", linear, often more or less curved, glabrous, obtusely 4-angled. Seeds minute pink 1-seriate, distinguishable through the capsule wall.

There are no specimens actually collected inside our area but it has been collected both sides, in the Gangetic plain and the Sikkim tarai. It will therefore almost certainly be found in the Northern Area.

"Roots often cellular and float-formed," *Keenan*.

3. TRAPA, L.

Aquatic herbs with the floating leaves rosulate, rhomboid, their petiole with a spongy dilatation, submersed leaves* in opposite pairs and cut into capillary segments. Flowers axillary solitary 4-merous with cupular hypanthium not produced above the ovary, sepals persistent, two or all spinescent in fruit. Sepals, petals and stamens in alternate whorls inserted on the margin of a perigynous disc. Ovary adnate below to the hypanthium, conical above, 2-celled with 1 ovule only in each cell pendulous from the inner angle. Fruit consisting of the lignified hypanthium, ovary and calyx together forming a 1-celled 2-4-horned indehiscent nut with a short often spinous beak through which the radicle issues. Cotyledons very unequal.

1. *T. bispinosa*, *Roxb.* Singhara, Pani-phal, *H.*; The Water Chestnut.

Floating leaves .8—2.5" diam., broader than long, denticulate, dentate, serrate or incised, with entire base, beneath red and densely pubescent or villous. Petiole 4—7" long, the inflated portion about 1" long, hairy or woolly. Fruit somewhat urn-shaped .9" long with the two horns forming the handles of the urn; the second pair of horns are usually wanting.

In tanks throughout the province! Fl. Aug. Fr. Nov.—Dec.

According to the *F. B. I.* the typical plant has leaves 2.5—3" wide, slightly crenate and very villous beneath, while var. *incisa* has leaves only about .75", inciso-serrate and much less villous. The common form in our area has the leaves about 2" diam. and coarsely toothed. Fls. white, .75" diam., not much raised above the surface of the water.

The kernel of the fruit is eaten.

FAM. 68. TURNERACEÆ.

A tropical American and African family of which we are only concerned with the following genus:—

1. TURNERA, L.

Shrubs or herbs with alternate simple leaves usually 2-glandular at the base with small or 0 stipules. Flowers regular 2-sexual axillary

* These organs are probably floating adventitious roots as described in *Nat. Pflanz. Fam.* They arise below the axils of fallen leaves.

solitary, rarely fascicled or in racemes, yellow; peduncle sometimes adnate to the petiole, bracteoles 2 or 0. Hypanthium short usually swollen at the insertion of the stamens. Sepals 5. Petals 5, hypogynous, inserted at the base of the hypanthium. Stamens 5, more or less perigynous and often connate at base, anthers oblong with longitudinal dehiscence. Ovary free 1-celled with 3 parietal placentæ and 3 styles simple or with flabellately divided stigmas. Ovules numerous anatropous, 2-seriate on the placentæ. Fruit a 3-valved capsule bearing the seeds in the middle of the valves (as in *Samydaceæ* or *Flacourtiaceæ* to which the family is closely allied). Seeds oblong curved with a membranous aril, fleshy albumen and terete embryo.

1. *T. ulmifolia*, L. Basanti, *Vern.*

Herb or undershrub with densely hairy shoots broad- or narrow-lanceolate or elliptic-lanceolate coarsely serrate leaves 3—4" long with 2 large glands at the end of the .5—1"-long petiole. Fls. yellow 1.5—2" diam. with the peduncle adnate to the petiole and bearing a pair of leaves below the flower (bracts?). Hypanthium funnel-shaped hairy with lanceolate sepals .3—4" long. Capsule sub-globose oblong .3" hairy and minutely tubercled, sometimes only 2-valved, with elliptic-oblong brown rugose seeds.

Bettiah, *Rastler!* Roadsides, Orissa! Fl., Fr. c.s. Introduced from America.

FAM. 69. PASSIFLORACEÆ.

Herbs or shrubs climbing by means of tendrils, very seldom twining, with alternate stipulate simple and palmi-nerved or usually palmately-lobed, rarely penni-nerved leaves frequently with glands on the under-surface or petiole. Flowers axillary cymose rarely solitary regular 1—2-sexual and sometimes dimorphous. Hypanthium usually well-developed, mostly tubular or campanulate with 3—5 sepals. Petals usually present and free, sometimes connate, alternating with the sepals imbricate in bud, marcescent. A 1—many seriate "corona" of filamentous or other formed scales usually clothes the intra-staminal zone of the hypanthium. Stamens 5 usually on a gonophore, sometimes inserted inside a semi-perigynous disc, anthers oblong, introrse. Ovary usually on the gonophore but sometimes sub-sessile, 1-celled with 3 rarely 4 parietal placentæ and 1—3 styles with more or less capitate stigmas. Ovules numerous on the placentæ 2—many-seriate anatropous. Fruit a berry or capsule. Seeds usually many with a fleshy aril and albumen, cotyledons foliaceous.

1. PASSIFLORA, L. Passion-flower.

Flowers 2-sexual with well-developed hypanthium. Sepals often coloured within. Petals free. Stamens on a long gonophore with the ovary. Coronal filaments very numerous. Ovary with 3 placentæ and more or less distinct styles. Fruit baccate.

A large American genus with few representatives elsewhere. Some species are common in gardens.

1. *P. foetida*, L.

A slender foetid-smelling climber with palmately-3-lobed leaves 1.5—2.5" long, ciliate and denticulate with gland-tipped setaceous hairs, similar hairs also beneath and simple hairs above, stipules laciniate with gland-tipped segments. Flowers 1", greenish, mostly solitary axillary, with an involucre of finely pinnatifid bracteoles with capillary glandular segments. Fruit like a small green gooseberry.

Widely distributed, in most districts! Fl., Fr. r.s. and c.s.

FAM. 70. CARICACEÆ.

Small trees, often with an unbranched crown of long petioled alternate palmi-lobed leaves and with milky juice. Flowers monœcious or usually diœcious, the females shortly cymose, solitary, or fascicled axillary, the males smaller in axillary panicles, 5-merous. Calyx short. Corolla of male gamopetalous, of female much larger polypetalous. Stamens in the male 10 in two whorls in the corolla-tube. Female with staminodes. Ovary 1- or 5-celled with short style and 3—5 palmately-branched lobes. Hermaphrodite flowers occasionally occur in three forms, either the stamens are only 5 hypogynous in an otherwise nearly normal female flower, or the stamens are 10 perigynous inserted high up in a tube adnate to the corolla, or the stamens are 10 epigynous closely adnate to the ovary with their bases connected by a ridge. Ovules very numerous parietal. Fruit a large 1-celled or 5-celled berry. Seeds many with an outer sappy and an inner hard testa, albuminous.

1. *CARICA*, L.

1. *C. papaya*, L. Papaya, Papita, *Vern.*; The Papaw.

A well-known small tree with very large palmately lobed leaves, the lobes again variously lobed. Sepals and petals in alternating whorls. Flowers greenish-white or white, females large subsolitary or in very short cymes, males paniced. The different 2-sexual forms referred to above all occur in this species in India, always (where I have seen them) on a male inflorescence. Fruit 1-celled.

Fl., Fr. end of r.s. and beginning of the c.s. The digestive ferment Papain is extracted from the milky sap.

FAM. 71. CUCURBITACEÆ.

Herbaceous, more rarely shrubby, climbing by means of tendrils. Leaves alternate simple palmately lobed or pedately divided, rarely pinnately lobed, venation palmate or pedate. Flowers small to very large, solitary axillary clustered cymose or racemose, monœcious or diœcious. Calyx and corolla inserted on a variously shaped often

elongate hypanthium which is constricted above the ovary.* Corolla poly- or gamo-petalous. Stamens inserted at various levels on the hypanthium, normally 5 with extrorse anthers each with one anther-cell, but usually connate in pairs so that only one remains free (in which case there appear to be two stamens with 2-celled anthers and one with 1-celled anther and are *shortly described* as "three stamens"), anthers often connate and their cells straight or variously curved or twisted. Ovary usually 1-celled, the three parietal placentæ often however meeting and filling up the ovarian cavity, or ultimately 3-celled. Ovules anatropous usually numerous. Style stout with 3—5 stigmas. Fruit a berry, entirely succulent or finally with a hard rind (when it is called a pepo), rarely entirely dry. Seeds with a hard testa, exalbuminous with straight embryo.

The morphology of the tendril has been investigated by several authors. It is apparently a shoot or partly a shoot and partly petiolar and foliar. The axil of the leaf often contains a peculiar stipule-like bract, described as a solitary stipule by *Roxburgh* in the case of some species. This member has scarcely been noticed in any other work I have seen. It would also appear to be the first leaf of a suppressed axillary shoot. It is very noticeable in species of *Luffa*, *Cucurbita*, etc.

In all the genera examined by me with the compound microscope, viz. *Trichosanthes*, *Luffa*, *Momordica*, *Bryonia*, *Cucurbita* and *Cephalandra*, the ovary is initially 1-celled with parietal placentæ. In some cases the apparent septa is an exceedingly small-celled tissue or mucilage formed subsequently to the meeting of the enlarged placentæ with which the ovarian cavity becomes filled and the tissue of which is plentifully supplied with spiral vessels. In *Luffa* the septa are the ingrown placentæ. Germination is epigeal, the cotyledons sometimes attaining very large dimensions.

The following species all belong to the tribe Cucumerinæ in which the ovules are mostly horizontal, leaves not compound, female flowers usually solitary.

I. Petals free or corolla deeply 5-partite.

A. Flowers white (or greenish in *Melothria*, sp.).

- | | |
|---|---------------------------|
| 1. Anther-cells conduplicate or sigmoid. | |
| a. Fls. large, solitary. Hypanthium funnel-shaped** | 1. <i>Lagenaria</i> . |
| b. Fls. large or m.s. Hyp. tubular elongate. | |
| Petals fimbriate. Tendrils 2—5-fid | 2. <i>Trichosanthes</i> . |
| Petals entire or toothed. Tendrils 1—2-fid† | 3. <i>Gymnopetalum</i> . |
| 2. Anther-cells straight or curved. | |
| Flowers small. Hypanthium campanulate | 4. <i>Melothria</i> . |

B. Flowers yellow.

- | | |
|--|------------------------|
| 1. Fls. small, solitary or clustered. Anthers 3 free. | |
| Anther-cells straight, connective mucicous | 5. <i>Mukia</i> . |
| Anther-cells curved or sigmoid | 6. <i>Bryanopsis</i> . |
| 2. Fls. m.s., solitary or clustered. Anthers cohering, | |
| cells horse-shoe shaped or conduplicate. | |
| a. Peduncles not bracteate. | |
| Connective crested. Tendrils simple | 7. <i>Cucumis</i> . |
| Connective mucicous. Tendrils 1—3-fid† | 8. <i>Citrullus</i> . |

* In referring to the shape of the hypanthium in the generic and specific diagnosis the male hypanthium and the female part of the hypanthium above the ovary is alluded to. As the wall of the hypanthium forms also the ovary wall the shape of the ovary is sufficiently explicit for the lower part.

** In the female the shape of the hypanthium above the ovary is alluded to.

† 1—2-fid means *simple* to 2-fid.

- b. Peduncles (or those of male) slender with a large median or apical bract. Tendrils simple
3. Flowers large, solitary. Stamens inserted near mouth of hypanthium, anther-cells sigmoid
4. Fls. large, male-peduncles often paired, one with racemed fls. (exc. *Luffa*, sp.). Stamens often 5. Stamens 3—5. Anther-cells sigmoid
Stamens 5. Anther-cells straight
9. *Momordica*.
10. *Benincasa*.
11. *Luffa*.
12. *Thladiantha*.
- II. Corolla distinctly gamopetalous with tube exceeding the lobes.
- Flowers yellow, very large. Tendrils 2—4-fid
- Flowers white, m.s. Tendrils simple
13. *Cucurbita*.
14. *Cephalandra*.

1. LAGENARIA, *Seringe*.

Large herbaceous climbers, pubescent, with 2-fid tendrils, ovate or orbicular cordate and dentate leaves and long petiole with 2 glands at the apex. Flowers large white solitary monoecious or dioecious, M. long-F. short-peduncled. M. hypanthium funnel-shaped subcampanulate with 5 narrow sepals, petals 5 free obovate, stamens (apparently) 3 with connate included anthers and conduplicate anther-cells. Pistillode 0. F. perianth as in male, ovary oblong, with short style and 3 2-fid stigmas. Fruit large indehiscent polymorphous. Seeds compressed smooth with a marginal groove.

1. *L. vulgaris*, *Ser.* Syn. *Cucurbita lagenaria*, *L.*; Lauki, Kadu, *H.*; Lau, Ladu, *Beng.*; Loewa, *Uran*; Suku, *K.*; Bottle-gourd.

A coarse glandular and softly hairy usually monoecious plant with hairy leaves 7—8" diam., 2-glandular at the base, and large solitary white flowers 3—4" diam. Male peduncle 5—6", hyp. .5—.75", sepals .3—.4", petals often 2" by 1" ovate with excurrent mid-rib. Fem. sepals .25" linear, hyp. tube above the ovary very short, hypanthium and young fruit villous or hairy.

Cultivated in all districts. Fl. July—Jan. Fr. c.s.

The unripe fruit contains a thick white pulp which in the cultivated plant is sweet and edible. The ripe fruit is variously-shaped with a very hard shell; a common form is dumb-bell-shaped used for bottles (*tumba*, *K.*), musical instruments, etc.

2. TRICHOSANTHES, *L.*

Herbaceous or suffruticose with 2—5-fid tendrils and white flowers, males in long racemes (exc. *dioica*) with a solitary female or male at the base from the same axil, or females separate. Hypanthium elongate tubular or wider above and dilated above the ovary. Corolla rotate with nearly free fimbriate petals. Filaments 3, anthers connate (free in *dioica*). Fruit ellipsoid to elongate or globose, smooth. Seeds many compressed, usually margined.

- Perennial. Bracts large sheathing 1. *palmata*.
- Annual or perennial. Bracts very small or 0.
- Longer male peduncle with a raceme of flowers 2. *cucumerina*.
- Both male peduncles with single flowers. St. free 3. *dioica*.

1. **T. palmata**, Roxb. Kaubutki, K.; Makal, H., Beng.; Jar Mahwar, Kharw.; Ma Kirla, Or.

Trailing on bushes or climbing on high trees with a suffruticose stem and long pendent branches, 2—5-fid tendrils, and rather large simple or lobed cordate and denticulate leaves attaining 6" by 5". Flowers white 2·5—3" diam., bracts on the raceme broadly obovate foliaceous and over 5" long with large deep green circular glands and sharply dentate. Fruit bright scarlet globose or usually ellipsoid 2—2·5" by 2" on axillary short stout peduncles.

Widely distributed but nowhere very common. Purneah, common! S.P.! Ranchi, Palamau and Singhum in Chota Nagpur, in valleys and on the plateaux! Angul! Fl. Aug.—Sept. Fr. Nov.—Dec., rarely to Jan. Perennial.

Large green glands sometimes near base of leaf. Always some leaves lobed on large plants, lobes mostly 5 broadly or narrowly lanceolate with the nerve slightly excurrent, in one variety incised and sub-spinulose, upper surface smooth and bright green with small pits when fresh but very scabrous with small round discs (cystoliths) when dry, lower surface paler with cystoliths on the nerves when dry, primary nerves 3—5 (or 7, lowest forked near base). Petiole 1—2". Some specimens have the nerves slightly scabrid-hairy beneath, others glabrous but with more marked cystoliths, but the former are in flower and the latter in fruit and it may be a matter of age. Flowers dioecious (or sometimes monoecious?). Male peduncles usually paired, the racemed one 3—4". Calyx-tube 1·5—2·5" long. Rind of fruit 25" thick when fresh. Seeds embedded in dark-green pulp, oblong, flattened, slightly narrowed at base, 4—5" long.

The fruit and root boiled with mustard oil is used for headache. The root is said to be poison and applied for snake-bite.

2. **T. cucumerina**, L., inc. *T. anguina*, L. (see variety). Bir Kaita, K.; Ban potol, Beng.

A slender rather succulent climber with long-petioled deeply cordate 5—7-angular or -lobed and dentate leaves 3—4" diam. rarely 5". White flowers 75—1·2" diam. with fimbriate petals and spindle-shaped rostrate fruits 1—3" long at first green with white stripes, ultimately red.

Frequent in Chota Nagpur! Behar, Hope! Probably in all districts.

Fl. Aug.—Dec. Fr. Sept.—Jan. It is always described as annual, but this is not always the case. Not only is the rootstock sometimes stout but I have found the remains of a previous crop of fruit on a new flowering plant.

Stems often angled and 25" diam. L. mostly sub-orbicular, smooth to touch, basal sinus very marked, either rectangular or almost enclosed by the basal lobes, margin denticulate from the mucronate nerve endings. Primary nerves closely shortly pubescent or somewhat scabrous beneath, above puberulous, petiole 1—1·5". Tendrils 3-fid. Monoecious. Male and female from the same axil. Male raceme 2·5—3" or 5—8" long. Fem. solitary shortly stalked. Hypanthium 25—75".

- Var. **anguina**. Syn. *T. anguina*, L.; Kaita, K.; Chachinda, H.; The Snake Gourd.

This is the cultivated form. Leaves 4—6" or up to 11" diam., sometimes very deeply lobed with narrow sinuses except the basal one which is very broad. Fls. 1·5—2". Fruit very long, attaining 2 ft. and often spiral, green with white stripes when young.

Very commonly cultivated. There are all gradations between this and the wild form. *Chachinda* is usually served up in the shape of French beans, long narrow strips of very light vivid green but no flavour.

3. *T. dioica*, Roxb. Potol, Beng.; Palwal, H.

A climber with rather slender angled stems hispid and with soft hairs, ovate cordate leaves 2—4" with a deep sinus, margins denticulate and occasionally lobulate, petiole .5—1.5" hispid and hairy or almost woolly. Fls. all axillary, M. often paired, one short- the other long-peduncled, hyp. slender 1.2—1.5" long, villous or woolly. F. short-peduncled 1.5", a glandular bract at base of peduncle. Sep. oblong-lanc. .2". Fruit 2—3.5" or (in cultivation) 4", oblong, orange. Seeds .3—.5", little-compressed with a slightly corrugate margin.

Rare in a wild state. Darbhanga, *Prain's Collector!* Fl., Fr. r.s.

L. scabrous with cystoliths when dry, basal lobes rarely somewhat hastate. Tendrils usually forked. Peduncle of long-peduncled male slender, often 2" long. Pet. .5" with long fringes. Stamens 3 distinct.

The unripe fruit cooked forms a commonly eaten vegetable. *Roxburgh* says that it is reckoned extremely wholesome. The tender tops are also used as a pot-herb and are regarded as tonic and vermifuge. The tender shoots and dried fruits are very bitter and aperient and given in decoction to assist digestion. Seeds anthelmintic (*Nadkarni*).

3. GYMNOPTALUM, Arn.

Leaves as in *Trichosanthes*. Tendrils simple. Fls. white or yellow, as in *Trichosanthes* but F. also sometimes racemed like the male, hypanthium sometimes curved, sepals linear or subulate, petals entire or toothed but not fimbriate. Fruit often ribbed when young. Seeds compressed marginate in a blackish-green pulp.

1. *G. cochinchinense*, Kurz. Kaubutkila, K.

A pretty climber with bright-green foliage and white flowers 2" diam. M. solitary and racemed from the same axil. F. solitary or occasionally also racemed. Corolla-lobes oblong toothed or entire. Fr. 2" by 1.25" bright orange-scarlet, ovoid-oblong, with 10 strong ribs when young.

Ranchi and Singbhum, on the ghats and plateaux. Fl. Aug.—Oct. Fr. Sept.—Nov.

Stems sparsely pubescent or hispid. L. lower deeply cordate orbicular, 5—7-lobed and denticulate 2—4", scabrous above, hispidulous beneath, basal lobes rounded and sinus wide, other lobes acute or acuminate. Raceme 5—9" with foliaceous bracts .5", obovate-cuneate, palmatisect. Hypanthium curved pubescent 1", sepals .25". Anthers connate. Fem. hyp. .5—6" above produced as a calyx-tube .5—6" above the pubescent ovary, which is 10-ribbed. Seeds brown, somewhat compressed, .3" by .12".

4. MELOTHRIA, L. (inc. Zehneria).

Usually slender herbs with simple tendrils and entire to deeply-lobed leaves. Fls. small white greenish or yellowish-white, monoecious or dioecious, pedicelled corymbose or racemose or clustered on the rachis of a raceme, very rarely in axillary clusters, female solitary, fascicled or tubelled. Hypanthium tubular-campanulate or broadly campanulate with minute sepals. Corolla deeply 5-partite. Stamens 3 inserted about or below the middle of the hypanthium, anthers free or slightly cohering with anther-cells straight, flexuose or sigmoid, connective mucicose

or papillose at the top or produced beyond the cells, staminodes sometimes present in female. Hypanthium much constricted above the ovary which is oblong or fusiform, more rarely globose, with 3 placenta and numerous ovules. Disc present annular at base of the short style. Stigmas 3, rarely 2. Pistillode present in male. Fruit baccate with usually many ovoid or oblong-rounded or compressed, smooth tubercular or pitted seeds, sometimes obscurely margined.

The *F. B. I.* keeps *Zehneria* separate from *Melothria*. *Cogniaux* unites these two genera as well as *Mukia*. The last differs in its pronounced yellow flowers always clustered axillary short-pedicelled or sub-sessile and small, round, never fusiform fruit.

L. polymorphous. M. fls. corymbose. Petals triangular . . . 1. *heterophylla*.
L. 3-lobed. M. fls. clustered on the angles of racemes. Petals
ovate 2. *zehnerioides*.

1. **M. heterophylla**, *Cogn.* Syn. *Zehneria umbellata*, *Thw.*; Ban Kundri, *H., Beng.*; Chengor, *K.*; At', *S.*; Karakia, Matka, Makirla, *Or.*; Tura, *Gond.*

A prostrate or climbing plant with angled smooth stems from a tuberous root (a chain of fusiform tubers in old plants), polymorphous leaves usually 5-nerved and pale beneath, always cordate, hastate, or sagittate at the base, denticulate, rarely exceeding 6" in length and always with a very short sometimes pubescent petiole .25—.75" long; glabrous or hispid above. Hypanthium greenish, petals small triangular white. Male flowers articulate .2" on slender pedicels .17" long in peduncled corymbose racemes under 1.5" long, and usually with a solitary short-peduncled female from the same axil; connective papillose on the top, pistillode 3-lobed, pedicels with a fusiform bract from near the middle. Ovary narrow. Fruit ellipsoid 1—1.6" long scarlet with red pulp and 12—20 smooth ellipsoid slightly compressed white seeds, sometimes with a slightly corrugate margin. Fruiting peduncle .3—.6" stout.

Throughout the province inside the forests and especially in rocky ravines (probably on account of the pigs being unable to get at the tubers). Fl. April—Oct. Fr. May—Jan. Dies down at the end of the c.s. and puts out new shoots in the hot season.

Every part of the plant is eaten, including the leaves and ripe fruits. The following forms occur:

- I. Leaves not, or only slightly, lobed with rounded lobes, ovate cordate.
 - a. L. small 1—2.5" with minute pits above when green (as in most of the forms) showing as small raised discs (cystoliths) when dry. Puri!
 - b. L. 2.5—5.5" glaucous. Puri! Angul! Mayurbhanj, *Burkill!* Chota Nagpur!
 - c. Leaves up to 7" with 5-nerved base but only 2—3 sec. n. It is called Ma-kirla in Angul from confusion with *Trichosanthes palmata*, from which it may be distinguished in leaf by its weak habit. L. only denticulate, neither rugose nor with impressed nerves above nor hispid on the nerves beneath, also by its short petiole.
 - d. Like (c) but more lobed and sinuate, called "Matka" in Angul, never dentate or serrate as in *Trichosanthes*.
- II. Leaves hastately or sagittately lobed.
 - a. Lobes sub-equal. Burdwan, *Clarke!* Mayurbhanj!

b. Mid-lobe very much larger than the side lobes.

i. Leaves under 3". Puri.

ii. Leaves up to 6" long or more, cystoliths less evident. Purneah! Chora Nagpur!

III. Leaves deeply 3—5-palmatifid with all lobes narrow and usually small. Puri!

NOTE.—*Clarke* (*F. B. I.*, ii, p. 625) says that the seeds are sometimes only 4—6 but he includes *Bryonia amplexicaulis*, *Lamk.* He also notes that the bracts on the pedicels are sometimes absent. They appear to me always to occur on some of the pedicels and in young stages of the inflorescence. They are very curious structures, being often inflated! The female flower is often solitary in the axils of leafy bracts of lateral branchlets with a similar inflated bract in the same axil.

2. *M. zehneroides*, *Haines*, *Journ. Asiatic Soc.*, xv, No. 7, 1919.

A slender climber with striate sparsely hispid stems, 3 (—5)-lobed leaves 2.5—3" long scabrid on the margins and nerves and with very scabrid petiole 3—5". Fls. small white clustered at the angles of short racemes, ♂ and ♀ mixed, campanulate with linear-subulate sepals. Anthers all 2-celled with nearly straight cells and connective neither swollen nor produced. Fruit 3—4" sub-globose or somewhat ellipsoid on slender peduncles with flat elliptic-obovate white seeds 13" long.

Purneah! Fl., Fr. Dec. [But all the mature male flowers fungus-infested in my specimens and buds only available.]

Leaves with lanceolate or oblong or linear oblong lobes, the basal sometimes with a subsidiary lobe very like forms of *Zehneria umbellata* but easily distinguished by the hispid nerves and a few long hairs at the top of the petiole insertion. Racemes zigzag 1—2.5" long, pedicels 2—3" scabrid. Fem. fl. 3", hypanthium white broadly campanulate, sepals small linear, corolla rotate with broadly ovate acute papillose petals.

5. MUKIA, *Arn.*

Scabrous herbs with simple tendrils and 3—7-angular not deeply-lobed cordate leaves, often sub-sessile. Fls. small yellow, M. and F. clustered in the same axil; males very shortly peduncled and F. sub-sessile. Hyp. campanulate, sepals very small subulate, corolla 5-partite. St. 3 inserted low down, anthers free with straight cells. Ovary ovoid with thick style 2—3-lobed. Placentæ 2—3, ovules not very many. Berry small globose. Seeds ovoid compressed strongly margined, faces rough or smooth.

1. *M. maderaspatana*, *Kurz*. Syn. *M. scabrella*, *Arn.*; *Cucumis maderaspatanus*, *L.*; *Melothria maderaspatana*, *Cogn.*; *Bilari*, *H.*

A very scabrous small climber with firm 3—7-lobed and toothed very rough deeply cordate leaves attaining 4" by 3.5", usually much smaller. Petiole of upper leaves sometimes 0, of lower sometimes attaining 2". Flowers 12—17" diam. Berries scarlet with firm epicarp 3—4", often hairy.

Common, climbing over bushes in low jungle and open places. Fl., Fr. Sept.—Dec. Very pretty when in fruit with its clusters of scarlet berries.

6. BRYONOPSIS, *Arn.*

Climbing with 2-fid tendrils. Leaves palmately or sub-pedately 3—7-lobed. Flowers small yellowish, M. and F. clustered in the same axils.

Hyp. (*i.e.* above the ovary in F.) widely campanulate with minute sepals. Corolla 5-partite. Stamens 3 inserted low down, anthers free with curved or sigmoid cells, connective mucous. Pistillode 0. Ovary ovoid with slender 3-fid style, disc 0. Placentæ 3. Berry globose. Seeds not very many, oblong or ovoid compressed with a corrugate vertical band (in our species).

1. **B. laciniosa**, L. Syn. *Bryonopsis laciniosa*. Naud.; Kahubotke, S.; Pachguria, *Kharw.*; Mala, *Beng.*

A climbing foetid herb with cordate usually deeply 2—7-lobed or -partite leaves 2—4". Petiole 1—1.5". Flowers small yellowish, males with slender 5—1" pedicels, females shorter. Fruit smooth globose 5—6" diam. green or when quite ripe red, with white stripes. Seeds in a blue-green pulp, pear-shaped.

Common in hedges. Purneah! Throughout Chota Nagpur! Angul! Fl., Fr. April—Dec.

Stems nearly smooth. Leaves sometimes only 3-lobed and less than half-way down but usually 5-lobed beyond the middle and with two subsidiary basal pedate lobes, orbicular-ovate, three central lobes usually lanceolate and narrowed at their bases, slightly scabrid above, almost smooth beneath, margin minutely denticulate, cystolithic dots above when dry but not very conspicuous. Flowers sometimes in much abbreviated racemes. Petals 2" light-yellow.

The fruit is eaten readily by horses and cattle.

7. CUCUMIS, L.

Hispid or scabrid herbs with simple tendrils and monoecious flowers. Males fascicled or sub-solitary, females solitary, axillary short-peduncled. Hypanthium short. Corolla deeply divided. Stamens 3, anther-cells conduplicate or only flexuose. Connective produced *into a crest above the anther*. Ovary sometimes apparently 3-septate, style short, stigmas 3, obtuse. Fruit fleshy. Seeds oblong compressed mostly smooth.

A. Leaves scabrid. Fruit quite smooth.

L. palmately 3—5-lobed beyond the middle. Fr. oval 1. *trigonus*.

L. scarcely lobed. Fr. roundish 2. *melo*.

B. Leaves membranous hairy. Fr. hispid or muricate 3. *sativus*.

1. **C. trigonus**, Roxb. Bing Dirmbu, K.

A procumbent and trailing plant, scarcely ever climbing, with scabrous stems and petioles and small deeply palmately 3—5-lobed harsh leaves 1—2.5" diam., scabrous on both sides and with the lobes dilated at the tips or again sub-lobed. Fls. yellow 5" diam. Fruit usually ellipsoid, rarely ovoid-globose, 1.25—1.5" diam. striped green and white or green and paler green, quite smooth, finally yellowish.

Very common on open dry ground. Fl., Fr. Aug.—Oct.

The root is said to be perennial and according to *Naudin* it is by this character alone that the species can properly be distinguished from the next. It is very probably the wild form or one of the wild forms of the cultivated Melon. Petiole 5—1.5". Male fls. sometimes solitary. Hypanthium densely hairy or villous, 25", with very small sepals, corolla 5" diam., hispid-hairy without. Pedicels 3".

2. *C. melo*, L. Kakri (the vegetable), *H.*; Karbuz (the fruit); Melon.

The above names refer to the cultivated plant. The wild form is called Bing Dimbu by the Kols. This is a procumbent annual plant sometimes with the stem rather thickened towards the base, the whole plant scabrid and hispid but the hispid hairs are often deciduous above the base, especially on the leaf surfaces between the nerves, thus leaving it nearly scabrous. Leaves orbicular or ovate with shallow rounded or sub-angular lobes or sub-entire, denticulate with mucronate nerve-endings, texture thinner than in the last species, 1.5–2.5" diam., basal sinus often very shallow, petiole 1.5–3", tendrils often long which it uses chiefly for climbing among grass only. Male flowers usually 5–6 axillary with peduncles about .25". Hypanthium .25" campanulate villous, sepals distant linear-subulate very small. Corolla .5–1.25" diam. divided beyond the middle, lobes obtuse pubescent. Fem. solitary, much as in the male. Fruit spherical usually striped as in the last.

Common in waste ground in Chota Nagpur and probably in other districts! Fl., Fr. r.s.

The cultivated Melon only differs by the larger size of all its parts and perhaps by the somewhat softer indumentum. *Prairie* says it has both soft and harsh hairs. The fruit of the wild plant ultimately turns yellow, and is conspicuous lying on the ground attached to the plant long after the death of the vegetative parts, which are distinctly annual.

3. *C. sativus*, L. Khira, *H.*; Kaknai, *Or.*; Cucumber.

A hispidly hairy climber with membranous deeply cordate angled or shallowly 3–5-lobed leaves about 4.5" diam., the larger up to 6" by 5.5", both sides hairy with softish hairs but the upper with thickened bases and the ribs beneath scabrid or hispid, margin denticulate, terminal lobe sometimes lanceolate and basal lobes sometimes sub-hastate. Petiole 2–4". Flowers yellow .7–1" diam. Males clustered, hyp. tubular or campanulate with long white hairs .25–.3", sepals linear spreading .15–.2", fil. very short, anthers cohering with connective crested or clavate above the cells. Female solitary, hypanthium .15" more urceolate with oblanceolate sepals .2", thickly covered with very bulbous-based hairs or soft spines ending in a deciduous hair so that the fruit is covered with harsh hairs or soft spines and finally more or less muricate, cylindric.

Apparently wild in several places in Chota Nagpur in open and scrubby jungles! and in the Porahat Forests (e.g. between Nakti and Tebu)! Fl. r.s. Fr. up to Oct.

The cultivated plant is the well-known Cucumber and the above-described forms are probably feral. *De Candolle* surmised that the wild plant is indigenous in India in the region of Afghanistan.

The flattened and elliptic seeds, like those of *C. melo*, yield a sweet edible oil which is nutritive and diuretic. The pulp of the fruit is also diuretic and beneficial in eczema (*Nadkarni*).

8. CITRULLUS, Neck.

Usually prostrate and trailing hispid or scabrous herbs with simple or 2–3-fid tendrils and palmately or pinnatifidly lobed leaves often with

sub-pinnatifid segments. Flowers monoecious, solitary, rarely geminate, yellow, not very large with short campanulate hypanthium. Corolla rotate, deeply lobed. Stamens 3, anthers scarcely cohering, connective not produced, cells conduplicate or sigmoid. Ovary with 3 placentæ, short style and 3 reniform stigmas. Fruit at first very fleshy, globose or ellipsoid, smooth, indehiscent. Seeds very many oblong compressed smooth.

Leaves 2—4·5", pale, with the close scabrous cystoliths
Leaves 3—8", thin, sparsely scabrid. Cultivated

1. *colocynthis*.
2. *vulgaris*.

1. C. colocynthis, Schrad. Indrayan, *H.*; Colocynth or Bitter Apple.

Rather a pretty prostrate very scabrous grey coloured herb with usually simple tendrils ovate or lanceolate or lanceolate-oblong leaves pinnatifidly lobed, the lowest lobes palmatifid opposite, segments again pinnatifid, lobed or lobulate, closely covered with small round discs when dry and nerves hispid. Fls. 5—7" diam. Fr. globose 1—3" diam. smooth variegated green and white on a hispid and hairy peduncle. Seeds 2—25" by 15".

Said to be generally cultivated, but I have not seen it so in our province. My specimens were collected in the Central Provinces and were apparently wild. Fl. Nov. Fr. Jan.

The fruit is bitter, acrid and cathartic and finds a place in the *British Pharmacopœia*. It is poisonous in large doses.

2. C. vulgaris, Schrad. Syn. *Cucurbita citrullus, L.* (also in *F.I.*); Tarboj, *K.*; Tarbuz, *H.*; The Water Melon.

Prostrate with pubescent or hairy or nearly glabrous stems and 2—3-fid tendrils. Leaves 3—5-partite with the segments pinnatifid or lobed, sometimes linear, denticulate or margin nearly smooth, usually about 6" by 5", dotted beneath and somewhat scabrid with hispid or hairy nerves. Fls. solitary or paired on long peduncles 1—2". Hypanthium short campanulate with linear sepals 25" long. Corolla salver-shaped 1" diam. lobed nearly to base, petals 3—5-nerved, somewhat puberulous. Stamens distinct, anthers sigmoid. The second flower in the axil is often abortive. Fruit 4—10" diam.

Largely cultivated, especially on the sides of rivers. Annual. Native of Tropical Africa, and *De Candolle* relates that both sweet and bitter fruits are found in the wild state. Fl., Fr. h.s.

The axil of the leaf often contains a peculiar obovate stipule-like bract 75" long, 3-nerved and foliaceous, which is probably the leaf of a suppressed axillary shoot. It would be described by *Roxburgh* (but he gives no detailed description of this species) as a stipule and corresponds to his "solitary axillary cordate stipule" in *Luffa pentandra*.

9. MOMORDICA, L.

Tendrils simple. L. undivided or palmatisect. Fls. monoecious or dioecious, solitary peduncle often with a large bract. Hyp. campanulate. Corolla nearly polypetalous. Filaments 3, anthers with horse-shoe-shaped or conduplicate cells. Style long, stigmas 3. Fruit indehiscent or sometimes 3-valved, muricate echinate or smooth. Seeds

obovate or oval sometimes rectangular often corrugate on the margin and sometimes on the faces.

In a species outside our area the *M.* peduncles are 2--5-fld. and the stamens are two only.

Fls. monoëcious. L. very deeply 5--7-lobed. Fr. tubercled . 1. *charantia*.

Fls. diëcious. L. entire or slightly lobed. Fr. echinate with soft spines 2. *dioica*.

1. *M. charantia*, L., inc. *M. muricata* (F.L.); Karcla, H.; Kirla, K.; Karena, Or.; Karala, uchchhe, Beng.

A softly-hairy rather slender climber with pedately 5--7-fid or -sect leaves 1--4.5" diam., the segments again lobulate or sinuate and denticulate, the teeth usually ending in a fine point. Fls. yellow .5--.6" diam., males on filiform peduncles often 3.5" long with one orbicular foliaceous bract near the middle, female peduncle nearly as long, bract near the base. Petals sometimes distinct to base, obovate, spreading. Fruit ovoid or fusiform, tapering both ends, ribbed and covered with tubercles, 2--3" long, yellow when ripe, beaked. Seeds compressed with corrugate margins.

Very common in hedges and widely cultivated. Often found wild in waste places. Fl. Aug.--Jan. Fr. Aug.--Feb.

The fruit is bitter, but wholesome and eaten as a vegetable. It is said to be tonic and stomachic and useful in gout and rheumatism. It is also anthelmintic (*Nadkarni*).

2. *M. dioica*, Roxb. Ochen, K.; Kaksa, H.; Ban-Karela, Beng.; Kanchan-arak', S. (the fruit "Karla").

A slender nearly glabrous climber with foetid smell, angular stem, deeply cordate simple or 3-lobed often sinuately denticulate ovate leaves 2--4.5" and solitary axillary yellow diëcious flowers with petals .7--1" long. M. on slender peduncles 2--6" easily recognised by the persistent spathaceous deeply concave orbicular bracts wrapping round the buds and enclosing base of the flowers. F. peduncles usually somewhat shorter or as long as the male with a small bract somewhere near the middle, ovary densely hirsute-fimbriate, the fimbriæ in fruit bearing soft fleshy spines which are lanceolate to ovate when dried.

Common in hedges throughout the province and apparently wild. Fl. Aug.--Sept. Fr. Sept.--Oct.

Root perennial, tuberous. L. punctate beneath and dots sub-translucent when fresh (appearing as white dots above when dry), basal auricles sometimes very large and meeting round the sinus. M. fl. calyx campanulate .4" long with oblong-lanceolate or linear sepals as long as tube. F. fl. ovary .3", sepals .2--.3" linear or linear-lanceolate. Fruit 1--3", ellipsoid acute or ovoid. Seeds .4--.45", more or less compressed, closely inverted with an aril-like integument, ellipsoid, dark grey, nearly smooth or with corrugate margins.

The leaves are eaten as a sag and the fruit is also eaten when young.

NOTE.—The short-peduncled female plant has been repeatedly mixed up with *Luffa graveolens* and *L. echinata*, but the peduncle is rarely as short as in those species; the young fruit too is ovoid and beaked and the fimbriæ, though sometimes slightly hairy, are never hispid; the remains of the sepals form another useful character (cp. with those species).

10. BENINCASA, *Savi.*

A single species.

1. **B. cerifera**, *Savi.* Syn. *Cucurbita Pepo* (*F.I.*); Kumra, *H., Beng.*; Rakhsa, *K.*; The White Gourd Melon.

A rather large climber, softly hairy all over and with 2-fid tendrils. Resembles a *Cucurbita* in its large solitary axillary yellow flowers and foliaceous sepals, but the corolla is only *very slightly gamopetalous*. Flowers monœcious, the male with a longer peduncle than the female, hypanthium (with calyx) campanulate, sepals 5 foliaceous, pinnatifid or serrate. M. with 3 stamens with free exsert anthers, cells sigmoid. Fem. with densely hairy ovary, 3 flexuose stigmas and 3 parietal placentæ. Fruit rounded-oblong, at first hairy, finally glabrous, 12—18" long with a whitish bloom. Seeds white, oblong, compressed, with tumid margins.

Fairly generally cultivated. Fl., Fr. c.s.

Leaves reniform-orbicular, 3—6" long and broad, deeply cordate and sometimes with small angular lobes, margin toothed; petioles hairy, 1—3", tapering above. Flowers about 2" diam.

The young fruit is eaten cooked and is also made into sweetmeats. It is said to be alternative, antimalarial, cooling and laxative, and is said to be a good antidote for many kinds of vegetable poisons.

11. LUFFA, *Cav.*

Tendrils 3—5-fid. Fls. monœcious. Males in long racemes (except in *graveolens*) with a solitary male or solitary female from the same node, or female in a different axil. Bracts usually glandular. Male hypanthium obconic or campanulate. Corolla rotate from the top of the hypanthium or lining it to the base. Filaments 3—5 inserted at base of corolla tube, anthers free or in three groups, more or less exsert, cells sigmoid or sinuous on the margins of the often lamelliform connective. Fem. hyp. scarcely produced above the ovary which is narrow and ultimately 3- rarely 4-celled. Fruit ultimately dry with a very coriaceous or sub-woody epicarp and fibrous mesocarp, opening by a stopple.

The placentation in this genus becomes apparently axile or nearly so from the ingrowing of the placentæ.

I. Male flowers racemed, sometimes also a solitary one from same axil.

A. Stamens always 3. Fruit covered with bristles

1. *echinata*.

B. Stamens 3—5. Fruit not bristly.

St. usually 3. Fruit sharply 10-angled

2. *acutangula*.

Stamens usually 5. Fruit smooth

3. *ægyptiaca*.

II. Male flowers clustered. St. 5. Fr. softly bristly

4. *graveolens*.

1. **L. echinata**, *Roxb.*

A procumbent or scandent herb with 5-angled slender stems, distinctly 3—5-lobed ovate or broadly ovate deeply cordate and denticulate leaves 1—2.5" long and broad, somewhat hispid or hairy both sides and on the nerves beneath strigosely or hispidly hairy, cystolithic discs small when dry. Tendrils 2-branched. Fls. white 5—1"

diam. Males in few flowered racemes 2—8" long with slender pedicels. Fem. solitary, often in same axil as males, with peduncle 3—8" long densely echinate with soft hispid spines. Capsule 1—1.3" long ellipsoid with bluntly conical tip densely spiny with rigid prickles.

Purneah, often near rivers! Fl. Sept.—Nov. Fr. Oct.—Jan.

There is considerable confusion in Herbaria in respect of this species, and I have omitted the Tirhut locality (of Bengal plants) as the so-called specimen from Darbhanga is *Momordica dioica* (in young fruit)! Another specimen is a *Cucumis*!

Leaves with somewhat hairy petioles about as long as themselves, with peculiar oblong glandular axillary bracts. Inflorescence more or less hairy, bracts oblong. Sep. 1" pubescent ovate or ovate-oblong. Petals obovate. Ovary with bluntly conical tip (quite different to the beaked ovary in *Momordica dioica*). Style 3-fid half-way down with large stigmas. Seeds compressed oval .15" grey-black slightly scabrous.

2. *L. acutangula*, Roxb., inc. *L. amara*, Roxb. Jui, Ho.; Paror Jhinga, S.; Jhinga, Ara-torui, H.; Tita Dhundul, Beng.

An extensive annual climber (very doubtfully distinct from the next species, *q.v.*) with orbicular smooth angled stems and orbicular angled or slightly 5—7-lobed leaves deeply cordate, 3—5" both ways, minutely closely scabrous above with tubercle-based points, more softly so beneath with short hairs, the tubercles or cystoliths at base of hairs never very large, margin dentate. Tendrils 3-fid. Male flowers racemed or sometimes paniced, sometimes only 1" long with glandular bracts near the base of the pedicel, sepals lanceolate 3". Fem. larger, solitary, often from same axil. Fruit 3—4.5" clavate or pyriform, narrowed at base to a stalk often its own length, 3-celled, tardily opening by a stopple and probably not always doing so. Seeds black .4" flattened, elliptic, rather broader one end, which is furnished with 4 grooves and small conical points, making it much resemble a beetle with a rough thorax.

Widely cultivated and wild or feral in several districts. Fl. r.s. Fr. c.s.

Along rivers in N. Champaran is an apparently wild plant with deeply-lobed leaves and only three stamens and smooth fruits. According to the usual diagnosis this should be *L. acutangula* but it really much more resembles *L. ægyptiaca* (*q.v.*).

The unripe fruit of the cultivated plant is largely eaten as a vegetable. It is said to be demulcent, diuretic and nutritive. The seeds are emetic and purgative. The wild plant is very bitter and the fruit violently cathartic and emetic (*Nad-karni*, who calls the wild plant *L. Plucketiana*, a synonym).

I would have combined this and the following were it not that *L. acutangula* is probably nearer the parent species, but if combined it would be necessary to call the species *L. ægyptiaca* (the older name).

3. *L. ægyptiaca*, Mill. Doro, M.; Pulu, Ho.; Ghia Torui, H.; Dhundul, Beng.; The Egyptian Loofah or Towel Gourd.

A climber with very tough smooth sometimes angled stems, sulcate when dry. Leaves from orbicular to hastate-acuminate, often attaining 12", mostly 7-lobed with very deep basal sinus, other lobes shallow or deep, denticulate, minutely gland-pitted beneath when fresh and puberulous, especially on the nerves, scaberulous above or both sides with the hair-bases developing into small hard raised discs when dried

and often pubescent on the main nerves; the lobes are usually well marked and acuminate. Petiole 3—5". Male racemes often 12—18" long, bracts spatulate-oblong 3" with 1—5 large round glands nearly covering their surface. Calyx widely campanulate, hypanth. 3—3.5" long and sepals 5" lanceolate, corolla sulphur-yellow, spreading, 3—4" diam., thinly hairy. Stamens 5 or filaments connate at base in the case of two pairs or stamens 3, anthers very sinuous dehiscent on the lateral margins, filaments hairy below. Female peduncles 2—3", calyx glandular, sepals up to 6", corolla 4—4.5" diam. Staminodes on disc at base of corolla often 5, ovary appressed-villous, stigmas 3—4, 2-cleft. Fruit 6—18" cylindrical, not angled, but with 10 darker coloured stripes. Seeds grey or black with very thin margins, smooth or with small tubercles.

Cultivated and feral in all districts. Fl. r.s. and c.s. Fr. c.s.

I have little doubt that this is but a variety of the last and that the characters given to separate the two are not at all constant.

A feral form in the Ramnagar valley has 3 stamens or 4 stamens and absolutely cylindrical fruit 4" long. A feral smooth fruited *Luffa* in the Santal Parganas had 4 stamens. At Sidhao a similar plant in all respects to the Ramnagar plant was found except that it had 5 stamens! Sometimes 3-stamened forms easily split into 5.

The feral form has a fruit usually under 8" long. The cultivated fruit is eaten as in *L. acutangula*. The fibrous dry mesocarp constitutes the Loofoah used for scrubbing brushes, stuffing saddles and other purposes.

4. *L. graveolens*, Roxb.

A slender climber with a "most disagreeable heavy smell" (*Roxb.*), stems somewhat villous but glabrescent, leaves cordate broad ovate to reniform 1.5—3" sinuate and denticulate. Tendrils 3—4-fid. Flowers yellow 1—1.5" diam., sep. ovate. M. sub-sessile. F. short-peduncled with 1—2 sub-orbicular or oblong glandular bracts on the peduncle which is only 2—4" long. Young fruit beaked, narrowly ellipsoid, when ripe oblong nearly 2" long covered closely with soft spines and villous between, when ripe brownish-black. Seeds oval, compressed, black (*Roxb.*).

Purneah, Kurzi Rajmahal Hills, Roxburgh! It also occurs in the Sikkim Tarai, but the Chota Nagpur locality in *Bengal Plants* is, I think, an error. The only specimen (so called) from C.N. is in young fruit, and is *Momordica dioica*, *Roxb.*! The two can be distinguished by the tendrils, by the longer peduncle of *M. dioica* and absence of the glandular bracts and also by the broad scales and absence of villi in the latter, whereas the fruit of *L. graveolens* has narrow lanceolate scales or spines and intermixed villi. Fl. Sept.

12. THLADIANTHA, Bunge.

Climbing with simple rarely 2-fid tendrils. Leaves deeply cordate, denticulate. Fls. large (in our species), yellow dioecious, males racemed with often a one-fid. peduncle from same axil, bracteate or not, female peduncle elongate but only 1-fid. Hypanthium short campanulate, the bottom shut by a horizontal scale, sepals lanceolate. Corolla campanulate 5-partite, lobes revolute about half way down. St. 5 inserted near mouth of hypanthium, anthers all 1-celled, narrow-oblong, straight.

Ovary oblong, style deeply 3-fid with 3 reniform stigmas. Placentæ 3. Fruit ellipsoid baccate cylindric ribbed, with many seeds.

1. *T. calcarata*, Clarke. Syn. *T. dubia*, *F. B. I.*; *Momordica calcarata*, *Wall.*

A large climber with deeply cordate, neither angular nor lobed ovate leaves about 4" by 2.5" acute, usually villous beneath. Male racemes with serrate or inciso-serrate bracts. Female peduncle 2—3" hairy. Flowers about 2" diam. golden yellow. Fruit 1.5" oblong.

Dalsingsarai, Darbhanga, *Prain's Collector!* It is common in Eastern Bengal, Sikkim and Assam. Fl. r.s. Fr. Sept.

It resembles a *Trichosanthes* superficially.

13. CUCURBITA, L.

Stout hispid or hairy herbs with 2—4-fid tendrils and cordate ovate angular or lobed leaves. Flowers very large yellow solitary monœcious. Hypanthium above the ovary campanulate, sepals sometimes foliaceous. Corolla gamopetalous campanulate lobed less than half-way down. Stamens inserted low down, fil. 3 short, anthers connate in a column or club with conduplicate cells. Ovary oblong, style short, stigmas large, fleshy, 3—5, often longitudinally lobed. Large epigynous cushion-shaped disc 5-lobed. Fruit a pepo. Seeds ovoid or oblong compressed smooth, margined or not.

The ovary is filled with tissue and the ovules are on large swollen parietal placentæ which meet in the axis and are recurved.

The following limitation of species is according to *Naudin* and *De Candolle*:—

- | | | |
|---|--|----------------------|
| A. Leaves somewhat harsh and rigid. | | |
| L. with acute lobes, peduncles sulcate. Corolla narrowed at base with erect lobes | | 1. <i>pepo</i> . |
| L. with rounded lobes, peduncles not sulcate. Corolla lobes curved outwards | | 2. <i>maxima</i> . |
| B. Leaves soft. Indumentum fine and soft. | | |
| Sepals often foliaceous. Peduncle pentagonal, expanded below the fruit | | 3. <i>moschata</i> . |

1. *C. pepo*, DC. Karkaru, *K.*; Konrar, Kumra, Safed-kadu, *H.*; Pumpkin,* Marrow.

A stout hispid annual with orbicular shallowly acutely lobed leaves 4—8" diam. with soft hair between the hispidulous nerves beneath and also sometimes hispid with short bristles. Petiole 4—10" with *rigid prickly hairs* and also pubescent. Male peduncles 4", female 1.5", strongly grooved in fruit. Hypanthium cupular villous with distant subulate sepals 1—2" hispidly hairy. Corolla usually 4" long and 4" diam., mid-rib sometimes excurrent, ribs hairy.

The most commonly cultivated species. Fl., Fr. chiefly r.s. *De Candolle* thinks it most likely Mexican in origin.

The species includes *C. malopepo*, *L.*, and *C. ovifera*, *L.*, and shows extraordinary variety in the shape and size of the fruit, either smooth and oblong as in the

* Both vernacular and English (or American) names such as Pumpkin, Squash, etc., are often loosely applied, and to the fruit rather than to the plant.

Vegetable Marrow, pear-shaped, covered with small knobs (*Barberine*) round and depressed, dish-shaped, etc. The flesh is usually pale and scentless.

2. **C. maxima**, *Duchesne*. The Gourd, Lal Kumra (when flesh is red), *H.**

Besides the characters given in the Key it differs chiefly from the last by the absence of the prickly hairs on the petiole. The fruiting peduncle is striated but not grooved.

The fruit attains an enormous size and is usually oblong but varies in shape almost as much as does *C. pepo*. The flesh is often reddish.

De Candolle considers it to be of African origin.

3. **C. moschata**, *Duchesne*. The Musk Melon.

The species is easily recognised by its general softness, the fruiting peduncle being pentagonal and enlarged beneath the fruit which is more or less covered with a glaucous bloom. The sepals are most frequently terminated by a broad foliaceous tip and the flesh of the fruit is usually somewhat musk-scented.

Commonly cultivated! Its native country is entirely unknown.

14. CEPHALANDRA, *Schrad.*

Climbing herbs with simple tendrils and 5-angled or -lobed or -partite leaves. Flowers rather large, dioecious, solitary, or males in abbreviated racemes, axillary white, ebracteate. Hypanthium campanulate or funnel-shaped, short. Corolla campanulate, lobed about half-way down. St. 3 with exsert connate anthers and conduplicate anther-cells. Ovary oblong, style long with 3 bifid stigmas, placenta 3. Fruit smooth fleshy cylindric. Seeds ovoid compressed margined.

1. **C. indica**, *Naud.* Syn. *Coccinia indica*, *W. & A.*; Kundri, *K.*; Kanduri, *Bhimb, H.*; Ban-kundri, *Or.*; Tela-kucha, *Beng.*

Stems 5-angled, somewhat scabrous or smooth. Leaves 1.5—3.5" rarely 4", ovate or orbicular, variously 3—5-angled or -lobed and the lobes occasionally constricted at the base and again lobulate, but always easily recognisable by their being glabrous, delicately venose beneath but marked with numerous small round discs above, base 5-nerved and nervules usually ending in glandular distant denticulations, frequently several large circular glands near the petiole, petiole .5—1.5" long. Male flower solitary or 2—4 clustered on a very abbreviated rhachis. Pedicels .3—6" long. Sepals spreading subulate or oblong acute .15—1.7" long. Corolla 1—1.2" long and 1.5" diam. campanulate with large spreading ovate-lanceolate lobes papillosely hairy within. Stigma spreading. Fruit oblong narrowed apically or at each end, scarlet when ripe but green with usually 10 white streaks when unripe.

Common in hedges in most districts! Also cultivated as a vegetable. Fl. Aug.—Dec. and sometimes again seen in flower in March. Fr. soon after.

A form found in the Mals of Orissa has fleshy rather glaucous leaves with the margins sparsely scabrous-ciliate.

The fruit is largely eaten.

* See note on previous page.

FAM. 72. *BEGONIACEÆ*.**1. *BEGONIA*, L.**

Succulent herbs, often rhizomatous or tuberous, with alternate simple more or less unequal-sided palm-nerved leaves with cystoliths and free stipules often persistent. Flowers usually showy mostly in terminal or axillary dichasial cymes, monœcious and usually bilateral, rarely quite regular. Male perianth of two outer valvate opposite petaloid tepals and 2—0 inner smaller ones (petals?), perianth of female of 2—5 tepals (rarely 6—8), if more than two imbricate, the outer 2 more or less covering the inner, superior. Stamens many, free or monadelphous, anthers with a large clavate connective. Ovary completely enclosed in the hypanthium, inferior, 2—4-celled with axile divided or simple placentæ, 2—4 free or partially connate styles and variously shaped stigmas. Ovules very many. Fruit usually capsular, often winged, dehiscent or irregularly breaking up. Seeds very many minute, terete or globose with reticulate testa and scanty or 0 albumen.

1. *B. picta*, Sm.

A pretty little plant, varying in size from one leaf an inch or two long and peduncles 4" high to several leaves and flowering stem 18" high. Stems hairy. First leaf radical, later usually few, bronze-green above and crimson beneath, broadly ovate cordate sometimes shortly acuminate, margin unequally dentate with teeth ending in hairs, upper surface rough with tubercle-based hairs, lower with some hairs on the nerves; in favourable localities they attain 9.5" by 8.5", and with a petiole 10.5". Fls. pink, M. and F., on separate branches of the inflorescence. Larger M. tepals .5—7" ovate. St. many monadelphous, yellow. F. fl. 5-tepalous, 2 outer up to .8". Ovary and capsule 3-winged or one wing obsolete, closely covered with crystalline branched hairs (very pretty when fresh), placentæ 2-fid.

Chota Nagpur, esp. on the plateaux on damp banks under shade, common! Sambalpur! Fl. Aug.—Oct. Fr. Sept.—Jan.

I have a field-note of a plant with 5 small white petals, but it was not collected. It may be a variety of the above.

FAM. 73. *CACTACEÆ*.

Succulent plants, sometimes arboreous, with columnar, club-shaped, spherical or terete, compressed or angled, ribbed or warted stems and branches, rarely as in *Pereskia*, with well-formed leaves, but leaves reduced to small subulate minute often caducous scales or subulate and fleshy with tufts of hairs, bristles, or spines in their axils.* Flowers axillary or terminal on special tubercles, usually large and showy, generally solitary, in *Pereskia* in several-fid. cymes. Perianth regular or somewhat zygomorphous, not evidently separable into calyx and corolla, rotate, funnel-shaped or salver-shaped, of many superior tepals from a tubular hypanthium. Stamens very

*The small area or cushion thus formed is here termed an "areole."

many, inserted at various levels in the hypanthium. Ovary inferior 1-celled with several parietal placentæ. Ovules many anatropous with two integuments (as in most Polypetalæ). Fruit baccate 1-celled. Seeds many with curved embryo which is cylindric or club-shaped and scarcely differentiated or with two thin or fleshy cotyledons, albumen scanty or copious.

The germination of *Opuntia* (the only one I have observed) is epigeal with two normal small rather fleshy cotyledons, between which at once arises a clavate fleshy stem without intermediate more normal forms of stem.

Only the naturalised or semi-naturalised species are here dealt with; several others are found in gardens, especially epiphytic species of *Rhipsalis* with flattened 2-edged serrate branches.

I. Leaves reduced to scales.

A. Barbed bristles 0. Stems columnar, strongly ribbed or angled.

Flowers salver-shaped or funnel-shaped with tubular hyp.

1. *Cereus*.

B. Areoles with barbed bristles. Stems with broad flattened joints.

Fls. rotate or funnel-shaped. Stamens not exerted

2. *Opuntia*.

Fls. campanulate. Stamens far-exserted

3. *Nopalía*.

II. Leaves well-developed. Flowers cymose

4. *Pereskia*.

1. CEREUS, *Haw.*

Stems either erect and attaining large girth or slender and scandent with climbing roots or epiphytic, columnar in form with strong prominent ridges or angled or ribbed. Leaves reduced to scales often only developed in the earliest stages. Areoles with felted hairs with more or less numerous prickles. Flowers from the older areoles solitary, large, erect, salver-shaped or somewhat zygomorphous with very unequal spirally arranged tepals, of which the lowest often clothe the hypanthium outside the ovary, the median are calyciform and the inner petaloid. St. included or exerted from the hypanthium with long filaments. Ovules with long funicles often connate in groups on the large swollen placentæ. Berry very succulent, smooth or tubercled.

1. *C. hexagonus*, *Haw.* Bonga-daru, *K.*; Sapin, *S.*; Soju, *Mal.*, *P.*

Stems several from the root, tall columnar with usually sharply 6-ridged stems covered with clusters of sharp spines but no barbed bristles. Fls. large solitary, funnel-shaped, white, somewhat zygomorphous.

Frequent in village hedges. Chota Nagpur! Santal P.! Puri! Balasore! Fl., Fr. May—Sept.

There is some doubt about the name as specimens and notes are both deficient. The description of *C. hexagonus* in *Britton and Rose (The Cactaceæ, Washington, 1919)* is as follows: Up to 15 metres high, joints 12 cm. diam. or more, short, ribs 4—7, usually 6, thin, 3—5 cm. high. Fls. 20—25 cm., tube slender, 10 cm., uppermost scales green, short, outer tepals lanceolate to oblong-lanceolate, 6—7 cm., tinged with purple, inner much thinner, white, oblong-lanc., 7—8 cm. Fruit pale red, ovoid, 5.5—13 cm., somewhat oblique.

Burkill in *Records of Bot. Surv. of India*, 1911, apparently calls this *C. pterogonus*, *Lam.*, but the habit of the latter plant is entirely different.

2. OPUNTIA, *Haw.*

Shrubs with the stems often woody, branches jointed with large fleshy and compressed limbs bearing when very young small cylindrical or subulate caducous leaves leaving axillary scars or "areoles" from which arise very numerous fine barbed bristles and often one or more larger prickles or spines. Flowers solitary, large or mod.-sized from the marginal or apical areoles, usually yellow or reddish, regular, rotate or funnel-shaped. Outer tepals sepaloid, inner numerous petaloid. Stamens shorter than the perianth, inserted on the cupular or saucer-shaped hypanthium, of which the upper part falls off with the perianth and stamens. Ovary sunk in the hypanthium (which does not differ from the rest of the axis and bears areoles, and if broken off and planted will behave like a cutting and grow!). Ovules few or very many, enveloped by the much expanded end of the funicle.

- A. Spines deciduous except one large one (rarely 2—3) on each areole 1. *monacantha*.
 B. Several large spines usually remaining on each areole.
 1. Spines straight slender tawny, brown or black. 2. *elatior*.
 Fls. lemon yellow changing to rose-pink var. *nigricans*.
 Fls. orange
 2. Spines all pale yellow, the largest stout and rarely also curved 3. *Dillenii*.

1. *O. monacantha*, *Haw.* (*Supp. Plant. Succ.*, 1819). Syn. *Cactus indicus*, *Roxb.*; Nagphani, *Vern.*

A large succulent jointed shrub with erect branches and with the limbs (the internode-like portions of the axis between the articulations) much compressed obovate to oblanceolate, bright-green. Areoles bearing 1—3 spines only, of which at least one is often over 1" or 2" long, often brown or whitish and dry-looking. Flowers yellow or only reddish outside, corolla spreading rotate, stamens yellow short, pistil longer than the stamens. Fruit green, nearly smooth.

Apparently more plentiful in the damper districts (possibly through the absence of its enemies), Purneah, Chandpur (Balasore), Cuttack and Puri, frequent! Singbhum! *Burkill** records also the following localities: Darbhanga, Muzaffarpur, Samastipur, Dalsing Sarai, Gaya (1856, *Kurz*) and Ranchi (*Wood*). Fls. chiefly in the h.s., also January, opening during sunshine.

The limbs of this species like other *Opuntias*, being branches, usually decrease in size from below upwards, so that it is difficult to give measurements, and the young ones bear small sessile subulate fleshy leaves. Outer petals smaller, obcordate, inner oblong.

This cactus is eaten by the Cochineal insect, which on introduction caused its destruction over large areas in India.

2. *O. elatior*, *Mill.* (*Gard. Dic.*, 1768), inc. *O. nigricans*, *Haw.* Tall Indian Fig.

Habit of last with compressed limbs of much the same shape (usually described as ovate-oblong), but frequently faintly faceted by slightly raised lines joining the areoles, somewhat glaucous. Areoles with 2—5 strong divaricate tawny or purplish-black spines. Flowers yellow soon

* *Records of the Botanical Survey of India*, 1911.

becoming tinged with purple or outer petals red and inner dirty yellow, perianth somewhat campanulate, stamens purple, pistil shorter than the filaments (always?). Hypanthium with tufts of bristles and a few spines. Fruit red marked with the areoles, but bristles and spines deciduous, top depressed.

Exceedingly common in the Arrah and Patna districts, *Burkill*. Purneah, *Burkill*. Very plentiful in Orissa, *Burkill*.

The stems become woody below with age. Leaves subulate compressed above.

Var. *nigricans*, *Haw.* (*Miscellanea Naturalia*, 1803), sp.

I do not see how *O. nigricans* is to be separated as a species from *O. elatior*. The characters given appear trivial, such as the flowers being orange (as contrasted with lemon-yellow changing to rose-pink) and the spines black. Bankipur, *Burkill*.

The Cochineal insect does not feed on it.

3. *O. Dillenii*, *Haw.* (*Supp. Plant. Succ.*). Nagphani, *Vern.*

A large straggling fleshy shrub with often drooping branches and large flat limbs, lower often longer and corky, median about 11—15" long and only about 3" thick, mostly oblanceolate, articulations often with a ring of spines or bristles when young. Young leaves subulate fleshy 2", sub-spinulose, seated on a swollen fleshy base (petiole?), in the axils of which are the rudimentary bristles and tomentum. Areoles finally with 5—6 (more rare only 2—4) very pale yellow spines and numerous yellow barbed bristles. Flowers entirely pale sulphur yellow or greenish-yellow or slightly tinged with red within at the base towards evening, somewhat funnel-shaped, with petals about 2" long. Hypanthium narrowly turbinate with areoles like those on the young limbs, white tomentose but without spines or bristles (the latter sometimes present?).

Arrah, Bankipur and Patna, *Burkill* (*loc. cit.*). A very common species about Litchpara and Hiramapur in the Santal Parg. Singbhum! Puri, very common!

Fl., Fr. June—Sept. Flowers open in the morning and close in the evening.

Burkill gives as a distinctive character that some of the spines are always curved, "the largest stout, light horn-coloured in life, darkening in herbaria with age," but I do not often find these curved spines. He probably includes the Puri species in "*elatior*" as he does not mention *Dillenii* from that region!

It is the principal species used for fencing the Casuarina plantation on the Puri sands, and makes a thick effective hedge on sandy soil. Easily grown from cuttings.

3. NOPALEA, *S. Dyck.*

Flowers campanulate with very many tepals, the outermost scale-like. Stamens far exceeding the perianth. Ovules embraced on two sides by the long flattened funicle. The rest much as in *Opuntia*.

1. *N. coccinellifera*, *S. Dyck.* Syn. *Opuntia cochinelifera*, *Miller.*

Limbs fleshy obovate without spines on the areoles.

Only recorded from Shahabad (Arrah), *Burkill*.

4. PERESKIA, *Plum.*

Succulent shrubs with thick twigs and broad more or less fleshy leaves in the axils of which are areoles and clusters of spines. Flowers cymose axillary or in terminal panicles, rotate, regular, medium-sized.

Tepals many free or connate, the outer usually short and fleshy green or harder and almost prickly, the inner petaloid. Stamens inserted on the margin of the saucer-shaped or cupular hypanthium which is somewhat swollen above the ovary but not produced into a tube. Ovary inferior 1-celled, or 5-celled at the top. Ovules few or many, parietal or pendulous anatropous. Fruit baccate globose or pyriform, sometimes with prickles. Seeds few, elegantly sculptured with lines. Embryo curved with the large cotyledons rolled round one another.

1. *P. bleo*, DC. Barbadoes Gooseberry.

A large shrub armed on some branches with long needle-like spines. L. alternate or fascicled, fleshy, narrowly-elliptic oblong acute 2—3", shining, sec. n. scarcely visible. Flowers pretty, pink, 1.5" diam. in dense cymose panicles the ultimate branches of which resemble peduncles, with many bracts. Outer 4—5 tepals calyciform short and green, several intermediate tepals gradually passing into petals, the innermost 5—7 being distinctly petaloid 7—8" long. Stamens very many with free slender filaments shorter than the petals and yellow anthers. Style long, stigma capitate deeply (about 7-) -grooved.

In gardens and hedges and almost naturalised in some parts of Ranchi. Fl. March—April and also at other times.

2. *P. aculeata*, Plum. The name Barbadoes Gooseberry is more correctly applied to this species. It is sometimes found in gardens and has a pair of hooked spines in each axil and white flowers. The fruit is edible.

FAM. 74. UMBELLIFERÆ.

Herbs with usually fistular stems, compound (simple in *Bupleurum* and *Hydrocotyle*) and often much dissected alternate leaves with a sheathing petiole, exstipulate or rarely stipular. Flowers small white or yellow, more rarely pink, in simple or compound umbels, 2-sexual or polygamous, rarely dicecious, regular or the outer in an umbel sometimes irregular with the outer petals larger (*radiant*). Sepals superior, usually very small or 0. Petals 5 inserted under the epigynous disc often emarginate with an inflexed tip and a median fold, imbricate or valvate and involute in bud (*exc. Hydrocotyle*). Stamens 5 inserted under the disc which is usually tumid and 2 lobed and surrounds the styles. Ovary inferior, 2-celled styles 2. Ovules 1 pendulous in each cell. Fruit 2-coccus, usually ridged and with oil-canals (*vittæ*)* in the pericarp. Seed 1 in each coccus albuminous. Embryo small, radicle superior, cotyledons linear, often unequal or oblong.

The plane of separation of the two carpels is called the *commissure*. In the centre is a vascular system forming ultimately a distinct slender entire or forked axis (*carpophore*), from which the ripe carpels sometimes remain for a time suspended, but this is not always differentiated. Each coccus has normally 5 primary ridges, viz. 1 *dorsal*, 2 *marginal* or lateral, next the commissure, and 2 *intermediate*, i.e. one each side between the dorsal and marginal ridges. In some species there are 4

* The *vittæ* are often externally visible in the ripe fruit as dark streaks; they show under the microscope in transverse section as minute holes in the pericarp.

other ridges whose positions are alternate to these; they are called secondary ridges and are in a few cases more prominent than the primary.

The germination is epigeal.

Umbels simple or sessile. Leaves simple sub-orbicular

Umbel compound (capitate in *Pycnocycla*):—

I. Leaves entire, usually very narrow. Fls. yellow

II. Leaves compound (radical rarely simple and ovate):—

A. Primary ridges most conspicuous, vittæ in the furrows between them:—

1. Fruit narrowest at the commissure, in horizontal section didymous or laterally compressed.

Vittæ solitary in the furrows. Bracts 0 to many

Vittæ 2 or more in the furrows. Bracts 0 or few

2. Fruit widest at the commissure, in horizontal section circular or somewhat dorsally compressed, lateral ridges, if winged, distinct, not connivent.

a. Ridges not winged.

i. Umbels capitate, heterogamous

ii. Umbels not capitate, fls. similar or outer radiant.

Fls. white or pink. Primary ridges strong, hairy

Fls. white or pink. Lateral ridges large corky

Flowers yellow. Leaves cut into filiform segments

b. Primary ridges sub-alate or alate

3. Fruit very wide at the commissure, much dorsally compressed, in transverse section lenticular, lateral ridges with connivent wings

B. Secondary ridges of the fruit more conspicuous or at least as strong as the primary. Vittæ under the secondary ridges, often obscure:—

Fruit globose, smooth. Bracts 0

Fruit echinate. Bracts pinnatisect

1. *Hydrocotyle*.

2. *Bupleurum*.

3. *Carum*.

4. *Pimpinella*.

5. *Pycnocycla*.

6. *Seseli*.

7. *Cenanthe*.

8. *Fœniculum*.

9. *Ligusticum*.

10. *Peucedanum*.

11. *Coriandrum*.

12. *Daucus*.

1. HYDROCOTYLE, L. Marsh Penny-wort.

Creeping herbs with usually orbicular simple cordate entire angled or lobed palmi-nerved leaves and small scarious stipules. Fls. minute white or red in small simple axillary or sessile compound umbels, bracts usually present. Sep. minute or 0. Petals entire. Fruit strongly laterally compressed, vittæ obscure or 0.

L. .5—2.5" diam., not lobed. Bracts 2 (rarely 3—4) broad-ovate. Fls. few.

L. .25—75" diam., lobed. Bracts obscure. Fls. 10—15

1. *asiatica*.

2. *rotundifolia*.

1. *H. asiatica*, L.

A variable herb with long creeping stems rooting at the nodes, young leaves and petioles villous, never quite glabrescent. L. orbicular-reniform never lobed but often with large rounded crenatures or sometimes coarsely dentate or sub-entire. Umbels usually several at a node, perhaps representing a sessile compound umbel, each with a pair of ovate sub-amplexicaul bracts .1—1.5" long. Fls. 3—5 rarely 6 in an umbel, sub-sessile, petals deep-red ovate acute or obtuse imbricate. Stamens red. Fr. with very narrow commissure, didymous, cocci .11—1.3" diam. broader than long or as long, cocci with 5 primary ridges strong, sometimes with 2 or 4 of the sec. ridges also developed

or the intermediate spaces venous, thinly pilose, epicarp very thick corky and endocarp thin. Seed much laterally compressed.

In wet places. Ranchi plateau! Singbhum, side of nalas in the hills! Mayurbhanj Mnts.!

The characters given above will be seen to break down the distinction of the sections of the genus given in the *F. B. I.* The species is however easily separable from *H. javanica* by the few fld. umbels, large ovate bracts and thick-walled fruits. The following varieties look very distinct superficially:—

Var. *α*. Leaves 1·5—2·5" diam., very villous before expansion (the margins are rolled inwards in bud). Petioles 1—4·5". Peduncles up to 1" long. Bracts pink and pubescent when in flower. A form of this has true compound umbels with the rays ·25" long and bracts 2—3 lanceolate-ovate! Fruit white.

Chota Nagpur! Fl., Fr. Nov.—Jan.

Var. *β*. Leaves under 1" diam., less villous. Petioles ·5—1". Peduncles 2—4 under ·5". Fruit reddish.

Mountains of Orissa! Fl., Fr. May.

2. *H. rotundifolia*, Roxb.

A much more delicate plant than the last species, though somewhat resembling the last variety of that species. Leaves membranous distinctly 5—7-lobed or -lobulate with the lobes or lobules crenate; rarely exceeding ·7" diam., with scattered short hairs beneath. Petioles ·5—1·5" very slender. Peduncles glabrous ·1—·75" long, 10—15-flowered with very minute bracts, flowers sessile. Fruit somewhat compressed, angled from the prominent primary ridges, glabrous, ·08" with hard thin pericarp.

Higher hills of Chota Nagpur. Neterhat, near streams, elev. 3000 ft.! Fl., Fr. r.s.

2. BUPLEURUM, L.

Glabrous with entire, often grass-like leaves and small yellow flowers in compound umbels with the bracts and bracteoles foliaceous, setaceous or 0. Sepals 0. Petals obovate, emarginate. Fruit laterally compressed somewhat constricted at the commissure with terete or sub-pentagonal cocci and distinct rarely obscure primary ridges, vittæ 1—3 between the ridges, rarely 0 or many. Seed terete, rarely slightly grooved on the inner face.

Bracts 3—5, ·15—2", bracteoles, exceeding the pedicels

Bracts 0—2 under ·15". Bracteoles not half as long as the very slender pedicels

1. *mucronatum*.

2. *falcatum*,
var. *biharensis*.

1. *B. mucronatum*, W. & A.

A tall much-branched herb (up to 6 ft.) with often flexuous stem, grass-like leaves up to 6" long often mucronate at the tip, small yellow fls. in much paniced umbels, 3—5 conspicuous lanceolate bracts ·15—·2" long and bracteoles exceeding the pedicels and carpels. Carpels elliptic or oblong.

Higher mountains of Chota Nagpur. Sarguja, *Clarke*; Bistrampur, *Prain's Coll.* Fl., Fr. Oct.—Nov.

Leaves often much attenuate towards the base and sometimes sub-obtuse scarcely amplexicaul, primary nerves between midrib and not very prominent margin 2—3 rarely 4.

2. B. falcatum, L. Var. *biharensis, Haines.*

An erect slender not much branched herb up to 3—4 ft. with grass-like leaves 5—6" long by .3" broad acuminate at the tip, small yellow fls. in umbels with 1—2, or 0, inconspicuous bracts up to .15" long and bracteoles 4—5 lanceolate cuspidate not half as long as the .15—2" long very slender pedicels. Pedicels 4—7 rather exceeding the .15" long narrowly oblong carpels.

Higher mountains of Chota Nagpur. Neterhat! Fl., Fr. Sept.—Jan.

Cauline leaves slightly narrowed to the amplexicaul base with a prominent white margin and 4 primary nerves between midrib and margin.

This differs from the type which is a Himalayan plant in the short bracteoles and long pedicels, which in the type are less than half the length of the fruit.

3. CARUM, L.

Annual or perennial with pinnate to decomposed leaves and compound umbels with few or many bracts and several to many bracteoles. Flowers white or pink polygamous, outer usually sterile often with radiant petals. Sepals small or 0. Petals retuse or emarginate. Fruit ovoid ellipsoid or oblong, laterally compressed and constricted at the commissure (didymous), cocci glabrous, papillose or muricate isodiametric, sub-pentagonal, plane on the inner face with slender conspicuous or obscure primary ridges, 1-vittate between the ridges. Seed terete or slightly dorsally compressed, plane or slightly grooved on the inner face.

A. Ovary (hypanthium) glabrous or pubescent. Rays 3—12.

L. ternately divided, segments forked or again ternate, linear to lanceolate. Rays 3—6 glabrous. Fruit dotted or hispidulous

As in *stictocarpum*, but fruit hispid, .08—1"

L. 2—3-pinnate, segments linear to filiform. Rays 4—12.

Ovary pubescent, fr. muricate sub-hispid.

B. Ovary very villous. Rays 18—30, villous-pubescent

1. *stictocarpum*.

2. *Roxburghianum*.

3. *copticum*.

4. *villosum*.

1. C. stictocarpum, Clarke.

A herb 1.5—2 ft. high with many slender leafy branches and 1—2-pinnate leaves with the pinnae and their segments usually 3 only but 5 on the lower leaves, ultimate segments linear-lanceolate glabrous. Fls. minute, white or pinkish in many small umbels with usually 3—6 slender rays .5—2" long, rarely rays up to 12 (*Clarke*), bracts linear-setaceous to linear-lanceolate 6—8 with scarious ciliate margins. Ovary pubescent or (var. *hebecarpa, Clarke*) scarcely puberulous. Frt. under .06" shining yellow with microscopic dots or in var. *hebecarpa* up to .08" and hispidulous.

This I have found throughout the Higher Vindhyan range from Pachmari, through the Balaghat plateau to the Mountains of Bilaspur, and it probably enters

our area but has not been seen in flower or fruit there. The western form has nearly glabrous fruits but the eastern one is *Clarke's* variety *hebecarpa* which passes into the next species. Fl., Fr. Oct.—Feb.

2. *C. Roxburghianum*, Benth. Ajmud, H.

A slender plant 1—3 ft. high, much branched, the leaves cut into slender linear-lanceolate or obtuse often lobed segments. Rays slender usually 4—5. Pedicels 6—14. Ovary pubescent. Fruit densely hispid-pubescent .08—1".

Kishenganj, Purneah, *Kurz!* Fl. Sept. to March. Fr. April. Cultivated.

This, as *Clarke* says, is probably only a cultivated form of the last. It differs only in the fruit which is more distinctly ridged and more pubescent. The fruit is used in curries and as a carminative medicine.

3. *C. copticum*, Benth. Ajowan, H.

A very slender plant 1—2 ft. high minutely pubescent or glabrescent, with 2—3-pinnate leaves, the ultimate segments very slender linear or filiform. Bracts several, rarely 0, sometimes divided, linear. Rays usually about 10 slender .5—1.5", pedicels 6—20 more or less pubescent, bracteoles 3—5 small linear. Fruit ovoid .08" muricate or densely papillose-hispid, ridges usually distinct making the cocci sub-pentagonal.

Sahebganj, *Kurz!* Cultivated. Fl. Feb.—May. Fr. May.

The seeds have an aromatic smell and warm pungent taste. They are used as spices and as a carminative. *Nadkarni* states that the plant is a source of Thymol.

4. *C. villosum*, Haines (Journ. As. Soc. Beng., xv, No. 7, pl. ix).

Stems 2.5—3 ft., pubescent, very leafy below. L. lower 2—3-pinnate and pinnatifid; upper 2-pinnate ovate, ultimate segments narrow-oblong or cuneate and lobed, minutely pubescent above, puberulous on the nerves beneath, segments or lobes mucronulate. Umbels 2" diam., very long peduncled dense-flowered. Rays 18—30 villosely-pubescent .5—8". Bracts about 10 linear .2—3". Pedicels 25—30, .1—1.5". Bracteoles about 10, .1" long filiform. Hypanthium densely villous. Calyx obsolete. Petals white .03—04" not including the long inflexed tip, thinly pilose. Disc flattened above, 2-lobed. Styles long slender.

Sandstone Hills of Ramnagar, N. Champaran! Fl. Dec. Root rather woody and apparently perennial.

The fruit is unfortunately not known, so no Latin description of the species has yet been published.

4. PIMPINELLA, L.

Biennial or perennial herbs with the first year's leaves sometimes simple, cauline leaves 1—2-pinnate or decomposed but sometimes simple (on the same plant and heteromorphous). Bracts few or 0, bracteoles usually linear sometimes 0. Flowers 2-sexual or polygamous. Sepals minute or 0. Petals with a long inflexed point. Fruit usually didymous, laterally compressed, ovate or ovate-oblong. Cocci terete or sub-pentagonal, plane on the inner face, ridges slender, obscure or prominent, vittæ 2—3 in the furrows. Seed with inner face plane or nearly so.

A. Leaves sub-similar. Disc 0.

L. 3—7-foliolate, i.e. 3-foliolate or with one pair of 2—3-foliolate pinnæ. Bracts 0

1. *Heyneana*.

B. Radical and sometimes lower cauline leaves 1—3-foliolate with very large ovate-lanceolate lfts. Upper different. Disc prominent.

Rays glabrous, bracts 0

2. *monoica*.

Rays hispidulous-pubescent. Bracts several

3. *bracteata*.

1. *P. Heyneana*, Wall.

A slender erect branched herb 1—3 ft. high with glabrous striated stem and 1—2-ternately compound leaves, usually orbicular in outline. Fls. minute in leaf-opposed umbels 1·5—3" diam. Bracts 0, bracteoles 0—1, rarely 2 setaceous, ·25" or less long. Fruit didymous, broader than long, glabrous ridges slender, primary often pale and conspicuous when dry.

Damp places under shade, Chota Nagpur, frequent! Fl. Oct. Fr. Dec.—Jan.

Lower petioles about 2" long. Lfts. rarely 2" long, lanceolate or ovate-lanceolate, sharply deeply often doubly serrate, sparsely puberulous both sides. Peduncles 1·5—4". Rays 4—14, ·5—1·5" long with 6—10 unequal glabrous pedicels ·1—·5". Cocci ·08", vittæ about 8.

2. *P. monoica*, Dalz.

A biennial herb 3—4 ft. high with striate stems very copiously corymbosely branched. First year leaves radical 3-foliolate with ovate-lanceolate cordate leaflets, cauline leaves of second year pinnately 3—5-foliolate, lfts. ovate-lanceolate acuminate spinulosely-serrate, upper linear with linear lobes. Umbels 1—2" diam. very numerous terminating all the branches with small white flowers *without bracts*. Bracteoles 0—2. Frt. minutely papillose ovoid compressed ·07" long. Carpels each with 3 distinct primary ridges with 2 vittæ between, sub-pentagonal with plane inner face.

Highest mnts. of Chota Nagpur. Ranchi and Palamau 2500—3000 ft.! Neterhat! Fl. Nov.—Dec. Fr. Dec.—Jan.

L. glabrous or with short hairs both sides. First year's leaflets 3—5" doubly crenate-serrate, crenatures sub-spinulose, base of leaflet often very oblique 5-nerved, petioles and petiolules long. Such leaves are occasionally found on the lower part of the stem in the second year. Upper petioles reduced to sheaths with ciliate margin. Rays of umbel glabrous (pubescent in plants outside our area) 8—13 slender ·5—1". Fls. ·06—·08" diam.

3. *P. bracteata*, Haines (*Journ. As. Soc. Beng.*, xv, No. 7, p. 314).

A stout biennial 3—4 ft. high with striate stems branched above. First year's leaves much as in last but more pubescent and crenatures mucronate. Cauline leaves (of second year) lower 3—5-foliolate with ovate leaflets like the radical, leaflets of upper lanceolate, uppermost pinnatifid with linear-lanceolate lobes ending in sub-spinulose tips. Umbels 1—2" diam. with about 6 linear bracts ·2—·5" long and 3—5 bracteoles ·1—·2" long. Fruit minutely papillose, glabrescent.

Highest mnts. of Chota Nagpur. Ranchi and Palamau 2500—3000 ft.! Neterhat! Fl. Oct.—Dec. Fr. Jan.

Stems and leaves pubescent or hispidulous both sides esp. on the nerves. Radical and lower cauline leaflets sometimes sub-orbicular. Lateral leaflets sometimes falcate, lateral petiolules 0—6". Uppermost petioles reduced to sheaths. Rays of umbel 8—12 pubescent 5—8' long. Fls. .08—1" diam. Pedicels 2—3".

5. PYCNOCYCLA, *Lindl.*

Perennial herbs with rush-like few-leaved stems. Leaves pinnately dissected with narrow segments. Umbels short-rayed or capitate with many small bracts and bracteoles. Flowers only one perfect central in each umbellule, sessile, surrounded by several pedicelled males. Hypanthium hairy, sepals small lanceolate, often unequal. Petals obovate emarginate hairy. Fruit oblong lanceolate hairy, one carpel often abortive, surrounded by the inflated pedicels of the barren flowers. Fruit cocci with inner face deeply grooved, primary ridges filiform, vittæ numerous, very slender, scattered. Seed lunate or with a T-shaped groove on the inner face.

1. *P. glauca*, *Lindl.*

An interesting Umbellifer with woody root-stock, rush-like stems 8—18" high (including peduncle), terete, striate and glaucous, ultimate segments of the leaves filiform sub-terete 5—3" long. Flowers white or purplish collected in heads resembling those of a Scabious or Composite. Heads about 5—1" diam. terminal on long pubescent peduncles. About 7—8 males or neuters envelope and enclose one fruit which attains about 65" long.

Grass lands of the Chota Nagpur plateaux. Tongo (Ranchi) *Bressers!* Tagore's Hill (Ranchi), *Carter!* Neterhat! Fl., Fr. May—Nov.

6. SESELI, *L.*

Leaves 2—3-pinnate or twice 3-partite. Bracts few or many, sometimes pinnate, bracteoles several or many. Sepals minute or 0. Petals emarginate pink or white. Fruit oblong, ovate or spherical, not laterally compressed but usually widest at the commissure. Cocci with inner face plane, rarely concave, ridges strong, often hairy, vittæ one in each furrow. Disc not prominent on the fruit. Seed semi-terete.

1. *S. indicum*, *W. & A.*

A carrot-like herb with spreading and erect striate very pubescent branches from the root, 12—18" high. Radical leaves oblong or oblong-lanceolate 4—7" with the petiole, 2-pinnate or pinnae pinnatisect 2—3 prs., larger 1.5" with ovate pinnatifid pinnules and lobulate obtuse apiculate segments, cauline similar but smaller and more crisped, all hairy especially beneath with short white hairs. The fruit in this species is not always widest at the commissure, primary ridges strong, densely glochidiate.

Not common. Mahanadi River bed and other sandy places, Angul! Fl., Fr. Feb.—April.

Peduncles leaf-opposed 2—4". Flowers white or pink 1" diam. in dense umbels 1—2.5" diam. with about 15 rays, .8" (somewhat longer in fruit) long, hairy, bracts

·25—·3" spreading in flower, reflexed in fruit, 8—9 linear-subulate green with scarious margins, bracteoles similar but smaller. Pet. broadly ovate with long inflexed tip.

In Upper India the ridges of the fruit are very strongly developed and *glabrous*, and so they are in *Roxburgh's* figure.

7. CENANTHE, L.

Herbs growing in wet places, sometimes creeping or stoloniferous. Leaves 1—3-pinnate. Umbels with 0 or few bracts and several linear bracteoles, sometimes radiant with polygamous flowers. Sepals small or outer m.s. Petals emarginate or with long inflexed point. Fruit glabrous, globose or longer than broad with broad commissure. Cocci semi-terete with inner face plane, lateral primary ridges large and corky, others subequal or very small or obsolete, vittæ 1 in the furrows.

More or less decumbent, stoloniferous. Peduncles 3—6" . 1. *stolonifera*.
Erect without stolons. Peduncles under 3" or umbels sessile 2. *benghalensis*.

1. *Ce. stolonifera*, Wall.

A glabrous herb with stout fistular more or less decumbent stems about 2 ft. long with long stolons, 1—2-pinnate leaves with sheathing bases and leaf-opposed umbels 3—4" diam. of small white flowers. Peduncles 3—6" long or more.

Marshy places and river banks. Neterhat 3000 ft. Fl. May—June.

Lower leaves with 5—7 pairs of pinnæ, petioled above the sheath, upper leaves sessile on the sheath which has scarious margins, radical leaves (with petiole) about 1 ft. long, pinnæ with 3—5 leaflets; lfts. lanceolate or rhomboid-lanceolate with cuneate base, incised or serrate. Bracts 0. Rays many ·5—1·5". Bracteoles about 9 linear, shorter than the pedicels. Calyx with 5 subulate teeth nearly as long as ovary, which is slightly laterally compressed without prominent ridges. Pet. white with a long inflexed cusp. Anthers pale pink. Inner fls. male, outer female with longer erect styles. Cocci ·12" long. Seed terete.

2. *Ce. benghalensis*, Benth.

A less stout plant than the last, without stolons. Lfts. generally smaller only ·25—1" long, of the lower leaves ovate, of the upper lanceolate. Peduncles short or 0. Rays of umbel few, about 4—6 only, usually under ·75" long. Cocci ·1" or less.

Sides of muddy rivers. Purneah.

8. FENICULUM, Adans.

Tall glabrous herbs with pinnately-decompound leaves, the ultimate segments linear or capillary. Bracts 0, bracteoles few small linear or 0. Sepals 0. Petals yellow emarginate with a short obtuse point. Disc large, lobes conical. Fruit oblong or somewhat ovoid-oblong, sub-terete with broad commissure, primary ridges stout sub-equal, furrows 1-vittate. Seed furrowed, flat or concave on the inner face.

1. *F. vulgare*, Gaertn. Syn. *Anethum* Panmori, *Roxb.*; Panmohari, *Beng.*; Saunf, *H.*; Fennel.

Perennial, or in India, annual, 2—3 ft. high, glaucous, with a characteristic aromatic smell, stems terete, striate, polished, almost solid.

(*Roxburgh* says *not* striated as in *Dill* and *Sowa*.) Leaves divided into filiform segments, ultimate .5—1.5" long with no petiole above the large sheath or up to .5". Rays 10—25, 1—1.75" long with 10—30 pedicels. Stamens much longer than the petals. Ovary oblong. Fruit variable in length, usually about .2—3" oblong with strong ridges and a conspicuous vitta between each running the whole length of the carpel. There are also two vittæ on the inner face.

Often cultivated.

The striking, more than superficial resemblance of this plant to *Peucedanum graveolens* justified *Roxburgh* in placing them in one genus, and almost suggests that the taxonomic value of the shape of the fruit has been here carried too far in so widely separating the two species. Except in fruit the Indian *Fennel* and *Dill* more closely resemble one another than do the Indian and European Fennels.

9. LIGUSTICUM, L.

Perennial with 1—3-pinnate or twice 3-partite leaves, ultimate pinnæ large. Bracts 0—many, bracteoles many. Sepals 0. Petals obovate emarginate, white. Fruit ovoid or ellipsoid with broad commissure, cocci plane on the inner face, dorsally sub-compressed with very prominent primary ridges which are often sub-alate, dorsal furrows 1—3-vittate (on same plant), lateral furrows usually 3-vittate, commissure with several vittæ.

1. *L. alboalatum*, *Haines* (*Journ. As. Soc. Beng.*; xv, No. 7, p. 314).

A Parsley-like stout herb 3—4 ft. high with fistular striate stems and long-peduncled terminal umbels 2—3.5" diam. of small white flowers giving place to whitish conspicuously 10-ridged or -winged fruit .2" long much dorsally compressed.

Wet places, Neterhat Plateau, 3000 ft. Fl. May. Fr. June.

Rootstock large white. Radical leaves 4—10" long excluding the petiole which is as long, oblong-lanceolate in outline, 2-pinnate with the ultimate segments pinnatifid or inciso-serrate with linear-lanceolate lobes or teeth; pinnæ 5—7 prs. 1—3" long, lobes or teeth aristulate, nearly glabrous; cauline leaves often sessile on the large membranous sheaths, pinnæ with narrow segments, often lanceolate or lobed. Peduncles pubescent above. Bracts 0—2 linear. Rays over 12, hispidulous on the upper surface, .7—1.25" long. Bracteoles about 9 linear unequal. Petals .05" obovate with keeled face and inflexed tip. Pollen blue. Ovary at first somewhat laterally compressed with strong ridges. Fruit .17" broad, lateral ridges alate and 3 dorsal ridges sub-alate. Vittæ 1—3 in the dorsal furrows.

10. PEUCEDANUM, L.

Perennial rarely annual herbs with 1—3-pinnate or 1—3-partite leaves, ultimate segments lanceolate or ovate, rarely (*P. graveolens*) filiform, sometimes toothed. Rays of umbel numerous, bracts various or 0, bracteoles many—0. Fls. often polygamous, yellow (in our species) or white. Sep. 0 or small. Petals obovate, emarginate or 2-fid. Ovary glabrous rarely pubescent. Fruit much dorsally compressed, ellipsoid, oblong or orbicular, more or less winged on the lateral ridges which are closely appressed face to face, other ridges little elevated fine or obsolete, dorsal furrows 1-vittate, lateral 1-rarely 2-vittate. Seed much dorsally compressed, inner face plane.

A. Leaves cut into filiform segments

1. *graveolens*
(*sowa*).

B. Leaf segments not filiform.

1. Ovary glabrous.

Cauline leaves pinnate, lfts. entire
Lower cauline leaves 2-pinnate, lfts. deeply serrate

2. *dhana*.
3. *nagpurensis*.

2. Ovary pubescent. Lfts. ovate inciso-serrate

4. *sativum*.

1. **P. sowa**, *Kurz.* Syn. *P. graveolens*, *Benth.* (in part); *Anethum Sowa*, *Roxb.*; Vern. Sowa, *H.*; Salpha, sowa, *Beng.*; Dill.

A graceful annual 2—3 ft. high with striated darker and lighter green stems covered with a whitish bloom and decomposed leaves cut into filiform segments. Fls. yellow in umbels 1·5" diam., often enlarging to 3·5" diam. in fruit. Pedicels 1—2" long, slender. Peduncles 1—5".

Often cultivated. Fl., Fr. c.s.

Perhaps not more than a tropical variety of *P. graveolens*, differing only in the more delicate growth, in the fruit being somewhat smaller .12—·14" by .07", the mericarps more convex, marginal wings narrower and firmer and the ribs more prominent.

It exceedingly resembles the *Fennel* both in foliage and flower, and apart from the hypanthium and fruit good discriminating characters are difficult to define. The ultimate leaf segments are usually only .1—·5" long, those of *Fennel* usually .4—1·5" long. Hypanthium of *Fennel* in full flower .05—·06" soon elongating to .15—·2" in fruit, with conspicuous raised ribs (ridges); in *Dill* the flowering hyp. is .02—·03" elongating to .12—·14", and except the marginal wings the ribs or ridges are not obvious till the seed is nearly ripe and are then scarcely raised.

The seeds are used in medicine and in cookery.

2. **P. dhana**, *Ham.* Var. *Dalzellii*, *Clarke*.

A glaucous glabrous herb with flowering stems 1—2 ft., but with leaves chiefly radical 3-partite or simply pinnate with 3—5 thick oblong to lanceolate 3-nerved leaflets 2—3·5" by .3—·7". Flowers small yellow in umbels with unequal and often very long rays attaining 5" in fruit. Cocci ellipsoid .25"—·35" by .25".

High plateau lands of Chota Nagpur! Fl. March—May. Fr. May—June.

Leaflets entire (rarely toothed?). Rays of umbel 5—10, some attaining 5" long in fruit. Bracts 3—6 linear acuminate. Pedicels numerous. Bracteoles 4—8. Sep. minute triangular or obsolete. Disc yellow and glandular. Fil. long. Ripe carpels compressed, usually .25—·3" long, broadly oblong, laterally winged, with 3 fine distinct narrow ridges on dorsal face, slightly emarginate both ends.

The typical *P. Dhana* has more compound leaves with narrower leaflets; variety *Dalzellii* is described by *Clarke* as having leaflets shortly oblong or even sub-orbicular.

3. **P. nagpurensis**, *Prain.* Syn. *P. glaucum*, *DC.*, var. *nagpurensis*, *Clarke*; Epondom, oponom, *K., S.*; Trio-singhi, *Birja*.

An erect stout herb 3—4·5 ft. high with a fusiform root and striate polished stems. Leaves twice ternately compound with leaflets on the lower leaves very large ovate acuminate and strongly serrate, upper lanceolate to linear and uppermost occasionally filiform. Flowers green or brownish, petals oblong-lanceolate with an inflexed tip. Cocci elliptic oblong .3—·4" long, broadly winged, the wings projecting both ends, dorsal ridges fine but distinct.

In the forests, frequent in the mountains of Singbhum, Palamau and Manbhum! Common in Koderma (Hazaribagh). Neterhat! Angul, *Chattarjee!* Fl. Oct.—Nov. Fr. Dec.

Leaflets of lower leaves 3—6" long by 2—3.5" broad, with straight or rounded or, in terminal, sometimes rhomboid base, nerves strong, tertiaries reticulate, impressed above, raised beneath. Lower petioles 8—12" long. Umbels 2—3" diam. in flower or 4" in fruit, more regular than in *P. dhana*, rays about 12, .25—1.5", bracts 0—1 oblong with a long setaceous point, .3". Pedicels 14—25, bractcoles 3—4, setaceous, .25—3", spreading and reflexed in fruit. Sepals short truncate mucronate. Stamens often only 2 perfect.

The stems are used for shepherds' pipes or flutes (rotu, K., trio, *Birja*). The root is used as a stomachic.

4. *P. sativum*, *Benth.*, is the Parsnip, only cultivated, I believe, in the gardens of Europeans.

11. CORIANDRUM, L.

Only one species.

1. *C. sativum*, L. Dhaniya, H.; Coriander.

An annual slender-branched glabrous herb with a disagreeable odour, with pinnately decomposed leaves, leaflets of lower leaves ovate lobed and crenate, upper linear. Flowers white or pinkish, outer radiant in compound umbels with few, 5—10, rays, bracts 0, bractcoles few filiform, sepals acute, petals emarginate with inflexed point. Fruit globose with the 4 secondary ridges on each coccus somewhat stronger than the 5 primary which are often inconspicuous wavy lines, vittæ obscure, solitary under each secondary ridge and two vittæ on the concave commissural surface; diam. of fruit about .2" but rather variable.

Rather widely cultivated in the gardens of Indians and often self-sown. The fruits are much used in curries. They yield Oil of Coriander which is stimulant, aromatic and carminative and is officinal.

12. DAUCUS, L.

1. *D. carota*, L. Gajur, H.; The Carrot.

Small country carrots are largely grown in Chota Nagpur with a white or purplish root very different in appearance from the European garden carrot, which, however, succeeds well in the cold season and on the plateau lasts throughout the hot weather.

The cocci have the four sec. ridges hispid with bristles and the 5 smaller primary with smaller sub-gloccidiate hairs.

FAM. 75. ARALIACEÆ.

Trees or shrubs (never herbs in our area) sometimes scandent, often but little branched, frequently prickly. Leaves always palmately-nerved if simple, usually palmately compound or pinnate, sometimes decomposed, alternate, with stipules more or less adnate to the petiole or 0. Flowers regular, small, sometimes polygamous, in dense umbels, umbels usually racemed or paniced. Calyx superior, reduced to a raised margin with sepals small or obsolete. Petals 5 or 6—7 or more, valvate or sub-imbricate, sometimes calyptrate, inserted with the stamens round or under the margin of an epigynous disc. Stamens as many as and

alternate with the petals.* Ovary inferior, 2—many-celled, styles as many as the cells, distinct or united. Ovules solitary, pendulous in each cell. Fruit coriaceous or drupaceous, one or more cells sometimes suppressed. Seed pendulous, albumen uniform or ruminant. Embryo minute, radicle next the hilum.

- I. Petals lightly imbricate, pedicels jointed.
Shrubs (in our area)† with compound leaves 1. *Aralia*.
- II. Petals valvate.
- A. Albumen uniform.
1. Ovary 2-celled. Cultivated shrub, leaves 2—3-pinnate 2. *Panax*.
2. Ovary 4—10-celled.
- Large climber. Leaves digitate . 3. *Heptapleurum*.
- Small tree. Leaves palmate or digitate . 4. *Trevesia*.
- B. Albumen ruminant. Ovary 2-celled. Small trees.
- Leaves pinnately decomposed . . . 5. *Heteropanax*.

1. ARALIA, L.

Herbs, shrubs or small trees, often hairy or prickly. Leaves alternate or whorled, digitate pinnate or 2—3-pinnate with serrate or nearly entire leaflets, stipulate. Umbels variously arranged. Fls. often polygamo-dioecious. Calyx margin truncate or 5-sepalous. Petals 5 ovate, lightly imbricate in bud. Ovary 2—5-celled with 2—5 styles. Fruit 4—5-celled and angular or subglobose and 2—3-celled. Albumen uniform.

1. *A. armata*, Seem.

A small very prickly unbranched tree or shrub with large 2—3-pinnate hairy leaves 2—3 ft. long with prickly rachis and secondary rachides. Stipules 1—2" intrapetiolar. Lower pinnæ about 9" long. Pinnæ about 5 pairs with subsidiary pinnæ or leaflets at their base, lowest pinnæ about 9" long and the next higher pair somewhat longer, pinnules or leaflets softly hairy, about 6 pairs on the longer pinnæ and a terminal, ovate, caudate, 2—3.5" long, petiolules 0—4".

Simlipahar Mountains in Mayurbhanj, above 3000 ft. Fl., Fr. Aug.—Dec.

Lfts. finely serrate. Panicle often 1.5 ft. long, upper part and pedicels pubescent, bracts caducous (or 0?), pedicels .5—75" unequal. Fls. about .1" diam. without the petals which are usually reflexed and .4" long, white. Fr. .2" long ellipsoid or sub-globose, sharply 5-angled (at least when dry).

Several species of so-called *Aralia* are grown in gardens for their ornamental foliage, but these plants sometimes belong to other genera. The flowers are usually greenish and insignificant from a horticultural standpoint.

2. PANAX, L.

Shrubs or trees with pinnate or digitate or 2—3-pinnate leaves and entire or serrate leaflets. Umbels paniced, pedicels jointed under the

* Numerous in *Tupidanthus*, a small tree sometimes seen in gardens.

† The above Key is only applicable to the genera so far as they are represented in Behar and Orissa, e.g. *Aralia* also contains herbs and small trees and *Heptapleurum* contains large trees. The limits of the genera have, however, been very considerably changed by different authors.

flowers which are often polygamous. Calyx-limb 5-toothed or nearly entire. Petals 5 valvate. Ovary 2- rarely 3-celled, styles distinct. Fruit with as many seeds as cells.

N.B.—*Panax* as here defined is the genus of that name in the *Genera Plantarum* and *F.B.I. Harms in Nat. Pflanz. Fam.*, taking the Ginseng section of *Aralia* as the true genus *Panax*, includes the Linnean *P. fruticosum* in the genus *Polyscias*.

1. ***P. fruticosum*, L.** Syn. *Polyscias fruticosa*, *Harms*; *Nothopanax fruticosum*, *Miquel*.

A shrub with 2—3-pinnate leaves and toothed leaflets. Fls. very small yellow in umbels 3" diam. Calyx .04" long, corolla caducous. Styles 3 recurved. Fr. .15".

Found as a pot plant in nearly every Indian verandah. Native of Java.

The leaves are excessively variable. In var. *multifidum* they are decomposed and very finely out.

2. ***P. cochleatum*, DC.**, with simple often spoon-shaped leaves belongs to the genus *Nothopanax*, which is distinguished by the leaves being simple, lobed or digitate.

NOTE:—A very common plant in Indian verandahs and gardens with simply pinnate leaves and leaflets with a white margin may also be a *Panax*. I have never seen it in flower.

3. **HEPTAPLEURUM, Gaertn.**

(*Schefflera*, *Forst.*, Section *Heptapleurum*, *Harms in Nat. Pflanz. Fam.*)

Trees or large shrubs, sometimes scandent, without prickles. Leaves digitate with coriaceous entire or sub-entire leaflets, rarely uni-foliolate or twice digitate. Umbels paniced or in branched racemes, bracts woolly, pedicels not jointed under the flower. Flowers 5—10- usually 5—6-merous (including the carpels). Style very short clavate or scarcely developed, the broadly conical top of the ovary being apparently stigmatic. Fruit sub-globose, 5—6-angled. Seeds compressed, albumen uniform.

1. ***H. venulosum*, Seem.** Syn. *Schefflera venulosa*, *Harms*; *Sukri-raya*, *Sukrirun*, *K.*; *Sunumjur*, *S.*; *Ban-simar*, *Beng.*; *Jari*, *Or.*; *Saprunia* (*Bonai*, *Cooper*).

A large climbing or epiphytic shrub attaining 3 ft. girth with digitate 5—7-foliolate leaves and yellow flowers in paniced umbels.

Climbing on trees and rocks in the more humid parts of the province or in the mountainous districts, frequent. Throughout Chota Nagpur ascending to the top of Parasnath! Santal Parganas! Puri! Mayurbhanj! Bonai, *Cooper*! Angul, common! Sambalpur! Fl. May—June. Fr. r.s.

Clarke says (Journal L.S., xxi, 252): "I noticed that *Heptapleurum* commences its life here (i.e. Parasnath) as a scandent epiphyte, but subsequently reaching the ground, it grows to a large size as a tree, and shows no signs of its early history."

Lfts. unequal 2—6" by 1—2" elliptic-oblong acuminate glabrous rather coriaceous, sec. n. 3—4 rather strong but not much stronger than intermediate, tertiaries reticulate. Petioles 3—12". Petiolules 1—4" long. Stipules connate within the petiole. Panicles glabrous. Umbels 3—4" diam. racemed on the 5—8"-long

branches of the short panicle. Bracteoles 0. Calyx truncate. Petals 5—6, 3-nerved. Style 0.

Var. **Roxburghii**. Syn. *Schefflera Roxburghii*, *Gamble*; *Aralia digitata*, *Roxb.*

This is distinguished from *H. venulosum* by the less leathery leaves, main nerves scarcely more prominent than the secondary and reticulations, not very oblique, about 60 degrees with the midrib, panicles with a rather long rhachis (*Gamble*), whereas *venulosa* has the main nerves far the most prominent, very oblique, about 30 degrees with the midrib, panicles with a short rhachis (teste *Gamble*).

Perhaps also the petals are more caducous and narrow-oblong compared with the ovate petals of *venulosa*, but although one of the two species or varieties is very common, neither has been sufficiently collected to indicate their relative distribution. A specimen from Parasnath summit has been named *Roxburghii* at Kew. Its leaflets are broadly elliptic and venulose.

4. TREVESIA, *Vis.*

Shrubs or small trees, often prickly and sometimes steliately hairy. Leaves palmate or digitate or the petiolules united by a foliaceous wing, stipules intrapetiolar or obsolete. Flowers polygamous, rather large for the family, in panicked umbels. Calyx-margin entire or toothed. Flowers 8—12-merous, ovary with as many cells as the petals, styles united into a small boss or short column. Fruit ovoid. Seed compressed, albumen uniform.

1. *T. palmata*, *Vis.*

A small erect scarcely-branched soft-wooded prickly tree 10—20 ft. high with the young parts covered with a reddish tomentum. Leaves large sub-orbicular, palmate with the leaf lobes deeply gashed or with sharp lanceolate lobules which are rather shallowly serrate. Flowers white in large drooping panicles composed of numerous umbels 2—4" diam.

Valleys north of Betriah and in the Ramnagar Hills! Purneah, near the northern boundary! Valleys in Singbhum (e.g. *Jui gara* in the Leda Forest), very rare! Fl. Jan.—March. Fr. May—June.

Leaves 1—2 ft. diam. with cordate base, divided about or rather more than half-way down into about 9 lobes, beneath with stellate tomentum gradually glabrescent. Petioles 2—3 ft. prickly towards base. Panicles 18" long. Bracts about 1". Fls. 25—40 in an umbel, buds 4" diam., the ribbed corolla 8—10-petalous often calyptrate, calyx with wavy margin. Peduncles of umbels attain 4". Fruit broadly oblong-ovoid, truncate or sub-globose, 65" diam., ribbed when dry.

5. HETEROPANAX, *Scem.*

An unarmed small tree with very large pinnately decomposed leaves and large panicles with the umbels racemose on the branches, bracts small ovate persistent, pedicels not jointed under the flower. Fls. polygamous, calyx-margin nearly entire. Petals and stamens 5. Ovary 2-celled with 2 distinct styles. Fruit much laterally compressed, 2-seeded. Seeds compressed, albumen ruminated.

1. **H. fragrans**, *Seem.* Rengebanam, K. (the name given to *Oroxylum indicum*, which it superficially resembles).

An erect small tree up to 2 ft. girth with enormous tri-pinnate leaves 3—4 ft. long and 2—3 ft. across, elliptic or ell.-ovate glabrous entire leaflets 3—7" long, or the terminal attaining 9" by 4.5". Flowers small yellow in umbels racemed on the branches of an erect panicle 18"—2 ft. long which is covered with a deciduous rusty stellate scurf or tomentum. Fruit closely resembling that of an Umbellifer but not splitting into mericarps, strongly compressed at right angles to the septum, .4" diam.

Rather frequent in the more humid districts or among mountains. Champaran! Chota Nagpur, frequent in valleys near streams and on the cool sides of hills! S.P., very common on north aspects on the trap of the Rajmahal Hills! Angul! Fl. Dec. Fr. Feb. Evergreen.

The pinnae are sometimes 4—5-nate together with a single leaflet at the nodes of the main leaf rachis. Lfts. 1—7 on the ultimate pinnules with base usually somewhat oblique and rounded, apex shortly acuminate. Styles spreading.

Var. **serrata**, *Haines.* Lfts. ovate-lanceolate caudate, sharply, most sub-spinulosely, serrate. Bark rugose, blaze soft white with indistinct spots.

Near streams in the mountains, Southern Range, Palamau!

FAM. 76. CORNACEÆ (Tribe Alangioides).

Trees or shrubs, sometimes thorny, with alternate entire or lobed often palmately-nerved exstipulate, sometimes leaves with cystolith cells. Flowers white or cream-coloured, regular, 2-sexual in axillary fascicles or cymes. Calyx superior, usually feebly developed, reduced to a marginal rim on the hypanthium or with 4—10 teeth. Petals 4—10 linear or somewhat lanceolate, valvate in bud, free or somewhat connate at the base. Stamens epigynous as many as the petals or 2—4-times as many, sometimes adnate and inserted with them between the calyx-rim and the disc at the base to the petals, connective elongate and anthers narrow adnate. • Disc epigynous swollen. Ovary completely inferior and adnate to the hypanthium 1—2-celled. Style inserted in the middle of the disc, with usually 2-1—2-celled. Style inserted in the middle of the disc, with usually 2-seldom 3-lobed stigma, the lobes lobulate at the margin. Ovule 1 pendulous from the top of each cell, compressed, micropyle superior usually lateral. Fruit a drupe crowned by the calyx usually 1-seeded. Seed with thick testa and fleshy albumen, cotyledons foliaceous palmately-nerved, thin with cordate base, radicle long terete.

1. **ALANGIUM**, *Lamk.* (including *Marlea*, *Roxb.*).

In the *F.B.I.* *Marlea* is separated from *Alangium* by the characters of having stamens equalling the number of petals and by the flat cotyledons, whereas the cotyledons of *Alangium* were said to be crumpled

and the albumen ruminant. As noted in my *Flora of Chota Nagpur* the cotyledons of *A. Lamarckii* are flat and the albumen *not* ruminant and I therefore follow *Harms* in bringing our species of *Marlea* under *Alangium*, the characters of which are as above.

Leaves oblong or elliptic. Fls. fascicled
Leaves broad, often lobed. Fls. in cymes

1. *Lamarckii*.
2. *begoniæfolium*.

1. A. Lamarckii, Thw. Syn. *A. hexapetalum*, Lamk. & DC.; Ankol, K.; Dhela, S., Kharw.; Akola, H.; Ankula, Dolanka, Ur.; Akarkanta, Beng.; Kumri, Mal P.

A bushy tree, usually small and thorny, with oblong, oblong-lanceolate, or elliptic leaves 3—6" by 1—2" pubescent all over when young. Flowers m.s., white in axillary fascicles or from the axils of fallen leaves with 5—10 petals 5—9" long, recurved or revolute after expanding. Stamens 20—30 very villous below. Fruit 3—75" sub-globose or ellipsoid, black, succulent with bony endocarp, crowned by the calyx, appearing ribbed when dried.

A common tree but rather locally abundant. It prefers the well drained sides of nalas but is often found in waste ground. Champaran, in mixed forests near rivers! Extending south and south-east to Monghyr and Santal Parganas. Common in Chota Nagpur! Puri! Mayurbhanj! Angul! Orissa States, common, Cooper! Sambalpur, local! Fl. March—May. Fr. June—July. More or less leafless at the time of flowering. New leaves appear May—June. Some trees are very beautiful when covered with their masses of sweet-scented flowers, others flower sparsely.

Attains 4 ft. girth in favourable localities (near rivers) but no great height, rarely 30 ft. Bark light-coloured, somewhat flaking, blaze cream-coloured. Leaves with sometimes unequal base which is 3-nerved or the first pair of sec. n. is close to the base, other sec. n. about 5 and tertiaries more or less parallel, upper surface with pubescent nerves, beneath sparsely hairy and with gland pits or tufts of hair in the nerve axils; when fresh the leaf is also minutely pellucid-punctulate. Petiole .25". Hypanthium usually broadly cup-shaped in flower with 5—6 pubescent teeth. Cotyledons with 3-nerved base.

In Monghyr is a form with leaves over 6" long and ovate-lanceolate, very pubescent beneath.

Dhela wood is strong and is much used for agricultural implements. The bark and root are used in jaundice, the seed for the cure of boils (in Sambalpur). The fruit is eaten.

2. A. begoniifolium, Harms. Syn. *Marlea begoniæfolia*, Roxb.; Timil, Akhani, Nep.

A small thin-crowned tree with spreading long branches on which the large leaves are often distichously arranged. Leaves ovate and entire to sub-quadrate and with large lobes, 4—8" long, young villous, old glabrous or nearly so above, pubescent on the nerves beneath and with tufts of hairs in the nerve axils, basal nerves 3—5. Flowers cream-coloured in 2-chotomous cymes 2—3" long. Calyx minutely toothed, petals 6—8, stamens as many with short stout very villous filaments and long anthers. Fruit broadly ellipsoid 3", not ribbed when fresh, seed slightly grooved, .25", black on both faces with a lateral white band.

Northern Purneah! Fl. June. Fr. Aug. Decid. Jan.—March.

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
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PART IV
GAMOPETALÆ.

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BOTANICAL SURVEY OF INDIA
CALCUTTA

DIVISION II.—GAMOPETALÆ.

FAM. 77. RUBIACEÆ.

Trees, shrubs or herbs, rarely scandent, sometimes thorny, with simple entire opposite or whorled leaves, often with gland-pits in the axils of the secondary nerves, and with inter-petiolar or intra-petiolar usually connate stipules, or leaves whorled without stipules. Flowers small or minute to very large, solitary or in variously formed inflorescences. Ovary inferior closely invested by the hypanthium, which usually bears a toothed or lobed calyx. Corolla gamopetalous, regular, 4—5-merous or rarely lobes up to 12, æstivation various. Stamens usually as many as the petals, sometimes fewer where the petals are more than 5, inserted in the tube or mouth of the corolla, anthers 2-celled, usually dorsifixed, sometimes sessile. Disc epigynous, usually annular or swollen. Ovary usually 2-celled, very rarely 1-celled (*Gardenia*), rarely 3—9-celled. Style simple or cleft. Ovules 1 or more in each cell, usually attached to the septum; on parietal placentæ in *Gardenia*. Fruit various. Seeds with fleshy or horny albumen. Embryo straight or curved, cotyledons usually flat, sometimes semi-terete, radicle superior or inferior.

The germination in those species examined by me is epigeal and the cotyledons are foliaceous and grow considerably. It is noteworthy that interpetiolar stipules are present in the cotyledons in *Ixora*, *Gardenia* and perhaps others.

* Trees or shrubs. (Undershrubs in some, 6, 20 and 21.):—

- I. Flowers collected into dense heads on a globose or somewhat oblong receptacle. Seeds often winged.
 - A. Ovules numerous in each cell.
 1. Hypanthia confluent or connate. Cor.-lobes imbricate 1. *Anthocephalus*.
 2. Hypanthia not connate.
 - a. Cor.-lobes valvate. Receptacle bracteolate. Sepals distinct 2. *Adina*.
 - Sepals 0 3. *Mitragyna*.
 - b. Cor.-lobes imbricate. Receptacle ebracteolate 4. *Nauclea*.
 - B. Ovule 1 in each cell. Hypanthia sometimes confluent.
 - Fruit of free or connate drupels with 4 pyrenes 5. *Morinda*.
- II. Flowers not collected into heads on a globose receptacle (but cymes sometimes capitate).
 - A. Ovules more than 1 in each cell.
 1. Corolla-lobes valvate.
 - a. Fruit baccate. Flowers in terminal corymbose panicles. One calyx-lobe usually white and foliaceous 6. *Mussaenda*.
 - b. Fruit capsular. Flowers in thyrsiform panicles with two foliaceous bracts. Seeds winged 7. *Hymenodictyon*.
 2. Corolla-lobes twisted in bud.
 - a. Fruit capsular small. Fls. small paniced 8. *Wendlandia*.
 - b. Fruit indehiscent. Fls. large or m.s. (exc. *Hyptianthera*).
 - i. Fls. small clustered axillary 9. *Hyptianthera*.
 - ii. Fls. large or m.s.
 - † Bracteoles connate into a calyculus. Fls. in axillary small cymes or fascicles 10. *Diplospora*.

- †† Bracteoles not connate into a calyculus.
 Stigma fusiform.
 ! Unarmed. Fls. in terminal corymbs 11. *Webera*.
 !! Sometimes armed. Fls. solitary, fasci-
 cled or in small cymes.
 Ovary 1-celled, placenta 2-5 12. *Gardenia*.
 Ovary 2-celled 13. *Randia*.
- B. Ovules solitary in each cell.
1. Fruit baccate or drupaceous.
- a. Corolla lobes twisted in bud.
- i. Flowers in terminal corymbose panicles.
 Style not twice as long as tube 14. *Ixora*.
 Style twice as long as tube 15. *Pavetta*.
- ii. Fls. 1-3 sessile terminal, or fls. in axillary
 fascicles 16. *Coffea*.
- b. Corolla lobes valvate. Stamens inserted near
 cor.-mouth. Fruit with 2-many pyrenes.
- i. Flowers in axillary cymes or fascicles.
 Often thorny.
 Ovary 2-celled 17. *Canthium*.
 Ovary 3-5-celled. Calyx 5-toothed 18. *Vangueria*.
 Ovary 3-9-celled. Calyx 3-6-fid. Style-
 arms 3-9 19. *Lasianthus*.
- ii. Flowers in terminal cymes. Unarmed
 under-shrubs.
 Corolla straight 20. *Psychotria*.
 Corolla curved 21. *Chasalia*.
2. Fruit capsular. Shrubs foetid when bruised.
 Erect. Style 5-fid. 22. *Hamiltoniana*.
 Twining. Styles 2 23. *Pæderia*.
- ** Herbs (climbing shrub in *Hedyotis scandens*). Corolla
 valvate in bud:—
- I. Ovules many in each cell.
- A. Petals toothed. Fruit indehiscent. Prostrate herb 24. *Dentella*.
- B. Petals not toothed. Fruit usually dehiscent or of
 cocci.
1. Flowers secund on the cyme branches.
 Sub-succulent herbs. Capsules compressed 25. *Ophiorrhiza*.
2. Flowers clustered or in cymose panicles, not
 secund.
 Seeds angled or plano-convex. Sepals contiguous 26. *Hedyotis*.
 Seeds angled or globose. Sepals remote 27. *Oldenlandia*.
 Seeds peltate boat-shaped, coarsely pitted. Sep.
 remote 28. *Anotis*.
- II. Ovules solitary in each cell.
- A. Leaves not whorled (sometimes apparently whorled
 from the congested axillary shoots). Fruit dehis-
 cent or of 2 cocci.
1. Flowers axillary, clustered.
 Not fleshy. Fruit capsular or of 2 cocci 29. *Spermacoce*.
 Fleshy. Fruit corky, compressed and keeled 30. *Hydrophylax*.
 2. Fls. subspicate on the branches of terminal cymes 31. *Knoxia*.
- B. Leaves whorled, exstipulate.
 Fls. minute in axillary and terminal cymes. Carpels
 indehiscent 32. *Rubia*.

1. ANTHOCEPHALUS, *A. Rich.*

Tree with large leaves and narrow lanceolate caducous stipules enclosing the narrow-lanc. bud. Flowers small in dense terminal solitary globose heads without bracteoles and with more or less connate

hypanthia. Calyx-limb with 5 well-developed lobes. Corolla-tube long, funnel-shaped, lobes imbricate. Stamens on the throat with short filaments. Epigynous disc of 5 fleshy lobes. Ovary 4-celled above, 2-celled below, placentæ twice bifid. Style exserted, stigma prominent narrowly clavate. Ovules very many. Each fruit consists of a thin epicarp and 4 horny or coriaceous cocci above which are easily separable from the fragile lower part and contain most of the numerous angular punctulate seeds (the *F. B. I.* says seeds few, but I have counted over 50 from one fruit), common receptacle globose fleshy in fruit. Seeds minute, embryo clavate in fleshy albumen.

1. **A. cadamba**, *Miq.* Syn. *Nauclea cadamba*, *Roxb.*; *Kadam*, *H.*, *S.*; *Sanko*, *K.*

A large and, in the forest, very straight tree with spreading subwhorled branches and large ell.-oblong or ovate, sometimes subcordate-based leaves 5–10" long. Flowers small orange-coloured with erect narrowly oblanceolate sepals 12" long, corolla 3" long, and far exserted white stigmas. Pseudocarp large, fleshy, orange, 2–2.5" diam.

Wild along the northern frontier! Also wild in hill valleys of the Central and Southern areas in Singbhum! Athmallik! and some of the Orissa States, *Khar-sawan*, *Gangpur*, *Bonai* and *Pallahara*, *teste Cooper*. Very often planted, but in dry localities stunted. Fl. May–July. Fr. Aug.–Oct. Evergreen in its natural home, often deciduous when planted.

Attains 6–8 ft. girth with smooth brown bark and thick yellow-brown blaze, white on the wood. Leaves glabrous or (*teste Brandis*) pubescent beneath, acute or shortly acuminate, sometimes suddenly cuneate on the petiole, sec. n. 8–15 strong slightly curved. Petiole 1–2". Stipules 5–6". Ped. stout 5–1".

A very fast-growing tree when young and in favourable localities (with plenty of water) attaining 10–15 ft. in two years. The wood is used for planking and boxes. *Gamble* gives weight as 40 lbs. The fruit is eaten. The seed requires a perfectly clean seed-bed or the seedlings quickly die.

2. **ADINA**, *Salisb.*

Trees or shrubs with large broad stipules enclosing the terminal bud and caducous on its expansion. Flowers small in dense heads on a globose hairy receptacle with or without bracteoles, hypanthia not connate, angled, sepals 5 narrow. Corolla funnel-shaped or tubular with an urceolate upper part, 5-lobed. St. in the throat of the corolla, fil. short. Ovary 2-celled, style filiform, stigma capitate or shortly clavate. Fruit a small capsule of 2 cocci dehiscent from below and towards a persistent columella, with many oblong winged seeds.

1. **A. cordifolia**, *Hook. f.* *Kumba*, *Kurumba*, *K.*; *Karam*, *H.*, *S.*; *Halanda*, *Or.*; *Mundi*, *Or.* (*teste Grieve*).

A large tree with broad crown, broadly ovate or orbicular cordate leaves 4–8" long and broad and sub-orbicular stipules enclosing the terminal bud. Heads 75–1" diam. yellow axillary usually in vertical rows of three. Fruiting heads dry 4–5" diam.

Throughout the whole area. Attains large size in the Sameshwar hills, in parts of Singbhum and in the Angul forests! Fl. June–July. Fr. Feb.–May. Deciduous Feb.–May.

Often 7—8 ft. girth with a straight clean bole. Bark smooth light coloured exfoliating in patches, blaze pink with an inner white border and yellow on the wood. Leaves pubescent beneath, shortly abruptly acuminate, with 5—8 sec. n. of which 1—2 are close to the base. Petiole 2—3" tomentose or glabrescent. Peduncles 1—3" with two small caducous bracts towards the ends. Bracteoles filiform hairy and somewhat expanded upwards. Buds silky-pubescent. Sep. linear. Corolla .25", tube pubescent.

The timber is a good-deal used both for building and for planking. It has also been used for light railway sleepers. Planks are apt to split badly when dry. It is also used for the backs of brushes and other small articles and takes a good polish. *Gamble* gives the weight as 45 lbs. The value of 'P' appears very variable (from 464 to 760). On a clean seed bed it is not difficult to grow; plants raised by me in Chaibassa attained 38 ft. high and 28.75" girth in 16 years.

3. MITRAGYNA, *Korth.* (*Stephegyne*, *Korth.*).

Trees or shrubs with stipules as in *Adina*. Fls. much as in *Adina* each surrounded by palæaceous bracteoles, but calyx truncate entire or with 5 only small teeth. Corolla tubular-funnel-shaped with 5 valvate lobes. Stigma capitate or mitriform. Fruit and seeds as in *Adina*, from which it appears to me to be rather artificially separated.

1. *M. parvifolia*, *Korth.* Syn. *Stephegyne parvifolia*, *Korth.*; *Karam*, *Kaim*, *Kalmi*, *H.*; *Sande-kuma*, *Ho.*; *Guni*, *Amsabita*, *Mund.*; *Guri*, *Kharw.*; *Gore*, *S.*; *Gulikadam*, *keli-kudur*, *Mitkunia*, *Beng.*; *Mur*, *Mundi*, *Or.*; *Tikuk*, *Th.*

A mod.-sized tree with silver-grey twigs, broadly ell. obtuse leaves 4—6" by 3—4" and oblong keeled stipules covering the buds and falling on their expansion. Heads of flowers 1" diam., 1—3-together on a short lateral axillary branch or peduncle bearing two pale-coloured leaves or bracts near the summit; these persist more or less in fruit. Flowers narrowly funnel-shaped. Bracteoles clavate. Fruiting heads 5—6", capsules ellipsoid verrucose.

Throughout the area, fairly common. More in the plains and valleys than *Adina*. Fl. May—June. Fr. following March and April but ripe seed also collected in Nov. Deciduous May.

Bark and blaze much as in *Adina cordifolia*. Leaves glabrous except near the axils of the 7—10 prominent sec. n., base rounded or cuneate, not cordate, sometimes obovate with rounded shortly cuspidate apex. Petiole .5—1.5". The flower heads are terminal on the short lateral branchlets and the secondary peduncles arise in the axils of the bract-leaves and overtop the older head forming a cyme, lateral peduncles 1—2" long.

The wood is said not to be as good as that of *Adina cordifolia*. The branches are often lopped for fodder. It coppices from the cambium and should therefore be cut low. Trees grown by me in Singbhum were 33 ft. high with a girth of 30.4" after 16 years.

4. NAUCLEA, *L.*

Trees or shrubs with large leaves and broad stipules sheathing the terminal bud. Flowers in globose heads as in *Adina* with or without bracteoles. Hypanthium turbinate or obconic free. Calyx lobes 5 usually tipped with valvate processes. Corolla tubular-funnel-shaped with short imbricate lobes. Fruit of 2 dehiscent many-seeded cocci. Seeds winged. Embryo clavate.

Glandular-pits in the nerve axils are frequent in *Adina*, *Stephegyne* and in *Nauclea*, obscure in *Sarcocephalus*, absent in *Anthocephalus* and *Cephalanthus*.

1. *N. purpurea*, Roxb.

A small tree with pale glabrous twigs and large oblong stipules .5—6" long. Leaves 5—10" by 2.5—4.75" elliptic-lanceolate or oblanceolate acute or subacute quite glabrous, shining above, base narrowed into the petiole rather slender .75—1.75" long petiole. Sec. n. 7—8 prominent beneath with glandular pits in the axils of some, other nerves obscure.

Ravines in the Santal Parganas, very rare!

Bark smooth, blaze light yellow turning brown. *N. purpurea* has not hitherto been found north of the Circars and as flowers have not been collected from our tree there must be a little doubt of its identity. The floral characters of *N. purpurea* drawn from other specimens are: Heads 1.5" diam. terminal 1—3 together on peduncles 2—3" long which are bracteate near the middle, bracteoles conical bristle-like, calyx silky, lobes purple, corolla glabrous. Fruit crowned with the persistent base of the calyx-lobes.

5. MORINDA, L.

Trees or shrubs with connate sheathing stipules. Flowers white more or less connate by their hypanthia into peduncled heads. Calyx short or 0. Corolla with short or long tube and 4—7 coriaceous valvate petals. Stamens 4—7, filaments short. Ovary 2-celled or each cell again divided by a false septum, style slender, 2-branched. Ovules 1 in each cell ascending from near the base of the true septum. Fruits forming a pseudocarp with the succulent enlarged hypanthia enclosing many 1-seeded pyrenes or those of each fruit sometimes cohering in a 2—4-celled putamen, or drupels nearly free. Seeds obovoid or reniform, testa membranous. Embryo terete, radicle inferior.

Leaves ovate, obovate or elliptic. Syncarp globose.

Leaves usually very broad, glabrous or nearly so

Leaves sometimes narrow, pubescent or tomentose

Leaves elliptic-lanceolate. Fruits free, fruiting heads elongating, oblong

1. *tinctoria*.

var. *tomentosa*.

2. *angustifolia*.

1. *M. tinctoria*, Roxb. Chaili, K., S.; Salí, M.; Al, Ach, H.; Achu, Or.

A small tree 15—25 ft. high with large ovate obovate or elliptic leaves or the upper ones near the inflorescence oblanceolate, usually shortly suddenly acuminate and base suddenly narrowed into a 1" long petiole. Fls. white .75—1" diam. in solitary or 2-nate leaf-opposed or terminal peduncled heads with the hypanthia more or less connate. Pseudocarp 1" diam. whitish-green, with the boundaries of the separate fruits marked by lines or sometimes the tops of these, separate.

Central and Southern areas. Fl. May—Sept. Fr. Jan.—Feb.

Attains 3 ft. girth with brown or grey corky bark and grey-brown blaze. Twigs square or oblong in section, usually reddish brown in the type. Petiole .5—1.5". Stipules ovate acute or acuminate, sometimes accrescent and foliaceous. Heads

solitary, axillary or two in a terminal cyme, only .25" diam. without the corollas. Anthers included .2". Ovary 2-celled.

The following varieties may be distinct species:

Var. 1, tinctoria proper.

Shoots glabrous. Leaves usually very broad 6—11" by 4—6", glabrous except in the nerve axils, base unequal or cuneate on the petiole, sec. n. 7—9. Heads glabrous or buds puberulous. Corolla-tube .5—6", petals oblong .35", filaments .12", top of ovaries free in flower and drupels prominent in fruit style-arms glabrous narrowly lanceolate.

Central area, common near villages, perhaps wild in Santal P.! Wild in Southern area and common on the Durgapur sandstones in Angul!

Var. 2, tomentosa, J.D.H. Syn. M. tomentosa, Heyne.

Shoots densely pubescent. Leaves usually elliptic 5—9" by 3—5", pubescent both sides especially beneath, base tapering, sec. n. 5—10. Heads very pubescent. Cor.-tube .8", petals .4", anthers subsessile, top of ovary and drupels connate, style arms filaments pubescent.

It is not known whether these floral characters are constant. If they are the variety should be ranked as a separate species.

Singbhum, in valleys! Angul! Sambalpur!

The root-bark is collected for dyeing from both varieties.

2. M. angustifolia, Roxb.

A small tree, or flowering as a large shrub, with long narrowly elliptic-lanceolate or oblanceolate leaves 6—12" long acuminate or sub-acuminate and tapering at the base into a petiole .3—1" long. Flowers white with a corolla tube .5—6" long in globose heads which gradually elongate and in fruit are oblong. Fruits free, obovoid-globose, nearly white, .3—4" diam.

Jungles of N. Purneah! Fl., Fr. Oct.—Jan.

Bark of twigs pale brown. L. nearly glabrous but minutely puberulous beneath on nerves, sec. n. 13—18, curved near the margin, tertiaries oblique distinct. Stipules short and broad or narrowly ovate. Peduncles 3—1.5". Calyx truncate or with most minute teeth. Corolla salver-shaped, throat naked, petals .4" long lanceolate. Drupes 4-celled. Pyrenes 1—4 pyriform compressed, each containing a peripheral flattened seed and an inner hollow chamber.

The root bark is said to be used for dyeing like that of the other species. The structure of the pyrenes is remarkable and they at first look to be deformed by insect puncture but this is not so.

6. MUSSÆNDA, L.

Shrubs or undershrubs, sometimes scandent with opposite or 3-nately whorled leaves with strong sec. n. and free or connate interpetiolar, sometimes caducous stipules. Flowers usually yellow in terminal cymes frequently very conspicuous from one of the sepals being developed as a large white or coloured leaf. Hypanthium oblong, turbinate or globose, sepals with the exception of the foliaceous one often deciduous. Corolla tubular below, funnel-shaped above, throat villous, lobes 5 valvate with everted margins in bud. Stamens in the tube or throat, fil. very short, anthers linear. Ovary 2-celled, stigmas linear. Ovules many

on peltate fleshy placentæ. Fruit baccate, areolate at the top. Seeds many minute, pitted. Embryo minute in dense fleshy albumen.

Undershrub, tomentose or villous

1. *incana*.

Shrubs. Cultivated in our area.

Foliaceous sepal large white 3—4" long.

Sepals persistent in fruit. Erect

2. *Roxburghii*.

Sepals deciduous, more or less scandent

3. *macrophylla*.

Foliaceous sepal only 1—2", yellow

4. *luteola*.

1. *M. incana*, Wall.

An undershrub 1—3 ft. densely clothed with appressed hairs, with ell., ovate, or oblong hairy sub-sessile leaves 4·5 by 2·5" and sub-sessile corymbose cymes 1—1·5" diam. of chrome-yellow flowers with the foliaceous sepal 3" including the stalk cream or pale-lemon coloured. Berry 4—5" long with adpressed hairs.

Forests on the Porahat plateau, Singbhum, rare! I have also found it in Bengal bordering on Purneah where it is likely to occur. Fl. July—Aug. Fr. Sept.—Oct.

Leaves pale beneath, sometimes 5—6" sometimes only 2", usually acute or sub-acute with 9—10 strong sec. n. sunk above. Corolla 75" long. Fruit with small areole, somewhat depressed-globose.

2. *M. Roxburghii*, Hook. f.

A large shrub with elliptic acuminate or caudate leaves narrowed at the base, 3—8" long, strigose on mid-rib beneath and sparsely so between the nerves, sparsely setulose above, sec. n. 8—10, petiole very short, stout. Corymbs dense, 2" diam. Corolla-tube very strigose, 7—8" long, limb 3" diam. Petaloid sepal 2—3" including the slender stalk. Fruit broadly ellipsoid areolate above with setaceous sepals 2—3" long.

Cultivated in gardens. Fl. June—Nov. Native of Assam.

3. *M. macrophylla*, Wall.

A more or less scandent shrub with much more broadly elliptic cuspidate leaves about 5 by 3", suddenly cuneate on the short petiole, sec. n. 8—10. Hairs much more lax especially on the cyme. Corolla 4—6" diam. Fruit with lax hairs, sepals deciduous.

Cultivated in gardens.

M. frondosa, L., is distinguished chiefly by the narrowly lanceolate acute sepals as compared with the oblanceolate obtuse sepals of *M. macrophylla*.

4. *M. luteola*, Delile, is an African species with ovate-lanceolate leaves 1·5—2·5" long only. Foliaceous sepal pale yellow. It is a pretty bushy shrub.

7. HYMENODICTYON, Wall.

Trees or shrubs with bitter bark and deciduous stipules not enclosing a prominent compressed terminal bud as in the preceding genera. Leaves large. Flowers small-racemed or spicate on the short branches of axillary and terminal nodding panicles which have usually a pair of foliaceous persistent bracts on the rhachis or peduncle. Hypanthium sub-globose, sepals 5—6 very small. Corolla tubular and slender below, ventricose above (funnel or bell-shaped, *F. B. I.*), glabrous within, lobes 5 short valvate. St. with short filaments inserted at the top of the tube, anthers linear. Ovary 2-celled, style filiform, stigma capitate or spindle-shaped. Fruit a loculicidal 2-valved capsule. Seeds many imbricate, testa broadly winged. Embryo small.

1. *H. excelsum*, Wall.

A large or m.s. tree with leaves at the ends of the branches ovate to very broadly elliptic 4—10" by 3—6". Flowers greenish, crowded on the abbreviated branches of thyrsoid sub-erect or drooping tomentose panicles 3—6" long (or more if the axillary panicles are included) which are subtended by long-petioled leaf-like bracts which become dry in fruit. Capsules .7—1.25" long ovoid or ellipsoid, finally reflexed (or on reflexed rhachis).

In all the hill districts and also in Purneah! Usually in dry rocky situations, especially near rocky nalas. Fl. Aug. Fr. ripens Jan. Leafless from Nov.—May, when it may be easily recognised by the characteristic pyramidal panicles of reflexed capsules and the pair of dry foliaceous bracts.

Bark dark-grey thick rugged, blaze soft pale pink streaked white, or nearly white streaked brownish-red or yellow. Leaves softly pubescent shortly suddenly acuminate, base acute, sec. n. 7—10, tertiaries very fine. Stipules .25". Petiole 1—4" long. Pubescent hypanth, with calyx .07", corolla .25—3".

The wood yields good planks which take a good polish and do not warp. The tree coppices freely from the collar and also from the cambium. The seed requires a clean bed and in nature often germinates in a rock crevice. The inner bark and root are given in fever by the Kols and Santals.

8. WENDLANDIA, Bartl.

Small trees or shrubs with well-developed often persistent stipules. Fls. small white 2—3-bracteolate in terminal dense paniced cymes. Hypanth. small globose with 4—5 small persistent sepals. Corolla with a long or short tube and 4—5 lobes imbricate in bud, throat glabrous or hairy. St. with versatile exerted anthers. Ovules on two small globose axile placentæ. Capsule small globose splitting loculicidally through the top, 2-valved with minute compressed seeds.

Stipules recurved. Corolla lobes longer than the tube 1. *exserta*.
Stipules erect. Corolla lobes much shorter than the tube 2. *tinctoria*.

1. *W. exserta*, DC. Syn. *Rondoletia exserta*, Roxb.; *Tilia*, H.; *Tilai*, K.; *Hundru*, S.; *Tiruwa*, Mal. P.

A handsome small tree, hoary or pubescent all over, with oblong- or ovato-lanceolate acuminate leaves 4—8" by 1—2.5" and persistent or sub-persistent broadly-oblong or ovate recurved stipules. Flowers very fragrant about .08" long with the reflexed petals .1" long. Capsule hoary pubescent .06—07" diam. crowned by the erect lanceolate hairy sepals.

In all districts except, perhaps, Balasore and Cuttack! Rather local but sometimes sub-gregarious in second-growth forest and on broken ground. Fl. March—April. Fr. April—May. Evergreen.

Rarely attains 2.5 ft. girth with light brown bark. Easily recognised by its grey foliage. Leaves with 12—16 prominent sec. n., tertiaries short often indistinct, base acute petiole .5—8". Panicles pyramidal 3—6", lower branches sometimes axillary. Branches with rhomboid-lanc. hairy bracts .15—2" long each subtending a subsessile cyme of about 3 flowers. Corolla tube broad, nerved.

Sometimes used for house posts. It is a very high-demanding trees which, like so many *Rubiaceæ*, appears only to germinate or the seedlings only to survive on ground quite free from weeds, and hence often comes up on landslips, abandoned jhumed areas, etc., and is useful for clothing such places.

2. *W. tinctoria*, DC. Hundru, Undru, K.; Tilai, S.; Tile, Khond.

A small tree or large shrub, densely branched, not hoary, with nearly glabrous elliptic, oblong or obovate leaves 4—8" by 2—3·5", acute or obtuse narrowed into the ·5—·75" long petiole. Stipules ·25—·4" erect orbicular or ovate with a long laterally compressed cusp. Corolla ·2—·75" long with the lobes much shorter. Capsule ·06—·07" diam. pubescent, reddish.

Chiefly in Sal forest and distinctly a shade-bearer. Throughout the province but especially in the Central Area in valley forests! Fl. Jan.—March. Fr. March—April. Evergreen, renews leaves March—April.

Bark brown stringy, blaze light rose-coloured, white on the wood. Shoots pubescent. Leaves shining above, pubescent on the 8—12 sec. n. beneath and when young, often with a short obtuse apex. Panicles 6—8" or sometimes 10" pubescent pyramidal, bracts subulate, fls. sessile. The flowers open before the corolla tube lengthens.

The bark is used as a mordant in dyeing.

9. HYPTIANTHERA, W. & A.

A glabrous shrub with short-petioled leaves and white flowers sessile in axillary fascicles. Hypanthium shortly tubular slightly dilated upwards, calyx-tube above the ovary very short with 5 sepals. Corolla very shortly tubular with 4—5 erect or spreading twisted lobes, very caducous, hairy within. Anthers 4—5, sessile, oblong, hairy, inserted by their backs to the tube and nearly included. Disc a pulvinate ring. Ovary 2-celled with very short stout villous style and 2-cleft stigma. Ovules 4—10 in each cell on a pendulous placenta. Fruit baccate small. Seeds 4—5 in each cell, angled, with a characteristic fibrous testa.

1. *H. stricta*, W. & A.

A shrub or small tree attaining 20 ft. with sharply 4-angled or compressed horizontal decussate branches and spreading lanceolate, oblong or linear-oblong acuminate glabrous often undulate leaves 3—6" by ·75—1·5" glossy both sides. Flowers small white sessile with a corolla only ·1—·17" long with broadly ovate lobes. Berries globose-oblong ·25—·3" diam. crowned by the persistent calyx.

Not common. Purneah and North Champaran, attaining 20 ft. near streams! Cool valleys in Singbhum! Ravines in the Santal P.1 Mayurbhanj, near streams in the mountains! Fl. April—May. Fr. Feb.—March. Evergreen.

When arboreous trunk slender with slightly grooved bark. Leaves slightly pubescent on nerves beneath when young, often caudate, base rounded or cuneate, sec. n. 5—7 slender, other nerves obscure. Petiole ·25—·5". Stipules acuminate persistent hairy. Bracts lanceolate hairy ·08", bracteoles much smaller. Calyx with hypanthium ·1" long with narrow-lanceolate teeth. Corolla-tube shorter than calyx, hairy behind the anthers. Flesh of berry very viscous.

10. DIPLOSPORA, DC.

Trees or shrubs with short-petioled distichous leaves. Flowers in fascicles or short cymes axillary or from leafless axils, white or greenish, sometimes polygamo-dioecious, bracts free or (in our species) connate in a cup. Hypanthium short, calyx 4—5-lobed or truncate. Corolla-tube short, petals 4—5 spreading, twisted in bud. Stamens on the

mouth of the tube, anthers exerted oblong or linear. Ovary 2-celled. Disc sometimes large swollen. Ovary 2-celled, style with 2 linear or oblong stigmas (or branches). Ovules 2—7 in each cell, on the septum. Fruit baccate with 3—7 2-seriate imbricate seeds in each cell.

1. *D. singularis*, Korth.

A straight glabrous tree attaining 3 ft. girth with pale brown compressed twigs, bifarious oblong or ell.-oblong acuminate or caudate leaves 4—6.5" shining both sides with petiole .3—6". Flowers sessile in very short-peduncled capitate cymes mostly from the leaf-scars, involucrate with 4-connate bracts and the base of the short peduncle also sheathed by a smaller whorl. Corolla green salver-shaped with scarcely exerted tube, petals .3" oblong acute soon spirally twisted. Fruit on short woody bracteate peduncles .7—8" diam., globose areolate at top. Seeds 4—7 in each cell flattened oblong, .25" long.

Evergreen jungles, Mals of Puri! Fl. April—May. Fr. Dec.—Feb.

Bark smooth, somewhat striate, grey. Blaze pale brown, then yellowish or flesh-coloured, darkening on exposure. L. paler beneath, base acute or cuneate, sec. n. 3—6 slender, their axils often gland-pitted and hairy round the gland. Stipules triangular with a long acuminate tip. Cyme of about 4 groups of 3 fls. and a terminal one. Calyx tubular-campanulate .12", tube sometimes 2-cleft; lobes 4, half as long as persistent tube, broad. Upper part of corolla-tube and base of petals villous. Fil. short, anthers erect linear.

Distrib.: Chittagong, Burma and Malay Peninsula to Borneo.

11. *WEBERA*, Schreb.

Trees or shrubs. Flowers 5- rarely 5-merous in terminal corymbiform cymes, bracteolate. Hypanthium ovoid or turbinate. Corolla funnel- or salver-shaped, throat glabrous or pubescent, lobes twisted in bud. Stamens on the throat or mouth, fil. short or 0 with slender exerted anthers. Ovary 2-celled with stout short pubescent styles and stout fusiform grooved stigma. Ovules numerous, rarely few (or 2 or 1 in species outside our area) in each cell, often immersed in the fleshy peltate placenta. Berry small globose. Seeds plano-convex or almost cupular or shaped like the segment of an orange. Embryo small, cotyledons foliaceous.

1. *W. corymbosa*, Willd. Syn. *Rondeletia asiatica*, L.; *Chomelia asiatica*, O. Kze.; *Tarenna zeylanica*, Gaertn. (1788)*; Jaujoka, Or.

A dwarf or large shrub or a small tree attaining 20 ft. with glossy oblong or oblanceolate-oblong leaves 3—9" long suddenly contracted to a short acute or acuminate tip and with 8—17 strong sec. n. sharply turned up close to the margin. Flowers sweet-scented white, .4—7" diam. in 3-chorous densely hirtellous corymbose cymes about 2" diam. in flower or 3" diam. in fruit. Corolla .4" long in the bud, tube

* *Chomelia* is the oldest generic name, but is already in use for another American genus. *Tarenna*, Cooke states, is the next in priority, but I do not understand why *asiatica* is rejected as a specific name if *Rondeletia asiatica* is a synonym as stated by Willdenow (p. 1224).

·15", pubescent above, shorter than the petals which are villous within. Ovary-cells about 4-ovuled on spongy placentæ. Berry black, ·25" diam., globose, crowned by the erect calyx.

Southern Tract only, are chiefly in Puri, a stunted bush on the laterite, where it is common, but becoming almost a tree in the mountains of the Southern Range! Fl. Nov.—Dec. Fr. Jan.—June. Evergreen.

Axils of the sec. n. gland-hairy. Petiole ·5—7" with a resinous secretion which also occurs on the nodes and inflorescence. Interpetiolar stipules with a broad persistent base and a deciduous triangular and cuspidate blade. Calyx ·12" tubular above the hypanthium, hyp. and calyx together ·15—16" long in flower. Throat of corolla closed by white villi. Anthers sub-sessile ·2" long. Style pubescent in middle, passing gradually into the large grooved stigma. Seeds 3—4 in each cell shaped like the segments of an orange.

12. GARDENIA, L.

Trees or shrubs, often resinous, armed in a few species with axillary thorns. Leaves opp. or 3-nately whorled, or sometimes fascicled in the thorny species, nerve-axils usually glandular. Fls. large or m.s., usually solitary terminal or axillary, more rarely fascicled, often dimorphic, white or turning yellow, corolla tube usually long. Petals 5—12. St. as many with sub-sessile linear included or only half-exserted anthers. Ovary 1-celled. Style stout, stigma clavate or fusiform, sometimes 2-cleft. Placentæ 2—5. Fruit a berry or drupe. Seeds many, imbedded in the placentæ, compressed. Embryo small, in horny albumen.

I. Thorny species. Fls. 1·5" diam. or less, dimorphic.

Small tree. Cor. salver-shaped

Shrub. Cor.-tube campanulate

II. Unarmed. Flowers 2—4·5" diam. Sec. n. strong parallel.

L. 1·5—3", subsessile, sec. n. 12—18. Fls. sessile

L. 4—8", petiole ·3—5", sec. n. 18—35. Fls. peduncled

L. 4—6", petiole ·1", sec. n. 14—20. Fls. peduncled, lobes longer than the tube

L. 6—10", subsessile, sec. n. 12. Fls. peduncled, lobes shorter than the tube

1. *turgida*.

2. *campanulata*.

3. *gummifera*.

4. *lucida*.

5. *florida*.

6. *latifolia*.

1. **G. turgida**, Roxb. Buniain, Th.; Dudni, Durdi, Duduri, K.; Karhar, Kharw., Uran; Dundukit', S.; Kharkar, Mal. P.; Dhauuk, H.; Kurdu, Or. (*teste Cooper*).

A straight small tree with narrow crown and white or pale grey rigid spreading branches armed with sharp straight thorns or some branches thornless. Leaves 1—4", elliptic or usually obovate, glabrous or pubescent beneath or (var. *montana*, Roxb.) often orbicular and densely tomentose beneath. Fls. usually described as dimorphic and 1-sexual, but my specimens are 2-sexual (assuming that the pollen is fertile), when 1-sexual males fascicled, female or hermaphrodite flowers solitary apparently terminal, larger than the males with ovary about ·4" long, calyx with the small linear-subulate teeth ·25" long, corolla-tube glabrous, ·7" long, tubular, scarcely dilated upwards, petals ·5" oblong, anthers 5—6 (apparently perfect) linear quite sessile attached by their back, included, style ·35", stigma large cylindrical grooved with apex 2-lobulate. Fruit large, 1·5—3" diam., globose grey, with fleshy

pericarp and thin woolly endocarp with 5 placentæ and densely packed with hard angular seeds.

Abundant in dry forests, especially on slopes of clay and quartz-stones. Also frequent in second-growth forest. Chiefly in the Central and Southern areas, rare in the Northern area. Fl. April—May, mostly when leafless, but also at other times. Fr. takes a year to ripen. Deciduous March—May.

Bark white or pale-grey; blaze with chlorophyll, then white with yellow specks, then cream-coloured (on wood). L. subsessile or narrowed into a very short petiole, sec. n. about 5, of which 1—2 close to base very oblique; stipules sheathing with triangular caducous limb. The male calyx is described as only .17" with wide truncate mouth and corolla-tube .3—5". The herm. fl. has an annular swollen disc round base of style.

The wood is close-grained and *Gamble* says "good," but except for temporary purposes does not seem to be used. *Gamble* gives weight as 56 lbs. Growth slow. *Innes* says the fruit is boiled and eaten when upripe, and when ripe becomes rather poisonous (as in *Ramdia dumetorum*).

2. *G. campanulata*, *Roxb.*

A shrub, 15—20 ft. with membranous ell-obovate or oblanceolate leaves, 1.5—3" narrowed into the short petiole, glabrous. Male flowers fascicled under .5" diam., fem. fl. .3—5" with very short lobes, both campanulate. Fr. .75—1.25" diam., ellipsoid or sub-globose.

Recorded only by *Sir J. D. Hooker* and *Anderson* from Parasnath in our area, and perhaps extinct there as I have not found it. It occurs however in the Sikkim Tarai, and might therefore be found on the borders of Purneah. Fl. March. Fr. Nov.

3. *G. gummifera*, *L. f.* Bururi, *M.*; Burui, *Ho.*; Bruru, *Bhumij*; Dekamali, *H.*; Kurdu, *Or.*; Gururu (Angul).

A handsome shrub, sometimes 12 ft. with sessile or sub-sessile shining oblong to obovate leaves 1.5—3", normally with a narrowly cordate base but sometimes base cuneate. At certain seasons a clear drop of gum completely covers the leaf-buds. Fls. large, nearly sessile, with slender tube 1.8—2.5" long and 5 oblong lobes 1—1.5" by .5—75". The sepals are triangular acute keeled and half-spreading, only .1" or less in the usual form but subulate-acuminate in var. Frt. 1—1.5" ovoid or ellipsoid with fleshy mesocarp and hard thin endocarp, beaked with the calyx.

Central and Southern areas. In most of the districts except the Santal Parg. and near the sea, but very local! It occurs sub-gregariously on many of the dry hills with a clay soil derived from clay and quartz schists! Fl. March—May esp. in April when the bushes are bare of leaves. Fr. June—Aug.

Bark white, blaze white with chlorophyll. Twigs, leaves and inflorescence often covered with resin. L. rounded or obtuse, with 12—16 sec. n. with villous gland pits in their axils. Stipules connate truncate. Fls. sometimes 2—3 together terminal but becoming lateral in frt. Calyx .2—2.5" with sepals sometimes subulate. Corolla-tube often densely pubescent.

It yields a clear yellow resin from wounds in the bark, and the resin is also collected from the leaf-buds. It is the Dikamali or Cambi Resin used externally as antiseptic and stimulating, internally as carminative and anti-spasmodic, also as an anthelmintic. Useful in flatulent dyspepsia (*Nadkarni*). The fruit is eaten in July and August.

Var. **gummiferoides**, Haines (C. P. List wrongly placed under *G. lucida*).

This plant appears in some respects intermediate between *G. gummifera* and the next species, but if not a hybrid it is certainly more closely allied to *gummifera*. It has now been observed in fruit.

A small tree about 20 ft. with a clear bole having the bark of *gummifera*. Leaves attenuate at base and often subacute, sec. n. 14—18. Calyx 3—4" puberulous with subulate acuminate sepals with filiform tips as in *lucida* 2—2.5" long. Corolla-tube 1.5—2" long puberulous. Anthers half-exserted. Fruit as in type but verrucose.

Sambalpur! This is also the only district in the province where *G. lucida* occurs. The half-exserted anthers is probably a sexual character.

4. *G. lucida*, Roxb. Dekamali, H.

A handsome shrub attaining 25 ft., branched low down, with elliptic-oblong distinctly petioled leaves 4—8" long either acute both ends or the large adult leaves with broad rounded base shortly cuncate on the petiole, sec. n. 18—35. Fls. large white fragrant peduncled mostly lateral with calyx 3—7" long, the sepals linear-subulate or subulate-acuminate much longer than the tube, corolla-tube 1.5—2.5" puberulous. Fruit oval or ovoid .8—1.2" long, dry with thin shell and crowned with the slightly enlarged calyx often .6" long or more.

Sambalpur, Boropahar Range on the shales in the Nakti Chaptar forest, locally abundant! Fl. April—July with the young leaves. Fr. April—June (of following year). Evergreen but old leaves fall just before flowering.

The bark is usually more grey than in the last. The adult leaves are very different and usually dark green with a petiole 3—5" long. Stipules at first large or oblong on the bud, but the blade deciduous, sometimes however persistent and up to .7". Leaves sometimes puberulous. Peduncle 3—6".

The gum has the same properties as in *G. gummifera*. For sowing I find it preferable to separate the numerous seeds, though in nature a whole fruit will rot and the seeds germinate in a heap. The seedlings do best in partial shade.

5. *G. florida*, Willd. Gundha-raj, Vern.; Gardenia, Cape Jasmine.

A large shrub with varnished shoots and buds, opposite or ternately whorled obovate or oblanceolate or nearly elliptic strongly-nerved leaves 4—6" by 1.5—2.7" and solitary very fragrant large white, often double, flowers terminal in the forks of the branches or becoming lateral by displacement on single shoots.

A native of China, very common in Indian gardens, and as some of the other *Gardenias* are also cultivated a detailed description is given. Fl. Sept.—April.

Shoots puberulous. Buds compressed 3—5" long. L. tapering below the middle to a very short petiole about .1" long only, shining and dark-green, glabrous except the shortly tufted glandular axils of the 14—20 sec. n. which are pale beneath and upturned just within the margin, uniting with the next, intermediate and tertiaries simple or some reticulating. Stipules usually united spathaceous or 2-cleft, 4—5" long. Peduncles 3—5". Calyx with the ovary 1.2", 5—6-ridged with the ridges ending in long subulate sepals laterally compressed at base and 6—7" long. Corolla-tube very stout .75—1" by 2—3.5" broad, wider above, lobes (or in double flowers, outer lobes) obovate or oblanceolate 1.2—1.5" long. Berry ellipsoid, orange, strongly-ribbed.

6. *G. latifolia*, Aiton. Papa, Ho.; Papara, M. H.; Popro, S.; Pempri, Mal P.; Gogal, Gond.; Damkurdu, Or.; Dambaru (Mayurbhanj).

A very handsome small tree with a round low crown of large opposite or 3-nate broadly-elliptic or orbicular or, when young, obovate leaves, which sometimes reach 15" by 6". Flowers large solitary white 3-4" diam., usually borne when the leaves are small. Calyx somewhat mealy and pubescent, somewhat ridged by the decurrent sepals which are very unequal subulate and end in a hair, tube (excluding ovary) with the teeth .5-.8" long. Corolla tube 2-2.5" long funnel-shaped above, hairy, lobes 5-9 usually over 7, anthers partly exerted (always?). Fr. 1.5-2" diam. globose, slightly scabrous.

Chiefly in rocky hills and especially along rocky nalas throughout the Central and Southern areas! Fl. chiefly in April when leafless, and with new leaves in May, but also at other times. Fr. found at all times from Dec. to June, ripens about 8 months after flowering chiefly in the r.s. Deciduous March-April.

Bark quite smooth, very pale, shoots stout, buds resinous. Young leaves closely pubescent beneath, obtuse or rounded, base narrowed sub-sessile, sec. n. about 12, strong, reaching nearly to margin, glandular hairy in the axils beneath. Stipules with a broad ovate and cuspidate deciduous limb, the lower part persistent connate sometimes becomes detached at the base and remaining as a movable tube .2-.25" long on the twig. Peduncles short. Scent of flowers strong and heavy. Endocarp woody.

The tree is remarkably xerophytic. The seeds often germinate in the crevices of bare rocks, over which the stem forms a large cushion. It is also sometimes epiphytic on trees.

The wood is made into combs in Sambalpur. The fruit is eaten. *Gamble* recommends the wood to be tried as a substitute for boxwood stating that it is also easy to work and durable. Weight 51 lbs.

13. *RANDIA*, L.

Small trees or shrubs, often armed with strong axillary thorns. L. often fasciated on short branches and when opposite one of the pair sometimes arrested, stipules short intrapetiolar free or connate. Flowers large or m.s. solitary or fasciated, or in axillary or leaf-opposed cymes white or turning yellow with age, often dimorphic. Corolla-tube usually short. Anthers sub-sessile linear or oblong exert or partly so. Ovary 2- rarely 3-4-celled. Stigma usually large, fusiform. Fruit a 2-celled many-seeded berry. Seeds angled, cotyledons orbicular.

I. Corolla-tube short broad or campanulate, shorter than petals.

A. Flowers large or m.s., solitary or few and fasciated. Sepals broad.

L. 3 8" oblong or elliptic. Cor. 1-2" diam. Fr. 2"-2.5"

L. 1-3" obovate. Cor. .5-1.5" diam. Fr. .75-1.25"

B. Flowers .6-8" diam. Sepals very short deltoid. Fr. .4"

II. Corolla-tube slender .5-1.25". Sepals linear

1. *uliginosa*.

2. *dumetorum*.

3. *malabarica*.

4. *fasciculata*.

1. *R. uliginosa*, DC. Syn. *Posoqueria uliginosa*, Roxb.; Pirar, Th.; Perar, H.; Kumbikum, K.; Pendra, Pinde, S.; Pindaro, Mal. P., (also in Purneah); Piralo, Beng.; Mohwan (Koderma); Telkur, Tolkor, Or.

A small tree or a shrub with thick black branchlets, handsome when in flower, with large elliptic or oblong more rarely obovate fasciated leaves 2-8" by 1-4" and numerous solitary pure white flowers 1-2"

diam. or the males corymbose. Hypanthium with short calyx together .5—6" long, turbinate, sepals 5—7 very broad, obtuse or rounded. Berry large ellipsoid 2—2.5" long.

Throughout the province, in the plains and valleys in the hills, nowhere very common except on cotton soil. Fl. May—July. Fr. Dec.—Feb. Leaves turn colour in Dec. and Jan. and the bush is usually leafless Feb.—April.

It varies much in thorniness being sometimes quite unarmed, thorns sometimes ternate. Leaves obtuse or rounded or acute at apex narrowed at base into a very short petiole, when quite young hairy on the 6—8 strong sec. n. beneath. Stipules broad rounded or triangular. The flowers are described in the *F. B. I.* as either large and sessile or small and peduncled and the calyx-tube as 1.5", but some flowers 1.5" diam. have a peduncle over 1" long and 1½" is probably a misprint for ½". Corolla-tube not much exceeding the calyx, petals orbicular. "Tube of the large form with a ring of hairs inside and a fusiform 2-lobed stigma, that of the small form is glabrous within and with entire stigma," *F. B. I.* Stamens 5—7. Scales round base of style (in fem.) 5—7. Seeds compressed smooth.

The fruit is eaten and makes a good vegetable when cooked.

2. *R. dumetorum*, Lamk. Syn. *Posoqueria dumetorum*, nutans, longispina and floribunda, *Roxb. (F.I.)*; Mana, *Th.*; Mainphal, *H.*; Manda (Gaya), Mowan, *Khar.*; Potua, Potab, Portoho, *K.*; Loto, *S.*; Mohana, *Or.*; Potwaphal (Sambalpur).

A small tree or large shrub usually armed with straight axillary thorns. Leaves mostly clustered on short branchlets oblanceolate to obovate obtuse or shortly acuminate 1—3", the base narrowed into a short slender petiole .2—4" long. Flowers white, turning yellow .5—1.25" diam., solitary terminal on new shoots or in 3—4-fld. sessile cymes, subsessile or with pedicels .5". Calyx-tube strigose, sepals ovate or obovate lanceolate or oblong. Corolla-tube campanulate .25—4" long, lobes ultimately reflexed obovate, oblong or oblanceolate. Berry globose or ovoid, yellow when ripe, 1—1.5" diam. crowned by the calyx-tube.

Throughout the area, common in the plains and valleys. Fl. April—June. Fr. Aug.—Jan. Leafless March—April.

Bark nearly smooth but fissured with fine lines, grey; blaze thick soft pink or reddish. The thorns increase in number and size according to the vigour of the tree and are especially long on young coppice shoots. Leaves sometimes 3.4—4.5" and elliptic-obovate, glabrous or pubescent beneath. In the Singbhum plant with the flowers in sessile 3—4-fld. cymes the sepals are lanceolate or oblong and corolla tube .3—4" long softly silky or pubescent but the solitary and cymose forms are I believe the same species as in some other *Randia* and *Gardenia*. Endocarp of fruit fleshy white. Seeds many embedded in brown pulp.

The fruit is used to intoxicate fish. It has a most agreeable smell, but produces an uncomfortable burning sensation in the throat. The Kuls say that it is not edible. Mr. Innes (*Report on Famine Foods*) states that when unripe it is boiled and eaten but the ripe fruit is rather poisonous. *Campbell* states that it is applied externally in fever and that the bark is given internally and externally for fever, and that it is also used as a dye. *Nadkarni* says that the rind and fruit have useful emetic, diaphoretic and antispasmodic properties. The bark is a sedative and nervine carminative.

N.B.—*Wight* and *Arnott* in the *Prodromus* keep *Randia longispina* and *R. dumetorum* distinct. The following points of difference are taken from their work omitting non-contrastable characters:*

* Since completing the family the 4th part of the *Flora of Madras* has been published. *Mr. Gamble* separates the two forms as species and there is a note on the subject in *Kew Bulletin*, No. 8 of 1921.

R. dumetorum. L. oval cuneate at base. Fls. solitary terminal, calyx-lobes oblong. Fr. globose, rarely oblong.

R. longispina. L. obovate to oblong, cuneate at base. Fls. usually 1—3 terminating short axillary shoots, rarely solitary axillary. Calyx-lobes ovate with often a small tooth in the sinus. Fr. short ovoid, slightly retuse at base.

Both these forms occur in our area as well as others.

Roxburgh, who apparently had both his *Posoqueria longispina* and König's *P. dumetorum* growing under his eye, and who seldom errs in the discrimination of species, states that *P. longispina* differs very conspicuously in the long slender spreading and drooping branchlets, in the limb of the calyx being permanent and the fruit obovate, whereas *Randia dumetorum* has short and rigidly erect branchlets, globose berry, and the calyx-limb deciduous. Unfortunately *W. & A.* state that the calyx-limb is permanent in both! Certainly some individuals have the limb deciduous, but whether this character is associated invariably with others or whether even constant in the same individual can only be fully determined in the field.

3. **R. malabarica**, Lamk. Syn. *Gardenia fragrans*, Koen.; *Griffithia fragrans*, Wight; *Phirika*, Or.

An erect very rigid thorny shrub 4—8 ft. with grey divaricate branches and numerous abbreviated branchlets or leafy fascicles. Leaves glabrous .7" to nearly 3" oblanceolate to obovate or some elliptic-oblong, subsessile or narrowed into a short petiole .3" long. Flowers white salver-shaped .75" diam. in dense sessile corymbs or sub-umbellate cymes. Very pretty in fruit from its numerous umbellate globose scarlet berries 4—6" diam. with a depressed areole.

Orissa, very common near the coast from Balasore southwards! Very common on the Khandagiri sandstones but also found on laterite. Fl. chiefly March—May. Fr. Oct.—Dec.

Leaves shining coriaceous with slightly recurved margins, sometimes rather fleshy close to the sea and round the Chilka Lake, apex obtuse or rounded, sec. n. 3—4 with ciliate glandular pits in their axils beneath. Rhachis of corymb very short, pedicels .25—3" bracteate and sheathed at base with 2 connate bracteoles. Calyx tubular .17" lobes very short deltoid. Corolla-tube .3", petals 3—4" oblong. Fruit 2-celled with 1—several seeds in each cell.

This species is sometimes placed in a separate genus *Griffithia* (*G. fragrans*, *W. & A.*) on account of the decidedly deciduous calyx which separates by a transverse crack from the apex of the ovary.

4. **R. fasciculata**, DC.

A shrub or small spreading tree copiously armed with axillary erecto-patent thorns .5" long. Leaves small 1—3" elliptic or ovate obtuse or acuminate. Flowers white fragrant 1" diam. with tube usually .9" long, mostly in 3-fld. cymes at the ends of the short branchlets, sometimes also axillary. Berry black .25—3" diam. with 10—12 angled seeds.

Northern Purneah! Ravines in Singbhum, rather rare! Fl., Fr. Dec.—May.

Twigs pubescent. Leaves thinly hairy on and in the axils of the nerves beneath, base obtuse or acute, sec. n. 3—5. Petiole .1—25", stipules deciduous broad and short with a long linear cusp. Cymes on peduncles .2—3" long or sessile between a pair of leaves. Fls. subsessile. Calyx-tube above the ovary nearly .1", sepals .2" linear with broad base and sometimes slightly dilated at tip, thinly hairy. Corolla-tube .5—1.25" in some specimens, petals broadly oblong, sometimes apiculate, base hairy. Stigma large mitriform, shortly exerted. Berry marked with a prominent areole.

14. IXORA, L.

Small trees or shrubs with opp. or ternate leaves and flowers in terminal 3-chotomous often corymbose cymes, 4- very rarely 5-merous. Hypanthium small. Calyx with small 4-toothed persistent limb. Corolla-tube very long and slender with 4 spreading lobes. Stamens on the mouth with usually very short or obsolete filaments and slender exerted linear anthers with 2-fid base. Ovary 2-celled, style filiform exerted but never twice as long as corolla-tube, stigma slender at first fusiform, afterwards usually dividing into two branches. Ovules 1 in each cell peltately attached to the septum. Fruit with two plano-convex or ventrally concave coriaceous pyrenes. Seeds peltate. Cotyledons flat thin, radicle inferior.

Wild Species:

- Leaves acuminate. Lower cyme-branches 2" long or more.
 Cor.—tube over .26" 1. *undulata*.
 Leaves subsessile, rounded. Cyme branches usually under 2"
 long 2. *parviflora*."

Garden Species:

A large number of garden species of *Ixora* are in cultivation in gardens. The two most common, and also most beautiful, are—

3. *I. coccinea*, L. A compact shrub with shining oblong sessile leaves 3—4" long and bright scarlet flowers in large handsome compact corymbs. The petals are acute. Peduncles and pedicels coloured like the flowers.

4. *I. stricta*, Roxb. Less compact in habit with sub-sessile, oval or oblong, leaves 5—6" long and large compact convex corymbs of flowers of a salmon-scarlet colour. The petals are rounded.

1. *I. undulata*, Roxb. Chadaigodi, Or.

A large shrub with oblong or lanceolate shining leaves 5—9" by 1.5—3.3" glabrous, acute or usually acuminate, and mostly with undulate margins. Petiole .5—1" long. Flowers white, odorous, corymbose on the slender branches of long peduncled brachiate panicles. Cor.-tube .28—.32" long, petals spreading and reflexed .16—.18" long. Fruit succulent .3" diam. dull-purple or slate-coloured with two plano-convex pyrenes.

Not very common and always in the vicinity of water. Santal P., fairly frequent! Singhum, in the Saranda forests! Manbhurn and Hazaribagh on Parasnath! Hundrughagh (Ranchi), Prain! Keonjbur, teste Grievé! Bonai, Cooper! Mayurbhanj, elev. 2500 ft.! Puri (Kuhuri forest and in the Mals)! Fl. April—May. Fr. Aug.—Sept. Evergreen.

Blaze pink, then white. L. usually tapering both ends and distinctly petioled though some of the leaves on the Ranchi specimens are scarcely petioled, sec. n. 12—16 with many rather irregular intermediate, all very slender. Stipules broad and rounded but with a slender cusp. Panicles 6—8" long often with a slender peduncle 3" long, at other times a branch arises at its base, internodes long and elongating in fruit, lower bracts .3" long sometimes with a broad toothed base, upper bracts narrowly linear. Flower-buds slender clavate, .45" long. Calyx with ovary only .05—.06" long. Pyrenes slightly concave with a slightly curved embryo, long radicle and ovate cotyledons.

2. *I. parviflora*, Vahl. Pete, K.; Merom met', S.; Dattranjin, Kharw.; Kholan, Ghatw.; Konthra, Mal P.; Kota Gandhal, Loha

jangia, *H.*; Rangan, *Beng.*; Telkurwan, Telkuria, *Or.*; The Torch-tree.

Usually a small tree, more rarely a large shrub, with smooth very coriaceous, oblong or elliptic, sub-sessile leaves 3—6" by 1·5—2·5" obtuse or rounded at the apex and with rounded or cordate base. Flowers white odorous sub-sessile, in usually very compact panicles 2—4" rarely 6" long, branches brachiate or ascending 1—1·5" long only. Cor.-tube ·22—·25" long, petals spreading and reflexed, very obtuse, ·15" long, sometimes 5 in number and size of flower somewhat variable. Anthers tailed. Fruit ·25—·3" diam., depressed globose shining black (never didymous when fresh).

Common throughout the Central and Southern areas, often in Sal forests and near naals, but also in dryer localities than the last. Fl. March—May. Fr. May—June. Evergreen.

Trunk often 18" girth with pale-grey nearly smooth bark and flesh-coloured blaze. Sec. n. about 12—14 very fine and inconspicuous, soon reticulating. Petiole sometimes ·2" long, stout.

The branches are used as torches in Sambaipur. The fruit is eaten in Chota Nagpur.

15. PAVETTA, *L.*

Very like *Ixora* but the stipular bracts on the inflorescence and the leaves more membranous, stipules more united into an intrapetiolar sheath, style twice as long as the corolla-tube or more with the slender stigma not 2-fid and rarely notched, and the ovules usually attached to a prominent placenta. Frt. (in our species) baccate and usually 1-seeded only.

1. *P. indica*, *L.* Sikriba, Sikiba, *K.*; Buddhi-ghasse, *S.*; Budhi, *Kharw.*; Jui, *Beng.*; Kuku-chalia, Macharanka, *Or.*

A large shrub or small bushy tree with elliptic or obovate glabrous, pubescent or tomentose leaves 3—9" long and large trichotomous corymbose panicles of slender white flowers ·5—·75" long with very slender styles exerted ·7—1" beyond the mouth of the corolla. Fruit globose black ·3" diam. with usually 1 seed only (*Roxb.* says usually 2).

Throughout the whole area, plains, valleys and shady slopes of the hills in the damper forests but not very common except in Angul. Fl. June—Aug. Fr. Oct.—Jan. and shrivelled berries may be found in other months. Deciduous.

L. acute or obtuse, rarely acuminate, base cuneate, sec. n. 11—15 strong. Petiole ·5—1". Stipules broader than long with cuspidate tips. Panicles 4—8" diam., bracts stipular with or without the more or less rudimentary leaves at the base of the lower branches, with scarious or membranous margins. Petals oblong-oblancoate, ·2", tip rounded. Anthers exerted ·17—·2". Seed sub-globose enclosing the placenta on one side. Embryo curved.

The *F.B.I.* distinguishes several varieties of which the following occur:

α. *indica proper.* Leaves glabrous beneath or nearly so, cymes nearly glabrous, corolla glabrous. Champaran! Purneah! Angul!

β. *tomentosa.* Leaves softly pubescent or tomentose beneath, sometimes also puberulous above. Cymes pubescent, tomentose or villous. Corolla glabrous. The common form in the rest of the province!

16. COFFEA, L.

Shrubs with broad stipules and white or yellowish m.s. flowers in axillary or terminal fascicles or solitary or axillary dense cymes. Hypanthium short, calyx tube short or 0, often glandular, persistent; sepals often minute or 0. Corolla-tube short or long with 4—7 spreading lobes twisted in bud. Anthers 4—7 sessile, often recurved or twisted. Ovary 2-celled, style filiform with 2 linear or subulate branches. Ovules 1 in each cell peltately attached to the septum. Fruit a drupe with 2 plano-convex or ventrally concave coriaceous or cartilaginous pyrenes. Seeds concave or grooved ventrally, albumen horny, embryo short towards base of seed, curved, cotyledons thin cordate, radicle inferior.

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| A. Deciduous. Leaves ovate. Corolla-tube .7—8" long | 1. <i>bengalensis</i> . |
| B. Evergreen cultivated species. Leaves narrow. | |
| L. ell.-oblong. Fls. in close cymes. Cor.-tube .35—5" | 2. <i>arabica</i> . |
| L. ell.-oblong or ell.-oblanceolate. Fls. sub-solitary. Cor.-tube .2—25" | 3. <i>liberica</i> . |

1. *C. bengalensis*, Roxb. Banamali, Or.

A pretty shrub 3—4 ft. high with bright green ovate acuminate leaves 3—4" by 2—2.5", setaceous-tipped stipules .17—2" long and pure white salver-shaped flowers, 1—1.5" diam. with a tube .7—8" long. Fruit an ovoid black drupe .4—5" long with 1—2 pyrenes. Seed grooved.

In the damper regions. Champaran and Purneah! Forming semi-thickets in damp low ground under dense shade in the Singbhum forests, but rare! Mayurbhanj, elev. 2500 ft.! Mals of Puri! Fl. with the new leaves, rarely when quite leafless. April—May. Fr. Jan.—April. Deciduous Feb.—April.

Leaves hairy on the nerves beneath when young; sec. n. 3—5 slender, petiole .17—26". Fls. sessile 1—3 in a fascicle terminating the shoots, sometimes on new shoots with 4 lanceolate bract-scales at the base and a single pair of leaves supporting the fascicle, sometimes axillary (according to the floras). Calyx obsolete or of several minute glandular teeth. Petals .5—9". Anthers .3" sessile apiculate, the tips only exerted. Style short.

The coffee is of little use according to *Roxburgh*, and I have never heard of the natives making any use of it.

2. *C. arabica*, L. Arabian Coffee.

A handsome evergreen bush with compressed spreading branchlets and bifarious oblong or elliptic-oblong shortly acuminate glabrous and shining leaves 4—8" long with rounded or subacute base and petiole .25—4". Stipules broadly lanceolate with a long or short subulate cusp ultimately broadly semi-orbicular and the cusp deciduous. Flowers white 1—3-nate or in abbreviated 1—2-nate axillary cymes, sub-sessile, subtended by short amplexicaul green bracts. Cor.-tube .3—45". Petals 5, .4—65". Drupe oblong with 2 pyrenes (the well-known coffee beans).

Often cultivated for ornament and on the Ranchi and Hazaribagh plateaux, also for coffee for local consumption. Native of Abyssinia: Fl. March. Fr. Dec.

Leaves with 10—12 sec. n. Inopod and with large gland-pits, sometimes double, in their axils. Cymes sometimes with foliaceous bracts at their base. As it renews its leaves between the time of flowering and fruiting the fruits are mostly from leafless nodes.

3. *C. liberica*, Bull. Liberian Coffee.

A stouter bush or small tree with stiffer less distichous leaves and less handsome. Leaves 7—8" long elliptic-oblong or elliptic-oblong-lanceolate, stipules obtuse, not cuspidate. The flowers are mostly solitary at the crowded nodes subtended by a double calyculus (connate bracteoles). Corolla-tube 2—2.5". Petals often 7—8 oblong 4—6". Drupe purple, .75—1" long.

Occasionally cultivated. Fl. March. A native of Guinea.

Base of leaf cuneate on a petiole .5—1" long, sec. n. 6—10 with large gland-pits at the base of most of them, pits usually surrounded by a ring of pubescence. The buds and twigs are in my specimens covered with a resinous deposit as in *Gardenia*.

17. CANTHIUM, Lamk.

(*Plectronia*, L., in part, and the name adopted in some works.)

Shrubs or small trees, sometimes armed with axillary thorns. Leaves with nerve-axils often glandular. Stipules connate. Fls. small in axillary fascicles or corymbose cymes, white or greenish, sometimes polygamous. Hypanthium and calyx short, 4—5-toothed. Corolla usually globose or urceolate, sometimes campanulate or funnel-shaped, a ring of deflexed hairs within and throat villous, lobes small, 4—5, valvate. Anthers 4—5, subsessile on the throat or mouth. Ovary 2-celled, style stout, stigma large. Ovules 1 pendulous in each cell. Drupe globose or didymous with 2 pyrenes or 2-celled putamen, or one carpel sometimes suppressed and then oblong or reniform. Seed oblong. Embryo long with short cotyledons.

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| I. Trees or large shrubs without thorns. Leaves over 3.5" long. | |
| Trunk straight erect. L. 5—9". Cymes glabrous. Fr. .8" | 1. <i>glabrum</i> . |
| Branches low. L. 4—6". Cymes dense pubescent. Fr. .3" | 2. <i>didymum</i> . |
| II. Shrubs with copious axillary thorns. Leaves under 3.5" long. | |
| Leaves pubescent. Flowers 5-merous | 3. <i>parviflorum</i> . |
| Leaves pubescent. Flowers 5-merous | 4. <i>parvifolium</i> . |

1. *C. glabrum*, Blume. *Ranisera*, Or.

A small or m.s. tree with spreading green branches and spreading bifarious dark green leaves 5—8.5" long, ovate- or oblong-lanceolate or elliptic, quite glabrous, tapering or suddenly acuminate, base rounded or cuneate on the petiole, sec. n. 5—7, some with pit-glands in their axils, tertiaries obscure. Petiole 3—5". Stipules with broad thickened base and a subulate keel ending in a sharp acumen, about 2" long. Cymes shortly-peduncled, 1—2" long and broad in fruit, glabrous and rather lax. Fls. (not seen in my specimens) 5-merous, pedicelled. Fruit globose green .8—1" with a conspicuous areole .25" diam. on top, and two one-seeded pyrenes, triangular in transverse section.

Mals of Orissa, 2000 ft. in valleys! Fl. probably r.s. Fr. Dec.—Jan. Evergreen.

Trunk straight with smooth bark, blaze finely striated red and yellow. L. sometimes 9" by 5", paler beneath, base decurrent as a ridge either side of petiole. Peduncle about 3—5", pedicels (in fr.) .3". Corolla-tube sub-globose, .08", lobes as long. Stigma mitriform notched.

2. *C. didymum*, *Roxb.* Syn. *Plectronia didyma*, *Kurz.*; *Jur., K.*; *Garbha gojha, S.*; *Rangruri (Ranchi)*; *Dalsing, Kumar-chikni, Or.*; *Beniman (Sambalpur).*

A low-branched tree or large shrub with spreading or drooping branchlets flattened at the upper extremities. Leaves bifarious, dark green ovate or lanceolate-ovate, acuminate, 4—6" by 2.5—3", base rounded or cuneate often unequal, sec. n. 3—5, some with gland-pits in their axils. Petiole 3—5". Cymes sessile or shortly peduncled, pubescent or puberulous, very dense, 7—1" long and broad. Flowers 5-merous, greenish or white, 2" long and .25" diam., corolla with campanulate tube and rotate lanceolate petals. Frt. black globose or slightly longer than broad, 3" with 2 oblong nearly terete pyrenes.

Central and Southern areas. A very common tree along the edges of streams and dry watercourses in all the forest districts. Fl. Feb.—April. Fr. May. Evergreen.

Bark smooth but with vertical cracks, dark grey. Leaves shining above, pale beneath, tertiary nerves indistinct. Stipules variable, deltoid or linear or, in one variety in Puri, one of each pair becoming large and foliaceous as in *Mesoptera!* Peduncles usually very short and stout having connate bracts at the apex subtending the cyme-branches, which are at first 2—3-chotomous and then scorpioid. Pedicels 1—5" long with very minute bracts at their base. Hypanthium with the small deltoid sepals .05—07", sometimes glabrous. Stamens on mouth of corolla with short filaments. Style long, stigma mitriform. Pyrenes slightly rugose in some plants.

I have never seen the fruit didymous in its natural state, though it may become so when dried. The pedicels are often recurved in fruit.

The wood is used to a slight extent for handles of implements, etc. *Gamble* states that it has a great resemblance to boxwood and is hard, close- and even-grained. Weight about 50 lbs. The bark is said to be used for killing fish in Sambalpur so it probably contains much tannin.

3. *C. parviflorum*, *Lamk.* Syn. *Plectronia parviflora*, *Bedd.*

An intensely thorny glabrous shrub with obtusely 4-angled twigs, opposite and decussate slender very strong and sharp thorns from above all the axils, and fascicles of small leaves and small green flowers in short sessile cymes below the thorns. In fruit the leaves are mature, ovate or elliptic, 1.5—3" long with the base narrowed into a short slender petiole. Fruit yellow sub-globose .75" diam. on peduncles about .5" long, apical areole often surrounded by the 4 short linear deciduous sepals.

Puri, rocky hills near the coast! Fl. April—May. Fr. Nov.—Dec. Deciduous March—April when the young leaves appear with the flowers.

Bark grey with longitudinal flakes. Thorns .5—1.5". There is often a fascicle of leaves below the thorns due to the development of an axillary bud, the subtending leaf of which has fallen. Leaves at time of fl. 3—7" obtuse, sec. n. 3—5 slightly raised, translucent. Stipules minute subulate. Cymes shorter than the leaves, mostly bifurcate from the base and then 3-chotomous. Fls. 4- (—3)-merous, .15—2" diam. Calyx minute toothed. Cor. campanulate to globose with spreading ovate lobes, mouth villous. Anthers on the mouth, sessile, exserted. Stigma large capitate, slightly 2-lobed.

The ripe fruit is eaten and the young leaves used as a sag.

4. *C. parvifolium*, *Roxb.*

A mod.-sized rigid much-branched thorny shrub with the shoots and leaves beneath hairy. Leaves .5—1.5" ovate or elliptic subacute.

Petiole very short. Flowers 5-merous sub-sessile axillary crowded. Corolla sub-globose, lobes lanceolate acute. Fruit sub-globose, compressed, .3" diam., putamen tubercled.

Monghyr, *Hamilton!* Fl. r.s.

I have not seen this species in the field.

18. VANGUERIA, *Juss.*

Only differs from *Canthium* in that the ovary is 3—6-celled and the fruit 3—6 pyrenes.

Leaves and pedicels glabrous. Corolla with mouth woolly, anthers exerted, petals not acuminate, anthers exerted horizontal

1. *spinosa*.

Leaves and pedicels pubescent. Corolla mouth scarcely villous, petals with acuminate tips, anthers included erect

2. *pubescens*.

1. *V. spinosa*, *Roxb.*

A large shrub armed with long straight supra-axillary thorns. Twigs lenticellate. Leaves elliptic or ell-ovate acuminate 3—4", glabrous except sometimes tufts of hair in the axils of the sec. n., rarely thinly hairy, sec. n. 5—6 looping within the margin and intermediate nearly as strong. Flowers in sessile cymes in the axils of the new leaves. Hypanthium very short, broader than long, with 5 minute linear or subulate sepals. Corolla sub-globose green .14" long and broad, not ribbed within, mouth densely villous or woolly, lobes spreading ovate with cuspidate but not acuminate tips, .12" long, margins narrow white. Anthers spreading horizontally on the mouth. Ovary half superior, 5-celled. Style long, stigma large lobed. Fruit 1—1.5". (*Roxburgh*, however, says only as large as a cherry.)

Purneah! Fl. April—May. Fr. Dec.—Jan.

This is the plant which runs through Eastern Bengal and Sikkim and ascends the mountains to 4000 ft. It appears to me to be distinct from the next, with which it is united in the *F.B.I.*

2. *V. pubescens*, *Kurz.* Syn. *V. spinosa* var. *mollis*, *F. B. I.*; *Serali*, *Kataiara, K.*; *Boi-bindi, S.*; *Monphal, Kharw.*; *Moyena and Mainphal, H.* (through confusion with *Randia?*); *Gurbeli, Or.*

A small tree or large shrub, often armed with long straight supra-axillary thorns. Leaves ovate elliptic or oblong acute or acuminate, 3—6" sometimes 6" by 3", usually only 1—2.5" at the time of flowering, more or less pubescent. Flowers small green sub-globose in dense axillary cymes. Corolla green sub-globose .12—13" long and not quite as broad, tube with prominent ribs within, throat thinly villous, the hairs hardly showing at the mouth, never densely woolly at mouth as in last, lobes triangular acuminate or caudate. Anthers wholly or partly included, erect and smaller than in last species. Style long, stigma grooved. Fruit .7—1" diam.

Central and Southern Tracts, usually near ravines and nalas. Shahabad (*Kaimur Hills*)! *Chota Nagpur!* *Santal P.!* *Gaya!* *Angul!* *Sambalpur!* *Kalahandi!*

Fl. April—May with the new leaves. Fr. Aug.—Dec. Leaves turn yellow in Jan. and drop about March.

Twigs rarely lenticellate, often hirsute, sometimes nearly glabrous. Leaves usually acuminate, base rounded or cuncate on the petiole, sec. n. 5—7 always pubescent beneath. Petiole 2—4". Stipules short and broad, very obtuse, caducous. Pedicels hairy and a few hairs sometimes on corolla. Fruit with 5—6 radiating flattened pyrenes or fewer by abortion.

The young leaves are eaten as a vegetable. The fruit is also eaten. The tree is sometimes unarmed. Some thorny forms somewhat resemble *Randia dumetorum* and the fruit is sometimes said to kill fish, possibly through confusion with that plant.

19. LASIANTHUS, Jack.

Shrubs. Leaves distichous with arching sec. n. and close-set cross tertiaries and with broad, rarely narrow, interpetiolar stipules. Flowers small in axillary rarely peduncled often bracteate clusters, cymes or heads. Hypanthium short, calyx-tube short or long with 3—7-teeth, rarely truncate, persistent. Corolla funnel- or salver-shaped, throat villous, lobes 3—7 valvate in bud. Stamens 4—6 on the throat, filaments short, anthers often apiculate, included. Ovary 4—9-celled, style-arms or stigmas 3—9 short obtuse. Ovules 1 linear basal erect in each cell. Drupe small with 3—9, 3-quetrous and 1-seeded pyrenes. Embryo terete, radicle inferior.

1. *L. truncatus*, Bedd.

A shrub 4—6 ft. somewhat resembling *Heptianthera stricta*, with appressed shortly pubescent branchlets, lanceolate acuminate leaves about 5.5 to 1.5" and axillary fascicles of sessile inconspicuous white flowers. Fruit blue succulent ovoid downy crowned by the calyx, with 4—5 pyrenes.

Deep shady valleys in the Tholokabad forest, Singbhum! Very rare. Fl., Fr. April—May.

Leaves often undulate and variegated yellow, pubescent on the nerves beneath, narrowed both ends, with 7—9 oblique arched sec. n. strong beneath and numerous sub-parallel cross nervules, petiole 17—25". Stipules triangular long-acuminate strigosely pubescent. Calyx-tube short 3-toothed or truncate in fruit. Corolla tubular, pubescent, sometimes calyptrate. Anthers 5 sessile. Ovary 4—5-celled.

Only previously reported from Ganjam!

20. PSYCHOTRIA, L.

Shrubs or small trees with intra-petiolar sometimes connate stipules with often glandular axillary hairs. Flowers in terminal cymes, heads or fascicles. Hypanthium short, calyx-tube hardly any, sepals small persistent (in our species) or often deciduous. Corolla-tube straight, short, petals usually 5, valvate. Stamens on the throat or mouth, anthers included or not. Ovary 2-celled, style branches 2. Ovule 1 basal erect in each cell. Fruit small with one to two 1-seeded plano-convex pyrenes. Seed plano-convex, ventrally flat or grooved, albumen sometimes ruminant. Cotyledons broad thin.

Leaves 3—6". Cymules in a spiciform panicle

1. *adenophylla*.

Leaves 8—10". Fls. in dense terminal corymbose cymes

2. *denticulata*.

1. *P. adenophylla*, Wall.

A shrub 3—4 ft. (or up to 7 ft. in the Mals) with nearly glabrous branches. L. 4—6" elliptic, ell.-oblong or oblong-obovate shortly

suddenly acuminate, base tapering into a short 2—4" long petiole, sec. n. 10—16 slightly curved strong, tertiaries obscure, gland pits in axils of many of the secondary nerves. Fls. small white 1" long in short pubescent rather dense cymes at intervals along the rhachis of a racemiform panicle 3—4" long. Fruit obovoid 2—3" umbonate 2-celled. Seeds, usually only 1 maturing, corrugate, ventral face flat, albumen ruminant.

Oris.a, Puri District under shade from Khurda southwards! Mayurbhanj, elev. 2000 ft.! Fl. June—Aug. Fr. Dec.—Feb. Evergreen.

Under surface of leaf with microscopic white dots when fresh. Stipules half-tubular with a rounded tip due to the falling off of the acumen, deciduous and leaving a scar with ring of brown hairs. Cymules about .25". Pedicels very short. Calyx cup-shaped truncate or obtusely-lobed.

Distrib.: Chittagong, Sikkim, Assam and Burmah.

2. *P. denticulata*, Wall.

A stout shrub 3—5 ft. high with thick subsucculent branches, large elliptic, lanceolate or oblanceolate shortly acuminate leaves 8—10" long with attenuate base and 15 to 20 nearly straight strong secondary nerves. Petiole 8—1". Stipules very large 8—1" broadly oblong and with two filiform tips 1—2" long, their bases connate inside the petioles, soon deciduous and then showing the brown pubescence in their axils. Fls. greenish-white 2" diam., salver-shaped, sub-sessile in dense, terminal corymbose cymes 2—3" diam. on peduncles 2—3" long. Corolla tube broadly tubular 1" long, petals slightly longer oblong-lanceolate, throat villous.

Meghasani, Mayurbhanj, elev. 3000 ft. near rivers! Fl. May—June.

Branchlets compressed below the nodes. L. slightly puberulous on mid-rib and lower part of secondary nerves beneath, nerve pits very minute or absent. Cymes pubescent, branches opposite or 2—4 in a whorl with stalks 5—1" long, bracts small, (.15") ovate or lanceolate with filiform tip. Calyx teeth small, broadly triangular. Tips of petals incurved and slightly imbricate in bud, throat villous. St. 5 erect on the throat, anthers oblong exerted. Disc large swollen. Fruit (not seen in our specimen) subglobose .15—2", pyrenes plano-convex, smooth.

21. CHASALIA, Comms.

Corolla-tube slender curved. Seeds orbicular compressed and ventrally concave. Albumen ruminant. The rest as in *Psychotria*.

1. *C. curviflora*, Thw. Syn. *C. lurida*, Miq.

A glabrous undershrub 2—4 ft. high with pale branches, oblong or somewhat oblanceolate shortly acuminate leaves 5—10" long with 7—11 sec. n. and petiole 5—8" long. Fls. 3—4" long, white, sessile in dense cymes on the rhachis of a short terminal subcorymbose panicle with a peduncle 1—2" long. Fruit didymous sub-globose .25", blue.

Under dense shade and near streams. Meghasani 3000 ft., Mayurbhanj! Mals of Orissa, 2000 ft.! Fl. April—June. Fr. Aug.

Sec. n. of leaves slightly curved then running parallel to margin, tertiaries obscure. Stipules shortly broadly ovate. Panicle 1—2" broad with short branches. Hypanthium .07", nerved, nerves joined round the top, sepals minute.

N.B.—I have described the Orissa form only of this species, which is very variable. Sir J. D. Hooker states that the flowers are dimorphic with respectively long and short stamens and style.

22. HAMILTONIA, Roxb.

An erect shrub, foetid when bruised with prominently-nerved leaves and intrapetiolar acute persistent stipules. Flowers small, white or lilac, sweet-scented, capitate on the branches of broad terminal 3-chotomously branched paniced or sub-umbellate cymes. Hypanthium ovoid. Sepals 4—5 subulate, often glandular, persistent. Corolla funnel-shaped with long tube, petals 4—5 valvate. Stamens inserted in the throat, filaments short subulate, anthers obovate-oblong. Ovary 5-furrowed, almost free from hypanthium, 5-celled, soon 1-celled by absorption of the septa. Style filiform, arms 5 linear. Ovule 1 basal erect in each cell. Capsule 1-celled, 5-valved at the top, 5—1-seeded. Seeds 3-quetrous. Cotyledons cordate induplicate.

1. *H. suaveolens*, Roxb. Selauli, Sarkapi, K.; Buddhi Ghassi, S.

A shrub 4—8 ft. high, or sometimes up to 15 ft., with erect terete branches and opposite ovate, elliptic-lanceolate or -oblong acute leaves 4—9" by 1.5—3", hairy above, more or less pubescent beneath, with 15—20 strong sec. n. and reticulate nervules. Flowers capitate on the branches of the large panicle, with glandular-hairy bracts and bracteoles. Sepals 1" long with gland-tipped hairs. Corolla-tube slender, .5—6" long, hairy, limb .25" diam.

Usually in rocky places and on northern aspects of rocky hills. Champaran, in the hills! Common on trap rocks, Santal Parganas! On Quartzite rocks in Singbhum, Ranchi, Manbhum, Hazaribagh and Palamau, ascending to top of Parasnath! Gaya ghats! Angul! Probably also in other Orissa States and districts. Fl. Aug.—Jan.

Branches glabrous (in our specimens, sometimes hispid-pubescent, *teste F. B. I.*). Petiole .25—.75". Stipules .15—2". Panicle hairy and also sometimes with gland hairs above.

The root is used in diarrhoea and cholera. The flowers are much frequented by Humming-bird Hawk-moths.

23. PÆDERIA, L.

Slender twining shrubs, foetid when bruised. Leaves with intrapetiolar triangular deciduous stipules. Flowers in axillary and terminal 2—3-chotomously branched paniced cymes. Calyx 4—5-toothed persistent. Corolla-tube tubular or funnel-shaped, pubescent, petals 4—5 valvate with inflexed crisped margins. Anthers 4—5 sessile in the tube, linear oblong. Ovary 2-celled, stigmas 2 capillary twisted. Ovules 1, basal, erect, in each cell. Fruit compressed (in our species), epicarp thin, fragile shining, separating from 2 orbicular or oblong dorsally compressed membranous or coriaceous pyrenes. Testa adnate to the pyrene. Cotyledons large cordate thin.

1. *P. foetida*, L. Gandhali, H.; Ghandha bhadulia, Beng. (both names in allusion to the smell); Golalarang, Kharw.

A slender climbing wiry foetid shrub with ell.-ovate or oblong-ovate or narrow-ovate acute or acuminate leaves 2—5.5" by .8—3", and nearly sessile dingy purple tubular-funnel-shaped flowers .5" long in axillary and terminal cymose often scorpioid panicles. Fruit ell.-ovate or oblong

polished, often red, compressed, .4" long, with a thin fragile veined epicarp separating from the two thin .35"-long pyrenes which have a broad wing all round.

Usually gravelly mixed forest near rivers. Purneah! Along Koil R., Palamau! Ranchi-Manbhum Ghats! Ranchi, near Pitorea, Wood. Fl. Aug.—Oct. Fr. Dec.

Climbing by means of the twining stems and twisted 1—3.5" long petioles. L. glabrous with rounded or sub-cordate base, sec. n. about 7, axils sometimes hairy with glands. Panicles 4—6" pubescent. Sepals 4—5 small obtuse or triangular, ciliolate. Petals one-fourth the length of tube, oblong with white incurved crisped margins, tube glandular-hairy within.

The leaves are boiled and made into soup, the odour disappearing. The leaves and root are considered wholesome and tonic, and the plant is used internally and externally for rheumatism, for which it is considered specific (*Nadharni*).

24. DENTELLA, Forst.

Herb. Leaves small, sometimes appearing whorled from the abbreviated axillary shoots. Fls. minute inconspicuous at the forks of the branches or ends of the shoots. Hypanthium globose. Calyx at first 5-sepalous, ultimately basal portion elongating into a tube. Corolla funnel-shaped with the petals 2—3-toothed, induplicate-valvate. Fruit indehiscent 2-celled with many minute angular seeds covered with microscopic raised dots.

1. *D. repens*, Forst.

A small prostrate weed copiously sub-dichotomously branched with the branches 2—10" long rooting at the nodes. Leaves membranous narrow elliptic or oblanceolate or spatulate, .2—3" long including the short petiole, sparsely hairy or ciliate or glabrous with scarious truncate stipules. Fls. mostly solitary, very inconspicuous, sessile, white. Hypanthium hispid, or when dry appearing fibrillous. Sepals linear .05". Fruit .08" diam., usually closely covered with fibrillæ which collect the dust, so that in the field it appears like a little ball of mud (sometimes glabrous, *teste F. B. I.*!), crowned by the persistent calyx .07" long.

Common along moist river beds, damp banks, rice-fields, etc. Purneah, very common! Gya! Monghyr, bed of Ganges! Chota Nagpur! Probably in all districts. Fl., Fr. Sept, and throughout c.s.

25. OPHIORRHIZA, L.

Herbs, rarely undershrubs with usually more or less elliptic leaves and caducous stipules. Fls. white or pink, secund on the branches of axillary or terminal 2-chotomous cymes. Hypanthium short often compressed with 5 small persistent sepals. Corolla tubular or funnel-shaped, lobes 5 short valvate, back often winged. Stamens 5 on the tube, anthers linear. Disc large 2-lobed. Ovary 2-celled, style filiform, ovules many on basal ascending placentæ. Capsule coriaceous compressed, produced above the hypanthium, dehiscing at the top with broad gaping valves. Seeds many minute angled. Embryo clavate.

Leaves lanceolate. Fl. .2—3" long. Fr. .25—3" broad

1. *Harrisiana*.

L. ell. or oblanceolate. Fl. .5—7.5" long. Fr. .4"

2. *fasciculata*.

1. *O. Harrisiana*, Heyne.

A succulent herb 1—1.5 ft. high erect from a creeping root with lanceolate satiny leaves 2.5—4" long, puberulous on the nerves beneath.

White flowers .2—3" long, hispidulous, ribbed, on the 3—5 erectopotent stout fleshy branches of the cymes, which elongate to 2 or 2.5" in fruit and bear the curious transversely compressed fruits .25—3" broad along the inner face. Bracts on the cyme 0.

Near streams under the shade of trees, Baruni Hill forest, Puri! Fl., Fr. September.

L. acuminate both ends with about 12 close-set secondary nerves depressed above. Stipules with a long filiform tip. Cymes minutely pubescent. Fruit hispidulous-pubescent.

NOTE.—The above description is entirely from my notes on the fresh specimens, which I have been unable to compare as they were lost in camp. The pubescent capsules would bring it under *O. trichocarpa*, Bl., but *O. trichocarpa* is altogether more pubescent than the Puri plant.

2. *O. fasciculata*, Don.

An erect sub-succulent weak herb about a foot high ascending from a creeping root with pubescent stems, elliptic or somewhat ovate or oblanceolate leaves 3—6", somewhat pale and glistening when fresh, membranous when dry, and slender-tubed white flowers .5—75" long on the branches of a corymbose pubescent cyme which has a long peduncle and long tapering linear persistent bracts on the branches. Capsule compressed .4" broad, side lobes almost wing-like.

On moist shady banks and ravines under trees. Neterhat 3000 ft.! Fl. May—Sept. Fr. Aug.—Oct.

L. thinly pubescent on the nerves beneath, somewhat acuminate and base tapering into the .5—1.5" long petiole. Sec. n. slightly arched, strong, about 12. Stipules lanceolate and with a long filiform tip. Peduncle 2—3". Cyme branches .5—75" pubescent. Bracts .25—4". Hypanthium much compressed with very short sepals only reaching the top of the disc. Seeds many minute brown tetrahedral.

Distrib.: Sub-tropical Himalaya and Khasia Hills.

26. HEDYOTIS, L.

Shrubs, undershrubs or herbs. Leaves occasionally ternately whorled, with usually conspicuous stipules furnished with bristles, sometimes combined into a sheath. Fls. white or lilac, in axillary clusters or capitate cymes, more rarely in lax axillary or terminal cyme. Sepals 4, acute, persistent, their bases usually broad or adjacent to one another (*cp. Oldenlandia*). Corolla funnel- or bell-shaped, lobes 4, valvate. St. 4 in the tube or throat. Ovary with filiform style and 2-fid or 2-lobed stigma, ovules numerous on axile placentæ. Fruit small, indehiscent or capsular or of 2 cocci. Seeds plano-convex or angled. Embryo clavate.

Some authors now unite *Hedyotis* and *Oldenlandia*. The more or less shrubby species are distinguished by this habit, but some of the herbaceous species are only separable by the more dilated stipules and the wider base of the sepals, which characters are only relative and not always evident. Both genera being large, and to avoid multiplication of synonyms, however, I prefer to keep them distinct as is done in the *F. B. I.*, merely indicating the intermediate species.

- | | |
|---|-----------------------|
| I. Climbing shrub with fls. in large terminal cymes | 1. <i>scandens</i> . |
| II. Herb with slender rhizomes. Cymes axillary lax. Fr. indehiscent | 2. <i>vestita</i> . |
| III. Annual herbs. Capsule dehiscent loculicidal on top. | |
| Leaves 2—6" broad. Fruiting-calyx .2—2.5" | 3. <i>hispida</i> . |
| Leaves under 1" broad. Fruiting calyx .12—14" | 4. <i>pinifolia</i> . |

1. *H. scandens*, Roxb. Syn. *Oldenlandia scandens*, K. Schuan.

A large scrambling shrub with green terete smooth branches thickened at the nodes, opposite lanceolate or elliptic acuminate leaves 2.5—4", pale and nerveless beneath and dense corymbose cymes of small white sweet-scented 4—5-merous flowers. Fruit sub-globose .12—15" long with top of capsule loculicidal produced above rim of hypanthium and sometimes exceeding the sepals.

Riverain jungles, Purneah! Fl. Sept.—Jan. Fr. Dec.—Feb.

L. glabrous, sometimes caudate, base narrowed, sec. n. very obscure but slightly raised above. Petiole .15—4" connected by broad stipules which have a short acumen or are 2-cuspidate when young. Corymbs about 1" diam. puberulous, sometimes shortly paniced. Hypanthium .1" produced above the ovary in flower, sepals distant linear-subulate. Corolla-tube very short about one-fourth as long as the linear-oblong .22" long petals which are villous at base within. Filaments flattened villous within, shorter than petals. Style hairy, stigmas oblong.

2. *H. vestita*, Br.

A diffuse herb from a slender twisted nodose tuberous rootstock with pubescent hirsute or sub-villous branches, narrowly elliptic or oblong soft pubescent leaves 1.5—3" by .5—1" and small flowers in axillary short 3—5-nate slender cymes on peduncles .12—3" long, once or twice 2—3-chotomously branched. Fruit very small indehiscent, hispid, .05" diam.

Singbhum, in Sal forest in the valleys, rare! My specimens are in fruit only. Fl. Aug.—Sept. Fr. Nov.—Jan. Perennial.

Leaves hairy both sides, acute both ends, scarcely acuminate, base narrowed subsessile or shortly petioled, sec. n. 4, very oblique, raised beneath. Stipules connate below, short, but with a setaceous hairy acumen .12—2" long. Cymes hispid-hairy .25—5", 3—10-fl., bracts linear .08—12" long. Pedicels very short. Calyx with hypanthium hispid, .08—1" long with the sepals rather exceeding the tube, contiguous or connate at base, linear or narrowly triangular 1-nerved acute.

The usual Deccan form is *H. auricularia*, L., distinguishable by the less hairiness and the capitate cymes, but this has hitherto not been recorded from our area.

3. *H. hispida*, Retz. Syn. *Oldenlandia hispida*, Benth.

A diffuse herb with stems 8—15" long, branches hispidulous terete or somewhat compressed with two raised stipular lines each side, sometimes grooved between these lines. Leaves lanceolate or linear-lanceolate, 1.25—3" long, nerveless (exc. mid-rib), pale beneath, hispid beneath and on the margins. Stipules with linear-subulate appendages .15—3" long. Flowers clustered axillary sometimes numerous in heads .7" across, calyx densely hispid, .25" long in fruit (including hyp.), the tube shortly tubular above the hypanthium with lanceolate sub-aristate lobes. Fruit crustaceous, .09" diam. and about .1" long, loculicidally 2-valved from the top. Seeds many angular.

Very common in Chota Nagpur! Usually in poor open forest land on clay soil. Fl. r.s. Fr. Nov.—Jan.

Root sometimes woody. Leaves seldom hispid on the upper surface except at the margins, trabeculate when dry, sessile or subsessile, margins sometimes recurved, thickened.

4. *H. pinifolia*, *H.f. ex Wall. Cat.*

A much more slender and wiry plant than the last with the stipular lines on the branches usually making them acutely 4-angled and with the slender leaves sub-acicular .5—1.5" long, often fascicled, scabrid, nerveless except the mid-rib, margins revolute, tips very acute or pungent. Stipules about 1.5" including the long bristles. Cymes usually fewer-fld. Fls. similar but smaller, only .12—14" long *in fruit*, sub-sessile or shortly pedicelled, hispid, lanceolate teeth only half as long as the rest of the fruit. Corolla only .1" long including the petals. Top of capsule free 2-lobed (as in last but more so), keeled, seeds many small brown, 3-angled.

Common on fire-lines, etc., in the forests of Chota Nagpur, chiefly on clay soil and over 1000 ft. Gya hills! Fl. r.s. Fr. Nov.—Dec.

27. OLDENLANDIA, *L.*

Slender, erect or diffuse, often 2—3-chotomously branched herbs with the leaves generally small and narrow and stipules often scarious and bristly. Fls. small, mostly white or pinkish, on 1—4-fld. axillary peduncles or in terminal paniced cymes, rarely subsessile. Hypanthium not or slightly produced above the ovary with 4 very small sepals, usually erect and distant in fruit, sometimes with alternating smaller teeth. Corolla funnel- or salver-shaped with long or short tube, petals 4, rarely 5, valvate. Ovary 2-celled, stigmas 2-linear. Ovules numerous. Capsule small with the crown sometimes projecting above the hypanthium, loculicidal at the top or to the base. Seeds angled or rounded, smooth or pitted. Embryo clavate in fleshy albumen.

Hedyotis is well united with this genus in the *Flora of Madras*; the species with broad-based sepals adjacent in fruit (e.g. *crystallina*) are scarcely distinguishable. The older name is *Oldenlandia*.

† Leaves narrow, sometimes grass-like. Seeds angled, smooth.

I. Corolla-tube short or only slightly exceeding the sepals.

A. Peduncles axillary from the lower or all the axils, not in leafless panicles.

1. Diffuse or sub-erect.

Sepals triangular-subulate distant. Pedicels long slender, usually paired on a slender peduncle.

L. not acicular

Hispidulous. L. sub-acicular. Peduncle often 0 or short. Pedicels often 2—4-nate

Glabrous. Pedicels solitary, very short, often not exceeding flower or 0

Sepals broadly lanceolate, contiguous. Fls. 1—2 from all the axils. Small prostrate herb

2. Erect, corymbosely branched. Pedicel slender solitary axillary. Sepals very short, distant

B. Peduncles mostly from the upper axils, several-fld., sometimes cymose but not in open terminal cymes or panicles.

Pubescent. L. .2—5". Stipules with bristles. Sep. nearly as long as corolla. Capsule .05—.06"

Rigid nearly glabrous. Stipules mucicous. L. .3—9", sepals half as long as corolla. Capsule up to .15"

C. Peduncles from the upper axils and in terminal leafless lax cymose panicles.

Branches acutely 4-angled

II. Corolla-tube long, far longer than the sepals.

A. Whole plant divaricately branched ending in dichotomous cymes with very slender peduncles

1. *corymbosa*.

2. *scabrida*.

3. *diffusa*.

4. *crystallina*.

5. *herbacea*.

6. *umbellata*.

7. *arenaria*.

8. *brachiata*.

9. *dichotoma*.

- B. Plant strict or only branched above.
 Fls. .2" long. Capsule .12" long and broad. 10. *nagporensis*.
 Fls. .6" long. Capsule .16" long, oblong. 11. *gracilis*.
 †† Leaves elliptic or ovate, rarely oblong, over .25" broad.
 Seeds subglobose, pitted.
 Branched from the base. L. not sub-verticillate 12. *paniculata*.
 Sub-simple, short with one pair of leaves below and a sub-
 verticil above 13. *nudicaulis*.

1. *O. corymbosa*, L.

A branching diffuse slender glabrous or minutely hispidulous annual with linear, linear-lanceolate or narrowly elliptic-lanc. leaves .5—2" long without visible sec. n. Flowers minute white paired, more rarely only 1 or 3—4 on the axillary peduncles which are longer or shorter than the very slender .1—5" long pedicels. Sepals subulate .04—05" long. Corolla-tube slightly exceeding the sepals. Capsule .08—1" long and broad, not projecting beyond the hypanthium.

A common weed, usually in rather moist places, dried rice-fields, moist paths, etc., ascending to the tops of the pats in Chota Nagpur! Probably in all districts. Fl., Fr. June—Jan.

Very variable with branches from 2" to 1 ft., leaf margins recurved, stipules short membranous with 2—3 long fine teeth and often smaller intermediate ones. Corolla about .09" long including the petals.

The next species is practically a well-marked variety of this which I keep distinct because *O. diffusa* is usually kept distinct although it differs quite as little.

2. *O. scabrida*, DC. Syn. *O. corymbosa*, F. B. I. (in part).

A sub-erect much-branched slender herb 5—9" high with 4-angled scabrellous or hispidulous stems and very narrowly linear or subacicular leaves .5—1.5" long with the margins recurved scabrellous or hispidulous and ending in a pungent tip, not unlike those of *Hedyotis pinifolia*. Stipules scarious .07—1" including the 1—4 slender appendages or bristles. Peduncles mostly solitary axillary and 1-fld. but sometimes 2-nate or 3—4-fld. with a minute slender bract at the fork. Ped. and pedicels filiform. Sepals narrowly lanceolate, slightly shorter than the corolla-tube, margins hispidulous. Fruiting calyx .12—13" long with the teeth rather shorter than the hypanthium, the latter slightly hispidulous or glabrescent. Capsule slightly projecting above the hypanthium. Seeds broadly oblong angled.

Lohardagga, Gamble! Singbhum!

3. *O. diffusa*, Roxb.

Scarcely more than a variety of *O. corymbosa*, very diffuse, distinguished by the flowers being solitary and sessile or with peduncles scarcely exceeding the length of the flower. Glabrous, with narrowly lanceolate or linear leaves.

Wet ground, Purneah! Probably common. Fl. r.s.

4. *O. crystallina*, Roxb.

A small diffuse flaccid glabrous annual or the well-marked stem ridges and leaves slightly hispidulous, branches 2—4" long, L. ell. or lanc., .25—6", minutely dotted. Peduncles 1—2-fld.; if 1-fld. then shorter

than the leaves. It differs from the preceding especially in the broader leaves and the broadly lanc., sometimes hispid, sepals .07" long, the bases of which nearly touch even in fruit (as in *Hedyotis*) and which are nearly as long as the corolla. Hyp. in fruit strongly 4-nerved or -ribbed.

Garden paths, etc. Fl., Fr. Jan.—March.

Stem often minutely hirtellous. Fls. .09" sometimes 5-merous. Petals ovate. Seeds rounded oblong minutely pitted.

5. *O. herbacea*, Roxb. Syn. *O. Heyneii*, F. B. I.

An erect much corymbosely branched herb 1—2 ft. high with lower leaves linear-lanceolate tapering both ends, very acute, about 1", upper smaller linear. Stipules 0, obscure or with minute teeth. Fls. very numerous, solitary in the axils of all but the lowest leaves, on very slender peduncles .25—.75" (rarely 1") long. Top of capsule ridged projecting above the hypanthium and reaching to about the level of or beyond the top of the sepals. Seeds minute black or brown, ellipsoid 3-angled.

Not recorded from the Northern Tract, but from Chota Nagpur southwards it is fairly common in open jungles and waste ground. Ranchi! Hazaribagh, *Gamble!* Manbhum, *Clarke, Gamble!* Puri! Sambalpur! Fl., Fr. Sept.—Jan.

Quite glabrous, even the 4 raised lines or angles on the stems. Corolla .1—1.5" long, several times longer than the very small subulate sepals. Fr. nearly globose or very slightly didymous, .1".

The entire plant is used in medicine and is regarded as a bitter tonic and febrifuge.

6. *O. umbellata*, L.

A diffuse annual with branches 2—6" long, stems rather woody, about 6—8-ridged or -lined, hispidulous (sometimes glabrous, F. B. I.). L. .2—.5" (in our area). Fls. minute white in 3—7-fl. umbels at the ends of the branches and also sometimes axillary. Capsule very small .05—.06".

On sand dunes on the Orissa coast! Fl., Fr. Sept.—March.

L. often clustered with recurved margins. Stipules with several bristles. Sepals narrow lanceolate nearly as long as capsule and not much shorter than the corolla-tube. Crown of capsule only reaching the top of the hypanthium. Seeds shortly oblong, obscurely angled.

7. *O. arenaria*, Haines (*Journ. As. Soc. Beng.* xv, No. 7).

A herb glabrous or nearly so with many diffuse striate stiff branches 4—8" long, linear sessile leaves .3—.9" long with recurved margins connected at base by membranous truncate stipules without bristles. Fls. minute on short stout pedicels about as long as themselves in dense terminal umbels. Sepals lanceolate minute about half as long as the corolla tube. Corolla funnel-shaped. Capsule broadly-oblong, not didymous, .12"—.15" long (3—3.7 mm.), top slightly raised above the hypanthium but not as long as the sepals. Seeds pale brown, ellipsoid, obscurely angled.

Sands of Orissa coast. Fl., Fr. Aug.—Oct.

8. *O. brachiata*, Wight.

A very slender erect annual 3—8" high with acutely 4—6-angled glabrous stem and linear or almost filiform leaves .5—1.3" long. Flowers minute on capillary pedicels in elongate lax terminal cymes and sometimes also a few axillary. Sepals minute distant subulate. Crown of capsule slightly raised above the hypanthium.

Patna, Hamilton! This is so far the only record from our area.

9. *O. dichotoma*, Koen.

A very slender copiously paniculately branched annual 8—18" high, branches terete with 2 raised hispidulous lines each side, the ultimate ones filiform. L. linear to linear-lanc. or narrowly lanceolate, 1—2", sec. n. scarcely visible. Fls. very minute bluish .15" diam. solitary on long filiform pedicels, or 2-nate on axillary peduncles and in terminal capillary panicles; peduncles and pedicels .4—1.3" long.

Frequent in Chota Nagpur in open places or on rocks. Kuru (Ranchi), Gamble! Hazaribagh, Clarke! Manbhum, Clarke! Behar, Kurz! Neterhat! Fl., Fr. Aug.—March.

It is closely allied to the last, and Wallich's type sheet (6204) shows the slender stems with 4 raised hispidulous lines. Sepals very minute subulate about half as long as corolla tube, sometimes hispidulous. Capsule not exceeding the hyp., only .06", often splitting with the hyp. to the base. Seeds about 20 (cells about 6-seeded, J. D. H.), globose-oblong, granulate.

10. *O. nagporensis*, Bruce. Syn. *O. senegalensis*, Hiern (F. B. I.).

A very slender annual with linear leaves 1—2.2" long and wiry stem terminating in a wide spreading very lax cymose panicle. Cyme-branches divaricate, pedicels capillary 1—2" long, flowers minute, pink, sepals subulate, much shorter than the slender corolla-tube, which is .08—.12" long only, petals acuminate. Capsules .15" long and broad.

Hazaribagh, Clarke! Singbhum! Fl. Sept.—Oct. Fr. Nov.
Leaves acuminate, margins flat or recurved.

11. *O. gracillis*, DC.

A slender, almost grass-like herb, with sparingly branched stem 8—18" high, erect linear-acuminate glabrous flat grass-like leaves 1.5—3.5" long, and narrow panicles of erect pale-brown or lurid green-purple flowers very easily recognised by the corolla, .3—.5" long on very long slender pedicels. Capsules .17—.25".

Open grassy places, noticeable especially after grass fires. Champaran! Purneah! Plateau and Pats of Chota Nagpur (Hazaribagh, Manbhum, Neterhat etc.)! Fl., Fr. Feb.—June.

A very distinct species.

12. *O. paniculata*, L.

A more leafy and usually stouter species than any of the preceding, much branched from the base with stems 6—18" long obtusely 4-angled. L. elliptic to broadly elliptic, acute or obtuse, .5—2" long and often .5" broad, sec. n. scarcely visible, base narrowed into a petiole. Fls. in axillary and terminal cymes which are only 2-flid. in impoverished plants but up to 10-flid. in luxuriant ones. Sepals very small deltoid.

Corolla-tube short. Capsule '1" and often broader, top usually ridged and projecting beyond the sepals. Seeds subglobose, pitted.

Northern tract: Darbhanga! Southern tract: Puri district (Balugaon) *Hooper!*
Fl., Fr. apparently throughout the year.

Stipules with only two median bristles.

13. *O. nudicaulis*, *Roth.*

A small herb 1—6" high with either two pairs of leaves or a lower small pair and two pairs above which are sometimes separated, by such a short internode as to appear whorled. Stem furfuraceous or with thick hairs below, naked towards the panicle. Leaves broadly elliptic or ovate, the larger 1—2" long, flaccid, pubescent on the nerves beneath and ciliate. Flowers small, white, with slender pedicels in long stalked dichotomous cymes often bearing a pair of bract-leaves at the first fork. Calyx-teeth slender nearly as long as the tube in flower, widely separate and minute in fruit. Corolla lobes valvate rotate, oblong, '06—'08", tube very short, throat, villous. Capsule compressed, '1" diam., loculicidally dehiscent at the top. Seeds dark brown, slightly pitted, obscurely angled.

Frequent in waste ground, open forest, etc. Chota Nagpur! Fl., Fr. Aug.—Oct.
Stems rarely branched with each branch bearing a whorl of leaves. L. with 4—5 distinct oblique sec. n., apex rounded. Cymes 2—4" long, one from each of the axils of the first pair of larger leaves and three terminal.

28. ANOTIS, *DC.*

Prostrate or ascending rarely erect herbs with stipules like those of *Oldenlandia*. Flowers in cymes. Hyp. short, sepals usually distant, 4. Cor. tubular or funnel-shaped, lobes 4, shorter than tube, valvate. Ovary 2- rarely 3—4-celled, ovules few in each cell on placenta ascending from near the base of the septum. Capsule didymous or laterally compressed, loculicidally 2-valved at the top, cells 1—few-seeded. Seeds peltate, boat-shaped or plano-convex, coarsely pitted. Embryo clavate.

1. *A. calycina*, *Wall.*

A glabrous or minutely hairy herb 4—10" high, erect from a creeping base with lanceolate to ovate-lanceolate sub-acuminate ciliate leaves '5—2" long. Stipules short and broad with bristles. Flowers sessile and on slender pedicels, very small, lilac, in very divaricate dichasial cymes 2—3" long. Corolla '15" long with very slender tube. Capsule '13" broad didymous, widest above, base rather tapering. Seeds brown-black peltate pitted on the convex side.

Parasnath, near the top, several times collected, but I have seen it nowhere else in the province. Fl., r.s. Fr. Oct.—Nov.

29. SPERMACOCE, *L.* (inc. *Borreria*).

Herbs or low undershrubs with usually square branches; often with the habit of *Hedyotis*. Leaves opp. or sub-verticillate with their stipules connate with the petioles into a broad truncate tube with marginal bristles. Fls. small or minute, solitary or in axillary or terminal fascicles

or cymes. Calyx-tube (above the hypanthium) hardly any, sepals usually small, sometimes two smaller or absent, sometimes interposed teeth or bristles present. Cor. funnel- or salver-shaped with 4 valvate lobes. St. 4 on throat or tube often exerted. Ovary 2-celled, style filiform with two short arms or capitate stigmas. Ovule 1 in each cell on the middle of the septum. Capsule dehiscent septically or septifragally into two valves or mericarps, and each mericarp loculicidal from the top, or septum sometimes adnate to and closing one mericarp. Seed oblong, ventrally grooved. Cotyledons very thin. Radicle inferior.

NOTE.—Meyer makes three genera out of the dehiscence of the capsule, of which two concern us, *Spermacoce* and *Borreria* (Meyer). In *Spermacoce* he says the capsule is not bipartite, one valve dehisces, the other remains closed by the septum formed out of the lamellæ belonging to both valves. To this genus he assigns *S. hispida*. In *Borreria* the capsules are 2-partite, the septa are incomplete, being inflexed at the margins of the valves which are more or less open ventrally. To this belongs our species *stricta*. The *F. B. I.* also states that one mericarp remains closed by the septum in *S. hispida*. This however is not invariable and I have met fruits in which the septum stands quite free between the two open mericarps!

L. much longer than broad. Corolla under .15". Capsule (see above) under .1" 1. *stricta*.
L. rarely three times longer than broad. Cor. over .3". Capsule (see above) over .1" 2. *hispida*.

1. *S. stricta*, L.f. Syn. *Borreria stricta*, Meyer.

A more or less erect much branched herb 6—18" high with linear-oblong or linear to oblong-lanceolate leaves .8—2" long, scabrid-hispid above and on the very oblique nerves beneath, acute or acuminate, sub-sessile, base hispid. Flowers few or many in dense axillary and terminal clusters. Hypanthium pubescent above .06". Sepals 4 with often 2 additional bristles, narrowly linear, spinulose tipped but not hispid, .07—06" long. Corolla white salver-shaped or somewhat funnel-shaped, .09—12" long including the ovate-triangular petals. Filaments slender. Fruit sub-muricate or hispid-scabrid above, .08" long, septicidal, each valve carrying part of the septum near its margins but open in the centre, also loculicidal above. Seed free in the partially open capsule, ellipsoid, deep brown, highly polished.

A common weed in waste lands and open places in the forests in most or all districts! Fl. r.s. Fr. Oct.—Dec. Annual.

The stems have usually two narrow wings and are very sparsely shortly hispid; sometimes there are two additional equally strong or weaker wings or lines, making it 4-angled.

2. *S. hispida*, L.

A procumbent scabrid or hispid herb much branched from the root with rather distant pairs of obovate oblong or elliptic leaves .4—1" long, usually obtuse or rounded, more or less scabrid both sides. Flowers clustered pale lilac or white with tubes .37—5" long, slightly dilated upwards. Hyp. narrow ellipsoid, .08". Sepals .05—06" hispid, two usually stouter than the others. Petals short obtuse. Capsule .11—12" long, septifragal, the thin septum being left entire between the concave oblong, loculicidal valves which are entirely open ventrally. Seed brown, polished, microscopically tessellate.

A very common weed in open waste lands and pastures. Fl. July—Oct. Fr. Sept.—Dec.

Stems usually with 4 acute angles or ridges sparingly scabrid below, hispid above. Bristles on the stipules long in both species.

30. HYDROPHYLAX, *L.f.*

Creeping glabrous succulent littoral herbs with sessile ovate-oblong leaves and stipules united with the petioles into an entire or toothed cup. Flowers solitary, axillary, shortly pedicelled, rose or lilac, 4-merous. Hypanthium 4-angled. Sepals ovate-lanceolate, persistent. Corolla rather fleshy, between bell- and funnel-shaped, with a ring of hairs within; petals 4 ovate, valvate. Stamens on the throat, filaments filiform, anthers linear. Ovary 2-celled, style filiform, pubescent, stigma obscurely 2-lobed. Ovules 1 in each cell, peltately attached to the septum. Fruit large, corky, oblong-ovoid, compressed, curved, acutely 3-4-keeled between the acute margins, 2-seeded.

1. *H. maritima*, *L.f.*

Stems creeping several feet, scarcely branched. Leaves very fleshy .5—1" by .25—.5", mostly obovate acute, sometimes papillose. Flowers pretty, gentian-like, .3—.5" diam. with a tube .3—.5" long and 4 spreading lobes. Fruit .5—7" long crowned with the enlarged sepals.

Sandy sea shores of the Orissa coast, Puril Fl. June.

The plant is a sand-binder, but is not of great use in this respect owing to its being so little branched and the roots given off at the nodes are of no great length.

31. KNOXIA, *L.*

Erect herbs or undershrubs, stems often grooved, with two lines of pubescence. L. opp., stipules connate with the petiole into a sheath. Fls. dimorphous, pink or lilac, small, subsessile on the elongating branches of terminal cymes. Calyx teeth minute or 1—2 elongate, persistent. Corolla tubular-funnel-shaped, throat villous, lobes 4 valvate with inflexed tips in bud. St. 4 in the tube. Ovary 2-celled, style filiform, stigma 2-lobed. Ovule 1 pendulous in each cell. Fruit very small, of two connate or separating indehiscent mericarps falling away from or with the columella. Seeds with thickened funicle. Embryo axile, cotyledons thin.

Leaves petiole acute. Mericarps united
Leaves sessile obtuse. Mericarps separating

1. *corymbosa*.
2. *brachycarpa*.

1. *K. corymbosa*, *Willd.* Syn. *Spermacoce teres* and *S. exserta*, *F.I.*

An erect sparingly branched slender annual 1—4 ft. high with pubescent or tomentose stems, long narrow acuminate leaves 3—5" long and terminal corymbosely branched cymes with the minute white or purplish flowers sub-spicately arranged on its branches. The somewhat compressed and ridged fruit is .07—09" long and falls away from the central persistent filiform columella leaving a minute perforation through its axis; the mericarps remain united. Seeds black, flat on one face and keeled on the other.

Common throughout the province in grass lands and also under shade. Fl., Fr. Aug.—Dec.

Stem with long internodes, 3-chotomously branched above, hairs crisped. L. tapering both ends more or less pubescent, with 6—10 slender oblique sec. n. Spiciform branches of cyme .25—1" long. Corolla about .06—08" long. Stamens included.

2. *K. brachycarpa*, Bl. Syn. Spermacece lævis, F. I.

A herb of similar habit to the last. Stems often grooved and with two lines only of pubescence on the rounded faces. Leaves oblong 2—4" with obtuse or rounded tip and usually obtuse base, sessile. Flowers lilac, very shortly pedicelled, about .18" long including the ovary. Mericarps oblong, .08" long, plano-convex, separating and falling separately from the persistent filiform columella.

Top of Parasnath, C. B. Clarke! Fl., Fr. Oct.

Stems sometimes hairy, F. B. I. Leaves erect hairy on the nerves, sec. n. 8—10 very oblique. Corolla .12—13" with obtuse lobes.

32. RUBIA, L.

Scabrid or prickly erect diffuse or climbing herbs with whorled leaves. Flowers small or minute, in axillary and terminal cymes, pedicels jointed with the flower. Hypanthium ovoid or globose. Calyx 0. Corolla rotate or shortly bell- or funnel-shaped, lobes 4—6 valvate. Stamens 4—6 on the tube, anthers globose or oblong, exserted. Ovary 2-celled, style 2-fid or styles 2, stigma capitate. Ovules 1 erect in each cell attached to the septum. Fruit small didymous, or globose by the suppression of one carpel, indehiscent, often fleshy. Seeds adhering to the pericarp, cotyledons broad thin, radicle slender inferior.

Leaves ovate-cordate, 4 in a whorl, petioled
Leaves sub-acicular, 4—8 in a whorl, sessile

1. *cordifolia*,
2. *angustissima*.

1. *R. cordifolia*, L. Manjit, H.; Jata Singhi, Birja; Madder.

A herb scrambling over bushes by means of its scabrid or minutely aculeate stems, petioles and whorled leaves. Leaves ovate-cordate acuminate or, in our area, usually ovate-lanceolate with rounded or cordate base, 2—3" long with 5—7 principal nerves, scabrid above, hairy beneath. Petiole 1—3" aculeate with small hooked prickles. Flowers yellowish-white .1" diam. umbellate on the branches of 3-chotomous cymes 1—3" long. Corolla hispid with 5—6 recurved petals. Fruit globose fleshy .12—17" diam. or didymous.

Higher Mts. of the Central Area. Neterhat, 3000 ft. Parasnath 4000 ft. Fl., Fr. Oct.—Jan.

The root gives a dye (madder) and is also used in Indian Medicine. The plant is very variable and only the local form is described above.

2. *R. angustissima*, Wall.

A weak very scabrid branched scrambler superficially resembling an Asparagus with ridged branches and numerous close whorls of linear-acicular leaves 1—1.8" long. Fls. very small cream-coloured, at the ends of axillary ribbed pedicels or on two-bracteate peduncles or (f. F. B. I.) in 3—5-fld. cymes on the peduncle. Fruit globose .2".

Sandstone Hills of N. Champani Fl., Fr. Nov.—Jan.

Stems polished. L. mostly 8 in a whorl, .05—.08" broad, scabrid with strong midrib beneath, flat or grooved above. Pedicels shorter or longer than the subtending leaves. Corolla subglobose .05" with 5 lanceolate petals much longer than the very short tube.

FAM. 78. COMPOSITÆ.

Shrubs or usually herbs, very rarely trees. L. alternate or sometimes opposite, usually simple without stipules, base of leaf or petiole sometimes sheathing. Flowers (florets) sessile in a dense head on a common receptacle, each head surrounded by a calyx-like involucre of bracts (connate into a 2-celled utricle in *Xanthium*) and resembling a single flower, heads with their respective involucre sometimes again combined into heads of a higher order (compound heads) and then sometimes reduced to a single flower each. Florets all alike in sex (homogamous) and similar in form, or dissimilar in sex (heterogamous) or in form; when dissimilar the outer florets are either 1- or several-seriate and more slender than the inner or furnished with a strap-shaped or linear appendage (ligule) to the corolla, when ligulate the outer florets constitute the *ray*- (heads radiate) and the inner florets constitute the *disc*-fls. Calyx superior, reduced to scales, hairs or 0, and in fruit constituting the *pappus*. Corolla tubular or somewhat funnel-shaped, 2—5-toothed or cleft or ligulate or somewhat bilabiate. Stamens 5 (rarely 4) inserted in the corolla tube, anthers usually connate in a tube, pollen spinulose or verrucose. Ovary inferior 1-celled with 1 basal anatropous ovule with one integument. Style 2-fid. or arms connate in barren florets, furnished with a pubescence or hairiness (brush-hairs) distinct from the stigmatic lines or areas. Fruit (cypsele) dry indehiscent, closely investing the exalbuminous seed, which has a very thin testa, pappus sometimes caducous or 0. Embryo straight, cotyledons plano-convex, radicle short.

NOTE.—The structure of the style is important in classification but is a difficult field character. The character of tailed or ecaudate anthers is also important and this is nearly as difficult, not being easily seen in the field. In addition therefore to the usual classification based on the *Genera Plantarum* an artificial key is appended in which the above characters are as far as possible eliminated. The distinction between a few genera (e.g. *Conyza Blumea*) is, however, wholly dependent on them. The brush-hairs have apparently the function of sweeping out the pollen from the ripe (proterandrous) anthers as the style is thrust up through the staminal tube.

I. Tubifloræ. Inner or disc florets never ligulate. Juice not milky (*vide* p. 478):—

A. Style neither with a thickening nor with a corona of hairs at or just below the bifurcation (*vide* p. 478):—

Tribe I. Vernoniæ. Heads with the fls. all similar and tubular, homogamous never yellow. Leaves alt. Anthers cleft at base. Style with long semi-terete acuminate arms stigmatic on their inner surfaces, with brush-hairs on their outer surfaces and extending to below the fork.

Heads simple. Stems leafy

1. *Vernonia*.

- Heads compound. Leaves chiefly radical.
- Tribe II. Eupatoriæ. Heads with fls. similar and tubular, never yellow. Anthers sub-entire at base. Style arms not acuminate, stigmatic areas narrow marginal often short, brush-hairs short blunt above the stigmatic lines and never extending to the fork.
1. Anther tip truncate
 2. Anther tip appendiculate:—
Pappus paleaceous
Pappus of slender hairs. Invol. bracts 4
- Tribe III. Astereæ. Hds. homogamous or heterogamous, fls. similar and tubular or dissimilar. Anthers ecaudate. Style-arms more or less flattened bearing the stigmatic surface in two conspicuous marginal lines, above which is a short or elongated more or less conical tip with brush-hairs or -papillæ.
1. Heads radiate, ligules never yellow. Inner pappus of long hairs:—
Ligules very narrow 2—3-seriate. Pappus hairs sub-similar
Ligules broader 1-seriate. Pappus-hairs sub-similar
Inner pappus of hairs, outer a ciliate corona
 2. Heads not radiate but outer fls. filiform:—
a. Pappus 0 or minute. L. pinnatisect or pinnatifid:—
Erect odorous herb. Hds. purple, panicked .
Prostrate villous herb. Hds. yellowish, solitary
 - b. Pappus long. Erect leafy herbs
- Tribe IV. Inuleæ. Hds. heterogamous with fls. dissimilar or 1-fl'd. and compound. Receptacle not paleaceous (exc. *Athroisma*). Anther-cells caudate (exc. *Laggera* and non-polleniferous anthers). Style arms sometimes resembling those of Vernoniæ, sometimes truncate or typically (style of Inulineæ) with obtuse or rounded tips with the stigmatic lines marginal meeting over the top and short brush-hairs only towards the tip.
1. Style nearly that of Vernoniæ (or entire in sterile fls.), bracts not scarious, rarely sub-scarious. Hds. not radiate; outer fls. usually filiform:—
a. Hds. simple (though sometimes clustered, not on a common receptacle):—
i. Pappus copious. Herbs:—
Anther-cells ecaudate. Florets purple
Anther-cells caudate (exc. as above)
 - ii. Pappus copious. Shrub
 - iii. Pappus 0 or 2—3 caducous hairs only
 - b. Hds. compound. Pappus 0
 2. Bracts scarious or hyaline. Style arms usually obtuse or truncate. Hds. often clustered, not radiate:—
Leaves pinnatifid. Recep. with pales enclosing the fls.
L. simple. Cottony herbs. Pappus 0 .
L. simple. Glabrous herb with 1-fl'd. hds. compound in a leafy involucre. Pappus 0
 3. Bracts not scarious. Style of Inulineæ (see above). Hds. not clustered, often radiate. Pappus of hairs:—
Shrubby, and hds. not radiate (in our species)
Herbs. Frt. hardly ribbed. Pappus not double, that of ray scanty or 0 .
Frt. ribbed. Pappus of all fls. double, outer of scales
2. *Elephantopus*.
3. *Adenostemma*.
4. *Ageratum*.
4*. *Mikania*.
5. *Erigeron*.
5*. *Aster*.
5**. *Callistephus*.
6. *Cyathocline*.
7. *Grangea*.
8. *Conyza*.
9. *Laggera*.
10. *Blumea*.
11. *Pluchea*.
12. *Epaltes*.
13. *Sphæranthus*.
14. *Athroisma*.
15. *Gnaphalium*.
16. *Cæsulia*.
17. *Inula*.
18. *Vicoa*.
19. *Pulicaria*.

Tribe V. Helianthæ. Hds. radiate, heterogamous (unisexual in *Xanthium*), rarely ligules absent. Receptacle paleaceous. Anthers ecaudate. Style somewhat flattened truncate or appendiculate, stigma marginal narrow or broader and meeting in the middle (in sterile fls. often style entire). Pappus of 2—4 awns or bristles or paleaceous or 0, rarely plumose. Leaves often opposite.

1. Invol. bracts of female heads forming a 2-celled utricle, each cell with a single flower, armed with spines in fruit

20. *Xanthium*.

2. Invol. normal. Hds. heterogamous, several—many-fld.:—

a. Leaves opposite. Cypselæ not dorsally compressed. Hds. not very large:—

i. Inner invol. bracts embracing the outer frts. Pappus 0:—

Outer invol. bracts 5 spreading narrow glandular

21. *Siegesbeckia*.

Outer invol. bracts 4 in opp. pairs, broad

22. *Enhydra*.

ii. Inner invol. bracts not embracing the outer frts., pales of receptacle narrow. Pappus 0 or 2 teeth

23. *Eclipta*.

iii. Invol. bracts not embracing frts. but pales of receptacle concave and embracing the frts.:—

Ray. fls. with small white ligules. Pappus of 2—5 unequal bristles connate at base

24. *Blainvillea*.

Ray with yellow ligules. Pappus of minute scales with 1—few bristles or 0. Recept. not elongate

25. *Wedelia*.

Ray with yellow ligules. Pappus of 2—3 bristles or 0. Receptacle very elongate

26. *Spilanthes*.

b. L. opp. or alternate. Heads (Sunflowers) very large. Pappus of 1—3 deciduous bristles of scales or both:—

Peduncle not clavate above. Ligules yellow

27. *Helianthus*.

Peduncles clavate above, ligules often red

27*. *Tithonia*.

c. Cypselæ dorsally compressed. Pappus of 2—4 strong awns or a minute corona (exc. 28 and 34):—

i. Pappus 0. Leaves opp. simple

28. *Guizotia*.

ii. Pappus of 2—4 strong awns. L. pinnate or pinnatifid:—

* Leaves opposite:—

Cypselæ slender, not beaked

29. *Bidens*.

Cypselæ slender and beaked

30. *Cosmos*.

** Leaves alternate or chiefly radical:—

Cypselæ linear with 2 retrorsely hispid awns

31. *Glossogyne*.

Cypselæ linear-oblong, with two smooth awns

32. *Glossocardia*.

33. *Chrysanthellum*.

iii. Pappus a minute corona. L. alternate

d. Cypselæ turbinate or oblong. Pappus of feathery bristles

34. *Tridax*.

Tribe VI. Heleniæ. Hds. usually radiate and heterogamous but ligules sometimes minute or suppressed. Bracts of invol. herbaceous 1—2, rarely 3-seriate. Receptacle without pales. Style of herm. fl. as in Helianthæ. Pappus 0 or of scales or bristles. (None indigenous.)

L. opp. without oil-glands. Hds. compound

35. *Flaveria*.

L. opp. with oil-glands. Hds. simple

36. *Tagetes*.

Tribe VII. Anthemidææ. Heads rayed or disciform, heterogamous or homogamous. Invol. bracts 2—many-seriate, dry or with scarios tips. Receptacle not paleaceous (in our species). Anthers ecaudate. Style-arms truncate. Pappus 0 or of short scales. L. alternate. (The *Chrysanthemum*, often grown in India, may be taken as an illustration of this tribe but our species have not radiate heads.)

1. Heads solitary, disciform and heterogamous:—
 - a. Leaves pinnatifid. Hds. peduncled
 - b. L. simple. Hds. sessile or shortly peduncled:—
 - Invol. bracts spreading in fruit
 - Invol. bracts incurved in fruit
2. Heads panicled, disciform, homogamous or heterogamous

37. *Cotula*.
38. *Centipeda*.
39. *Sphæromorphæa*.
40. *Artemisia*.

Tribe VIII. Senecionidææ. Heads heterogamous, rayed or disciform. Invol. bracts mostly 1-seriate and subequal often forming a tube with a few bracteoles at the base. Recept. not paleaceous (sometimes fimbriate). Anthers rarely tailed. Style-arms truncate penicillate round the tip (rarely tip conic, e.g. *Emilia*, or obtuse, very rarely acute). Pappus of fine hairs. Leaves alternate.
Hds. disciform. Fls. pink
Hds. radiate. Fls. yellow

41. *Emilia*.
42. *Senecio*.

Tribe IX. Calendulææ. Hds. radiate. Invol. bracts 1—2-seriate. Recept. naked. Anther cells mucronate. Style-arms truncate. Cypsel large, deformed, often tubercled. Leaves alternate

- 42*. *Calendula*.

B. Brush hairs on or below the fork forming a corona, or style thickened or otherwise changed at the fork (*cp.* p. 475):—

Tribe X. Cynaroidææ. Fls. all tubular. Invol. bracts many-seriate, tips scarios spinous or foliaceous. Receptacle densely bristly (paleaceous in 46). Anther-cells tailed. Pappus various or 0. Leaves alt. often spinescent.

1. Hds. 1-fld. crowded into involucrate compound hds.
2. Heads many-fld. simple:—
 - a. Basal areole of cypsel horizontal:—
 - i. L. spinescent. Filaments papillose-hairy
As in 44 but hds. very large, bracts appendaged
 - ii. Leaves unarmed:—
Filaments free, glabrous. Pappus-feathery
Fil. free, hairy. Recept. paleaceous. Pappus sub-paleaceous
 - b. Basal areole of cypsel oblique or lateral:—
 - i. Involucre not bracteate at base. Fls. purple or white:—
Cypsel smooth
Cypsel 10—15-ribbed
 - ii. Invol. bracteate at base with spinous leaves.
Fls. orange-red

43. *Echinops*.
44. *Cnicus*.
44*. *Cynara*.
45. *Saussurea*.
46. *Goniocaulon*.
47. *Tricholepis*.
48. *Volutarella*.
49. *Carthamus*.

II. Liguliflorææ. Sap milky. All florets ligulate (*cp.* p. 475):—

Tribe XI. Cichoriææ. Hds. homogamous and fls. similar with truncate 5-toothed ligule. Style-arms slender. Leaves alternate.

1. Cypsel truncate. Fls. blue. Pappus paleaceous

- 49*. *Cichorium*.

2. Cypsele narrowed or truncate. Fls. yellow. Pappus hairy:—
 Cypsele narrowed each end, many-ribbed or ribbed and grooved. Leaves chiefly radical 50. *Crepis*.
 Cypsele flattened, beaked, ribbed on faces 51. *Lactuca*.
 Cypsele truncate, columnar with few stout ribs, stems more or less prostrate or slender 52. *Launæa*.
 Cypsele sub-terete or compressed, not beaked, ribbed, stems stout erect leafy 53. *Sonchus*.

ARTIFICIAL KEY TO COMPOSITÆ.

§ Juice not milky. Inner flowers of head not ligulate (*cp.* p. 482):—

I. All flowers similar and tubular (*cp.* p. 480):—

A. Receptacle neither paleaceous nor densely bristly and leaves never spinose:—

1. Heads purple or pink. Leaves alt. or radical:—

a. Invol. bracts many:—

Heads simple. Stem leafy

Heads compound. Leaves mostly radical

b. Invol. bracts 1-seriate, more or less connate.

2. Hds. blue, pink or white. Leaves opposite:—

Fls. white. Pappus-hairs 3--5, short

Fls. blue or white. Pappus of 5 awned scales

Scandent. Fls. white. Introduced

3. Fls. white in 1-fld. heads collected into compound heads on axillary receptacles. L. alternate

4. Fls. yellow (normally outer ligulate). L. opposite

B. Receptacle densely bristly (paleaceous in 46; see also 14, in which filiform outer fls. are sometimes absent). Leaves or involucre bracts often spinose or cottony:—

1. Each head 1-fld. surrounded by an involucre of spinose bracts and crowded into dense balls

2. Each head several-fld. but not compound:—

a. Flowers usually purple, never orange:—

i. Leaves and invol. bracts not spinose (or sub-spinose in *Tricholepis*):—

More or less cottony. Fil. free, glabrous

Glabrous. Filaments papillose

Recept. paleaceous. Glabrous. Fil. hairy

ii. Leaves or invol. bracts or both spinose:—

* Heads m.s. purple or rarely white:—

Pappus hairs feathery, connate into a ring at base

Pappus of unequal scaberulous hairs, Frt. ribbed

** Heads very large, over 3" diam., blue

b. Fls. orange-red. Invol. and leaves often spinose

1. *Vernonia*.
2. *Elephantopus*.
41. *Emilia*.

3. *Adenostemma*.
4. *Ageratum*.
4*. *Mikania*.

16. *Cæsulia*.

35. *Flaveria*.

43. *Echinops*.

b

45. *Saussurea*.
47. *Tricholepis*.

46. *Goniocaulon*.

44. *Cnicus*.

48. *Volutarella*.

44*. *Cynara*.

49. *Carthamus*.

- II. All flowers tubular but outer different, filiform and usually 2—3-toothed, inner stouter usually 5-toothed, outer usually female, inner usually hermaphrodite (cp. pp. 479 and 480):—
- A. Pappus 0 or insignificant. Small herbs:—
1. Heads purple or rose:—
 - a. Stems or peduncles winged. Leaves not pinnatifid:—
 - Heads not compound, under .5" 12. *Epaltes*.
 - Heads compound, Clusters .5—1" 13. *Sphæranthus*.
 - b. Stems or peduncles not winged. Leaves pinnatifid 6. *Cyathocline*.
 2. Heads green, grey or yellow:—
 - a. Receptacle paleaceous. Heads compound 14. *Athroisma*.
 - b. Receptacle not paleaceous. Heads not compound:—
 - i. Small herbs with solitary or sub-solitary heads:—
 - Leaves pinnatifid. Pappus minute cupular 7. *Grangea*.
 - L. pinnatifid. Pappus a small auricle or 0 37. *Cotula*.
 - L. simple. Invol. bracts spreading in fruit 38. *Centipeda*.
 - L. simple. Invol. bracts incurved in fruit 39. *Sphæromorphæa*.
 - ii. Erect herbs with much paniced heads 40. *Artemisia*.
- B. Pappus distinct, of hairs or bristles. Receptacle not paleaceous:—
1. Shrub growing in salt marshes 11. *Pluchea*.
 2. Terrestrial herbs (or shrubby in *Inula*):—
 - a. Anther-bases entire or sagittate, not tailed:—
 - Hds. yellow or pinkish. Style tips of *Astereæ* 8. *Conyza*.
 - Hds. purple or pink. Style of *Vernoniæ* 9. *Laggera*.
 - Hds. greenish or yellow. Style of *Vernoniæ* 10. *Blumea* (few).
 - b. Anther-bases tailed:—
 - Invol. bracts not scarious. Style of *Vernoniæ* 10. *Blumea*.
 - Invol. bracts scarious or hyaline. Style-arms truncate 15. *Gnaphalium*.
 - Invol. bracts not scarious. Large herb with leaves white beneath 17. *Inula*.
- III. Inner flowers tubular, outer (ray) fls. ligulate (cp. pp. 479, 480):—
- A. Receptacle not paleaceous:—
1. Ray fls. neither yellow nor orange. Pappus of hairs:—
 - Ray fls. several-seriate, very narrow 5. *Erigeron*.
 - Ray fls. 1-rarely 2-seriate, broader 5*. *Aster*.
 - Outer invol. bracts foliaceous. Pappus with an outer ring of short connate bristles 5**. *Callistephus*.
 2. Ray flowers yellow or orange:—
 - a. Pappus of hairs:—
 - i. Style arms slender acute. Cypsele hardly ribbed. Pappus without scales 18. *Vicoa*.

- Cypselæ ribbed. Pappus with outer row of scales 19. *Pulicaria*.
- ii. Style arms truncate with a crown of short hairs 42. *Senecio*.
- b. Pappus of 5—6 scales. Recept. fimbriate 36. *Tagetes*.
- c. Pappus 0:—
- Hds. simple, large, orange 42*. *Calendula*.
- Heads compound, ray fls. only 1 in each head, very short, tongue-like. Leaves opp. 35. *Flaveria*.
- B. Receptacle paleaceous:—
1. Male and female heads separate. Involucre of female capsule-like, 2-celled. Leaves alternate 20. *Xanthium*.
2. Male and female heads not separate:—
- a. Leaves alternate, pinnatifid or pinnatisect (rarely lower opp. in 32):—
- i. Heads compound 14. *Athroisma*.
- ii. Heads simple:—
- Pappus of 2 smooth stiff awns 32. *Glossocardia*.
- Pappus of 2 retrorsely scabrid bristles 31. *Glossogyne*.
- Pappus a minute rim 33. *Chrysanthellum*.
- b. Leaves opposite or upper only alternate:—
- i. Lower leaves pinnatisect or 1—2-pinnate:—
- * Pappus of 2 awns:—
- Ligules white or yellowish. Frt. not beaked 29. *Bidens*.
- Ligules rosy or orange. Fruit beaked if white or yellow 30. *Cosmos*.
- ** Pappus of feathery scales 34. *Tridax*.
- ii. Leaves entire, serrate or crenate:—
- * Inner invol. bracts and often the pales embracing the flowers:—
- Outer invol. bracts 5 spreading, glandular 21. *Siegesbeckia*.
- Outer invol. bracts 4, broad, not glandular 22. *Enhydra*.
- ** Inner invol. bracts not embracing the flowers but pales of recept. embracing the fls.:—
- ! Small or m.s. herbs with heads under 2" diam.:—
- Ligules small white 24. *Blainvillea*.
- Ligules small yellow. Receptacle elongate 26. *Spilanthes*.
- Ligules yellow. Receptacle not elongate 25. *Wedelia*.
- !! Large herbs with heads over 2" diam. (Sunflowers):—
- Fls. usually yellow, peduncle not clavate 28. *Helianthus*.
- Fls. often red, peduncle clavate above 27*. *Tithonia*.
- *** Neither invol. bracts nor pales embracing the flowers:—
- Fls. white, outer invol. bracts many 23. *Eclipta*.
- Fls. yellow, outer invol. bracts 5 sub-foliaceous 28. *Guizotia*.

§§ Herbs with usually milky juice. All flowers ligulate
(cp. p. 479):—

I. Flowers blue

49*. *Cichorium*.

II. Flowers yellow:—

A. Stout fistular erect herbs with more or less
spinulose serrate leaves and sub-corymbose
heads

53. *Sonchus*.

B. Leaves all radical or stems slender, often spread-
ing or procumbent:—

1. Cypselis beaked, compressed

51. *Lactuca*.

2. Cypselis not beaked, rarely compressed:—

Cypselis narrowed to each end, ribbed

50. *Crepis*.

Cypselis columnar (ribs very stout), truncate

52. *Launæa*.

1. VERNONIA, Schreb.

Herbs, shrubs or small trees, sometimes climbing. Leaves alter-
nate, often toothed, sometimes gland-punctate. Heads terminal or
axillary, solitary or paniced, homogamous, with the flowers purple and
all tubular. Involucral bracts many-seriate, inner longest. Receptacle
naked or pitted, sometimes shortly hairy. Corolla equal slender,
lobes 5 narrow. Anther-bases obtuse or minutely tailed. Style-arms
subulate or linear. Fruits truncate striate, ribbed or angled, pappus
usually long with many minutely plumose hairs and often a row of
shorter outer hairs, bristles or scales.

A. Heads solitary or clustered, sessile or subsessile. Fr. 8—10-
ribbed:—

1. Bracts aristate or aristulate. Invol. over 4" long:—

Hds. 1—3 axillary and terminal, bracts tapering

1. *teres*.

Hds. clustered at the ends of short axillary branches,
bracts obtuse below the short awn

2. *Roxburghii*.

2. Bracts acute or mucronate. Invol. under 3" long:—

Heads clustered on the branches of a large panicle

3. *divergens*.

B. Heads distinctly peduncled:—

Coarse herb. Invol. 5" long. Fr. ribbed

4. *anthelmintica*.

Slender herb. Invol. 2" long. Fr. not ribbed

5. *cinerea*.

1. *V. teres*, Wall.

A rigid scabrid herb with simple erect leafy stems 1—2.5 ft. high,
pubescent with brown hairs. Leaves hard sub-sessile narrowly oblong
to obovate, 2—5" long, acute scabrid and punctulate above, hispid
beneath, with few distant mucronate teeth, reticulate. Heads large,
6—8" long and nearly as broad, sessile mostly solitary in the axils
but with often 2—3 terminal. Involucre rather cobwebby, bracts
lanceolate or outer subulate, often squarrose, tapering into a short
awn. Fruit about 8—10-ribbed, silky, 13—15" long with pappus 3"
long, dirty white or reddish.

Common, especially on clay soils in open scrub jungles. Fl., Fr. Oct.—Dec.

2. *V. Roxburghii*, Less. Dora bohok', S.; Agnijal, Or.; Ban Jatangi (Bonai).

An erect stout rigid herb 3—4 ft. with harsh sub-sessile or shortly
petioled oblanceolate or obovate shortly acuminate acutely serrate
leaves 3—7" long by 1—2.75" broad, and purple heads clustered at the

ends of the branchlets often in considerable panicles, sometimes and in young plants only at the top of the main stem, when it somewhat resembles the last species. Involucre 4—5" long, outer bracts not at all squarrose, outer shorter ones sometimes lanceolate but inner linear-oblong obtuse or subacute, the midrib ending in a very short awn. Fruits 12—14", truncate silky between the 8—10 ribs. Pappus brownish-white, outer shorter hairs often 0.

Waste ground and open scrub jungles, Central and Southern areas, frequent! Very common on the trap hills of the Santal Parganas! Common at Neterhat 3000 ft. Fl. Sept.—Feb. and sometimes also in h.s.

Stems more or less striate and hairy. L. scabrid above, usually hispid on the nerves beneath, base tapering, petiole sometimes 3". Bracts often red at the ends.

The plant is often handsome when well grown. The leaves are ground up in water and the mixture drunk for cholera in Sambalpur.

3. *V. divergens*, Benth. Bara pathol, S.

A stout perennial 4—8 ft. high. Leaves distinctly petioled, elliptic oblanceolate or obovate, serrate, hispidulous above, hispid-pubescent beneath, 3—7". Heads much smaller than in the preceding 25" long, or with the flowers 4" long, crowded in large corymbose panicles at the top of the stems. Involucral bracts rather few, outer short, inner oblong obtuse with a short pointed mucro scarcely awned. Fruit glabrous pale brown truncate about 8—10-ribbed, 07"—08" with pappus reddish or white 2" long, outer short scales 0.

Usually in the damper districts or on high hills. Korcho Hill, S.P.! Neterhat, 3000 ft.! Parasnath, 4000 ft.! Kalahandi, Cooper! Fl. Dec.—Jan. Fr. Feb.—May.

Stems ridged, pubescent. Petiole 2—1" long. Under-surface of leaves with minute glistening glands. Heads narrowly campanulate.

4. *V. anthelmintica*, Willd. Syn. *Centratherum anthelminticum*, O. Kuntz; Saoraj, S.

A coarse annual 2—7 ft. high with coarsely dentate or serrate elliptic or obovate, more rarely lanceolate, leaves attenuate at the base into a short petiole, lower often 8" by 3", upper gradually smaller and more lanceolate. Heads stout with a stout peduncle 4—2" long, often sub-corymbose, oblong 6—7" long (they are usually described as 5—75" broad but this is only the case with dried specimens). Involucre 4—5" long, outer linear-oblong constricted beneath the free green or coloured dilated tips. Fruit 15" long truncate black somewhat dilated upwards, ribbed and hairy, outer pappus of linear chaffy scales, inner 2—25" long of hispid hairs.

Usually in shade in village topes. Frequent in Chota Nagpur and S.P.! Probably also in other districts. Fl. Sept.—Dec. Fr. Nov.—Jan.

Stems as thick as the thumb below shortly pubescent or puberulous, paniculately branched above, branches ridged or striate pubescent or tomentose. Leaves rather membranous acuminate. Involucral bracts frequently with spreading tips. Flowers with slender tube 3—5" dilated above into a 5—6-lobed limb. Anthers tailed or acutely sagittate. Longer pappus hairs caducous, scales persistent.

The seeds are highly reputed as a vermifuge. They are also used in conjunction with other medicines for leucoderma (*Nadkarni*).

5. *V. cinerea*, Less. Jhurjhuri, S.; Barangom, S. (*teste Campbell*).

An erect or somewhat decumbent branched herb 8" to 3 ft. high

with slender ribbed hairy stems and often hoary-tomentose branches. Leaves excessively variable in shape from linear to elliptic, ovate or obovate, entire or toothed, sessile or attenuate into a short petiole, usually 7—2" long, always pubescent or hairy. Heads 25" oblong peduncled in dense or very loose panicles with light purple flowers. Involucre narrowly campanulate 2", bracts mostly linear acuminate spinulose-tipped. Fruit 05" long not ribbed, hairy, pappus 15—17" caducous with an outer ring of short persistent hairs or bristles.

A common weed of waste ground. Fl., Fr. most of the year except the h.s.

Lower leaves sometimes 3" in stout plants. Corolla-lobes linear-oblong. Anthers shortly tailed and apiculate.

The whole plant is used in decoction to promote perspiration in fever. The seed is used as an anthelmintic and also given to horses as a tonic. The flowers are administered (internally) in conjunctivitis (*Nadkarni*). The leaves are eaten as a pot-herb (*Campbell*).

2. ELEPHANTOPUS, L.

Herbs with alternate leaves, radical rosulate (in our species). Heads (partial) of 2—5 flowers collected into a dense terminal cluster, bracts of each partial head about 8 dry, flat or conduplicate. Corolla purple, limb 4—5-lobed with the lobes unilateral and limb cleft on the other side. Style arms subulate. Fruit truncate, 10-ribbed. Pappus with rigid slender hairs dilated below, or chaff-like.

1. *E. scaber*, L. Samdulan, H., Beng.; Manjurjuti, S.

An erect rigid herb 8—18" high with rosulate or clustered and erect obovate or oblanceolate radical leaves 4—6" long and slender dichotomously branched strigosely hairy stems 8—18" high with few alternate sessile or amplexicaul leaves 1—3" long. Clusters of partial heads easily recognisable from the conspicuous cordate leafy bracts, usually 3 in number, and giving the cluster a three-cornered appearance. Fruit 15" long, brown, ribbed, hairy, with an oblique callus at the base, pappus of 4—5 rigid scabrid hairs 2" long.

Very common in open ground and under partial shade, in all districts. Fls. Sept.—Nov. Fr. Oct.—Dec.

Leaves serrate or crenate, hairy both sides, sec. n. 7—10 and tertiaries raised beneath. Radical leaves with a slender attenuate base or petiole, with sheathing base. Leafy bracts of general head 4—8" long, bracts of partial heads lanceolate spinose-tipped, inner 4—5" long.

3. ADENOSTEMMA, Forst.

Herbs with leaves mostly opposite. Flowers never yellow, in homogamous corymbose heads. Involucral bracts many, narrow herbaceous, sometimes connate; receptacle flat naked. Corollas all equal tubular with short tube and campanulate 5-toothed limb. Anthers with a glandular tip, base obtuse. Style arms elongate, dilated above. Fruits obtuse, 5-ribbed, glandular with 3—5 short rigid pappus hairs which are often clavate.

1. A. viscosum, Forst. Syn. *Ageratum aquaticum*, F.L.

A weak herb, often with a decumbent rooting base, corymbosely branched above 18—24" high. Leaves from linear or oblong-lanceolate to broadly ovate or cordate, sessile or petioled, crenate or serrate. Heads rather pretty, 3—5" diam., white or somewhat rose-coloured, remarkable from their very long linear clavate white style-branches.

In grassy places in the damper districts, near nalas and under shade in the dryer districts. FL, Fr. Oct.—Jan.

Usually more or less pubescent or glandular above. A very variable plant of which there are at least two well-marked forms in our area.

Var. 1, typica.

Leaves oblong-lanceolate 2.5—4" tapering into a short petiole, distantly serrate. Heads without the styles .25" long and broad. Involucral bracts oblanceolate-oblong herbaceous 2-seriate. Fls. glandular. Calyx of 3 stipitate glands. Corolla .12". Style-arms .2" long.

Valleys at higher elevations in Chota Nagpur!

Var. 2, latifolia.

Leaves broadly ovate 4" by 2.5" attenuate on the petiole. Fruits densely warted.

Purneah.

The common form in the valleys has not been particularly examined. It has broadly ovate leaves.

4. AGERATUM, L.

Erect herbs or shrubs with opposite leaves or the upper alternate. Fls. white or purple in corymbose or paniced homogamous heads. Involucral bracts 2—3-seriate; linear, subequal. Corollas all tubular, equal, regular, limb 5-cleft. Anthers appendaged, base obtuse. Style-arms elongate obtuse. Fruits 5-angled with a pappus of 5 short free or connate scales or of 10—20 narrow unequal scales.

1. A. conyzoides, L. Uchunti, Beng.; Poksunga, Boksunga, Or.; Ilami, Nep.

An erect hispidly hairy herb 1—2 ft. high with coarsely crenate ovate hairy petioled leaves 1—3" long and terminal corymbs of small white or blue-purple heads of flowers .12—2" diam. with campanulate involucre. Fruit black with a pappus of 5-awned scales.

A very common plant but chiefly in the damper districts and often a weed in cultivated fields and gardens. FL, Fr. all the year round.

5. ERIGERON, L.

Herbs or shrubs with alternate leaves and white, blue or purple ray-flowers. Heads heterogamous, rayed, but rays sometimes very small. Ray fls. many-seriate female, ligule small, very slender; disc fls. 2-sexual, tubular, yellow, 5-cleft. Involucre campanulate or hemispheric, bracts few- or many-seriate. Anther base obtuse, entire. Style arms of herm. fl. flattened with lanceolate or usually short 3-cornered tips. Cypselae compressed, usually small and narrow, margins

often nerviform. Pappus a single or double row of bristles, the outer fewer and shorter than the inner.

1. *E. asteroides*, Roxb.

An erect rather coarse hairy and glandular herb 6"—2 ft. high, much branched from near the ground with ascending branches often longer than central stem. Radical leaves obovate petioled, coarsely toothed, cauline amplexicaul oblong or somewhat obovate, toothed or lobulate .5—2" long. Heads solitary or few and corymbose, peduncled, .2—3" long, .25—5" diam., with 1—2 rows of short spreading very slender blue ligules, then several rows of filiform whitish female and fewer inner yellow campanulate hermaph. or male florets. Cypsel .03", nearly glabrous, flat pale with dirty white or brown pappus .14—15" long, scabrid under magnification.

Chiefly in cultivated ground. Behar, Sone R., J.D.H. Singbhum! Banks of Ganges, S.P., Kurz! No doubt also in Purneah as it occurs in Maldah, Clarke! and probably in the whole Northern and Southern Central Areas sporadically. Fl., Fr. Oct.—April.

L. mostly about 1" but rarely 2.5" with coarse lobules, hairy. Invol. bracts 1—3-seriate, rather hispid and glandular-papillose, inner .18" linear with scarious margins often constricted below the recurved tips (or hair-pointed, C. B. Clarke). Ray-fls. filiform .14—15" acute and ligulate, intermixed with short filiform-tubular fls. with simple styles. Disc. fls. tubular, .11".

Aster differs only from *Erigeron* in that the ray flowers have usually large ligules and are only 1—2-seriate. The cypsel larger. Pappus of scabrid hairs, outer sometimes shorter, rigid and palaceous. *Aster amellus*, one of the so-called Michaelmas daisies, is common in gardens on the Ranchi plateau. The "Chinese aster" is *Callistephus chinensis*, the inner pappus is of hairs or bristles, the outer a short corona fringed with cilia.

A plant frequently called *Erigeron limifolium* in herbaria (and sometimes *Erigeron canadense*) is *Conyza ambigua*, DC, q.v.

6. CYATHOCLINE, Cass.

Annual usually erect odorous herbs with pinnatisect alternate leaves. Heads small variously coloured, paniced, disciform, heterogamous with the outer fls. many-seriate, filiform, female, 2-toothed, the inner hermaphrodite or functionally male, regular, 5-cleft. Involucre hemispheric, bracts sub-2-seriate narrow with scarious margins, receptacle peltate saucer-shaped with raised free margins, naked. Anther-bases truncate. Style of female flower with two arms, of herm. simple or cleft. Fruit minute smooth, pappus, 0, or of 4—5 minute gland hairs.

1. *C. lyrata*, Cass.

A pretty erect or sometimes decumbent scented herb, usually 8"—2 ft. high with hairy stems, pinnate or pinnatifid leaves, basal attaining 6" with the lobes toothed or pinnatifid, rachis winged and toothed, cauline leaves with large auricles. Heads .2" diam. bright rose-purple. Disc flowers stout, viscous pubescent with simple style. Fruits somewhat fusiform-oblong, .015" long.

In wet places, moist banks, rice-fields, rocks in streams, etc. Fl., Fr. Dec.—March.

7. GRANGEA, Forsk.

Suberect or prostrate villous herbs with alternate pinnatifid leaves and sub-globose disciform yellow or yellowish terminal or leaf-opposed heterogamous heads. Outer flowers 1- to many-seriate, filiform, female, 2-4-fid, disc flowers hermaphrodite with very slender tube and campanulate 4-5-cleft limb. Involucre broadly campanulate, bracts few-seriate, outer herbaceous, receptacle convex or conic, naked. Anther-bases obtuse. Style-arms of disc-fls. flattened, cuneate, obtuse or with triangular points. Fruit flattened or subterete, pappus cupular, formed of the short calyx-tube and often a ring of bristles or short hairs.

1. *G. maderaspatana*, Poir. Bhediachim, S.

A procumbent weed with woody rootstock and villous or hirsute branches 3-4" or up to 10" long. Leaves oblong pinnatifid or lobulate, often oak-leaf-shaped, villous, radical 1-3", cauline mostly 5-1" long. Heads button-shaped .25-4" diam. shortly peduncled, involucre bracts 2-3-seriate, outer herbaceous oblong .25" long. Outer fls. very slender with long exerted style, inner usually with 4-lobed corolla. Anthers appendaged oblong. Fruit stipitate .1" long, pale brown, calyx-tube with a ring of short hairs.

A common weed of rice fields, wet ground, etc. Patna! Chota Nagpur! Santal P., Kurz! Probably all districts. Fl., Fr. c.s. and h.s.

The flower buds during an epileptic fit are introduced into the nostrils to restore consciousness, *Campbell* (under *Centipeda orbicularis*).*

8. CONYZA, Less.

Herbs, sometimes large, with alternate entire or cut leaves and corymbose or paniced heterogamous disciform yellow, or yellowish or, in fruit, reddish heads of flowers. Ray-flowers 0 but outer flowers 2-many-seriate filiform, 2-3-toothed, pale-coloured, inner hermaphrodite yellow, tubular, limb 5-toothed. Involucre campanulate, bracts 2-many-seriate, narrow, outer smaller. Receptacle naked or pitted and fimbriate. Anther bases obtuse entire, connective usually produced. Style arms of outer fls. flattened with long or short tips. Style arms of herm. fl. not very long, flattened, bearing the stigmatic surface in two marginal strips and with short brush-hairs towards the tip. Cypselé minute, compressed with usually nerviform margins and with slender 1-seriate soft pappus hairs.

The genus *Conyza* connects the Asteroideæ with the Inuloideæ through *Laggera* and *Blumea*, from which it differs in the constantly ecaudate anthers and style arms flattened within with a more or less conical papillose tip.

A. Heads very small, .1" diam. or less

1. *stricta*.

B. Heads over .1" diam.:—

1. Leaves entire, shallowly crenate or remotely serrate:—

Tall branched, 5-6 ft., minutely pubescent. Hds. pink 2. *viscidula*.

Stems strict, 1-2 ft., grey villous. Hds. yellow 3. *ambigua*.

2. Leaves distinctly toothed or lobulate:—

Leaves lobulate, grey villous. Disc. fls. .2" long 4. *ægyptiaca*.

Leaves serrate, hairy. Disc. fls. .15" long 5. *japonica*.

* See note under *Centipeda*, which this little plant closely resembles.

1. *C. stricta*, Willd.

An erect herb 2—4 ft. or in some cases 4—6 ft. high fastigiately branched with linear, linear-obcuneate or (lower) oblanceolate leaves 1—2" long shortly hairy or harshly pubescent both sides, entire or somewhat toothed. Heads very numerous paniced small yellow ovoid 1" long or less. Involucre bracts '07", linear, 2-seriate, with 1 or more outer ones. Cypsele pale yellow 7 mm. only, puberulous, pappus silky '07" rather scanty white.

In moist and grassy places on the hills and plateaux 2000 ft. and above. Ranchi, Horhap forest, etc.! Neterhat! Singbhum Hills! Parasnath! Fl., Fr. Oct.—Dec.

A very distinct plant, somewhat harshly pubescent all over. Receptacle flat, naked. Anther tips produced as very narrow appendages.

2. *C. viscidula*, Wall.

A tall straight herb 5—6 ft. high with stem very striate as thick as the finger below and with very numerous obliquely spreading branches bearing lateral and terminal panicles of pinkish flowers. Leaves lanceolate, lower attaining 8" by 2.5", smaller upwards, entire or shallowly crenate with the sinuses mucronate, those on the flowering branches mostly entire. Heads 2.5" oblong, with pink-tipped bracts and often pink outer florets. Achenes very minute, '02" long, pale with nerviform margin.

Moist grassy glades. Singbhum, not common! Hazaribagh, on Parasnath! Neterhat (Ranchi and Palamau), elev. 3000 ft.! Jaigri, Palamau, 3000 ft., *Gamble!* Fl., Fr. Dec.—Feb., also April.

Stems and branches minutely pubescent. Leaves puberulous beneath and on the nerves above, narrowed at base into a short sub-amplexicaul petiole. Flowering branches more pubescent, repeatedly branched, ultimate 1.5—2" long bearing a loose corymb of slender-pedicelled heads. Involucre campanulate with about 20 linear 3-seriate bracts 1.7" long, bristle-pointed with a green centre and narrow scarious margins, hairy and glandular outside. Herm.-corolla with linear-oblong lobes. Anther cells apiculate. Stigmatic arms long papillose.

3. *C. ambigua*, DC. Syn. *Erigeron linifolius*, Willd. (*Clarke*, Compos.)

A grey or glaucous-green herb, 1—2.5 ft. high with usually several erect stems from the root. Stems appressed hairy and also villous, densely clothed with sessile linear, entire or remotely serrate leaves 1.5—2.5" long by about 2" broad, subtomentose and villous beneath, densely hairy above. Branches of racemose panicle each with 1—5 heads 1.5—2" long and broad in narrow racemiform panicles. Bracts many linear with hairy centre and scarious margins, very acute. Outer flowers very numerous pale 1.5", filiform with 2—3 very minute acute teeth. Disc flowers slender pale-yellow. Anthers narrow somewhat appendiculate. Cypsele pale-brown 0.5" compressed with nerviform margins sparsely silky. Pappus, dirty white as long as the corolla.

Sunny places, highest hills of Chota Nagpur, over 2500 ft.! Fl., Fr. April—May.

Whether this is really *Willdenough's* "*Erigeron linifolius*" I am not sure, but it is certainly *Clarke's* and probably the plant alluded to on p. 254, *F.B.I.*, and repeatedly called by that name in *Herbaria*. I doubt its being merely an escape in India. I have found it also in the mountains of Jaunsar, and it has no appearance of being an escape in our province. Cases of perfect naturalisation such as *Tridax*

procumbens are hardly parallel, as these plants are as much at home in the plains as in the hills and there are no obstacles to their wide spread.

4. *C. ægyptiaca*, Ait.

An erect strict herb 1—2 ft. high with sometimes several stems from the same rootstock, villously hairy and also with very short underlying gland hairs. Leaves erect narrow sessile with linear lobes or deeply gashed, 1.5—2" long. Heads in terminal small paniced corymbs, broadly-oblong or ovoid, about .2" long and broad, yellow but soon becoming white, sub-globose and .4" diam. with a very soft pappus. Cypsele pale, under .05", compressed oblong-obovoid thinly pubescent.

Higher elevations only. On the grassy plateaux of Chota Nagpur, 3000 ft. Fl., Fr. May—June.

Involucre bracts hispid-hairy in centre, scarious at the margins, longest .25". Outer flowers very many filiform, style far exsert and undivided. Disc fls. comparatively few .2" long with pubescent tube and yellow lanceolate lobes. Anthers appendaged. Style branches short below the very narrowly conical or lanceolate papillose tip. Hypanthium silky. Pappus rather scanty, hairs scabrid.

5. *C. japonica*, Less.

Perhaps only a variety of the last, smaller, 8—12" high, more rigidly hairy and leaves not lobed but with sharp deep serratures. Heads smaller ultimately loosely corymbosely paniced. Cypsele minute, thinly shortly silky, pappus as long as corolla.

Same localities as the preceding. Neterhat, 3000 ft. Fl., Fr. May—June.

Lower leaves 1.5" oblanceolate sub-petioled, cauline oblong 1—1.5" with amplexicaul or cordate base. Heads .2" long oblong or ovoid, at first in clusters at the top of the stem. Invol. bracts linear .15" hairy with membranous margins. Disc fls. .15". Anthers produced beyond the cells as in the last. Style arms lance-shaped flattened.

9. LAGGERA, Sch.-Bip.

(Here limited to *Blumea*, Sect. *Caulopteræ* of *De Candolle*.)

Usually coarse herbs with leaves frequently sessile or decurrent on the stem. Heads large or m.s. with the outer involucre bracts squarrose at the tip and florets purple. Anther bases mucronate or sagittate without slender tails (though short tails are sometimes present). Other characters of *Blumea*.

Leaf bases decurrent as long continuous wings on the internodes 1. *alata*.
Internodes with deeply lobed or toothed wings nearly glabrous 2. *pterodonta*.
Internodes not winged, leaves not decurrent or very slightly so, villous 3. *aurita*.

1. *L. alata*, Schultz-Bip. Charsira dare, S.

A stout much-branched leafy pubescent or tomentose herb 2—6 ft. high easily recognised by the continuous entire wings on the stems and branches. Leaves oblong or oblong-oblanceolate sessile with the decurrent bases forming the wings, 1—4" long with small mucronate teeth. Heads .35" long and nearly as broad with purple florets and outer involucre bracts with spreading and recurved tips, usually 2—3 subracemose on the numerous axillary branchlets, drooping in fruit. Cypsele silky .03—.04" long with persistent white pappus.

Grassy places at the higher elevations. Neterhat. common! Parasnath! Fl., Fr. Nov.—Jan.

2. *L. pterodonta*, Benth.

A stout much-branched leafy glabrous or puberulous herb 3—5 ft. high easily recognised by the deeply toothed, lobed or interrupted wings on the stems and branches, and the sessile oblanceolate leaves which are toothed and usually pinnatifid at the base. Heads as large as in the last often on slender peduncles, and with glabrous rigid involucre bracts.

Ranchi, under trees usually near houses! Manbhum, Campbell! Fl., Fr. r.s. and c.s.

The lobes of the wings are usually linear-oblong, very unequal, rounded or acute at tip and sometimes $\frac{7}{8}$ " long.

3. *L. aurita*, Schultz-Bip.

A coarse strongly scented (somewhat like turpentine) grey-green villous and glandular herb 2—3 ft. high, often much branched from the large tap root. Stems well clothed with deeply lobed or pinnatifid sessile leaves 1.5—2.5" long with the basal lobes shortly decurrent on the stem. Heads ovoid .3—.5" long and broad, on peduncles 1—2" long, in sub-racemes and corymbs at the ends of the upper branchlets. Corolla and anthers purple.

Waste places. Singbhum! Manbhum, Camp! Fl., Fr. Jan.—March.

Stems with usually few lateral branches but corymbosely branched at the summit. Leaf-lobes toothed, villous both sides and with short gland-tipped hairs. Outer involucre bracts linear spreading and recurved, villous, inner straight often with purplish sub-spinulose tips. The anthers have short tails but tails of adjacent anthers connate. Style pubescent, arms very short obtuse. Cypsel hairy. Pappus long white persistent.

10. BLUMEA, DC.

Herbs with alternate leaves and small or m.s. heads of yellowish rarely purple or white florets. Heads not rayed. Involucre ovoid or campanulate or conical of very narrow bracts imbricate in several series, outer smaller. Receptacle flat or convex glabrous or pubescent. Outer florets numerous, female, filiform with corolla very minutely 2—3-toothed, inner florets 2-sexual or functionally 1-sexual narrowly tubular-funnel-shaped, 5-toothed. Anther bases with slender tails or, if anthers are non-polliniferous then often ecaudate (all ecaudate in *B. flava*), tips often empty membranous obtuse or truncate, pollen spinulose. Fls. usually proterandrous in perfect flowers. Style finally exerted with short filiform or linear-subulate, obtuse arms without conical tip, minutely papillose. Cypsel small subterete, angled or ribbed. Pappus scanty and often caducous with the hairs microscopically hairy, sometimes a very minute scarious ring in addition to the hairs.

Some of the species are almost impossible to strictly define and single key characters can only serve as a rough guide. It is believed that many of the forms are hybrids.

I. Decumbent or with many branches spreading from the root.

Leaves not lobed:—

Heads solitary. L. half amplexicaul entire or coarsely toothed

l. amplexens.

Heads corymbose, rarely sub-solitary. L. sessile, spinulosely toothed

II. Erect. Heads clustered or paniced:—

A. Heads sessile or nearly so, single and in distinct clusters along the stem and branches and fascicled at their ends:—

Stems white-woolly. Heads lemon-yellow with yellowish bracts

Hairy or glabrescent. Heads sessile, involucre purple, florets orange yellow.

Glandular-pubescent. Stems purple. Heads pedicelled, chiefly terminal, florets yellow.

B. Heads not clustered or, if clustered, then clusters very numerous and paniced (exc. one variety of *virens*), never lemon yellow. Anthers of polleniferous fls. caudate:—

1. Florets purple or the outer white, hds. not over .2" by .1", in dense panicles. L. simply toothed, not lobed

2. Florets not purple. Heads small or m.s.:—

a. Heads clustered at the ends of the panicle-branches.

Cypsele angled, rarely also faintly ribbed:—

Height 1—2 ft. Lower leaves often lobulate or cut.

Upper leaves simply toothed

b. Heads not clustered (except when young) but pedicels usually divaricate. Cypsele distinctly ribbed, silky:—

Height 2—3 ft. All leaves more or less deeply lobed or gashed. Heads small, receptact. pubescent

Height 2—3 ft. Leaves variously cut. Hds. .25—3", recept. pubescent

Height 2—6 ft. Leaves very membranous, often glabrous, upper simply toothed. Heads small, under .25", recept. glabrous. Bracts mostly spinulose-tipped

As in *virens* but bracts tipped with hairs

C. Heads in very open panicles on slender pedicels, florets lemon-yellow or golden. Anthers ecaudate

2. *oxyodonta*.

3. *Hamiltoni*.

4. *glomerata*.

5. *atropurpurea*.

6. *Wightiana*.

7. *lacera*.

8. *laciniata*.

9. *Jacquemontii*.

10. *virens*.

Var.

11. *flava*.

1. *B. amplexens*, DC.

A herb with several stems from the root, villous above, sparsely hairy and usually reddish below. Leaves oblong or oblanceolate, lower attaining 3.5", upper .5—1.5" amplexicaul, young hairy, old hispidulous, entire or remotely toothed. Heads yellow, m.s., .25—3" diam., solitary at the ends of long bracteate peduncles 1—1.5" long (but young often subcorymbose before the shoots lengthen). Invol.-bracts almost filiform, outer hairy and with capillary tips. Receptacle rather convex. Lobes of herm. fl. hairy. Cypsele minute, sparsely hairy with a crown of minute pales and few deciduous hairs.

Khandpara State, near the Mahanadi! Fl. March.

The heads are sometimes entirely female with a ring of empty ecaudate anthers round the style of the central flowers.

2. *B. oxyodonta*, DC.

A small species with many decumbent branches 4—10" long spreading from the root, with oblong, elliptic or mostly obovate leaves .5—1", rarely the lower ones attaining 3" and petioled, those on the branches sessile, thinly hairy to tomentose, nerves excurrent as spinulose teeth.

Heads subsolitary or clustered or paniced about .2" long, on short or long often tomentose and glandular pedicels. Invol. bracts linear with scarious margins, nearly glabrous or pubescent or tomentose. Cypsel nearly glabrous 8—10-ribbed.

Common in open pasture lands. Bettiah, *Clarke!* Throughout Chota Nagpur ascending to Parasnath! Probably throughout the province. Fl., Fr. Jan.—June.

3. B. Hamiltoni, DC. Syn. *B. hieracifolia*, var. *Hamiltoni*, *F. B. I.*

An erect softly lanuginous herb 1—2 ft. high with one or several stems from a rosette of radical leaves scarcely branched, bearing distant clusters of lemon-yellow flowers in the axils of bractiform leaves and densely fasciated at the top of the stem.

Damp pastures and open wet ground. Neterhat 3000 ft.! Fl. May—June.

A pretty species easily recognised from its white woolly stems. L. oblanceolate lower 1—3" cottony beneath, regularly dentate with small teeth, base tapering, petiole 0, upper leaves gradually smaller. Heads ovoid .25" by .15", shortly pedicelled, rarely .5" in fruit. Bracts linear villous. Cypsel brown slenderly 5-ridged and thinly pubescent.

4. B. glomerata, DC. Syn. *Conyza fistulosa*, *Roxb.*

An erect usually rather slender annual 8"—2 ft. high with elliptic or obovate or oblanceolate sharply denticulate leaves, hairy especially about the mid-rib beneath, glabrescent above; in the smaller plants a simple elongating stem with solitary and clustered sessile heads with purple bracts and yellow flowers forming a dense spike above; in the larger with slender erect or ascending branches similarly bearing heads of flowers which are about .2—25" long.

Dry places such as along boundary- and fire-lines. Chota Nagpur, common! Parasnath, *Clarke!* Behar, *J. D. H.!* Santal Parganas! Sambalpur! Probably throughout the area. Fl., Fr. Jan.—May.

L. sessile or narrowed into a slender petiole, lowest attain 4—5" but often much smaller, and gradually becoming smaller and more sessile upwards, often sinuate rarely slightly lobulate. The shining purple bracts and often generally purple tinge of the inflorescence makes it rather a pretty plant. Receptacle glabrous or pilose. Tips of herm. corolla sometimes pilose. Achenes glabrous or pubescent, striate or ribbed.

Forms with hairy receptacles or ribbed cypsel would be placed by some botanists under *B. membranacea*. I only do so if both characters exist together and are accompanied by membranous leaves.

5. B. atropurpurea, Haines. Syn. *B. membranacea*, var. *gracilis*, *J. D. H.?*

An erect strict herb 2—2.5 ft. high with simple striate purple stem densely glandular-pubescent above and with a few long villi. Leaves simple obovate, often purple, larger at base of stem 3—4" including the short petiole, smaller upwards with sessile decurrent base and becoming bractiform, lower entire and denticulate or sinuate and lyrate, upper narrower and dentate, finely pubescent beneath and with sessile glands, shortly sparsely hairy above. Heads .2" by .15" broad like those of *B. glomerata* but pedicelled, solitary and clustered towards the end of the stem and of numerous slender ascending branches 2—3" long in the lower part. Outer bracts with purple margins and green or black mid-

rib spinose-tipped, inner green, ciliate. Receptacle glabrous. Corolla lobes with sessile glands. Pappus exceeding the corolla. Achenes minutely pubescent ribbed.

Glades and open grassy places, Purneah. Fl., Fr. Dec.—Jan.

This differs from *B. subcapitata* (*Conyza subcapitata*, Wall.) in the absence of the villous tomentum and in the less lacerate leaves and the close glandular pubescence. It connects *B. glomerata*, DC., and *B. lacera*, DC. According to diagnoses it might also be *B. membranacea* var. *gracilis*, but it is entirely different in general appearance and leaf texture.

6. *B. Wightiana*, DC.

A pleasantly aromatic (smell of hops) usually erect herb with several stems from the root 8—18" high. Leaves at base of stem 2—4" long, cauline 7—2" including the petiole, obovate or elliptic and tapering into the petiole, never lobed but margin with small sharp teeth, and sometimes also dentate, both surfaces closely hairy or pubescent (or in one form thinly hairy and glandular). Heads often pale purple small, clustered, or in dense cymes at the top of the stem or in very many flowered dense narrow panicles, branches of panicle pubescent and glandular as also are the bracts of the involucre. Flowering heads ovoid 2" long by 1" wide or finally cylindric, often dioecious. Corolla pale purple or white at the tip, lobes of herm. fl. glandular or minutely ciliolate. Achenes pale brown .07 mm. minutely pubescent, not or very indistinctly angled.

Rather common but chiefly on the higher hills. Ranchi, Singbhum and Palamau, 2000 ft., common at Neterhat, 3000 ft. Manbhum, Campbell! Parasnath! Santal Parganas, Kurz! Kalahandi, Cooper!

The less hairy and more open-panicled forms in the absence of corolla sometimes resemble small forms of *B. membranacea*; they may be distinguished by the linear acuminate involucre bracts with softly hairy tips (whereas those of *B. membranacea*, at least in one form, are more rigid and spinous-tipped), and by the cypseles.

7. *B. lacera*, DC. Syn. *B. lactucæfolia*, DC. ?

A coarse or rather slender very variable weed, often grey in the more silky forms, with a strong camphor or turpentine odour, sub-tomentose or pubescent or very sericeous, or stems below sparsely pilose. Leaves obovate-oblong, sharply, sometimes doubly, toothed, gashed or serrate and lower often lyrate or lobulate, lower or all narrowed into a petiole, always more or less hairy, often densely sericeous beneath. Flower heads yellow in oblong or corymbose, close or open, pubescent or sub-tomentose corymbs at the ends of all the upper branches. Invol. bracts linear or acuminate with scarious margins, more or less hairy, often glandular. Recept. glabrous. Cypsele grey-brown sub-angled, rarely faintly lined, minutely pubescent and glabrescent.

A common weed, growing on roadsides, waste-places, banks of rivers, etc. In all the districts. Fl., Fr. chiefly h.s.

Var. *α*. L. ell.-obovate attenuate at base, toothed or serrate, densely white silky beneath, about 2—3" long on the stem, uppermost sessile smaller. Heads small .2" long.

Common.

Var. *β*. *Burmanni*, F.B.I.? Coarser, lower leaves lyrate-pinnatifid 4 by 2.5". Heads large .3" long by .2—2.5" broad (in fresh plant). L. hairy beneath slightly pubescent or sub-glabrous above. Corolla .17" long with sessile glands.

Purneah! This may be *B. lactucæfolia*, DC. If it is it should be kept distinct under that name.

Var. λ. **glandulos**, DC. Copiously pilose-glandular in addition to the other indumentum.

It is rather a form than a variety, such gland hairs being always more or less present.

Var. δ. **erianthoides**. Leaves 3" scarcely lobulate or entire with the margins closely spinulose with small teeth of different sizes, silvery sericeous beneath. Upper part of plant sometimes almost dichotomous from the development of strong axillary branches.

Chota Nagpur! Fl. Feb.

This plant exactly matches with one from Bombay named at Kew *B. eriantha*, DC., but if we discard the procumbent habit of *B. eriantha* (and the Bombay plant appears to have been erect) there is nothing left to separate it from *B. lacera*!

8. *B. laciniata*, DC.

A coarse strongly fœtid or aromatic (not camphoraceous) very erect green annual herb 2—4 ft. high with striate leafy stems with thin spreading hairs and stalked glands but often sub-tomentose upwards. Leaves 2·5—4·5" (or the lowest sometimes nearly 6", usually dry when the plant flowers), irregularly pinnatifid or sharply lobed or cut with the margins often undulate and sinuate, spinulose-toothed, those on the panicle sometimes small simple lobed or toothed, all pubescent hairy and glandular. Heads yellow long-pedicelled ovoid ·25" long in large oblong or spreading panicles 4—10" broad of very numerous branches from the leaf axils. Invol. bracts linear with green mid-rib and scarious margins, outer very short and narrow, very glandular. Corolla ·15" long, lobes short deltoid thinly ciliate and with sessile glands. Receptacle pubescent broad. Achenes ribbed hairy.

Banks and open places, biennial. Frequent. Patna (Wall No. 3085)! Manbhūm, Camp.! Hazaribagh, Clarke! Bettiah! Neterhat (Palamau, elev. 3000)! Puri! Fl., Fr. March—Dec.

The above is the usual form. Small plants have the leaves much less cut and can then be distinguished from *B. lacera* by the indumentum, pubescent receptacle, and the ribbed achenes, and in the field especially by the smell, which is less pleasant in this plant. The pubescence on the receptacle is deciduous in fruit.

The ciliate or pubescent tips of the corolla occur also in specimens of *B. lacera* and are probably variable.

9. *B. Jacquemontii*, Hook. f.

Tall 2—3 ft. with stems stout below; closely resembling *B. virens* in its characters but much more villous and with larger heads. L. 3—5" lower petioled, mostly deeply gashed or lyrate, uppermost quite sessile oblong, all sharply toothed and hairy. Panicles densely villous above. Heads ·25—·26" long on divaricate pedicels, ·5—·7" diam. when widely open in fruit, bracts rigid many-seriate less narrowly linear than in *B. virens* but lanceolate towards the ends, pubescent all over the back, usually purple, and without the very thin scarious margins of *B. virens*. Fruit much the same as in that species, 8—10-ribbed.

Top of Parasnath, Clarke, etc.! Neterhat!

Fl., Fr. April—May.

10. *B. virens*, DC. Syn. *B. membranacea*, DC.

An erect glabrous or thinly hairy and glandular herb varying from 1 ft. to 6 ft. in height and becoming woody below. Leaves very

membranous, simple, obovate or lower deeply lobed or pinnatifid or lyrate, always with very sharp sometimes spinose teeth glabrous or very thinly hairy, lowest often attain 6" (with the petiole) or only 3", uppermost becoming very small and bractiform, subsessile, elliptic or lanceolate. Heads very many small, on slender divaricating pedicels 2—7" long, in large panicles terminating all the upper branches. Involucre green or purplish, the bracts in many (about 4—5) series of which the outer are very short subulate and spreading (at least in fruit) and all, or the lower only, spinous pointed, longest linear about 2". Flowers yellow. Cypsele minute oblong .03—.04" distinctly ridged and with about 8 dark intermediate furrows, silky-pubescent and surmounted by a minute ring at top.

A species of moist banks and ravines in the forest at all elevations or of the higher mountains. Rather common. Purneah! Singbhum frequent! Ranchi and Palamau, ascends to Neterhat 3000 ft. and Parasnath 4000 ft. Hazaribagh, Clarke! Manbhum, Campbell! Angul (attains 6 ft. in ravines)! Fl., Fr. at various times.

B. virens is the glabrous form, *B. membranacea* is supposed to differ by being glandular and hairy, but all intermediates occur; the hairs are thin spreading villous or gland-tipped, never dense. One form has the upper invol. bracts tipped with a pencil of hairs, and generally the *B. virens* form has the bracts less spinose-tipped than *B. membranacea*. The heads (when fresh) are only 2 rarely 2.5" long by 1" wide in flower. The pedicels often bracteolate.

Var. *gracilis*, J. D. H.

This form has the heads subsolitary or racemose on the slender branches, or clustered on a simple stem. The leaves are membranous, sharply toothed and sub-lyrate green.

Parasnath! Cp. *B. atropurpurea*.

Var. *muralis*, J. D. H. Glandular hairy. Leaves elliptic-ovate or lanceolate toothed or serrulate, very membranous, invol. bracts rigid coloured purple like those of a *Vernonia*.

Palamau, Gamble Herb. The colouring is, however, not apparent in this specimen.

11. *B. flava*, DC. Syn. *Lagera flava*, Benth.; Moharenti, Or.

As erect herb 1—3 ft. high with amplexicaul irregularly toothed bright green glabrous, rarely scaberulous leaves, lower attaining 6" by 2.5", oblong with rounded auricles, upper sessile, hastate. Heads small bright yellow arranged in cymose leafless clusters on the branches, with campanulate shining green glabrous involucre.

Very common on clay soils in poor open forest in Chota Nagpur! Champaran! Angul to Sambalpur! Fl. Nov.-Jan.

Leaves often sharply dentate and denticulate. Heads often unisexual, very numerous, 17—25" long. Bracts herbaceous, oblong, inner 1-nerved with hyaline tips or caudate. Receptacle flat, glabrous. Anthers sagittate, not tailed. Pedicels very slender. Cypsele very minute, glabrous. Pappus white.

11. PLUCHEA, Cass.

Tomentose or glutinous or glandular shrubs with alt. leaves and heads small in terminal leafless corymbs or large and subsolitary, heterogamous, disciform, white, yellow or lilac. Outer fls. filiform, fem. Inner few, herm. in form, barren, tubular, 5-fid invol. bracts ovate, usually broad, dry, rigid. Anther bases sagittate, tailed. Cypsele 4—5-angled, small. Pappus hairs slender free or of the inner fls. connate.

1. *P. indica*, Less.

A low shrub, glabrous or nearly so except the pubescent corymbs. Leaves often gland-dotted, 1—2" long, obovate or oblanceolate sub-serrate, narrowed into the short petiole. Heads .25" diam. with only 3 herm. fls. Invol. bracts many-seriate, outer with broad rounded tips, .2" long.

This shrub of the Sunderbans is only described as it may be found in the delta of the Mahanadi, which contains so many other Sunderbans plants and has been but very imperfectly botanised.

Fl. Jan.—March.

12. EPALTES, Cass.

Herbs with usually decurrent alternate leaves and small heterogamous disciform heads with numerous outer female filiform 2—3-toothed fls. and usually sterile centre 3—5-fid fls. Involucre bracts many-seriate dry rigid. Anther bases sagittate with small tails. Cypsele 5—10-ribbed with no pappus in the female fl., usually abortive in the centre fls. with or without 2—3 caducous pappus hairs.

1. *E. divaricata*, Cass.

A glabrous annual herb with divaricate winged branches and linear, linear-oblong or lanceolate leaves 1—3" long, narrowed at the base. Heads globose .25" diam. purplish, on winged peduncles. Invol. bracts sub-spinose at the tips, inner longer than the flowers. Cypsele .02—.03" long obovate-oblong.

Watery places, rice-fields, etc. Chilka Lake, *Alcock!* Fl. Oct.—Feb.

Much dichotomously branched. Leaves sometimes linear-oblanceolate and distinctly denticulate. Heads small with invol. bracts .15—.24" long dry sharp-pointed.

13. SPHÆRANTHUS, L.

Annual herbs with branches spreading from the root and alt. decurrent toothed leaves. Heads apparently large but consisting of many small heads sessile on a common receptacle and forming globose or ovoid clusters resembling single heads, clusters usually involucrate. Heads disciform heterogamous, outer fem. fls. few or many, slender, minutely 2—3-toothed, central fls. herm., fertile or sterile with thickened tube and 4—5-toothed limb. Invol. bracts narrow acute dry unequal. Anther-bases sagittate, auricles tailed or only acute. Style arms of herm. fl. filiform or connate. Cypsele oblong, sub-compressed. Pappus 0.

1. *S. indicus*, L. Syn. *S. hirtus*, Willd.; Mundi, H.; Murmuria, Ghork-mundi, Beng.; Murisa, Buikadam, Or.; Belaunja, S.

A viscous pubescent strongly-scented herb with winged stems, sessile obovate or oblanceolate toothed leaves 1—2" long and terminal and leaf-opposed compound magenta-coloured heads .5—.75" long; common receptacle elongated surrounded by many linear bracts with soft sub-spinous tips.

Wet places, rice-fields, etc. Common throughout the province. Fl., Fr. c.s. and until the habitat dries up.

Stems attaining 1 ft. or 18" in length. Decurrent wings toothed and peduncles also with crisped or toothed wings. Fem. fl. with 2 linear style arms. Herm. fl. with tailed anther-cells and long subulate pubescent style.

The root is used as a stomachic and anthelmintic and the seeds have the same properties. The flowers are esteemed as alternatives and tonics, useful in skin diseases. *Nadkurni*.

14. ATHROISMA, DC.

An annual herb with alt., petioled pinnatifid leaves and small heads in globose or ovoid terminal peduncled clusters as in *Sphæranthus*, sessile on a common cylindrical receptacle without common involucre. Individual heads ovoid, receptacle furnished with broad dry pales enclosing the flowers and 1—2 invol. bracts like the pales. Outer fls. fem. very few, filiform, herm. fls. several with campanulate shortly 4-fid limb, anther-bases with connate acute auricles. Style arms of herm. fl. short flattened obtuse. Cypsele black, inner face flat, outer convex margin ciliate. Pappus of short stellately spreading finely fimbriate connate scales.

1. *A. laciniatum*, DC.

A viscid, glabrous papillose or pubescent herb with ascending branches 6—18" long. Leaves few 1—2" with oblong toothed segments. Clusters of heads white, .5—1.5" long.

Marshy places along the foot of the Rajmehal Hills, *Kurz*. Fl., Fr. April-May.

L. 1.5—2.5" long with segments oblong toothed or sometimes coarsely-toothed or lobulate. Compound heads globose or ovoid-oblong .25—.5 long on short clavate peduncles. Individual heads ovoid .15" with the broad pales very conspicuous and wrapping round the flowers as in many *Helianthoideæ*. Ray fls. very few (I do not find them in some heads). Herm. fls. corolla .07". Cypsele .06" trabeculate with shortly woolly margins.

15. GNAPHALIUM, L.

Hoary or woolly or green but cottony herbs with alt. entire leaves and small heads in terminal or axillary corymbs or fascicles, heterog., disciform. Outer fls. fem. filiform, 3—4-toothed, centre fls. fewer slender with 5-toothed limb. Invol. ovoid or campanulate with many-seriate scarious bracts sometimes white, yellow or brown. Recept. naked or pitted. Anther cells with slender tails. Style arms of herm. fl. truncate or capitate. Cypsele oblong or obovoid not ribbed. Pappus hairs 1-seriate, caducous.

- | | |
|---|-------------------------|
| A. Heads in leafless corymbose clusters | 1. <i>luteo-album</i> . |
| B. Heads clustered, often leafy, never corymbose:— | |
| 1. Clusters numerous, axillary and terminal:— | |
| a. Clusters often becoming spicate at the ends of the branches:— | |
| Hds. usually spicate under .1" long. Pappus hairs free | 2. <i>indicum</i> . |
| Hds. over .1" long. Pappus hairs united at base . . . | 3. <i>purpureum</i> . |
| b. Clusters very numerous small rounded, never spicate. | |
| Densely woolly. Leaves under .5" long | 4. <i>pulvinatum</i> . |
| 2. Clusters yellow subsolitary terminal subtended by short leaves. Heads minute | 5. <i>flaccidum</i> . |

1. *G. luteo-album*, L.

A woolly herb branched from the root with branches 4–12" long, the central usually erect, often corymbosely branched above. Leaves 1–2·7" long oblong-spathulate or oblong-oblanccolate or upper linear-oblong, woolly on both surfaces, half-amplexicaul. Heads pretty, glistening golden-yellow, brown or whitish in dense terminal corymbs. Invol. bracts oblong obtuse. Cypsele tubercled or with minute curved bristles.

Damp places, near rivers, etc. Nepal border, Kurz! Behar, J. D. H.! Ranchi, Wood! Singbhum, frequent! Fl., Fr. h.s.

The variety with golden-yellow heads and many stems is called var. *multiceps*. The commoner one with pale-brown heads, found probably in all districts, is called var. *pallidum* (Syn. *G. pallidum*, Ham.).

2. *G. indicum*, L.

A woolly or softly cottony herb with many stems spreading from the root or central one erect 4–8" long. Leaves narrowly oblong or linear-obovate or spathulate apiculate '5–'8" in some forms, up to 2·5" in another form. Heads '1" long or less in axillary clusters from the upper leaves and forming terminal spikes. Invol. bracts erect linear-oblong or outer ovate-lanceolate, acute or obtuse, usually green below and shining yellow-brown above (which gives the colour to the head), longer ones '08–'09". Herm. corolla '05–'06". Cypsele minutely, hispidulous. Pappus hairs free.

In rice fields, damp sands of river-beds, etc., throughout the area! Very common. Fl., Fr. c.s.

There appear to be two rather distinct forms:—

Var. α . Very woolly. Leaves under 1" long. Spike elongated.

Var. β . Less woolly. Leaves up to 2·5". Clusters more axillary. This passes into *G. purpureum*.

3. *G. purpureum*, L.

A herb, less cottony or woolly than the last with ascending stems 6–12" high and narrowly spathulate leaves 1–2·5" or (*teste F. B. I.*) attaining 4" long with broadly rounded, sometimes apiculate tip. Heads mostly in axillary clusters from the upper leaves, scarcely forming a spike, '14" long, outer bracts with sometimes acuminate tips, inner linear-oblong rounded '12" long. Herm. corolla '07" long, tip puberulous. Cypsele smooth or minutely papillose. Pappus hairs distinctly united at the extreme base.

Singbhum, Chaibassa! Fl. August.

4. *G. pulvinatum*, Delile.

A small very woolly plant with many stems spreading from the root 3–4" long with small narrow spathulate leaves about '25" long only or less, much crowded above and small heads in clusters almost immersed in wool in their axils. Involucre bracts '06–'08" long, linear-lanceolate or linear, almost hyaline acute. Cypsele slender minutely papillose.

Damp ground. Bettiah, *Hieronymus!* Palarnau, *Camble!* Probably common. Fl., Fr. c.s.

5. *G. flaccidum*, Kurz.

A flaccid annual with simple erect flexuous stems or branching from the root, 4—6" high, sparingly cottony. Leaves obovate-spathulate, 1—2" long. Heads minute usually crowded into a single globose yellow cluster at the end of the stem or branches, cluster 7—1" diam. subtended by leaves shorter than itself. Inner bracts yellow glistening.

Very rare. Found near Maldah close to our area, *C. B. Clarke!* Fl. Feb.—March.

16. *CÆSULIA*, Roxb.

A glabrous herb with alternate narrow serrulate leaves and small one-flowered heads in axillary sessile involucrate globose clusters subtended by a common involucre, sessile on a broad convex common receptacle. Floret tubular and narrowly campanulate or salver-shaped, deeply 5-fid. Involucral bracts 2, opposite, keeled or winged, and at length adnate to and including the cypsel. Anther-bases with branched tails. Pollen spinose. Style branches short, very obtuse. Pappus 0.

1. *C. axillaris*, Roxb.

A small herb or with several stems attaining 15", erect or sub-erect, with linear leaves 3—5" long acute with thickened margin and numerous very oblique sec. n., base tapering into a very short petiole with dilated base embracing the clusters. Clusters also with usually two large involucral leaves adnate to the common receptacle. Clusters pearly-white when ripe with each flower (head) enclosed by two fleshy strongly compressed involucral bracts with a hyaline appendage. Anthers far exserted.

Marshy places, very common! All districts. Fl., Fr. Aug.—Jan.

17. *INULA*, L.

Herbs or shrubs with alternate leaves. Heads heterog., radiate or not. Outer fls. female, 1—many-seriate, yellow or white, 3—4-toothed, with long, short, minute, or 0 ligule. Central fls. herm. tubular, yellow, tube slightly wider upwards, 5-toothed. Invol. bracts many-seriate, outer herbaceous, with the outermost often foliaceous. Recept. pitted or areolate. Anther bases with simple or branched tails, those of adjacent anthers sometimes connate. Style-arms of herm. fl. linear, broader upwards, obtuse. Cypsel usually ribbed. Pappus hairs rather short, 1—2-seriate, smooth scabrid or bearded.

1. *I. Cappa*, DC.

A stout shrub 3—4 ft. high with leaves white woolly beneath, denticulate with short mucronate teeth or some coarsely toothed. Heads 3—4" long in close corymbs 2—4" diam. Involucre 2" diam. at base slightly narrowed upwards with very many linear acuminate silky bracts. Florets very many deep yellow, ligules 0 (sometimes present

in forms outside our area). Cypsele '06" silky. Pappus dirty white, hairs slightly thicker at the ends.

Sandstones of Ramnagar Hills, 1800 ft. and above! Fl., Fr. Oct.—Dec.

Stems white woolly. Leaves 4—6" narrowly elliptic with an acute very sharply mucronate tip, lower petioled, uppermost sessile. Longer bracts '2". Herm. corollas '22—'24" long. Pappus '2".

Our plant described above differs in several details from the higher level form.

18. VICOA, Cass.

Herbs with alt. entire or toothed leaves, upper amplexicaul. Heads radiate and heterogamous or disciform and homogamous, solitary, terminal or on leaf-opposed peduncles. Ray. fls., if present, 1—2-seriate, fem., 2—3-toothed. Disc. fls. herm., slender, hardly dilated, 5-toothed. Invol. campanulate, bracts many-seriate, narrow, with scarious margins. Recept. without pales but margins of pits sometimes toothed. Anther bases with slender tails. Style arms of herm. fl. flattened, broader upwards, obtuse or truncate, quite smooth. Cypsele small, hardly ribbed. Pappus hairs 1-seriate, slender; of ray few or 0.

Very close to *Inula* and Sir J. D. Hooker says best united with it.

Pubescent or glabrescent. L. 3—4 times as long as broad.

Involucre bracts not villous 1. *indica*.

Villous. L. 2—3 times as long as broad. Invol. bracts villous 2. *vestita*.

1. *V. indica*, DC. Syn. *Inula indica*, L.; *V. auriculata*, Cass.

A much branched rather rigid erect herb with slender stems and branches, 2—3 ft. high and somewhat reminding one of a Ragwort or Fleabane. Leaves sessile from a broad auricled base, narrow, 2—4" long, acuminate papillose-pubescent and with small glistening glands beneath, sparsely hispidulous above. Heads solitary in large corymbose loose panicles at the top, yellow, '8—'12" diam., with ligules '2—'3" long. Cypsele of herm. fl. brown terete hairy '04" long.

Very common in open jungles on clay soils in Chota Nagpur! Extending to Angul, Sambalpur and Kalahandi! Fl., Fr. Nov.—May.

Stems slender pale-brown smooth. Leaves entire or serrulate, somewhat rugose, sec. n. numerous oblique looped. Peduncles slender bracteate. Involuc. bracts outer short subulate, inner linear acuminate, all glandular. Receptacle deeply pitted with margins of pits slightly toothed and puberulous. Tails of adjacent anthers connate. Cypsele of ray flowers quite smooth and without pappus.

2. *V. vestita*, Benth.

A shorter stouter plant than the last, 6—15" high, woolly and softly hairy, with oblong or linear-oblong obtuse or subacute serrate leaves 1—2" long. Involucre bracts '2" with squarrose filiform recurved tips. Cypsele subsilky.

Banks of the Ganges, Santal Parganas, Kurz! Patna, J.D.H.! Bankipur! Bettiah, Hieronymus! Fl. March—May.

Stems sometimes purple corymbosely branched above but sometimes flowering when only 4" high. L. half amplexicaul with broad subcordate base, villous rarely 2.5" long. Peduncles 1—2" villous. Heads solitary axillary and terminal '6—'7" diam. with linear ligules '2" long.

19. PULICARIA, *Gaertn.*

Herbs, usually woolly or villous, with alt. sessile, often amplexicaul leaves. Heads solitary radiate or disciform, yellow. Ray fl. if present, female, ligules narrow or minute or 0. Disc fls. herm., slender shortly 5-fid. Invol. hemispheric or obconic, bracts few-seriate, narrow acuminate or awned. Receptacle pitted. Anther-cells with capillary tails, simple or branched. Style-arms of herm.-fl. linear, obtuse. Cypsele smooth or ribbed. Pappus double, outer of short jagged teeth, inner of filiform or flattened hairs.

A. Pappus hairs deciduous leaving the scales:—

Heads ligulate. Cypsele glabrous. Root perennial

1. *angustifolia*.

Heads disciform, homogamous. Cypsele hairy. Annual

2. *foliolosa*.

B. Pappus hairs thickened at the tips, connate with the scales and deciduous with them. Suffruticose:—

Heads ligulate. Cypsele nearly glabrous. Perennial

3. *crispa*.

1. *P. angustifolia*, *DC.*

A herb with many diffuse or suberect pubescent branches 6—12" long from a perennial rootstock, clothed with sessile linear or linear-oblan-ceolate, rarely somewhat obovate, toothed or entire leaves about 1" long and gradually smaller upwards, becoming bractiform on the terminal peduncle. Heads bright yellow .7—1.2" diam. Invol. broadly campanulate, bracts linear to linear-oblong, .2" long, subequal erect and pubescent with slightly squarrose acute scarious tips. Ray fls. about 15—20, .35—.4" long. Pappus hairs slender pubescent slightly thicker upwards, as long as or exceeding the corolla tube, with an outer ring of minute scales. Cypseles pale-brown .07" hispid-puberulous, not ribbed.

Open places. Plateaux of Chota Nagpur:—Ranchi, *Clarke!* Neterhat! Fl., Fr. May.—Oct.

L. sometimes all about .5", lower sometimes 1.5", with a nerve parallel to midrib each side. Peduncles not thickened above. Corolla of disc flowers .18". Anthers long linear short-tailed.

2. *P. foliolosa*, *DC.*

A densely branched leafy annual 8"—2 ft. high, pubescent or tomentose but not white-cottony, with half-amplexicaul linear-oblong or oblanceolate leaves 1—2", or lower up to .4" long and spatulate-oblong. Heads very numerous, orange-red, lateral and terminal, .25—3" diam. Invol.-bracts narrowly linear, glandular and sparsely pilose or ciliate. Ray fls. filiform tubular, ligules 0.

Banks of the Ganges, S.P., *Kurz!* Banks of the Ganges (without locality) *J.D.H.!* Fl., Fr. April—May.

Leaves more flaccid in texture than in the other species, entire, tips usually rounded. Peduncles very slender, often pilose or villous. Invol. bracts .15" glandular on the back.

3. *P. crispa*, *Benth.*

A suffruticose white-cottony herb 1—2 ft. high with half-amplexicaul linear, linear-oblong or somewhat oblanceolate crisped and toothed leaves .5—2" long decreasing in size on the peduncles, and heads of yellow flowers .3—5" diam. Invol. bracts linear acute slightly

pubescent. Ray fls. ligulate often shorter than the bracts. Cypsele oblong terete sparsely pilose. Pappus hairs barbellate and slightly thickened upwards, connate at the base with the outer ring of minute scales.

Banks of Ganges, Lucknow to Patna, *Madden!* Sone R., Deori, *J. D. H.!* Gya!
Ganges Banks, S.P., *Kurz!* Fl., Fr. Jan.—April.

20. XANTHIUM, L.

Annual coarse rough herbs, unarmed or with 3-fid spines, alternate toothed or lobed leaves and 1-sexual, single or clustered axillary heads, males (herm. in form) in the upper axils. Involucre of female heads with the bracts united into an ovoid 2-celled utricle, each cell with a single apetalous flower with free style arms exerted from the utricle which has two beaks or horns. Male heads globose, many-fl. with short free 1—2-seriate narrow involucral bracts and cylindric receptacle with hyaline pales enclosing the flowers. Corolla tubular 5-toothed, filaments monadelphous but anthers free with obtuse bases and inflexed mucronate tips, ovary sterile, style simple. Cypsele of (fem. fl.) enclosed in the hardened cells of the utricle; pappus 0.

An interesting genus, not always at once recognisable as a Composite in fruit; the peculiar involucre simulating a two-celled ovary.

1. *X. strumarium*, L. Chhota-gokhru, *Vern.*

A herb 1—3 ft. high with closely hispidulous or strigillose stems and long-petioled ovate-triangular coarsely lobed and toothed leaves 2—4" long with the base often cordate and cuneate on the petiole, strongly 3-nerved. Fem. involucre burr-like, 5—1" long closely covered with hooked spines, male heads at the top of the inflorescence or stem 25" diam. with prominent exerted anthers.

Waste ground, especially near river-beds. In most districts but only locally abundant! Fl., Fr. c.s. Fr. h.s.

Leaves scabrid or hispid. Petiole often exceeding the blade. Stem not armed in our species but in an allied species *X. spinosum*, L., recently introduced (*vide Prain*) into Bengal, and likely to spread into our area; it is armed with 3-fid spines.

21. SIEGESBECKIA, L.

Glandular-pubescent herbs with opposite toothed leaves. Heads heterogamous small, loosely paniced with usually 5 outer glandular involucral bracts different from the inner ones. Outer female flowers enclosed by invol. bracts 1-seriate, scarcely radiate, tube short, limb 2—3-fid. Disc fls. herm. fertile or inner sterile, tubular with campanulate 5-fid limb or narrow and 3—4-toothed. Receptacle with membranous concave pales often enclosing the flowers. Style arms of herm. fl. short flattened subacute. Cypsele obovoid-oblong, not compressed, obtuse. Pappus 0.

1. *S. orientalis*, L.

A branched rather coarse annual 2—5 ft. high with pubescent stems, opp. ovate coarsely crenate, softly pubescent leaves with the blade decurrent on the petiole, larger 7" by 3", upper gradually smaller. Heads

very small yellow, easily recognised by the 5 long outer linear-spathulate glandular invol. bracts and the inner embracing the flowers and black cypseles.

Common in somewhat damp localities under shade:—Chota Nagpur! probably in all districts. Fl., Fr. c.s.

Leaves 3-nerved. Outer fls. few, ligulate, 3-toothed. Inner with apiculate anthers.

22. ENHYDRA, Lour.

Marsh herbs with opposite sessile sometimes gland-punctate leaves and axillary subsessile heads terminal, unilateral or in alternate axils, heterogamous, sub-radiate. Ray fls. fem. many-seriate with minute broad 3—4-toothed ligule. Disc fls. herm. fertile or inner sterile 5-fid. Invol. bracts 4 foliaceous and sometimes petaloid in opposite pairs. Recept. with pales enclosing the flowers, tipped with glandular hairs. Anther bases obtuse. Style arms of herm. fl. flattened oblong obtuse, tips hispid. Cypsele oblong, enclosed in the rigid pales, outer dorsally, inner sometimes laterally compressed. Pappus 0.

1. *E. fluctuans*, Lour. Harhuch, *H.*; Hingeha, *Beng.*

Stems prostrate rooting at the nodes, succulent, with short ascending flowering hairy branches and flowers in yellow heads, the four greenish-yellow involucreal bracts or leaves giving the heads the appearance of single flowers.

River-beds, Ranchi, 2000 ft. Fl., Fr. Dec.—Jan.

Leaves narrowly oblong 1—2" serrate, gland punctate beneath. Heads terminal and axillary sessile, 3—7" diam. Corolla of ray-flower 3-lobed to one side.

23. ECLIPTA, L.

Strigose or hirsute herbs with opposite leaves and small peduncled axillary or terminal heterogamous rayed heads. Invol. broadly campanulate with bracts 3-seriate, outer herbaceous, large and broad. Ray fls. fem. sub-2-seriate, fertile or sterile, with small entire or 2-toothed white (rarely yellow) ligule. Disc fls. with broad-campanulate 4—5-fid limb. Receptacle flat, outer pales narrow, flat,* inner narrow filiform* or 0. Anther bases obtuse. Style-arms flattened with short or triangular obtuse appendages. Cypsele of ray narrow, 3-quetrous, often barren; of disc stouter, laterally sub-compressed. Pappus of teeth or 2-aristate or obsolete.

1. *E. alba*, Hassk. Mochrand, bhangra, bengraya, babri, *H.*; Kesari, Kesuti, *Beng.*; Hatu kesari, *K.*; Kesarda, *Or.*

A diffuse or erect usually much branched weed, frequently rooting at the lower nodes, strigillose hispid or hirsute all over with the hairs rising from a thickened base (best seen when dry). Leaves short petioled subentire or toothed, usually oblong or elliptic. Heads sub-

* The *F. B. I.*, following the *Genera Plantarum*, states that the pales enclose several flowers. I do not find this. Even if the third series of bracts be regarded as pales, these are narrow and flat and do not enclose any fls.

globose 17—35" diam., outer flowers with a narrow white ligule. Peduncles very short (in all the specimens from our area, but sometimes long and slender), sometimes paired. Invol. bracts ovate acute or obtuse, strigose. Pales mostly filiform with slightly dilated shortly hairy tips. Cypsele 1" long, 2-edged, verrucose on the flatter faces or all over, tip hairy, pappus obsolete or of 2 short awns or teeth.

Common in pasture lands, roadsides, etc., in Chota Nagpur! Probably in all districts of the province. Fl., Fr. Aug.—Feb. and perhaps throughout the year.

Leaves very variable, only 5—8" in some decumbent specimens, 2—4" in others, tapering into a very short petiole, tip acute or acuminate. Involucre bracts strongly 3—more nerved, inner (or outer pales?) 1-nerved. Disc flowers with campanulate limb exceeding the short narrow tube.

The plant is used in Hindu medicine for various purposes, among others for scorpion stings.

24. BLAINVILLEA, Cass.

Scabrid or villous herbs with leaves opposite, or upper alternate, petioled, toothed. Heads small, sessile or peduncled, heterogamous, radiate or subdisciform, white or yellow. Ray fls. with small 2—3-toothed or 0 ligules. Disc fls. tubular with dilated 5-fid limb. Invol. bracts few, outer herbaceous, inner passing into the membranous concave or conduplicate pales of the small convex receptacle. Style-arms of herm. -fl. narrow flattened with acute or sub-obtuse appendages. Cypsele truncate, of ray fls. 3-quetrous or dorsally compressed, of the disc 3—4 angled or laterally compressed. Pappus of 2—5 unequal bristles connate at base.

1. *B. latifolia*, DC. Syn. *B. rhomboidea*, Cass.

An erect somewhat coarse herb with straw-coloured hispid-pubescent stems much branched above, 1—3 ft. high, or 3—4 ft. in rich soil. L. opp. or upper alt. 1—4", ovate or upper ovate-lanceolate, with cuneate base, coarsely serrate or crenate-serrate, hairy both sides. Heads white 12—2" in flower enlarging to 3—4" in fruit, solitary in the forks and subcorymbose at the top of the branches. Invol. bracts 2-seriate, outer 5 oblong acute 25" long in fruit. Inner cypseles embraced by the fimbriate or toothed pales which overlap them. Pappus of 3 bristles or 3 hairy scales.

A common weed throughout the area. Fl., Fr. Sept.—Jan. Annual.

Leaves 3-nerved at the base. Petiole of lower leaves often 1' long, upper shorter. Peduncles hardly any, then often elongating to 1—2". Outer (ray) fls. few with long tube and minute obovate notched ligule, style with slender arms. Disc fls. with black anthers and flattened style arms. Outer layer of cells of the cypsele often golden yellow, margins and angles slightly pubescent.

25. WEDELIA, Jacq.

Herbs or suffruticose with opposite leaves and axillary or terminal radiate heads with yellow entire or 2—3-toothed ligules. Involucre with sub-2-seriate bracts, outer 3—5 usually herbaceous or foliaceous, pales of receptacle embracing the flowers. Disc flowers tubular broader upwards, 5-toothed. Style-arms flat, linear with hairy or pubescent

margins and acute tips. Cypselles of disc obovoid or cuneate-oblong with rounded top, if laterally compressed then edges rounded, smooth or tubercled or scabrid on top. Pappus of minute scales with occasionally one or few bristles added, or 0.

A. Erect or procumbent herbs.

Stems creeping below. Hds. .9—1.3" diam.

1. *calendulacea*.

Erect or sub-erect. Hds. .3—4" diam.

2. *Wallichii*.

B. Scandent. Shrubby. Hds. .75—1" diam.

3. *scandens*.

1. *W. calendulacea*, Less. Kesaraja, Beng.; Bhanra, H.

A bright little plant with stems creeping below often for 1—2 ft. with erect branches, oblong or lanceolate-oblong leaves 2—3" long narrowed into the sessile base and bright yellow flowers .9—1.3" diam. at the ends of long peduncles from the upper leaf-axils.

Watery places. Fl., Fr. March—Sept.

Stems thinly strigose or glabrate. Leaves subentire, crenate or with large serratures, sparsely strigose both sides. Involucre campanulate with broad oblong bracts spreading above. Ligules about 8, narrowly 3-lobed or -toothed. Corolla lobes of disc fls. ciliolate. Pappus a denticulate cup.

The vernacular names of this plant and *Eclipta alba* are confused, and whereas *Dutt* gives this as the plant chiefly used in medicine, *Nadkarni* gives *Eclipta*. Both plants appear to be considered tonic and alterative and useful in cough, skin diseases and alopecia. There is no similarity in the plants themselves.

2. *W. Wallichii*, Less.

An erect or suberect herb 6" to 2 ft. high with hispid pubescent stems, flaccid ovate or ovate-lanceolate crenate-serrate acuminate leaves 1—4" long and yellow shortly-peduncled terminal and leaf-opposed heads .3—4" diam. Outer invol. bracts calyciform, 4—5, imbricate .2—2.5" long oblong acute, each subtending a ray flower, inner narrower. Disc fls. 4—7 only, each subtended by a conduplicate nerved linear-lanceolate pale. Cypselé brown .14" obovoid, scarcely compressed top hispid. Pappus a very short scaly or toothed ciliate ring.

Among grass on the top of Parasnath, 4000 ft. Fl., Fr. Oct.—Dec.

Leaves 3-nerved above base, hairs scattered, white, often appressed, suddenly narrowly cuneate on the .5—7.5" long slender petiole. Peduncles .5—1" long. Ligules about as long as involucre, pubescent below as is the ovary, .1" broad above. Corolla of disc fls. pale, anthers black, minutely tailed, style arms spreading and recurved slightly dilated above and subobtuse, yellow.

3. *W. scandens*, Clarke. Syn. *W. biflora*, DC.

A large suffruticose climber with ovate acuminate serrate petioled leaves which are 3-nerved. Invol. bracts oblong or ovate-lanceolate often recurved, inner bracts subobtuse. Cypselé 3—4-angled, rough tip broadly truncate.

This shrub, which is found in the Sunderbans and extends down the East coast, is likely to be found in the Mahanadi Delta.

26. SPILANTHES, L.

Herbs with opposite leaves. Heads radiate or not, ligules yellow or white, 2-lobed. Involucre ovoid or campanulate, bracts sub-2-seriate.

Receptacle very conical and elongate with paleæ which embrace the flowers. Disc fls. tubular with a spreading 4—5-fid limb. Style arms of disc-fls. truncate, sometimes dilated at the tip. Cypsel of disc usually laterally compressed. Pappus 0 or of 2—3-bristles.

1. **S. acmella**, L.

A herb with long weak stems creeping at the base, sometimes 2—4 ft. long, or erect or ascending, ovate or lanceolate-serrate leaves 1.5—2" long and pretty yellow heads .5" diam. with very prominent centre, on long terminal peduncles.

Watery places, not common. Fl. Sept.—Dec. and perhaps at other times.

Var. *α*. **typica**.

Leaves often coarsely toothed. Cypsel prominently hispidly ciliate on the prominent margins and sometimes the faces shortly hairy.

Sameshwar Hills, N. Champaran! Chota Nagpur, *Wood* (precise locality not noted)! Manbhum, *Ball*! Santal Parg., *Kurz*!

Var. *β*. **calva**.

Stems long often red and villous above, leaves serrate, ligules 2-fid. Cypsel of disc 2-edged black and shining and completely glabrous, outer 3-angled.

Neterhat, elev. 3000 ft.!

The involucre bracts in var. *calva* are lanceolate, .12" long, those of the type often shorter and more ovate. The creeping form superficially resembles *Wedelia calendulacea* before the receptacle elongates.

27. **HELIANTHUS**. L.

Herbs, often very large, with opp. or alt. coarse leaves and medium to very large radiate heads, solitary or in loose corymbs. Involucre hemispherical or very broad, bracts 2—many-seriate, outer at times with foliaceous tips. Ray flowers neuter (and occasionally in cultivation all the disc flowers become ligulate). Cypsel thick, slightly compressed or 4-angled. Pappus of 2 deciduous awns sometimes with a caducous bristle between them, or of two large dry scales.

A large North American genus.

Annuals.

Leaves and stems hispidly hairy

Leaves and stems softly cottony

Perennial, with tuberous roots

1. *annuus*.

2. *argyrophyllus*.

3. *tuberosus*.

1. **H. annuus**, L. Surajmukhi, *Vern.*; The Sunflower.

This, the common Sunflower, is often cultivated. The seeds give an oil and are also used as a food for poultry.

2. **H. argyrophyllus**, *Torr. & Gr.* Safed Surajmukhi, *Vern.*

Cultivated and frequently self-sown near houses. *Prain* calls it the "Rains Sunflower."

3. **H. tuberosus**, L. Brahmokha, *Vern.*; The Jerusalem Artichoke.

A well-known plant resembling a sunflower in leaf. Widely cultivated.

The genus **Tithonia** is allied. The heads are large on clavate peduncles. Pappus 0 or of many scales with or without 1—2 caducous bristles. The flowers are often red and handsome. *T. tagetiflora*, Desf., is common in gardens.

28. GUIZOTIA, Cass.

Herbs (natives of Africa) with leaves opposite or upper alternate, and axillary and terminal rather large peduncled rayed yellow heads. Invol. campanulate with the outer bracts herbaceous or almost foliaceous, the inner paleaceous. Pales of recept. embracing the fls. Corolla villous at the base, the lower hairs reflexed and covering the top of the hypanthium. Cypselæ of ray fls. 3-, of herm. fls. 4-angled. Pappus 0.

1. **G. abyssynica**, Cass. Syn. *Verbesina sativa*, Roxb.; Gunja, Beng.; Ramtila, H.; Sarguja, K.

A leafy herb forming in cultivation beautiful golden-yellow crops. Stem slightly hairy. Leaves opposite sessile and half-amplexicaul, 3—5", linear oblong or lanceolate, serrate. Heads .5—1" diam. on peduncles 1—2" long. Ovary tipped with a ring of hairs and the hairy base of the corolla.

A very common crop in Chota Nagpur and the uplands of Orissa! Also cultivated to a less extent in the Northern Area. Fl., Fr. Nov.—Dec.

The seeds yield an oil used as an article of food. They are also ground into flour, of which cakes are made. They are smooth, of a blackish brown colour, somewhat obovate with the angles rounded.

29. BIDENS, L.

Herbs with opposite entire or divided leaves. Heads rayed, or disciform and then homogamous. Ray fl. fem. or neuter with white or yellow ligule. Invol. bracts sub-2-seriate with connate bases, outer herbaceous, inner membranous, pales of recept. narrow, nearly flat. Style-arms of herm. fl. hairy above with a short appendage. Cypselæ 4-gonous or dorsally compressed, linear or cuneiform, often narrowed but not beaked above. Pappus of 2—4 retrorsely hispid bristles, rarely 0.

1. **B. pilosa**, L.

Usually a tall herb 2—4 ft. high with opp. 3-foliolate or pinnate or 1—2-pinnatifid leaves and long-peduncled heads of yellow disc fls. and 5—7 white ray flowers, or the ray fls. sometimes absent. Easily recognised by its angular slender black cypselæ .5—7" long with 2—4 rigid awns with retrorse bristles by which they adhere to the clothes.

Chiefly in the damper or higher districts Purneah! Chota Nagpur, all districts, especially at the higher elevations. Fl. Sept.—Dec. Fr. Nov.—Jan.

Stems striate, glabrous (in our area). Lfts. .5—2" long, ovate or lanceolate, serrate. Heads very variable, the ray ligules sometimes .75" broad, white (in our specimens, sometimes said to be yellow), at other times evanescent. Invol. bracts with broad scarious margins and receptacle covered with brown-nerved pales with scarious margins. Heads at first only .2" long, elongating in fruit and the pales becoming longer than the involucreal bracts. Awns pale.

30. COSMOS, Cav.

Herbs often with showy flowers closely allied to *Bidens* and distinguished from that genus by the purple or rosy neuter ray flowers, more rarely white or yellow, and the beaked cypseles which are very elongated when ripe. An American genus.

A. Leaf segments not filiform:—

Flowers rosy, pink or purple

Flowers yellow

1. *caudatus*.

2. *sulphureus*.

B. Leaf segments filiform. Flowers bright red or purple

3. *bipinnatus*.

1. *C. caudatus*, H. B. K.

A herb 1–3 ft. high with pinnate leaves, the pinnæ pinnatifid and cut, ultimate lobes lanceolate or oblanceolate, very acute. Flowers of ray mostly pink, ligule faintly 3-toothed, the central florets yellow. Outer invol. bracts with hispid margins. Cypsele very slender with a beak as long as itself, together 1'2" long, beak hispid with two slender awns.

Semi-wild in the Santal Parganas. Fl., Fr. c.s.

Branches sulcate glabrous or with few hairs, peduncles puberulous.

2. *C. sulphureus*, Cav.

A rather coarse herb, 2–3 or sometimes 5 ft. high with sulcate hairy stems. Leaves much as in last with pinnules decurrent ovate acute, or ultimate longer and lanceolate. Invol. bracts of both series 8 (as in last), lanceolate acute, outer series spreading shorter (*Cavanille's* fig. shows them subequal, specimens at Kew much shorter!). Corolla deep yellow, ray fls. 8 with sharply 3-toothed ligules. Cypsele as in last.

Native of Mexico. Common in gardens and often running wild. The last described plant may belong to *C. sulphureus*, as the outer bracts are much smaller than the inner, whereas in true *C. caudatus* they are a little longer!

3. *C. bipinnatus*, Cav. The well-known garden plant with finely divided foliage and pink, purple or white flowers.

31. GLOSSOGYNE, Cass.

Perennial herbs with leaves chiefly from the rootstock and only a few alternate ones on the stems. Leaves usually 1–2-pinnatifid. Closely allied to *Bidens*, from which it chiefly differs in the long subulate acute papillose stigmas or style-arms.* The outer invol. bracts are only slightly connate at the base. Ray fls. female or neuter. Cypsele with 2 retrorsely hispid awns, truncate.

1. *G. pinnatifida*, DC.

A herb with numerous stems from a very woody rootstock and sub-pinnate or twice pinnatifid leaves 1–3" long with linear or linear-cuneate acute segments. Flowering stems 4–10" high, nearly naked, cymosely branched, heads terminal, 2" long and broad in flower.

* Under a high magnification the style arms themselves are seen to be very short and glabrous, and these stigmas are therefore usually described as *appendages* to the style arms. In *Bidens* the "appendages" are very short oblong with rounded tip and papillose on the edges.

ligules whitish with dark veins, about .1" broad. Cypsele linear sulcate .3" long with the awns widely spreading when ripe.

Plateaux of Chota Nagpur! Fl., Fr. April—Nov. It usually flowers after the firing of the grass lands in which it is found.

32. GLOSSOCARDIA, *Cass.*

A small herb with alt. slender 1—2-pinnatisect leaves. Heads small terminal and axillary, rayed, yellow. Ray fls. usually one only with 2-fid ligule, female. Disc fls. herm., few fertile, 4-fid. Invol. oblong with few bracts, inner oblong with broad membranous margins. Pales on receptacle flat. Style-arms of herm. with linear acute hispid tips. Cypsele narrowly oblong, dorsally much compressed, faces bearded. Pappus of 2 smooth stiff awns.

1. *G. linearifolia*, *Cass.*

A curious little plant 1—6", rarely 10" high, branched, glabrous with the leaves cut into linear segments and somewhat shining oblong heads .3" long remarkable for the few large oblong black 2-horned cypseles, very hairy on the faces.

Chiefly amongst rocks. Singbhum! Ranchil Fl., Fr. Sept.—Oct. It is also found in the Central Provinces and will probably therefore be found in other of the western districts.

The involucre bracts spread after the fall of the cypseles.

33. CHRYSANTHELLUM, *Rich.*

Annual glabrous herbs with alternate pinnatifid or radical toothed leaves. Hds. small, rayed. Ray fls. fem. 1-seriate with spreading yellow ligule. Disc fls. herm. with very short tube and a campanulate 5-lobed limb. Recept. flat with narrow scarious pales. Style-arms of herm fl. with long subulate arms. Cypsele oblong or linear-oblong, dorsally compressed, outer sometimes tubercled, thick with obtuse margins, inner smooth flat margined or 2-winged. Pappus a minute corona or 0.

1. *C. indicum*, *DC.*

Stems numerous spreading and procumbent, branched and leafy, from 3" in some cases to 1 ft. long. Leaves .5—2", rarely 3" long, deltoid, 2-pinnatifid, final segments broadly linear or cancate. Heads peduncled .15—2" diam. in flower, .25—3" in fruit, with the invol. bracts widely spreading, nerved, oblong with rounded or apiculate tips, golden yellow. Cypseles .1" long, outer thick corky umbonate sub-compressed, 3-grooved on each face, inner (strongly resembling the mericarp of an Umbellifer) somewhat obovate, compressed, ridged on each face and with lighter-coloured margins.

Common on banks, open pasture, etc., in Chota Nagpur! Behar, *Bengal Plants*. Fl., Fr. Sept.—Dec.

34. TRIDAX, *L.*

Herbs with opposite toothed, lobed or pinnatisect leaves. Heads on very long peduncles, rayed. Ray fls. fem. ligulate or 2-lipped with the

outer lip large 3-fid or -partite, the inner small 2-lobed or -parted or 0. Disc. fls. herm. tubular, slightly wider upwards, 5-lobed. Invol. bracts few-seriate, outer short broad herbaceous, pales membranous. Anther-bases with short acute auricles. Style-arms of herm. fl. hairy above with subulate tips. Cypsele turbinate or oblong, silky. Pappus of aristate feathery bristles.

1. *T. procumbens*, L.

Stems usually several procumbent hairy, attaining 18" in length with ascending tips and very long erect peduncles. Leaves in rather distant pairs, 1—2" long, coarsely toothed or lobed, lobes serrate, both sides hairy, petioles short. Peduncles sometimes 12" long. Heads 3—5" diam. in flower, .75" in fruit. Involucre hirsute .25" long. Ray fls. with a slender hairy tube and spreading deeply 3-lobed ligule .1—1.5" long. Cypsele black densely hairy or silky, pappus of ray fls. .13", of disc fld. fls. longer.

Abundant in pastures, banks and waste ground in Chota Nagpur and south to Kalahandi! Probably in all districts. Introduced from South America. Fl., Fr. all the year round.

35. FLAVERIA, Juss.

Herbs with opposite leaves and yellow flowers formed into close clusters of heads resembling single heads. Individual or simple heads small 1—5-fld. homogamous or with 1 very shortly ligulate female, involucre of 2—4 bracts with sometimes 1—2 outer scales. Receptacle naked. Style of herm. fl. with truncate arms. Cypsele narrow, 8—10-ribbed. Pappus 0.

1. *F. repanda*, La Gasca. Syn. *F. contrayerba*, *Flora of Bombay*; *F. australasica*, *Flora of Madras*.

An erect glabrous often 2-chotomously branched herb varying much in stature from 8" to 2 ft. with opp. or pseudo-verticillate linear-lanceolate, lanc., or oblanceolate, rarely ell.-lanceolate, 3-nerved leaves 1—2" long, tapering into a slender petiole which is again dilated at the amplexicaul base or those subtending the heads sessile with dilated base. Compound heads 3—5" diam. globosely fasciculate, involucre, axillary, subtended by a leaf (see above) and several bracts equalling or exceeding the head.

Watery places, occasional. Fl., Fr. Sept.—Jan.

There seems to be a difference of opinion as to the name of this plant. The cypseles in our species are grey-black, .1" long with about 10—12 black fine distinct ridges and are enclosed in the two proper bracts of the simple heads, which are connivent, .18—2" long. *F. contrayerba*, Pers., differs by the usually larger leaves and far more loosely compound heads (sometimes becoming distinctly branched). *F. australasica*, Hook., also has somewhat larger leaves and its cypseles are longer, viz. .14" long with stronger ridges, but the plant would appear to be little more than a variety. The two former are natives of Central America and the last a native of the interior of Australia.

36. TAGETES, L.

Herbs, often gland-punctate, with opposite pinnatisect, rarely sub-entire, serrulate leaves. Heads orange with 1-seriate (rarely 0) fem.

ligulate ray fls., disc fls. 2-sexual with 5-fid corolla. Invol.-bracts 1-seriate more or less connate into a campanulate or cylindrical cup. Receptacle fimbriate. Anther-bases obtuse. Style of disc fls. with slender truncate and penicillate or shortly appendaged arms. Cypsele linear, compressed or angular, base attenuate with conspicuous basilar callus. Pappus of few (usually 5—6) scales, sometimes aristate.

1. *T. patula*, L. Genda, Gendu, *Vern.*

Erect. Leaf segments linear-lanc. with more or less spinulous serratures. Heads solitary long-peduncled. Invol. glabrous. Corolla golden to tawny.

Banks of the Ganges, *Kurz!* Cultivated in all Indian gardens. Native of Mexico. Fl. chiefly r.s.

37. COTULA, L.

Small herbs with alt. pinnatifid or pinnatisect, rarely only toothed or entire leaves. Heads small, peduncled, yellow, disciform. Outer fls. fem. 1—2-seriate, corolla conic or 0. Centre fls. herm., tube slender or stout and 2-winged, limb 4-fid. Invol.-bracts sub—2-seriate, margins often scarious, receptacle naked. Anther-bases entire. Style-arms of herm. fl. truncate or obtuse. Cypsele of the ray or all stipitate, compressed, sometimes sheathed at top by the base of the corolla, at others with a short ear-shaped pappus.

Leaves with acute lobes. Outer cypseles alate or margins thickened

1. *anthemoides*.

Leaves with spinule-tipped lobes. Cypseles small angled, not alate

2. *hemispherica*.

1. *C. anthemoides*, L.

A small prostrate herb with leaves 1—2-pinnatifid or 1—2-pinnatisect. 3—75" long, segments with lanceolate lobes. Peduncles often very slender. Outer cypseles broad flat with winged margins, often much thickened.

Gangetic Plain from Rajmahal (Santal Parganas) westwards (*vide F. B. I.*). Fl., Fr. Feb.—March.

2. *C. hemispherica*, Wall.

A small suberect, prostrate or diffuse herb with many stems 3—8" long often thickened below, glabrous or villous above, with pinnatisect leaves 5—2", segments linear spinulose or with 2—3 spinulose or mucronate teeth towards the ends, uppermost leaves simple. Heads small yellow solitary peduncled, 17" diam. on short peduncles, erect in flower, inclined or drooping in fruit. Outer fls. minute with 2-toothed or 0 corolla. Cypseles angled, not winged.

Along river banks. Purneah, *Kurz!* Fl., Fr. Jan.—April.

Both are rather pretty little plants with *Anthemis*-like foliage. This has leaves more finely cut than in *C. anthemoides* with rather wide rhachis.

38. CENTIPEDA, *Lour.*

Herbs with alt., often toothed leaves and small heads sessile on the branches or racemose, disciform, yellow or pale grey. Outer fls. fem., many-seriate with minute obscurely-lobed corolla. Centre fls. few herm. with short tube and campanulate 4-fid limb. Invol. bracts 2-seriate, spreading in fruit, receptacle naked. Style-arm of herm. fl. short truncate. Cypseles 4-angled obtuse, angles hairy. Pappus 0.

1. *C. orbicularis*, *Lour.*

A small prostrate herb with very numerous branched stems spreading from the root. Leaves '3—75" long or less, oblanceolate or obovate-oblong coarsely toothed. Heads inconspicuous sessile or subsessile globose '1—12" diam., receptacle marked with the small elevated seats of the flowers after fall of the minute sharply 4-angled cypseles which are only '018" long.

In muddy places or damp ground. Singbhum and Ranchi, common! Lohardagga, *Gamble, Clarke!* Santal Parg., *Kurz!* Purneah! Sambalpur! Doubtless in all districts. FL., Fr. March—Jan., probably all the year round where moist conditions favour it.

The habit of the little plants of the genera *Grangea*, *Cotula*, *Centipeda* and *Sphæromorphæa* are very similar. *Sir J. D. Hooker* states that *Centipeda* and *Sphæromorphæa* should be placed near *Grangea*, i.e. in the Asteroidæ; *Cotula* also seems closely allied to *Grangea*, both having stipitate cypseles.

39. SPHÆROMORPHÆA, *DC.*

A small perennial, pubescent with crisped hairs, with prostrate branches, and alt. sessile leaves. Heads axillary, subsolitary, shortly peduncled, disciform, yellow. Outer fls. female, many-seriate, corolla elongate slender tubular, inflated below. Centre fls. herm. fewer, fertile tubular, 4-cleft. Invol. bracts many-seriate, oblong, obtuse, coriaceous, incurved in fruit. Style arms 2-fid. Cypsele subcylindric, slender, broadly ribbed, hairy at the base only. Pappus 0.

1. *S. Russeliana*, *DC.*

Root stout woody with woody straggling prostrate flexuous branches 6—8" long and obovate or oblanceolate obtuse toothed leaves '25—1" long narrowed into a very short petiole, gland-dotted beneath. Heads sometimes paired, '15—2" diam. globose. Invol. bracts broadly oblong or obovate obtuse, closing over the head in fruit, not spreading as in *Centipeda*.

In fields. Manbhum, *Camp!* Giridih, *Prain!* Orissa, *vide Bengal Plants* (but I have seen no Orissa specimens; *Russell's* plant was collected in the Circars). FL., Fr. May.

40. ARTEMISIA, *L.*

Herbs or shrubs, usually strong-scented, with alt. entire, serrate or 1—3-pinnatisect leaves and small usually paniced, sometimes solitary or fascicled, homogamous or heterogamous disciform heads. Outer

fls. usually female, 1-seriate, very slender 2—3-toothed. Inner fls. herm., sometimes sterile, 5-fid. Invol. bracts few-seriate, outer shorter, margins scarious. Recept. naked or hirsute. Anther bases obtuse. Style arms of herm. fl. with truncate usually penicillate tips, in the sterile flower often connate or connate with disciform top. Cypsele very minute, faintly striate. Pappus 0.

Inner fls. sterile. Leaves simple or coarsely toothed

1. *parviflora*.

Inner fls. fertile. Leaves multifid

2. *caruifolia*.

1. *A. parviflora*, Roxb.

A suffruticose herb 3 ft. high with erect rather strict stems tomentose or hairy above and often ridged or grooved. Leaves sessile linear-cuneate, linear, or oblanceolate usually acutely lobed or with long deep serratures towards the apex, upper often entire; all usually with narrow stipule-like appendages. Heads yellowish-green subglobose 1" long only, secund in elongate strict paniced racemes. Herm. fls. about 6—12, sterile, with tip of entire style dilated and anthers with very acute acuminate or aristulate tips. Invol. bracts broadly oblong with broad scarious margins.

Ranchi and Palamau, Neterhat, 3000 ft.! Parasnath 4000 ft.! Fl. Sept.—Nov. Fr. Dec.—Jan.

Inodorous. Leaves 1—2.5" long, sub-flabellately nerved, tip sometimes very acutely 3—5-fid. Style of fem. fl. with 2 linear arms.

2. *A. caruifolia*, Ham.

An erect herb 2—4 ft. high with smooth striate rather stout herbaceous stems and multifid leaves with very narrow weak segments. Heads globose drooping 12" diam. in secund axillary leafy racemes. Invol. bracts oval to oblong with broad scarious margins or outer with narrow margins. Centre (herm.) fls. fertile. Receptacle swollen, glabrous.

Purneah and Northern Santal Parg., near Sahebganj, Kurz! Fl. March—April.

41. EMILIA, Cass.

Herbs with radical leaves crowded often lyrate-pinnatifid, cauline few amplexicaul. Heads red, pink or yellow, long-peduncled, solitary or corymbose homogamous with all florets tubular and herm., elongate 5-toothed. Involucre cylindric, bracts 1-seriate, without any subsidiary bracteoles at the base, striate, sometimes connate. Recept. flat naked. Style-arms subterete. Cypsele subterete or angled and 5-ribbed. Pappus hairs copious soft white.

1. *E. sonchifolia*, DC. Sadi-modi, Beng.

A nearly glabrous erect, rarely diffuse, herb usually 12—20" high, with lyrate and usually pinnatifid lower leaves 3—4" long and few lanceolate or oblong-lanceolate upper cauline leaves with large auricles. Easily recognised by the tubular involucre shortly 8—10-toothed only splitting into its component bracts in fruit and the small rose-coloured florets scarcely longer than the involucre.

Common in cultivated ground! Probably throughout the province. Fl., Fr. chiefly in r.s.

Stems at base and leaves on the nerves beneath sometimes sparsely hairy. Heads .35" long in flower, .5" long in fruit. Cypsele .12" long, nearly uniform in width throughout, with 5 scabrid ribs.

2. E. flammea, Cass. Syn. *Cacalia coccinea*, *Bot. Mag.*; Tassel Flower.

A very common garden plant often sowing itself like a weed. It bears heads of scarlet flowers which are much stouter than in the last, and the plant is often but not always hairy.

42. SENECIO, L. Ragwort.

Herbs or shrubs, sometimes scandent. Leaves radical or alternate, entire or cut. Heads usually yellow, radiate (rarely ray fls. 0). Invol. bracts 1- or sub-2-seriate, equal, erect with a few very short outer bracteoles, receptacle various. Ray fls. fem. ligulate, disc. fls. herm. tubular, 5-fid. Anther-bases obtuse or auricled or minutely tailed. Style-arms of herm. fl. recurved with truncate and penicillate tips, rarely rounded or with a short narrow point. Cypsele subterete or outer dorsally compressed, 5—10-ribbed, pappus-hairs soft white, smooth scabrid or barbellate.

1. S. nudicaulis, Ham.

An erect biennial or perennial herb with strong fleshy roots from a short erect stock and glabrous oblong amplexicaul usually lobed and toothed leaves. Heads yellow .7" diam. corymbose, ligules about 12, .25—3" long. Invol. bracts 2—25", green, 2-seriate with few bracteoles, inner series oblong with scarious margins, outer acuminate. Cypsele .06—07" ribbed and hispid, apex truncate annular, pappus fine dirty white .2", that of ray soon deciduous.

Highest hills of Chota Nagpur. Neterhat plateau! Parasnath! In open grass lands. Fl., Fr. April—June.

Lowest cauline leaves oblong with tapering base, shallowly lobed, upper rarely entire, sinuate or dentate, lobes mucronulate, tip rounded, rather fleshy, cauline with acute lobes or teeth but rounded tip, auricled. Peduncles bracteolate above. Disc fls. tubular-campanulate, numerous, anthers ecaudate, style arms narrow linear with dilated tips, ovary pubescent.

Calendula officinalis, L., is the English Marigold, often seen in gardens in the cold season and called *Genda* by the Indians. The cypseles are curved boat-shaped and muricate, the outer also ventrally crested.

43. ECHINOPS, L. Globe-Thistle.

Thistle-like herbs with white tomentum and alternate pinnatifid spinous leaves. Heads compound in globose balls, blue or white, each composed of one flower only, sessile or stipitate on a common receptacle and each surrounded by its proper oblong involucre of many-seriate rigid often spinescent bracts, sometimes all connate into a tube with one long spine on the outer side. Fls. herm. with slender tube and 5 slender lobes, anther-bases sagittate, auricles connate with short entire or fimbriate tails. Style-arms thick and with a thick basal ring.

Cypsele elongate, usually villous, pappus of many short free or connate bristles.

1. E. echinatus, Roxb.

A much-branched spreading rigid annual 1—2 ft. high with numerous cottony-villous 2-chotomous stems. Leaves in outline oblong, pinnatifid with ovate-lanc. sinuate lobes, strongly spinose, minutely scabridly puberulous above, cottony beneath. Balls of heads 1—2" diam. with a common involucre of short 3-cuspidate spinose bracts. Proper involucre with 6—8 outer oblanceolate bracts of which 1 (or 2) is often produced into a long spine. Florets white, cypsele 1/7" long, obconic, silkily villous surrounded by the hardening inner connate invol. bracts which are 3" long and have ciliate tips.

Behar and Chota Nagpur, C. B. Clarke. Hazaribagh! Fl. April—June.

44. CNICUS, L. Thistle.

Erect often cottony or villous thistles with alternate often decurrent pinnatifid or toothed and spinescent leaves. Heads usually white or purple, homogamous, all flowers tubular and herm. or rarely diœcious. Invol. bracts many-seriate, outer often foliaceous, usually spinescent. Receptacle densely bristly. Cor.-tube slender 5-fid. Anther-bases with connate auricles and slender tails. Style-arms obtuse. Cypsele glabrous obovoid, top truncate or umbonate, basal areole nearly straight, pappus copious with many-seriate feathery hairs united in a deciduous basal ring.

1. C. arvensis, Hoffm. Syn. *Cirsium arvense, Scop.*; *Carduus arvensis, Robs.*; Creeping Thistle; Creeping Plume-thistle.

A handsome weed about 2 ft. high with a creeping root and very spinous sessile or very slightly decurrent oblong-lanceolate wavy leaves. Heads numerous, peduncled, ovoid, pale- or lilac-purple, diœcious. Invol. bracts broad-lanceolate adpressed with short spreading spine. Cypsele linear-oblong compressed.

Fields, northern area and cooler parts of Chota Nagpur! Not very common Fl., Fr. c.s.

A common English weed.

Cynara Scolymus, L. The Globe Artichoke; Kunjir, Urdu; Hathi-chuk, Vern.

This handsome thistle is often cultivated in India, and has heads 5—6" diam. with blue florets. The base of the inner involucre bracts and part of the receptacle are eaten. The Artichoke is probably only derived by cultivation from *Cynara cardunculus, the Cardoon*, which is native of the Mediterranean region (*De Candolle, Origin of Cultivated Plants*).

45. SAUSSUREA, DC.

Heads often cottony with unarmed leaves. Heads homogamous with purple or bluish herm. fls. with slender tube and narrow 5-fid. limb. Invol.-bracts many-seriate appressed, inner longer narrower. Receptacle densely bristly. Filaments free with sagittate anther-bases

and connate auricles with tails usually long entire ciliate or woolly. Style-arms linear. Cypsele glabrous oblong 4—5-ribbed or -angled, top truncate and cupular or crowned with a thickened disc and persistent base of style, basal areole straight, pappus-hairs 1—2-seriate, inner feathery, base thickened and connate into a deciduous ring, outer pappus caducous or 0.

Inflorescence cottony. Achenes .2"
 Inflorescence glabrous. Achenes .1"

1. *candicans*.
 2. *affinis*.

1 *S. candicans*, *Clarke*.

A handsome herb with stems 2—5 ft. high more or less lanuginous, corymbosely branched (or in small specimens scapose and 1-headed). Leaves cottony or white-tomentose beneath, lowest petioled lyrate-pinnatifid, sometimes attaining 18" by 5", upper sinuate-pinnatifid and uppermost narrowly oblong. Heads 1" diam. long-peduncled in large open paniced corymbs (but see above). Invol. bracts cottony or pubescent, acuminate. Cypsele 5-angled muricate.

Very rare. Hills of Chota Nagpur, Kolhan, *Gamble!* It is chiefly a Himalayan plant. Fl. March—May.

Leaves with a large terminal elliptic lobe and a few lower ones. Heads .8—9" long in fruit with the pappus far exceeding the .5" long involucre. Bracts linear-lanceolate, sharply acuminate.

2. *S. affinis*, *Spr.*

An annual less robust herb than *S. candicans*, erect about 2 ft. high (sometimes much more outside our area), with striate puberulous stems and deeply pinnatifid leaves white-cottony beneath, terminal lobe usually large lanceolate or broadly triangular-ovate dentate acute. Heads pink or pale lilac-red .5—6" long, long-pedicelled, in open glabrous paniced corymbs sometimes reduced to a few heads. Outer bracts very short, inner .3—4" with 5—6 distinct dark nerves. Achenes .1", pappus .3" feathery.

Not common in our area and only on the northern fringe. Extends from Gorakhpur on the west to Rajshaye on the east of it. "Poorneah," *T.T.!* ("Bengal, regio trop.," *J.D.H. & T.T.*, but the name may be Poornah?). Fl., Fr. Feb.—April.

Radical leaves long petioled 3—4", cauline sessile auricled 1.5—2" rarely 4" with the segments up to 2.5" (in Rajshaye) oblong-obovate and coarsely dentate, often the leaves less lyrate than in *S. candicans* with the terminal lobe only 1" and lateral .9", less white beneath than in that species. Longer pedicels of corymb sometimes 4—5.5". Small Gorakhpur specimens have sometimes only 3 heads.

46. GONIOCAULON, *Cass.*

An erect glabrous annual with acutely 4—8-angled stem. Leaves narrow alt. toothed. Heads narrow, fascicled and corymbose, homogamous with few fls. all herm. with slender tube, limb longer 5-fid to the middle or more. Invol. oblong, base very narrow, bracts many-seriate, pale, very narrow, rigid, acute, outer gradually shorter. Recept. palæaceous. Filaments hairy, anther-bases sagittate, connate with short tails. Style-arms filiform. Cypsele glabrous, oblong, about 20-ribbed, basal areole straight. Pappus of many-seriate very unequal scales.

1. **G. glabrum**, Cass. Syn. *G. indicum*, Clarke; *Athanasia Indica*, Roxb.

A somewhat strict herb 2—3 ft. high with ribbed and angled hollow stems and narrow sessile serrate leaves 2—4" long. Heads numerous, purplish-rose, 5—7" long, narrow, florets about 5 only.

High cultivated lands, but rare in our area. Behar, Kurz! Fl. Jan.—March.

Stems prominently angled. Leaves oblong, linear-oblong or sometimes obovate, somewhat obovate or spatulate. Heads in terminal corymbs.

47. **TRICHOLEPIS**, DC.

Herbs with entire or toothed leaves or the lower pinnatifid, often with raised dots (crystal-cells?). Heads terminal, solitary, peduncled; florets all herm., with slender tube and limb 5-cleft to the middle, purple red or yellow. Invol. bracts many-seriate, narrow, often appendaged with long recurved hair-points or slender spines or mucronate, outer shorter. Receptacle densely bristly. Filaments papillose, anther-bases sagittate with connate auricles and slender lacerate tails. Style-arms slender. Cypselae glabrous oblong or obovoid, ribbed with basal areole very oblique or lateral, pappus hairs many-seriate, very unequal, serrulate barbellate or feathery, long and slender or short and paleaceous, or 0.

1. **T. stictophyllum**, Clarke.

A herb with a somewhat stout and woody rootstock, branched from the base with branches only 6—10" long or erect and little branched 2 ft. high (depending on the jungle fires), angular grooved and glabrous. Leaves sessile linear, entire or obscurely toothed, acute or rounded, nerves parallel to the mid-rib. Heads purple long-peduncled terminating the branches, 8—9" long. Invol. bracts appressed, outer glabrous ovate sub-spinose-tipped, inner linear-lanceolate with flexuous hispid acumina. Cypselae many-ribbed 3" long, linear-oblong compressed. Pappus copious of slender feathery hairs, 3" long, slightly united at the base.

Grass lands on the parts of Chota Nagpur. Neterhat, 3000 ft.! Fl., Fr. April—July.

Leaves 2—5" long, smooth glabrous. Bristles on receptacle longer than the cypselae.

48. **YOLUTARELLA**, Cass.

Stiff herbs with alternate sometimes spinose leaves. Heads terminating the branches, solitary, purple or blue, heterogamous. Invol.-bracts many-seriate, innermost narrow acute, outer shorter acute, awned or spinescent. Receptacle flat, densely bristly. Outer fls. 1-seriate, neuter, resembling the disc fls. in form, disc fls. herm. with short slender tube and cylindric 5-fid. limb. Fil. glabrous or hairy, anther-bases sagittate, auricles connate shortly tailed. Style filiform, arms free or connate. Cypselae 5—15-ribbed, often striate and pitted between the ribs, basal areole oblique or lateral. Pappus bristles many-seriate, innermost 2—4 dilated and flattened, outermost gradually shorter.

1. *V. divaricata*, Benth.

An erect or straggling rigid herb with sub-dichotomously branched channelled slightly scabrid, thinly cottony stems. Leaves 1.5–3" rarely 5" pinnatifid (sometimes entire, *F. B. I.*), lobes sometimes lobulate, tipped with short weak spinules. Heads about 1" long, bottle-shaped, pale purple. Invol. bracts outermost ovate with reflexed spines, inner 6–7" linear-lanc. green with spreading or erect yellow spines, innermost with erect soft spines.

Occasional, Behar, *J.D.H.*! Gya, *Clarke*! Manbhum, *Camp.*! Angul, in the bed of the Mahanadi! Fl., Fr. Jan.—March.

Fls. many. Petals linear. Filaments free minutely papillose, anther tails more or less adnate to filament. Style-arms linear-subulate. Hairs on receptacle 2" long. Cypsel compressed 3–4-angled, 2", somewhat tapering to the base, striate and punctulate on the ribs. Pappus hairs connate in a ring at the base and deciduous with it.

49. *CARTHAMUS*, L. Safflower.

Herbs with alt. spinescent leaves. Heads normally homogamous. Invol. bracts many-seriate, inner dry, outer with a foliaceous toothed or spinescent appendage (sometimes disappearing in cultivation). Receptacle flat bristly. Florets yellow, white or purplish, herm., rarely a few marginal male or neuter, tube slender, limb dilated 5-cleft, segments long linear. Fil. hairy in the middle, anther bases sagittate, auricles connate with short fimbriate tails. Cypsel glabrous, obovoid, 4-angled or compressed, basal areole oblique or lateral. Pappus 0 or paleaceous.

1. *C. tinctorius*, L.; Kusumb, kajirah, Vern.

An erect branching herb 1–2 ft. high with broad-lanceolate, spinosely serrate (rarely unarmed) suberect oblong sessile leaves and large terminal heads 1–1.3" long of orange-red flowers. Outer invol. bracts large foliaceous ovate-oblong 1–1.5" long constricted above the base, green, usually spinous, inner ovate-oblong or lanceolate acute. Cypsel obovoid 4-angled truncate with 4 bosses at the top.

Cultivated formerly in Patna, Gya and Monghyr, and occasionally in Hazaribagh, but the cultivation appears to be dying out. Soane River, *J.D.H.*! Fl., Fr. Feb.—April.

The very spinose form is known as *Kusela* in Patna, and is probably nearer the original wild plant which may have been *C. oxyacantha* (wild in the Punjab and westwards to Caucasus). The almost spineless form is known as *bhuili* in Patna (*Watts*).

The plant is cultivated not only for the dye derived from the flowers but also the oil derived from the seeds.

Cichorium Intybus, L., is the Chicory and its var., *Endivia*, is the Endive; the latter is cultivated. It is distinguished from the type by its leaves being oblong sinuate instead of runcinate. The flowers are a beautiful blue in heads 1–1.5" diam. with the corollas all ligulate.

50. *CREPIS*, L.

Herbs with milky or watery juice and radical or alt. often amplexicaul entire toothed or pinnatifid leaves. Heads peduncled, yellow or red, fls. all ligulate and herm. Invol. bracts many-seriate imbricate

or outer very much shorter than the linear 1-seriate inner. Cypsele fusiform or oblong rarely short and cylindric, glabrous or scaberulous, 10—20-ribbed, tip narrowed, pappus usually copious, silvery with simple (not feathery) hairs which are rarely brownish, stiff or brittle.

A genus closely allied to *Lactuca* and *Launæa*. From *Lactuca* our species may be distinguished by the cypseles gradually narrowed from the middle to each end, not distinctly beaked, terete or usually only slightly compressed, and from *Launæa* by the many ribs.* They belong to the section *Youngia*, which *Clarke (Comp. Ind)* considers should be united to *Lactuca*; some of the cypseles in a head may often be found considerably compressed.

Leaves runcinate or pinnatifid. Heads under .25" long

1. *japonica*.

Leaves linear sub-entire. Heads over .5" long

2. *acaulis*.

1. *C. japonica*, *Benth.*; Syn. *C. lyrata*, *Clarke*.

An elegant herb, varying much in stature at the time of flowering, 6" to 2 ft. high with stems simple or branched, glabrous or slightly villous, naked or sparsely foliose. Leaves mostly radical in a rosette, membranous, lyrate runcinate or pinnatifid, from 1.5" in small specimens to 8" long in robust ones. Heads very small, .15—.23" long, copiously paniced, inner invol. tubular with about 8 linear glabrous bracts, with base of midrib thickened in fruit and united with the similar thickenings of the other bracts, outer bracts few, very short. Flowers 10—20 in a head with very short spreading ligules. Cypseles .07" long, rich red-brown when ripe, slightly tapering each end, compressed and often slightly curved, with about 12 fine ribs or ridges, scaberulous above.

Chiefly on damp banks under shade. Champaran! Singbhum! Ranchi, ascending to top of the pass! Parasnath! Manbhum, *Campbell!* Annual. Fl., Fr. March—June and Sept.—Nov., perhaps all the year round.

Stems angular, corymbosely branched above and with scattered slender branches below in luxuriant specimens. Radical leaves with denticulate or mucronate lobes, often puberulous both sides. Petiole slender short. Cauline leaves smaller, and those subtending the upper branches filiform. Pappus white .1" long.

2. *C. acaulis*, *Hook. f.* Syn. *Lactuca glabra*, *DC. & Clarke (Comp. Ind.)*.

A dwarf herb with flowering stems scarcely more than 2" high (just after the jungle fires) or erect and attaining 12". Leaves very narrow, linear, widest in middle or somewhat wider upwards, 3—6" long, entire or denticulate or sinuate-dentate, glabrous except the papillose margin, scarcely petioled or petiole amplexicaul. Heads cymose on pedicels .3—1.3" long. Invol. narrow .5—.6" long, bracts about 6—8, linear-oblong with a few outer shorter ones. Florets about 12, .6—.7" long, yellow. Cypsele .2—.25" long, grey, somewhat attenuate upwards from the middle with a short neck, slightly narrowed at base, with about

* In *C. acaulis*, however, the finer ribs between the 4—6 strong ones are not always very clear, but seem to be rather the normal surface of the cypsele in which is a groove, and as the cypseles are often compressed *Clarke* placed this species in *Lactuca*. Sir *J. D. Hooker* considered that it belonged to *Crepis* in virtue of its habit. The slight neck distinguishes it from *Launæa*.

5—6 very strong ribs and the intermediate spaces each with a darker narrow groove in their centre.

On the plateaux, usually conspicuous on the bare ground after jungle fires. Chota Nagpur, frequent on the pats and on the hills! Kalahandi! Fl., Fr. March—June.

Rootstock deep fleshy. Stems usually with few leaves. Pedicels with a few bracteoles. Heads 7—9" diam. Bracts green, 3-nerved, with scarious margins. Pappus 25" long, white soft silky, microscopically barbellate.

51. LACTUCA, L.

Herbs with milky juice. Leaves radical and alternate, cauline often amplexicaul. Heads paniced corymbose racemose or sub-spicate, homogamous, fls. all ligulate. Invol. usually narrow, bracts usually few-seriate, not thickened in fruit, inner slender subequal, outer often very short. Cypsele compressed or flattened, *beaked*, faces ribbed, the middle rib often strongest, beak slender or short, dilated into an entire or toothed pappiferous disc. Pappus copious, hairs very slender, simple, persistent or separately deciduous, sometimes with a minute outer ring.

1. *L. polycephala*, DC.

Erect 1 ft. high or with many spreading stems and then somewhat resembling *Crepis acaulis*. Stems glabrous striate often sub-dichotomously branched, sometimes corymbose above with linear amplexicaul and sagittately auricled leaves 1—3" long, entire or with sharp teeth or dissected. Heads yellow, becoming *globose* in fruit. Invol. bracts about 8, erect in flower, 25" long, lanceolate-oblong with scarious margins. Cypsele 1—13" or including the distinct slender beak 15—16" long, prominently closely winged or sharply ridged. Pappus short white with very fine hairs.

Specimens have been obtained from the north and west of the Northern Area, also Purneah, Kurz! Fl., Fr. June—Feb.

L. somewhat tapering and widest at the base, sometimes distinctly lanceolate, radical often 4" long, lateral nerves fine wavy, forming loops parallel to midrib.

2. *L. scariola*, L., var. *sativa*, or *L. sativa*, L., is the garden lettuce, largely cultivated in India in the c.s.

L. scariola is a native of the Western Himalaya and Tibet.

52. LAUNÆA, Cass.

Perennial glabrous herbs with milky, usually yellow, juice. Leaves chiefly radical, sinuate-lobed or pinnatifid rarely only denticulate, often spinulose-toothed. Heads racemose or paniculate, solitary or fascicled, sometimes sessile on the rhachis, all ligulate and homogamous. Involucre campanulate or cylindric, bracts many-seriate, inner subequal, outer various often small, midrib or keel often thickened in fruit. Anther-bases sagittate with setaceous auricles. Style-arms slender. Cypseles narrow subterete angled or slightly flattened, rarely winged, truncate both ends or rarely emarginate, ribbed; ribs 4—5 very stout and close, sometimes narrowly winged or 2-grooved, truncate each end. Pappus copious, hairs many-seriate, very slender, white, connate at the base into a deciduous ring.

- A. Stems stoloniform, rooting at the nodes:—
 Heads solitary or clustered at the nodes 1. *pinnatifida*.
- B. Heads not stoloniform:—
 Heads sub-racemose, solitary or clustered on the rhachis 2. *nudicaulis*.
 Heads terminal on the paniculately branched inflorescence 3. *asplenifolia*.

1. *L. pinnatifida*, Cass.

A slender herb with long procumbent stems rooting at all the nodes, where they bear a tuft of entire or toothed leaves and very short flowering stems. Peduncles .5—1" long with many bracteoles. Involucre .5—6" long, outer bracts short broadly ovate, inner linear-lanceolate. Cypsele .2" subterete with 4—6 thick rounded minutely rugulose ribs. Pappus .25—3", soft, white.

On the sands of the Orissa coast from Konarak (Puri) southwards! Fl. June—Sept.

Root-leaves 1—3" often pinnatifid-sinuate, others (at nodes) sometimes only .3—2" subentire or toothed or larger ones sinuate or runcinate-pinnatifid.

It is one of the sand-binding plants.

2. *L. nudicaulis*, Les.

A glabrous herb 6—8" high with nearly naked sub-erect simple or branched flowering stems from a rosette of radical leaves, or stems usually numerous spreading and attaining 18" and then often with leaves at the base of the branches. L. 3—6" sessile oblanceolate pinnatifid and runcinate or sinuate-lobed or dentate, base much narrowed, margins closely almost spinulose denticulate. Heads .3—5" long, sparsely sub-spicate and clustered with short bracteate pedicels .1—3" long. Cypseles 2-morphic, compressed narrowed above striate and scabrid and corky white with 4—5 broad obtuse ridges scarcely narrowed above. Pappus .2—3" soft white very slender much longer than the minute cypsele.

Behar, Hope! Purneah! S.P., bed of the Ganges, Kurz! Palamau, Gamble! Manbhumi, Campbell! Singbhum! Fl., Fr. May—Jan.

The denticulations when dry are usually hard and white. Involucre narrow cylindric, outer bracts very short, inner about 8, linear-oblong with white scarious margins, midrib obscure. Florets about 15—20. Purneah specimens collected by Clarke have leaves only 2" long, runcinate, and with close white (when dry) spinulose teeth and sessile clustered heads or the very short pedicels completely clothed with small bracteoles. Invol.-bracts .4" long.

3. *L. asplenifolia*, DC.

A *Crepis*-like herb with the leaves all radical, 3—5" long, oblong-oblanceolate pinnatifidly lobed with the lobes usually broadly oblong and patent, acute, obtuse or rounded, entire or denticulate not spinulose-serrulate as in *L. nudicaulis*, glabrous. Scapes several, branched 6—9" long, naked or with one or two leaves at base, bracts small dry subtending the branches. Heads pedicelled with long or short pedicels. Involucre .35—4" with linear obtuse bracts with scarious margins, few outer shorter and several very short outermost (or bracteoles) at end of pedicel. Cypsele .08" with strong ribs which are minutely serrulate and intermediate weaker ribs. Pappus hairs united at their base, .3" long, very soft and fine.

Behar, *J.D.H.*! Purneah probably, as it occurs in Maldah! Hazaribagh, *Clarke*! Frequent in the Gangetic Plain. Fl., Fr. Jan.—May.

The Maldah specimens are 1 ft. high with much branched flowering stems and heads 5" long. The Behar (*Dalalganj*) specimens are very dwarf with the scapes only 2" high, the leaves runcinate with lanceolate lobes.

53. SONCHUS, L.

Herbs with milky juice. Leaves radical or alternate, cauline often amplexicaul, entire toothed or pinnatifid, often spinulose toothed. Heads yellow irregularly corymbose umbellate or paniced, fls. all ligulate and herm. Involucre often dilated thickened and conic at the base with many-seriate herbaceous bracts, outer smaller. Receptacle flat naked. Cypsele sub-terete or compressed ribbed, not beaked. Pappus copious, hairs many-seriate, very slender, simple, united at the base into a deciduous ring.

Inflorescence glandular. Cypseles sub-terete with 4—6 strong ribs.	1. <i>arvensis</i>
As in last, but inflorescence not glandular	Var. <i>glaber</i> .
Inflorescence not glandular. Cypseles flattened sub-alate .	2. <i>asper</i> .
Inflor. sometimes glandular. Cypseles as in (2), but muricate between the facial ribs	3. <i>oleraceus</i> .

1. **S. arvensis**, L. Syn. *S. orixensis*, *Roxb.*; Ban-palang, *Beng.*; Bir barangom, *S.*

A tall crisply-succulent hollow-stemmed herb 3—4 ft. high nearly glabrous or with copious gland-tipped hairs above and always white flocculent under the young flower heads. L. glaucous beneath lanceolate from an amplexicaul base with rounded auricles, attaining 10—16" in length and irregularly runcinately pinnatifid and spinulosely denticulate, uppermost linear. Heads (in fresh flower) 5—6" long and 7—8 diam., contracted in the middle, umbellate or in umbelliform corymbs, ultimately long-peduncled. Cypseles pale brown sub-terete or somewhat compressed with 4 (—6) strong ribs and 1—2 weaker ones between, ribs all rugulose.

Fl., Fr. Oct.—Feb.

Var. α **typica**, glandular-hairy above. This is rare in our area.

Var. β **glaber**, *Haines*. Gland-hairs absent. Purneah, *Burkill*! Higher hills of Chota Nagpur, Singbhum! Palamau and Ranchi (*Neterhat*)! Parasnath *Clarke*.

The plant is greedily eaten by horses and cattle.

2. **S. asper**, *Vill.*

A plant of similar habit to the last but the leaves usually broader, sometimes ovate- or obovate-oblong less runcinate and generally copiously spinose-toothed rather than denticulate. Inflorescence never glandular. Heads usually shorter peduncled, the ultimate peduncles rarely more than 2" while those of *arvensis* are frequently 2—4" long in fruit. Cypseles very different, being flattened elliptic or obovate with sub-alate margins and three (3—5) strong nerves or fine ribs on the faces.

Occasional as a weed in cultivation (but there are no specimens in the *Cal. Herb.* from our area)! Fl. Dec.—April.

3. *S. oleraceus*, L.

Similar to the last and leaves often runcinate-pinnatifid as in *S. arvensis* but the auricles are acuminate, the inflorescence sometimes glandular, heads usually short-peduncled. Cypselas as in *S. asper* but muricate between the ribs.

I have only seen it as a weed in gardens and I doubt whether it is native in the province. Fl. Feb.—May (*Clarke*).

FAM. 79. STYLIDIACEÆ (Candolleaceæ).

Herbs with alternate or clustered entire leaves without stipules. Fls. 1—2 sexual in racemiform cymes, panicles or corymbs, irregular. Calyx superior 2-lipped, corolla seldom regular. Stamens 2, filaments connate with the style into a column, anther-cells ultimately sub-confluent. Ovary inferior 2-celled. Stigma at apex of column. Ovules many in each cell on the middle of the septum. Fruit a 1—2-celled, 2-valved capsule, valves sometimes cohering both top and bottom. Seeds many minute, albuminous, embryo minute, next the hilum.

1. STYLIDIUM, Swartz.

Corolla with tube split above and 4 radiating lobes, the place of the fifth occupied by a smaller recurved petal or spur at the back of the sinus. Column elongate, apex at first deflexed, elastically reflexed when irritated.

Leaves clustered. Corolla white or purple
Leaves scattered. Corolla rosy or purplish

2. *Kunthii*.
1. *tenellum*.

1. *S. Kunthii*, Wall.

A delicate little herb 1—4" rarely attaining 8" high with rather fleshy broadly oblong spatulate or obovate-orbicular leaves .3—·5" clustered about the base or top of the very short stem, and numerous erect long-stalked lax dichotomous cymes of minute irregular white or purple flowers .12—·15" diam., sessile at the forks.

Damp ground. Purneah! Sambalpur (*Cal. Herb.*)! Fl., Fr. Oct.—Jan.

Inflorescence with scattered glandular hairs. Buds reflexed. Bracts usually 2 at the forks of the peduncle .1—·25" linear-oblong. Calyx upper lip of 3 oblong sepals .07" long, lower spoon-shaped, .12" long, notched. Corolla lobes .05—·07" long, anterior lobes longer than the two lateral, all oblanceolate and emarginate with minute 2-fid ligules at their base. Capsule .3—·5" linear, valves dehiscing from the top.

2. *S. tenellum*, Swartz.

Stem 4—8" glabrous simple erect leafy, leaves scattered oblong or oblong-obovate smaller upwards, lower .5" narrowed at the base, passing into the linear .17" long bracts at the cyme forks. Fls. sessile at the forks, rosy or purplish. Capsule .5—·75" linear, valves united at the top and base.

Chota Nagpur, Hazaribagh (var. *minima* with stems only 1—2" long and 1—4-fl.), C. B. *Clarke*! Manbhum, *Ball* (only .7—1" high)! Manbhum, *Campbell* (perhaps from Parasnath)! The last is up to 4·5" high. Fl., Fr. Sept.—Jan.

FAM. 80. CAMPANULACEÆ.

Herbs or undershrubs, often with milky juice. Leaves alternate, more rarely opposite, simple exstipulate. Inflorescence not cymose, fls. bracteate or axillary, bracteoles 0 (exc. in *Sphenoclea*). Calyx superior or adnate to the ovary, 4—6-partite, usually persistent. Corolla regular or (in Tribe Lobeliæ) irregular, gamopetalous, with valvate lobes. Stamens 4—6 alternating with the lobes, inserted with the corolla on the margin of the epigynous disc (in *Sphenoclea* on the corolla tube), anthers free or syngenesious. Ovary 2—5-celled, ovules many in the inner angles often on swollen placentæ. Style 1 with stigmas as many as the cells. Fruit capsular or more rarely baccate, in *Sphenoclea* circumsciss. Seeds many, small, ellipsoid, albuminous. Embryo erect, radicle next the hilum.

- I. Corolla 2-lipped, dorsally split. Anthers connate 1. *Lobelia*.
 II. Corolla regular. Anthers free or somewhat connate:—
 A. Fls. not in a dense spike, stamens not epipetalous:—
 1. Capsule dehiscent at the top (not involving the hypanthium):—
 Corolla stellately 5-partite. Capsule .1" diam 2. *Cephalostigma*.
 Corolla campanulate. Capsule over .2" diam. 3. *Wahlenbergia*.
 2. Fruit (including hypanthium) dehiscent at base or sides 4. *Campamula*.
 B. Flowers in a dense cylindrical spike. Stamens epipetalous. Capsule circumsciss at top 5. *Sphenoclea*.

1. LOBELIA, L.

Herbs or (non-Indian species) shrubs with alternate toothed or subentire leaves and axillary or subracemose flowers. Calyx 5-partite. Corolla longitudinally split above, 2-lipped, upper lip shorter 2-partite, lower 3-lobed. Staminal-tube free or nearly so, 2 lower or all anthers tipped with bristles. Ovary 2-celled with hemispheric placentæ. Stigma shortly bifid. Capsule loculicidally 2-valved above. Seeds very many, minute.

- A. Anthers all barbate on the apex:—
 1. Seeds distinctly trigonous:—
 Suberect or ascending, glabrous. Corolla over .17" 1. *trigona*.
 Very slender erect, thinly hairy. Cor. under .17" 2. *terminalis*.
 Procumbent, puberulous. Corolla .25" 3. *affinis*.
 2. Seeds ellipsoid compressed. Erect 4. *trialata*.
 B. Two anterior anthers only barbellate:—
 Stems 3-alate, spreading. Corolla under .3" 5. *aligera*.
 Stems not 3-alate, creeping. Cor. .3—5" 6. *radicans*.

1. *L. trigona*, Roxb.

A small herb, suberect or with many ascending branches 3—12" long, glabrous. L. broadly ovate subsessile crenodenticulate .25—75" long. Peduncles from the leaf axils but the latter approximated above, usually two to two and a half times as long as their subtending leaves of which only the uppermost are bractiform. Corolla .18—2" long. Capsule .2", base of fruiting hypanthium not tapering acutely into the peduncle. Seeds ellipsoid distinctly 3-gonous.

Rather common in Chota Nagpur in damp places. Ranchi! Singhbhum! Manbhum, *Camp.*! Sirguja, *Wood!* Santal Parganas, *Gamble!* Probably in all the Northern Districts. Fl., Fr. Oct.—Jan.

Stems acutely 3-angled, often as much as in *trialata*, from which, in addition to characters given above, it may be distinguished by the ribbed hypanthium and peduncles mostly towards the top of the stem.

2. *L. terminalis*, Clarke.

A very slender erect herb with thinly hairy stems and branches, in our area only 1—3" high (var. *minuta*, Clarke) but said to attain 10". Lower leaves ovate dentate under .5" (in our specimens; up to .75", *F. B. I.*), upper bractiform incised-serrate. Peduncles mostly from the uppermost part of the stem, erect slender some three to five times as long as their subtending leaves or bracts and usually sub-corymbose. Fls. blue, corolla .08"—.16". Capsule rounded at base. Seeds distinctly trigonous.

Damp ground among grass on wet pastures, Purneah! Fl., Fr. Oct.—Dec.

3. *L. affinis*, Wall.

A trailing herb with shining slightly angular puberulous branches, broadly ovate petioled leaves .3—1" long and solitary axillary long-peduncled blue flowers, the peduncles nearly 1" long but not usually exceeding the leaves. Hypanthium .12" long hairy, rounded at base with sepals .2—.25". Corolla as long as sepals, hairy above. Seeds ellipsoid distinctly trigonous.

On moist banks, Purneah! Fl., Fr. Oct.—Jan.

Petioles from one-third to one-half as long as the crenate and denticulate blades.

4. *L. trialata*, Ham.

A glabrous suberect or erect branched herb usually 4—8" but attaining 16" in height with short-petioled rhomboidly ovate leaves .25—1.3" long, the upper narrowly rhomboid and passing into bracts, not approximated as in *trigona*, crenate or denticulate. Peduncles .25—.5" shorter or upto twice as long as the subtending leaf or bract. Hypanthium obconic tapering acutely into the peduncle, .15—.2" long in fruit, glabrous, not ribbed (or not nearly as distinctly as in *trigona*). Sepals linear. Seeds ellipsoid compressed, not angled.

In similar places and often in association with *trigona*, with which it is sometimes confused though quite distinct. Common in Chota Nagpur in the hills. Singhbhum! Ranchi, *Gamble!* Parasnath (Hazaribagh)! Sarguja, *Clarke!* Fl., Fr. Sept.—Dec.

5. *L. zeylanica*, L., var. *aligera*, Haines* (*sp. v. Journ. As. Soc. Beng.*, xv, 7, p. 316).

A herb with many branches spreading from the root 9—18" long prominently 3-ate, glabrous. L. .7—1.3" long elliptic-oblong obtuse

* This was described as a new species mainly on account of the anthers. *L. zeylanica*, L., is placed in *The Flora of British India* and other works in the section of *Lobelia* with anthers all *nearly equally barbate* at the apex. Its close affinity to *L. trialata* was, however, recognised. In *DC. Prodrromus* *L. zeylanica* is included under *L. affinis*, and it is stated that *Linnaeus* mixed up different species under this name.

or subacute with broadly sessile base, sometimes with a few short hairs on the nerves beneath, margin rather thickened and crisped-serrate. Peduncles solitary axillary exceeding the leaves. Hypanthium .22—.25" turbinate narrowed into the peduncle and with sparse reflexed hairs on the ribs; sepals narrowly lanceolate exceeding the tube and hypanthium. Corolla .22" long and broad, posterior petals colourless with a yellow linear appendage, lobes of lip sub-equal rhomboid-lanceolate crisped .1" long. Dorsal anthers ciliolate on the edges, 2 anterior barbed at the apex. Capsule .2—.23" by .1", beaked. Seeds minute brown broadly-ellipsoid scarcely compressed.

Pats of Chota Nagpur near streams. Neterhat 3000 ft. Fl., Fr. April—June.

6. *L. radicans*, Thunb.

A procumbent glabrous herb, stems not angled. Leaves linear or linear- or oblong-lanceolate .5—1" narrowed at the base, sessile bifarious, sub-entire or remotely toothed. Peduncles axillary equalling or longer than the leaves. Corolla .3—.5" with glabrous or obscurely pubescent tube, green with pink marks and a green gland on each side the central lobe at its base. Two lower filaments hairy. Capsule .25" with acute base. Seeds ellipsoid slightly compressed.

Naturalised near the Ranchi lake, Prain! Carter! Fl. Sept.—Oct.

2. CEPHALOSTIGMA, A. DC.

Small, erect branched herbs, sparsely patently hairy. L. alternate subsessile, margin thickened entire, waved or crisped. Flowers small, racemed or paniced on filiform pedicels. Calyx 5-partite. Corolla stellately spreading deeply 5-fid with narrow petals, blue or whitish. Ovary sub-globose 2—3-celled. Style terete with shortly obtusely 3-lobed stigma. Capsule loculicidally 2—3-valved at the apex, often conical. Seeds very many ellipsoid compressed or 3-gonous.

A. Seeds ellipsoid, not trigonous

1. *Schimperi*.

B. Seeds distinctly trigonous:—

Leaves scattered. Calyx patently pilose.

2. *hirsutum*.

Leaves subverticillate below the panicle. Calyx nearly glabrous

3. *Hookeri*.

1. *C. Schimperi*, Hochst.

A little herb usually 6—7" high but sometimes attaining 12" mostly with a central stem and copious lateral delicate branches ending in minute flowers. Stems and branches ridged sparsely hairy. Leaves sessile oblong denticulate and somewhat sinuate, upper lanceolate and gradually smaller and narrower. Branches capillary cymose or simple. Fls. pale-blue .12" long in flower, .2" long in fruit. Calyx patently hairy, the erect linear petals only as long as the sepals. Capsule with a conical beak nearly as long as the sepals. Seeds much longer than broad, not at all trigonous though occasionally slightly angled, shining-brown.

Frequent in the hills of Chota Nagpur in open places. Singbhum! Hazaribagh! Ranchi! Palamau, Gamble! Frequent at Neterhat! Fl., Fr. Oct.—Dec.

2. C. hirsutum, Edgew.

A little rather weak erect herb 3—7" high with hairy stem dichotomously branched above. Leaves more membranous than in *C. Schimperi*, 3—9", elliptic-oblong or elliptic, undulate and slightly toothed, narrowed below at base and very shortly petioled, sparsely patently pilose. Pedicels capillary .12—.5" long. Calyx patently pilose and sepals linear-lanceolate sparsely hispid-hairy. Corolla pale blue or white starlike .17—.22" diam. Capsule with conical tip. Seeds nearly as broad as long, sharply 3-gonous or sub-3-ate.

Chota Nagpur, chiefly on clay soils in the hills. Simgbhum! Hazaribagh (Pirtand, Parasnath)! Ranchi, Gamble! Fl., Fr. Oct.—Jan.

It is not easily distinguished from *C. Schimperi* except by the seeds. The hairiness of the calyx is rather variable, while the sepals of *Schimperi* are also sometimes slightly hairy. The habit is somewhat different and the leaves usually broader and less sessile.

3. C. Hookeri, Clarke.

A very slender erect plant 3—9" high ending in a paniculately branched naked inflorescence, puberulous or slightly pilose. Leaves tending to be verticillate, elliptic narrowed both ends and sometimes sub-petioled, often minutely crenate, sparsely pilose. Panicles often nearly naked, the bracts most minute, linear. Calyx .05—.06" in flower, .12" in fruit, nearly glabrous with glabrous shortly triangular or lanceolate sepals. Corolla .1" blue. Capsule with conical tip exceeding the calyx, seeds 3-gonous.

Parasnath, 4000 ft., Clarke. Fl. Oct.

Differs from *hirsutum* especially in the glabrous inflorescence and calyx and the more naked panicles. L. sometimes ell.-oblong often verticillate below the inflorescence which is 2—5" diam. with very small linear bracts and filiform glabrous pedicels .3—.1" long.

3. WAHLENBERGIA, Schrad.

Herbs with alt. or opp. leaves and loosely paniced flowers. Calyx 5-partite. Corolla campanulate, 5-lobed, often very deeply. Stamens free from corolla, filaments often dilated at the base, anthers oblong free. Ovary 2—3-celled. Stigma of 3 narrow lobes. Capsule erect 2—3-celled, loculicidally 2—3-valved above. Seeds very many.

1. W. gracilis, DC. inc. W. agrestis, A.DC., and W. indica, A.DC.

A very variable herb. In our area erect glabrous or very nearly so, 3—8" with many branches spreading from the root or up to 15" strict and very slender. Leaves linear to oblong, denticulate, sessile, lower 1—2", upper reduced to bracts. Branches of panicle usually bifurcate with pale-blue narrowly campanulate fls. .3" long or .25" diam.

In rice fields or damp ground. Bettiah, *Hieronymus*! Purneah! Chota Nagpur! frequent. Possibly throughout our area. Fl., Fr. May—Jan.

Sepals .1" about equalling the hypanthium or slightly longer, linear. Corolla-lobes narrow-ovate, sometimes tipped with a yellow incurved tip, and margins slightly reflexed. Lower part of filament dilated as a rhomboid membrane inclined inwards, filiform above. Capsule .25—.3".

4. CAMPANULA, L.

Herbs with alternate or radical subrosulate leaves. Flowers blue, purple or white, sub-solitary, paniced spicate or subcapitate, lower often axillary. Calyx deeply 5-lobed, persistent. Corolla campanulate, 5-lobed or 5-fid. Stamens 5 free, filaments dilated at the base. Ovary 3-celled, stigma shortly 3—(5)-lobed. Capsule truncate, dehiscing by small valves at the base or sides. Seeds very many, ellipsoid or compressed.

1. *C. canescens*, Wall.

An erect herb with strict hairy stems 8—20" high, often several from the rootstock. Cauline leaves linear, linear-oblong or lanceolate, 1—2" long, sessile or contracted into a very short petiole. Flowers lilac or grey-purple, dimorphic (in one form without corolla or stamens), usually subspicate on the branches of narrow panicles, becoming more diffuse with elongate pedicels in fruit.

Alluvial banks of the Soane, Behar, *J.D.H.*! Parasnath, *T.T.*! It occurs on the plateau lands in the Central Provinces and will probably be found in Chota Nagpur on the *pats*. Fl. March—April.

Leaves hairy, entire, serrate or crenoserrate, radical, and lowest cauline leaves elliptic or oblanceolate. Calyx .2" or much smaller in the imperfect flower. Corolla campanulate .25" or 0 and stamens 0 in the imperfect flower. Capsule .1" or (*vide C. B. Clarke*) .2—25".

5. SPHENOCLEA, Gaertn.

An annual erect herb with alt. leaves and small flowers, bracteate and 2-bracteolate in cylindrical or somewhat conical capitate spikes. Calyx half-superior, 5-fid. Corolla campanulate, 5-lobed. Stamens on the corolla alternating with the small lobes, filaments short, anthers ovate. Ovary inferior or half-inferior in fruit, 2-celled with 2 large axile placentæ, style very short, stigma simple or obscurely lobed. Capsule membranous below, circumsciss, with numerous small oblong minutely verrucose seeds and terete embryo.

1. *S. zeylanica*, Gaertn. Jhil-mirich, Beng. (teste Roxburgh).

An erect weedy-looking annual with fibrous roots, much-branched stem 1—2 ft. high, fistular, glabrous. Leaves 1—3" lanceolate, sessile or shortly petioled, entire. Heads terminal or leaf, opposed .3—1" long peduncled. Fls. .05" diam., sepals united below on the line of dehiscence of the capsule and falling off with the lid. Minute petals white.

In swamps, but not common. Orissa, Cuttack! Fl., Fr. nearly all the year round.

FAM. 81. PLUMBAGINACEÆ.

Herbs or shrubs with alternate often fleshy simple leaves. Flowers capitate, racemed or paniced on terminal scapes or peduncles with the bracts often scarious and usually sheathing the flower, bracteolæ 2.

Calyx inferior tubular, 5--10-ribbed, mouth frequently funnel-shaped scarious. Petals free or gamopetalous with a very short tube, rarely with a linear tube. Stamens 5 opp. the petals and often adnate below to the corolla. Disc 0. Ovary superior, 1-celled, 5-angular above, styles 5, free or connate, stigmas sub-capitate. Ovule 1, pendulous from a basal ascending funicle, anatropous. Fruit capsular membranous or with a hardened apex, rupturing near the base or circumsciss, apex often 5-valved. Seeds cylindric, pendulous, albuminous or not, radicle superior.

Styles distinct. Shrubs with fls. in paniced racemes
 Styles united. Shrubs or undershrubs with spicate fls.

1. *Ægialitis*.
 2. *Plumbago*.

1. *ÆGIALITIS*, R. Br.

A glabrous small tree or shrub with broad coriaceous leaves and petiole dilated downwards with amplexicaul and winged (adnate stipules?) base. Flowers white or pale yellow in paniced racemes with the pedicel included in the sheathing bract and bracteoles. Calyx tubular strongly ribbed. Petals linear gamopetalous below with the filaments adnate to the persistent tube. Styles distinct, on the angles of the ovary. Ovule large linear. Fruit linear. Embryo free with large hypocotyl and 2 small spreading cotyledons and small white radicle. Albumen 0.

1. *Æ. rotundifolia*, Roxb. Bana Ruar, Or.

Leaves orbicular or broadly ovate 1.5--3" long with fine close spreading parallel nervation reticulate between the nerves and a long fleshy petiole 1.5--2" long with sheathing membranous base. Peduncles from the sheathing base of the petiole and terminal, racemes 1.5--2" long. Calyx .5" with small 2-fid teeth terminating the ribs. Petals with erect linear-oblong lobes .3". Filaments long. Capsule .7".

Deltaic swamps of the Mahanadi, Cuttack! Fl. Dec.—Jan. Fr. May.

Bark grey, soft, lenticellate. The wood is very abnormal. *Gamble* says that it resembles that of a Monocotyledon, consisting of soft cellular tissue studded with scattered small patches of pore-bearing wood. *Brandis* says that the fruit is 3" long, but mine appears to be quite ripe with perfect seeds. *Clarke* says (*F.B.I.*) that it is unknown.

2. PLUMBAGO, L.

Herbs, undershrubs or shrubs with diffuse or sarmentose branches and entire leaves. Flowers spicate. Calyx tubular covered with stalked glands, 5-fid. Corolla-tube long slender, lobes 5 spreading round. Stamens free, filaments dilated at base. Ovary narrowed at apex, style slender with 5 branches stigmatose most of their length. Capsule membranous, circumsciss near the base.

Flowers white. L. ovate, suddenly narrowed into petiole
 Flowers red. L. ell. tapering to the petiole
 Flowers blue. A garden plant

1. *zeylanica*.
 2. *rosea*.
 3. *capensis*.

1. *P. zeylanica*, L.

An undershrub with rambling green branches, ovate or oblong-ovate leaves with the base suddenly narrowed into a short amplexi-

caul petiole, and terminal paniced spikes of very pretty long-tubed white flowers '5—'75" diam., of which the calyx is covered with conspicuous stalked viscid glands.

Usually among rocks. Singbhum! Ranchi! Manbhum, *Camp!* Parasnath! S.P. (Rajmahal Hills), *Kura!* Fl. Sept.—Nov. Fr. Nov.—Dec.

Leaves usually about 3—4" with the short petiole. Fls. 1" long.

The root is said to excite digestion and promote appetite. It is also used in piles, anasarca, diarrhœa and skin diseases (*Dutt*).

2. *P. rosea*, L. It is easily distinguished by the colour of the flowers and is often cultivated, but though wild in the Bengal Duars it is not so in Behar and Orissa. Fl. Feb and at other times.

3. *P. capensis*, *Thunb.* A well-known beautiful shrub with bright pale blue flowers and sub-verticillate leaves. Native of the Cape of Good Hope.

FAM. 82. PRIMULACEÆ.

Herbs with radical or if cauline alt., opp. or whorled exstipulate leaves. Flowers regular, sometimes dimorphic. Calyx inferior gamosepalous, usually 5-lobed. Corolla hypogynous, rotate, bell- or funnel-shaped usually 5-lobed. Stamens on the corolla-tube, opposite its lobes, with sometimes alternating staminodes. Ovary 1-celled with undivided often capitellate stigma. Ovules many, usually amphitropous on a free central placenta. Capsule dehiscent by valves or circumsciss, few- or many-seeded. Seeds minute, usually angular, often sunk in the placenta. Albumen fleshy or horny. Embryo transverse.

A. Corolla-lobes imbricate. Capsule 5-valved

1. *Androsace*.

B. Corolla-lobes contorted:—

1. Capsule dehiscent by valves. Corolla 5—6-cleft

2. *Lysimachia*.

2. Capsule circumsciss:—

Corolla 5-partite, exceeding the calyx .

3. *Anagallis*.

Corolla 4—5-lobed, shorter than the calyx

4. *Centunculus*.

1. ANDROSACE, L.

Low herbs with rosulate or imbricate leaves and small white or red flowers in 1—several-fld. scapes. Corolla salver-shaped with very short tube or funnel-shaped, mouth annulate or with folds opposite the lobes. Anthers subsessile, included in the tube. Capsule ovoid or globose, 5-valved. Seeds 2, rarely more, angular or subglobose.

1. *A. saxifragæfolia*, *Bunge*.

A delicate little herb with radical suborbicular cordate subentire or serrate leaves '3—'75" diam. hairy above. Petiole '75". Peduncles 1'5—2'5" slender with 3—4 fls. '25" diam. on slender hairy pedicels '5—1'25" long. Calyx enlarged in fruit, with spreading lobes. Corolla white with annulate yellow mouth.

Damp ground and near streams. Singbhum! Purneah! Fl. Jan.—March.

2. LYSIMACHIA, L.

Herbs with entire opposite alternate or whorled usually minutely gland-dotted leaves and solitary spicate or racemose usually white or

yellow flowers. Corolla rotate or funnel-shaped, 5—6-partite. Stamens inserted on the base of the lobes. Ovary subglobose, style filiform persistent. Capsule 5-valved or bursting irregularly, many-seeded. Seeds 3-gonous or plano-convex.

Fls. white, in elongate racemes

1. *obovata*.

Fls. yellow, mostly axillary on very slender peduncles

2. *peduncularis*.

1. **L. obovata**, *J. D. H.* Syn. *L. candida*, *Lindl.*, var. *obovata*.

An erect slender pretty herb with strict leafy stems 12—20" high terminating in elongate racemes of small funnel-shaped white flowers 3—35" diam. Capsule as long as the persistent calyx.

In watery places, *pats* of Chota Nagpur, elev. 3000 ft. Fl., Fr. May—July.

Glabrous. Radical leaves elliptic or oblanceolate with an attenuate base passing into the petiole, 1.5—2" with the petiole, cauline alt., erect shorter and smaller upwards, minutely gland-dotted. Racemes 2—8". Pedicels slender 3—8" in fruit, shorter or longer than the subulate bracts. Sepals linear acuminate, .2", with some yellow glands. Corolla .3" long, lobed more than half-way down, lobes oblong rounded .1" broad.

2. **L. peduncularis**, *Wall.*

A small erect annual 4—8" high, not or sparingly branched, with narrowly winged stems, lanceolate leaves 1—2" long narrowed into the short petiole and axillary small yellow flowers on axillary capillary peduncles.

Damp places in Bamboo forests, Porahat, Singbhum! Fl., Fr. Dec.—Jan.

Pubescent. Peduncles .5—1.5" long. Sep. .12—17", oblong-lanc. acute. Filaments connected at base by a membrane. Capsule .12" diam., valves rounded at apex.

Previously only collected in Birma by *Wallich*.

3. **ANAGALLIS**, *Tournef.* Pimpernel.

Slender herbs with opposite entire dotted leaves and solitary axillary ebracteate flowers. Calyx 5-partite. Corolla rotate 5-partite. Stamens with villous filaments. Capsule globose circumsciss. Seeds many peltate.

1. **A. arvensis**, *L.* Scarlet Pimpernel and Blue Pimpernel.

An erect or procumbent herb with 4-angled branches 5—10" long and sessile ovate or oblong-ovate or lanceolate leaves .5—8" rarely up to 1" (in our area). Fls. very pretty blue (in our area, usually scarlet in Europe) 3—5" diam. on slender peduncles which are decurved in fruit.

Usually near cultivation. Champaran! Chota Nagpur, rare, *Wood!* Hazari-bagh, *Gambie!* Fl., Fr. Jan.—March.

Branches usually prostrate and ascending. Peduncles 1—2". Sepals narrow lanceolate, acuminate. Capsule .25" diam.

Common in England, often called "the poor man's weather glass" from the flowers closing in dull weather.

4. **CENTUNCULUS**, *L.*

Small delicate herbs with sub-opp. or alt. entire leaves and minute solitary axillary ebracteate white or pink flowers. Corolla short

urceolate. Stamens 4—5 on the throat with filaments flattened at base. Capsule globose circumsciss. Seeds many peltate (*vide F. B. I.*), or with two flat and one convex surface.

1. **C. tenellus**, *Duby*. Syn. *Anagallis pumila*, *Swartz*.

Erect and strict or with many branches from near the root. Glabrous 1—5" high, usually crowded with the small leaves and minute flowers. L. 1—3" including the minute petiole, ovate to obovate, acute or obtuse. Sep. narrow subcaudate. Petals lanceolate acuminate from a globose tube. Peduncles equal to or exceeding the leaves, sometimes sub-racemose.

Chota Nagpur, frequent on damp banks! Santal Parg., *Gambel*! Fl., Fr. Oct.—Dec.

FAM. 83. MYRSINACEÆ.

Small trees or shrubs with alternate simple leaves, usually gland-dotted especially round the edges and on the calyx. Stipules 0. Flowers regular 2-sexual or polygamo-dioecious. Calyx inferior or in *Mæsa* more or less superior, 4—6-, usually 5-lobed, persistent, sometimes accrescent. Corolla gamopetalous deeply divided or polypetalous, petals contorted or imbricate. Stamens 3—7 opposite the petals, anthers sometimes connate, very rarely opening by pores. Ovary superior or in *Mæsa* semi-inferior, 1-celled, narrowed into the style, stigma simple rarely shortly lobed. Ovules few or many, inserted on a free central placenta. Fruit usually baccate, in *Ægiceras* cylindric and finally dehiscent. Seeds mostly globose and excavate at the base with pitted or ruminant albumen and transverse embryo.

- | | |
|--|----------------------|
| A. Ovary half-inferior. Flowers racemose. Seeds angled | 1. <i>Mæsa</i> . |
| B. Ovary free from the calyx-tube. Fruit 1-seeded:— | |
| 1. Fruit baccate sub-globose:— | |
| Cor. nearly or quite polypetalous, very small, white or greenish | 2. <i>Embelia</i> . |
| Corolla gamopetalous, small or m.s., pink | 3. <i>Ardisia</i> . |
| 2. Fruit elongate, finally dehiscent. Fl. long. | 4. <i>Ægiceras</i> . |

1. **MÆSA**, *Forsk.*

Trees or shrubs with entire or serrate leaves and small 1—2-sexual, 4—5-merous flowers in axillary and terminal racemes, bracteate and 2-bracteolate. Calyx half-inferior or nearly free in flower, adnate in fruit, with small persistent sepals. Corolla gamopetalous with round imbricate sometimes unequal petals. Stamens on the tube with short filaments. Stigma capitate or shortly 3—5-lobed. Ovules many on globose placentæ. Berry globose with numerous subtrapezoid seeds.

1. **M. indica**, *Wall.* Syn. *M. montana*, *A. DC.* in part; *Ramjani*, *Beng.*

A shrub 4—8 ft. high with markedly lenticellate branches, ell., ovate or ovate-lanceolate coarsely serrate leaves 3.5—6" by 1.5—3" and

small white flowers in simple or compound racemes 1—3" long. Berry white, 2" diam., ultimately sub-coriaceous and smaller.

Valleys and cool sides of hills on the Ranchi and Porahat plateaux! Kochang, *Gamble!* Fl. March—April. Fr. Dec.—Jan.

L. acute to caudate-acuminate, shining above, pale beneath and nearly glabrous with 6—7 sec. n. Fls. 13" diam. Calyx-lobes sub-orbicular broadly ovate or sub-orbicular, microscopically ciliate, lineate (in the Kochang specimen). Petals veined sub-orbicular. Fil. very short. Pedicels 12".

2. EMBELIA, *Burm.*

Shrubs, mostly climbing, or small trees. Leaves entire or serrate petiole often margined or glandular. Flowers small, polygamous or usually dioecious, white or greenish-yellow sub-fascicled and in axillary or terminal, simple or compound racemes with small bracts but ebracteolate. Calyx 4—5-lobed, persistent. Petals 4—5, free or only slightly connate at base, imbricate in bud. Filaments more or less adnate to petals, anthers ovate-oblong. Stigma capitellate, ovules few. Fruit small 1-(rarely 2-) seeded. Seed globose, base hollowed, albumen pitted subruminate. Embryo curved, transverse.

1. *E. robusta*, *Roxb.* Gointa mata, *K.*; Baberang, *H.*; Bhabri, *S.*; Baibiring, *Or.*; Nununia, *Or.* (teste *Gamble*).

A large shrub or small tree with light grey lenticellate branches, ell. or obovate acuminate or obtuse leaves pale beneath, and small dioecious greenish-white flowers in axillary and extra-axillary racemes 5—15" long. Fr. red sub-globose 12—17" diam. with a crustaceous epicarp and fleshy endocarp; tipped by the style.

Throughout Chota Nagpur, rather common, especially in open scrub jungles! Santal Parganas! Throughout Orissa to Sambalpur and Puri! Bonai, *Cooper!* Fl. May—July. Fr. Nov.—Jan.

The branches in the type are glabrous, in our specimens the twigs are rusty pubescent or tomentose. A dwarf compact form occurs on Parasnath, but ordinarily the branches are somewhat straggling. Leaves very variable on the same plant 12—6" long, entire or denticulate above, with a very short rusty, sometimes stellate, pubescence especially beneath, narrowed at base into a 3—5" long pubescent petiole; sec. n. 5—9. Pedicels 12". Bracts shorter, linear. Calyx pubescent without, deeply lobed, glandular. Corolla 17" diam. puberulous. The female flower has short imperfect epipetalous stamens.

The dried berries contain Embelic acid and are used for expelling tape-worms and are also carminative, stomachic and stimulant, used in dyspepsia and skin diseases.

3. ARDISIA, *Swartz.*

Shrubs or small tree with entire or toothed leaves and white or pink flowers in simple or compound umbels or racemes with small usually deciduous bracts. Calyx often somewhat accrescent in fruit. Corolla 5-partite with acute petals twisted to the right in bud. Stamens 5 with very short filaments and ovate-lanceolate acute free anthers. Ovary narrowed upwards, stigma pointed, ovules few. Seed solitary globose, albumen pitted or ruminate.

Shrub or small tree. L. 4—9". Fls. over 5" diam., pink

Shrub. L. 2—4". Fls. under 5" diam., spotted

Leaves 2—4". Fls. 6—7" diam.

1. *solenacea.*

2. *depressa.*

3. *nov. sp.*

1. *A. solenacea*, Roxb. Syn. *A. humilis*, *F. B. I.*; Gara Boi (the stream ear-ring), *K.*; Nursing Kara, Batguri, *Or.*

A small tree or large shrub attaining 25 ft. with large bright green rather fleshy leaves clustered towards the ends of the branchlets and mod.-sized rose-coloured waxy flowers with yellow stamens in peduncled axillary often contracted or corymbose racemes. Berry '3—5" diam., depressed-globose, black when ripe.

Along streams, frequent in the forests. Champaran! Purneah! Chota Nagpur! Bonai, *Cooper*! Mayurbhanj! Orissa down to Sambalpur and Kalahandi! probably throughout our area in favourable positions. Fl. April—May. Fr. Oct.—Jan. Evergreen.

Leaves 4—9.5" obovate-oblong or oblanceolate with numerous obscure secondary nerves narrowed into a petiole .25" long. Peduncles 1—3" stout and raceme often 2—3". Fls. .75—1" diam., both calyx and corolla covered with glands which are black when dry. Sepals orbicular with membranous margins, erect.

2. *A. depressa*, Clarke.

A shrub 6—8 ft. with dark green obscurely-nerved wavy, narrow leaves 2—4" and small pinkish flowers in racemed umbels. Petals spreading waxy white with brown or pink scales.

Near streams. Singbhum, deep valleys in the Karampoda forest, very rare! Bonai, *Cooper*! Mayurbhanj, common in ravines above 3000 ft.! Fl. March—May. Fr. May—June.

Leaves lanceolate or narrowly oblong-lanceolate acuminate 2—4.5". Twigs rusty tomentose. Leaves entire with numerous very fine sec. nerves, beneath with numerous scattered rusty scales or glands and fewer above. Petiole .25—3" rusty tomentose. Umbels cymose on peduncles .5—1" long, axillary or clustered on small shoots and lateral from deciduous scale-leaves. Pedicels .15—25". Sepals spreading lanceolate pubescent. Petals .12" long with glands. Fruit globose black .25" diam.

3. *A. nov. sp.* near *A. oblonga*, *A.D.C.*, and *A. solenacea*, *Roxb.*

This is an imperfectly known species sent to me by Mr. Haslett without field notes.

Apparently a shrub. L. elliptic-lanceolate 2—3" long at time of flowering (probably immature), narrowed both ends, punctate, sec. n. fine indistinct, petiole about .2—3". Inflorescence at the base of the new shoots, chiefly from the scars of fallen scales, few axillary, corymbose, peduncles 1—2" long, pedicels .6—8". Calyx spreading, sepals imbricate .1—12", suborbicular, obtuse or rounded, copiously glandular, margins not membranous. Corolla .6—75" diam., rotate, petals oblong-ovate acute, gland-dotted. Anthers linear-oblong .25" less distinctly glandular than in *A. solenacea*. Ovules over 12.

Southern range, Puri, *Haslett*! Fl. April.

It differs from *A. solenacea* in the small leaves and their shape, in the inflorescence at the base of the new shoots, sepals not membranous at margin and other points. From *A. oblonga* it differs in the many-flowered (9- or more-) corymbose racemes, larger flowers and less conspicuous leaf nervation. In *A. oblonga* also the flowers appear before the fall of the mature leaves as they do in *A. solenacea*.

4. *ÆGICERAS*, Gaertn.

A shrub or small tree with entire coriaceous sessile or subsessile leaves and axillary terminal or leaf-opposed ebracteate umbels with

slender pedicels. Fls. 2-sexual. Sepals imbricate. Corolla-tube short, petals 5 acute twisted to the right in bud. Stamens on the tube with linear filaments hairy at the base, anthers cordate-lanceolate dehiscing longitudinally, the cell transversely septate. Ovary oblong narrowed into a filiform style, stigma small. Ovules many immersed in a central globose placenta. Fruit cylindric, curved, acute, coriaceous 1-seeded, tardily dehiscing longitudinally. Seed exalbuminous, germinating within the pericarp, radicle inferior, long, enlarged at the base, cotyledons very short.

1. *Æ. majus*, Gaertn. Teluni, Or.

An erect very bushy or virgate shrub with obovate or oblong-obovate coriaceous leaves 1.5—3" long rounded at the tip and narrowed into a 3—6" long stout petiole. Umbels very dense, flowered, subsessile, with oblong pale bracteoles .15" long with red glands. Flowers white or somewhat pink with finally reflexed-oblong acuminate petals .2" long and campanulate tube nearly as long. Stamens exerted with versatile anthers. Ovary linear-oblong pink.

Sea coast and often among littoral rocks. Chandpur, Balasore! Mahanadi delta. Cuttack! Chilka lake, Puri! Fl. Jan.—May.

Glabrous. Sec. n. of leaf 5—6 faint translucent. The leaves sometimes appear to secrete water all over their surface. Pedicels 3—4" long. Sepals broad thick. Young fruit straight, very acuminate, closely embraced at the base by the calyx.

FAM. 84. SAPOTACEÆ.

Trees or shrubs usually with milky juice, the young parts usually rusty-tomentose. Leaves alternate coriaceous entire petioled exstipulate, or stipules very caducous. Flowers 2-sexual axillary (*Sarcosperma*, not so far found in our area, has subopposite leaves and paniced flowers), often from leafless axils, bracts and bracteoles 0 or minute. Calyx inferior with 4—8 imbricate lobes or lobes 2-seriate and outer valvate, persistent. Corolla-tube shorter than calyx with the petals as many or 2—4-times as many as its lobes. Stamens on the corolla tube epipetalous 1—3-times as many, or some reduced to staminodes, 1—3-seriate, fil. short, anthers oblong-lanceolate, connective often produced. Ovary sessile 2—8-celled with linear style, stigma a point. Ovule solitary in each cell, axile. Fruit baccate 1—8-seeded. Seeds ellipsoid or compressed, hilum long, testa usually crustaceous. Embryo straight with large fleshy cotyledons or albuminous with flat cotyledons, radicle inferior.

Sepals and petals each 5, imbricate

Sepals 4, 2-seriate, petals 6—12

Sepals 6—8, 2-seriate, petals 18—24, 2-seriate

Sepals 6, 2-seriate. Petals 6, imbricate

1. *Sideroxylon*.

2. *Bassia*.

3. *Mimusops*.

4. *Achras*.

1. SIDEROXYLON, L.

Trees with milky juice and small flowers in axillary fascicles, pedicels pubescent villous or tomentose. Calyx lobes 5, much imbricated. Corolla tube campanulate, petals 5 imbricate. Stamens attached to

base of corolla, 5 perfect, 5 reduced to staminodes, sometimes petaloid. Ovary villous 5-celled. Berry 5-fewer-seeded. Seed albuminous, usually oblong, compressed, testa hard.

1. *S. tomentosum*, Roxb. Pania, *Th.*; Kanta Bobhula, *Or.*

A small or m.s. usually thorny tree with tomentose or densely brown-hairy twigs, and obovate elliptic-obovate or oblanceolate leaves 2—5" long clustered towards the end of the twigs with 9—12 straight strong spreading sec. n., pubescent or tomentose beneath especially when young, slightly rusty or glabrescent above. Flowers white rather small with corolla 3—3.5" long, solitary or fascicled mostly from old leaf scars. Fruit yellowish, subglobose or broadly ovoid 1—1.25" long seated on the 5-fid calyx. Seeds usually only 1 developed, deep-brown.

Bettiah forests! Singbhum, valleys in the Latua and Saranda forests, near streams! Santal Parganas! Frequent in the Southern tract near streams. Puri! Bonai, *Cooper*! Puri! Angul! to Sambalpur! Fl. April—June. Fruit ripens the following March—April. Evergreen.

Bark grey or light brown, blaze bright red exuding drops of milky juice. Leaves rarely 6" long by 2.5" wide, obtuse or suddenly acute, base narrowed into the .25—3" long petiole. Hairs branched. Sec. n. not always much stronger than the intermediate, reticulate some distance from the margin. Two outer sepals ovate-oblong pubescent or tomentose, inner narrower. Petals twice as long as tube. Stamens opp. the petals alternating with a corona of petaloid staminodes with filiform tips. Ovary tomentose. Fruit with very bitter flesh.

Wood light brown, moderately hard. Wt. 56 lbs., *Gamble*. Used for beams and carpenters' planes, *Beddome*.

2. BASSIA, L. Mohwa.

Trees with coriaceous leaves clustered at the ends of the branchlets with deciduous caducous stipules. Flowers axillary or from the axils of fallen leaves. Sepals usually 4 with the two outer valvate enclosing the inner pair, very rarely 5 imbricate. Corolla campanulate or ovoid-urceolate with 6—12, usually 8 or 10 small lobes 2-seriate, contorted in bud. Stamens 12—40, anthers lanceolate, connective often mucronate or tailed. Ovary villous, cells 4—12, usually 6 or 8. Berry 1—3—rarely 4—5-seeded. Cotyledons fleshy.

The germination of hypogeal.

L. with 10—12 sec. n. Corolla fleshy. St. 22—26	1. <i>latifolia</i> .
L. with 15—20 sec. n. Cor. not fleshy. Stamens 30—40	2. <i>butyracea</i> .

1 *B. latifolia*, Roxb. Mahua, *H.*; Madkom, Mandukam, *K.*; Mahul, *Beng.*, *Or.*, Madgi, *Uran*. The fruit or seed is known as Kochra, *Beng.*; Kuindi, *K.*, *S.*; the oil Kuindi sunum or dola, *K.*, *S.*

A large or m.s. tree with dense rounded rather low crown, pubescent or tomentose twigs, large elliptic or oblong-elliptic rigid leaves 5—8" by 2.5—3.5" with petioles 1—1.5" long, and numerous ovoid very fleshy cream-coloured flowers on long rusty-tomentose pedicels clustered at the ends of the usually leafless branches, from the leaf scars. Berry ovoid 1—2" long.

Common throughout the Central tract, but in the forests chiefly confined to the hills. North of the Gangetic plain it is scarce but is found occasionally! *Hamilton* recorded it as only common in the south-west corner of Purneah. Common in the

Southern tract, but less so in the Puri and Angul districts. Fl. Feb.—April when more or less leafless. Fr. June—July. The leaves at the top of the tree usually fall first; the new leaves appear about May.

Bark nearly smooth, brown, blaze thin brown, then thick and red or dark red, with visible latex tubes which exude drops of latex. Corolla-tube ovoid .5" long, petals elliptic or narrowly elliptic .22—3" long, erect in flower, 7—14 according to some authorities, in my specimens 8 in two series with the outer series twisted, the inner imbricate. Stamens sub-sessile, anthers dorsally hairy, aristate, 3-seriate. Seeds ellipsoid, 1 double convex, or 2—4 more or less flattened on one or two sides, pale-brown, 1.3—1.5" long with a long hilum, testa easily cut with³milky juice.

The flowers form the well-known and valuable article of food, the part eaten being the fleshy corollas, which after being sun-dried have the colour of raisins. Alone they are said to be indigestible and are usually cooked with rice or rice-water. When raw they are a favourite food of wild animals. A spirit (daru, H., arki, K.) is also distilled from them. It is said to be a powerful stimulant as well as an astringent tonic and appetiser, and to be largely used on the continent of Europe for the manufacture of brandy. The unripe fruit is cooked as a vegetable. The oil from the seeds is used to adulterate ghee, for cooking, for lighting and for the manufacture of soap and candles. To obtain it the kernels are split and sun-dried, pounded into coarse flour in the "dhenki," then put into an air-tight basket, steamed, wrapped up tight in Sabai grass and put into the oil-press. *Nadkarni* says that the bark is a remedy for rheumatic affections and cures itch.

The wood is good and largely used for oil mills but living trees are never felled by the Kols. *Gamble* says that it is hard and durable and he gives the wt. as about 62 lbs.

As no care is taken by the natives to propagate the tree there is probably a gradual decrease in their number, and most of the trees being outside the Reserved Forests, Sir E. Gait has recently caused plantations to be made of it on waste grounds in Singbhum. The seed germinates readily but the tree is exceedingly slow-growing. The seed is sown in July or as soon as ripe as in damp weather the radicle will start growth without sowing. The seeds germinate in about 10 days. The plumule is stout, somewhat rusty pilose. Those sown by me at Chaibassa attained an average of 22 ft. high and 13.8" girth after 16 yrs. This is exceptional as *Campbell* in Manbhum records trees of 28 yrs. old only 15 ft. high, *Crawford*, at Purulia, trees 15 yrs. old and 10 ft. high. *Mr. Grant* in Bhagalpur planted about 12 bighas with nursery plants 6" high and after 3 yrs. with constant cultivation and watering the plants were 2—3 ft. high and less. The tree moreover needs much protection as cattle and goats browse it down, which is the reason of natural seedlings being seldom found in the fields. The Chaibassa soil is a decomposed gneiss. The tree is light-demanding but likes a little shade when young.

2. *B. butyracea*, *Roxb.* Chiuli, *Th.*; Gophal, *Beng.* ,

A large tree with very large obovate leaves 9—12" long clustered towards the ends of the branches, villous beneath or glabrous when mature, shining above with usually 16—22 strong sec. n. arching or forked within the margin. Petiole .7—1". Flowers white on crowded rusty pedicels .7—1" long just below the new leaf-bud. Sepals .3—5" ovate. Corolla .7" with 8—10 spreading oblong petals free nearly to the base. Berry ellipsoid green shining with milky juice, 1.75" by 1" or smaller, seated on the 5 persistent closely imbricate suborbicular pubescent or tomentose calyx-lobes which have thickened bases. Seeds usually 1—2.

Rare in our area. Ravines in the Sameshwar hills, N. Champaran! It also occurs in the Morung on the Nepal side of the Purneah boundary. Fl. Oct.—Dec. Fr. April—July. Nearly evergreen, new leaves about the time of flowering.

The tree attains 10 ft. girth in the hills further east, but has not been observed large in our area. Bark thick dark grey. Stipules lanceolate acuminate .15—2" caducous.

The fruit is eaten and also yields a vegetable butter and is used for soap and candles, but is too scarce to be of economic value in Behar and Orissa.

3. MIMUSOPS, L.

Trees with coriaceous leaves with many fine spreading secondary nerves. Flowers often fascicled. Sepals 6 or 8, 2-seriate, outer valvate, inner imbricate. Corolla-tube very short, petals 6 or 8 with double ligules on their backs or (according to another view) 18—24, 2-seriate. Stamens 6—16 inserted with the petals, usually 6 or 8 and as many, often toothed or lobed, staminodes; connective excurrent. Ovary hirsute 6—8-celled. Fruit a globose or ovoid berry. Seeds 1—6, compressed, ellipsoid with fleshy albumen and flat cotyledons.

In *M. hexandra* the petal is smaller than its 2-fid ligule and appears like a ventral ligule on a 2-fid petal, but in *M. fragrans* and others the dorsal series are very slender or fimbriate. In *M. Elengi* the grouping into threes is less apparent, and *Clarke, Prain* and others describe the lobes of the corolla in the genus as 18—24, 2—3-seriate. The dorsal lobes or appendages always seem to be, however, in one series.

L. elliptic, acuminate. Flowers 8-merous (few also sometimes 6-merous)

1. *Elengi*.

L. obovate, rounded. Flowers 6-merous

2. *hexandra*.

1. *M. Elengi*, L. Bakul, *Beng.*; Baula, *Or.*; Molsuri, *H.*

A large or often a small tree with shining glabrous elliptic usually acuminate leaves 2.5—4" long and fascicled white pretty star-like flowers about 1" diam. on pubescent pedicels about as long as the petioles. Sepals usually 4+4, but rarely 3+3 on the same tree. Corolla lobes 24 (8 petals with their 2-fid ligules) all lanceolate and sub-similar. Stamens 8 and an inner series of petaloid rather membranous, villous, usually toothed, staminodes. Fruit rather variable, usually narrowly ovoid 1" long, orange-coloured, 1-seeded.

Very frequently planted in gardens and near temples in all districts! Fl. April—May. Fr. r.s. Evergreen.

The flowers are fragrant and are held sacred. They yield a volatile oil used as a stimulant medicine and perfume. A fixed oil is obtained from the seeds. The unripe fruit is very astringent and recommended for loose teeth. Other medicinal uses are given by *Nadkarni* and *Dutt*.

2. *M. hexandra*, *Roxb.* Khirni, *H.*; Khirokuli, *Or.*

A small tree (in our area, but sometimes very large) with glabrous oblanceolate-oblong, elliptic or elliptic-obovate leaves rounded and always some emarginate at the tip, usually 3—4" long with obscure sec. nerves. Petiole .3—5". Flowers .25" small, white, on .25—3" long pedicels in fascicles of 2—6 and from the axils of fallen leaves. Sepals 3+3. Petals 6 narrower than their 2-fid ligules. Berry oblong ellipsoid .5" long.

Purneah, perhaps only feral! Orissa, wild! Often cultivated. Fl. Nov.—Jan. Fr. April—June. Evergreen.

Bark rough grey, blaze crimson, exuding (like the last) drops of latex. Leaves clustered towards the ends of the branches.

Whether the large tree is different from the small one or shrub I do not know, but there are two distinct varieties in our area.

Var. **typica**. Leaves 3—4". Outer sepals elliptic or oblong. Stamino-
nodes narrow, often 2-fid. Anthers twice as long as filament.

Var. **orixensis**. Leaves 3.5—6". Outer sepals broadly ovate, only .17". Petals
appearing as mere ligules in the sinuses of the outer linear lobes (the true ligules).
Filaments slender twice as long as the short broad anther. Stamino-
nodes very short sub-quadrate fimbriate.

The fruit is eaten, but it is very poor.

4. ACHRAS, L.

Tree with coriaceous shining leaves clustered at the ends of the
branches. Flowers rather large, solitary axillary. Sepals 3+3, outer
sub-valvate. Corolla sub-globose with 6 (rarely 5) imbricate almost
contorted petals half as long as the tube or longer. Stamens one
opposite each petal inserted at its base alternating with petaloid stami-
nodes. Ovary 10—12-celled. Style with small lobed stigma. Berry
globose or ovoid, somewhat umbonate, 4—12-seeded. Testa hard, albu-
men fleshy, cotyledons large flat.

1. *A. sapota*, L. Sapota, Sapodilla-plum.

A large handsome tree with rough dark grey bark and dense crown.
Leaves oblong-lanceolate or elliptic-oblong, 3—5", obtuse or subacute,
shining both sides with numerous very fine inconspicuous sec. n. and
petiole .5—.75" long. Flowers long-pedicelled. Fruit globose, 1.5—2"
diam. usually with 5 large black shining seeds, pink flesh and brownish
epicarp.

Cultivated, more especially in Orissa. Fl. April. Fr. Feb.—March. New leaves
with the flower-buds March—April. Evergreen.

The fruit is very palatable. It is a native of South America, where the
astringent bark and bitter seeds are used medicinally.

FAM. 85. EBENACEÆ.

Trees or shrubs with alternate, rarely subopposite or opposite
exstipulate entire leaves and regular, usually dioecious, usually brac-
teate and 3—7-merous flowers axillary, solitary clustered or shortly
cymose with the pedicels articulate under the flower. Calyx inferior
gamosepalous, often accrescent in fruit. Corolla gamopetalous, regular,
with petals overlapping to the right, very rarely valvate. Stamens
inserted at the base of the corolla, as many or 2—3 times as many as
the petals, free or filaments more or less grouped, anthers mostly
narrow-lanceolate, with lateral dehiscence, rarely with apical pores; in
the female flower reduced to staminodes rarely 0. Ovary sessile 2—16-
celled with 1—2 anatropous pendulous ovules in each cell, styles 2—8
free or connate at base with small or often flabellate stigmas. Fruit
baccate, coriaceous or fleshy, with as many cells and seeds as in the
ovary or fewer—1 by abortion. Seeds compressed, testa thin, albumen
copious often ruminant. Embryo axile, straight or more or less
curved with flat cotyledons and superior radicle.

Flowers mostly 3-merous. Ovary 3- or 6-celled .

Flowers mostly 4—5-merous. Ovary 4—5- or 8—10-celled

1. *Maba*.

2. *Diospyros*.

1. MABA, *Forst.*

Trees or shrubs with alternate entire leaves and dioecious axillary 3-merous flowers, solitary short-pedicelled or in small dense cymes. Calyx 3 (—5)-partite or -lobed often cupular and enlarged in fruit. Corolla tubular lobes 3 (—5) twisted to the right. M. fl. stamens 3—22, filaments paired or otherwise connate, ovary rudimentary. Fem. fl., staminodes 0—12, ovary 3-celled or 6-celled or 3-celled with imperfect septa between the ovules, ovules 6 altogether. Fruit 1—6-celled and -seeded. Albumen uniform.

1. *M. buxifolia*, *Pers.* Goakuli, Guakuli, Gaurkasa, *Or.*; Angaru, *Beng.*

A twiggy much branched shrub or small tree with box-like leaves 4—1" long, small white flowers 18" long, the males usually in very short cymes, the females 1—3 together. Berries 3" long, ellipsoid-oblong, hairy above especially at base of style, sub-coriaceous succulent, 1-seeded.

Cuttack and Puri, usually in scrub jungles near the coast! Fl. March—April. Fr. June—July. Evergreen.

Young shoots pubescent. Leaves sometimes 1-3" long, round, oblong or obovate, coriaceous with the few sec. n. scarcely stronger than the fine reticulation. Petiole hardly any. Male fl. smaller than female, about 14—15" long hairy; calyx cupular 3—4-lobed, minutely hairy, about half as long as the corolla; corolla tubular, strigosely hairy on the outside; stamens 3 (6—12, *F.B.I.*, perhaps variable but 3-merous). Fem. fl. with broader obtusely-lobed calyx, and corolla 17" long with 3 strigose lines or patches, lobes sub-orbicular, staminodes 0, ovary 3-celled, style rather long with 3 minute lobes at apex.

2. DIOSPYROS, *L.*

Trees, rarely shrubs. Flowers green, white or yellowish, males mostly in 3—more-flowered cymes, females usually solitary. Calyx 3—5-lobed but mostly 4—5-lobed, often nearly to the base, often hardened in fruit. Corolla tubular, salver-shaped or campanulate with usually as many lobes as calyx, twisted to the right. M. fl. with 8—64 stamens, often in pairs, pistillode present. F. fl. with 0—16 staminodes. Ovary 4—16- usually 8-, very rarely 6- but never 3-celled. Ovule 1 in each cell. Styles short with often spreading or lobed stigmas. Fruit usually showing marks of the suppressed cells, seeds oblong.

The nervation is usually characteristic with alternate sec. n. and numerous often nearly as strong intermediate nerves, all forked and usually minutely reticulate. Petioles always short.

KEY.

1. Indigenous species. Leaves mostly under 9" long (except on coppice shoots and sometimes *Embryopteris*).

MALE PLANTS.

A. Flowers in peduncled cymes:—

1. Stamens 12—16:—

a. Flower-buds with short calyx and conical twisted corolla:—

1. Calyx flat or saucer-shaped.—

Bark dark, rugose. L. narrow 1—4" pubescent. 1. *cordifolia*.

- Bark light, smooth. L. ell. or ell-ovate 2—6" 2. *montana*.
 ii. Calyx tubular, sometimes half as long as
 corolla:—
 Bark dark. L. oblong-acuminate 4—7" 6. *ebenum*.
 b. Fl. buds ellipsoid or ovoid-oblong, calyx half as
 long as corolla or longer, tomentose . 8. *melanoxylon*.
 c. Buds subglobose. St. 13—22. Corolla urceolate 5. *sylvatica*.
 2. Stamens 18—22 or more:—
 Fl. buds globose. Cor. urceolate 1—15" 5. *sylvatica*.
 Fl. buds ovoid-oblong. Corolla 3". St. 20—64 3. *embryopteris*.
 B. Flowers in sessile or subsessile cymes or clusters.
 Stamens 13—20:—
 L. 3—4.5" long. Corolla glabrous . 4. *ovalifolia*.
 L. 1—3.5". Corolla with hirsute broad lines 7. *chloroxylon*.

FEMALE PLANTS.

- A. Flowers large, over .5" diameter:—
 1. Corolla broadly campanulate or urceolate with spread-
 ing lobes, usually broader than long:—
 a. Evergreen. Fls. white 1" diam. 1—5 together.
 Fr. over 1" diam. with a rusty scurf . 3. *embryopteris*.
 b. Deciduous. Flowers with the new leaves, .45—.55"
 diam.:—
 i. Ovary glabrous. Flowers solitary:—
 L. pubescent 1—4". Peduncle slender .25—3".
 Frt. globose yellow 1—1.5" diam., sepals
 ovate-lanceolate 1. *cordifolia*.
 L. often glabrous. Peduncles mostly under
 .25". Frt. globose to conical greenish-
 yellow, sepals rounded . 2. *montana*.
 ii. Ovary hairy. Fls. sub-sessile, reflexed sepals
 ferruginous-tomentose in fruit 4. *ovalifolia*.
 B. Flowers m.s. or small, under .5" diam.:—
 1. Cor. tube urceolate or broadly campanulate:—
 L. 4—8". Fls. over .25" diam. Calyx puberulous 5. *sylvatica*.
 L. 1—3.5". Fls. .18" diam., calyx densely hairy. Frt.
 .3" diam. 7. *chloroxylon*.
 2. Corolla tubular, longer than broad:—
 Calyx with cupular tube with a raised rim girding the
 ovary and fruit. Leaves narrow-oblong acuminate . 6. *ebenum*, var.
 Calyx not cupular. Inflorescence densely hairy. L.
 elliptic or ell-ovate 8. *melanoxylon*.
 II. Cultivated or imperfectly known species. L. 7—10" long
 exc. in II:—
 Wild. L. oblong or ell-oblong, glabrous, acuminate 9. *variegata*
 Cultivated. Leaves of same shape, silvery-silky . 10. *discolor*.
 Cultivated. L. ovate about 4.5" by 2". Frt. 1—3" diam. 11. *Kaki*.

1. *D. cordifolia*, Roxb. Syn. *D. montana*, F. B. I. in part; Ban-gab,
 Beng.

A small tree with dark bark, often thorny with branched thorns, pubescent twigs and small oblong, pubescent leaves 1—3" long with cordate or very rounded base. Male cymes mostly 3-flowered, fls. white .25" long, campanulate with short spreading lobes. Fem. fl. solitary on slender peduncles .25—.3" long. Berry globose orange-yellow 1—1.5" diam., albumen somewhat ruminant. Fruiting sepals

triangular-ovate usually acuminate, calyx thickened at base but not at all cupular.

Doubtfully wild in the Northern and Central areas but planted at Purulia, Manbhum, Monghyr! Undoubtedly wild in the Southern area: Balasore! Puri forests, frequent! Fl. April. Fr. ripens following March—April. Nearly or quite evergreen in the damper localities, bearing its flowers on the new shoots.

Bark on young trees nearly smooth but dark, on old trees rugose. Blaze brown, then yellow. Thorns sometimes bearing leaves. Leaves rarely 3.5 by 1.35", lanceolate or mostly oblong, sometimes oblong-ovate, very small ones at base of twigs often obtuse, others acute or acuminate, sec. n. usually 1—3 near base and 4—5 above, weak. Petiole .13—25". Male cymes rarely more than 3-fld., buds conical with saucer-shaped pubescent calyx obtusely lobed, fls. .2" diam. St. about 8 prs. Fem. fl. white, turning brown below and whitish above, calyx .6" diam., sepals twice as long as the tube, enlarged to .5" in fruit, not hardened, corolla-tube urceolate-campanulate .2" long, limb .45—.5" diam., staminodes 9—13 usually 8. Berry not at all apiculate, flesh very bitter.

2. *D. montana*, Roxb., incl. *D. Kanjilali*, *Duthie*; Sakamhara, *M.*; Saratiril, *K.*; Gada terel, *S.*; Patwan, *Kharw.*; Paten, *Uran*; Bis Tendu, *H.*; Halda, *Or.*; Hinjalman, *Poten*, *Gond*.

A small or m.s. tree with smooth reddish or greenish pale bark, glabrous shoots and twigs or sometimes puberulous, and ovate-oblong, elliptic or ell.-ovate very finely reticulate glabrescent leaves 2—6" long with obtuse, rounded or subacute base. M. fl. green in 3—7-more fld. cymes. Buds conical with the deeply lobed calyx only one-third or one-fourth as long as the twisted corolla, corolla after expansion tubular-campanulate with tube .15" and 4 rounded spreading lobes .08—1" long. Fem. fls. .5—.75" diam. on very short peduncles rarely .25" long (very exceptionally .3"), sep. 4 broadly- or ovate-oblong with rounded apex coriaceous in fruit. Fr. 1" globose to somewhat oblong or with short conical tip.

Usually near nalas, nowhere very common but widely distributed. North Champaran forests! Purneah! Santal P.! Chota Nagpur, frequent! Puri! Common in the Mals! Mayurbhanj! Bonai, *Cooper*! Athmallik! Angul! Sambalpur, frequent! Kalahandi! Fl. April—June. Fr. Dec.—Feb. Deciduous, the flowers appearing with very young leaves.

Bark peeling in very thin flakes, blaze green, then yellowish or flesh-coloured, rapidly darkening on exposure. Trunk and branches sometimes with stout conical thorns, at other times unarmed. Leaves attain 6.5" by 3.5" when mature, glabrous or pubescent, sometimes slightly cordate. The very fine darker nervules neither raised nor depressed well mark this species when once seen. Peti. .15—.3". Cymes with slender peduncles and pedicels and subulate bracts. St. 12—16, paired. Fem. fl. green or yellow, tube urceolate, limb spreading, .5—.75" diam., staminodes 2, 4 or 8. Frt. greenish yellow, finally black, .7—1" diam.

There are two forms which pass into one another:

a. Leaves always quite glabrous, more membranous than in the next.

β. Kanjilali (Duthie sp. in part). Leaves pubescent or glabrescent, usually more coriaceous when old and more grey in appearance. The pubescence is often very minute.

In both the apex may be obtuse or suddenly acute, more rarely shortly acuminate, sec. n. 7—11 from a very broad midrib, raised beneath when old, the lowest 2—3 usually very close to the base, very finely reticulate between.

Used for the wall-plates, etc., of native houses.

3. *D. embryopteris*, Pers. Kendu, Gara tiril, K.; Maka-kenda, S.; Maka-tendu, Kala-tendu, Gab, H.; Thusra-kendu, Or.

A handsome tree with low spreading branches almost to the ground, coriaceous oblong or narrowly oblong glabrous shining leaves 5–9" long or more, with rounded or obtuse base. Flowers white fragrant. Males in umbellate, cymes, buds ovoid-oblong with 4 small silky patches. Fem. fls. 1" diam., solitary. Fruit 2.5–3" diam., globose, covered with a deciduous red scurf.

Frequent along streams in the Central and Southern areas, especially in deep rocky ravines! Very common in the Mals of Puri! Fl. April–May, Fr. ripens the following April. Evergreen; the new leaves, which are bright crimson, appear about April.

Bark black, smooth. Leaf-buds lanceolate silky, L. acute or obtuse, sec. n. many, fine; scarcely raised, inclined very obliquely forward, very reticulate between. Petiole .5–.6". Male peduncles .3–.5" pubescent, often only 4-fld., calyx urceolate silky, corolla nearly .5", campanulate or urceolate with short sub-orbicular lobes; st. 20–35 or more, paired, pubescent. Fem. peduncles stout .5", sepals .5", broadly ovate or sub-orbicular, 1" in fruit and foliaceous with cordate base, petals 4–5, .5" diam. Seeds usually about 8, large in pulp.

The pulp of the fruit is largely eaten by monkeys and said to be sometimes eaten by human beings, but to produce great thirst; I find that it burns the throat. The pulp is very viscid and is used for caulking (gab) boats. It is full of tannin and *Gamble* says is used for making fishing nets more durable. Both rind and bark have astringent properties, and are used medicinally in diarrhoea and for hæmorrhage of internal organs and as a styptic for wounds. The oil from the seeds is also used in dysentery.

4. *D. ovalifolia*, Wight.

A small tree with narrowly elliptic or oblong leaves 3–4.5" long with rounded or slightly retuse tips, petiole .15–.25", sec. n. about 8 not strong, soon reticulate and with close reticulations between. Fls. sessile clustered axillary and from leaf scars. Male 3–12 together, .17" long campanulate, calyx .1", tomentosely hairy with spreading lobes as long as the tube, corolla lobes short ovate, stamens 13–20 glabrous. Fem. fl. 1–2 (2–6, *F. B. I.*) together, .25" diam. with broadly ovate petals and 0–7 staminodes, ovary hairy 4–6-celled. Fruit .7" globose subsessile glabrate with the reflexed lobes of the calyx .2" long and broad, permanently tomentosely hairy both sides. Albumen equable.

Puri Division, very rare (Burkul) *Gamble*! Flowers with the new leaves May–June.

5. *D. sylvatica*, Roxb. Gara-tiril, K., S.; Kalicha, Kauchia, Or.

A tree sometimes large but often flowering when quite small. Leaves typically narrow-elliptic or elliptic-oblong and acuminate, 4" by 2" to 8" by 3.5", but small at the time of flowering, thinly pubescent beneath when young, sec. n. 4–8 not finely reticulate between. M. fls. very small, 3–4-merous, globose, .1–.15", in numerous small dense peduncled cymes, axillary and from the scars of caducous scales on the new shoots, sometimes paniced on special leafless branchlets. Fem. fl. pure white, .2" diam. and .3" long, with the lobes usually erect, in distichous rows mostly below the leaves, often on special branchlets, more or less silky pubescent. Fruiting calyx with a short

campanulate tube and 3—5 broadly oblong obtuse very coriaceous lobes .3" long usually with reflexed margins. Fruit .5—6" diam., easily recognised by the 1—4 seeds of which the testa yields a crimson juice.

In the damper forests. Singbhum, along streams, rather scarce! Santal Parg., frequent in the Rajmahal! Puri, very common everywhere, often as a shrub in the laterite scrub! Angul, common near rivers! Sambalpur, rather scarce! Fl. April—May. Fr. Jan.—March. Nearly evergreen, new leaves at the time of flowering.

Attains 60 ft. by 5 ft. in girth. Bark smooth dark grey or black with lichen-white patches, blaze hard, brown then white. Leaves rather variable, the lower on a shoot sometimes oval and in the shrubby form often only 3—5" long and not acuminate. Petiole .3—75". M. cymes with peduncle .3—6" long, corolla broadly campanulate or urceolate with orbicular lobes, stamens at extreme base or on receptacle. Fem. fl. with 4 staminodes. After the fall of the fruit the regularly arranged short knobbed pubescent peduncles .15—25" long on short branchlets make this species easily recognisable and remain for a long time.

Var. *latifolia*. Leaves broadly elliptic 3—3.5" broad. Sambalpur!

6. *D. ebenum*, Koenig. Var. *acuminata*, Haines.

A small evergreen tree with drooping branches and minutely pubescent twigs. Leaves oblong acuminate, 4—6.5", shining above, pale, very thinly hairy and glabrescent beneath. M. fl. in peduncled cymes at the base of the new axillary shoots or (from suppression of the shoot) in 2-nate axillary cymes. Cymes 3-fld. hairy, calyx .15" tubular, stamens 14—16 more or less paired with one of each pair barren. Fem. fl. on short pedicels .2—3" long thickened above, divaricate, paired, bracteate, calyx obconic-tubular, corolla yellowish .4" long glabrous ovoid-tubular with 4 nearly straight narrow-oblong lobes .2" long. Fruit globose .7", sunk at base in the cup-shaped calyx, which has 4 reflexed distant oblong lobes.

Puri (Champagarh forest)! Angul! Fl. March—April. Fr. June.

Bark black, finely rugose, blaze brown, then orange-brown, the latter rapidly darkening on exposure. Leaves somewhat narrowed and acute or obtuse or rounded at base, sec. n. 4—8 oblique scarcely stronger than the shorter intermediate and tertiaries very reticulate. Petiole .2—3". Male peduncles .1—4", calyx-lobes 4, one-third to one-half as long as tube, corolla .3", lobes free two-thirds way down, narrow-oblong. Female calyx with 4 spreading oblong acute or broadly lanceolate lobes .25" long, thickened and raised into a crenulate ring round the young fruit, staminodes 8, inserted at base of corolla-tube, filaments sparsely ciliate, anthers oblong-lanceolate shorter than filaments. Ovary minutely puberulous, stigma 4-lobed. Fruit 8-celled and -seeded.

The typical *D. ebenum* gives the well-known ebony wood of Ceylon, but only small trees occur in our area and appear to differ a good deal from the type.

7. *D. chloroxylon*, Roxb. Gourkasa, Or.

A shrub or small tree often armed with stout or slender and sharp axillary thorns. Leaves always more or less hairy beneath, young densely brown pubescent, only 1—2" at time of flowering but old leaves attain 3.5" long, elliptic or rhomboid-obovate obtuse and base rounded. Male fls. subsessile in numerous sessile capitate cymes, 4-merous, corolla white campanulate, only .16—15" across with a tuft of hairs at the back of each petal. Fem. fl. solitary sessile, fruiting calyx strigosely hairy, .3" diam., berry .3—35" diam.

Frequent in Puri, both in the Mals and the scrub jungles! Khandpara, especially on cotton soil! Fl. June—July. Fr. March—April. Evergreen. Renews leaves April—May.

Bark dark grey or black, rugose. Shoots rusty tomentose. Leaf-buds perulate, mature leaves coriaceous with about 3 sec. n. only. Petiole .17". Male buds globose with broadly ovate or orbicular sepals, stamens 16, glabrous, anther-slits at first sub-apical. Fem. fl. .18" diam., staminodes about 8, ovary glabrous. Seeds 2—3.

Gamble gives weight of wood as 46 lbs. It is apparently only used for fuel.

8. *D. melanoxylon*, Roxb. Inc. *D. tomentosa*, Roxb.; Tiril, Terel, K., S.; Tend, Kharw.; Kend, Kendu, H., Beng., Or.

A small and bushy or a large straight tree with grey- or rusty-tomentose shoots. Leaves mostly sub-opposite, 4—8", broadly-ovate or elliptic, old coriaceous, tomentose to glabrescent beneath. M. fls. 4—6-merous in peduncled 3—12-fl. villous simple or branched often drooping cymes, buds narrowly ellipsoid .25" long with the tubular calyx half as long as the silky corolla or more, corolla after opening .25—.26" long tubular-funnel-shaped with suberect small obtuse lobes. Fem. fl. solitary axillary or from leaf-scars, subsessile or on short thick peduncles, calyx broad with edges recurved, somewhat 4—5-angled. Corolla .3—.4" diam., similar in shape to male, staminodes 8—10, ovary densely hairy, 4—8-celled. Fruit subsessile, 1—1.5" diam., globose to ovoid, smooth and yellowish when ripe with thick coriaceous fruiting calyx 1" diam., with wavy reflexed margins to the short broad lobes.

One of the commonest trees throughout the Central and Southern Areas (I have no record of its occurring in the Northern Area nor does *Hamilton* record it from Purneah; it appears to end abruptly at the Gaya ghats) both in scrub-jungles and high-forest. Fl. May. Fruit ripens the following May. Deciduous or evergreen according to locality. It flowers on the new shoots.

Attains 6 ft. in girth with a long clean bole in some saddles of the Singbhum mountains. Bark black, rough, often in oblong plates, blaze chrome-yellow. L. vary from 2—5" in width and from ell. to orbicular on the same branch, tip obtuse or rounded or subacute, base usually acute in form *melanoxylon*, rounded in form *tomentosa*, old with a rugose appearance above with impressed nerves in form *tomentosa*, nerves often raised in *melanoxylon*, sec. n. about 8—12 branched and irregular or forked and reticulate some distance from margin and very reticulate between. Petiole .25—.35". Male cymes (including peduncle) 6—9" long, sometimes from axils of caducous scale-leaves on lower part of new shoots, calyx campanulate .17—.2" long, with acute or subacute lobes half as long as tube or less, stamens 12—16. Fruit densely hairy when young, when ripe usually 3—4-seeded rarely only 1—2- or 5—8-seeded, testa rugose shining, albumen ruminant.

Well-grown trees often yield considerable pieces of pure black ebony and it is used in Chaibassa for carving. Poles are largely used for native houses. When burnt the wood emits showers of sparks. The fruit is excellent and as one-seeded berries occur it would probably repay cultivation. The reproduction by root-suckers from any piece of root left in the ground makes it difficult to eradicate in new cultivation and suitable for purposes of re-forestation. It is also easily grown from seed and coppice. *Gamble* gives the weight of the wood as about 68 lbs. for heartwood.

9. *D. variegata*, Kurz?

A tree superficially rather resembling *D. embryopteris* with smooth bark, very large oblong or elliptic-oblong leaves mostly 10" by 3.75", easily distinguished by the prominent 7—8 sec. n. raised beneath, first

spreading then more or less arched, nervules raised and reticulate, quite glabrous with sub-obtuse or cuneate base.

Ravines in the Rajmahal Hills but only once found by me! Fl., Fr.?

Blaze pink, twigs rather pustular with lenticels. Leaf-buds narrow, pointed, silky as in *embryopteris*. L. shortly acuminate, shining above, petiole .4". Fruiting peduncle .2", remaining after fall of calyx and fruit (as in *D. sylvatica* and many other *Diospyros*). The male flowers of *D. variegata* are described as in very short sparingly pubescent cymes with a salver-shaped corolla nearly glabrous without and with about 16 stamens.

Our specimen exactly matches specimens of *D. variegata* in the *Calcutta Herbarium* from Assam.

10. *D. discolor*, Willd.

A handsome tree with oblong leaves about 9" long, easily recognised by being densely silvery-silky beneath with numerous slender sec. n. Fls. white .5" diam. in short dense cymes axillary and pseudo-terminal, sweet-smelling with very large anthers. Fruit large red velvety.

In gardens in Ranchi! Fl. April. Fr. Dec. Native of the Philippines.

11. *D. kaki*, L., Persimon, is a small tree allied to *D. embryopteris*, also sometimes seen in cultivation, with ovate leaves, m. fls. in small 3-fl. cymes, solitary fem. fls. .3—5" long and a globose edible fruit 1—3" diam., reddish or yellow or scarlet when ripe. It is eaten.

Persimon is also the name of an American *Diospyros* (*D. virginiana*, L.) which is very closely allied.

FAM. 86. STYRACEÆ.

Trees or shrubs with alternate exstipulate simple leaves. Flowers regular usually white and moderate-sized, 2-sexual, in axillary and terminal simple or compound racemes or spikes, sometimes reduced to a single flower, bracts small. Calyx campanulate, superior or inferior, 5—4-toothed or truncate, persistent. Petals 6—4, usually 5, united into a short, rarely long, tube, sometimes free, imbricate. Stamens 8—10 or many with free or connate filaments often in bundles and more or less adnate to the corolla, anthers with lateral dehiscence. Ovary 2—5-celled or septa not reaching apex of ovary, style filiform, stigma small or capitate, ovules 1 or few, axile, pendulous or erect. Fruit drupaceous or leathery, 1- rarely 2—3-seeded. Seeds albuminous. Embryo straight or curved.

Stamens many, several-seriate. Fruit a drupe

Stamens 10, 1-seriate. Fruit coriaceous

1. *Symplocos*.

2. *Styrax*.

1. SYMPLOCOS, L.

Leaves toothed or entire, often coriaceous. Racemes or spikes axillary, sometimes much reduced. Flowers with 1—3 bracteoles at their base. Calyx superior, sepals 5 small imbricate. Petals 5 free or connate at base. Stamens many, several-seriate, adnate to corolla-tube and sometimes connate into a tube beyond, anthers shortly oblong. Ovary 3-, rarely 2- or 4-celled, stigma small capitate sub-3-lobed. Ovules 2 pendulous from the inner angle of each cell. Drupe

ellipsoid or sub-globose, 1—3-seeded. Seeds oblong. Embryo terete, axile, sometimes curved.

Leaves 2—5". Fls. pedicelled. Fr. oblong-ellipsoid . 1. *racemosa*.
Leaves 4—7". Fls. sessile. Fr. subglobose . 2. *spicata*.

1. *S. racemosa*, Roxb. Lodh, *Th.*; Ludam, *K.*; Lodam, *S.*; Lodh, Lodhra, *Th.*, *H.*, *Beng.*; Ludho, *Or.* (sometimes Nidhu, *teste Hannah*).

A small tree with oblong, elliptic or ell.-lanceolate coriaceous leaves 3·5—5·5" long, entire, crenate or serrulate and white flowers 4—5" diam., turning yellow with age, in axillary simple or compound racemes 2—3" long. Drupe oblong (diseased globose drupes occur) 3—5" long crowned by the calyx.

Throughout the province, except perhaps along the coast from Balasore to Puri (whence I have no note of its occurrence). Common in Purneah in open jungles and grass, through Chota Nagpur to Sambalpur! Fl. Oct.—Jan. Fr. Dec.—May. Evergreen.

Bark smooth or rough, grey or in young parts pale yellowish. Leaves 1·5—2·5" wide, glabrous or slightly pilose on the mid-rib, acute or obtuse both ends or acuminate, sec. n. slender irregular curved 5—8. Petiole 2·5—5". Racemes pubescent or hairy pedicels 0·5—1·3". Sepals 0·8—1", broadly oblong-ovate, connate below, puberulous or glabrous. Petals connate at base. Anthers as broad as long with very small connective. Epigynous disc finely pilose. Fruit purple-black, 1·7—2·5" broad. Seed and embryo straight.

The bark is used in conjunctivitis in several districts. It is also said to be used for dyeing red. *Campbell* says that the wood-ash is used as a mordant. A concoction of the leaves is used as a mordant for the Chaili (*Morinda*) dye in Chota Nagpur. Powdered bark also used in dysentery and other bowel complaints. *Nadkarni* states that it is found to contain several alkaloids but no tannin.

2. *S. spicata*, Roxb. Marang Ludham, *K.*

A small tree with very shining elliptic or oblong serrate or serrulate acuminate leaves often attaining 9" by 3", and white flowers 2·5—3" diam. in simple or branched axillary spikes 1—3·5" long. Drupe globose-ovoid 2·5" diam., crowned by the small glabrous calyx.

Along streams only. Saranda forests in Singhum, rare! Bonai, *Cooper*! Mountain forests of Mayurbhanj, frequent, esp. at elevations of 2000 ft. and over! Fl. Sept.—Oct. Fr. April. Evergreen.

Bark grey. Leaves usually about 5—6" by 2·5", narrowed at base, sinuately or sharply serrate except at base, pale (with microscopic white dots beneath), sec. n. 7—9 fine distinct. Petiole 3—4". Spikes with pubescent rhachis and small ovate pubescent bract and bracteoles. Sepals orbicular 0·4" or less. Stamens as in last. Seed curved.

2. STYRAX, L.

Trees or shrubs sometimes stellately pubescent with entire or toothed leaves and white rarely pinkish subsolitary axillary or racemose flowers, bracts small. Calyx campanulate, inferior or more or less perigynous, with 5—4 teeth or subtruncate. Corolla with short tube and imbricate or valvate petals on the hypanthium. Stamens 10, mostly connate at their somewhat broadened base and adnate to the corolla tube, anthers large linear. Ovary nearly free, 3-celled below, 1-celled above.

style subulate, stigma capitate. Ovules few in each cell. Fruit coriaceous (toughly chartaceous, *Clarke*), breaking up irregularly or 3-valved, 1- rarely 2-seeded. Albumen copious, embryo straight, axile or eccentric, with broad or lanceolate cotyledons.

1. *S. serrulatum*, *Roxb.*

A small tree with brown twigs, stellately scurfy shoots, lanceolate or elliptic-lanceolate caudate serrate leaves 3-6" long and white flowers which are 1-3 axillary or extra-axillary and running into terminal racemes by suppression of the upper leaves. Calyx irregularly lobed. Corolla .5" diam. with short tube and suberect narrowly elliptic petals .3" long.

Mountains of Mayurbhanj, elev. 2500 ft. Fl. March. Fr. c.s. Deciduous Feb. Young leaves very membranous, bright green, 3-4.5 by 1.5-2" at time of flowering, soon glabrous except on the nerves beneath and the nerve-axils, sec. n. about 4-7 oblique fine but very distinct and reticulate. Petiole .2-3". Pedicels .2-35" minutely bracteate and bracteolate. Hypanthium often embracing one-third of the ovary. Petals tomentose. Filaments with expanded base tomentose, glabrous above (hairy *F.B.I.*). Ovary and young fruit white tomentose. Fruit ellipsoid .5" embraced by the toothed or sub-truncate calyx.

FAM. 87. OLEACEÆ.

Trees or shrubs, rarely undershrubs, sometimes scandent, with opposite (rarely alternate in *Jasminum*) simple or compound, rarely gland-punctate exstipulate leaves. Fls. regular mostly in 3-chotomous cymes or panicles rarely fascicled or racemed, 2-sexual, polygamous or rarely dioecious. Calyx small, truncate or 5-9-, usually 4-lobed, inferior. Corolla gamopetalous but tube very short in a few genera (petals almost free in some *Linociera*), 5-9-petalous or usually 4-petalous, sometimes 0, petals valvate or imbricate in bud. Stamens 2 on the corolla-tube (hypogynous in apetalous species), anthers dehiscing laterally or sub-extrorsely. Ovary free 2-celled, style short or long, stigma simple or 2-lobed. Ovules 1-2, rarely 3-4 in each cell, axile near base or apex. Fruit capsular or baccate, drupaceous or dry. Seed 1, or 1 (rarely 2) in each cell, erect or pendulous, albumen present or 0. Embryo straight, radicle superior or inferior.

I. Petals imbricate:—

A. Fruit baccate:—

Shrubs mostly scandent. L. simple, 3 foliolate or rarely pinnately 5-7-foliolate

1. *Jasminum*.

B. Fruit a dry thin-walled compressed capsule:—

Leaves simple. A small tree

2. *Nyctanthes*.

C. Fruit a pyriform woody capsule:—

Leaves pinnate. A tree

3. *Schrebera*.

II. Petals valvate or in two pairs. Fruit a drupe. Leaves simple:—

A. Inflorescence axillary:—

Petals in pairs, distinct or tube very short

4. *Linociera*.

Corolla tubular or 0

5. *Olea*.

B. Panicles terminal

6. *Ligustrum*.

1. JASMINUM, L. Jasmine.

Shrubs, usually scandent, rarely undershrubs. Leaves opposite, more rarely alternate, simple or pinnately 3-several-foliolate, petiole usually articulated. Flowers white, pink or yellow in 2—3-chotomous cymes very rarely reduced to a single flower, with linear and small or ovate, sometimes petaloid bracts. Calyx with funnel-shaped or cylindric tube and 4—9 sepals or truncate. Corolla salver-shaped, tube narrow, petals 4—10, imbricate in bud. Stamens included, connective usually shortly produced. Stigmas usually 2, ovules usually 2 in each cell near the base. Berry didymous of two globose or oblong carpels or of only one fleshy carpel. Seed 1 rarely 2 in each carpel, erect, exalbuminous, radicle inferior.

The species are often dimorphic with long and short styled forms, sometimes also with two quite distinct sizes of flowers. The lowest leaves on a shoot are often much smaller and of different shape to the upper ones.

A. Leaves all simple:—

1. Scandent. Sepals over .2"—.12" (exc. sometimes

arborescens):—

a. Longer sepals over .3" (in small fld. forms of

pubescens only .2—'.3"). Corolla-tube .4—'.75":—

Cymes 3—5-fld. L. glabrous or nearly so

Cymes dense, many-fld. L. pubescent

1. *sambac*.2. *pubescens*.

b. Sepals under .25", usually under .2":—

Cymes rather dense. L. glabrous. Cor.-tube

.3—'.35"

Cymes lax. L. glabrescent. Cor.-tube .4—'.5"

3. *scandens*.4. *arborescens*.

2. Shrubby, suberect or diffuse. Sepals under .12":—

Shrub. L. ovate, pubescent or glabrescent

As in last but densely tomentose

Undershrub. L. narrowly lanceolate

Bushy or scandent. Sep. minute or 0. L. small

4. *arborescens*.var. *Roxburghianum*.5. *strictum*.6. *auriculatum*.

B. Leaves 3-foliolate (lateral lfts. sometimes very small):—

1. L. pubescent ovate .7—'.2". A garden shrub

6. *auriculatum*.

2. Glabrous. Sepals minute or obsolete:—

Lfts. lanceolate 3—5" long-acuminate or cordate

7. *caudatum*.

Lfts. ovate 2—4" acute or acuminate

8. *flexile*.1. *J. sambac*, Ait. Vern. Mallika, Balphul, Motiya (*teste Nadkarni*).

A scandent or sarmentose shrub with pale branchlets, glabrous or nearly glabrous shining leaves, thin when dry, with numerous very fine raised nervules, varying from broadly ovate (usually at base of shoot) to elliptic or lanceolate, with tufts of hair in the axils of the nerves beneath. Petiole .1—'.2" always pubescent above. Flowers in 3—5-fld. terminal cymes, pedicels .1—'.3", calyx tube .08", sepals filiform or subulate or 1—2 linear and the others filiform .25—'.45", always more or less hairy. Cor.-tube .6", petals usually 6, .5—'.55", narrowly or broadly oblong.

Forests of the Mals, Puri! Kuadall (Angul) in rocky ravines! Nilgiri! Fl. April—May. Very fragrant and often cultivated.

There are two well-marked varieties in our area:—

α. Twigs very slightly pubescent and glabrescent. L. at the ends of the twigs elliptic or lanceolate acute or acuminate, base obtuse rounded or narrowly cuneate on the same shoot, lower 2—3", upper 3—4·5", glabrous except the nerve axils. Cymes with a peduncle 5—1·5" long, bracts filiform 2—2·5", petals about 1—1·5" broad. Puri and Angul!

β. Twigs closely pubescent. L. broadly elliptic to elliptic with tip acute or very obtuse and mucronate, nerves beneath pubescent. Cymes sometimes subsessile the two lowest flowers axillary in the top pair of leaves, petals 2" broad, oblong minutely cuspidate.

Among rocks on hill sides, Nilgiri State!

The leaves, sometimes at least, are minutely gland-punctulate beneath.

The flowers yield a fragrant essential oil.

2. *J. pubescens*, Willd. Chameli, Mogra, H.; Binga bharbhan, S.

A sub-scandent shrub with drooping densely pubescent or tomentose branches, ovate or ovate-lanceolate acute or sub-acuminate leaves 1—3·5", puberulous or with a short curly pubescence and always pubescent on the nerves beneath. Fls. white in dense-flowered capitulate cymes on 2-bracteate axillary peduncles or usually terminating short axillary branches, dimorphic both in size and length of style. Calyx densely pubescent or villous-pubescent with 7—9 filiform sepals mostly 5—6" (shorter ones occur on some flowers). Fruit ellipsoid 5—6" surrounded by the long hairy sepals.

Purneah! Champaran! Santal P. along ravines! Ranchi ghats! Manbhum, Camp! Hazaribagh, Wood! Often cultivated. Fl. Dec.—March. Fr. April—May.

L. (as in many of the genus) very small at base of the shoots, average about 2", base rounded, sec. n. 3—4 slender of which 1 from base. Petiole 1·5—3". Bracts same shape as leaves. Larger flowers 1·75" diam. shortly pedicelled, cor-tube 75". Smaller fls. 6—7" diam., sessile, sepals only 1·5—3", corolla-tube 4—5".

There appears to be no connection between the size of the flowers and the relative lengths of style and stamens. Both forms of flower occur in the same locality so that there is no difficulty in recognising the identity of the plant. The B. & O. plant has often rather short pubescence on the calyx and connects *J. pubescens* with *J. undulatum*, Ker., which two species should perhaps be united.

Nadkarni states that the flowers are lactifuge and the roots emmenagogue. Lactifugal properties are also ascribed to other species.

3. *J. scandens*, Vahl.

A rather stout sarmentose shrub or climbing by means of its recurved petiole-bases which become hardened, stems glabrous, twigs sometimes thinly pubescent. L. ovate-lanceolate coriaceous larger 5—5·5" by 2" acuminate, base rounded, quite glabrous, minutely punctulate beneath, sec. n. only 3 and tertiaries faint. Petioles 5—6" prominently articulate, bases joined by a marked stipular often pubescent line. Cymes numerous, rather dense, axillary and terminating short lateral branches, 3-chotomous, branches 3-fld. Pedicel and campanulate calyx-tube together 1·5—2", sepals 1·2—1·5", usually 6, subulate pubescent divaricate and recurved and often joined at base by a narrow spreading limb. Cor-tube 3—3·5", petals 2·5—3", linear or linear-oblong and suddenly acute. Drupes often geminate ellipsoid black 4" by 3".

Northern and Southern Tract. Champaran! Mals of Orissa, rather common! Fl. Jan.—March. Fr. March—May.

Peduncles of cymes .5—6" or those of terminal cymes with a pair of leaves at base and 1—1.5" long.

4. J. arborescens, *Roxb.* Hundi, *K.*; Gada Hund Baha, *S.*; Bonomali, *Or.*

Sub-erect with a thick trunk or scandent, with young parts pubescent all over. Leaves very broadly-ovate to ovate, more rarely ovate-lanceolate, acute or usually acuminate, only 1.5—3" in flower, attaining 5" by 3.5" when mature and exceptionally 8.5" by 5.2"; sec. n. 4—8, of which 1—2 are close to base. Flowers white in lax 7—many-flid. 3-chotomous cymes. Pedicels .2—5" long. Sepals linear erect or somewhat spreading straight, sometimes sub-clavate, .04—12" long unequal. Corolla-tube .4—5", petals often 6, linear or narrow-oblong and acuminate, .5—7.5". Ripe carpel solitary oblong or ellipsoid, often curved, .5" long, nearly black.

One of the commonest Jasmines especially by the sides of rocky nalas. Gaya ghats! Santal P. Chota Nagpur, all districts! Orissa, all districts! Sambalpur! Kalahandi ("a mass of very fragrant flowers; rocky hill-sides and dry soils," *Cooper!*) Fl. April—May. Fr. June—July. Deciduous, renews leaves in March and April.

Branches, leaves and cymes nearly glabrous in fruit. Leaves sometimes ternate, punctulate beneath, often two very small ones at the base of the shoots. Petiole .25—4" or in very large leaves 7", articulate. First cymes sometimes 3—5-flid. only.

Var. Roxburghianum, *Wall.*, sp.

This is said (*Bengal Plants*) to have elliptic-oblong, often obtuse leaves persistently softly hairy both sides and minute narrowly triangular calyx-lobes. But I do not find that it consistently differs from *J. arborescens* in anything but the tomentose or softly hairy indumentum.

Hazaribagh! Also found in Upper Burmah.

5. J. strictum, *Haines* (*Kew Bulletin*, No. 8 of 1921).

An undershrub sending up from a woody rootstock annual strict stems 1—2 ft. high, quite erect and with no tendency to climb. Leaves mostly opposite, linear- or oblong-lanceolate gradually acuminate erect on the spreading or upcurved 1—2" long petiole. Cymes more or less pubescent or puberulous terminal and from the uppermost axils, 3—5-flid.

Grassy places on the Neterhat plateau, elev. 3000 ft. Fl. May—June.

Stems minutely puberulous. L. 3—3.5" long by .6—7.5" broad, gland-punctate beneath with thickened margin and 8—10 slender oblique sec. nerves looped inside the margin. Bracts setaceous. Calyx-tube produced beyond the ovary, teeth unequal erect linear .05—1" long. Flowers sweet-scented. Corolla-tube slender .35—4.5" long, petals 6—10, .4—5" long by .1" wide or less, linear acuminate. Fruit not seen.

6. J. auriculatum, *Vahl.* Chameli, *Vern.*

Scandent or more often in cultivation an erect bush with mostly simple ovate leaves, but some or all the leaves will be found to have a subsidiary pair of leaflets often reduced to mere auricles, thus making the leaves 3-foliolate.

Native of Southern India and Central Provinces but often cultivated in our area. Fl. April—August. Fr. Dec.—Feb.

Twigs usually densely pubescent. L. .7—2", acute or obtuse and mucronate with rounded base, thinly pubescent or densely pubescent on the nerves beneath and when young, rarely quite glabrescent. Petiole .05—2". Fls. .3—4" diam. in rather dense cymes terminal and from the upper leaf-axils the whole forming a corymb. Sepals minute or obsolete. Cor.-tube .3—4". Petals .25". Ripe carpels globose black .2—25".

7. *J. caudatum*, Wall

A glabrous climber with opposite 3-foliolate leaves with lanceolate long-acuminate or caudate leaflets, terminal 3—5" lateral rather smaller, sec. n. 5—7 hairy in the nerve axils. Petiole .5—1". Fls. in very slender axillary 1—7-fld. cymes with slender peduncles and long pedicels .3—7", sepals minute, being mere mucronations of the .1" long calyx, corolla with very slender .75—1.1" long (—1.25", *F. B. I.*) tube and finely acuminate petals .5—7". Ripe carpels obliquely-oblong .45".

Ramnagar Hills! Fl. Aug.—Nov. Fr. Feb.

8. *J. flexile*, Vahl.

A glabrous climber with opposite 3-foliolate leaves with ovate acute or acuminate leaflets, terminal 2—4" lateral rather smaller, sec. n. 5—7 hairy in the nerve axils. Fls. in slender lax axillary and terminal cymes, upper paniculate, sepals minute, corolla with tube .7—1" and acute or obtuse petals .5". Ripe carpels .3".

Meghasani (Mayurbhanj), rare, elev. 3500 ft.! Fl. Nov.—Feb. Fr. March.

There are no better characters for separating *J. caudatum* and *J. flexile* than those given in the key, and I think they should both be united under the name of *J. flexile*, Vahl.

The petiole in my specimen of *flexile* is only .3—4", but they are often longer than in *J. caudatum*, and apparently the plant climbs by them.

2. NYCTANTHES, L. (in part).

A small tree with opposite ovate leaves and mod.-sized flowers in small sessile bracteate heads disposed in terminal 3-chotomous cymes. Calyx ovoid-cylindric, sub-truncate, finally split or deciduous. Corolla salver-shaped white with an orange tube, petals 4—8 imbricate in bud. Ovule 1 in each cell, erect, basal. Fruit orbicular compressed papery or leathery, separating into 2 valves.

The germination is epigeal. The expanded cotyledons are palminerved orbicular 1" diam. with attenuate base and a petiole .3—75". The first leaves are coarsely serrate.

1. *N. arbor-tristis*, L. Saporom, K. S.; Kula marsal, M.; Harsinghar, H.; Sitik, Sephalika, Beng.; Kharkhasa, sihara Gond.? (in Sambalpur).

A small tree with usually drooping 4-angular branchlets, very scabrous ovate entire or somewhat toothed acute or sub-acuminate leaves 3—5" long and fragrant flowers .7—1" diam. which open in the evening and drop next morning. Capsule .75—1" diam., about .2" thick.

N. Champaran! Very common in the hills of the Central and Southern areas, especially on steep northern slopes and along rocky ravines! On some slopes of

sliding hæmatite-schist layered parallel to the surface it is sometimes the only tree, and as it coppices well is most useful for fuel. It is common as second-growth on the Rajmahal trap.

Fl. Sept.—Oct. Fr. Dec.—Jan. Deciduous April—May.

The seeds yield a medicinal oil, *Campbell*. This oil is not mentioned either by *Dutt* or *Nadkarni*, but the latter says that the powdered seeds are used in scurvy. The flowers contain an essential oil used in perfumery, and the orange tubes are used for dyeing. The leaves are sometimes used for polishing wood. The root is eaten, *Dillor*.

3. SCHREBERA, *Roxb.*

Tree with opposite odd-pinnate leaves and flowers in terminal 2—3-chotomous cymose panicles with small bracts. Calyx campanulate, with 4—7 small somewhat irregular lobes. Corolla salver shaped, petals 4—7 imbricate in bud. Stamens near top of tube. Ovules 3—4 in each cell, pendulous from its apex. Capsule obovoid or pyriform woody, loculicidally 2-valved. Seeds winged, albumen 0, cotyledons plano-convex or contorted, radicle superior.

1. *S. swietenioides*, *Roxb.* Sandapsing, *K.*; Akasara, *Ekasira, S.*; Gae-ka-lundi, *H.*; Chapsing, *Ghater, Kharw.*; Ghanto, *Uran*; Mukha, *Mokha, Or.*

A mod.-sized tree with 3—7-foliolate leaves, ovate, oblong or ovate-lanceolate leaflets 3—7" long, pale beneath and terminal panicles of whitish flowers closely covered with brown scales and 5—6" diam. Capsules drooping, pyriform, 2.5" by 1" verrucose with 2—4 large angular seeds in each cell.

Common in the hills of the Central and Southern areas, but rather local. Fl. May—June with the new leaves. Fr. Oct.—March. Deciduous Feb.—March.

Bark pale grey nearly smooth exfoliating in thin scales, blaze pale brownish-yellow with a rather grating or cheesy cut. Twigs pale lenticellate. Young leaves pubescent, mature 9—12". Lfts. articulate, opp., terminal sometimes 4.5" broad, all sub-acuminate, base narrowed into a short or very short petiole or that of terminal lft. 1—2", rhachis finely pubescent, sec. n. about 8 rather strong beneath, finely reticulate between. Inflorescence pubescent subcorymbose. Corolla-tube 5" long. Anthers slightly exerted. Cotyledons large crumpled.

Gamble says that the wood is brownish-grey, hard, durable and of good quality, in grain rather like boxwood. Wt. about 57 lbs. *Brandis* says that it is used for the beams of weavers' looms, for combs and in turning. It is not much sought after in our province, but is used for building small houses.

4. LINOCIERA, *Swartz.*

Trees or shrubs with opp. entire leaves and small white flowers in axillary, rarely terminal, cymes or panicles, sometimes clustered at the ends of peduncles which are axillary or from the axils of caducous scales, bracts small. Sepals small erect united into a very short tube at base. Petals long or short, nearly free or cohering by pairs, induplicate-valvate in bud. Style short. Ovules 2 in each cell, pendulous from its apex. Fruit a drupe. Seed usually solitary with thin testa, albuminous or not, radicle or superior.

Petals caudate, cohering in pairs. L. 2—4.6"
Petals not caudate, connate only at base. L. 3—8"

1. *malabarica.*
2. *intermedia.*

1. *L. malabarica*, Wall. Pochandia, Or.

A small or mod.-sized tree with very pale twigs, glabrous elliptic, oblong or obovate leaves 2—4.5", rounded obtuse or shortly cuspidate, rarely acute, with about 10 obscure spreading sec. n. looping within the margin. Fls. small white remarkable for the elongate caudate petals, .2—.25" long which adhere in pairs, clustered at the ends of axillary peduncles or of the branches of short panicles about 1" long, or peduncles solitary from the axils of caducous scales on the new shoots. Drupe .3—.5" obliquely oblong, endocarp thin, seed albuminous.

Mals of Puri, in evergreen forest, frequent! Angul and Narsingpur, near nalas and ravines! Fl. March—April. Fr. the following March—April. Evergreen, renewing leaves April.

Trunk 2—5 ft. girth. Bark light grey nearly smooth roughish with lenticels, blaze rough speckled light brown, soon darkening. Leaves with a thin pale margin. Petiole thick .15—.3" long, brownish. Inflorescence and calyx grey-sericeous. Fls. sessile or subsessile. Sepals ovate .05" or less. Young fruit with minute ciliate scales.

A fine wood, very like boxwood. Wt. 65 lbs. *Gamble*.

2. *L. intermedia*, Wight. Suliuli-Kuda, Deori Kuda, K.; Musurdanta, Or.

A small or sometimes a large glabrous tree with leaves 3—8", oblong ell-oblong or almost lanceolate oblong, shortly, usually suddenly acuminate, minutely dotted beneath, base tapering or acute, sec. n. 8—10 distinct both sides but fine, usually showing pale above when fresh, looped and tertiaries very reticulate, petiole .3—.9". Fls. small white in axillary pyramidal panicles 2—4" long. Drupe blue-purple pruinose oblong obtuse .3—.7" long, often oblique from insect puncture, exalbuminous.

Frequent near streams in the Central and Southern tracts! Singbhum! Ranchi ghats and Neterhat, elev. 3000 ft.! Santal P.! Mayurbhanj, ascending to top of Meghasani! Bonai, *Cooper*! Angul! Sambalpur! Kalahandi! Fl. Feb.—April. Fr. (takes a year to ripen) March—May. Evergreen, renews leaves at the time of flowering.

Attains 5 ft. girth with nearly smooth brownish bark and rather hard mixed white and brown blaze. Twigs pale brown often markedly lenticellate. Panicles at the base of the new shoots lax brachiate glabrous, the fls. in subsessile clusters on the branches. Sep. triangular. Petals nearly free .15" oblong with incurved margin.

Var. **Roxburghii**, *Clarke*, is separated by the panicles being smaller than in the type and the drupe under .5". The Bonai and Kalahandi plants have drupes .7—.6" and may therefore be considered so far typical, but there seems no sharp line of demarcation.

At the top of Parasnath is a small form which only I would refer to var. *Roxburghii*. It has erecto-patent oblong shortly suddenly acuminate leaves about 4.5" by 1.5" only, with weak nerves. Frt. blue pruinose .5" long, in my specimens *albuminous*! Possibly the endosperm is late in absorption. I have not seen the flowers, nor apparently had *Clarke*, and it might be a different species or genus.

5. OLEA, L. Olive.

Olea differs from *Linociera* in the longer tube of the corolla and the flowers are dioecious or polygamous. The albumen fleshy.

The small tree occurring on the top of Parasnath referred to under *Linociera*, of which the flowers have not been seen, has albuminous seeds and may be an *Olea*.

1. *O. dioica*, Roxb.

A small tree with ovate or ovate-lanceolate leaves or sometimes elliptic or oblanceolate leaves always toothed or serrate 4—7" long and slender lax panicles of flowers with a green or white corolla is frequently found in the Tarai and Duars and might therefore be found in Purneah. It flowers in March.

6. LIGUSTRUM, L. Privet.

Trees or shrubs with often conspicuously lenticellate branchlets and entire leaves; the pair of small bracts in the axils belonging to undeveloped axillary shoots sometimes resemble stipules. Flowers small white in terminal panicles. Calyx small truncate or 4-toothed. Corolla tube very short or long, petals induplicate-valvate in bud. Ovules 2 in each cell, axile near the top, style rather long, stigma subclavate 2-lobed. Drupe 1—3-seeded with endocarp thin or chartaceous. Testa thin, albumen fleshy, radicle superior.

Flowers .09—1" diam. Drupes .4—5" long

1. *robustum*.

Flowers .16—17" diam. Drupes .3—35" long

2. *Roxburghii*.

(The smallness of the drupes in *Roxburghii* may be due to their not being fully developed.)

1. *L. robustum*, Blume. Haduali, Or.

A large shrub or small tree (or, *vide* A. L. Banarjee, sometimes a big tree), with lenticellate twigs and pubescent shoots. Leaves glabrous, distichous membranous when young, lanceolate, ovate-lanceolate or elliptic, usually narrowed both ends, sometimes acuminate, 2.5—4.5" with about 8 sec. n., petiole .1—2". Flowers very small, .09—1" long just before petals spread and about .1" diam. after expansion, racemed and clustered on the obliquely spreading densely pubescent branches of terminal pyramidal panicles 6—10" long. Drupes .4—5 narrowly oblong, often slightly oblique.

Ravines in the Rajmahal Hills, rare! Mals of Puri near streams and on hillsides to the tops of the mountains! Fl. June—August. Fr. Dec.—Jan.

Branches compressed at the nodes, often bifurcate, pubescence curly. Sec. nerves 5—8 irregular and fine, obscure beneath. Petiole articulate at the base, the two first bracts of the axillary buds often simulate intrapetiolar stipules. Calyx campanulate, .05—06" long, minutely 4-toothed. Corolla-tube scarcely as long, petals oblong obtuse, ultimately spreading or reflexed. Bracts subulate, nearly equal to the .06" long pedicels in flower.

2. *L. Roxburghii*, Clarke. Haduali, Or.

Scarcely distinguishable from the last except by the larger flowers. The leaves seem to be usually smaller 1.5—3", sec. n. less prominent 5—6. Panicle glabrous or pubescent, brachiate (at least in fruit). Fls. .14" long just before petals spread, and .16—17" diam. after spreading, calyx .06" long. Drupes .3—35" long by .2—25" wide, oblong, slightly curved 1—2-seeded seated on the small 4-lobed calyx and thick .15" long pedicel.

Mals of Puri, Berberah!

My specimens are only in fruit, and flowers are required to make quite sure of the identification.

FAM. 88. SALVADORACEÆ.

Trees or shrubs, often spinose or with olive-grey foliage and opposite entire leaves and minute stipules. Fls. small clustered or paniced, dioecious or polygamo-dioecious. Calyx inferior campanulate or ovoid, 3—5-fid. Corolla gamo- or poly-petalous, 4-merous, petals imbricate. Stamens 4, hypogynous or on the cor.-tube, alt. with the petals, filaments sometimes connate. Ovary free, 1—2- or imperfectly 4-celled, style short, stigma entire or 2-fid. Ovules 1—2 in each cell, erect from the base, anatropous. Fruit a berry or drupe, mostly 1-seeded. Seed erect, globose, exalbuminous.

Corolla gamopetalous. Ovary 1-celled, 1-ovuled
Corolla polyperalous. Ovary 2- or pseudo-4-celled

1. *Salvadora*.
2. *Azima*.

1. SALVADORA, L.

Trees or shrubs. L. often fleshy or coriaceous. Fls. 2—1-sexual, spicate or racemose on the branches of axillary and terminal panicles with minute bracts. Calyx-lobes 4. Cor. campanulate, lobes 4 and tube sometimes with 4 small teeth between the bases of the filaments (staminodes?). Stamens 4 on the tube. Ovary 1-celled, style 0, stigma truncate. Ovule 1. Fruit a globose drupe seated on the slightly enlarged calyx, endocarp crustaceous (but see note under *S. persica*).

1. *S. persica*, L. Jhak, Vern. (*fide Prain*); Pilugach, Or.

A large straggling shrub or small crooked tree with spreading and weeping branches, opp. coriaceous or fleshy ell.-oblong leaves, and copious panicles of minute greenish-white flowers or small 1-seeded berries (or drupes, see note). The crushed plant, especially the fruits, has a pungent odour of cress by which it is easily recognisable.

Western Bihar, *Bengal Plants*. Mahanadi Delta, Orissa! Fl., Fr. April—May. *Roxburgh* says that it flowers and fruits all the year round. Evergreen. *Renews* leaves in May.

Bark deeply cracked. L. 1.25—2" rounded both ends, sec. n. 3—4 scarcely visible; by transmitted light the chlorophyll cells appear separated by thick translucent walls. Stipules minute connected by a line. Petiole .2—3". Panicles, including those from the uppermost axils, 4—8" long with long slender opposite branches ending in the minute scattered flowers. Pedicels articulate .05" in flower, .1" in fruit. Fls. .07" long, sepals rounded, petals oblong-obovate with slightly inflexed tip, stamens shorter than corolla. Ovary minutely pedicelled. Berry .2" diam. Seed embedded in pulp with green testa and large green embryo with orbicular plano-convex cotyledons.

The bark of the root is a vesicant.

Note.—The fruit is usually described as a drupe, but in my specimens there is no sign of a hard endocarp, and *Roxburgh* describes the "berry smooth red juicy"!

2. AZIMA, Lamk.

Rambling shrubs with axillary thorns. Fls. dioecious, very small sessile clustered axillary and from leaf-suppression more or less spicate

or paniced, bracteoles linear. Calyx campanulate or urceolate 2—4-lobed or -fid. Petals 4 oblong, nearly free, imbricate in bud. Stamens 4, hypogynous. Ovary 2-celled, stigma subsessile, large, 2-fid. Ovules 2—1 in each cell. Berry globose, 2—1-seeded (or drupaceous with membranous endocarp).

1. **A. tetracantha**, Lamk. Syn. *Monetia barlerioides*, L'Herit.; *Tri-kantajati*, Beng. (*vide* Roxb.).

A formidably armed shrub with the thorns often 4-nate (paired in the leaf axils), hairy twigs and glabrous coriaceous leaves reminding one of a *Carissa*. L. ovate to lanceolate (‘or elliptic with cuneate base’), with 1—3 sec. n. only. Fls. very small yellowish, .07” (*Clarke* describes them as .5” diam.!). Berry .3—5” diam. white when ripe, 1—2-seeded.

Scrub jungles near the coast. Balasore! Puti! Fl., Fr. April—May.

Thorns straight .6—1” long on the twigs, lower part often green, tips needle-like. L. shining both sides, larger 2” by 1.6”, base (in my plants) rounded, margins recurved, apex spinulose, petiole .15”. Upper bract-leaves sparsely hairy. Calyx urceolate silky with recurved lobes. Petals green membranous oblong recurved .1”.

The berries are eaten.

FAM. 89. APOCYNACEÆ.

Trees, shrubs or, rarely, herbs, often twining and usually with milky juice. Leaves opposite or whorled or in some introduced species (*Plumeria*, *Cerbera*, etc.), alternate, quite entire simple exstipulate.* Flowers regular, 2-sexual, cymose or paniced. Calyx inferior with 5, rarely 4, imbricate lobes, often with glands at the base within. Corolla rotate or salver-shaped with lobes spreading, rarely funnel-shaped, lobes contorted and often twisted in bud (valvate in *Parsonsia*). Stamens as many as lobes, on the corolla with short filaments, anthers usually conniving over the stigma and sometimes adhering to it but not forming a column (as in most *Asclepiadaceæ*), pollen granular. Disc often present, consisting of glands or annular or cupular. Ovary 2-celled (1-celled in the American genus *Allamanda*) or usually of 2 more or less distinct carpels united by the style, the top of which is usually enlarged. Ovules 2—many in each cell, rarely 1 only. Fruit of free or connate follicles, more rarely a berry, or drupe. Seeds often with a coma of silky hairs or winged, albumen present or not, cotyledons flat concave convolute or contorted, radicle usually superior.

The family abounds in important rubber-producing plants, especially in Africa. The juice is frequently poisonous.

1. Anthers not attached to the stigma (though often conniving round its top), anther-cells not spurred:—

A. Ovary syncarpous, style entire at base:—

1. Ovary 1-celled. Cultivated shrubs with very large fls.

1. *Allamanda*.

2. Ovary 2-celled:—

Armed shrubs. Ovules few

2. *Carissa*.

* But sometimes with a stipular line and stipule-like glands.

- Unarmed shrubs. Ovules many. Only occasional in gardens
- Melodinus* (p. 562).
- B. Ovary with the two carpels often appressed but distinct (sometimes united below in *Rauwolfia*) in flower, style split at base:—
- I. Leaves alternate:—
- a. Ovules few in each carpel. Frt. drupaceous or baccate:—
- Calyx glandular. Flowers large yellow
Calyx eglandular. Fls. white or red
3. *Thevetia*.
Cerbera (p. 562).
5. *Plumeria*.
- b. Ovules many. Fruit follicular
4. *Kopsia*.
2. Leaves opposite:—
- a. Ovules 2 only in each carpel. Frt. sub-baccate
6. *Vinca*.
- b. Ovules many in each carpel. Fruit follicular:—
- i. Herbs or undershrubs. Fls. white or pink
7. *Tabernamontana*.
8. *Holarrhena*.
- ii. Trees or shrubs. Flowers white:—
- Calyx glandular. Follicles stout fleshy
Calyx eglandular. Follicles long slender
9. *Rauwolfia*.
3. Leaves whorled:—
- Shrubs or undershrubs. Ovary sub-syncarpous.
Frt. drupaceous
Trees or shrubs. Ovary apocarpous. Frt. of slender follicles
10. *Alstonia*.
- II. Anthers adhering to the stigma by a point on the connective (usually leaving a drop of latex when torn away), anther-cells produced downwards into a subulate empty spur:—
- A. Mouth of corolla with scales:—
1. Erect trees or large shrubs. Fls. white or coloured:—
- L. whorled. Anthers included
L. opposite. Anthers exerted
11. *Nerium*.
12. *Wrightia*.
2. Climbers. Fls. pale-coloured, petals caudate
13. *Strophanthus*.
- B. Mouth of corolla without scales. Climbers:—
1. Anthers more or less exerted. Carpels more or less connate in flower:—
- Lobes of corolla linear-oblong, valvate
Lobes of corolla broad, contorted
14. *Parsonsia*.
15. *Vallaris*.
2. Anthers included:—
- a. Flowers very large, white:—
- Corolla campanulate. Carpels connate
Corolla salver-shaped. Carpels not connate
16. *Beaumontia*.
17. *Chonemorpha*.
- b. Corolla mod.-sized or small:—
- i. Tips of corolla-lobes not deflected in bud:—
- Fls. m.s., sepals long
Fls. small, sepals minute
18. *Aganosma*.
19. *Anoderidron*.
- ii. Corolla lobes deflexed at the tip in bud:—
- Flowers very small, follicles very slender
20. *Ichnocarpus*.

1. ALLAMANDA, L.

Shrubs, usually climbing, sometimes small trees, with opposite and whorled leaves, entire and shortly petioled with intra-petiolar glands. Flowers very large, usually yellow, in few-fl'd. terminal and axillary cymes. Corolla with a short tubular base, then suddenly campanulate, lobes rounded contorted to the left, throat with a ring of ciliate scales. Ovary 1-celled with 2 parietal placentæ and many ovules. Fruit globose with numerous stout green prickles, finally 2-valved.

An American genus of which there are now several species common in gardens in our province. The most frequent is probably *A. cathartica*, L., with very large yellow flowers 3—4" across. It is a climber, but often seen sub-erect from being pruned.

2. CARISSA, L.

Thorny, often 2-çhotomously-branched shrubs, often scandent, with opposite coriaceous leaves and milky juice. Flowers small or m.s., white or pinkish, in 3-çhotomous cymes. Calyx 5-partite. Corolla salver-shaped, throat naked, lobes overlapping to right. Stamens at top of tube, included. Disc 0. Ovary 2-celled, style filiform, stigma large, minutely 2-fid. Ovules 1—4 in each cell. Berry 2-, or by abortion, 1-celled. Albumen fleshy, cotyledons ovate.

Note.—In the *Indian Forester* for July, 1919, there are figures of the species here dealt with, but at the time of writing that article it was not known that the Linnean *C. spinarum* is really Roxburgh's *C. diffusa*; the synonymy of the species as named in that article is therefore given below.

- | | |
|--|------------------------|
| I. Cells of ovary 1-ovuled. Leaf-nervation obscure | 1. <i>paucinervia</i> |
| II. Cells of ovary 2-ovuled. Leaf-nervation distinct:— | (<i>opaca</i>). |
| A. L. never acuminate, apiculate. Thorns straight:— | |
| Diffuse shrub. L. broadly ovate, venose, 6—1.6". | |
| Cor.-tube 4—5.5". Petals 2—4" | 2. <i>spinarum</i> . |
| Scandent shrub. L. ovate to oblong, 1—2". Cor.- | |
| tube 5—6". Petals 3—4" | var. <i>scandens</i> . |
| B. L. acuminate, not mucronate. Thorns often curved. | 3. <i>inermis</i> . |
| III. Cells of ovary 4-ovuled. Leaves elliptic or oval with | |
| rounded ends | 4. <i>carandas</i> . |

1. *C. paucinervia*, A. DC. Inc. *C. opaca*, Stapf, and *C. gangetica*, Stapf.* Syn. *C. spinarum*, Lamk. (*non* L.); *C. spinarum*, F. B. I., and of most other authors in whole or in part; *C. spinarum*, *typica*, and *C. spinarum*, var. *paucinervia*, Haines, in *Ind. Forester*, *loc. cit.*, figs. 2 and 3; Kanuwan, K.; Karwah-janum, Karwar', S.; Jangli Karaunda, H.

A rigid 2—3-çhotomously branched erect shrub, sometimes sub-arboreous, with pairs of divaricate straight often forked thorns 1—2" long. Leaves 5—1.8" from narrowly elliptic-oblong to broadly ovate, acute and apiculate, with usually acute or rhomboid base, pale beneath, sec. n. 2—3, rarely 4, faint when fresh (sometimes conspicuous in the herbarium). Petiole .07—1.5". Flowers small white star-like, very slender in usually 2-nate terminal lax puberulous cymes with peduncles up to 1". Corolla-tube .25—3.5", petals 2—3" acuminate. Ovules 1 only in each cell. Fruit ellipsoid to sub-globose, .25", black when ripe.

* Since writing the above I have learnt from Mr. Gamble, who knows the typical *C. paucinervia* in the Nilgherries, that that species is really quite distinct, and that the plants so named from Monghyr and other plains localities in *Herbaria* (see also F. B. I., iii, p. 631) are errors of identification. If it be conceded that these latter are not *C. paucinervia*, then one of the chief reasons for my uniting *opaca* and *gangetica* under varieties of *paucinervia* disappear and our plant should be called *C. opaca*, Stapf., as I understand will be done in the *Flora of Madras*. Mr. Gamble also keeps variety *gangetica* distinct. This requires further investigation in the field.

If *C. paucinervia* is really distinct, then the shrub so named officially, growing in the Calcutta Botanic Gardens, must also be an error of identification.

Common in the dryer and less forest-covered tracts. Gaya! Monghyr, *Ham.*! Hazaribagh! Ranchi, chiefly near the ghats! S.P. in the west! Manbhum in the north! Sambalpur, rather scarce! Fl. March—May and sporadically up to September. Fr. Nov.—Dec. and onward to March. Evergreen. New shoots March.

Rarely diffuse (var. *hirsuta*). Twigs glabrous, puberulous or very pubescent when young. L. usually ovate with rhomboid base, but basal angle of lower larger leaves wide, more rarely leaves (typical *paucinervia*); narrowly ellipsoid or lanceolate-rhomboid, usually glabrous. Cymes rarely solitary, or sessile or axillary. Sepals .07—.08". Petals narrowly linear-lanceolate, often puberulous. Anthers near top of tube.

Stapf (m.s.) divides the species into three, as follows:

α. *paucinervia*, *A. DC.* L. lanceolate, acute, 2.5—3 cm. by 1—1.5 cm. Corymbs 3—5-fld. Cor.-tube 7—9 mm., lobes 3—4 mm.

Monghyr, *Ham.*! Occasional in Chota Nagpur! but the type is from the Nilgherries.

β. *opaca*, *Stapf.* L. broadly ovate-elliptic to elliptic-oblong. Branchlets pubescent to tomentose. L. broadly ovate-elliptic to ell.-oblong, 1.5—3.5 cm. by 1—2 rarely 2.5 cm. Cor.-tube 7—8 mm., lobes 5—7 mm.

This is one of the common forms originally usually recognised as *C. spinarum*. It apparently includes var. *hirsuta*, of *Herbaria* (*Ind. For.*, l.c., p. 387), which is sometimes diffuse or sub-erect and often with pubescent leaves when young. This occurs in Hazaribagh, *Wood!* and occasionally in other parts of Chota Nagpur.

γ. *gangetica*, *Stapf.* Branchlets glabrous. L. 3—5 cm. by 1.5—3 cm. Cor.-tube about 78 mm., lobes 4—6 mm.

The commonest form in our area. But the size of the leaves is immensely variable on the same plant, and I do not think it is separable from *opaca* even as a variety.

The leaves are used for tanning. The fruit is eaten.

2. *C. spinarum*, *L. Syn. C. diffusa*, *Roxb. (Ind. For., loc. cit., figs. 4 and 5)*; *C. spinarum*, *F. B. I.* in part only; Anku-koli, San Karendra, *Or.*

A dwarf shrub with very numerous diffuse or sub-erect branches, or scandent. Branches subglabrous or usually pubescent with straight simple or forked divaricate thorns. L. '6—2.5" broadly ovate to broadly oblong with sub-cordate or rounded base, very shining, with 3—6 sec. n. conspicuous and raised above when dry, spreading and then arched or looped well forward and reticulating with several shorter ones from the midrib, apex acute or obtuse and apiculate. Petiole 0—.08". Fls. in close terminal or axillary pubescent sessile or shortly peduncled, often many-fld. cymes; corolla-tube '4—.55" thinly pubescent, anther-swelling above middle of tube; petals '3—.4" or only '2", oblong or oblong-lanceolate, not acuminate. Ovules 2 in each cell. Fruit ovoid or elliptic.

Orissa, from Balasore southwards, not far from coast! Very common in the laterite scrub jungles.

The two following forms may be distinct species, but are more probably one depending upon locality, whether in the open or with other forest growth, and especially upon the prevalence or otherwise of browsing.

α. *diffusa* = the type in the Linnean herbarium. Dwarf (perhaps from the sarmentose shoots always being browsed). L. nearly all ovate '6—1.6" only. Cymes congested subsessile. Corolla-tube '4—.55". Berry '3—.4". Seeds usually 4. (*Ind. For., loc. cit., fig. 4.*)

β. scandens. Widely scandent with long straight thorns 1" or more on the branches. L. 1.5—2.5" very obtuse or subacuminate with petiole .1" long. Cor.-tube .5—6", lobes .3—4" lanceolate. Berry nearly .5", usually 2-seeded. The pedicels and flowers sometimes pink. (*Ind. For., loc. cit., Plate 19, fig. 5.*)

Same localities but in the forests, whereas the first occurs only in scrub.

3. *C. inermis*, *Vahl.* Syn. *C. Dalzellii*, *Bedd.*; *C. macrophylla*, *Wall*; *C. suavissima*, *Bedd.*? (*Ind. For., loc. cit., figs. 6 and 7*); Kerenda, *Or.*

A very stout woody climber with large conical thorns on the trunk and nearly straight or usually somewhat curved divaricate thorns .5—7" long on the branches. Twigs glabrous. L. less coriaceous than in the other species, lanceolate or broadly or narrowly ovate, acuminate, 2—3.5" or sometimes 4.5", tip scarcely mucronate, base very obtuse or rounded or cuneate on the petiole, sec. n. 2—3 from near the base and 2—3 weaker ones above, all rather indistinct. Petiole .15—2. Cymes contracted, terminal and axillary, subsessile 3-fld. or 3-chotomous, pedicels .15". Sep. subulate acuminate or tip setaceous, ciliolate .1". Cor.-tube .75—9" glabrous, petals 5—6, lanceolate-oblong or linear .5—7" with slender acuminate tip. Ovules 2 in each cell. Berry globose .7" diam. (unripe?).

Mals of Orissa, sometimes on the tops of the hills, in the forest! Fl. April. Fr. May.

This agrees neither with the description in the *F. B. I.* of *C. macrophylla*, nor of *C. suavissima*, *Bedd.*, but it matches *Wallich's* No. 1679c. The climbing habit and globose fruit separates it from *macrophylla* of *F. B. I.*, the smaller flowers and the smaller fruit and strong thorns from *suaivissima*, but the Oriyas say that the fruit sometimes does attain 1".

Var. *inermis*, proper (*Ind. For., fig. 7*).

L. ovate, with cuneate or rounded base.

Var. *macrophylla*, (*Ind. For., fig. 6*).

L. lanceolate acuminate, base cuneate.

Var. *Dalzellii*,

This is described as an erect shrub without spines between the leaves of the flowering branchlets. L. ovate to ovate-lanceolate, long-acuminate, usually acute at the base, quite twice as long as broad. The habit appears to be the only tangible difference, and this requires confirmation.

4. *C. carandas*, *L.* (*Ind. For., loc. cit., fig. 1*).

A large shrub or small crooked tree with rigid dichotomous branches and pairs of divaricate very strong often forked thorns 1—2" long. Leaves 1—3.5" broadly elliptic-oblong or oblong with rounded or very obtuse sometimes retuse ends, usually muticous, green both sides, sec. n. 4—8 looping and connected with intermediate and tertiaries, raised above when dry and distinct, petiole .1". Fls. in rather lax usually binate terminal peduncled cymes with peduncles up to 1"; pedicels often slender and .2" long; corolla tube .6—7"; petals oblong, .4—5"

Ovules 4 in each cell. Berry ellipsoid, .5—7", or in cultivation 1", 4 or more-seeded.

Very commonly cultivated in all districts for its fruit.

Melodinus monogynus, Roxb., is a large climber with Jasmine-like flowers and an apple-like fruit. It is native not far from Purneah and is sometimes cultivated in gardens.

3. THEVETIA, Juss.

1. **T. neriifolia**, Juss. Pila Kaner, *H.*; Zurd, *Kanel*; Kokla-phul, Champa, *Vern.*; Konyar-phul, *Or.*; Berenjo, *S.*

A large evergreen shrub or small tree with crowded alternate 1-nerved linear leaves and large yellow funnel-shaped flowers 1.5—2" diam.

The pericarp of the fruit when nearly rotten easily breaks into 2 valves and the endocarp also finally breaks into 2 valves before germination.

Common in all gardens and semi-wild in the Maniband forest in Khurda! Fl. Fr. most of the year. Native of tropical America.

L. 3—5" tapering both ends, glabrous, margin revolute. Cymes sub-terminal shorter than the leaves, few—1-fld. Ovary of two more or less connate carpels flat on their inner faces. Ovules 2 in each carpel. Drupe sub-globose, green.

It is easily grown from seed and is of very quick growth.

4. KOPSIA, Blume.

Glabrous trees or shrubs with opposite leaves. Flowers in terminal cymes. Calyx 5-partite, eglandular within but sepals with glandular tips. Corolla salver-shaped, tube very slender, throat hairy. Stamens near the top of the tube. Disc of 2 glands. Carpels distinct, style thickened at top. Ovules 2 in each carpel, 1 on either side of a thick placenta. Fruit of 2 short stout coriaceous or rather fleshy carpels, each 1-celled or 2-celled by the intrusion of the placenta.

1. **K. fruticosa**, A. DC. Syn. *Cerbera fruticosa*, *Ker.*

A large spreading evergreen shrub, bearing large handsome lanceolate leaves and very pretty rose-coloured flowers somewhat resembling those of *Vinca rosea*.

Native of Burma, often cultivated.

Cerbera odollam, Gaertn., is a large shrub or small tree wild in the Sunderbans and Chittagong and possibly occurring in the Mahanadi delta. *Cerbera* has scattered alternate leaves and funnel-shaped corolla and the fruiting carpel or carpels has a thick fibrous and woody pericarp.

5. PLUMERIA, L.

Small trees with very thick branchlets scarred with the bases of the fallen petioles. Leaves alternate large, entire, deciduous, with numerous secondary nerves spreading almost at right angles to the mid-rib and joined in an intramarginal nerve. Flowers showy in terminal corymbose cymes, in pairs in the axils of large caducous bracts. Calyx

perigynous, sepals 5, broad, obtuse. Corolla funnel-shaped with a slender tube and 5 large oblong petals. Anthers subsessile at the base of the tube. Ovary almost inferior, of 2 ovoid carpels adherent by their backs to the torus, and connected only at the apex by the swollen stout style with mitriform stigma. Ovules many. Fruit of two stout follicles. An American genus.

1. **P. acutifolia**, Poir. Gulachin, Gulchin, Vern.; Gulainchi, H.; Gulanj baha, Champa pungar, S.; Pagoda Tree; Spanish Jasmine.

Leaves oblong but more or less tapering both ends, 8—12" long. Flowers white with a yellow centre, very fragrant in short umbellately divided cymes on a long peduncle, petals obovate-elliptic, 1.5" long; tube .5—7", hairy within.

Very common in gardens. Deciduous in the c.s. Fls. h.s. and r.s.

2. **P. alba**, L.

Leaves darker green, obtuse, with narrowly revolute margin. Fls. subspicate on the branches of the corymbose panicle, pure white. Petals 2" oblanceolate with rounded tip.

Frequent but less common than the last.

3. **P. rubra**, L. Frangipani, Vern.

Bears dense heads of pretty red flowers.

All the species are sometimes called *Frangipani*. There are others in cultivation but less common. All are easily raised from cuttings.

6. VINCA, L. Periwinkle.

Herbs or shrubs with opposite entire leaves and axillary flowers. Calyx 5-partite with narrow sepals. Corolla salver-shaped, throat constricted, tube with reflexed hairs below the included stamens. Disc of 2 large glands. Carpels distinct, style with thickened top and annulate viscid stigma sometimes with a reflexed membrane. Ovules 6 or more in each carpel. Follicles 2, slender. Seeds truncate each end.

Leaves lanceolate. Fls. .25" diam.

1. *pusilla*.

Leaves ovate to obovate. Fls. 1—2" diam.

2. *rosea*.

1. **V. pusilla**, Murr.

A small erect herb 6—15" high with acutely 4-angled stems. Leaves 1—2.5", lanceolate acuminate with minutely scabrid edges, otherwise glabrous, stipular glands subulate, petiole .2—2.5", slender. Flowers white, sepals .15" filiform. Corolla-tube .3—4" long, swollen above. Follicles 2—3" long, very slender, diverging, membranous.

Frequent in cultivated land. Chota Nagpur! Fl., Fr. r.s.

2. **V. rosea**, L.

A beautiful herbaceous or somewhat suffruticose plant 1—2 ft. high with deep green polished oval, obovate or oblong leaves and pure white or deep rose-coloured flowers usually paired and sessile in the

axils. Base of petiole 2-glandular. Corolla 1—2" diam. Follicles .9" long.

Very common in gardens. Fl., Fr. all the year round, and often self-sown. Probably native of America.

7. TABERNÆMONTANA, Br.

Trees or shrubs. Flowers white in axillary and terminal cymes. Calyx 5-lobed or -partite, glandular within, rarely eglandular. Corolla salver-shaped, petals oblong or suborbicular. Stamens about middle or below middle of the tube. Disc 0. Carpels distinct, style with top urceolate ovoid or clavate, stigma short or long, 2-lobed. Ovules usually many and many-seriate. Follicles ovoid or oblong, often curved, dry coriaceous or fleshy with the seeds buried in pulp, grooved on one face, smooth striate or rugose. Albumen fleshy, sometimes ruminant. Cotyledons ovate, radicle long or short.

1. *T. coronaria*, Br. Syn. *Ervatamia coronaria*, Stapf; Chandni, Vern.; Tagar, H.

A very handsome bushy shrub with dark green foliage paler beneath and pure white flowers.

Very commonly cultivated and apparently wild in Purneah! This is not unlikely, as I have found it undoubtedly wild in Sikkim and the foothills of Sikkim and Bhotan. The *F. B. J.* says that the native country is unknown! Bettiah, *Hieronymus* (wild?)! Fl. h.s. and r.s. Fr. c.s. Evergreen.

Leaves glabrous shining mostly unequal in each pair, the larger 4—5" long, oblong-ob lanceolate acuminate or caudate, rarely obovate, sec. n. fine, 5—6, petiole .25—4", axils glandular. Flowers 1.5—1.8" diam. Calyx .1" long only with obtuse or rounded lobes. Cor.-tube .8—1" slender, petals obliquely obovate, or ovate-oblong obtuse, rounded in the wild form, sometimes acute in the cultivated. Follicles 1.5—2" long, spreading and recurved, coriaceous, sessile or stipitate, turgidly oblong, 3—7-ribbed, inside orange or red and seeds with a fleshy red aril.

A double-flowered form is very common in gardens. The flowers have no scent by day but are sometimes fragrant at night.

8. HOLARRHENA, Br.

Trees or shrubs. Flowers white in terminal or subaxillary corymbose cymes. Calyx usually glandular within, lobes small. Corolla salver-shaped throat contracted, naked, petals overlapping to the right. Stamens near the base or low down in the tube, anther-cells rounded at the base. Disc 0. Carpels 2 distinct, style short, stigma oblong-fusiform entire or 2-toothed, ovules many. Follicles 2 long slender, terete. Seeds linear or oblong, compressed concave with a coma. Albumen scanty. Cotyledons complicate broadly ovate palmi-nerved, hypocotyl long on germination which is epigeal.

1. *H. antidysenterica*, Wall. Koriya, Th.; Dudhia (Monghyr), Vern.; Kuar, Tuar, K.; Hat, S.; Kurchi, H., Beng., Koraiya, Kharw.; Korkoria, Uran.; Kurdu, Mal P.; Samoka, Gond.; Kure, Kuda, Khurni, Or.; Khorhoi, Khond.

A large shrub or small tree with somewhat distichously spreading subsessile ovate to elliptic-oblong leaves 6—12" by 1.5—5", strongly

nerved beneath and terminal corymbose cymes 3—6" wide of sweet-scented white flowers .75—1.5" diam. Follicles slender divaricate 6—9" (16", *F. B. I.*) long by about .16" broad. Seeds (Indra-jao, Inderjao, *H.*) linear-oblong, .5" long, with a long brown coma.

Very common in all districts. Sometimes sub-gregarious. Frequent on the Khurda laterite, but usually prefers damp localities. Fl. May—July. Fr. Dec.—Feb. Deciduous Feb.—April. It flowers on the new shoots.

Bark thick smooth. Blaze brownish exuding latex from the layer next the wood. Twigs and leaves glabrous, pubescent or tomentose. L. with a rounded apex or obtusely acuminate, base usually obtuse or rounded, the first pair of leaves on a twig are usually broadly elliptic and only 3" long, sec. n. 8—13. Sep. .1". Corolla-tube .4" pubescent, petals .5—6" or longer.

The bark and seeds are an excellent cure for chronic dysentery. A case in Singbhum of nearly a year's standing was cured in a few weeks. The leaves are distasteful to cattle and goats.

9. RAUWOLFIA, *L.*

Shrubs or undershrubs with 3—4-nately whorled, rarely opposite leaves which have glandular axils. Fls. rather small, white or pink, in 3—4-nate terminal cymes alternating with the leaves and sometimes becoming lateral through the growth of the branch in fruit. Calyx eglandular within. Corolla tubular-funnel-shaped or salver-shaped, sometimes sub-irregular, throat usually densely hairy within and concealing the anthers in the tube, lobes overlapping to the left. Disc large cupular or annular. Carpels distinct or connate. Style filiform, stigma broad calyptriform at the base, tip 2-fid. Ovules 2 collateral in each carpel. Ripe carpels drupaceous, distinct or connate, usually 1-seeded. Seeds ovoid, albumen fleshy, cotyledons flat.

Glabrous. Leaves mostly over 4"
Pubescent. Leaves mostly under 4"

1. *serpentina*.
2. *canescens*.

1. *R. serpentina*, *Benth.* Chandra, *Beng.*; Patalgarur, *Or.*

A pretty glabrous undershrub 1—2 ft. high bright green shining opposite and 3—4-nately whorled oblong or obovate rather membranous leaves 3—7" long, and small white flowers with pink tubes in terminal peduncled bright red cymes. Drupes polished green and finally black .25—5" diam.

In grassy usually damp places. Singbhum rare! Puri! Angul, *Chattarjee*. Fl. May—July. Fr. July—Sept. Sometimes also seen in gardens in flower and fruit at other times.

Leaves acute or acuminate with 8—12 slender sec. n., paler beneath, petiole .25—7" long. Peduncle 2—3" long. Pedicels bright scarlet. Bracts minute subulate. Corolla-tube slender .7—9" long, often curved, petals about .2". Anthers a little above the middle of the tube. Endocarp slightly rugose.

A reputed cure for snake-bite.

2. *R. canescens*, *L.*

A spreading 2-chotomously branched shrub with pubescent branches, 3—4-nately whorled leaves, very small white flowers and pretty red berries.

Orissa, near Cuttack, etc., apparently an escape from cultivation! Fl., Fr. April—June. Native of West Indies.

L. usually in two unequal pairs in a whorl, larger 2.5—3.5", smaller about 1" ell.-oblong or ell.-obovate, softly pubescent, not shining, acute, sec. n. about 12, very fine spreading, petiole .1—25" with subulate glands. Fls. in 3—4-nate cymes, at first terminal, peduncles .2—1" long usually 3—5-fld. Calyx urceolate pubescent. Cor.-tube pubescent .2" long, lobes rounded, one-fourth the tube. Ovary entire slightly 2-lobed, cells 2-ovuled. Fruit .25" diam. globose, containing 2, 1-seeded stones, seated on the spreading somewhat enlarged calyx.

10. ALSTONIA, R. Br.

Trees or shrubs with 3—4-nately whorled leaves and mod.-sized flowers in subterminal corymbose cymes. Calyx short. Corolla salver-shaped, throat naked, annulate, or with reflexed hairs. Stamens near the top of the tube, included, anthers subacute. Disc sometimes 0. Carpels distinct, style with ovoid or oblong top and minute or 2-toothed stigma. Ovules many, and many-seriate. Follicles 2, linear, slender, distinct. Seeds oblong or linear, flattened, peltately attached, often ciliate, albumen scanty, cotyledons oblong, flat.

A. Leaves with close parallel secondary nerves. Petals overlapping to left:—

Tree. L. obtuse or obtusely acuminate

1. *scholaris*.

Shrub. Leaves finely acuminate

2. *venenatus*.

B. Leaves with distant nerves. A tree, cultivated only

3. *macrophylla*.

1. **A. *scholaris***, *Brown*. Kunumung, K.; Chatni, S.; Chatawan, H.; Chatina, Or.; Chhatanda, Gond (? Angul).

A large usually straight handsome tree with the branches and leaves whorled, leaves 3—7 usually 6 in a whorl, 4—8" long, whitish beneath. Flowers greenish-white in umbellately branched cymose panicles. Fruit of two slender pendulous follicles 1—2 ft. long.

In the damper districts throughout the province, never very common. Purneah! Chota Nagpur, in valleys, not common! S.P., in valleys! Puri! Angul! Orissa States, fairly common, *Cooper*. Narsingpur! Fl. Nov.—Jan. Fr. r.s. Evergreen.

Attains 6 ft. girth. Bark nearly smooth, blaze moderately hard, mottled brown and cream, then white with a copious flow of milk. L. glabrous oblanceolate to obovate obtuse or retuse (or obtusely acuminate, *F.B.I.*), narrowed into a .25—5"-long petiole, sec. n. very numerous close horizontal. Inflorescence puberulous, peduncled or sessile, branches 2—4" with often 2—3 whorls of secy. branches .25—1" long and flowers subcapitate at the ends. Corolla .3—5". Disc 0. Ovary hirsute. Follicles .12" diam. terete, clustered. Seeds .3".

"The wood is not durable but is easily worked. It is used for boxes, furniture, scabbards and other purposes. Wt. about 28 lbs. per c. ft.," *Gamble*. It used to be occasionally sold for tea-boxes in the Duars. The bark is described (*Dutt*) as tonic, alternative and useful in fever and skin diseases.

2. **A. *venenatus***, R. Br.

A shrub sometimes 20 ft. high with numerous erect stems and mostly 3-nately whorled, linear or oblong-lanceolate long-acuminate leaves 4—12" long. Flowers pure white in terminal 2-chotomous cymes much shorter than the leaves. Calyx glabrous with ciliate sepals, very small. Corolla tube very slender .75—1" long with the anther swelling near the top, petals, .5". Follicles slender terete 3.5—4" long by .2—25" wide in middle, tapering both ends and with a long beak .7—1" long.

Ravines in the Angul hills, rare! Kalahandi, *Cooper*! Fl. April—May also July. Fr. Feb.—May (it probably flowers at various times and fruits soon after).

Bark delicately rugose, blaze green, greenish-yellow and white. The green is much more diffused in the bark than in most trees.

Leaves with very numerous spreading strong sec. parallel nerves united in an intra-marginal one, softly hairy beneath but more or less glabrescent with age.

3. *A. macrophylla*, Wall.

A small or large tree with oblanceolate 4-nately whorled leaves 9—12" long and white fragrant salver-shaped flowers in corymbose cymes. Cor.-tube .2" long, petals oblong nearly as long as tube, ciliate. Follicles 9—12" slender.

Introduced, native of Penang, Java, etc., now frequently seen in gardens, where it flowers as a small tree.

Leaves with about 20 sec. n. reaching nearly to the margin and then running nearly parallel with it, hairy beneath, petiole short. Calyx pubescent .04" with broadly ovate lobes. Seeds oblong .25" brown-tomentose and bearded with long brown hairs, peltately attached to placenta.

11. *NERIUM*, L. Oleander.

Glabrous shrubs with 3—4-nately whorled, rarely opposite, narrow coriaceous leaves with numerous close slender spreading sec. n. Flowers large in racemose cymes. Calyx glandular within. Corolla salver-shaped with a narrowly funnel-shaped tube, throat with 5 broad toothed or fimbriate scales opposite the petals which are obovate and overlap to the right but twisted to the left. Stamens at the top of the tube included, anthers sagittate adhering to the stigma, tips filiform, cells with long spurs furnished with twisted hairs. Disc 0. Carpels distinct, many-ovuled, stigma with a basal reflected lobed membrane surmounted by 5 tubercles, tip subglobose. Follicles long cylindric straight hard appressed. Seeds oblong, villous with terminal coma.

L. linear or linear-lanceolate, flowers odorous, sepals erect

1. *odorum*.

L. lanceolate, Flowers inodorous. Tips of sepals often patent

2. *oleander*.

1. *N. odorum*, Soland. Kaner, Kanel, Karpad, H.; Karabi, Beng., Rajbaha, S.

A beautiful well-known shrub with usually erect (in the wild form often prostrate, ascending, perhaps from the rush of water) rod-like branches and narrow leaves tapering each end. Flowers 1—1.5" diam. usually rose or white, fragrant, in terminal cymes.

Wild in stream beds of the United Provinces and Deccan but not in our area, very common in gardens. Fl., Fr. most of the year in cultivation. I have only seen the wild plant flowering in the h.s. and r.s. and fruiting c.s.

Follicles 7" by .3".

2. *N. oleander*, L.

The true *Oleander* of the Mediterranean region appears to be sometimes found in gardens. The chief points of difference are those in the Key. A further difference appears to be in the depressed 2-fid, less umbonate stigma according to *De Candolle*.

12. *WRIGHTIA*, Br.

Trees or shrubs with the milky juice white or yellow, opposite leaves and m.s. fls. in terminal or sub-axillary sessile cymes. Calyx short,

5-partite, with glands or scales inside. Corolla salver-shaped with usually short tube and throat with 1—2 series of scales. St. at top of tube, fil. short dilated, anthers exserted, sagittate, adhering to stigma, cells spurred at base. Disc 0. Carpels free or connate, many-ovuled, stigma ovoid with usually a toothed basal ring. Follicles distinct or connate or adherent by both ends. Seeds linear, compressed, tip narrowed, naked, base with a deciduous coma, albumen scanty or 0. Cotyledons broad, convolute, radicle short, superior.

- L. 4—10", sometimes glabrous. Corona white. Follicles only
 connate at tip or free 1. *tinctoria*.
 L. 3—5", never glabrous. Corona coloured. Follicles connate 2. *tomentosa*.

1. *W. tinctoria*, Br. Kapar, *Rajwari*; Khirna, *Kharw*.

A small, usually crooked tree, with the milky juice white, sub-sessile elliptic-oblong, obovate or oblanceolate leaves with a sudden short blunt acumination, 4—10" long (but always quite small at the time of flowering). Flowers white, pretty, .75—1" diam., conspicuous for their corona of scales cut into linear segments and exserted cone of yellow anthers. Follicles 10—20" long, always curved and cohering at the tip until nearly ripe, slender.

Always on rocky ground and not common in our area. Palamau, Kechki and Berlah forests! and near Deltonganj in scrub jungles! Gaya ghats, probably extending into the Monghyr Hills! Fl. with the very young leaves, Mar.—May. Fr. Dec.—Jan.

Bark light grey. Blaze green, then white with copious latex. Leaves not shining, glabrous in the type (*F.B.I.*), but always softly pubescent or even velvety in our area, pale beneath and rather a pale green above, those at base of shoots often only 2.5" long, young leaves dry more or less blue with reddish nerves, sec. n. 7—9 more rarely up to 12 prominent and softly pubescent beneath, whitish. Petiole hardly any .15" long. Cymes pubescent with small linear bracts. Follicles about .25" diam.

2. *W. tomentosa*, Roem. Tuar, *K.* (the word merely means milk, and is applied to other trees with milky sap); Khirna, Kherua, *Kharw*; Dudh Koraiya (Monghyr), Khiri, *Th.*; Phaokurni, *Or.*

A small tree with slender pubescent branches and distichous elliptic shortly caudate acuminate (or with a short obtuse acumination), tomentose leaves 2—4" long, rarely attaining 6" by 3.5", and easily distinguished from the last by the 8—14 close strong sec. n. only .1—.3" apart and petioles .2—.3" long with the milky juice yellow or yellowish-white. Flowers 1" diam. greenish-orange or cream-coloured with deep-orange or red toothed coronal scales. Follicles 6—12" connate into a compressed grooved pendant cylinder, greenish, verrucose with white tubercles.

In valleys and damper places than the last but sometimes in association in rocky valleys. Much more widely distributed throughout the whole province in favourable situations, but nowhere very common! Fl. April—July. Fr. Dec.—Feb. Deciduous Feb.—March.

Bark light grey rough with lenticels only, blaze soft, first with a thin chlorophyll layer, then nearly white or a pale greenish brown, with copious latex. The leaves (as in others of the genus, but more markedly) are arranged like the leaflets of a pinnate leaf and far more numerous on the twigs than in *W. tinctoria*, rarely obovate but base often somewhat cuneate. Seeds slender with white coma.

"The wood is used for turning and carved work. Weight about 40 lbs." *Gamble*. The pod-like fruits make the tree easily recognisable.

13. STROPHANTHUS, DC.

Small trees or shrubs, without milky juice in some species, climbing in our area, with opposite leaves and large or m.s. flowers in terminal cymes. Calyx glandular within. Corolla with tubular base, then campanulate with 5 lobes remarkable by being produced into sometimes very long tails, throat with 10 scales sometimes connate. Stamens at the top of the tube, included, anthers sagittate, tips filiform adhering to the stigma, base spurred. Disc 0. Carpels distinct, many-ovuled, style filiform, rugose with cellular papillæ, tip dilated, stigma simple or 2-fid. Follicles oblong or elongate free, usually spreading. Seeds compressed, fusiform, narrowed into a feathery tail or with a sessile coma; base with a deciduous tuft of hairs.

1. *S. Wallichii*, A. DC.

A climber with lenticellate branches, oblong cuspidate or shortly caudate glabrous leaves 3—4" long with minute subulate stipules (?) and intrapetiolar glands and terminal 2-chotomous cymes of pale-coloured flowers veined purple within, easily recognised by the long twisted caudate petals often 2" long. Follicles 6—8" long, .75" broad at base and 1.75" broad above base, then tapering to the tip, divaricate in a straight line.

Singbhum forests, in valleys! Mals of Orissa, frequent! Fl. April—May. Fr. c.s. but remaining open until next flowering.

L. usually about 4" by 2" with 6—10 fine sec. n. reticulate within the margin. Petiole .12—25". Cymes 3—4", lax, with recurved linear bracts at the forks. Sepals linear-subulate .5", nearly free. Corolla-tube constricted about the middle, .75" long, throat with 5 deeply 2-fid scales. Follicles woody pustulate on woody peduncles.

14. PARSONSIA, Br.

Twining shrubs. Juice scarcely milky in our species. Leaves opposite. Fls. small white or greenish in 2—3-chotomous, often dense, cymes. Calyx 5-partite, glandular or with 5 scales within or naked. Corolla salver-shaped with short cylindrical or globose tube and naked throat, lobes overlapping to the right. Filaments often twisted, anthers half exsert, acute, conniving over and adhering to the stigma, cells spurred and empty at base. Disc of 5 lobes or scales. Carpels connate, style-top dilated, truncate, stigma columnar or elongate conical, ovules many. Fruit of 2 connate follicles tardily separating when quite ripe. Seeds linear or oblong, tip narrowed and penicillate, albumen scanty, cotyledons linear-oblong, flat.

1. *P. spiralis*, Wall.

A twiner with elliptic or oblong-lanceolate glabrous leaves 2—5" long and greenish flowers in lateral rather close corymbose cymes 2—3.5" diam. Fruiting carpels forming a grooved poniard-shaped follicle 5—6" long and .5" diam. at base.

Mahanadi delta, Cuttack! Fl., Fr. practically all the year. Evergreen.

Leaves with cuneate to rounded or sub-cordate base, shortly acuminate, sec. n. 4—6 rather fine looping within the margin, petiole 5—8", interpetiolar glands on the stipular line subulate. Cymes including the stout peduncle about as long as broad. Calyx 15", sepals ovate thick. Corolla-tube exceeding the calyx, petals erecto-patent 17" linear lanceolate or linear-oblong. Anther sagittate lanceolate 15" long. Seed 75" glabrous.

The plant much resembles an *Asclepias* in fruit.

15. VALLARIS, *Burm.*

Twining shrubs with opposite, pellucid, punctulate leaves and white mod.-sized flowers in lateral or subterminal cymes or fascicles. Calyx 5-partite, glandular or not within, sepals narrow. Corolla salver-shaped with short tube and naked throat, petals broad, overlapping to right. Stamens at top of tube with exerted anthers adhering to the stigma, cells with rigid basal spurs, connective with a large dorsal gland. Disc various. Carpels connate, many-ovuled, style pubescent, obscurely annulate at top, stigma thick conical. Fruit of 2 connate follicles tardily dehiscent when ripe ("at length separating," *F. B. I.*, but I have never seen them separate). Seeds 2-seriate, ovate, acuminate or beaked, compressed, tip comose, albumen scanty. Cotyledons flat, thin.

1. *V. Heynei*, *Spreng.* Adaka red, Adatta red, Kukur-botur, K.

Stems light grey cord-like tough lenticellate. Leaves oblong elliptic acuminate, nearly glabrous, 1.5" by 6" to 4" by 1.5". Cymes of white flowers, pretty, usually subcorymbose, 2—3" diam. Sepals lanceolate 17". Corolla 5—8" diam. with tube only 1" long, and broad rounded petals. Disc fleshy, annular. Fruit 6" by 1.5" diam., terete, subtruncate at the base, tapering above the middle to a blunt apex.

N. Champaran! Chota Nagpur, valleys in Hazaribagh and Singbhum! Palamau, *Wood!* Gangpur! Mayurbhanj, in valleys! Fl. April—May. Fr. Nov.—Jan. New leaves in March of a light bright green.

L. rather membranous with 5—9 arching fine but distinct sec. n., base acute or obtuse somewhat decurrent on the 3—5" petiole.

Bark very bitter and astringent, chewed by the Kols for fixing loose teeth.

"When suspended from the roof on a certain day in June it is believed to keep away snakes during the rains." *Rev. Thompson.*

16. BEAUMONTIA, *Wall.*

Very large climbing shrubs with opposite leaves with strong arched sec. nerves, and very large white flowers in terminal cymes with leafy bracts. Corolla with a very short tubular base, then campanulate with broad lobes. Stamens low down, anthers horny sagittate, adhering to stigma, spurred at base. Disc deeply 5-lobed. Carpels connate. Fruit long, thick, woody, finally dividing into two spreading follicles.

1. *B. grandiflora*, *Wall.*

Frequently cultivated in gardens, native of the Eastern lower Himalaya. Fl. r.s. Evergreen.

Stems very thick and woody, shoots rusty pubescent. L. usually elliptic-oblong or obovate-oblong, abruptly acuminate, about 5—8" long only in our area, much larger in its wild state. Corolla 3—5" long, lobes rounded.

17. CHONEMORPHA, G. Don.

Very large climbing shrubs with broad opp. leaves and large white flowers in lax terminal and pseudo-axillary cymes. Calyx with a ring of glands within. Corolla salver-shaped with lowest part of tube very narrow then suddenly widened, throat naked, petals broad, obliquely obcuneate, overlapping to right and twisted to the left. Stamens at the swelling of the tube, fil. short villous, anthers sagittate, elongate, pungent, adhering to stigma, cells spurred. Disc thick, annular or cupular. Carpels distinct, top of style globose, stigma conoid or sub-clavate. Follicles long, straight, parallel, 3-gonous. Seeds ovoid or oblong, flat, shortly beaked, coma long, albumen thin. Cotyledons oblong, flat.

1. *C. macrophylla*, G. Don. Barkla dudhia, *Th.*

A powerful climber with thick brown lenticellate branches marked with opposite leaf scars, younger strigillose. Leaves very large, 8—16", elliptic, ovate, obovate or orbicular, cuspidate, with 7—12 strong sec. n. and well-marked cross nervules. Flowers 2.5—3" diam. in axillary and terminal peduncled narrow cymes with opposite ovate deciduous bracts. Follicles 8—15" by .75".

Ravines of the Ramnagar Hills! Fl. May—July. Fr. Jan. It is often also found in gardens.

Juice very milky. Young leaf-buds densely yellow-tomentose, mature leaves softly pubescent beneath. Petiole 1—1.75" stout. Stipular line with glandular teeth. Calyx 3—5" with lanceolate sepals. Petals obovate .7—1" wide.

18. AGANOSMA, G. Don.

Stout climbers, juice not or slightly milky, with opp. leaves and m.s. or large flowers in terminal tomentose cymes. Sepals narrowly lanceolate acuminate, rarely oblong-ovate, with subulate glands at the base. Corolla salver-shaped with short basal narrow tubular portion, then suddenly tube wider* with bearded longitudinal bands behind the anthers, petals overlapping to the right and scarcely twisted in bud. Stamens at the base of the broader tube, anthers sagittate, rigid, adnate to stigma, spurred at base. Disc cupular, 5-lobed. Carpels distinct, many-ovuled. Top of short style urn-shaped, stigma columnar. Follicles terete, straight or curved and sometimes cohering at the tip. Seeds ovate or linear-oblong, flattened, glabrous. Cotyledons oblong.

1. *A. caryophyllata*, G. Don. Ratan, S.; Malati, *Or.*

A large and beautiful climber with ovate or elliptic acute, obtuse, or shortly acuminate leaves 3—5.5" by 1.5—3" and lax pubescent corymbose cymes 6—8" diam. of large white flowers 1.5" diam. Sepals linear spreading 1—1.2". Corolla narrowly tubular for .2", then more widely tubular and fluted for .3", petals spreading, somewhat obliquely ovate acuminate, tip not or only slightly spiral, twisted in bud. Follicles

* Sir J. D. Hooker, in this and similar cases, calls the wider tubular portion a "long throat."

densely yellow-tomentose when young, spreading or recurved or cornute and cohering by their tips, very variable in size, 4—14" long and 3—7" diam. tapering gradually to the tip.

Monghyr, *Ham.*; Manbhum, *Campbell!* Rocky ravines in the Santal Parg. Baruni Hill, Khurda, etc. Puri! Rocky valleys in Angul and Daspalla! Often cultivated. Fl. August. Fr. Feb.—April.

Stems grey shining pustulate and thinly strigose. Young shoots densely tomentosely hairy. L. glabrous or tomentose beneath, base rounded, sec. n. 2—5 usually red in colour, very oblique, minutely reticulate between, petiole 25—75", leaves of a pair sometimes unequal, petiole 25—75". Sepals sometimes only 6", tomentose. Disc large, concealing the ovary. Seeds flat 6—1" long with a coma rather longer.

19. ANODENDRON, *A. DC.*

Climbing shrubs with opp. leaves with rather distant nerves, juice not or only slightly milky (in our species). Flowers small in axillary and terminal wide spreading paniced cymes. Calyx with obtuse sepals eglandular within. Corolla salver-shaped with contracted mouth, petals narrow, overlapping to the right, twisted to the left. Stamens below middle of tube, anthers sagittate, adherent to stigma, shortly spurred at base. Disc cupular. Carpels distinct, sunk in the disc and adherent to it dorsally at their base. Style very short, top cupular, stigma thick conic. Follicles diverging acuminate, hard.

1. *A. paniculatum*, *A. DC.*

A very large climber with stout grey-black or green perfectly smooth and cylindrical stems up to 3" diam. Leaves coriaceous, oblong or somewhat wider upwards and shortly suddenly acuminate, lower large 7—8" by 4—5", sec. n. strong nearly straight, 12—15. Fls. small pale yellow 3" diam. with linear petals, villous in large lax 3-chotomous axillary and terminal brachiate panicles. Follicles spreading 5—6" by 75" at the rounded base, woody, poniard-shaped.

Rather rare. Along streams in evergreen forest. Singbhum, rare! Mals of Orissa! Fls. March—April and fruits ripen about a year after.

Blaze white with brown patches exuding a copious flow of brown coloured sap, not at all milky. Upper leaves 4—5" by 1.5" narrow-oblong cuspidate. Panicles 3—6". Seeds brown ellipsoid thin concave pointed at one end, 7" long and ending in a large coma 1" long.

N.B.—According to a note by *Lister* on a Chittagong specimen the juice is sometimes milky. It is said sometimes to produce rubber.

20. ICHNOCARPUS, *Br.*

Climbing shrubs with small or minute flowers in long terminal and axillary paniculate cymes. Calyx 5-fid, glandular or not within. Corolla salver-shaped, throat contracted or villous, petals narrowed to an obtuse often twisted tip, upper half, deflexed in bud. Stamens at or below the middle of the tube, anthers sagittate, adhering to stigma, spurred at base. Disc free, 5-lobed. Carpels distinct, hairy, exerted from disc, style short, top obconic, stigma columnar. Follicles spreading or divaricate slender and subterete or rigid and compressed. Seeds narrowed at the tip with deciduous coma, albumen copious, cotyledons long flat.

Corolla-tube glabrous,* mouth villous . 1. *frutescens*.
 Corolla-tube pubescent, mouth puberulous 2. *ovatifolius*.

1. *I. frutescens*, R. Br. Onol-sing, K.; Dudhi-lota, S.; Saon-lar, Kharw.; Taparlohār, Soyam-noi, Or.

A large rambling shrub woody below with rusty-tomentose branches, elliptic or broadly-oblong acute or shortly acuminate glabrous leaves 1.5—4.5" by 1—2" and narrow panicles of small white flowers .3" diam. with narrow twisted bearded lobes.

Common, especially in hedges in moist localities, in all districts! Purneah, very common! Fl. Sept.—Dec. Fr. Jan.—April. The leaves turn brown or reddish in Feb. before falling.

L. pale and finely reticulate beneath, base rounded or acute, sec. n. about 5. Petiole .17—.25". Panicles usually leafy with short branches, pedicels .05—.2" only. Calyx with linear glands within, sepals .07", corolla-tube swollen in the middle, .12", usually pubescent, mouth villous. Follicles 3—6.5" linear divaricate slightly flattened, .1" broad, densely red tomentose when young with a brownish thin tomentum when mature. Seed about .5" brown linear grooved with a coma about .25".

The plant is much used for tying. The properties of the roots are said to be the same as those of *Hemidesmus indicus* but the plant is often confused with that and the roots lack the sweet aromatic perfume of the *Hemidesmus*.

2. *I. ovatifolius*, A. DC.

This is said to occur in Chota Nagpur (*Bengal Plants*), the distinguishing characters being those given in the key above, but as the tube of *I. frutescens* is nearly always pubescent or silky and De Candolle himself states that the flowers only differ in the slightly broader calyx lobes the distinction hardly seems adequate. De Candolle gives as the chief character of *ovatifolius* the ovate acuminate leaves with very obtuse base, whereas those of *I. frutescens*, according to his diagnosis, the elliptic and acute both ends. Such ovate leaves occur in plants in our area but these do not seem specifically different.

FAM. 90. ASCLEPIADACEÆ.

Herbs or shrubs, usually twining and nearly always with milky juice, closely allied to the Apocynaceæ and differing chiefly in the androecium. Leaves opposite, sometimes undeveloped, very rarely alternate, quite entire, exstipulate, but often with stipular lines and intrapetiolar or interpetiolar glands. Flowers regular, 2-sexual, 5-merous, usually in axillary umbelliform cymes. Calyx-lobes imbricate. Corolla-lobes valvate or overlapping to the right, very rarely to the left, tube or throat often with a corona of scales, processes or hairs (*corolline corona*). Stamens at the base of the corolla, sometimes free, but more usually connate into a fleshy column investing the pistil except the top of the stigma and usually bearing dorsal processes collectively termed the *staminal corona*; anthers at the top of the column, connate or free, adnate to the stigma and the tip often produced into a membrane appressed to or inflexed over the stigma; the pollen forms 1 or 2 masses (*pollinia*) in each anther cell, and these pollinia are united to a minute *corpuscle* between the anthers in such a way that the pollinium or

* But see remarks under both species.

pollinia of the left-hand lobe of one anther is connected to the same corpuscle as the pollinium or pollinia of the right-hand lobe of the next anther* ; the corpuscle is attached to the swollen top of the style or side of the stigma. Carpels 2 distinct, styles 2 short, united in the large stigma,† which is usually 5-angled and included between the anthers or produced beyond them into a simple or 2-fid column. Fruit of 2 (—1) follicles. Seeds compressed, usually flat margined or winged and with a coma (exc. *Sarcolobus*). Albumen copious. Embryo large, cotyledons flat, radicle short inferior.

- I. Filaments free. Pollinia granular, 2 in each cell (Periploceæ):—
- A. Corona coralline. Twiners:—
 Corolla very small, rotate, purple, lobes valvate
 Corolla small or m.s., rotate, greenish, lobes overlapping
 Corolla large, subcampanulate, purple
- B. Corona staminal. Prostrate herb (in our species)
- II. Filaments connate into a tube. Pollinia waxy, 1 in each cell:—
- A. Anthers with a membranous tip. Pollinia often pedicelled (Euasclepiadææ):—
1. Pollinia pendulous from the corpuscle:—
- a. Erect, leafy:—
 Coronal processes spreading fleshy sculptured
 Coronal processes erect spatulate
- b. Twiners, or suberect (12), or erect and leafless (13):—
- i. Corona double. Flowers large or m.s.‡:—
 L. narrow, deciduous. Corolla large. Follicles smooth
 L. broad. Inner corona with long appendages. Follicles echinate
- ii. Corona single staminal, processes discrete:—
 Corolla campanulate, large white
 Corolla rotate, small, purplish
- iii. Corona single staminal, processes united into a lobed or toothed ring or cup:—
 * Leafy twiners (or sub-erect in *Cynanchum*):—
 Flowers large. Corona with 5 horny processes. Follicles terete
 Flowers small. Follicles keeled or winged
 ** Erect or straggling leafless shrubs, branches fleshy
2. Pollinia erect on the corpuscle (rarely horizontal or pendulous in 19. *Tylophora*):—
- a. Corolla lobes overlapping (all twiners exc. *Tylophora* spp.):—
- i. Corona 0. Flowers small, crowded
- ii. Corona coralline, of pubescent ridges. Fls. small
- iii. Corona staminal (corolla sometimes also villous):—
 * Corolla salver-shaped. Fls. m.s. Coronal processes erect

1. *Hemidesmus*.
 2. *Cryptolepis*.
 3. *Cryptostegia*.
 4. *Streptocaulon*.
 5. *Calotropis*.
 6. *Asclepias*.
 7. *Oxystelma*.
 8. *Pergularia*.
 9. *Raphistemma*.
 10. *Pentatropis*.
 11. *Holostemma*.
 12. *Cynanchum*.
 13. *Sarcostemma*.
 14. *Sarcolobus*.
 15. *Gymnema*.
 16. *Telosma*.

* By removing carefully the usually hard dark-coloured corpuscle the pollinia can usually be withdrawn from the anther cell on either side.

† The enlarged portion is probably the swollen top of the combined styles, for brevity referred to as the stigma. The stigma proper is on the top and centre of this swelling.

‡ See also note under "[1. *Holostemma*," p. 554.

- ** Corolla campanulate. Fls. rather small. Corona appressed to column, with membranous tips 17. *Marsdenia*.
- *** Corolla rotate:—
 Fls. m.s. Coronal processes stellately spreading, fleshy, with small inner cusp. Pollinia oblong 18. *Dregea*.
 Fls. very small. Coronal processes rounded or depressed. Pollinia globose 19. *Tylophora*.
- b. Corolla valvate. Corona stellately spreading:—
 Climbing or epiphytic with fleshy leaves and waxy fls. 20. *Hoya*.
- B. Anthers without a membranous tip. Pollinia sessile or subsessile, erect or horizontal. Corolla valvate (Ceropegieæ):—
 1. Corona double. Flowers small 21. *Leptadenia*.
 2. Corona single, staminal:—
 Twining. Petals appendaged, often cohering at tip 22. *Ceropegia*.
 Erect, fleshy, with 4-angled leafless stems. Fls. large 23. *Boucerosia*.

1. HEMIDESMUS, Br.

Twining suffruticose herbs or shrubs. Fls. small, greenish purple, in dense subsessile cymes. Sepals glandular within. Corolla rotate with thick valvate lobes. Corona corolline, of 5 scales on the throat alternate with the lobes. Filaments distinct, anther-tips connate inflexed membranous, pollinia granular, 2 in each cell attached to corpuscle by dilated appendages. Stigma with flat crown, 5-angled. Follicles long slender, terete, divaricate or reflexed.

1. *H. indicus*, Br. Anandamal, H., Beng.; Kapri (Sambalpur).

A slender twining shrub with an aromatic rootstock, rather distant pairs of leaves, 1—4" by 3—1.5", most variable in shape but always apiculate, pale beneath and very frequently with a white streak above, base rounded and few sec. n. The small flowers .2"—.25" diam. are clustered in the leaf-axils and are green outside but purple within. Follicles spreading in fruit 4—5" by .2" diam.

Under shade and mostly in moist localities, distributed throughout the area, sometimes common! Fl. Aug.—Sept. Fr. Oct.—Dec. Evergreen.

Glabrous or (var. *pubescens*) pubescent. Leaves linear to broadly elliptic rarely obovate or lanceolate, sec. n. 5—6 but intermediate often nearly as strong and rather irregular, looping and very reticulate between. Petiole .15—.25". Cymes with numerous small ovate acute bracts on branches and pedicels. Sepals spreading and calyx sometimes .25" diam. in fruit. Petals rather fleshy and coronal scales usually mere small fleshy knobs. The corpuscle is prominent as a small white tongue to which the two pairs of pollinia are attached; they are dragged out of the anther by the growth of the filaments and ultimately lie naked.

The rootstocks which are about .2—3" diam. with brown skins but white within are easily distinguished from those of *Ichnocarpus* by their sweet smell. They are in high repute for fever and skin diseases.

2. CRYPTOLEPIS, Br.

Twining shrubs. Flowers small or mod.-sized in lax terminal or axillary cymes. Calyx with 5 scales within. Corolla with short cylindrical or campanulate tube and narrow lobes overlapping and twisted to

the right. Corona corolline, of 5 linear or clavate conniving scales at about the middle of the tube. Filaments subconnate at their broad bases, anthers with conniving acuminate tips, pollinia cohering in pairs in each cell, granular with oblong appendages. Stigma broadly conic. Follicles divaricate, terete.

Corolla .7" diam., sepals acute. Follicles 2—4" 1. *Buchanani*.
 Corolla 1—1.5" diam. Sepals obtuse. Follicles 5—8" 2. *elegans*.

1. **C. Buchanani**, *Rœm.* Utri dudhi, S.; Dudhla lar, *Kharw.*; Karanta, *H.*; Gar, *Or.*

A large twining shrub with glabrous oblong or elliptic leaves shining above and very pale-glaucous beneath, 3.5" long, 1.5—2.5" wide, with very numerous slender nearly horizontal sec. n. united within the margin. Flowers pale yellow about .7" diam. in lax often paniced cymes with opposite divaricate fleshy branches constricted at the nodes. Sepals ovate acute .1". Follicles poniard-shaped 2.5—4" long, .5—.75" diam. in middle.

Common throughout the area. Fl. May—June. Fr. Dec.—Feb. Evergreen.

Bark brown in old stems peeling off in large very thin strips. Milky juice very copious. L. rarely up to 6" long, base and tip rounded or base subacute and tip cuspidate, nervules reticulate. Petioles .3—6". Cymes usually 1—2" long and broad, pedicels .12". Cor.-tube .1—1.2", lobes .3" linear-lanceolate. Coronal scales clavate fleshy. Pollinia very minute, linear.

Campbell says that the milk is given to nursing mothers. This is apparently suggested to the Santals by the milky juice, species of *Euphorbia* being similarly used.

2. **C. elegans**, *Wall.*

Leaves smaller than in the last, 2.5—3.5" with rounded apex tipped by a small cusp, sec. n. not very close nor as parallel as in *C. Buchanani*. Petioles very slender .2—.5" long. Cymes with long peduncles and two long slender branches, few-flowered, pedicels slender. Flowers "yellow 1—1.5" diam.," *F. B. I.* Sep. ovate obtuse. Follicles slender 5—8" long, divaricate.

Orissa, *Heyne* (but possibly in Madras). Angul, *B. K. Chattarjee!* In young fruit in November.

3. **CRYPTOSTEGIA**, *Br.*

Large climbers with large flowers in terminal 3-chotomous cymes. Sepals lanceolate. Corolla campanulate with a short basal tubular portion, lobes broad, overlapping and twisted to the right. Corona corolline at base of the throat, subulate, entire or 2-cleft. Anthers acute, pollinia 2 in each cell, granular with subspathulate appendages. Stigma convex. Follicles thick, divaricate, hard, 3-winged.

1. **C. grandiflora**, *Br.*

A scrambling glabrous shrub with elliptic obtuse coriaceous shining leaves 3—4" long and large, light purple flowers 1.5—2" diam.

Rather frequent in gardens. Fl., h.s. and r.s. Native of Africa.

4. STREPTOCAULON, *W. & A.*

Twining or prostrate. Flowers small or minute in 3-chotomous, sometimes paniced cymes. Corolla rotate. Stamens free except at the tips of the anthers which have inflexed membranous appendages and connive over the stigma, pollinia 2 in each cell, granular; interposed teeth or glands between the filaments. Corona at the base of and adnate to the backs of the filaments, of linear or filiform scales. Follicles terete, divaricate.

1. *S. sylvestre*, *Wight.*

A trailing herb with elliptic orbicular-ovate or orbicular, sub-sessile, leaves 1—1.5" long which lie closely adpressed to the soil, and pretty little purple flowers .3—.35" diam. in small very shortly peduncled pubescent axillary cymes. Follicles not seen.

Sandy steep banks of rivers. Purneah! Fl. April—May and also December.

Branches 12—18" long from a woody rootstock, somewhat pubescent. Juice viscid milky. L. pubescent or tomentose beneath, base rounded or cordate, sec. n. 5—7 of which 1—2 near the base, rather strong beneath. Calyx .05", lobes ovate. Petals oblong. Coronal scales linear, white, with filiform tips.

This is rather a rare plant, only previously collected apparently by *Hamilton* and *Clarke*, neither of whose specimens nor mine own show fruit. The plant must not be confused with *Tylophora rotundifolia*, which has a similar habit and also has orbicular very shortly-petioled leaves.

5. CALOTROPIS, *Br.* Swallow-wort.

Shrubs or undershrubs or stout herbs, rarely sub-arboreous, not climbing. Leaves broad subsessile or short-petioled. Flowers large or m.s. in umbelliform or subracemose cymes. Sepals glandular within. Corolla broadly campanulate or subrotate with broad valvate lobes. Corolline corona 0. Staminal corona of 5 fleshy laterally compressed sculptured processes radiating from the staminal column. Anther-tips membranous inflexed, pollinia 1 in each cell, waxy, flattened, pendulous (on a lower level than the corpuscle) attached to the corpuscle by pedicels. Stigma depressed, 5-angled or -lobed. Follicles short thick.

Shrubs. Leaves subsessile:—

Corolla uniformly coloured, lobes spreading .

1. *gigantea.*

Corolla white with purple blotch on the erect lobes

2. *procera.*

Herbaceous. Petiole sometimes attaining 1":—

Corolla-lobes erect

3. *acia.*

1. *C. gigantea*, *Br.* Syn. *Asclepias gigantea*, *Willd.*; *Palati*, *palti*, *K.*, *Uran*; *Akaona*, *S.*; *Akaon*, *Kharw.*; *Akanda*, *Beng.*; *Madar Akona*, *H.*

A stout hoary-tomentose shrub, or occasionally a small tree with trunk 12" girth. L. large more or less obovate-oblong 4—8" long with a cordate, often amplexicaul base. Flowers handsome reddish light-purple or lilac or nearly blue, 1.5—2" diam., with spreading ovate-lanceolate petals. Follicles 3—4" long and 1.5" thick, recurved, obtuse.

Frequent in open waste ground and sometimes sub-gregarious (as on islands in the Mahanadi near Narsingpur), throughout the area. Fl. Dec.—July. Fr. Feb.—June. Evergreen.

Branches and leaves beneath felted white-tomentose. Calyx-lobes short spreading. Corolla-lobes revolute and twisted when old. Coronal processes with their bases elegantly curved, dorsally pubescent, their apices with two little spurs or tubercles. Top of column 5-angled, corpuscle small black at the angles.

Yields the well-known *Madar* fibre derived from the bast. The floss (coma of the seeds) is also sometimes spun but is used more for stuffing like other silk-cottons. It was at one time experimentally cultivated in "Chota Nagpur (*Watt, D.E.P.*, ii, p. 42). Various medicinal virtues are ascribed to the juice. The Kols use it as a drastic purgative and fever medicine, but they prefer the *Euphorbia*. The Sanals "give a decoction of the root in infantile convulsions and delirium during fever," *Campbell*. Mahouts use the leaves as warm fomentations in treating abscesses on elephants. *Nadharni* says that the root-bark and inspissated juice are alternative, tonic, diaphoretic and in large doses emetic, and gives other uses in various diseases.

2. *C. procera*, *Br.* Vern. names as in last.

A shrub much resembling the last but not usually over 4 ft. high. L. oblong cordate, usually suddenly often sharply acute or sub-mucronate, old glabrous both sides. Peduncles often paired in the axils, 1—3" long, tomentose, often branched. Fls. about 5" diam. having the lobes erect 5" long acute, white with purple blotch on the upper half. Coronal processes with a purple obtuse mucicous tip and fleshy upturned white base. Ripe follicles 3" by 1.5", (4—5", *F. B. I.*) recurved somewhat sausage-shaped, outer and inner coats (as in the last) with fibrous tissue between. Seeds obovate 25".

Generally distributed, in similar places to the last, but less common. Fl., Fr. most of the year.

The uses are apparently the same as it is often confounded with the last. (As regards its fibre see *Ind. For.*, Sept., 1897, p. 341.) I understand that the juice of these plants is not taken internally by the Urans for fever, and one sometimes sees Urans with large scars over the side due to the external application of the leaves for fever and spleen. They are said to produce large blisters.

3. *C. acia*, *Hamilt.*

A stout herb or undershrub 2—3 ft. high with glabrous oblong, obovate or oblanceolate leaves 6—8" long, narrowed into a petiole 3—1" long. The flowers are much as in *C. procera*, coronal processes 2-lobed.

In forest and grass lands. Bettiah! Northern Purneah! Fl., Fr. April—June.

6. ASCLEPIAS, *L.*

Erect herbs with opposite, alternate or whorled leaves and small or mod.-sized flowers in umbelliform cymes. Sep. glandular within. Corolla rotate, lobes often reflexed, valvate. Corona staminal of 5 erect spoon-shaped processes, anther-tips inflexed, membranous, pollinia 1 in each cell, waxy, pendulous, flattened. Stigma depressed, 5-angled. Follicles turgid, beaked.

1. *A. curassavica*, *L.* Blood flower.

About 2 ft. high with lanceolate or oblong-lanceolate glabrous or somewhat pubescent leaves 2—3" long and many-flowered umbels of orange or scarlet moderate-sized flowers with reflexed corolla and 5 erect spoon-shaped coronal processes adnate to the stipitate column. Follicles inflated.

Native of the West Indies. Often found in gardens and villages and very pretty when in flower.

7. OXYSTELMA, Br.

Twining herbs or undershrubs with narrow leaves, sometimes deciduous. Fls. large in lax umbelliform cymes with filiform pedicels. Corona double, corolline annular papillose or villous within and with membranous margin, staminal of 5 scales with cordate or dilated bases and 2-keeled within. Anthers with membranous inflexed tip. Pollinia 1 in each cell pendulous oblong compressed. Follicles thick oblique or curved.

1. *O. esculentum*, Br.

A pretty slender twiner with linear or narrow-lanceolate finely acuminate leaves 3—5" long with many sec. nerves looping within the margin. Fls. 1" diam., corolla white or pink, veined with purple, margins densely villous. Follicles oblong 1.5—2" long.

Along the Nepal frontier. Purneah, Kurz! Along the Ganges, above Patna. Fl. July—Sept. Fr. Nov. Perennial, deciduous.

8. PERGULARIA, L.

(Vide N. E. Brown in *Kew Bulletin*, 1907, p. 323.)

Twining, more or less hairy or tomentose, herbs or shrubs with cordate leaves and greenish white or yellowish, salver-shaped, short-tubed, flowers in racemiform or corymbiform cymes with filiform pedicels. Sep. glandular within. Corolla-lobes broad, overlapping to right. Corona double, corolline at base of staminal tube, annular, 5—10-lobed or -crenate, staminal of 5 laterally compressed processes adnate to the anthers and meeting over the top of the stigma, prominently spurred behind towards base. Anther with membranous inflexed tip. Pollinia 1 in each cell sub-compressed, pendulous waxy. Follicles echinate.

1. *P. extensa*, N. E. Br. Syn. *Dæmia extensa*, Br.; Mosiphul, Kharw.; Chagul-bati, Beng.; Uturdi, Or.

A slender subhispidly hairy or glabrate foetid climber with membranous orbicular or broadly ovate, deeply cordate, acuminate leaves 2—4" long and broad, and green, or yellowish-green, and red flowers .6—7" diam. (with white corona) in long-stalked, sometimes paniced, drooping corymbs. Follicles 1.5—2", lanceolar with long soft spines.

Palamau, in village hedges! Puri, ditto! Angul, very common, in hedges, and also occurs in the forests about Antulia and Baghmunda! Fl. Oct.—Dec. Fr. Dec.—Jan.

L. pubescent beneath, apex sometimes caudate, basal lobes rounded incurved sinus very broad. Petiole about as long as leaf. Peduncles 2—6", pedicels .5—2". Sepals short erect .12" with 2 small glands within, pubescent. Cor.-tube slightly exceeding sepals, lobes spreading densely villous-ciliate, linear- or ovate-oblong with reflexed margins. Corolline corona slightly exceeding tube with 5 oblong truncate petaloid lobes and small inflexed intermediate lobes. Pollinia clavate compressed.

The flowers and leaves are eaten in Palamau.

9. RAPHISTEMMA, Wall.

Twining shrubs with large white flowers in long-peduncled umbelliform cymes. Calyx 5-glandular within. Corolla with campanulate tube and oblique or spreading lobes, twisted in bud and overlapping to the right. Staminal corona of 5 scales which are produced into long slender linear tails meeting over the column. Column large, anthers with an inflexed membranous tip, pollinia 1 in each cell, not compressed, pendulous, waxy. Stigma flat 2-lobed. Follicles thick, acute.

NOTE.—The coronal scales are described as membranous in the *F. B. I.* They are so in the herbarium, but in our species at least they are thick and fleshy in a state of nature.

1. *R. pulchellum*, Wall.

Rather a large twiner with ovate cordate leaves 4–9" long and handsome pure white rather fleshy campanulate flowers 1–1.5" long and broad, in few-fl. cymes. Pedicels 1–1.3". Follicles 6" by 1.5", fusiform (*vide F. B. I.*).

Evergreen forest near streams in deep valleys, Singbhum! Fl. Aug.—Sept.

L. very membranous when dry, glabrous or puberulous beneath with 5–7 strong primary nerves and a wide basal sinus, around which the basal auricles sometimes incurve, tip usually cuspidate, base of midrib glandular, sec. n. of mid-rib 3–5, tertiaries not reticulate. Periole 2–5". Stipular lines with stout glands. Sepals elliptic rounded .2–.25" (very variable in size, *F. B. I.*). Corolla lobes obliquely spreading oblong.

Hooker describes the follicles from a drawing as "solitary (?) sharply deflexed from the very base, slightly upcurved, green." I have not seen them.

10. PENTATROPIS, Br.

Twining shrubs with small leaves and small purplish flowers in axillary sub-umbelliform cymes or racemes with filiform pedicels. Corolla rotate, petals twisted to the left and slightly overlapping to the right. Corona staminal, of laterally compressed radiating fleshy laminae spurred at the base and with a free apex. Anthers with a small membranous inflexed tip. Pollinia rounded. Follicles fusiform.

1. *P. microphylla*, W. & A.

A slender twiner with glabrous stems and glabrous oblong apiculate leaves .5–1.5" long with rounded or cordate base and petioles .1–.15" long. Fls. about .4" diam. on slender pedicels .25–.5" long arising from a short rhachis scaly with small lanceolate bracts. Follicles 1.5–2" long on firm pedicels .6–.8" long, acuminate.

Mahanadi delta! Fl. March—June. Fr. Aug.—Sept.

L. with 2–3 indistinct sec. n. Sep. ovate-lanceolate .07", petals broadly lanceolate .15–.2" minutely pubescent on the face, very acute.

It sometimes resembles *Hemidesmus indicus*.

11. HOLOSTEMMA, Br.

Twining shrubs with cordate leaves, membranous when dry. Flowers large, purple inside, in axillary few-fl. cymes. Sepals eglandular.

Corolla campanulate or sub-rotate, lobes thick ovate, overlapping to the right. Corona double; outer thick annular fleshy, sometimes 10-lobed partly adnate to base of corolla and of column; inner of 5 horny 2-winged processes at the backs of the anthers, the wings of adjacent anthers sometimes contiguous so that the column appears 5-winged with each wing 2-lamellate. Anther-tips membranous erect obtuse, pollinia 1 in each cell long linear pendulous attached to the black corpuscle (situated at the apex of each pair of wings) by very long black pedicels. Stigma 5-winged. Follicles thick.

NOTE.—Following the *F. B. I.* I have described the corona as single in the Key, but it appears to me to be more correctly described as double as above. The annular corona is quite free from the column above.

1. *H. Rheedei*, *Wall.* Syn. *H. Rheedianum* (*Cooke* in *Flora of Bombay*, but in the opinion of *Hook. f.* in *F. B. I.* this must be a different plant); *Moron arak*, *S.*

A handsome climber with glabrous shining stems. Leaves oblong-ovate 3—7" long with deep basal sinus, or upper somewhat triangular, tip cuspidate, glabrous above, puberulous or thinly pubescent beneath. Flowers white or pale-pink outside, crimson inside with corolla 6" long deeply cleft into ovate acute lobes. Follicles 4" by 1.3" pustulate.

Manbhum, *Campbell*! *Dalbhum*, *Gamble*! *Singbhum*, in ravines, rare! Fl. July—Sept. Fr. Jan. Also *Gorakpur* and *Sikkim Tarai* and therefore probably occurs in *Bettiah* and *Purneah*.

The leaves very closely resemble those of *Raphistemma* but are not so large nor relatively so broad, tip with a lanceolate cusp .25—3" long; basal lobes long usually leaving a deep oblong sinus, basal nerves 5—7, sec. n. 2—3 only but intermediate numerous and reticulations stronger than in *Raphistemma*; 5—7 subulate glands at base of midrib above. Petiole 1—1.7".

Leaves eaten, and a decoction of the root given for cough, *Campbell*.

12. CYNANCHUM, L.

Erect or twining herbs or shrubs with opp. rarely whorled leaves and small greenish or purplish flowers in axillary umbelliform racemose or subpaniculate cymes. Corolla rotate, lobes overlapping to the right or valvate. Corona adnate to the base of the column, 5-partite or cupular or campanulate, variously toothed or lobed, with or without scales or tubercles on the inner face opposite to the lobes. Anthers sessile or stipitate with membranous inflexed tip. Pollinia 1 in each cell, pendulous, waxy, not compressed. Follicle terete or sub-alate.

1. *C. callialata*, *Ham.*

A twiner with variously shaped leaves, the best characters for which are their rather soft fleshy texture, pale glaucous beneath, glabrous, shallow cordation and apiculate or shortly cuspidate tip, sec. n. 5—8 spreading, looping, obscure. Petioles .5—1.7" with swollen bases meeting round the stem. Fls. .3" diam. glabrous in shortly peduncled umbels with a short cupular, alternately toothed and crenate, corona. Follicles 2.5—3" lanceolate acuminate with one side flattened subalate on its edges, the other convex with two ridges.

Purneah! Parasnath, *Anders.*, *Clarke!* Fl. Sept.—Oct. Fr. Nov.—Jan.

Young shoots pubescent. L. 2.7—4.5" long from linear to broadly elliptic or rotund; my specimens have an emarginate apex with a sharp lanceolate cusp which does not occur in the others. Cymes .7—1" with the peduncle, nearly glabrous. Seeds .3" with the broad wing, broadly obtusely ovate with a long silky coma, base of wing sometimes crenate.

There are sometimes two small leaflets in the axils of the leaves.

13. SARCOSTEMMA, *Br.*

Shrubs with terete green often jointed branches and very small transient leaves. Flowers rather small, sometimes wax-like, in umbels from the nodes or terminal. Corolla rotate with broad lobes. Corona cup-shaped adnate to the base of the column, 10-lobed or -crenate, the lobes opposite to the stamens bearing large fleshy processes adnate to the backs of the anthers. Column short. Anther-tip inflexed. Pollinia 1 in each cell, pendulous, slender, waxy.

1. *S. brevistigma*, *Wight.* Kulu-tuar, *K.*

A usually leafless jointed shrub 2—3 ft. high with green straggling branches, or sometimes trailing over bushes and attaining 6 ft. Flowers white waxy fragrant .4" diam. very pretty, in umbels at the ends of the branches but not really terminal.

Usually on arid rocks. Ranchi (Horhap forest)! Singbhum! Puri! Fl. Sept.—Jan.

It bears small linear-oblong leaves .25—.75" long in the rainy season. Umbels with a hoary curly minute pubescence, usually sessile. Pedicels .3—.5". Petals with revolute margins, sometimes creamy-white. Column very short with the inner coronal processes pure white almost concealing the anthers, the column with the processes being flat-topped. Follicles (not seen by me) slightly diverging, thinly coriaceous, narrowed to the base.

The milk is used in the same way as that of *Calotropis*; it is said to be "very powerful" (the name signifies tiger's milk); it is probably a rank poison!

14. SARCOLOBUS, *Br.*

Twining with small crowded axillary cymose flowers. Corolla campanulate-rotate, petals overlapping to the right. Corona 0. Column very short, anthers marginate with inflexed, not conspicuously membranous tip, between the radiating walls of the column. Pollinia 1 in each cell erect with twisted pedicels. Follicles thick fleshy globose or oblong. Seeds large without a coma.

1. *S. carinatus*, *Wall.*

A small twiner with brown exfoliating bark on the stems. L. rather fleshy, broadly elliptic or oblong or narrowly elliptic on the same branch, pale beneath, with 3—5 sec. n. and green, not raised, reticulations. Flowers .35" diam. green or pale yellow with rotate corolla prettily marked with irregular purple radiating lines. Fruit (not seen on my specimens) .3", curved, beaked, with narrow undulate keels, pale yellow, fleshy.

Mahanadi delta! Fl. April—Aug.

My specimens have leaves only 1" long narrowed at the base into a .2" long petiole; other specimens show leaves up to 2", and *Griffith* (*Notulæ*, p. 53) says

"leaves with subcordate base," but none of the Calcutta Herb. specimens show this. Peduncle very short, pedicels minutely bracteolate at base. Sepals oblong obtuse .07". Pet. broadly ovate-oblong rounded. Anthers sessile.

Griffith says that a violent poison is produced from the seed (in Malacca).

2. *S. globosus*, *Wall.*, which is common in the Sunderbans, is also likely to be found in the Mahanadi delta. It has leaves 3—4" long, anthers shortly stipitate and globose fruits 4" diam.

15. GYMNEMA, *Br.*

Twining shrubs or suffruticose, with small flowers in umbelliform cymes. Corolla sub-rotate, campanulate or urceolate with thick twisted lobes, subvalvate or narrowly overlapping to the right. Corona 0 or corolline of fleshy processes on the throat produced downwards on the tube as double villous ridges. Column short, anther tips membranous, pollinia very minute, erect, subsessile on the corpuscle. Stigma large, conical or domed, projecting beyond the anther tips. Follicles slender acuminate.

Coronal processes with fleshy apices protruding above the throat.

Leaves pubescent:—

Flowers under .1" long. L. pubescent .

Flowers .12—13" long. L. tomentose beneath

Throat naked. Leaves glabrous

1. *sylvestre*.

2. *hirsutum*.

3. *tingens*.

1. *G. sylvestre*, *Br.* Syn. *G. hirsutum*, *W. & A.*? *Merasingi*, *H.*

A rather slender woody climber with densely, often yellow pubescent or hirsute branchlets, broadly elliptic oblong or ovate often cordate-based leaves 1—2" rarely 3" long, more or less pubescent especially on the nerves beneath and usually thinly hairy also above, at least when young. Fls. minute, .1" long (when petals are erect) and .12—15" diam., yellow, campanulate with rotate limb, in hairy peduncled umbelliform cymes about .4—5" long with the peduncle. Follicles usually solitary 2—3" by .2—3" near base, gradually tapering from base to tip. Seeds .3".

Shahabad! Gaya Ghats! Palamau! Tundi Hills, Manbhum, *Camp!* Khurda, Puri! It is fairly frequent in the Kaimur (Shahabad) Hills but not common elsewhere. Fl. Aug.—Sept. Fr. Jan.—March.

L. with 2—5 sec. n. of which 1 is usually from near the base, tip sometimes suddenly acute, petiole .1—4" long densely pubescent. Sepals ovate or broadly oblong, hairy, margin membranous. Corolla .06—09" long with lobes about as long as the tube, minutely ciliate. Corona with small fleshy callosities projecting above the sinuses of the corolla.

There has recently been a demand for this plant. It contains a principle called gymnemic acid, soluble in water. The leaves have a bitterish astringent slightly acid taste, and some time ago it was found that if chewed they have the property of destroying the taste for saccharine substances. *Mr. Hooper* more lately found that they destroyed the taste of bitter substances like quinine,* though *Cooke* says that in his own case he could not confirm this.

2. *G. hirsutum*, *W. & A.*

Said to be much stouter than the last with broader more ovate and cordate leaves, softly pubescent on both surfaces and with shorter

* Paper read at a meeting of the Nilgiri Nat. Hist. Soc., Ootacamund, March, 1887.

thicker petioles. The cymes are also more sessile with umbellate stout shorter pedicels and larger flowers .11—.13" long and .2—.24" diam.

Shahabad, Rotas, J. D. H.!

I am unable to distinguish *Hooker's* specimen from a form of *G. sylvestre* which is often very densely tomentosely pubescent. It is in fruit and the flowers have not been seen, though I have collected true *sylvestre* from the same locality.

3. *G. tingens*, W. & A.

A nearly or quite glabrous climber with membranous ovate to oblong, acuminate or caudate leaves 3—6" long, base sub-cordate, sec. n. 4—5 distinct. Petiole .5—1.5". Flowers pale yellow, .25" diam., on thinly pubescent slender pedicels .4" long. Peduncles .4—.5" long. Sepals .04", corolla-tube pubescent .1", and lobes .1". "Follicles 4" by 1", ovate-lanceolate, spreading, smooth fleshy," *Roxb.*

Monghyr, *Ham.* (*Wallich's* No. 8190a)!

16. TELOSMA, Coville. (*Pergularia*, F.B.I.)

Suffruticose twiners with rather large greenish or yellow flowers in sub-umbelliform cymes. Corolla salver-shaped with tube swollen at the base, lobes oblong or linear, overlapping to the right. Column rather large. Corona staminal, processes adnate to the back of the anthers, erect, laterally or dorsally flattened, 2-lamellate (in our species), the inner lamella or ligule overlapping the membranous tip of the anther and the stigma. Pollinia 1 in each cell, subterete clavate or globose obovoid, waxy, erect. Stigma umbonate or capitate. Follicles lanceolate, terete, rather turgid.

1. *T. pallida*, Craib. Syn. *Pergularia pallida*, W. & A.; Kongat, *Kharw.*, S.

A twining shrub with sub-watery juice, ovate acuminate often slender-petioled leaves 2—4.5" long, thinly pubescent beneath when young, and greenish or yellowish-white flowers .75—1" diam. in axillary umbelliform cymes. Follicles usually solitary about 3—4" long by .9" wide about the middle, rather suddenly acuminate, deeply grooved on one side.

Palamau! Santal Parganas! Chiefly in nalas and scrub-jungles. Fl. May. Fr. Nov.—Jan. Renew leaves at the time of flowering.

Stems brown, branches pale, somewhat furrowed and pustular, young with a short curly pubescence. Leaves sometimes caudate, with obtuse or sub-cordate base, when old often deeply cordate with nerves beneath shortly pubescent or glabrous, sec. n. 4—5 including 1—2 from or from near the base, slender. Petioles often only .5" at time of flowering, attaining 1—1.5". Calyx .2—.25" long, segments oblong-lanceolate. Corolla-tube .25—.35" long, lobes 3—.5" glabrous. Inner ligule of coronal processes narrower than the elliptic sometimes apiculate outer but exceeding it, outer not as long as the anthers. Follicles poniard-shaped very smooth with a thin shell, not wrinkled when dry, thickest about the middle.

17. MARSDENIA, Br.

(Excluding *Dregea*.)

Twining rarely erect, shrubby or suffruticose with annual shoots from a perennial stock. Flowers mod.-sized or rather small, in umbellate

cymes or clustered on the branches of a cymose cyme or panicle. Calyx 5-partite. Corolla campanulate, urceolate or subcampanulate with spreading lobes. Corona single or double, corolline of thickened calli and a villous ring in the throat or 0, staminal of 5 appendages, fleshy often inversely V-shaped below, flattened subulate or cuspidate and membranous above with erect tips incumbent on the anther, or exceeding it and meeting over the top of the stigma, rarely obsolete. Column short. Anthers with membranous tips, pollinia 1 in each cell erect waxy narrowly clavate on slender pedicels. Stigma convex or elongated. Follicles lanceolate or poniard-shaped.

Dregea was included in *Marsdenia* by *N. E. Brown*, and that arrangement was followed by *Cooke* in the *Flora of Bombay* and by me in the *Central Provinces List*. The two genera are however very distinct in our area, and I have therefore again separated *Dregea*.

Large climber. Fls. .3" long, corolla tomentose 1. *tenacissima*.
Scarcely scandent. Fls. .18" long. Corolla glabrous without 2. *Hamiltonii*.

1. **M. tenacissima**, *W. & A.* Jiti, Chiti, Siti, *Kharw., H.*; Kongat, *S.*; Marawi, *Th.*; Gha, *Or.*

A stout very tough-stemmed twiner with very milky juice, all parts densely softly pubescent or tomentose. Leaves velvety to touch both sides, broadly ovate, suddenly shortly acuminate or cuspidate, 4—7" by 3—5" with deeply cordate base. Flowers green sub-campanulate with erect lobes .3" long or with spreading lobes and .3" diam., in corymbosely-branched tomentose cymes 2—4" diam. which are sessile or very-shortly peduncled. Follicles 4.5—5" long by 1.2—1.4" diam. thickest about one-third the way from base, velvety.

Usually in the dryer hill tracts. Champaran, Sameshwar Hills! Rajmahal Hills, S.P.! Tundi Hills, Manbhum! Palamau and Hazaribagh, frequent in scrub jungles! Singbhum, rare! Angul Hills! Fl. April—June. Fr. Jan.—March. Deciduous.

Stems often .5" thick, permanently pubescent or puberulous. Leaves about 3" by 2.5" only at flowering time, adult sometimes 9" by 8.5" with nerves beneath and upper surface permanently softly pubescent, principal nerves 5—7, sec. n. on midrib usually only 1—2. Petiole 1.5—3". Calyx .15—16 long with ellipsoid segments. Corolla lobes nearly as long as tube, broadly-oblong rounded, pubescent outside, glabrous within. Column .18" long, staminal corona with erect linear-oblong appendages, which curve over the top of the stigma and are often toothed at the apex, their base dividing into two fleshy ridges. Follicles solitary or usually so, tapering from the thickest part to a short thick beak which is sometimes grooved on one side and the tip of beak sometimes turned towards the groove. Seeds flat margined with a coma 2" long.

It has a very strong fibre used for bow-strings, fishing lines, etc., and which *Roxburgh* refers to as one of the strongest he had met with in the vegetable kingdom. It has been several times recommended for cultivation.

2. **M. Hamiltonii**, *Wight*. Moron arak, *S.*; Gudgohalo, *Or.*

Stems sarmentose or ultimately scandent from a very stout woody stock. Branches pubescent. Leaves 1.5—2.75" at time of flowering, mature 4" by 2.4", oblong or ovate mostly, with cordate base, young with a close curly pubescence on the nerves beneath, puberulous above, mature glabrescent. Flowers yellow .18—2" long with suberect petals

or '15" long with spreading petals and '15—'25 diam., in sub-capitate or densely corymbose axillary cymes '8—1'3" diam. Calyx thinly yellow-pubescent or hairy. Cor.-lobes glabrous but throat densely villous. Fruit not seen.

Tundi Hills, Manbhum, *Camp.* (under *Gymnema hirsutum*, var. in *Herb. Cal.*)! Neterhat Plateau! Sambalpur! Usually in grassy Sal jungles. Fl. April—June. Apparently dies down to rootstock annually.

Leaves obtuse or shortly obtusely acuminate, sometimes oblique, sec. n. 4—8 of which 2 from near base, looped, raised beneath, cross nervules rather straight. Petiole '8—1'5", young subtomentose. Cymes often bifurcate on short peduncles, hairy-pubescent, bracts small, pedicels about as long as calyx. Calyx with oval or ovate rounded segments about half as long as corolla (when the lobes are erect). Cor.-tube suburceolate or sub-campanulate, lobes broadly-oblong rounded or ovate, nearly as long as tube. Corolline corona of thickenings and a villous ring in the throat. Staminal corona fleshy with narrow membranous subulate tips as long as or longer than the anther tips but narrower. Anther tips membranous broad not quite meeting over the stigma, which has a conical tip.

The fruit is said to be eaten.

18. DREGEA, *E. Meyer.*

Twining shrubs with greenish flowers in umbelliform cymes. Corolla rotate with broad lobes overlapping to right. Corona staminal, with fleshy spreading depressed lobes and a minute inner cusp incumbent on the anthers. Column very short fleshy, anther tips short inflexed. Pollinia 1 in each cell, narrow-oblong, erect, waxy, sessile or subsessile. Stigma conical or dome-shaped. Follicles thick hard, often ribbed when dry.

1. *D. volubilis*, *Benth.* Syn. *Marsdenia volubilis*, *Cooke*; Marang Kongat, S., K.

A stout twiner with stems attaining 1" diam. with somewhat corky and reticulate bark and pale usually pustular or very lenticellate branches. Leaves 2'5—7" long, ovate or broadly ovate acuminate, base cordate or rounded, sometimes even acute on some upper leaves, usually hoary with a fine curled pubescence. Flowers green '5—'6" diam. nearly glabrous in dense drooping umbels 1'5—2" diam., which are sometimes several together on short branches and with peduncles 1—3" long. Follicles solitary or usually paired and divaricate, 3—4" long and 1—1'5" thick, tapering from base or slightly bottle-shaped, with very blunt rounded apex, wrinkled or ribbed when dry.

Chiefly in scrub jungles. Singhum! Manbhum! Palamau! Fl. May—June. Fr. Dec.—Feb.

Leaves never densely tomentose as in *Marsdenia tenacissima* and quite glabrescent above, strongly nerved, usually glandular at base of midrib above, sec. n. arcuate, 2—4, of which all but one are frequently close to and 1—2 at the base. Pedicels '5—1" long very slender in flower, woody in fruit. Calyx segments spreading, lanceolate, '12" long. Corolla becomes yellowish and with lobes erect in age, lobes oblong or ovate very obtuse. Corona fleshy shining green, processes gibbous with a short beak towards the stigma. Seeds obovoid, '47" by '3", margined or narrowly winged, coma 1'2—1'8".

The juice is more or less milky but not nearly as much so as in *Marsdenia*. Fibre strong. Rind of unripe fruit used as a vegetable.

19. TYLOPHORA, Br.

Twining rarely erect or prostrate herbs, or suffruticose, with small or minute flowers in umbelliform or racemiform cymes. Sepals free or nearly so. Corolla rotate with broad lobes slightly overlapping to the right. Corona staminal, processes fleshy, depressed or swollen, produced down to the corolla base, often free above. Column very short. Anther-tips inflexed membranous. Pollinia 1 in each cell, minute globose or ovoid, waxy, erect or ascending or rarely transverse or pendulous from the ascending pedicel. Stigma disciform, 5-angled. Follicles acuminate usually slender or poniard-shaped. Seeds ovoid flat, winged.

Stems suberect with slender or twining tips

1. *fasciculata*.

Stems twining:—

Usually hairy. Corona with free apical tips

2. *asthmatica*.

Glabrous. Corona without free tips

3. *longifolia*.

Stems quite prostrate. Cymes hairy

4. *rotundifolia*.

1. *T. fasciculata*, Ham.

Suberect slender 2—3 ft. high with several stems from a short-stock furnished with numerous rather thick roots, sometimes shortly twining. L. 1.5—2" lanceolate or somewhat ovate, acute or somewhat acuminate, glabrous or puberulous. Fls. .17—.2" diam. shortly racemose or umbelliform on the branches of a slender pubescent panicle .7—1" long. Pedicels slender .1—2". Sepals narrowly lanceolate. Petals ovate acute. Coronal processes large rounded deflexed. Follicles 1—2", pericarp rather thick for the genus.

Hills, among grass and scrub, Nilgiri State! Fl. May. Fr. Aug.—Oct.

Stems pubescent above. L. with usually acute base and 2—3 very oblique sec. n.; broadly ovate in some specimens outside our area. Petiole .25—.4" slender. Follicles ovoid-lanceolate.

"A decoction of the root is said to be efficacious in extremely virulent types of fever. It is somewhat poisonous," M. S. Ramaswami.

2. *T. asthmatica*, W. & A.

A twiner with subtomentose stems (in our specimens), oblong or somewhat ovate-oblong apiculate leaves 2—4" long with rounded or sub-cordate base, pubescent beneath. Petioles .4—1" long. Flowers dull yellow, purple near base, .6" diam. on long filiform pedicels on the branches of a peduncled cyme, 1.5—2" long. Follicles .2—4".

Orissa, Mahanadi delta! Chilka Lake, Hooper! Fl. May. Fr. Sept.

The stems and leaves are variable in indumentum and some specimens are glabrous in Bengal. Sec. n. 3—5, of which 1 is from base, usually looped and not very strong. Cymes hairy. Calyx .2" with subulate-lanceolate hairy sepals. Petals broadly lanceolate, obtuse. Corona very large, the processes forming a closed ring with large round free lobes at base and free tips above finely acuminate.

Roxburgh states that the roots form an effective substitute for ipecacuanha.

3. *T. longifolia*, Wight.

A species of *Tylophora* collected by Campbell in Manbhurn is so named in the *Cal. Herb.*, but the specimen is not in condition for satisfactory determination. It looks to me more like *T. fasciculata*, Ham. *T. longifolia* has quite glabrous lanceolate leaves 3—6" long with a cordate base and elongate cymes bearing small distant umbels of small yellow flowers on the very long rhachis. Sepals ovate.

4. *T. rotundifolia*, Ham.

A creeping somewhat fleshy herb with prostrate pubescent or tomentose branches and opposite very shortly petioled elliptic or orbicular or very broadly ovate leaves 2—4.5" which lie closely appressed to the soil. Fls. .25—45" diam. on filiform pedicels .5—1.3" long in peduncled umbelliform cymes. Follicles single broadly lanceolate grooved on one side, 2.5—3" by 1" at the broadest part (a little below the middle), somewhat compressed, glabrous, with thick fleshy walls.

Sandstone Hills, N. Champaran! Fl. May—July. Fr. Nov.—Dec.

L. with sub-cordate base somewhat hairy or pubescent on the 3—5 strong secondary nerves beneath, lowest from near base. Petiole .1—2". Bracts at top of the short or long peduncle very small and narrow, persistent pubescent. Cymes hairy. Sepals linear-lanceolate, .15", hairy. Petals ovate. Coronal processes swollen globose without free tips above. Seeds .25" brown narrowly winged, coma .8" white caducous.

The fruit is very unlike that of most in the genus.

20. HOYA, Br.

Twining or often epiphytic and pendulous with thick fleshy or coriaceous leaves and often wax-like flowers in umbels. Corolla rotate, fleshy or waxy, lobes often convex or spreading or reflexed, valvate in bud. Corona, staminal, of large fleshy or horny processes, stellately spreading or ascending, often concave on the upper surface, margins often recurved so as to enclose a hollow space, the inner angle often produced into a tooth or spur. Column short, anthers conniving over the stigma with tips membranous, rarely 0. Pollinia 1 in each cell, erect waxy pedicelled. Follicles usually slender with thin pericarp, but variable. Seeds very small ovate or linear-oblong, coma long.

1. *H. pendula*, Wight.

A fleshy epiphyte with rather slender stem, twiggy pendulous branches, oblong elliptic-ovate or lanceolate acute thick leaves and white waxy flowers .7" diam. with a truncate stellate corona, in short-peduncled pendulous umbels.

Bihar (possibly Parasnath), Kurz! Parasnath, Anders. A *Hoya* occurring in Singbhum of which I have not collected the flowers may also be this.

"Branchlets and umbels sparsely hairy, leaves 1.5—3", margins recurved, base narrow or rounded, petiole .25—5". Peduncles .5—75", pedicels 1—1.5". Sepals lanceolate, shorter than the corolla-tube, corolla-lobes silky villous," *F.B.I.*

21. LEPTADENIA, Br.

Twining or erect and almost leafless shrubs, juice not milky in our species (exc. in fruit). Flowers small in axillary umbelliform cymes. Calyx 5-lobed. Corolla sub-rotate with spreading pubescent or bearded lobes, valvate in bud. Corona double; corolline of small processes in the throat between the lobes, staminal of an annular thickening or undulate wing. Column short; anthers inflexed at tip and ligulate or appendiculate, not membranous; pollinia 1 in each cell, globose, erect, sessile, tips with a small hyaline appendage. Stigma flat,

5-gonal. Follicles hard, smooth, acuminate. Seeds flat, *F. B. I.*, winged (margins sometimes involute in fresh specimens).

1. *L. reticulata*, W. & A.

A twiner with corky bark, tough green branches and thick but not milky juice, young parts hoary tomentose. L. 2—3", ovate, oblong, or some lanceolate, with very obtuse or rounded or subcordate base, mature pale and shortly hairy beneath or pubescent with rather curly hairs or glabrous, often hirtellous above. Petioles slender divaricate .6—1" long. Fls. greenish-white or yellow .2—3" diam. in hoary peduncled axillary sometimes 2—3-nate cymes. Follicles green glabrous 3—3.5" with a long acumen and often curved tip.

Very common near the Puri coast! Angul! Fl. July—Oct. Fr. March.

Branchlets often glaucous. L. acute or cuspidate, more rarely obtuse and then mostly apiculate, sec. n. about 5—6, rather irregular, reticulations translucent when fresh. Cymes .5—7" diam., rounded, dense; peduncles .25—5", pedicels short up to .25". Calyx pubescent, lobes ovate-oblong. Cor. villous-pubescent with thick lanceolate-acuminate petals with recurved margins and grooved within at base. Staminal corona not very conspicuous. Follicles on short thick stalks, somewhat of the shape of a long-necked bottle, slightly compressed .8—1" broad (usually much narrower in herbaria), minutely white-dotted, juice yellowish-milky scant, endocarp rather crustaceous. Seeds .2" linear-obovoid with involute margins.

22. CEROPEGIA, L.

Twining rarely erect herbs with a tuberous rootstock. Leaves sometimes minute or 0. Flowers often large, white or greenish and purple, in axillary peduncled umbelliform cymes, rarely solitary. Sepals narrow. Corolla-tube elongate, straight or curved, often swollen at the base, dilated above or not, lobes very various, erect or often incurved with cohering tips, often at length recurved or reflexed. Corona staminal, annular or cupular, 5—10-lobed and with 5 long ligulate processes within that are free or adnate to the anthers. Column short. Pollinia 1 in each cell, erect, sessile, with one pellucid margin. Follicles usually slender, terete.

Glabrous. Corolla lobes with cohering appendages
L. pubescent, peduncled hispid. Cor. lobes suberect

1. *tuberosa*.

2. *hirsuta*.

1. *C. tuberosa*, Roxb.

A slender twiner from a tuberous root. Leaves slightly fleshy, glabrous and shining both sides, broadly ovate or broadly elliptic, rarely lanceolate, larger 3 by 2", upper elliptic 2 by 1" with a long sharp apiculus. Flowers few in an umbel, 1—1.5" long (only .6" in my specimens, perhaps not fully developed). Sep. subulate, .15". Corolla inflated at base, beaked in bud, with about 24 brown stripes within and with long reflexed hairs in the neck, lobes one-third shorter than the tube, suddenly contracted from a triangular base into linear cohering appendages. Corona near top of column, shallowly cupular, lobes ovate ciliate, opposite to each and from their base arises a long linear and clavate appendage which meet above the stigma. Follicles 4—5" very slender. Seeds .25" linear.

Khurda forest, Purī! Fl. Sept.

Leaves with satiny lustre, "from orbicular to lanc." (*F. B. I.*), base rounded, sec. n. 5—6, of which 2 from base. Petiole .5—7". Corolla micro-puberulous outside. Anthers small oblong fleshy shining.

2. *C. hirsuta*, *W. & A.*

A hirsute climber with lanceolate to linear or (lower) broadly oblong, or a few ovate, leaves 2—3" or attaining 5" by 2" with rounded or subcordate base and acute tip. Flowers 1.5—2" long, tubular with a ventricose base about .25" diam. and limb .4—5" diam. above the throat, with lobes erect oblong ciliate cohering. Follicles erecto-patent 3".

Rajmahal Hills, rather scarce, *Kurz!* Manbhum, *Camp!* Ranchi (Hundrugagh), *Prain!* Fl. Fr. Aug.—Sept.

A variable plant. The roots of true *hirsuta* are fibrous, in our plant with a flattened globose tuber. Stems with spreading hairs. Leaves membranous when dry, thinly hairy, sec. n. 2—3 fine oblique, petiole .4—6". Flowers about 2 on a hairy peduncle .4—2" long, pedicels .25—5". Sepals linear-subulate .2—3". Corolla yellow with green tips or greenish blotched with purple.

NOTE.—*Anderson* records a species of *Ceropegia* from the top of Parasnath which I have not seen. He gives it no specific name.

23. BOUCEROSIA, *W. & A.*

(*Boucerosia* is sunk in *Caralluma* in the *Flora of Africa*.)

Fleshy leafless herbs with thick 4-angled stems not attenuate at the ends, angles toothed. Flowers terminal, large, solitary or umbelled, more or less purple. Corona annular, adnate to the column, 5-lobed; lobes 2-fid, subulate, erect or spreading with a linear fleshy process on the inner face at the sinus inflexed over the anther. Column minute. Follicles slender straight terete, smooth. Seeds flat winged comose.

1. *B. umbellata*, *W. & A.* Syn. *Caralluma umbellata*, *Haw.*

A cæspitose fleshy herb or undershrub 6—15" high, angles sinuate-dentate, the teeth ending with a scar. Flowers 1—1.25" diam. closely concentrically streaked with purple, glabrous, in dense umbels. Follicles acuminate attaining 6" on a pedicel of .8".

On bare rocks, Khandabolo Mt., elev. 3000 ft. Purī! Fl. r.s. Fr. Dec.

Stems quite unbranched in our specimens, which are flowerless, and in the entirely sessile umbel it differs from normal *B. umbellata*. The pedicels are very short being only .2" in fruit, but plants with similar short pedicels have been collected in the Northern Circars. In flower the allied species *B. crenulata* can be distinguished by the long hairs scattered over the whole inner surface.

FAM. 91. LOGANIACEÆ.

Trees, shrubs or herbs with opposite simple leaves often united by a stipulary line or sometimes petioles dilated at base, more rarely stipules present and distinct. Fls. regular large or usually small, cymose, sometimes reduced to solitary flowers, cymes sometimes capitate or paniced. Calyx inferior, small, 4—5-toothed or -lobed. Corolla 4—5-lobed or -partite. Stamens 4—5, on the tube, alternate with the lobes. Ovary free 2-celled with simple style and capitate 2-fid or 2-partite stigma.

Ovules 1 or more in each cell, placentæ on the dissepiment or basal in the inner angle. Fruit a septicidal capsule or baccate, 1—many-seeded. Albumen copious, embryo straight.

I. Trees or shrubs:—

Corolla imbricate. Capsule 2-valved . . .	1. <i>Buddleia</i> .
Corolla contorted. Fruit indehiscent, baccate	2. <i>Strychnos</i> .

II. Herbs. Corolla valvate. Fruit a didymous capsule:—

Fls. in 2—3-chootomous cymes, 5-merous	3. <i>Mitreola</i> .
Fls. solitary or clustered, 4-merous	4. <i>Mitrásacme</i> .

1. BUDDLEIA, L.

Trees or shrubs. Leaves entire or crenate, often with forked or gland-hairs, united by a stipulary line. Flowers 4-merous usually rather small, variously coloured in axillary or terminal and paniced sometimes very dense or globose cymes. Calyx campanulate. Corolla campanulate, tubular, salver-shaped or sub-rotate, tube sometimes curved, lobes imbricate. Stamens in the tube with short filaments. Ovary 2-celled, style short with clavate or capitate stigma. Ovules very many. Fruit a septicidal capsule. Seeds very many, oblong or fusiform with usually loose testa expanded into a wing or tail, albumen fleshy.

1. *B. asiatica*, Lour. Nimda, Beng.; Jhangi, Th. (but this merely means a shrub).

A pretty shrub 3—7 ft. high, clothed on the branches and leaves with a hoary or grey tomentum. Leaves lanceolate 3—6" long, acuminate. Flowers small white 12—2" long in small cymose clusters on the rhachis of spiciform panicles, these again often paniced. Capsule reflexed oblong 17—2" long crowded on drooping paniced racemes 4—6" long and supported by the persistent calyx.

Frequent in Champaran and Purneah! Occasional elsewhere near streams and in ravines. Singbhum! Santal Parg! Manbhum, Camp! Palamau, ascending to Neterhat, 3000 ft! Parasnath, Prain! Fl. Dec.—Feb. Fr. Feb.—March. Evergreen.

Leaves narrowed at the base into a short petiole. Spikes 3—6". The flowers in the Central area are usually very small and do not attain 15" except in a specimen from near the Soane River. Anthers sessile. Stigma clavate. Seeds very minute linear or ellipsoid, brown.

Exotic species of *Buddleia* are often seen in gardens, especially *B. madagascariensis*, Lam., with yellow flowers.

2. STRYCHNOS, L.

Erect or scandent trees or shrubs with palmately- or penni-nerved opposite leaves with stipular lines between the petiole-bases. Flowers 4—5-merous in terminal or lateral cymes with small bracts. Calyx small, lobed. Corolla salver-shaped, campanulate, or rotate, lobes valvate. Ovary 2-celled or 1-celled above, style usually long, stigma capitate or 2-lobed. Ovules many. Fruit baccate, 1—many-seeded, sometimes with coriaceous or woody pericarp. Seeds globose, discoid or oblong with horny albumen and small embryo.

The scandent species do not occur in our area; they bear axillary tendrils.
 Corolla-tube .2". Leaves palmi-nerved, petiole .3—5" . . . 1. *nux-vomica*.
 Cor.-tube .12—17". L. palmi- or penni-nerved. Petiole
 under .2" 2. *potatorum*.

1. **S. nux-vomica**, L. Kochila, Beng., Or.; The Strychnine tree.

A large, handsome or, on poor soils, often a small tree, with ovate or sub-orbicular shining leaves 2—4" long with three strong and two weaker nerves from close to the base and petiole .3—5" long. Flowers white or greenish-white tubular or salver-shaped with short lobes, in short peduncled cymes mostly at the ends of short branchlets. Fruit globose bright orange 1—2" diam. The discoid satiny seeds are surrounded by a white intensely bitter pulp.

Very common, chiefly as a small tree, on the laterite of Puri! Along the banks of the Mahanadi, in high forests, Angul! Rather common in Daspalla, Nayagarh and Narsingpur States but grows less common in the more northerly Orissa States, Cooper. Occasional in Chota Nagpur, but always near villages and probably not indigenous! Often planted. Fl. March—April. Fr. Dec.—Jan. Nearly or quite evergreen, new leaves in March.

Bark smooth, grey. L. very obtuse or rounded; rounded at base, or suddenly acute on the petiole. Cymes minutely pubescent, peduncles .3—1" long. Fls. .27—3" long when the lobes are erect, calyx very small, corolla-tube .2—2.5" long, throat glabrous. Stigma entire. Seeds several .5" diam. often depressed in centre.

The dried ripe seeds are the *Nux-vomica* of the British Pharmacopœia. Merely powdered they are a valuable tonic and largely used as a tonic for horses, which eat it if mixed with their food. They are the chief source of strychnine. The pulp is apparently eaten by some animals and birds and small quantities appear to be harmless to man, but it is intensely bitter. Gamble and Brandis state that the wood is bitter and not eaten by white ants! The weight is given as 54 lbs. The seeds germinate about August and the growth of two plants sown by me averaged 24 ft. in height and 19" girth after 16 years. These were, however, watered when young. The seedlings have palmately 7-nerved sessile first leaves (or cotyledons?) 1—2" long.

2. **S. potatorum**, L.f. Nirmali H.; Koyar, Or.; Kotaka, Cr.; The Clearing Nut.

A small densely branched tree with blackish cracked bark and elliptic or ovate leaves 1.5—5" long with nervation much as in the last or sub-penninerved; easily distinguished by the very short petioles, usually under .2" long. Flowers white in dense glabrous cymes mostly at the axils of fallen leaves with campanulate corolla only .12—18" long. Fruit globose .5—7" diam. with firm pericarp, the pulp and usually only 1, sometimes 2 large thickly lenticular seeds .4—5" long.

Not common, and chiefly in the Southern Area; Puri, in Muktapur jungles! Angul, frequent! Athmallik, near streams! Narsingpur! Sambalpur, in the Jhargati and Hathibari forests! Kalahandi! In the Central area it is reported in the *Him. Journals* as occurring along the Sone, and by Anderson as on Parasnath. Mandhum, Camp. (wild?)! Fl. May. Fr. Oct.—Feb. Sometimes deciduous in May, when the flowers appear on the bare branchlets and are immediately succeeded by the new leaves.

L. usually acute or subacute both ends, quite glabrous, with usually 2 strong lateral nerves each side which curve and nearly reach the tip and are joined by a number of weaker sec. n. Peduncles of cyme hardly any. Flowers fragrant; corolla-tube with tufts of white hair in the throat; lobes longer than the tube. Ovary gradually tapering into the short style. Stigma capitate, slightly 2-lobed.

Brandis states that the wood is durable, hard and close-grained. Wt. about 58 lbs., *Gamble*. The seeds rubbed round the inside of a vessel have the remarkable property of clearing muddy water. The fruit is used for poisoning fish, but the pulp is said to be eaten.

The seeds rubbed with water and salt are also used for conjunctivitis.

3. MITREOLA, *L.*

Herbs with opp. membranous leaves and small or membranous stipules. Flowers small white in 2—3-chotomous and unilateral helicoid cymes. Corolla urceolate 5(—6) lobed, lobes small, valvate. Stamens included. Ovary 2-celled, styles 2 connate in the stigma, ultimately divergent, placentæ peltate, ovules many. Fruit a laterally compressed truncate or 2-horned capsule, dehiscing from the top of the septum downwards. Seeds very many, minute, globose or elongate, albumen fleshy. Embryo linear.

1. *M. oldenlandioides*, *Wall.*

A slender erect herb 6—18" high with ovate or ovate-oblong acuminate, or oblong (*F. B. I.*), leaves 1·5—3" long and terminal and axillary panicles of minute white flowers soon passing into the laterally compressed obcordate 2-horned fruits 1·5" long and broad. Branches of panicle 2-chasial with a sessile flower in the fork, ultimately with the flowers or capsules sessile and unilateral.

Rajmahal Hills, *Kurz!* Singbhum! Hazaribagh and Manbhum, *Clarke!* Fl. Fr. Oct.—Nov. Annual.

Leaves puberulous, occasionally only 1—1·5" long and 5—9" wide, described in *F. B. I.* as oblong and tapering at both ends; mine have a rounded base suddenly acute on the petiole which is 3—5" long; sec. n. fine distinct, about 8. Fla. sessile or subsessile. Horns of capsule short incurved.

4. MITRASACME, *Labill.*

Small herbs with opposite or ternate leaves and stipules forming a minute sheath. Flowers small, white, terminal or axillary, solitary clustered or in irregular umbels, 4-merous. Calyx campanulate. Corolla urceolate, lobes valvate. Stamens included. Ovary 2-celled, styles 2, at first connate, usually finally divergent. Ovules many. Capsule subglobose or subcompressed truncate or 2-horned, dehiscing from above downwards. Seeds very many, minute, subglobose, testa smooth reticulate.

1. *M. alsinoides*, *Br.*

A small very slender herb 3—6" high, resembling one of the Caryophyllaceæ or Oldenlandiæ, with erect weak stem and opposite linear or lanceolate leaves 2" long which have raised glistening epidermal cells (like those of *Oldenlandia crystallina*). Flowers solitary axillary, pure white, 12—15" long and about 1" diam. on slender pedicels 5—1" long. Calyx 08", sepals somewhat cuspidate in fruit, capsule 08".

Singbhum! Hazaribagh, in a swamp, *Clarke!* Fl., Fr. Oct.—Nov.

FAM. 92. GENTIANACEÆ.

Herbs (aquatic in *Limnanthemum*) with opposite rarely alternate, entire, simple (3-foliolate in a genus outside our area) entire leaves, often basal-nerved. Flowers small or showy, regular or (*Canscora* and *Hoppea*) irregular especially in the stamens, mostly in ebracteate cymes, sometimes clustered. Calyx inferior, lobes 4—5 imbricate in bud. Corolla funnel-shaped or rotate, lobes imbricate or twisted to the right. Stamens on the tube, alternate with the petals, sometimes unequal or some altogether suppressed, anthers dehiscing longitudinally or by apical pores. Disc 0 or of glands. Ovary free, 1-celled, or more or less 2-celled by intrusion of the parietal placenta. Style 1, stigmas 2. Ovules numerous. Fruit capsular, often membranous, rarely baccate. Seeds numerous, small. Albumen copious.

I. Terrestrial herbs. Leaves opposite:—

A. Flowers regular or nearly so:—

1. Ovary 2-celled. Style filiform

1. *Exacum*.

2. Ovary 1-celled:—

a. Style short or 0. Corolla with glands at base

2. *Sweria*.

b. Style slender

3. *Erythræa*.

B. Flowers irregular, usually only 1—2 stamens perfect:—

Calyx tubular. Stigmas 2

4. *Canscora*.

Calyx campanulate. Stigma subentire. Minute herbs

5. *Hoppea*.

II. Aquatic herbs with alternate or subopp. leaves

6. *Limnanthemum*.

1. EXACUM, L.

Stems often angular with usually 3—5-basal-nerved leaves. Flowers regular, or slightly zygomorphic, in terminal and axillary cymose panicles. Calyx deeply 4—5-lobed. Corolla rotate with globose tube, blue or white. Stamens on the throat, filaments short, anthers with apical pores at length dehiscing to the base. Ovary more or less completely 2-celled, style long, stigma small sub-capitate. Capsule globose, septicidally 2-valved. Seeds very many, minute, subcuboid, testa granular.

A. Flowers .75—1.5" diam. Stems 1—3 ft. high:—

Fls deep blue. Calyx wings small .

1. *tetragonum*.

Fls. with white base. Calyx distinctly winged .

2. *bicolor*.

B. Fls. .5" diam., blue or white. Stem 3—12". Calyx winged:—

L. lanceolate or ell., sessile, 3-nerved. Calyx-wing lanceolate

3. *pedunculatum*.

L. ovate or broadly-ell., petioled, 4—7-nerved. Calyx-wing ovate

4. *petiolare*.1. *E. tetragonum*, Roxb. Kuchuri, Beng.

A lovely plant with 4-angled stems 1—2 ft., sometimes 3 or more ft. high, with sessile broadly lanceolate leaves 3—5" long, often united at their bases, and narrow panicles of azure-blue flowers .75—1.5" diam. with ovate petals and bright yellow anthers.

In damp, wet or grassy places in the open or glades in the forest. Not uncommon throughout Purneah! Santal P.1 and Chota Nagpur! Perhaps in all districts. Fl. Aug.—Dec. Fr. Nov.—Jan.

Glabrous. L. decussate, mostly 5-nerved, shining above. Calyx deeply 4-lobed, winged or keeled. Stigma exerted from the bud (flower probably protogynous).

Capsule broadly oval .25—.27", dehiscent laterally through the septum which is only partial in fruit, the central portion with the large dry placentæ lying loose in the cells. Seeds very minute, pale brown.

2. *E. bicolor*, Roxb.

Clarke says that it is frequent from Orissa southwards, but I have seen no specimens from north of Ganjam (which used to be included in Orissa). The flowers are said to be unsymmetric, the buds distinctly curved at the tips, and the anther cells curving and tapering upwards. But the fls. of *E. tetragonum* are sometimes slightly zygomorphic. The species is included in Bengal plants apparently on the strength of the Orissa locality.

3. *E. pedunculatum*, L.

A slender erect herb, strict or ramose, 3—12" high, with 4-angular stems, narrow-elliptic or lanceolate sessile or subsessile leaves .5—1.7" long and usually pale-blue flowers in terminal few—many-flid. cymes. Calyx .15" long with ovate lobes and a lanceolate dorsal wing. Corolla exerted .25—.3".

Not common. Hazaribagh, *Clarke*! Plains of Bihar, *Kew Herb.*! Fl. Nov.

4. *E. petiolare*, Griseb.

A small herb 3—12" high, usually branched above only, with ovate or elliptic-ovate leaves 1.5—3" long, 4—7-nerved, with broad base suddenly tapering into a slender but short petiole. Flowers 4-merous, white or bluish, axillary and in terminal cymes. Size of flowers rather variable (as probably in last) and calyx increasing in size in fruit when it is conspicuous by the large ovate acuminate veined wing at the back of each lobe. Wing in fruit .4" long. Seeds small brown angled subquadrate.

Moist banks and damp situations generally, in shade. Singbhum! Parasnath! Fl., Fr. Sept.—Nov.

2. SWERTIA, L.

Herbs with leaves often 3-basal-nerved and white, blue, or lurid, regular flowers in cymose panicles. Sepals 4—5, usually lanceolate. Corolla rotate, lobes 4—5, twisted to the right; at the base of each are 1—2 glandular pits or depressions, sometimes partly covered by a scale and with margins more or less fimbriate. Stamens 4—5, inserted near base of corolla, filaments often dilated downwards, anthers versatile. Ovary 1-celled, placentæ little-intruded; style short or 0, stigmas 2. Capsule sessile, separating into its 2 carpels. Seeds rarely few, testa close or very lax or winged, reticulate.

1. *S. angustifolia*, Ham., inc. *S. pulchella*, Ham., and *S. affinis*, *Clarke*; *Chiretta*, H.; *Chirainta*, Birja; *Bonga Marchi*, K.

A pretty, erect or diffuse herb 1—3 ft. high, with stems 4-angled above, long linear or linear-lanceolate sessile 3-nerved or sub-3-nerved leaves 2—4" long, and white or very pale blue 4-merous flowers .5—.7" diam. in numerous panicles, or the flowering branches forming one very large panicle. Each petal with one large gland at base.

Common in grassy glades in the valleys, and on the tops of high hills in open grassy situations. Fl. Oct.—Dec.

The following varieties occur:—

α **Wallichiana**, *Burkill*.

Inflorescence lax. Sepals very long linear acuminate attaining $\cdot 6''$, longer than the $\cdot 25$ — $\cdot 3''$ long petals which are white without black marking. Gland very large. Ramnagar Hills!

β. **pyramidalis**, *Haines*. Syn. *S. pulchella*, *Ham.*, in part, var. *pulchella*, *Burkill*?

Leaves lanceolate $2''$. Branches of inflorescence long, the whole forming a large ovoid panicle. Sepals $\cdot 25$ — $\cdot 3''$ equal to or shorter than the petals which are mostly about $\cdot 3''$ oblong-obovate, looking bluish from the numerous purple dots or dashes. Gland very large.

Neterhat, 3300 ft.!

γ. **pulchella**, *Burkill*. Syn. *S. affinis*, *Clarke*.

Leaves often very long linear, over $3''$. Branches of inflorescence lax and very numerous, usually forming an oblong panicle. Flowers much as in last but gland usually smaller.

Chota Nagpur, all districts! Purneah!

3. ERYTHRÆA, *Rich.*

Erect herbs with opposite sessile leaves and regular white or rose flowers in dichotomous cymes. Calyx tubular with 5 narrow keeled teeth. Corolla salver-shaped. Stamens 5 near top of tube. Ovary 1-celled, placenta far-intruded, style linear, stigmas 2. Capsule oblong, about as long as calyx, nearly 2-celled, 2-valved, cells separating. Seeds very small, reticulate.

1. **E. Roxburghii**, *G. Don*.

A pretty little plant 2 — $8''$ high with numerous persistent radical obovate or elliptic leaves about $1''$ long, and smaller narrower cauline. Flowers rose-coloured with very slender corolla-tube, $\cdot 27$ — $\cdot 3''$ long, long-pedicelled, in repeatedly branched dichasial cymes with small bracts.

In fields. Behar, T.A.! Sahibganj, S.P., *Kurz*! Bettiah, *Hieronymus*! Fl. March—April.

It somewhat reminds one of a miniature English "Centaury" and sometimes of *Canscora diffusa*.

Radical leaves usually obtuse. Pedicels in the forks of the cyme $\cdot 25$ — $\cdot 5''$. Calyx $\cdot 2''$. Corolla-lobes spreading, very small.

4. CANSCORA, *Lamk.*

Annual 2-chotomously branched herbs, with sessile, perfoliate or petioled often 3—5-basal-nerved leaves. Flowers often small, more or less irregular, white or pink, axillary and in terminal cymes or (not in our species) spicate. Calyx tubular, 4-toothed, sometimes winged. Corolla-tube about as long as calyx, lobes 4, often unequal, imbricate in bud. Stamens near top of tube, 1 or 2 longer than the others which are usually reduced to staminodes. Ovary 1-celled, placenta not much intruded, style linear, stigmas 2 short. Capsule oblong, 2-valved.

separating into its 2 carpels or breaking up irregularly. Seeds very small, polyhedral, dark brown, reticulate.

A. Calyx wingless, branches and pedicels slender wingless:—

Leaves (or bracts) on the panicle broadly ovate
Bracts on the panicle linear, minute or 0

1. *diffusa*.
Var *tenella*.

B. Calyx winged or not, pedicels sub-alate winged:—

Calyx neither striate nor winged
Stem, pedicels and calyx distinctly winged

2. *decurrens*.
3. *decussata*.

1. *C. diffusa*, Br.

A pretty little plant 6—18" high, repeatedly dichotomously branched or finally dichasially branched with very slender branchlets, a pair of sessile broadly ovate leaves or bracts at each fork and small pink flowers on capillary pedicels which are sometimes finely 4-angled. Calyx .2—28", tube striate with setaceous teeth as long or nearly as long as the corolla-tube. Limb of corolla .12—17" long. One stamen conspicuously larger than the other three.

On moist banks and wet rocks. Common in Chota Nagpur, all districts! Angul, B. Chattarjee! Probably in all districts. Fl., Fr. all the year.

Lower leaves oblong or oblong-oblancoate, acute or shortly acuminate, .8—1.8" long, 3-nerved a little above the narrow base, lowest shortly petioled.

Var. *tenella*, Clarke. Syn. *C. tenella*, Wight.

This differs conspicuously in the narrow lanceolate leaves and the absence of the large ovate bracts. It is distinguishable from the next species by the persistent dichotomy, whereas *C. decurrens* is to a great extent 3-chotomous with the central branch the strongest, the habit therefore less open; the pedicels of *C. decurrens* are much coarser and sub-alate.

2. *C. decurrens*, Dalz.

Erect 4—12", 2—3-chotomously branched above, branchlets less slender, narrowly winged, bracts the same shape as the leaves or upper subulate. Flowers small, pink, on 4-ridged or sub-alate pedicels. Calyx .25—28" long, not at all striate nor winged, sometimes slightly keeled at back of the teeth only, teeth short, rather bluntly subulate, shorter than the corolla-tube. Limb of corolla .17" long, one petal larger than the other and two connate rather higher up forming a pseudo-lip opposite to the larger stamen. Stamens subequal or one with only slightly longer filament.

Bunds of rice-fields. Singbhum! Fl., Fr. r.s.

Lower leaves lanceolate .7—1.3" long, very acute or apiculate, 3-nerved, upper narrowly lanceolate and passing into linear-subulate bracts. Capsule 2-valved to base, linear-oblong, .18" long.

A very different plant to the last, but of which Clarke (*F. B. I.*) writes, "very doubtfully distinct from *C. diffusa*, var. *tenella*!" Small specimens are sometimes reduced to a single peduncle and flower.

3. *C. decussata*, Roem. & Sch. Kalmeg, K.; Sankhahuli, H.; Dankuni, Beng.

An erect mostly 3-chotomously branched herb 6—15" high with 4-winged stem branches and pedicels, lanceolate or oblong-lanc. sessile 3-nerved leaves .17—1" long below, gradually smaller upwards and bractiform on the inflorescence. Flowers white, very irregular,

sublabiate. Calyx 3—4" with veined lanceolate wings and small sharp teeth. Tube of corolla as long as calyx, limb 2". One stamen conspicuously larger than the three others. Capsule oblong, shorter than calyx, 2-valved to base.

Chota Nagpur, frequent, esp. on clay in the forests! Angul, *Chattarjee!* Fl., Fr. Sept.—Feb.

Used as a tonic, laxative and in fever. *Dutt* says that it is also much prized as a nervine and used in insanity and nervous debility.

5. HOPPEA, *Willd.*

Small, much branched, glabrous herbs with small sessile leaves and small white or green flowers, sessile or shortly pedicelled in 2—3- cymose cymes. Calyx campanulate, 4-lobed. Corolla with subglobose or tubular tube and 4 (or 8) short or long, usually unequal lobes. Stamens with one only perfect and 3 barren, in the throat with short filaments and ovate anthers dehiscing introrsely. Ovary 1-celled, placentæ not far intruded, style short, stigma subentire. Capsule short, 2-valved. Seeds very many, minute.

1. *H. dichotoma*, *Willd.*

A minute herb, often only 1—2" high, sometimes 4", densely branched, with 4-winged stems and opposite sessile ovate leaves 2—25" long, becoming lanceolate and bractiform on the inflorescence. Flowers very small, appearing green, but with a white corolla, in dichasial cymes and in the forks of the dichotomous branches. Capsule subglobose.

Damp open ground. *Purneah*, common! *Chota Nagpur*, common! Probably throughout the province. Fl., Fr. c.s.

Calyx .08—1" long with lanceolate lobes equalling the tube, each with 2 green nerves uniting in a very acute tip, hyaline between the nerves. Corolla regular or nearly so, white, membranous, urceolate, sometimes with 4 very short oblong obtuse lobes, sometimes with 8 lobes and sometimes lobes triangular.

This little plant reminds one of the European *Scleranthus annua*.

6. LIMNANTHEMUM, *Gmel.*

Aquatic herbs with alternate or subopposite deeply cordate leaves. Flowers white or yellow, clustered at the nodes, 4—5 (—7)-merous. Corolla rotate, deeply cleft into valvate lobes which are ciliate, fimbriate or longitudinally folded down the middle, tube often with glands opposite the lobes. Stamens with short filaments and versatile anthers. Ovary 1-celled, placentæ 2—3, not intruded, style short, stigmas 2—3-lamellate. Capsule ovoid or oblong subindehiscent. Seeds numerous, orbicular, compressed, testa close, rather spongy, finely reticulate, sometimes papillose.

Fls. 1.5" diam., corolla densely white-bearded 1. *indicum*.
Fls. .5—75" diam. Petals with a median lamella, not bearded 2. *cristatum*.

1. *L. indicum*, *Thwaites*. Syn. *Menyanthes indica*, *L.*

An aquatic with floating leaves resembling those of a small water-lily, and very beautiful white flowers 1.25—1.5" diam., with fringed petals and yellow centres, borne in fascicles at the nodes, but only 1 or 2 flowering at a time.

Very common in tanks and backwards, in all districts! Fl. June—Sept.

Stems numerous from a rhizome, long and slender, looking like long petioles were it not that they bear the inflorescence about half or three-quarters of an inch below the leaf. Leaf rather fleshy, orbicular or orb.-oblong, deeply cordate with an acute sinus, 3—8" diam., beneath verrucose, above smooth, palmately-nerved, margin sinuate. Flowers in a dense sessile umbel on long pedicels which are deflexed after flowering. Sepals 5—7, narrow, green. Petals often 6, linear-oblong with entire recurved margins, beautifully densely fimbriate on the surface with long white hairs. St. 5—7. Ovary with 3 parietal placentæ and 3-lamellate stigma (sometimes 2, ?).

2. *L. cristatum*, Griseb.

Closely resembling the last, but smaller in all its parts. Stems long filiform, leaves floating elliptic to orbicular 2—3" diam. Flowers borne on slender pedicels which rise one by one above the water to open and the pedicels then recurved. Corolla .5—.75" diam., petals not hairy, but with a median vertical lamella, base yellow, throat with a ring of hairs.

In similar places to *L. indicum*, and flowering with it!

FAM. 93. HYDROPHYLLACEÆ.

Herbs without milky juice, sometimes glandular-hairy. Leaves simple or pinnate, exstipulate, alternate. Inflorescence various. Flowers regular, usually 5-merous. Sepals shortly connate at base, imbricate. Corolla usually rotate, lobes imbricate in bud. Stamens inserted near base of corolla, alternate with the petals, equal or not, filaments often hairy or dilated below. Anthers linear or sagittate versatile. Disc seldom developed. Ovary superior with broad base, 2-carpellary, 1—2-celled, often with a partial septum, placentæ 2 in each cell axile or at the margins of a partial septum. Styles 1—2, if one then more or less divided. Stigmas usually capitate. Ovules in each carpel many to 2, sessile or pendulous, anatropous or amphitropous, micropyle superior and exterior. Fruit capsular, loculicidally 2-valved, so that half the septum with the placentæ remain in the middle of each valve or valves separating from the septum. Seeds as many as the ovules or fewer, albuminous. Embryo small straight axile.

1. *HYDROLEA*, L.

Leaves simple entire. Flowers in short terminal paniced racemes or cymes. Corolla sub-rotate. Ovary completely 2-celled, styles distinct with capitate stigmas. Ovules very many. Capsule septifragal, 2-valved or wall irregularly breaking up.

1. *H. zeylanica*, Vahl.

An erect or diffuse herb 1—2 ft., often succulent, glabrous below. Lower leaves 4" by 1", lanceolate, acuminate, upper gradually smaller and bracteate. Inflorescence cymose at the ends of short lateral branches and terminal, paniced by the suppression of the leaves. Flowers blue, .4" diam. Capsule ovoid-ellipsoid, .17" long, septifragal

Marshy ground and rice-fields. Purneah, common! Bettiah, *Hieronymus*! Gaya, *Meebold*! Chota Nagpur, frequent! Angul, *Chattarjee*! Probably therefore in all districts. Fl., Fr. Jan.—Feb. There are two varieties, of which the erect form is a very pretty plant when in full flower:—

α. erecta. Erect with cauline leaves reflexed attaining 3—4", shortly petioled (as in the next). Cymes terminating the numerous often elongate lateral branches, pubescent but not glandular.

Marshy places, Purneah!

β. diffusa. Procumbent and rooting at the nodes, leaves rarely exceeding 2". Cymes very numerous, glandular-hairy as well as pubescent.

The common form in rice-fields.

FAM. 94. POLEMONIACEÆ.

Herbs, shrubs or trees, sometimes scandent, often glandular with simple or pinnate exstipulate alternate leaves or lower sometimes opposite. Flowers often showy, regular or (*Cobæa*) somewhat zygomorphous, usually cymose, hermaphrodite, 5-merous. Calyx inferior. Corolla gamopetalous, variously shaped, lobes twisted to the right. Stamens on the tube, alternate with its lobes. Ovary mostly 3-carpelary and 3 (—5)-celled. Style simple 1, sometimes 3-fid. Ovules very many. Fruit capsular 3-valved, sometimes with partial false septa in the middle of the valves.

***Cobæa scandens*, Cav.** A large climber with the rhachis of the pinnate leaves converted into tendrils at the end, and large campanulate somewhat zygomorphic solitary axillary flowers with large cordate bracts.

Often seen in gardens in the cooler parts of the province.

***Phlox Drummondii*, Hook.** A well-known garden plant.

FAM. 95. BORAGINACEÆ.

Trees, shrubs or more frequently herbs, often with cystoliths or hispid hairs, alternate (subopposite in some *Cordia*), or lower sometimes opposite, simple, exstipulate leaves and usually small regular, very rarely zygomorphous, flowers in dichotomous scorpioid cymes which are most often circinate when young, rarely solitary or subracemose. Flowers usually 5-merous, exceptionally 4- or 6—8-merous. Corolla often with scales in the throat, imbricate (rarely twisted) in bud. Stamens on the tube, usually equal, anthers introrse. Disc often present annular hypogynous. Ovary of two median carpels, 2-celled, but very soon 4-celled by the formation of false septa, and ovary frequently (tribe Boragæ) 4-lobed with the style from between the lobes. Ovules suberect, 2 to each carpel, one from the inner basal angle of each cell. Fruit drupaceous and with a 4-celled stone or two 2-celled stones or 4 pyrenes or breaking up into 4 nutlets. Seeds straight or curved, usually scanty albumen. Embryo straight or curved (not spiral

as in Convolvulaceæ), with cotyledons flat, plano-convex or plicate, radicle superior.

I. Ovary entire with terminal style. Fruit drupaceous:—

A. Style twice 2-partite:—

Trees or large shrubs. Calyx teeth short, often unequal

1. *Cordia*.

B. Style once 2-partite or divided to the base, or entire:—

1. Styles 2, or one 2-fid:—

Trees or shrubs

2. *Ehretia*.

Prostrate herb. Fls. often axillary

3. *Coldenia*.

2. Style 1 undivided:—

Shrub. Fls. in few-fl. racemes or sub-solitary

4. *Rhabdia*.

Herbs. Fls. in scorpioid cymes. Style-apex disciform

5. *Heliotropium*.

II. Ovary 4-lobed, with style from between the lobes (exc. 6), fruit of four nutlets (or 3—1 by suppression). All herbs:—

A. Style terminal. Fruiting calyx accrescent

6. *Trichodesma*.

B. Style from between the lobes (Boragæ):—

Cymes racemiform, scorpioid. Nutlets glochidiate

7. *Cynoglossum*.

Flowers axillary or upper in a bracteate raceme. Nutlets granular-scabrid

8. *Bothriospermum*.

NOTE.—The large group of Boragæ, to which the Forget-me-nots, Borage, Alkanet, etc., belong, is better represented in temperate regions.

1. CORDIA, L.

Trees or shrubs often with cystoliths (best seen when dry) and a marginal nerve in the leaves. Flowers in 2-chotomous corymbose cymes or clusters, ebracteate, polygamous. Calyx tubular or campanulate, accrescent in fruit, teeth usually short, often irregular. Corolla tubular or funnel-shaped with 4—8 recurved petals. St. 4—8 usually hairy at the base, anthers large exerted. Ovary 4-celled. Style twice 2-partite. Drupe with a hard 1—4-celled putamen. Seeds exalbuminous.

The cystoliths appear as superficial discs on the dried leaves, but mature leaves are required for comparison of one species with another. Owing to the usual absence of old leaves in herbaria and to my not having been able to collect flowers from the same trees as the mature leaves I am doubtful of some of the following forms.

I. Shrubs or very small trees. Leaves mostly under 3" long:—

Leaves sub-opposite, oblanceolate entire or undulate

1. *Rothii*.

Leaves alternate, elliptic, dentate, scabrous above

2. *monoica*.

II. Trees. Mature leaves over 3" long:—

A. Leaves under 5" long, not cordate-ovate nor broadly-ovate:—

L. oblong, elliptic or obovate. Petiole slender

3. *myxa*
(*obliqua*).

B. Leaves mostly cordate-ovate or broadly ovate, over 5":—

L. glabrous, entire, ovate or elliptic-ovate, petiole under one-fourth blade

4. *sp. ?*

L. glabrous, sinuate-dentate, acuminate. Petiole about one-fourth blade

5. *sp. nov. ?*

L. mostly cordate white-tomentose beneath, mostly obtuse, petiole one-third to half-blade

6. *Macleodii*.

L. stellate-pubescent or puberulous beneath, acute, petiole under one-third blade

Var.?

1. *C. Rothii*, R. & Sch.

A small tree with sub-opposite oblong-oblongate leaves, 1—2" long at the time of flowering, attaining 3—4" when mature, entire or undulate, pubescent beneath when young and hirtellous above, mature scabrid with white disc when dry. Flowers small white with calyx .12" long, corolla-tube included, petals 4 spreading oblong, .05—1". Fruit oblong-ovoid .25" acute seated on the cupular calyx which is .25" wide in fruit.

Behar, Kurz! Fls. May—June with the new leaves. Fr. Sept.—Oct.

Leaf penninerved with about 6 rather obscure sec. nerves. Petiole .3—6". Cymes 1—3" diam. pubescent.

2. *C. monica*, Roxb.

A shrub usually under 6 ft. in our area, or a small gnarled tree, with the flowers and new leaves fascicled or densely corymbose, on short shoots. Shoots and new leaves beneath white- or fulvous-tomentose, old leaves elliptic, ovate or obovate, 1—3", obtuse, dentate or crenate-denticulate with strong excurrent nerves, pubescent beneath, scabrous above, with close white cystoliths. Corymbs or fascicles only 1—2" diam., tomentose. Fruiting calyx broadly campanulate, .3" long and broad, shortly irregularly lobed, scarcely ribbed. Drupe ovoid .4—5" yellow, beaked when young.

Gangpur, Hazaribagh and Palamau, in dry jungles! Common on the Rhotas cliffs, Shahabad! From Orissa southwards, Clarke (in *F.B.I.*), but there appear to be no specimens from our part of Orissa. Fl. May—June. Fr. Nov.—Dec. Deciduous, flowers with the new leaves like most of the species.

Branchlets brown, not markedly lenticillate. L. tomentose both sides when young with 3—5 strong sec. n. of which one from the base, branches ending as points in the margin, tertiaries strong sub-parallel raised beneath, marginal nerve strong. Petiole .25—4". Flower buds apiculate, calyx in flower .2", in fruit .3", pubescent or tomentose, teeth villous. Corolla lobes .2", narrow. "Males usually 4-androus, fem. 5-androus. Stone 4-celled, drilled at apex, 3 cells barren," Clarke.

3. *C. myxa*, L.* Hemrum, K.; Buch, S.; Bahuar, Balanjan, Kharw.; Lasura, H.; Bohari, Beng.; Dhuanl, Gwhalo, Or.; Bahalpal (Sambalpur); Sebesten.

A small tree, usually with drooping branches and ashen twigs, only hairy when young. Leaves orbicular, ell.-oblong or obovate, but neither cordate (rarely with a very short triangular tip) nor acuminate, 2.5—5" long, entire or sinuate, not, or scarcely, scabrid above, hairy in the nerve-axils beneath. Petiole slender .7—1.5". Flowers white, fragrant, in corymbose, often paniced glabrous cymes usually terminating short lateral branches, sometimes panicle long-peduncled. Calyx not ribbed, globose in bud, funnel-shaped .16—2" in flower, soon accrescent becoming broadly campanulate to saucer-shaped and .5—75" diam. in fruit. Fruit conical when young, ripe ovoid .5—75", yellowish or pinkish, glassy, with very viscous 1-seeded pulp.

* N.B.—Hutchinson (*Kew Bull.*, 1918), restricts *myxa* to the Asia Minor tree with short expanded style arms, and calls the Indian tree *obliqua* which has usually more slender arms.

Frequent throughout the area! Most usual in the damper districts or along streams in the dryer. Fl. March—April. Fr. July—Aug. Nearly evergreen, flowers with well-developed leaves.

Bark brown with shallow wrinkles and furrows, blaze at first nearly white quickly turning brown on exposure to the air. Innovations often densely fulvous, somewhat stellate-pubescent and with longer hairs intermixed. L. 3—6-nerved at the base with other sec. n. 3—4 each side, smooth above to the naked eye but under the lens marked with small white dots, rarely also with scattered and grouped discs, nervules very reticulate. Cymes 2—4" diam. Corolla-tube as long as calyx, lobes 17" long, linear-oblong.

The wood is used for agricultural implements and as fuel. The fruit is said to be eaten, but is exceedingly viscous. "The mucilage is demulcent and highly esteemed in coughs, etc. The bark is a useful astringent and an infusion is used as a gargle," *Nadkarni*.

Var. *obliqua*, *Willd. (sp.)*. This appears scarcely to differ from *C. myxa* except by being pubescent and by the larger fruit. See also under 4.

4. *C. sp.*

A small tree, glabrous or nearly so except the shoots, with brown twigs sparingly marked with large lenticels and large ovate leaves 6—8" long. Leaves nearly smooth above with cystoliths sunk in the surface, base unequal not 3-nerved but with one or two very strong nerves a little above the base and a weaker nerve below them, sec. n. above the sub-basal ones about 4, tertiaries strong scalariform, nervules inconspicuous. Petiole stout 6—1.2", lenticellate. Inflorescence not seen.

Santal Parganas!

I am unable to match this tree either in the herbarium or by descriptions. The leaf tip is usually suddenly acute, the margin entire with a marginal nerve only rarely interrupted by the mucronate ending of a nervule. In the *Fl. Ch. Nag.* it was included with the next under *C. obliqua*, but a type leaf of *Willdenow's C. obliqua* at Kew is shallowly cordate, 5-nerved at base with 3 sec. n. above base and tertiary nerves as in *C. myxa*, and nervules very reticulate raised beneath, under-surface uniformly thinly pubescent.

5. *C. sp. nov.?*

This may be the same species as the last, from which it differs very much at first sight by the coarsely crenate-dentate leaves with more acuminate tip. The lenticellate brown twigs and petioles are similar, the base of the leaves sometimes sub-cordate, the venation similar, but the sec. n. all end in a tooth with a mucronate point.

Koderma forests, Hazaribagh!

Neither of these can be considered as varieties of *C. myxa*, and approach more nearly in appearance to *C. grandis*.

6. *C. Macleodii*, *H.f. & T.* Porponda, *Ho.*; Torai-sing, *M.*; Jugia, *S.*; Bharwar, Belwanjan, *Kharw.*; Ghanti, *Or.*; Sambhar-singha (Sambalpur).

A small tree with twigs, leaves beneath, and inflorescence covered with a dense felted white or tawny tomentum. Leaves broadly ovate entire, often deeply cordate, obtuse or very bluntly acuminate, 4—8" long or sometimes up to 10", with 3—5 nerves from or from near the base and other venation as in Nos. 4 and 5. Petioles 1.5—3", much longer in proportion to blade than in last two species. Flowers white in dense tomentose corymbs 2—4" diam. Young fruit beaked, ripe

subglobose, yellowish, somewhat tomentose, apiculate, seated in the broadly campanulate toothed or lobed ribbed or striate calyx.

Central and Southern areas, common on the hills except the coastal regions, whence I have no record of it. Fls. March—April. Fr. May—June. Nearly evergreen. Flowers with the new leaves.

Bark light grey, blaze pale, turning brown. Mature leaves somewhat rugose above and with numerous close cystoliths. Corymbs terminal, often appearing leaf-opposed or extra-axillary. Calyx in flower .25", tubular-clavate. Petals .3" or less, oblong.

The wood is used for cattle-yokes, axe-handles and agricultural implements. *Gamble* states that it is light brown, beautifully even-grained and very hard.

Var.?

Leaves minutely pubescent, not at all tomentose, beneath, more acuminate than in the type and apiculate. Petioles only .8—1" long.

Singbhum!

This also might be a separate species, but the inflorescence has not been collected. It differs from 4 and 5 in the want of conspicuous lenticels, in the indumentum, from No. 4 in the shape of the leaves, and from No. 5 in their being entire; it is also less acuminate than either. The petioles are much shorter than in most *C. Macleodii*, and in many respects it resembles *C. vestita*, *H. f. & T.*, a tree previously only known in the Siwaliks and Lower Western Himalayas.

2. *EHRETIA*, *L.*

Trees or shrubs, with the blaze (as in *Cordia*) nearly always pale rapidly turning brown on exposure to the air. Flowers small white in axillary or terminal often paniced cymes, rarely solitary. Calyx sub-5-partite. Corolla rotate or sub-salver-shaped, petals 5. Stamens 5 on the tube, anthers ovate or oblong exsert. Ovary 2-celled with terminal 2-fid or 2-partite style and small capitate stigmas. Fruit a drupe with one 4-celled two 2-celled or four 1-celled pyrenes, cells, or pyrenes sometimes reduced to one by suppression, 1-seeded. Seeds straight, testa thin, albumen scanty.

A. Trees. Fls. cymose and paniced:—

Leaves serrate

Leaves entire

B. Shrub. Fls. sub-solitary

1. *acuminata*.

2. *lævis*.

3. *buxifolia*.

1. *E. acuminata*, *Br.* Lahichan, Dantranga (tooth-reddener), *H.*

A small or m.s. tree with elliptic or ell.-oblong, acute or acuminate, sharply serrate leaves 3—5.5" long with a petiole .75—1.5" long. Flowers .15" diam clustered on the branches of dense pyramidal pubescent panicles 3—6" long. Drupes .12—1.7" diam., short ellipsoid, with 2 pyrenes, 4-seeded.

Purneah! Fl. March—April. Fr. June—July. More or less deciduous in Dec. or Jan. but flowers with the leaves.

Attains 4 ft. girth with pale-grey flaking bark and hard yellowish blaze in old trees. L. glabrous or minutely hispidulous above, teeth with incurved points when young, sec. n. strong 6—8 forked above and not reaching the margin, other nerves inconspicuous. Calyx .05" long, ciliate. Cor.-tube very short, lobes soon reflexed, broadly oblong. Style shortly 2-fid.

This seems to be the "*Ehretia* sp." to which *Hamilton* applies the above vernacular names and states that it is used for posts, beams and chests. Judging from the name "Dantranga" the bark is chewed as in the next species.

2. *E. lævis*, Roxb. Pusi-pan, S.; Bhairo, Hardi, Kharw.; Chamror, Dantranga, H.; Dokke, Gond.; Tambalu, Mosonia, Or.

A small or m.s. tree with white bark and ovate, broadly or narrowly elliptic or rarely obovate entire leaves usually only 3—4" at the time of flowering, often attaining 7" by 4" when mature, shining above and usually glabrous except for small tufts of hair in the axils of the nerves beneath. Petiole .5—1.2" long. Fls. .3—4" diam. in dichotomous scorpioid cymes 2—4" diam. which are usually borne laterally on the bare branches, more rarely terminal on the young shoots.

Northern Champaran! Purneah, Hamilton. Gaya! Throughout Chota Nagpur, usually on river banks! Gangpur! S.P.! Puri! Angul! Kalahandi, along the Tel River, Grieve. No doubt therefore in all districts, but nowhere very common. Fl. Feb.—March, or in some forms up to June, with the old falling leaves or when quite leafless or with the young leaves. Fr. usually April—May.

Bark pale grey or white, blaze white with small brown streaks, turning brown. Innovations usually rusty pubescent or tomentose. L. from glabrous, even when young (exc. the nerve axils) to permanently pubescent, sometimes oblique, base usually cuncate on the petiole, apex acute or shortly acutely or obtusely acuminate, sec. n. 5—7 becoming forked and reticulate before reaching the margin. Fls. sessile or pedicelled. Calyx .05" long, usually pubescent, with lanceolate or oblong-lanceolate lobes, scarcely accrescent. Petals .1" long, acuminate. Style 2-fid. Drupe black sub-globose .2—2.5" diam. with 1—4 pyrenes.

The tree is very variable.

Var. *pubescens*, Clarke. Branchlets hairy, mature leaves pubescent or hairy. Ramnagar Hills!

"Wood tough and durable. Wt. 35 lbs. Growth 5—8 rings per inch of radius," Gamble. It is not much used, but the leaves are used for fodder and the bark is chewed like "pan" and colours the teeth red. The fruit is eaten.

3. *E. microphylla*, Lamk. Syn. *E. buxifolia*, Roxb.

A small twiggy shrub 3—4 ft. with small subsessile obovate, mostly fascicled, leaves with entire or strongly crenate margins and rounded apex. Fls. small white campanulate .25" diam., solitary or 2-nate on a short axillary peduncle. Drupe .17—2", globose, with one 4-celled and 4-seeded pyrene.

Rocky jungles in the south of the Puri district! Rather rare. Bardwan, "with *Carlissa* bushes," Burkill! Fl. Oct.—Dec. Fr. Aug.—Nov.

Twigs strigosely pubescent. L. .5—1" often cuncate, hispid or scabrid above and, when dry, marked with large white cystolith-discs at the base of the bristles, solitary or fascicled on abbreviated shoots, pale beneath, narrowed into a very short hispid .05" petiole. Fls. 1-sexual, on slender peduncles .02—3", style deeply 2-fid.

3. COLDENIA, L.

Prostrate scabrous herbs with alternate crisped leaves and small axillary sessile or subsessile 4—5-merous flowers or the upper sometimes in one-sided spiciform cymes. Corolla-tube broad and short with spreading imbricate lobes. Ovary 2-celled or sub-4-celled. Styles 2 or more or less connate, minutely 2-lobed at apex and again splitting to base in fruit. Fruit nearly dry of 4 sub-connate pyrenes. Testa thin, albumen 0 or scanty, cotyledons flat.

1. *C. procumbens*, L.

A much branched herb with prostrate flattened branches, scabrous-hairy, with crisped coarsely serrate or lobulate leaves '5—1" long, densely scabrous or hispid on the top. Flowers very small, sessile. Fruit '15" pyramidal, of 4 connate 1-seeded pyrenes awned with the hardened style-lobes.

Very common, waste ground, sunny banks, etc.! Probably in all districts. Fl., Fr. Aug.—May. Annual.

Leaves elliptic-obovate, shortly petioled. Fls. scarcely '2" diam. Calyx '1" long with broadly lanceolate almost free sepals.

4. RHABDIA, Mart.

Shrub. Leaves small. Flowers small, 5-merous, terminal or in few-fl. terminal racemes on short lateral branches. Corolla tube campanulate. Ovary 2-celled or sub-4-celled with terminal style and capitate or minutely 2-lobed stigma. Drupe with 4 pyrenes.

1. *R. lycioides*, Mart. Tipa, K.; Jamchi, Jamoch, Or.

A shrub about 2—4 ft. high with tough erect or prostrate branches and linear- or oblong-oblancheolate acute leaves, narrowed at the base, '5—1'2" long by about '2—'35" broad, appressed hairy shining or almost silvery beneath. Petiole '05". Fls. '25—'4" diam., pink, on short pedicels, usually 2—3 at the ends of short lateral branches. Drupe orange-red '17".

Rocky river beds. Not very common. Singbhum, both in Saranda and Porahat! Angul, Lacer! Sambalpur! Fl. Oct.—Jan. Fr. Dec.—Feb.

Branches often rooting, appressed-hairy. L. with 2—4 very faint sec. n. Calyx persistent 5-partite, sepals lanceolate, acuminate. Ovary 2-celled (in our specimens).

Ropes are made from the tough split stems.

5. HELIOTROPIUM, L.

Herbs or shrubs (not in our area). Flowers small, usually white on the long scorpioid branches of 2-chotomous cymes. Calyx 5-lobed or -partite. Corolla salver-shaped or funnel-shaped, throat not hairy, lobes imbricate or induplicate in bud. Stamens included, anthers ovate or lanceolate. Ovary completely or imperfectly 4-celled. Style terminal, ending in a depressed conical or flat disc or thickening, stigma above the disc 0, or short or elongate, entire or with 2 linear branches. Fruit dry 2—4-lobed or of 4 more or less free nutlets. Seed straight or curved.

- | | |
|---|-------------------------|
| I. Calyx campanulate, broader than the corolla, with broadly oblong or sub-ovate sepals enclosing the single large margined nutlet. (Nutlets 2—4 in var. <i>malabarica</i> .) | 1. <i>supinum</i> . |
| II. Calyx narrow with narrow sepals, not concealing the nutlets:— | |
| A. Leaves large, often 2—4", ovate. Fruit separating into two 2-seeded pyrenes | 2. <i>indicum</i> . |
| B. Leaves under 1'5". Fruit of 4 nutlets:— | |
| 1. L. elliptic or obovate, silky. Fls. with a large bract-like sepal | 3. <i>ovalifolium</i> . |
| 2. L. linear or lanceolate, scabrid:— | |
| L. lanceolate. Fls. with conspicuous bracts | 4. <i>marifolium</i> . |
| L. linear or linear-lanceolate. Fls. with narrow bracts | 5. <i>strigosum</i> . |

1. *H. supinum*, L.

Prostrate with numerous stems from the root 6—12" long, densely softly hirsute or silky throughout. Leaves .5—8" (—1.5" *Clarke*), elliptic or ovate, obtuse, beautifully silky, with about 4 sec. n. impressed above, prominent beneath, and slender petiole .15—4" long. Fls. white starlike, surrounded by the broad densely hirsute calyx in short softly hirsute spikes .6—1" long, without bracts. Calyx .12—17" long with oblong or ovate sepals slightly connate half-way up. Corolla .1" diam., tube .07", villous outside, throat campanulate, lobes broadly oblong. Anthers large, lanceolate. Stigma above swelling nearly as long as the style. Nutlet in type ovoid strongly margined and somewhat warted, enclosed in the calyx.

Patna! Fl., Fr. Feb.—March, June, Dec. (Perhaps all the year.)

Var. *malabarica*, *Clarke*. Syn. *H. malabarica*, *Retz*.

Nutlets usually 4 smaller triangular, in horizontal section without margins or sometimes 2 or 3 only and with faint margins.

2. *H. indicum*, L.

A rather coarse herb with ascending hirsute branches and alt. or sometimes subopposite ovate or ovate-oblong leaves usually 2—4" long, rugose above and with a few hairs, pilose beneath. Flowers lilac, 2-ranked in elongate usually simple bristly cbracteate spikes 2—6" long. Fruit .17" long, 2-lobed, each lobe, 4-ribbed with 2 angular "beaked" 1-seeded pyrenes which have each an empty cavity on the inner side" (*Cooke*).

Common on railway embankments, roadsides, etc.! Probably throughout the province. Fls., Fr. all seasons.

Spreading 1—2 ft. with usually 2-cotomous branches. Leaves often with cordate base or unequal-sided, margins undulate, sec. n. strong beneath. Petiole .7—1.5", more or less winged. Calyx .1", thinly bristly. Corolla .2" long, funnel-shaped. Anthers ovate. Stigma above the thickening shorter than the style, obtuse.

3. *H. ovalifolium*, *Forsk.*

Usually with an erect central stem and spreading lateral ones, 6—15" high, with long silky hairs all over but not nearly so densely clothed as in last. Leaves elliptic .3—1.5" long or somewhat obovate, contracted at base into a slender petiole .5—7" long. Flowers funnel-shaped .12", 2-ranked in dense, finally elongate and somewhat lax spiciform once-forked cymes which appear to be bracteate from one of the sepals being much larger than the others and slightly accrescent in fruit; forks 1.5—3" long. Bractiform sepal elliptic or ovate, .12—2" long, rest of calyx about .1" long only with narrow-elliptic or linear-oblong lobes. Corolla hairy. Anthers linear with connective produced as an acumen. Style hardly any and stigma above the swelling short conical. Nutlets 4, strigosely hairy, .05" long.

Frequent, but not often collected! Banks of Ganges, *Kurz*! As it occurs in Darbhanga! Maldah! and the Central Provinces on the hills, it is probably common throughout our area. Many specimens in the Cal. Herb. are marked Bengal without further locality. Fl., Fr. Feb.—May, and Aug. (The only months noted; perhaps all the year.)

4. *H. marifolium*, Retz.

Branches many, decumbent from a woody base, appressed-hairy with lanceolate or ovate scabrous leaves .5—1.25" long and very short petioles or subsessile. Flowers small white in conspicuously bracteate 2-chotomous rigid spiciform cymes 1—2" long. Calyx .15" long, lobes slightly unequal, lanceolate hairy. Corolla .2" long, hairy with ovate lobes and minute teeth between the lobes. Style very short, stigma hardly as long above the prominent thickening, bluntly conical. Nutlets shortly bristly, 4, brown.

Hazaribagh, *Clarke!* Manbhum, *Clarke!* Banks of Soanc, *J.D.H.* Behar, *Hope!* Fl., Fr. Oct.—Jan. Perennial.

Forms with narrowly lanceolate leaves are very like *H. strigosum*, but the bracts are .1" long. Corolla sometimes .2" diam. Fruit densely strigose in some specimens.

5. *H. strigosum*, Willd.

Small, with often erect central stem 3—8" high and many spreading from the root. Stems and leaves with harsh appressed hairs. L. linear or linear-lanceolate, .2—7" long with recurved margins. Flowers white, .1—1.7" long, sessile or lower pedicelled, 2-ranked in mostly simple spikes 1—2" long with narrow small bracts. Calyx .06—08" long, strigose, one lobe broadly lanceolate, others narrow-lanceolate. Corolla strigose, tube about as long as calyx, lobes ovate short, plicate in the sinuses between. Anthers minute ovate but with connective produced into a long acumen. Style minute, swelling large with bluntly conical stigma about as long as the style. Nutlets dark grey-brown, acute, .06", hispid above.

Common in dry pastures. Purneah, *Kurz!* Ranchi! Manbhum, *Campbell!* Monghyr; Darbhanga. Fl., Fr. all the year.

6. TRICHODESMA, Br.

Coarse hispid herbs with the lower leaves opposite, hairs with usually cystolith-celled bases. Flowers m.s. 5-merous solitary axillary and running into terminal racemiform unilateral cymes. Calyx deeply lobed or partite, lobes accrescent in fruit. Corolla salver-shaped with broad tube or campanulate, throat naked, lobes overlapping to the left, a gland or depression near the base. Stamens with short filaments and lanceolate anthers connivent in a cone, connectives more or less hairy on the back, excurrent, at length twisted. Ovary 4-celled, style terminal, filiform with small stigma. Fruit ellipsoid or pyramidal, finally separating into nutlets closely adnate by their inner face to the 4-winged carpophore or conical torus, sometimes margined.

Ridges from the calyx-sinuses produced downwards into auricles.

Corolla over .6" diam. with distinct lobes	1. <i>indicum</i> .
Calyx rounded at the base, without auricles. Corolla under .6" diam., lobes not prominent (exc. the twisted tip)	2. <i>zeylanicum</i> .

1. *T. indicum*, R. Br. Hetmudia, S.; Hetamundia, Or.

A much-branched diffuse hispid herb 8—18" high with sessile usually sub-sagittate or cordate based linear, oblong, lanceolate, or ovate leaves 1.5—4" long. Flowers blue or violet, or white with brown throat, usually

over .6" diam. often 1", in leafy or few-fl. cymes. Calyx .4—6" long, hispid-hairy, lobes lanceolate, margins strongly ribbed and subulate at the connivent bases and produced downwards into a distinct auricle or spur. Cor.-lobes ovate, suddenly narrowed to a fine twisted tip. Nutlets white smooth with polished back, scarcely margined, .17"—2" long, ell.-oblong.

Frequent! Behar, *Hope!* Santal P.! Throughout Chota Nagpur ascending to Neterhat, 3000 ft.! Angul, *Chattarjee!* Probably, therefore, in all districts. Fl. Sept.—Jan. and perhaps at other times. Fl., Fr. most of the year. Annual.

Fls. usually nodding, often white or pale mauve. Pedicels lateral or leaf-opposed or extra-axillary often 2" in fruit. Base of cor.-lobes with brown glands.

2. *T. zeylanicum*, R. Br. Same vernacular names.

An erect herb 2—4 ft. high, very bristly below, more hairy towards the inflorescence. Leaves: lower petioled, often oblanceolate and up to 6.5", upper sessile, oblong or lanceolate-oblong, smaller upwards and passing into bracts. Flowers pale blue, usually about .4" diam. only, ultimately very numerous running out into bracteate racemes .2—5" long, the whole top of the plant becoming a large panicle with leaves at the forks. Calyx with lanceolate or ovate-lanceolate lobes often overtopping the corolla, margins conniving below but marginal ridges not produced at the base into spurs or auricles. Corolla tubular-campanulate with 5 very broad or obovate short lobes with twisted tails, limb sometimes appearing almost truncate except for the tails. Nutlets ovoid, grey polished outside, brown rough inside, not margined.

Perhaps more common in the western districts than the last! Singbhum, very common! Manbhum, *Ball!* Sambalpur! Kalahandi, *Cooper!* Annual. Fl., Fr. most of the year.

Lower leaves tapering into a petiole .6" long (perhaps also in *T. indica*, but lower leaves seldom present when flowering), cauline mostly with a petiole .1—2" long, leaf base not cordate. Pedicels up to 1—1.5" in fruit. Calyx .45—8" (the latter in fruit), sepals finally spreading in fruit, keeled as in *T. indica*. Cor.-tube .2—2.5". Ovary hemispheric with position of septa evident as ridges.

7. CYNOGLOSSUM, L.

Erect hairy often hispid biennial or perennial herbs. Flowers 5-merous, usually small (very small in our species), blue, or purplish in elongate ebracteate circinate scorpioid cymes. Calyx deeply lobed, spreading in fruit. Corolla subrotate, tube short with 5 scales in the throat. Stamens included, under the scales, anthers small ovate. Ovary lobes 4, style often stout, stigma small. Nutlets 4 forming a depressed pyramid, apices hardly produced above the hilum, bases rounded produced downwards, outer faces convex or flattened, glochidiate, carpophore conic at base, then slender.

Leaves lanceolate or oblanceolate to linear. Nutlets densely glochidiate all round .	1. <i>lanccolatum</i> .
Leaves elliptic to ovate. Nutlets usually sparingly glochidiate on upper face, but with a distinct margin of glochidia .	2. <i>denticulatum</i> .

The key characters are not very satisfactory and they pass somewhat into one another, but I find the character of sessile or pedicelled flowers and the character of the hairs still more difficult to work. *C. micranthum*, *Desf.*, also, I believe

sometimes occurs in the north. It is distinguishable by its very minute nutlets .05" long only.

1. *C. lanceolatum*, *Forsk.*

An erect herb 2-4 ft. high clothed with somewhat hispid, often reflexed, hairs on the stems. Leaves lanceolate or upper linear-lanceolate, radical usually oblanceolate tapering at base into very long slender petioles but often dying when the plant flowers pubescent. Racemes strigose branches usually unequal, 3" and elongate up to 6" or 1 foot in fruit. Flowers on pedicels about .1" long, white with a bluish or purple eye of 5 rays, .25" diam. Nutlets .1", densely glochidiate all over, sometimes forming an inconspicuous margin with the connate bases of the spines.

Common among grass and in waste places! Fl., Fr. c.s. and h.s.

Rootstock about .7" diam. on old plants. Hairs on stems somewhat spreading, scarcely tubercled at base. Radical leaves up to 4.5" long by 1.3" wide, tapering into a 6" long petiole; cauline smaller upwards, attenuate at base with short petiole, villous beneath along midrib and hairy with small tubercled-based and small simple hairs, above with tubercled-based more or less deciduous hairs. Calyx .1" long, campanulate in flower, .15" in fruit, deeply cleft three-fourths down into ovate-oblong lobes, spreading and often broadly ovate in fruit. Corolla with urceolate tube, lobes suborbicular, throat nearly closed by hooded sulcate pink scales.

2. *C. denticulatum*, *A. DC.*

A less stout plant than the preceding. Stems much forked with every alternate fork ending in a raceme and finally both forks equal and racemose hairy with hairs more or less appressed, white, with small tubercled bases. Radical leaves evanescent at time of flowering, elliptic, 3-4" by 1.7", acute or cuneate at base (not long-tapering as in last) with petiole 3-3.5"; cauline leaves often minutely denticulate, hairy, with scattered hairs rising from well-marked tubercled bases above, paler and shortly hairy beneath without tubercles, ovate to broadly lanceolate or elliptic. Racemes strigose, branches usually equal, attaining 6-8" in fruit. Flowers all pedicelled or upper sessile, pedicels .1-2" in fruit. Corolla pretty, pale blue with a darker eye .2-.25" diam. Nutlets .1-.15", the upper face sometimes with only 3-4 glochidia but with a distinct margin of connate glochidia. In other cases, however, there are as many as 12 or more glochidia on the face and the nutlet approaches to that of the last species.

Chota Nagpur, chiefly on the mountains! Fl., Fr. c.s.

The calyx and corolla are much the same size and shape as in the preceding. The two species are not always easily distinguishable and are scarcely more than varieties of one.

8. *BOTHRIOSPERMUM*, *Bunge.*

Weak herbs with small blue or white pedicelled flowers, lower axillary, upper sometimes becoming racemose in the axils of bracts. Calyx 5-partite, lobes narrow, somewhat accrescent or not in fruit. Corolla-tube short, throat with 5 scales, lobes spreading. Stamens 5 included, anthers ovate. Ovary deeply 4-lobed, style short, stigma capitate.

Nutlets 4, ellipsoid, granular scabrid, scar near the middle of inner face, large, hollow, smooth with an inflexed margin, carpophore oblong.

1. *B. tenellum*, *Fisch.*

A weak procumbent and ascending herb with thinly adpressed hairy stems, 7—12" long, long-petioled elliptic lower leaves about 1.5—2" long, upper smaller and those on flowering branches (bracts) about .3" only, subsessile, with extra-axillary or leaf-opposed small white flowers. Sepals .05—.06" in flower, enlarging to .14" in fruit, narrowly lanceolate. Nutlets densely minutely tuberculate, oblong, about half as long as the calyx.

Bettiah, *Hieronymus!* Behar, *J. D. H.* Fl., Fr. Feb.—May.

FAM. 96. CONVULVACEÆ.

Herbs or shrubs, very frequently twining to the left, often with milky juice, with alternate leaves, rarely (*Cuscuta*) leafless parasites. Leaves mostly simple and palminerved, sometimes palmately or pinnately compound, very rarely with stipules. Hairs simple or forked. Flowers regular, 2-sexual from minute to very large, solitary or cymose, usually with 2 well-developed bracteoles. Sepals 5 free or connate at the base, imbricate, often very unequal, persistent and sometimes accrescent or winged in fruit. Corolla tubular, salver-shaped, funnel-shaped, campanulate or almost rotate with limb subentire to deeply 5-lobed, lobes in bud rarely imbricate, usually induplicate-valvate and whole limb plaited. Stamens 5, rarely 4, usually at the base of the tube, sometimes unequal, included or exsert, pollen often with points or prickles. Disc annular entire or lobed or almost obsolete. Ovary superior of 2 (rarely 3—5) carpels, 1- or usually 2- or by the formation of false septa 4-celled, styles 1—2 or almost *nil*, terminal or rarely (*Dichondra*) from between lobes of the ovary, style-lobes or stigmas various. Ovules 2 in each carpel, collateral, erect, basal, sessile, more or less anatropous, micropyle directed down and outwards, integument 1. Fruit various, rarely (*Dichondra*) of nutlets. Seeds 4—1, albumen 0 or scanty, cotyledons foliaceous and plaited; in *Cuscuta* embryo spiral peripheral, cotyledons rudimentary.

Germination usually, or always epigeal, the expanded cotyledons very frequently retuse or 2-lobed or palminerved.

§ Plants with well-developed leaves. Infrastaminal scales 0 (1—15):—

I. Ovary deeply divided. Fruit of 2 nutlets:—
A small creeping herb

1. *Dichondra*.

II. Ovary entire. Fruit not divided into nutlets (2—15):—
A. Style or styles elongate. Petals not lobed (2—14):—

1. Styles 2, or style deeply 2-partite:—
Styles 2 undivided, stigmas capitate

2. *Cressa*.

Styles or style-divisions 2-fid, stigmas linear or clavate. Prostrate herb

3. *Evolvulus*.

2. Style 1, undivided up to the stigmas:—
- a. Fruit indehiscent; baccate, coriaceous or crustaceous. Sepals often fleshy in fruit or coriaceous, never brittle (4—6):—
- i. Stigma with linear or oblong lobes. Fruit dry, finally breaking up 4. *Rivea*.
- ii. Stigma with rounded lobes:—
- Ovary 4-celled. Fruit dry or baccate . 5. *Argyreia*.
- Ovary 2-celled. Fruit usually baccate . 6. *Littsomia*.
- b. Fruit usually dehiscent with valves, sometimes with very thin pericarp irregularly breaking up, sometimes with exocarp separating from a membranous endocarp. Sepals sometimes dry and brittle when capsule not valvular (7—14):—
- i. Sepals small, enlarged into wings in fruit:—
- Climbers with small white flowers (in our species) 7. *Porana*.
- ii. Sepals sometimes slightly accrescent, but not wing-like in fruit. Flowers never very small:—
- * Stigma with two rounded lobes. Ovary 3-celled in *Ipomæa*, sec. *Pharbitis*, 4-celled in sec. *Batatas*, 2-celled in others (8—11):—
- ! Corolla tubular or salver-shaped. Stamens exerted (capsule with false partitions between the seeds in 9 and 10):—
- Corolla tubular from a narrowly-tubular base, orange 8. *Mina*.
- Corolla salver-shaped with very long tube, white or purple. Stems often muricate 9. *Calonyction*.
- Corolla salver-shaped with m.s. rather swollen tube, red, yellow or white. Slender herbs, never muricate . . . 10. *Quamoclit*.
- !! Corolla campanulate or funnel-shaped. Stamens included:—
- Sepals usually similar, not usually herbaceous. Capsule usually valvular, but sometimes irregularly breaking up 11. *Ipomæa*.
- ** Stigma with ovate or elongate lobes. Ovary 1—2-celled:—
- ! Outer sepals different from the inner. Ovary 1-celled . . . 12. *Hewittia*.
- !! Sepals equal and similar:—
- Calyx not supported by two large bracts. Stigmas linear . . . 13. *Convolvulus*.
- As in *Convolvulus*, but stigmas ovate or lanceolate *Jacquemontia* (p. 633).
- Calyx supported by two large bracts 14. *Calystegia*.
- B. Style hardly any. Petals lobed or emarginate:—
- Climbing shrub with yellowish-white paniced flowers 15. *Eryciba*.
- §§ Twining leafless parasites. Corolla with infrastaminal scales 16. *Cuscuta*.

1. DICHONDRA, *Forst.*

Small prostrate or creeping herbs with roundish stalked leaves and solitary inconspicuous axillary flowers. Sepals nearly free. Corolla

broadly campanulate, shorter than the calyx, deeply 5-lobed, almost valvate. Ovary very deeply 2-lobed or almost apocarpous, each lobe 2-celled. Styles 2 from between the lobes, stigmas capitate. Fruit usually of two indehiscent or irregularly dehiscent nutlets. Seeds roundish, smooth.

A genus very close to the Boraginaceæ, but distinguishable from the radicle directed to the inferior micropyle, by the plicate and curved embryo. The habit and indumentum and shape of leaves are also rather those of the Convolvulaceæ.

1. *D. repens*, Forst.

A creeping herb somewhat like a *Hydrocotyle* with orbicular deeply cordate leaves about 1" diam. Stems and petioles thinly pilose. Leaves glabrous above, pilose on nerves beneath. Petioles slender erect. Flowers campanulate 1" long only. Corolla white, tube campanulate nearly as long as the oblong petals. Ovary very minute, villous. Nutlets 2 globose .07" diam., mottled brown, far exceeding the styles which become hidden between them. Albumen scanty. Radicle curving over the top of the cotyledons.

A very interesting little plant with a very wide distribution in both hemispheres, but not included in the *Flora of India* (a note states that it was found by Wallich beyond Ava). Found in my garden in Ranchi and probably introduced with plants from Calcutta. Fl., Fr. r.s.

2. *CRESSA*, L.

Dwarf low-lying, much-branched shrubs, usually minutely grey-hairy with small undivided leaves and sessile or very shortly stalked flowers, axillary or in terminal spikes or clusters. Sepals equal, imbricate, unchanged in fruit. Corolla funnel-shaped, deeply 5-lobed, lobes imbricate, not plaited. Stamens exsert. Disc inconspicuous. Ovary more or less 2-celled. Styles 2, stigmas capitate. Capsule 2—4-valved, 4 (usually) 1-seeded. Seed glabrous, cotyledons linear, plicate.

1. *C. cretica*, L.

A small very bushy plant 6—18" high, grey or hoary. Leaves sessile .25—3", the lower or larger cordate, the upper ovate or lanceolate, hairy. Flowers small, sessile, numerous, white. Sepals .12". Corolla .17", lobes reflexed, hairy and bearded. Ovary pubescent at tip. Capsule 4-seeded.

Orissa, near the Chilka Lake, Prain's Collector! Fl. r.s.

It looks at first sight very unlike one of the *Convolvulaceæ*. Flowers small, numerous, clustered at the ends of the branches, .15—2" diam. According to Wight it grows on salt, and generally flowers during the hot season when the ground about it begins to crack.

3. *EVOLVULUS*, L.

Small prostrate herbs (in our area), sometimes erect or shrubby. Leaves small entire. Flowers small, axillary, single or in a few-fl. inflorescence. Sepals subequal. Corolla limb 5-plaited, subentire. Filaments filiform. Ovary 2—1-celled, styles 2, each cleft into two linear

or subclavate stigmas. Fruit a 4—2-valved capsule. Seeds glabrous, cotyledons doubly folded, radicle incumbent.

1. *E. alsinoides*, L.

A charming little plant when in flower, reminding one of an English Speedwell. Branches numerous prostrate 4—15" long, thinly or densely silky. Leaves from linear to usually broadly elliptic .25—'5", rarely 1", densely appressed hairy or silky beneath. Flowers bright blue .25—'3" diam., 1—3 terminating slender peduncles which are longer than the leaves, and with 2—3 subulate bracts at the ends. Pedicels usually short or when solitary fls. subsessile on the peduncle. Sepals small lanceolate hairy. Corolla rarely white, subrotate, .2" long. Capsule .12—'14" diam., thin, 2—4-valved.

In all districts, usually in open pasture land, dry banks, etc. Fl., Fr. July—Dec.

4. RIVEA, Choisy.

Erect or twining shrubs with cordate leaves and large flowers mostly in axillary few-fl. cymes and often supported by large bracts at their base. Sepals equal short. Corolla broadly tubular, salver-shaped, or funnel-shaped, scarcely lobed. Stamens included with short filaments sometimes bearded at base. Disc annular. Ovary 4-celled, style slender, stigmas linear or oblong. Fruit baccate or indehiscent and nearly dry, pericarp ultimately irregularly breaking up.

Stout erect (or ultimately scandent). Sepals lanceolate, .5—'7"

Always scandent, often slender. Sepals ovate, .3"

1. *ornata*.

2. *hypocrateriformis*.

1. *R. ornata*, Choisy, var. *Griffithii*, Clarke.

A handsome erect shrub or undershrub, 3—5 ft. high, sometimes said to be scandent though I have not seen it so. Leaves orbicular-cordate, or somewhat reniform, 3—5" diam., white-silky beneath. Peduncles 3—7-fl. Sepals lanceolate or elliptic-oblong acute, .5—'75" long. Corolla-tube 2" and limb 2" or more across. Capsule .7" diam. yellow-brown usually breaking transversely across, seeds in a white pith.

N. Champaran, frequent! Fl. r.s. Fr. Dec.—Jan. Probably also Purneah.

I have kept no specimens, but the Champaran plant is the same as the erect shrub common in the savannah tracts of the Duars and sent to Sir D. Brandis, who apparently calls it *R. Roxburghii*, Prain (*Indian Trees*, p. 484), while Prain called it *R. ornata* in *Bengal Plants*! Whether the corolla is glabrous or silky outside I have no note.

2. *R. hypocrateriformis*, Choisy. Kalmi lata, Beng.; Pailwa sag, Kharw.

A climber with silky branches, orbicular-cordate leaves 2—3.5" diam. often broader than long, and white with appressed silky hairs beneath, and long-tubed white flowers 2" diam. on 1—3-fl. axillary and terminal peduncles. Sepals ovate, or elliptic-oblong and obtuse, .3—'4" long. Corolla-tube rather slender dilated upwards, 2" long, with obliquely spreading limb 1.3" long with well-marked bands on the corolla. Fruit globose .5" diam.

Behar, J. D. H.! Scrub jungles in Singhum, not common! Hazaribagh (Koderma forest)! Palamau! Ranchi, Clarke! Santal Parg.! Fl. Sept. Fr. Nov.—Dec.

Leaves with rounded or short-cuspidate tip, not thickly tomentose, lateral nerves about 4, of which 3 are from close to base, petiole 1—2.5" or about as long as their leaves. Corolla limb glabrous or puberulous without. Capsule seated on the 1" diam. calyx, when breaking up usually leaving the four vascular bundles marking the margins of the septa.

The leaves are said to be eaten in Palamau.

5. ARGYREIA, Lour.

Climbing rarely erect shrubs with usually silky hirsute or pubescent leaves and penninerved, but with several lateral nerves close to the base. From *Rivea* it differs chiefly in the more or less globose stigmatic lobes. Sepals equal or unequal, seldom accrescent. Corolla funnel-shaped, 5-angled or -lobed. Filaments often wider at base. Fruit baccate to dry and hard, indehiscent.

I. Cymes mostly sub-capitate or very dense. Sepals ovate to oblong, finally coriaceous:—

A. Leaves broadly ovate-cordate:—

1. Peduncles very long and stout:—

Bracts caducous. L. silvery tomentose beneath, glabrous above

Bracts persistent, orbicular. L. appressed-hairy beneath, hairy above

1. *speciosa*.

2. *cymosa*.

2. Peduncles short, sometimes only 1-fld.:—

Bracts sub-persistent, narrow-elliptic. L. appressed-hairy beneath, hairy above. Fruit succulent

3. *Roxburghii*.

4. *Daltoni*.

B. Leaves narrowly ovate or ovate-oblong

5. *tiliaefolia*.

II. Peduncles 1—3-fld. Sepals finally much enlarged, orbicular, fleshy when fresh

1. **A. *speciosa***, Sweet. Bich-tarak, guguli, Beng.; Samandar-sok, H.; Munda noi, Or.; The Elephant Creeper.

A stout handsome climber with woody stems often 5" diam., new shoots densely white tomentose. Leaves 6—12" diam. beautifully white silvery silky beneath, but above quite glabrous even when young. Flowers 2—3" diam., white woolly outside, bright purple or rose within, in very long-peduncled many-fld. sub-capitate cymes with large ovate-lanceolate acute thin softly woolly deciduous bracts, 5—1.5" long. Fruiting sepals leathery 5—6" long, fruits like broad acorns 6" diam.

Wild in Orissa. Puri district! Elsewhere only cultivated. Fl. r.s. and c.s. Fr. Jan.—April. Leaves renewed in April.

L. broadly ovate cordate with about 14 strong sec. n., of which some 6 are close to the base each side, impressed above, apex rounded or acute with excurrent midrib. Petiole 3—9", always shorter than the blade. Peduncles 5—9", stout, white tomentose. Flowers 2—3" long, corolla tubular-funnel-shaped, with the longitudinal lanceolate bands silky. Outer bracts acuminate.

2. **A. *cymosa***, Wight.

A somewhat far-spreading climber with sub-strigosely hairy stems, orbicular cordate acute or very shortly cuspidate leaves 3—5", softly appressed-hairy beneath and with shorter hairs above. Flowers white

and rose-coloured in long-peduncled capitate, 2—3-chotomous cymes 1—2" diam. Corolla 2—2.5" tubular-funnel-shaped. Berry .75".

Puri jungles, common! Fl. Nov.—Dec. Fr. Feb.

L. with 7—8 sec. n. of which 2—3 near the base. Petiole 1.5—2.5". Cymes scented on peduncles 3—6" or rarely 8" long, pubescent. Bracts persistent, tomentose-hairy .4" orbicular-cuspidate foliaceous or sometimes lower larger and just like small leaves. Fls. subsessile, sepals purplish, outer like the bracts .5—6" with very broad base, inner two narrow oblong. Corolla densely silky on the bands.

3. *A. Roxburghii*, Chois.

A rather robust twiner hirsute with spreading and reflexed hairs on the stem, broadly cordate leaves hairy with appressed fulvous hairs beneath and with shorter hairs above, larger about 6 × 5.5" with shortly suddenly acuminate apex. Flowers funnel-shaped 2—2.5" long in very short and few-flowered cymes .75—2" long only (without the flowers) including the peduncles. Fruits orange fleshy depressed-globose .75—1.1" diam. Fruiting sepals slightly fleshy broadly ovate and only .25—4" long in quite ripe fruits owing to the outer non-fleshy portions drying off.

Northern area only. Purneah, common! Fl. Aug.—Sept. Fr. Nov.—Dec.

Sec. n. about 10 of which 3—4 close to base. Petiole 1.5—4". The very short peduncles are very constant in our area though more eastern examples have them longer. Bracts sub-persistent .5" narrow elliptic densely strigosely hairy, some foliaceous 1.2—1.5", elliptic and acuminate. Flowers sometimes sub-solitary. Sepals .3—5". Corolla with a few appressed hairs on the lanceolate bands. Seeds 1—4, .3—35" oblong rounded scarcely compressed on two inner faces even in 4-seeded fruits.

4. *A. Daltoni*, Clarke.

A large handsome climber with strigosely-hairy or -pubescent stems, large narrowly ovate or ovate-oblong, shallowly cordate-based leaves reaching 8.5—9" by 4—5" with gradually tapering apex, thinly strigose with pulvous hairs beneath. Flowers bright red-purple 2.5" diam. with tube 1.5" long in 3—7-fl. cymes with persistent bracts, on stout peduncles 1—5" long.

Mountains in Singbhum! Angul! Fl. Sept.—Oct. Fr. Jan.—Feb.

Base of leaves sometimes rounded and not cordate, sec. n. 6—7 only, petiole 1—2". Cymes rather dense with foliaceous spatulate or linear-oblancoolate bracts .5—8" long, very persistent (even after the fruit has fallen). Pedicels short. Sepals .5—6" outer oblong, inner smaller lanceolate silky. Corolla tube with long soft hairs outside. Berry .7" diam.

5. *A. tiliaefolia*, Wight. Syn. *Convolvulus gangeticus*, Roxb.; *Stictocardia tiliaefolia*, Haller.

A dense twining shrub with large suborbicular or ovate deeply cordate leaves 2—4" long with a thin white tomentum beneath. Flowers 2.5—3" white with red centre, or rose-purple (*F. B. I.*), or pink (*Roxb.*), 1—3 on a peduncle .5—3" long. Calyx .4—6" in flower. Fruit thin dry 1—1.5" diam. including the accrescent fleshy calyx which is 1.2—1.6" long in which it is completely enclosed. The calyx with age becomes a network of veins from which the intermediate tissue sometimes disappears.

Tidal Forests. Probably occurs in the Mahanadi delta. Fl. Dec.—Jan.

6. LETTSOMIA, Roxb.

Distinguished from *Rivea* and *Argyreia* only through the 2-celled ovary. Sepals nearly equal, usually only slightly accrescent. Corolla from small to large, mostly shortly lobed. Anthers seldom exsert. Disc annular. Style elongate, slender, stigma of two rounded lobes. Fruit baccate, indehiscent, sometimes dry, 4—1-seeded.

- A. Stamens exserted. Flowers .5—6" long:—
 Bracts obovate or orbicular, woolly, persistent 1. *aggregata*.
 Bracts subspathulate or oblong, deciduous 2. *bella*.
- B. Stamens included. Flowers large, 1.5—2":—
 L. ovate-lanceolate gradually acuminate. Peduncles slender,
 not exceeding the petiole 3. *Thomsoni*.
 L. broadly ovate, caudate. Hairs patent or subpatent . 4. *strigosa*.
 L. lower broadly ovate, upper sometimes ovate-lanceolate.
 Peduncles exceeding the petioles. Hairs strigose 5. *setosa*.

1. *L. aggregata*, Roxb.

A pretty climber, resembling in new leaf *Argyreia speciosa*, with milky juice, white tomentose shoots, ovate cordate leaves 3—5" at time of flowering, attaining 6.5" when mature, white tomentosely hairy beneath, appressed hairy or pilose above. Flowers pink campanulate with spreading petals, .5—6" long only in peduncled capitate cymes with broadly obovate or orbicular woody subpersistent bracts resembling the outer sepals. Berry red, fleshy .3".

Southern tract only, Puri frequent. Fl. Sept.—Dec. Fr. Dec.—April. The new leaves appear in April.

L. mostly obtuse or rounded at apex, sec. n. 10—12 of which 3—4 near base, petiole 1—5". Peduncles .2—4" tomentose numerous. Two outer sepals concealing the rest woolly or in fruit hirsute, .35—4", inner oblong silky .3". Corolla white-hirsute on the lanceolate bands. Stamens far exserted. Berry ultimately dry with thin epicarp and membranous endocarp sometimes intruded between the seeds, seated on the persistent calyx which is scarlet within. Seeds .17" grey minutely woolly round the large areole.

NOTE.—The type has leaves glabrous above. Our species seem always to be var. *osyrensis*, Clarke.

2. *L. bella*, Clarke.

A pretty climber closely resembling the last, than which it is little more than a variety. Juice milky, stems white tomentose. L. 4—6", densely pilosely or silkily tomentose beneath and with silky adpressed hairs or glabrous above. Bracts .2—2.5" subspathulate or oblong deciduous.

Singbhum, often in grassy glades! Palamau, very common in the Southern Range! Ranchi ghats! Probably in all districts of Chota Nagpur, doubtfully extending into Orissa, although there appears to be a specimen from Ganjam, *Gamble*! and Angul, *Lace*!

Sec. n. 9—10, lowest 3—4 close to base. Petiole 1—3.5". Peduncles .5—3". Calyx .4—5" densely appressed hairy or hirsute, sepals oblong, 3 outer larger. Corolla .6—7" long by .8" diam. with white tube and spreading pink limb, anthers exserted pink. Fr. dry when ripe as in last, .3" diam. scarlet. Seeds brown.

A very luxuriant form is found in Palamau with leaves attaining 11 by 9.5" with petiole 3—8".

3. *L. Thomsoni*, Clarke.

A robust climber with hairy (not strigose) stems, ovate-lanceolate

gradually acuminate leaves 4—6" long with cordate or shallowly cordate base, thinly setosely hairy both sides. Fls. 1·5—2" long and 1·5" diam., purple, in peduncled capitate cymes with the peduncles mostly as long as the petioles. Bracts oblanceolate or spatulate-oblong 3—5" long, deciduous, much less hairy than the densely fulvous-hirsute sepals, the hairs of which entirely conceal them. Fruit dry 2—4-seeded, 3—4" diam.

N. Champaran, Ramnagar Hills! Fl. Oct.—Nov. Fr. Jan.

L. with about 10—12 sec. n. of which 3 close to the base, petiole 2—3·5" long, hairy. Cymes about 1" diam. Peduncles 2—4". Corolla with fulvous hairs on the lanceolate bands.

4. *L. strigosa*, Roxb.

Habit of the last which it somewhat resembles but that the leaves are broadly ovate and suddenly acuminate or caudate, more densely hairy (scarcely strigose) on both surfaces, sec. n. 12—16. Peduncles often 6". Bracts larger, 1", elliptic-oblong, sub-foliaceous, persistent.

Sikkim Tarai, close to Purneah, and will probably be found in Purneah. Fl. r.s.

The brownish hairs which copiously cover the plant are spreading on the branches, petioles and peduncles and long, scarcely appressed, on the leaf blades, so that the name "*strigosa*" is not an applicable one.

5. *L. setosa*, Roxb. Baghchaur, Gond.

A large handsome climber with milky juice. Stems and leaves beneath with adpressed setose hairs. L. broadly ovate or oblong-ovate, cordate, obtuse or acute or shortly cuspidate, 4—6" long and broad, upper sometimes ovate-lanceolate. Flowers 1·5—2" long, tubular-funnel-shaped, usually with white tube somewhat ventricose in middle and a purple limb, 1—1·3" diam. in dense stout corymbiform cymes 2—5" diam. on long stout strigose peduncles 3—9" long. Bracts broadly elliptic or orbicular-oblong, coriaceous, 3", densely strigose, deciduous in fruit. Berries yellow to bright orange, 3" diam.

Widely distributed. Champaran! Ranchi (Biru), Cardon! Singhum! Palamau, ascending to Neterhat 3000 ft.! Manbhumi, Kurz! Puri, Lace! Angul! Sambalpur! Kalahandi, Cooper! Fl. Oct.—Nov. Fr. Nov.—Jan.

Leaves sometimes sparsely setose above, the hairs leaving minute dots after falling, sec. n. 8—13 of which 3—4 are close to base. Petiole 1—5" strigose. Cymes with main branches 2—3-chasial, flowers sessile at the angles of the ultimate branches. Bracts leaving persistent scars on the cymes. Sepals 3—5" broadly oblong or 3 outer or all orbicular, thick, concave, somewhat fleshy and accrescent in fruit which they enclose till quite ripe, then spread and become coriaceous or woody. Corolla strigose on the white bands. Berry depressed-globose, succulent, 4—2-seeded.

NOTE.—The specific name "*strigosa*" suits this plant much better than the one to which it is applied and the names would have been better interchanged.

7. PORANA, Burm.

Scrambling or twining shrubs with usually cordate leaves and small or m.s. flowers axillary and in copious panicles. Sepals at first equal and small, very accrescent in fruit, developing into large veined wings. Corolla usually small, campanulate or somewhat funnel-shaped or salver-shaped with broad-lobed spreading limb. Fil. slender, anthers linear to

lanceolate. Disc annular or 0. Ovary 2-celled, with 2—4 ovules. Fruit small 1-seeded, usually finally 2-valved. Seeds smooth.

1. **P. paniculata**, *Roxb.* Era-bair, *K.*; Panjot-nari, *S.*; Bhudia-lar, *Kharw.*; The Bridal Creeper.

A beautiful climber forming large pure white patches in the jungle with its innumerable, paniced, small white flowers, and softly white-tomentose ovate-cordate leaves.

Ramnagar Hills, common! Rajmahal Hills, common! Stony nalas, banks, and northern sides of hills and ghats, throughout Chota Nagpur! Fl. Oct.—Dec. Fr. Jan.

Shoots tomentose. L. 1" by .5" to 5" by 3", rarely lower leaves 6" diam., acute or acuminate, base 5—6-nerved. Calyx in fl. .05" long. Corolla .25—3" long tubular-funnel-shaped. Fruiting sepals all equally enlarged or sometimes three .75 by .25" and two linear only .25" long. Capsule membranous globose hairy or tomentose .2" diam.

8. **MINA**, *Llave et Lex.*

Flowers with a very short corolla from which the stamens and style are far exerted and somewhat declinate. Calyx very short, sepals equal. Corolla with a very short tubular basal portion and a wider tubular-campanulate longer upper 5-lobed portion.

1. **M. lobata**, *L. & L.*

A climber very commonly grown in gardens with dichasial cymes of orange and scarlet flowers in elongate dichasial racemiform cymes. Leaves palmately lobed.

9. **CALONYCTION**, *Choisy.*

Twining, large often muricate or prickly herbs with simple cordate leaves and very large white or purple flowers in axillary few-fl. dichasial cymes, rarely solitary. Corolla salver-shaped with very long narrow cylindrical tube and a broad spreading scarcely lobed margin. Stamens exert, sometimes very slightly. Stigma with 2 rounded lobes. Fruit mod.-sized, 2-celled but often with false dissepiments between the seeds.

Flowers white. Pedicel not usually clavate in fruit

1. *bona-nox.*

Flowers purple. Pedicel very clavate in fruit

2. *muricata.*

1. **C. bona-nox**, *Boj.*, var. *grandiflora*. Syn. *Ipomœa Bona-nox*, *L.*; *C. speciosum*, *Choisy*; *Ipomœa grandiflora*, *Roxb.*; *Dudhia-kalmi*, *halkalmi*, *Beng.*; *Kunja-lata*, *Or.*; Moon-flower.

A large glabrous twiner with the stems sometimes muricate. Leaves broadly ovate cordate acute or acuminate with petioles about as long as the blades. Flowers 3—5" diam., pure white or with greenish plaits on 1—5-fl. peduncles 2—6" long; pedicels short, sometimes wider upwards but not greatly thickened in fruit. Capsule 1" ovoid oblong. Seeds glabrous.

Wild in Northern Purneah and the Mals of Orissa! Frequently cultivated for the large beautiful fragrant flowers which open of an evening and close the following morning. Fl. r.s. and up to Dec.

Leaves with deep sinus and rounded basal lobes, otherwise entire and not lobed, tip sometimes shortly caudate. Calyx 4—5", sepals with mucronate or cuspidate tips, not or scarcely enlarged in fruit. Corolla-tube 2.5—3".

2. C. muricatum, G. Don. Syn. *Ipomæa muricata, Jacq.*

A less robust climber with the stems muricate with soft prickles, leaves glabrous 3—5" or sometimes 6", broadly ovate cordate ending in a long acumen or shortly caudate or acute. Flowers pale pink or purple sometimes only 3—4 racemiform on a peduncle or more cymose, often appearing spicate in fruit from the extraordinary development of the pedicel which is thickly clavate for its whole 1.25—1.5" length and looks like a large inferior ovary. Sepals .5" ending in a long cusp or acumen, keeled. Corolla-tube 1—2" long by .2" long, limb about 1" long. Young fruit often pink. Capsule .5—7" diam. globose, apiculate. Seeds smooth.

N. Champaran! Hazaribagh! Palamau, common! But nearly always near villages. Fl., Fr. Sept.—Dec.

10. QUAMOCLIT, Tournef.

Twining herbs with simple cordate or lobed or, rarely, pinnate leaves and usually showy funnel-shaped or sub-salver-shaped (with weakly funnel-shaped tube) flowers in axillary long-peduncled umbellate cymes. Sepals equal, usually with cuspidate tips. Corolla-tube broader upwards often constricted under the spreading limb. Stamens exsert. Ovary and fruit 4-celled by false dissepiments between the seeds. The rest as in *Ipomæa*.

L. simple ovate cordate

1. *coccinea*.

L. pinnate with filiform segments

2. *vulgaris*.

1. Q. coccinea, Moench. Syn. *Ipomæa coccinea, L.*; *Quamoclit phœnicca, Choisy*.

A slender herbaceous climber with broadly ovate cordate leaves 1.5—2.5" long and few-flowered long-peduncled cymes of usually deep crimson very pretty flowers with the narrowly funnel-shaped tube, 1—1.2" long and limb about .7—9" diam.; sometimes yellow or orange flowers are found.

More or less naturalised throughout the province. Very common in gardens. Fl., Fr. r.s. and c.s.

Stems and branches puberulous or somewhat hispidulous. Leaves glabrous, tip usually rounded. Calyx .15—2" including the long subulate tips of the sepals. Ovary 4-celled. Capsule .25—27", ovoid with membranous septa.

2. Q. vulgaris, Choisy. Syn. *Ipomæa Quamoclit, L.*; *Q. pinnata, Boj.*

A very graceful slender climber with pinnate leaves 2—5" long with numerous filiform segments and brilliant crimson, or sometimes white, flowers of about the same size and shape as the last.

Very common in gardens and also often self-sown. Fl., Fr. chiefly r.s.

Both species are natives of Tropical America.

11. IPOMÆA, L.

Twining, more rarely prostrate, rarely erect herbs or shrubs with simple entire or lobed usually cordate-based or sometimes palmately compound leaves. Flowers often showy; solitary or cymose. Sepals

equal or unequal, often coriaceous or membranous, mostly short, sometimes accrescent in fruit and often becoming foliaceous papery or brittle but not thick and fleshy nor enclosing the fruit. Corolla campanulate or funnel-shaped, entire or slightly lobed with the vertical bands (which are the portions outermost in bud) usually well marked by their slightly different texture or venation. Stamens included, filaments often hairy or dilated at base, often unequal, pollen spinulose or echinulate or (*Merremia*, etc., of some authors) smooth or banded. Anthers ovate to linear, sometimes twisted. Disc annular, often lobed. Ovary 2-, rarely 3- (*Pharbitis*) or 4- (*Batatas*) celled, ovules 4. Stigma of two globose lobes. Capsule coriaceous or membranous or brittle, usually 4-valved. Seeds 4 or fewer. Cotyledons broad, plicate, often 2-lobed.

Ipomæa of Linnæus and in the *Fl. Brit. India* includes the groups sometimes distinguished as genera under the names of *Calonyction*, *Mina*, *Quamoclit*, *Pharbitis*, *Operculina*, *Aniseia* and *Merremia*. The separation of the last two (by Hallier, f.) appears to me especially artificial, and is based on the character of the extine of the pollen (whether smooth or echinulate) unsupported by other characters (I find the character of 2 or more lines, etc., in the bands unworkable), and separates obviously allied species. *Operculina* has been separated by the supposedly circumscribers exocarp. This distinction is based on too few observations, as the exocarp of *Ipomæa* (*Operculina*) *turpethum* sometimes splits longitudinally into 4 valves. *Pharbitis* and *Batatas* may be more natural, but these were not separated by Hallier. I therefore include all the genera *Pharbitis*, *Batatas*, *Operculina*, *Aniseia* and *Merremia* in *Ipomæa*, and separate therefrom only *Calonyction*, *Mina* and *Quamoclit*, which are easily distinguishable in our species.

I. Ovary 2-celled (Spp. 1—24):—

A. Sepals green herbaceous, usually hairy (Spp. 1—7, see also 19 and 21):—

1. Outer 2—3 sepals much larger than the inner, accrescent. (Small plants with undivided leaves under 3" and peduncles often 1-fl. and 2-bracteate, fls. under 2"):—

Glabrescent. Sepals decurrent at base in fruit (*Aniseia*)

Hirsute. Sepals lanceolate. L. ovate-oblong

Villous. Sepals cordate or sagittate, not decurrent, leaves ovate cordate

1. *uniflora*.
2. *barlerioides*.
3. *calycina*.

2. Sepals equal or nearly so, scarcely accrescent. (Usually weak twiners with very hairy calyx):—

a. Flowers pink in bracteate heads:—

- i. Leaves entire (see also *I. pes-tigridis*, var.):—
Heads sessile or sub-sessile. Fls. small

Heads long-peduncled with a large 2-cuspidate bract

- ii. Leaves deeply lobed (entire in one var.). Hds. long-petioled, many-bracteate

b. Fls. in lax persistently bracteate 2—3-fl. cymes:—

Leaves white beneath, often 3-lobed

4. *hispida*.
5. *involutata*.
6. *pes-tigridis*.
7. *pilosa*.

B. Sepals dry, membranous or somewhat fleshy with scarious margins, not hairy (hairy in 21, ciliate in 11, pubescent in 13 and 19). Spp. 8—24:—

1. Leaves not deeply palmately lobed or only 2—3-lobed:—

a. Small plants, never widely scandent. Fls. under 1", usually yellow or white:—

- i. Sepals glabrous (*Merremia*):—
- * Leaves longer than broad, usually oblong:—
 - Prostrate. L. sessile, often hastate, rarely 1". Fls. .3" 8. *tridentata*.
 - Twining. L. similar but larger. Fls. .75" 9. *hastata*.
 - Prostrate or twining. L. petioled. Fls. .7" 10. *cæspitosa*.
 - ** Leaves nearly or quite as broad as long:—
 - Stem creeping. L. reniform. Fls. .5— .75", sepals ciliate 11. *reniformis*.
 - Twining. L. often 3-lobed, ovate cordate. Fls. .7", in 3—7-fld. cymes, sepals glabrous 12. *chryseides*.
- ii. Sepals pubescent (*Ipomæa*):—
- Twining. L. ovate or suborbicular, cordate, entire 13. *obscura*.
- b. Flowers over 1", rarely yellow (*Ipomæa*, *Merremia* and *Operculina*). Spp. 14—20:—
- i. Peduncles 1-fld., more rarely 2—3-fld., often 2-bracteate. Never widely scandent:—
- * Creeping, prostrate or floating:—
 - Aquatic. L. mostly narrow 14. *reptans*.
 - Littoral. L. orbicular 2-lobed or emarginate 15. *pes-capræ*.
 - ** Prostrate or twining from a woody stock:—
 - Glabrous. L. oblong to linear. Corolla hirsute, sometimes yellow 18. var. *pauciflora*.
 - Pubescent. L. ovate to oblong-lanc. Corolla glandular 19. var. *humilior*.
- ii. Peduncles usually several—many fld. Climbers:—
- * Calyx glabrous, without external glands:—
 - ! Herbaceous. Leaves under 3":—
 - L. cordate-ovate 1—2", sometimes sub-3-lobed. Fls. purple or white, sepals .2—3" ovate-oblong. Corolla glabrous 16. *sepiaria*.
 - L. oblong, ell. or lanceolate, often cordate or hastate. Fls. white or cream. Sepals .3—35" ell. obtuse and apiculate. Corolla pubescent at tip 17. *cymosa*.
 - !! Shrubby. Leaves over 3" long:—
 - L. broadly ovate or ovate-oblong. Calyx .3—35". Corolla pubescent at tip only 17. *cymosa*, var.
 - Stems often sub-alate. Calyx .6—8". Corolla hirsute 18. *petaloidea*.
 - ** Calyx pubescent. Outer sepals much larger than the inner, accrescent:—
 - Stems usually 3—4-ate. Calyx .7—1". Corolla gland-dotted, otherwise glabrous 19. *turpethum*.
 - ** Calyx with outer sepals 2-glandular, .25":—
 - L. ovate-cordate acuminate. Corolla large, pink, puberulous 20. *carnea*.
2. Leaves deeply 5—7-lobed or palmately compound:—
- a. Sepals hairy, .5" accrescent. Corolla yellow, 2" 21. *vitifolia*.

b. Sepals glabrous:—

i. Leaves simple lobed. Exotics:—

Lobes of leaf elliptic or lanceolate, subentire 22. *palmata*.

Lobes of leaf again lobed or pinnatifid 23. *sinuata*.

ii. Leaves digitate palmately compound. Fls. white

24. *quinata*.

II. Ovary 3-celled, ovules 6 (*Pharbitis*):—

Leaves 3-lobed, hairy. Flowers blue or pink 25. *hederacea*.

III. Ovary 4-celled. Ovules 4 (*Batatas*):—

Scandent. Leaves deeply palmately lobed 26. *digitata*.

Prostrate. Leaves triangular or irregularly sharply lobed.

Cultivated herb with tuberous roots 27. *batatas*.

Several other species are often found in gardens, such as the Morning Glory (*I. purpurea*), an annual tropical American species usually called *Convolvulus major* by horticulturalists, and the beautiful blue perennial *I. Learii*, etc.

1. *I. uniflora*, Roem. Syn. *Aniseia uniflora*, Chois.

A creeping and twining herb with glabrescent stems, oblong, obtuse or emarginate, mucronate leaves 1.5—3.5" long mostly with slender .3—5" long petioles and solitary campanulate white flowers .8—1" long. Sepals in flower .4—5", fruiting reticulate-venous, .6—7.5" and somewhat decurrent on the pedicel, two outer ovate subcordate scarious. Corolla rather densely hairy. Capsule ovoid glabrous .5".

Usually found near wheels! Chota Nagpur, *Beng. Plants*; but I can find no specimens from Chota Nagpur either at Calcutta or Kew.

Leaves with usually cuneate base. Peduncle with pedicel 1.5—2" long with a pair of minute persistent bracts. Corolla-lobes short acute.

The pollen of this species is quite smooth, for which reason it has been placed in a separate genus *Aniseia* by many botanists. It appears to me to be too close to the two next to thus separate it.

2. *I. barlerioides*, Benth.

A trailing herb or ultimately twining with hirsute or hairy stems, ovate-oblong leaves 1—2" (—3" Clarke) long with shallowly cordate base and rounded, rarely acute, often mucronate apex. Flowers light-purple about 1.7" long and 1.25—1.5" diam. on axillary bracteate 1- (rarely 2-) fld. peduncles. Calyx hairy with 2 outer large leafy ovate-lanceolate or lanceolate sepals .55—7" long and 3 inner much narrower linear sepals, but nearly as long in flower.

Usually in grass. Ranchi and Palamau, on the tops of the *pats*! Manbhum, *Camp.*! Hazaribagh, *Clarke*! Fl. May—Oct.

Branches annual from a woody stock. Leaves hairy especially on the nerves beneath, acc. n. 3—5, of which 1—3 from the base each side. Petiole .15—2.5" long. Peduncles at first very short and about as long as petiole, soon elongating and sometimes attaining 3" in fruit, hairy, with two hairy lanceolate or ovate-lanceolate bracts towards the end .3—5" long. Pedicel very short. Corolla funnel-shaped from a basal very narrow tubular portion, bands well-marked when fresh, about 5—7-nerved. Fruiting sepals nearly 1" long. Capsule .5" ovoid, glabrous. "Seeds oblong, villous or pubescent" (*Clarke*).

3. *I. calycina*, Benth.

Slender, twining, hairy or villous with ovate and usually deeply cordate, rarely oblong or shallowly cordate, leaves 1—3" long, acuminate or acute, usually sparsely hairy. Flowers white or rose, solitary or in lax few-fld. cymes, rather small, .5—7.5" rarely 1" long. Pedicels

with a pair of narrow-lanceolate bracts at base. Calyx .35" in flower, .5" in fruit, cordate or hastate. Corolla funnel-shaped. Capsule .3—4" ovoid, glabrous. Seeds villous, margins with long silky hairs.

Ranchi, *Clarke!* Rarc. Fl., Fr. r.s.—Oct.

4. *I. hispida*, Roem. Syn. *I. eriocarpa*, *R. Br.*; *Convolvulus hispida*, *Vahl.*

A slender very hairy twiner with narrowly lanceolate to deltoid or ovate acuminate cordate-based leaves 2—3" long, or upper smaller. Flowers very small pink or purple, campanulate or urceolate, in sessile or subsessile capitate axillary cymes about .5—.75" diam. Capsule 2—4-valved globose hairy .25" diam., 2-celled, 4-seeded.

Not uncommon in open jungle and Arhar fields. Singbhum! Hazaribagh! Palamau, *Gamble!* Annual. Fl. r.s. Fr. Sept.—Nov.

L. with about 5—6 sec. n. of which 2—3 from the base, hairy or somewhat glabrescent. Petiole slender, 1—2" long with reflexed hairs. Cymes sometimes with a peduncle .3—.5" long, hirsute. Pedicels very short, bracteolate. Sepals very imbricate, two outer nearly enclosing the others, orbicular with a long spreading acumen or cusp. Corolla .5" long pubescent, lobes acute. Seeds glabrous or puberulous, grey.

5. *I. involucrata*, Beauv. Syn. *I. pileata*, *Roxb.*

A slender twiner with patently hairy stems and hairy broadly ovate deeply cordate petioled leaves 2—3" long and broad, and flower-heads remarkable for their broad entire boat-shaped involucre consisting of one bract (or perhaps two connate bracts) cuspidate each end. Fls. pale pink.

Northern Bengal (without precise locality), *Cal. Herb.!* Fl. Oct.

It somewhat resembles the entire-leaved form of *I. pes-tigridis*.

6. *I. pes-tigridis*, L. *Languli-lata*, *Beng.*

A rather slender twiner, fulvous hairy or hirsute all over with spreading hairs and deeply palmately 5—9-lobed leaves 2—5" diam., with lanceolate or elliptic acute or acuminate lobes contracted at the base. Flowers 1—1.25" in long-peduncled heads with persistent long bracts. Corolla pink funnel-shaped with spreading limb. Capsule .25" ovoid, papery, glabrous. Seeds minutely velvety or nearly glabrous.

Banks of fields, waste ground, etc., in all districts, common. Fl., Fr. r.s.

Petiole 1—2". Peduncles 2—4", rarely only .5" (*F. B. I.*). Heads dense. Outer bracts ovate or elliptic, .7—1", inner smaller, narrower, acute. Sepals .3—5", lanceolate, hardly accrescent in fruit.

Var. *capitellata*, Clarke.

The leaves are ovate-cordate, acute, entire.

Extends to Bihar, *C. B. Clarke.* I have not met with it.

7. *I. pilosa*, Sweet.

A m.s. very hairy twiner with spreading somewhat swollen-based hairs on stems, petioles and cymes. Leaves 2—6" ovate cordate with sometimes also two lateral triangular lobes, white cottony tomentose beneath and with hairs on the nerves, hairy above. Flowers about 1" long (including the lobes), purple, in few-fl'd. persistently bracteate

cymes. Sepals '4—5" narrow-lanceolate with a slender acumen. Capsule '25" ellipsoid or globose glabrous.

Behar, *Beng. Pl.* My specimens, however, were collected from the United Provinces outside our area. Fl., Fr. Sept.—Nov.

Petioles about as long as the leaves. L. with very excurrent midrib. Peduncles 1—4" with a pair of reflexed narrow lanceolate hairy bracts at the end and similar pairs at the cyme branches. Flowers usually 2—3 only. Corolla between campanulate and funnel-shaped with the lateral nerves of the bands scarcely stronger than the intermediate. Seeds mostly 4, pubescent or almost woolly at the margins.

8. *I. tridentata*, *Roth.*

A herb, not twining, with numerous prostrate stems 6—12" long from a woody rootstock and sessile or subsessile oblong, oblanceolate or subquadrate, often hastate or lyrate leaves '25—75", rarely up to 1'25" long, usually broadly truncate or emarginate at the tip which has 2—3 teeth, several spinulose teeth also at the hastate base. Flowers pale-yellow, 1—3 on a slender peduncle '5—1" long. Sepals glabrous elliptic-oblong ovate or somewhat obovate '15", or '2—25" in fruit, decurrent on the thickened pedicel. Corolla '3" long (in my specimens, perhaps, sometimes larger). Capsule '25", subglobose, papery, 4—2-seeded.

Behar, *Hope!* Chota Nagpur, Singbhum, frequent in open places! Orissa, near Chilka Lake, *Cal. Herb.!* Fl., Fr. r.s.

Nearly or quite glabrous. Leaves with the excurrent midrib forming the centre tooth. Peduncles slightly hairy, with small persistent bracts '06—'08" long, often with a branch below the first flower ending in a pair of bracts and a second pedicel thicker than itself subulate with the decurrent sepals (much as in *Anaseia*).

9. *I. hastata*, *nov. comb.* Syn. *I. angustifolia*, *Jacq.*; *Merremia hastata*, *Hallier*, f.

Perhaps not specifically distinct from the last, but said to differ by being larger and twining, with larger flowers '75", funnel-shaped, yellow with purple eye. Sepals '25—3". Capsule similar. Seeds similar, glabrous.

Orissa, near Chilka Lake, *Cal. Herb.!* Fl. May (and probably onwards).

I have sometimes seen *tridentata* with the ends of the branches spiral as though it might sometimes climb.

10. *I. caespitosa*, *nov. comb.* Syn. *I. linifolia*, *Bl.*

A slender twiner, sometimes rooting at the lower nodes, with linear-oblong or narrowly elliptic-oblong leaves 1—2" long, entire except sometimes the base shortly hastate and tip sometimes emarginate. Petiole hairy, '1—3". Flowers yellow, '7—8" long, in slender-peduncled cymes 1—2" long.

Purneah! Sambalpur, *Cal. Herb.!* Fl., Fr. Sept.—Nov.

Stems usually with spreading hairs, sometimes glabrate (*F. B. I.*). Pedicels with two very small but conspicuous spreading lanceolate bracts at their base. Calyx '15—2" long with oblong rounded sepals. Corolla campanulate, the bands distinctly nerved. Capsule as long as calyx, ovoid, papery, the septum usually evanescent. Seeds usually 4 glabrous.

11. *I. reniformis*, *Chois.* Syn. *Evolvulus emarginatus*, *Burm.* (1768); *Merremia emarginata*, *Hallier*, f.; *Convolvulus reniformis*, *Roxb.*

The name "*emarginatus*" appears to be the oldest, but its adoption, besides being less well known and less appropriate, involves yet another combination.

Moreover, there is a doubt whether this is not *Convolvulus gangeticus*, L. (*Amœnitates Academicæ*, iv, 306, published about 1760), in which case the name should be *gangeticus*.

A small herb with creeping, not twining stems, rooting at the nodes and small, usually reniform, sometimes ovate cordate leaves, and small yellow flowers .5—.75". Capsule .15—.2", subglobose 2-celled.

Chota Nagpur. Singbhum! Manbhum, Clarke! Fl., Fr. Sept.—Dec.

Glabrous or nearly so. L. .2—.75" long or broad, sometimes up to 1.5" (Clarke), crenate or dentate with petioles slender once to twice as long as the blade. Peduncle hardly any, 1—3-fld. Two outer sepals small, lanceolate or oblanceolate, three inner much larger entire or obcordate or 2-lobed, 1.2" long, ciliate with long hairs. Corolla campanulate. Anthers oblong. Ovary glabrous, tip attenuate into the style, stigma very large. Pollen smooth. Seeds black, glabrous, often only 2.

12. *I. chryseides*, Ker.

A slender, nearly glabrous twiner with angled stems, deeply cordate ovate acuminate leaves about 1.5" by 1.2", shallowly 3-lobed and repand-toothed. Petiole about .7". Fls. yellow, .7" in forked axillary short-to very-long-peduncled 3—7-fld. cymes. Capsule .25" diam., broader than long, somewhat 4-sided, umbonate, seated on the green or brownish subequal sepals, which are .2" long, oblong-obovate with spreading tip and incurved often coloured margins.

In wet shady places rather common. Purneah! Singbhum! Ranchi, Neterhat! Parasnath! Manbhum! Sambalpur! Fl., Fr. Sept.—Dec.

Stems hairy at the nodes. Leaves 1.5—1", rarely up to 2.3" long, upper surface with hyaline scattered hairs, lower paler glabrous, side lobes rounded, terminal acuminate or obtuse and mucronate. Petiole slender .7—1", sometimes muriculate. Corolla .5—.75" long. Filaments villous at base. Seeds minutely dotted, villous round the hilum, minutely puberulous.

13. *I. obscura*, Ker.

A slender twiner with hairy stems, sub-orbicular or ovate deeply cordate leaves about 1—2.5" each way, and rather small flowers .75" diam. yellow, or usually white with the bands yellowish, and always with a purple eye. Capsule much exceeding the sepals, ovoid, .3—.45", 2 (—4-) valved with 4 brown velvety seeds.

Behar, Hope! Ranchi, Wood! Manbhum! Palamau, frequent in the west in hedge-rows. Fl., Fr. Sept.—Dec.

Leaves with broad or narrow basal sinus, bluntly shortly acuminate or apex rounded, hairy beneath and slightly so above, about 7-palmately-nerved. Petiole shorter than or nearly as long as blade, hairy. Peduncles slender 1—3" long or less, 1—2-fld., pedicels .5—1". Sepals .15" or in fruit .2" broadly ovate-oblong, shortly cuspidate, pubescent, dry in fruit and often reflexed.

14. *I. reptans*, Poir. Syn. *I. aquatica*, Forsk.; Kalmi-sag, Beng.; Karmi, H.

An aquatic herb with the stems creeping on mud and floating, with lanceolate to elliptic-oblong or ovate hastate or cordate leaves 1.5—6" long and long slender petioles. Flowers 1—2" long and 1.5" diam., white or pale purple with a darker purple eye, solitary, or in 2—3-fld. peduncled cymes. Peduncles .5— (f. Clarke) 7" long. Calyx .4" long, sepals subequal, gland-dotted within, ovate or ovate-oblong obtuse, one or two mucronate. Capsule .3" ovoid, glabrous, 4—2-seeded.

Common in and on the sides of tanks, in all districts. Fl., Fr. practically all the year round. Said to be annual.

Glabrous except at the bases of the shoots and peduncles. Rooting at the nodes and with long floating stout and fistular stems often .3" diam. with milky juice. L. minutely dotted beneath, sometimes with a straight base, sec. n. about 3 each side at base and 6—8 above base. Petiole about three-fourths as long as the blade. Filaments thickened at base and densely papillose. Seeds nearly glabrous or microscopically hairy.

The tender shoots are eaten.

15. *I. pes-capræ*, Sweet. Syn. *I. biloba*, Forsk.; *Convolvulus pes-capræ*, L.; *Dopati-lata*, H.; *Chhagal-khuri*, Beng.; *Kasari-nai*, Or.

A prostrate and far-creeping herb from a large perennial elongate root. Stems glabrous. Leaves thick, 1.5—2.5" long and often broader than long, emarginate to deeply 2-lobed at the apex, cuneate or straight at the base where are two large coloured glands. Flowers bright rose-purple, darker in the throat, 1—2 rarely 3 on peduncles about as long as the leaves. Sepals oblong or ovate obtuse, the two outer smaller, transversely rugose towards the base. Capsule .5" ovoid, glabrous. Seeds villosely tomentose.

On the sands along the sea-face from Balasore southwards! Fl., Fr. most of the year.

Rarely twining. Petiole 1—4". Peduncle 1—4", bracts .2" lanceolate, caducous, pedicels .6—1.7" stout. Sepals .3—6". Corolla 1.5—2" long, scarcely lobed.

Useful as a sand-binder. *Roxburgh* states that it is eaten by horses and goats.

16. *I. sepiaria*, Koen.

A slender, rather variable, twiner glabrous (in our area) or pubescent with ovate cordate or hastate, or sub-3-lobed acute acuminate or shortly caudate leaves 1—2" long, very slenderly palmately 5—7-nerved with only 2 sec. n. above the base. Flowers delicate purple or white with a purple eye, 1.5—2" long and about 1.5" diam. in sub-umbellate cymes, with short to long peduncles and short pedicels, with very small bracts at their base. Sepals ovate-oblong, .2—2.5" with scarious margins, sometimes .3" in fruit. Capsule .25—3" ovoid, 4-valved, 4—2-seeded. Seeds tomentose, black.

Singbhum, occasional near streams! Hazaribagh, *Anders.*; common in the extreme south of the province. Balasore! Puri! Fl., Fr. Nov.—April.

Branches sometimes pilose. Leaves sometimes with the basal lobes oblong and as large as the terminal lobe, glabrous in our specimens, sometimes sinuate. Petiole usually short, from half to five-eighths as long as the blade. Peduncles .5—2.5" stout thickened upwards especially in fruit, often 7—9-fid. rarely only 3-fid, pedicels .1—2.5" thick. Calyx quite glabrous, sepals with rounded often minutely mucronate tips. Corolla-tube somewhat funnel-shaped or broader and sub-cylindric, bands several-nerved.

17. *I. cymosa*, Roem. & Sch. Syn. *Merremia umbellata*, Hallier, f. The name *umbellatus* (*Convolvulus umbellatus*, Wall. Cat.) does not appear to have been published before *cymosa*. It is not the name corresponding to the plate in *Rumphius*.

Stems long herbaceous scrambling, and sometimes rooting at the nodes, usually not twining, slightly angular, young pubescent. Leaves 1.5—2.5" oblong or elliptic or lanceolate, with broadly cordate or hastate base, upper sometimes linear and hastate, glabrous or puberulous

above and sometimes thinly hairy on the nerves beneath; petiole short pubescent or hairy on the upper side. Flowers white or cream on axillary 2-several-fld. peduncles .25—1.5" long, pubescent at base, bracts subulate under .1". Pedicels .2—5". Sepals .3—35" membranous or fleshy with scarious margins, elliptic, ell.-oblong or somewhat ell.-obovate, obtuse and aristulate or apiculate, nerves very obscure. Corolla 1.5" long (2" in var. *macra*, Clarke), pubescent at the tip (best seen in bud), funnel-shaped from a tubular base .3" long. Filaments slender, slightly dilated at base, glabrous, anthers narrow-oblong, not twisted, pollen irregularly globose, smooth. Capsule .3" diam., globose, glabrous. Seeds .25" long, densely clothed with long soft spreading hairs.

In damp places. Bamur and Sambalpur, very common! Fl., Fr. Jan.—March.

The species is extremely variable. Dr. Candolle (*Prodr.*, ix, 371) describes three varieties, and *I. caliginosa*, Choisy, is also supposed to be the same species, but none of these closely resemble the large-leaved form described below:—

Var. **cochleata**, var. nov. (var. *macra*, Clarke?).

Stems stouter, twining, with 2 or more raised lines and usually twisted, glabrous. Lower leaves often 5.5" by 3.5" ovate or ovate-oblong acuminate, shallowly cordate, sometimes slightly repand, otherwise entire, glabrous, of very slightly puberulous on nerves above, petioles 1.5—2.5" glabrous, upper leaves gradually smaller and more oblong, and petioles proportionately shorter. Flowers white in many-fld. cymes 2—3" long, sub-racemose on its branches. Peduncles 1—2" glabrous. Bracts linear or subulate .1—12". Pedicels .3—5". Calyx pearly white, succulent, .3" or .4" in fruit, outer sepals concave ovate, aristulate, or with a small cusp, inner narrower, margins thin or scarious. Corolla, etc., much as in the type, sometimes only 1" long.

Usually near rivers and streams. Singbhum, rather common! Manbhum! Palamau! Angul, common! Fl. Feb.—April. Fr. May. Evergreen, new shoots appear in June.

Juice slightly milky. Stems tough. L. with 6—9 strong sec. n., lowest 1—3 near base, tertiaries rather strong on the older leaves, upper leaves often more membranous and mucronate.

The flowers close in the evening as in many other species of the genus. They often do not open till noon.

18. I. petaloidea, Chois. Syn. *Merremia crispatula* Prain; *Convolvulus crispatulus*, Wall. Cat. The name *crispatulus* does not, however, appear to have been published prior to *petaloidea*, Wallich's catalogue not being publication.

A climber, often large and shrubby, but sometimes flowering when quite small, stems with 2—4 raised lines or narrow wings, glabrous. Lower leaves ovate, often attaining 7" by 5.5" or more, with shallowly cordate, retuse or rounded base, and 2—3" long petioles, upper leaves ovate-lanceolate to lanceolate-oblong 1.5—3" long, with petiole .3—7", all glabrous, and with characteristic reddish strong midrib and sec. n., and usually strong cross tertiaries. Flowers more or less yellow (sometimes white?) in 1—many-fld. rather dense cymes, with small linear very caducous bracts .2—25" long. Flowers easily distinguished from those of *cymosa* by the sepals being .6—8" long and by the corolla being densely hirsute except on the small basal tubular portion.

Capsule about .5" ovoid. Seeds minutely velvety with subvillous margins.

Ranchi ghats! Manbhum, *Campbell*! Hazaribagh, *Wood*! Behar, *Kurz*! Angul! Fl. March—Sept. Perennial. New shoots in June.

Leaves very rounded, emarginate or obtuse and mucronate at the apex, rarely the upper ones somewhat acuminate, glabrous and somewhat glaucous beneath, mid-rib shining, strong sec. n. 6—9, of which 2—3 close to the base. Petioles often with two narrow wings or crisped margins on the upper side. Peduncle glabrous or closely pubescent. Pedicels .5—8", somewhat thicker upwards. Outer sepals ovate or broadly elliptic concave acute or obtuse, sometimes with a minute apiculus. Corolla 1.75—2" long. Capsule rather shorter than the calyx, papery, 2-celled with 4 lanceolate-oblong valves.

Var. **pauciflora**, *Clarke*.

A very depauperated form with stems from a woody rootstock, not climbing. Leaves oblong to linear or oblong-lanceolate 1—1.5", with weak sec. n. and short petiole. Peduncles only 1-, rarely 2-fld.

Burnt grass lands on the plateau! Fl. May. An exactly similar form has been collected in Oudh!

19. ***I. turpethum***, *Br.* Syn. *Operculina turpethum*, *Manso*; *Banquetka*, *S.*; *Pitohri*, *H.*; *Tohri*, *Beng.*

A large climber but stems scarcely woody, narrowly 3—4-winged. Lower leaves broadly ovate cordate, often 6" by 4.7", acuminate or acute and apiculate, upper often oblong obtuse and mucronate, petioles .75—3", with crisped wings above on the lower leaves. Flowers white in 3—5-fld. cymes 2—3" long, including the pubescent peduncle, with large oblong cuspidate sub-persistent pubescent bracts .5—1" long. Sepals ovate-oblong or broadly elliptic, .7—1.75" long, outer 2 subherbaceous very broad, 3 inner membranous, all enlarged, hardened and often split in fruit. Corolla glabrous glandular, with tube about as long as calyx and broadly campanulate limb 1.5—2" diam. Capsule with the exocarp longitudinally or irregularly splitting (circumsciss according to some authors), leaving exposed the depressed globose transparent 2-celled endocarp. Seeds 4—1 obovoid brown, minutely reticulate glabrous, .2" long.

Not very common. Bettiah, *Hieronymus*! Singbhum! Manbhum, *Campbell*! Palamau, common about Carhwa! Angul! Fl., Fr. March—Dec. Perennial.

Juice rather milky. Stems, petioles, leaves and inflorescence shortly pubescent or downy or older parts glabrescent. Leaves with 9—12 strong sec. n., of which 2—3 close to the base, all nearly reaching margin, then incurved, tertiaries somewhat raised beneath, more or less scalariform, depressed above (when fresh). Pedicels 1—1.25", lengthening and stouter in fruit. Fruiting sepals often 1" across, brittle.

The powdered fleshy root made into a paste is applied in rheumatism, *Camp. Roxburgh* states that the bark of the roots is employed as a purgative. *Watt* states that it is a well-known purgative under the name of Turpeth-root or Indian Jalap. The Jalap of the British Pharmacopœia is the resin obtained from the roots of *Ipomœa purga*, *Hayne*.

Var. **humilior**.

Herbaceous, trailing. Stems angled or with raised lines only, pubescent. Leaves ovate to oblong-lanceolate, often subhastate, 1—2.5".

Peduncles often only 1-fl'd., with one pair of pubescent bracts only. Corolla 2".

Santal Parganas! Bhagalpur, Thomson! Near river banks. Fl. Dec.

This is a much smaller plant and I doubt whether it would ever develop into the larger form as it appears to die down to the perennial root each year. It has been collected in various parts of India.

It has the characteristic small yellow resinous glands on the outside of the corolla as in the larger form, and which curiously do not appear to have been previously noticed.

20. *I. carnea*, Jacq. Syn. *Argyreia superbiens*, *Cave* (teste *Cal. Herb.*).

A large straggling shrub with very milky juice, ovate cordate acuminate leaves, larger 6" by 4" to 8.5" by 6", nearly glabrous, and large convolvulus-like pink flowers 3" long and broad.

Very common in gardens in Chota Nagpur and sometimes used as a (very inefficient) hedge. Fl. chiefly c.s.

I am not quite sure of the correct name of this shrub; it is called *A. splendens* at the Agri-horticultural Society's Gardens, but is certainly not that. It climbs when given a chance but is usually cut back. Young twigs usually red. L. microscopically puberulous, sec. n. about 10 strong, of which 4 are close to base, tertiary scalariform, conspicuous. There is a gland each side at the base of mid-rib. Petiole 2—5". Cymes lax, 2-chotomous, axillary and terminal, minutely pubescent, conspicuously marked with the scars of the very caducous oblong-ovate .12" long bracts. Peduncles 4—6". Pedicels .5—8". Calyx .25", sepals subequal broadly ovate-oblong rounded, a small gland each side of base of outer. Corolla broadly hypocrateriform, scarcely campanulate, purple inside, tube puberulous. St. unequal, ciliate below, anthers oblong, pollen spinulose. Ovary 4-celled. Fruit never seen and the genus therefore somewhat uncertain.

Propagated by cuttings.

21. *I. vitifolia*, Sweet. Syn. *Merremia vitifolia*, *Hallier*.

An extensive but scarcely woody twiner, hairy all over, with vine-like leaves 2—6" diam., and bright primrose or sulphur-yellow very pretty flowers 2—2.5" diam. in 1—7-fl'd. peduncled hairy cymes. Capsule .5" diam., irregularly breaking up, semi-transparent, usually 4-seeded.

In the damper localities, especially along streams. Purneah! Santal Par! Singbhum! Hazaribagh, Wood! Palamau, Gamble! Rairakhoi! Angul, common! Sambalpur! Probably therefore in all districts in suitable localities. Fl. Oct.—March. Fr. March—May. Perennial, nearly evergreen.

Leaves suborbicular or broadly ovate in outline cut one-third to one-half the way down into ovate or triangular acute or acuminate lobes which are often strongly toothed, palmately nerved with 5—7 basal nerves, hairy. Petiole .5—4". Peduncles 1—4". Sepals .5" hirsute, hardened and .7—9" in fruit. Corolla 2" long, glabrous. Seeds black or slate-coloured with a matt surface.

22. *I. palmata*, Forsk. Syn. *I. pulchella*, *Roth.*; The Railway Creeper.

An extensive climber with somewhat fleshy slender stems and branches, the older tubercled with large lenticels. Leaves 1—2.5" long and broad, deeply 3—7 (usually 5)-palmately lobed almost to the base with elliptic or lanceolate or oblanceolate subentire usually obtuse and mucronate lobes. Flowers very numerous, usually solitary (1—3) on the peduncles, violet-purple with purple tube, 1.25"—2" long and about as wide, funnel-shaped with spreading limb. Sepals .25", ell.-oblong

with membranous margins. Capsules $\cdot 4''$ ovoid, glabrous, 2-celled, 2—4-valved. Seeds pubescent with woolly margins.

Exceedingly common on trellises, etc., in gardens and on railway platforms, and nearly constantly in flower. Native near the coast in the Bombay Presidency. Easily grown from cuttings of the branches.

23. *I. sinuata*, Orteg. Syn. *I. dissecta*, Pursh.

Similar in habit to the last with which it is often associated in gardens, etc., with pretty 5-palmatisect leaves about $3''$ diam., each segment again pinnatifid or unequally deeply lobed, basal segments each with a very large basal lobe. Petiole short, with few long hairs. Peduncles 1-fl. Fls. white $1\cdot 5''$ diam. with a purple eye. Sepals subequal, broadly lanceolate, membranous with green pulvinate base and cuspidate tip, $\cdot 7$ — $\cdot 8''$ long. Corolla tubular below then funnel-shaped and with spreading limb. Ovary 2-celled.

Common in gardens. Native of tropical America. Fl., Fr. chiefly r.s.

24. *I. quinata*, Br., Khalkhatia, Or.

Prostrate or twining with very slender glabrous or patently hairy stems, palmately compound 5-foliolate leaves with sessile lanceolate, narrowly elliptic or rhomboid acuminate leaflets, 1 — $2''$ long in the upper leaves, sometimes attaining $4''$ by $1\cdot 25''$ in the lower leaves, nearly glabrous. Flowers white $1\cdot 5''$ diam. on 1- or usually 2-fl. peduncles $\cdot 75$ — $2''$ long. Capsule $\cdot 5$ — $\cdot 75''$, ovoid, subacute, glabrous and shining, 2—4-valved.

In open jungles. Singbhum, frequent! Ranchi! Hazaribagh, Clarke! Manbhum, Kurz! Bonail Fl., Fr. Aug.—Oct.

Leaves with lower petioles $2''$, upper petioles $\cdot 25$ — $5''$, glabrous or with spreading hairs. Leaflets sessile or subsessile, tapering at the base, glabrous or hairy on the nerves beneath, sometimes linear-lanceolate. Bracts linear persistent. Sepals $\cdot 3$ — $4''$ long, elliptic or ell.-oblong, brownish with membranous margins, sometimes $\cdot 5''$ in fruit, two inner the larger. Corolla $1\cdot 5''$ long, funnel-shaped, bands several-nerved. Anthers curved. Seeds glabrous, shining, with the apex crested.

25. *I. hederacea*, Jacq. Syn. *Convolvulus hederaceus*, L.; *Ipomea nil*, Roth.; *Pharbitis nil* and *P. hederacea*, Chois.

A hairy twiner with retrorsely hirsute stems, ovate cordate 3-lobed leaves 3 — $5''$ long, and handsome bright-blue or rose-coloured flowers $1\cdot 5$ — $2''$ long with very long sepals, subumbellate on 1—5-fl. peduncles.

Common in hedges near villages in Chota Nagpur! Fl. Aug.—Nov. Fr. Oct.—Dec.

Leaves thinly hairy, lobes broadly ovate or oblong very acuminate. Petioles $1\cdot 5$ — $4''$. Peduncles hirsute with reflexed hairs 1 — $3''$, rarely $4''$, bracts linear. Sepals linear-lanceolate $\cdot 7$ — $1''$ long, hairy below, not enlarged in fruit. Anthers not twisted. Capsule subglobose $\cdot 3''$, glabrous. Seeds glabrous.

The seeds are said to be eaten.

26. *I. digitata*, L. Syn. *I. paniculata*, L.; *Convolvulus paniculatus*, L.; *Bhumikumra*, Beng.; *Bilai kand*, H.

An extensive twiner from a tuberous root with glabrous stems and sub-orbicular deeply 5—7-palmately lobed leaves 3 — $7''$ diam. with elliptic or lanceolate or spatulate lobes and widely cordate base. Flowers $1\cdot 5$ — $2\cdot 5''$ widely campanulate, pink-purple (dark reddish-purple, Roxb.),

many in a long-peduncled dense corymbose cyme. Ovary and capsule 4-celled, 4-valved with closely cottony or woolly seeds.

Purneah! Fl., Fr. r.s. Deciduous Dec.—Jan.

Leaves glabrous, usually lobed beyond the middle or nearly to base, bluntly acuminate, nerves about 5—7 basal and two higher up. The leaf much resembles that of *Modecca*, but lacks the large glandular areas. Petioles 2—5". Peduncles about as long as the petioles or 6—10". Pedicels .25—5". Bracts minute deciduous. Fls. sub-umbellate. Sepals elliptic .25—5", wider in fruit and concave and rather fleshy. Corolla with a narrow-tubular base scarcely exceeding calyx. Anthers not twisted. Capsule ovoid .3—5" long. The wool on the seeds is sometimes exerted from the capsule fissure.

The tuberous roots are used in native medicine as tonic and lactagogue. The plant is also sometimes cultivated for its flowers.

27. I. batatas, Lamk. Uku-sangar, K.; Sakakanda, H.; Kanda, Or.; The Sweet Potato.

A prostrate plant with milky juice and triangular or ovate usually sharply and irregularly lobed leaves 2—4" long with more or less cordate base and long stout petioles 2—8". Flowers purple 2" long and broad 2-several on long axillary peduncles with short pedicels and very small bracts at the base of the pedicels.

Cultivated in all districts, chiefly in sandy ground near rivers. Fl. about January, and as the tubers are usually lifted in November to December the natives often say that it does not flower. I have not seen the fruit. Native of America.

Stems glabrous or usually hairy. Some leaves often simple, usually acuminate but shape very variable and often broader than long, base 9-nerved, glabrous. Peduncles about as long as the petioles. Sepals 2—3", outer usually smaller, midrib excurrent as a small awn.

12. HEWITTIA, W. & A.

Twining usually pubescent herbs with cordate, sometimes 3-lobed leaves and mod.-sized flowers in 1—many-fl. axillary sometimes sub-capitate cymes. Bracts narrow. Sepals unequal, outer much larger than the inner, accrescent in fruit. Corolla campanulate. Stamens included or sub-exsert, filaments dilated at the base, anthers shortly lanceolate. Ovary 1-celled or partially septate, 4-ovuled. Style filiform, stigmas 2 ovate-oblong. Capsule globose, 4-valved. Seeds glabrous.

1. H. bicolor, Wight.

A twiner with pubescent stems, petioles, peduncles and leaf-nerves, somewhat resembling the small form of *Ipomæa turpethum*. Leaves cordate ovate simple or somewhat lobed, acute or acuminate, attaining 5" by 4", somewhat shiny both sides. Flowers pale yellow with a purple throat, 1—1.2" diam., on 1- (rarely 2—3-) fl. peduncles with 2 lanceolate bracts.

Thickets near watercourses, Singbhum! Not common. Fl., Fr. Jan.—Feb.

Leaves sometimes hairy all over beneath, tip sometimes shortly caudate, principal nerves 5—6 palmate, sec. n. of midrib 2—4. Petiole of lower leaves sometimes 3—5", of upper short. Peduncles variable in length, usually short. Bracts lanceolate .25—5", a little below the calyx. Outer sepals foliaceous ovate, .5", inner lanceolate or oblong, dry and reticulate in fruit. Corolla hairy or pubescent, shortly 5-lobed. Ovary villous.

or nearly glabrous, *Clarke*) with ovate finely acuminate leaves 1—2" long and small white or pinkish flowers in axillary peduncled cymes shorter than the leaves.

Monghyr Hills, Kurz! Puri Mals! Fl., Fr. April—Jan.

Leaves shallowly cordate or base straight, sec. n. 5—7, of which 2—3 are from the base and almost palmately nerved (only a little weaker than midrib). Petiole slender .5—1". Peduncles .5—1.3", shorter or longer than the petioles, 2—5-fld. Sepals ovate or lanceolate, acuminate, pubescent .25". Corolla .5" long, mouth not dilated, about .3" diam. Stigmas linear but rather stout, terete and very slightly dilated at the tips, recurved, .05" long. Capsule .2" globose, glabrous.

14. CALYSTEGIA, *R. Br.*

As in *Convolvulus* but with large foliaceous persistent bracts enclosing the calyx. Ovary 1-celled or incompletely 2-celled. Stigmas 2, ovate, or shortly oblong, compressed.

1. *C. hederacea*, *Wall.*

Prostrate as a weed of cultivation or climbing 6 ft. in bushes (*Clarke*). Stems glabrous. Leaves cordate or sagittate entire or lobed, .5—1—3", very irregular in form. Petiole 1". Peduncle 2" with ovate bracts .3". Sepals .3", oblong, obtuse, glabrous. Corolla 1" sub-campanulate, pink-purple. Capsule .3" ovoid, subacute, glabrous.

Purneah, Kurz! Fl. Dec.—Jan. Fr. Feb.

Usually dwarf trailing with somewhat deltoidly hastate or ivy-like 3—5-lobed leaves often under 1.5" with the mid-lobe generally larger and oblong. Peduncles sometimes slender and up to 4" long. Bracts .3", persistent and enclosing the fruit. Corolla sometimes white with pinkish limb or lilac.

15. ERYCIBE, *Roxb.*

Climbing shrubs with the innovations often ferruginous pubescent. Leaves entire coriaceous. Flowers small or m.s. in axillary and terminal cymose racemes or panicles. Sepals subequal, coriaceous. Corolla white or yellowish with a shortly campanulate tube and spreading limb with 5, 2-lobulate, induplicate lobes. Stamens inserted low in the tube, sub-included, with short filaments and lanceolate basifixed apiculate anthers. Ovary 1-celled, 4-ovuled. Style hardly any, stigma large sub-globose 2-lobed (or sometimes 5-lobed). Fruit baccate, 1-seeded. Albumen scanty, irregularly intruded between the plicate fleshy cotyledons.

1. *E. paniculata*, *Roxb.* Urumin, Hurmi, K.; Kari, S.; Durkuli Jorai-kuli, Or.; Chimina (Sambalpur).

A large climbing shrub with conical protuberances on the trunk, rusty-tomentose shoots, entire oblong, ell.-oblong, oblanceolate or obovate, acuminate leaves about 5" by 1.5" and terminal rusty-tomentose panicles of yellowish-white flowers .5" diam. with crisped marginate petals. Berry black .6" with dark-purple flesh, seated on the spreading calyx.

Along rivers and streams, Champaran! Santal P.! Gaya Ghats! Throughout Chota Nagpur, frequent! Throughout the Southern area! Fl. May—June. Fruit ripens the following May. Evergreen.

L. 3—6", tomentose when young, shining and glabrous when old, sometimes punctulate beneath, long- or shortly-acuminate, base usually narrowed into the

·4—·5" long petiole, sec. n. 4—6 oblique, not prominent. Panicles narrow, 4—7" long. Sepals ·1", oblong rounded or orbicular. Corolla-tube as long as calyx. Stigma sessile sub-globose, sometimes 5-lobed. Seed elliptic ·3".

The fruit is sweet and is eaten. The bark is given by the Santals in cholera.

16. CUSCUTA, L. *Dodder.*

Leafless, yellow-green, reddish, or colourless, rootless parasites, with twining uniformly slender often thread-like stems furnished with haustoria. Flowers small, white or rose, in cymes or fascicles, usually with small bracts, 5-merous or sometimes 4-merous in the same species. Sepals subequal, free or shortly connate. Corolla ovoid or campanulate, persistent, lobes small, imbricate in bud, tube naked or with a ring of scales below the stamens. Stamens inserted below or in the throat, often shortly exerted. Ovary 2-celled, sometimes incompletely, styles 2 distinct or connate, stigmas round or acute. Ovules 4. Fruit capsular, dry or fleshy, circumsciss or irregularly breaking up. Seeds 1—4, smooth. Embryo peripheral, spiral or annular, in fleshy albumen, cotyledons 0 or rudimentary.

Style connate below, 2-lobed above. On trees or shrubs

1. *reflexa.*

Styles 2, stigmas capitate. On herbs

2. *chinensis.*

1. *C. reflexa*, Roxb. Jansing, K.; Alaj-jari, Kharw.; Algusi, Beng.

Stems rather stout for the genus, fleshy, usually yellowish-green or yellow, often in dense masses with pendulous branches covering small trees and shrubs. Flowers white or pinkish, sweet-smelling of an evening, ·25—·3" long, tubular-campanulate with short reflexed lobes, solitary and in few—many fld. racemiform cymes with bracteate pedicels or sometimes fls. sessile. Scales at base of corolla emarginate fimbriate. Ovary narrowed into a very short style with 2 lanceolate branches or stigmas. Ovules on a very spongy thick placenta. Unripe fruit very fleshy with black marks or warts, ripe about ·3" diam. fleshy circumsciss near the base 1—4-seeded.

In all districts. Chiefly on *Zizyphus* and *Acacia*. Fl. Oct.—Dec. Fr. Dec.—Jan.

2. *C. chinensis*, Lamk.

A delicate thread-like pale-yellow twiner with flowers in dense often very numerous clusters. Sepals nearly free, triangular-ovate, ·05—·06" long, subobtuse. Corolla-lobes ovate, scales shortly fimbriate. Fruit ·15" (ripe?).

On *Polygonum*, *Portulaca*, *Guizotia*, etc. Lohardaga, Clarke! Manbhum, Camp. Herb. Fl. July—Nov.

FAM. 97. SOLANACEÆ.

Herbs, more rarely erect or climbing shrubs, very seldom small trees, without milky juice. Leaves alternate, sometimes in unilateral pairs especially towards the inflorescence with the two members of the pair often unequal, simple, rarely pinnate, exstipulate. Flowers usually m.s. or large, regular, and 5-merous (exc. in the gynæceum), more rarely

zygomorphic, or 6—7-merous, terminal on main or lateral shoots, solitary and often (conspicuously) extra-axillary or in cymose often extra-axillary inflorescence. Calyx persistent. Corolla sympetalous of various shape, usually plicate in bud or the lobes valvate, rarely imbricate. Stamens on the corolla-tube isomerous with and alternate to the corolla lobes, in zygomorphic flowers often unequal or some rudimentary; anthers sometimes dehiscent by apical pores. Hypogynous disc usually evident. Ovary superior usually obliquely 2-celled, rarely (*Nicandra*) 3—5-celled, or 4-celled,* or by abortion of the septum 1-celled. Style simple, stigma 2-lobed or -partite. Ovules very many on prominent peltate placenta (1 or few in a few exotic genera), anatropous or slightly amphitropous. Fruit baccate or capsular, usually 2-celled, many-seeded. Seeds compressed, discoid or subreniform. Embryo often curved and peripheral in the albumen, more rarely straight.

The endemic Solanaceæ from a sufficiently characteristic family in our area, but the Tribe *Salpiglossidæ*, which has zygomorphic flowers and often only 2—4 fertile sometimes didynamous stamens as well as straight embryo and contains the well-known garden plants *Salpiglossis*, *Schizanthus*, *Browallia* and *Brunfelsia*, are only separable from the Scropulariaceæ by the corolla being plicate in bud, with the exterior portions valvate.

- I. Indigenous genera. Flowers regular or nearly so with equal or only slightly unequal stamens. Embryo much curved:—
- A. Calyx reticulate-veined and greatly enlarged in fruit. Fruit baccate enclosed in the inflated calyx:—
1. Flowers solitary:—
 - Fls. m.s. blue-purple. Ovary unequally 3—5-celled
 - Fls. axillary, yellowish or white, often small. Ovary 2-celled
 2. Flowers clustered. Corolla tubular-campanulate
- B. Calyx not greatly enlarged and never completely enclosing the fruit:—
1. Flowers rotate. Fruit baccate:—
 - a. Ovary 2-celled, fruit sometimes 1-celled above. L. not pinnate (sometimes pinnatisect):—
 - Fls. 1—3 axillary. Filaments longer than the anthers
 - Fls. cymose, cymes usually extra-axillary. Filaments shorter than the anthers which open by pores or slits
 - b. As in *Solanum*, but L. pinnate, anthers opening by long slits, ovary 2—3—many-celled
 2. Flowers very large tubular or funnel-shaped. Fruit capsular. Ovary 3- or 4-celled
- II. Exotic genera. Flowers often zygomorphic. Embryo straight or slightly curved only:—
- A. Stamens all fertile, equal or unequal:—
- Shrubs. Fruit baccate
 - Herbs, glandular-pubescent. Fruit capsular
- B. Stamens only 2—4 fertile, the 5th rudimentary—Tribe *Salpiglossidæ*. (Only in gardens in our province and not further dealt with).

1. NICANDRA, Adams.

Calyx with 5 large foliaceous deeply cordate lobes much accrescent in fruit, reticulate-nerved and enclosing the fruit as in *Physalis*. Ovary

* Sometimes many-celled in cultivated forms of *Lycopersicum*.

somewhat irregularly 3—5-celled (probably by false septa). Placentæ large unequal on the inner angles and walls. Fruit a somewhat dry berry with numerous flat seeds and strongly curved embryo.

A single species, native of Peru.

1. *N. physaloidea*, Gærtn.

An erect annual glabrous herb with ovate or ovate-lanceolate lobed or coarsely toothed leaves 3—6" long tapering into the petiole and handsome light purple flowers 1" or more diam. terminal and becoming leaf-opposed or axillary. Sepals overlapping and making the calyx 5-angular, somewhat cuspidate, over 1" in fruit. Corolla with somewhat campanulate tube and spreading limb.

More or less naturalised on the Vindhyan plateaux and sometimes seen in gardens! Fl. Oct.—Nov.

2. *PHYSALIS*, L.

Glabrous or hairy herbs with the hairs sometimes stellate and with entire or somewhat lobed leaves and solitary axillary flowers. Calyx campanulate, 5-fid, greatly enlarged and bladder-like enclosing the fruit. Corolla campanulate, usually yellowish. Stamens attached near the base, anthers attached near the lower end of the very small connective. Ovary 2-celled. Fruit baccate, seeds compressed, embryo peripheral curved.

Corolla .2—2.5" with sometimes small spots at base. Fruiting calyx .5—1" long

Corolla .5" with 5 large purple spots near base. Fruiting calyx 1—1.75" long

1. *minima*.

2. *peruviana*.

1. *P. minima*, L.

An erect herb 4—15" high with pubescent or puberulous stems and membranous ovate toothed sinuate or lobulate acuminate leaves .7—1.2" in small plants, 1—2.5" in large plants. Flowers small yellow .2—2.5" long and broad, the corolla often with small spots at the base within. Fruiting calyx subglobose .5—1" long.

A common weed. Chota Nagpur! Probably in all districts though not collected. Fl., Fr. Aug.—Dec.

Leaves pubescent or puberulous. Calyx pubescent or hairy, the teeth not much enlarged in fruit.

Var. *indica*, C. B. Clarke, has a laxer habit with leaves usually more entire, calyx often more glabrous, and the fruiting calyx more ovoid with 5 distinct angles or wings.

2. *P. peruviana*, L. Tiparee, Vern.; The Cape Gooseberry.

A more bushy plant than the last with larger flowers and other characters of the Key.

Frequently cultivated for its fruit!

3. *WITHANIA*, Panq.

Shrubs with entire leaves and usually small white or yellowish flowers clustered in the axils with short pedicels. Calyx campanulate,

5-toothed, much enlarged and sub-globose in fruit, open or closed. Corolla tubular-campanulate, deeply 3–6-lobed. Stamens at the base of the tube. The rest as in *Physalis*.

1. *W. somnifera*, *Dun.* *Asgand, H.*

An erect weedy-looking shrub or undershrub, 2–4 ft. with sub-tomentose branches, entire ovate sub-obtuse leaves $\frac{1}{2}$ –4" with shortly cuneate base and greenish or yellowish flowers $\frac{3}{4}$ –5" long fascicled in the leaf axils. Berry $\frac{1}{4}$ – $\frac{3}{8}$ " diam. enclosed in the inflated membranous calyx which is $\frac{1}{2}$ – $\frac{3}{4}$ " long with very narrow mouth and unaltered lobes.

Occasional in waste ground. *Gayal Purneah, Kurz! Fl., Fr. Oct.—May.*

Branches with large pith. Leaves glabrescent. Petiole $\frac{1}{2}$ – $\frac{3}{4}$ ". Flowers shortly pedicelled with calyx $\frac{1}{2}$ " long.

The root is long, smooth and terete, whitish-brown. It is regarded as tonic and alterative and used in consumption, debility, etc. *Dutt.* The plant contains a poisonous alkaloid, and the seeds possess, like those of *W. coagulans*, the property of coagulating milk. *Nadkarni.*

4. **CAPSICUM**, *L.* *Chillee.*

Herbs or undershrubs with simple entire or repand leaves and white, rarely purple solitary or 2–3 axillary flowers. Calyx broadly campanulate, subentire or with 5 small teeth, not or scarcely enlarged in fruit. Corolla rotate, 5-lobed, valvate in bud. Filaments longer than the anthers, inserted at the base of the corolla, anthers dehiscing longitudinally. Berry very variable in form and size, sometimes only 2-celled in the lower part. Seeds discoid smooth or subscabrous. Embryo curved.

De Candolle considers that no *Capsicum* is indigenous in the Old World and I have never found a *Capsicum* even apparently naturalised in our area. The wild form of *C. annum* is not known; he considers its original home in Brazil. *C. frutescens* has been found wild from the Amazons to Eastern Peru. The following description of varieties is after *Bengal Plants*:

- I. Pedicels solitary, erect or reflexed; fruits erect, spreading or pendent, as long as, or longer than, the pedicels. Annual or biennial:—
 - A. Flowers white; berries at first green, afterwards becoming red, orange or yellow:—
 1. Fruit not globular:—
 - a. Berries tapering, much longer than broad:—
 - Fruit stout, mildly pungent, calyx not enclosing its base 1. *annuum.*
 - Fruit slender, keenly pungent; calyx enclosing its base var. *acuminata.*
 - b. Berries not much, if at all, longer than broad, usually obtuse; calyx not enclosing base of berry:—
 - Berries circular in section, subconic or ovate or oblong; flesh thin pungent var. *abbreviata.*
 - Berries swollen, angular in section, prismatic or quadrate or oblate; flesh very thick, hardly pungent var. *grossa.*
 2. Fruit globular, extremely pungent var. *cerasiformis.*
 - B. Flowers purple; berries at first dark purple, afterwards becoming orange red, much longer than broad, only slightly pungent; calyx hardly enclosing the base var. *nigra.*

II. Pedicels 2 or more, erect; fruit always erect, red, shorter than the pedicels, pungent; perennial; fls. white:—

Berries elongate, tapering, base embraced by the calyx.

Berries globose or nearly so, base seated on the calyx

2. *frutescens*,

var. *baccata*.

1. **C. annuum**, *L.* Chillie, Nepal Pepper.

Var. **acuminata**, *Fingerh.* Gachh mirich, *Vern.*

Var. **abbreviata**, *Fingerh.*

Var. **grossa**, *Sendt.* Kaphari mirich, *Vern.*; Spanish Pepper.

Var. **cerasiformis**, *Mill.* Cherry pepper.

Var. **nigra**, *Prain.* Purple Chillie.

All more or less cultivated in our area.

2. **S. frutescens**, *L.* Dhan gachh mirich, Dhan lanka mirich, *Vern.*
Bird's eye; Chillie.

This, as its name implies, is much more shrubby than the last and is sometimes 6 ft. high.

It is said to be quite naturalised in some parts of Bengal. Common in gardens and near gardens in our area.

Var. **baccata**, *Irish.* **C. minimum**, *F. B. I.*, in part. Brazil Pepper or Pimentas.

Occasionally cultivated.

5. SOLANUM, *L.*

Small trees, shrubs or herbs, sometimes climbing, usually with stellate indumentum, sometimes spinous, with alternate or paired, entire or lobed or pinnatifid leaves and cymose, rarely solitary, regular (or in one section zygomorphous) flowers. Calyx 5—10-toothed or -partite, not or somewhat enlarged in fruit. Corolla rotate, rarely broadly campanulate. Filaments usually shorter than the anthers inserted at the base of the corolla, anthers with the outer wall thicker than the inner, usually conniving in a tube and dehiscent by terminal pores or short slits. Berry usually globose, sometimes elongate in cultivation. Seeds very many, discoid. Embryo curved peripheral.

I. Unarmed. Anthers short, not attenuate (or only at apex):—

A. Roots with tubers. The Potatoe

1. *tuberosum*.

B. Roots without tubers:—

1. Herbaceous. Fls. small, white, .3" diam

2. *nigrum*.

2. Shrubby. Fls. over .5" diam.:—

Climbing shrub, cultivated only.

3. *Seafortheanum*.

Erect, densely tomentose shrub. Leaves simple entire

4. *verbascifolium*.

II. Armed with prickles (exc. in some cultivated forms of 9).

Anthers long, usually attenuate from half way up:—

A. Leaves simple entire, lanceolate acuminate, pure white beneath. Large shrub

5. *giganteum*.

B. Leaves mostly lobed, ovate or oblong:—

1. Erect shrubs or undershrubs, or (*melongena*) herbaceous:—

a. Leaves stellate tomentose both sides. Calyx and ovary hirsute

6. *ferox*.

b. Leaves often stellate tomentose beneath. glabrescent or thinly stellate-pubescent above. Calyx not hirsute:—

i. Fls. mostly under 1" diam. Berry 3—5".

Prickles short, triangular or curved:—

Leaves unarmed or with only 1 prickle beneath, calyx unarmed. Flowers white .

7. *torvum*.

Leaves with prickles, calyx usually prickly.

8. *indicum*.

Flowers blue, rarely nearly white

ii. Flowers mostly over 1" diam. Berry 1" or

more. Prickles on branches usually under

·4", sometimes 0

9. *melongena*.

2. Diffuse, herbaceous, with long straight prickles

·4—7" all over. Flowers 1" diam., blue. L. usually doubly lobed

10. *xanthocarpum*.

3. Climbing, with short prickles all over. Leaves small

11. *trilobatum*.

A few other species are cultivated in gardens, but are not general.

1. *S. tuberosum*, L. Alu, Vern.; The Potato.

A herb with large unequally and irregularly pinnatisect leaves and terminal (subsequently becoming lateral) cymes of blue or white flowers 1" or more in diameter.

Cultivated in the province in the cold season, but more especially in the Northern Tract and on the highlands of the Central Tract, only on a very small scale elsewhere, usually in the river beds.

The dreaded Potato disease (*Phytophthora infestans*) is almost unknown in the province, but in 1912—13 the potato crop in Bhagalpur was destroyed by it. This was due to the introduction of seed potato from the hills followed by damp foggy conditions in December (*Memoirs of Dept. of Agriculture*).

2. *S. nigrum*, L. Makoi, H.; The Black Nightshade.

An erect branched herb with entire or sinuate or sometimes toothed or lobed ovate or lanceolate-ovate or oblong leaves only ·5—1·5" in starved specimens, attaining 4" by 1·7" in luxuriant specimens, blade always decurrent on the petiole. Fls. small white ·3" diam. few sub-umbelled on extra-axillary peduncles. Calyx ·25" diam. with broad rounded lobes. Berry ·25—·3 diam. globose black (sometimes yellow or red, *Clarke*).

A frequent weed especially in the Northern Area! Singbhum! Palamau and Hazaribagh, *Wood*. Fl., Fr. most of the year. Extends to Europe.

Branches with raised lines and leaves glabrous or slightly pubescent. Petiole ·5—1". Pedicels deflexed in fruit about ·5" long. Anthers short, not at all attenuate.

The berries are said to be eaten. They are alterative and diuretic and a decoction of berries and flowers is said to be useful in cough and consumption. The plant has the same chemical constituents as the English *S. dulcamara* (the Woody Nightshade) and contains the alkaloid Solanine. *Nadkarni*.

3. *S. Seaforthianum*, *Andrews*. The Potato-creeper.

A pretty scandent shrub with the lower leaves ternatisect with lanceolate acuminate lobes, the upper simple lanceolate undulate. Flowers blue or flesh coloured in axillary cymose panicles.

Frequent in gardens. Native of the West Indies.

Two other plants are sometimes called Potato-creeper, viz. *S. Jasminoides*, *Paxt.*, with ovate or ovate-lanceolate subcordate obtuse or acuminate leaves often

unequally 2—5-partite, or lower 3-foliolate, and panicles of white or pale-blue small fragrant flowers on slender pedicels.

A native of Brazil.

S. Wendlandii, Hook. f., with a few short hooked prickles on the stems, branches and petioles. Leaves very variable in size, lower 6—10", pinnate below and pinnatifid above, with 4—6 lobes or leaflets each side which are ovate or oblong. Corolla very pale lilac-blue 2.5" diam. in cymes 6" or more.

A very handsome species, native of Costa Rica.

4. *S. verbascifolium*, L. Bondu, M.; Arosa, Urusa, Beng.

A large shrub 6—20 ft. high with white or buff stellately tomentose unarmed stems and branches, large lanceolate or elliptic acuminate leaves 6—12" long, stellately tomentose beneath and less so above, and white flowers .75" diam. in long-peduncled cymes 2—5" broad. Berries yellow, stellate when young, .3" diam.

Northern Tract from Champaran! to Purneah; Waste ground and scrub jungle Ranchi and Porahat plateau! Fl., Fr. Aug.—Dec. Evergreen.

L. sometimes ovate or ovate-lanceolate 3—6" broad with petioles 1—2". Corymbs terminal, becoming lateral in fruit, tomentose, on stout peduncles 1—4" in flower or 3—4" in fruit. Calyx .25—3" long with ovate or deltoid teeth, campanulate and somewhat enlarged and embracing the fruit. Corolla .4" long with very short tube, lobes stellate-pubescent. Stamens on the throat, anthers short oblong .12" long, scarcely exceeding the flattened filaments, not attenuate, opening by a short apical slit ultimately longitudinally dehiscent.

5. *S. giganteum*, Jacq.

A large handsome shrub 10—20 ft. high with white stellately mealy or tomentose more or less prickly stems and branches and large oblong-lanceolate acuminate leaves 6—10" long, beautifully white beneath, white tomentose both sides when young glabrescent above. Fls. blue .75" diam. in dense corymbose panicles 1.5—3" broad. Berries scarlet glabrous, .25—3" diam.

Mayurbhanj, Meghasani, 3500 ft.! Fl. March—April. Fr. May.

Base of leaves rounded in our specimens, cuneate in Madras ones, sec. n. about 12, oblique and attenuate. Petiole .75—1.5", rather slender, white with stellate tomentum as are the cymes. Pedicels slender, .2—5". Calyx .1—1.5" long with lanceolate lobes somewhat enlarged in fruit, white-tomentose. Corolla with lanceolate acuminate lobes white outside. Anthers yellow, elongate and attenuate above, with apical pores. Ovary puberulous. Seeds .12" diam. glabrous.

The tomentum is much finer and more mealy than in *S. verbascifolium*, in which the individual stellate hairs are very large.

6. *S. ferox*, L.

A large striking coarse herb or undershrub 2—4 ft. high with stellately woolly-tomentose and prickly stems, the stellate hairs large and stalked. Leaves elliptic-ovate, 5—10" long and 4—6" broad with large triangular teeth or lobes, prickly and densely lanate and with large stellate hairs beneath, and almost as much above. Flowers about .6" diam. in very short lateral, not axillary, cymes. Calyx with broadly ovate or triangular lobes densely hirsute. Corolla purple (white, Clarke) .5" long, densely villous outside. Fruit globose 1" diam. densely hirsute seated on the calyx, which is .75" diam. in fruit with broadly ovate lobes.

Purneah! Fl. Fr., Nov.—Jan.

7. *S. indicum*, L. Hanjad, Anjed, K.; Barhanta, H.; Baiakur, Beng.; Kantra, Or.

A stellately tomentose shrub or undershrub 3—6 ft. high with ovate or oblong sinuate or lobed leaves 3—6" by 1—4", grey- or dirty-white tomentose beneath, sub-scabridly stellate above, always more or less prickly on the nerves or mid-rib beneath and with lateral (or at first terminal) simple scorpioid cymes of blue, or sometimes nearly white, flowers .75" diam., 3—11 in a cyme on erecto-patent pedicels finally .5—7" long. Berry yellow .3—35" diam. exceeding the calyx which is not enlarged in fruit.

In every district, common in waste ground! Fl., Fr. nearly all the year.

Stems and branches with yellowish compressed often curved short prickles, young almost woolly. L. usually acuminate, but side lobes obtuse or rounded, base acute or uneven with the sides rectangular, rarely rounded or straight; sec. n. about 3—4 irregular. Petiole .4—1.5". Cymes usually very far from the axils with a very short peduncle or sessile, sometimes prickly, tomentose; pedicels thickened upwards. Calyx often prickly, tube very short, lobes .15", lanceolate, spreading in fruit. Corolla tomentose outside, lobes lanceolate. Fil. hardly any, anthers .22" long, attenuate from about half way up. Berry shining.

The berries are rubbed on the forehead for headache and are also used in Mayurbhanj for cough.

8. *S. torvum*, Swartz. Same vernacular names as the last. Bengar Betahet, S.

A tomentose shrub 5—10 ft. high in many respects very similar to *S. indicum*, but usually taller and more erect with fewer more erect branches, leaves without prickles or with one only beneath near the base of midrib, cymes often bifurcate and denser and flowers always white, calyx never armed. Fruit .5" seated on the calyx which is .35—4" diam. with lanceolate lobes.

Far less common than the last in our area, usually in the damper or cooler districts. Purneah! Plateaux of Chota Nagpur! Fl., Fr. most of the year.

Stems up to 1" diam. Branches prickly. Leaves up to 9" long, mostly 5—7", sinuate or coarsely lobed, closely stellate tomentose beneath and with shorter sparser stellate hairs above. Cymes 2" diam. or more. Fis. .7—1" diam., corolla stellately pubescent at the back or only towards the ends of the lanceolate lobes. Pedicels clavate in fruit, .5—7" long. The fruit is said to be eaten.

9. *S. melongena*, L. Syn. *S. esculentum*, Dun.; *S. insanum*, L. (the wild form); Dhoko (the wild plant), Bengar (the cultivated plant), K.; Baigan, H.; The Brinjal or Egg Plant.

Erect herbaceous, closely covered with short prickles or, in some cultivated forms, completely unarmed. Young parts closely tomentose. Leaves large elliptic 4—7" subentire, sinuate or shallowly lobed with rounded lobes. Flowers solitary or several in a cyme with the lowest only fertile, or in the wild plant all fertile, about 1" diam. Calyx .5—75" long in flower with elliptic or oblong or lanceolate lobes without very broad sinuses between, accrescent in fruit. Berry glabrous white yellow or dark purple, 1" or often of great size in cultivation.

Wild or feral, common in the dryer district! The cultivated form is grown everywhere in the rains. Fl. r.s. Fr. chiefly c.s.

De Candolle does not deal with this plant in his *Origin of Cultivated Plants*

except in the general summary, where he ascribes its native country to India. *Sentner* (teste *Clarke*) gives its home as Arabia.

Prickles flattened, straight or curved, .2—3" only, often only a few straight prickles on the calyx and the rest unarmed. Petiole about 1" long. Fls. often 6—9-merous. Fertile flower usually reflexed. Young calyx only toothed, older lobed half-way down and lobes quickly accrescent, often acuminate, tomentose, fruiting calyx sometimes .9" long. Corolla blue, up to .7" long, tomentose outside. Anthers scarcely attenuate, .3".

Roxburgh distinguishes three species, viz. (α) *S. melongena*, *Willd.* L. obliquely ovate, scollop-lobed. Fertile flowers solitary, drooping, barren in small racemes. Fruit oval. (β) *S. longum*, *Roxb.* (Kuli-baigun, *Beng.*) L. irregularly ovate, scolloped. Calyx sometimes armed. Fruit always cylindrical. (γ) *S. insanum*, *Willd.* Perennial, armed (in poor soil). L. ovate sinuate downy. Peduncles 1—4-fld. Fruit oval to spherical, often white.

10. *S. xanthocarpum*, *Schrad. & Wendl.* Syn. *S. diffusum*, *Roxb.*, and including *S. Jacquini*, *Willd.*; *Rangaini janum*, *S.*; *Ringni*, *H.*; *Kantakari*, *Beng.*; *Bejari*, *Ankaranti*, *Or.*

A diffuse rather pretty herb, sometimes woody at the base, very copiously armed all over with straight yellow very sharp prickles .5—7" long and many shorter ones. Leaves bright green with scattered stellate hairs, ovate, oblong or elliptic in outline, deeply lobed or sub-pinnatifid with the lobes or segments mostly again lobed or dentate. Flowers deep blue 1—1.3" diam. in extra-axillary few-fld. cymes. Calyx .15—2" long in flower with small linear lobes and usually very broad sinuses between, scarcely accrescent in fruit. Fruit globose, .5—1" diam., yellow, or sometimes white under shade, glabrous.

Roadsides and waste places, very common. Probably in all districts. Fl., Fr. Dec.—June. Perennial.

Branches from the root usually dichotomous and flexuose, often angled by the decurrent petioles, which are 1—2" long. Young parts sometimes stellate tomentose. Leaves with usually acute lobes. Calyx usually prickly, usually glabrescent. Corolla scarcely lobed. Berry often variegated green and white when unripe.

Roxburgh states that *S. diffusum*, *Roxb.*, is diffuse with the leaves oval deeply scolloped or lobed, with the lobes sometimes again scolloped or lobed, downy and prickly on both sides, while *S. jacquini*, *Willd.*, is creeping with angular stem. Leaves oblong-laciniate and nearly void of pubescence. Both are armed with long straight spines.

The fruits are eaten in curries, etc. Boiled in ghee they are given for cough and toothache.

11. *S. trilobatum*, *L.*

A very prickly climbing much-branched shrub with sharp recurved short compressed prickles and more or less deltoid or triangular irregularly lobed or sinuate leaves 1—2" long. Flowers pretty, purple-blue, 1" diam. with erect yellow stamens. Berry .25—3" diam., globose, red.

Orissa, from Balasore! To Puri! Common on the rocky shores of the Chilka Lake! Fl., Fr. April—Jan., perhaps all the year round.

Leaves rather fleshy in our area, sometimes hastately 3-lobed, mostly obtuse, with scattered stellate hairs, a few prickles on the mid-rib. Petiole .3—1". Pedicels .5—1', solitary or in few-fld. extra-axillary or terminal cymes. Calyx small, sepals .1—1.5'. Corolla stellately pubescent outside. Anthers .3", gradually attenuate.

6. LYCOPERSICUM, *Miller*.

Pubescent herbs with pinnate leaves, pinnæ, toothed or lyrate. Flowers mostly yellowish in few-flid. peduncled cymes. Sepals 5—6. Corolla rotate, limb 5—6-flid plaited in bud. Anthers long and narrow, gradually narrowed from base to apex, connivent in a cone, opening by slits. Ovary 2—many-celled. Seeds many, compressed, papillose, embryo curved.

Lycopersicum is sometimes included in *Solanum* as a section of that genus.

1. *L. esculentum*, *Mill.* Syn. *Solanum lycopersicum*, *L.* The Tomato.
Cultivated throughout the province. Native of South America.
The fruits in cultivation have often very numerous cells and placentæ.

7. DATURA, *L.*

Small trees, shrubs or coarse rank-scented herbs with simple often large, often sinuate lobed or deeply toothed leaves and large or very large solitary purple or white flowers. Calyx elongate tubular, 5-lobed, often 5-ribbed. Corolla tubular-funnel-shaped, sometimes somewhat zygomorphous. Stamens not longer than the corolla. Ovary 2- or spuriously 4-celled, style filiform. Fruit capsular (in the Indian species) or baccate, often spinous, 4-valved or irregularly breaking up. Seeds very many, compressed, rugose or dotted.

- A. Flowers erect or inclined. Fruit capsular:—
Fls. 2·5—5". Capsule ovoid erect regularly 4-valved 1. *stramonium*.
Fls. 5—7". Fruit globose, irregularly breaking up 2. *fastuosa*.
B. Flowers drooping. Fruit baccate (*Brugmansia*) 3. *suaveolens*.

1. **D. stramonium**, *L.* Syn. *D. tatula*, *Willd.*; *D. Wallichii*, *Dunal*; *Datura*, *Vern.*; The Thorn Apple.

A somewhat coarse annual 1—2·5 ft. with green or purplish stem, elliptic or ovate nearly glabrous leaves 2—5" long, sinuate or lobulate, with large triangular teeth and suberect white or purple flowers 2·5—5" long. Capsule ovoid, erect, 1·5", prickly, splitting regularly at the top into 42 valves. Seeds black suborbicular, subcompressed, 1—13" broad, minutely dotted.

Occasional in waste land! Ranchi ghats, Bishanpur! Fl., Fr. r.s. and c.s.
Leaves somewhat hispidulous on the nerves beneath. Petiole 3—1". Calyx 1·5", narrowly tubular, 5-angled, teeth acutely lanceolate puberulous. Corolla lobes erect with cuspidate tips, so that it is usually only about 1" diam. Peduncle 25" in fruit. Spines on fruit very sharp.

Var. α **tatula**, *Dunal*. Syn. *D. tatula*, *Willd.*

The flowers are usually only 3·5—4", calyx 1·5". Lobes of leaf nearly always acute. Prickles on capsule sharp, 1—3" long. Common.

Var. β **Wallichii**. Syn. *D. Wallichii*, *Dunal*.

Stems angular. Branches and leaves farinose or pulverulent-pubescent. L. ovate 4—5" sinuate-dentate with the teeth acute. Peduncle 3—5". Calyx 2" with the lobes short lanceolate or sometimes 4" long equal, tube pentagonal. Corolla 6", yellowish white, 2·3" diam. with caudate lobes 2—3" long. Capsule as in *tatula*.

Bankipur, *Kew Herb.*! Fl. March.

This appears in size of flower to come near to the next species.

The true *D. stramonium* is a hill plant, larger and coarser and with bigger flowers, up to 6" but the size of the flowers is rather variable. They are said always to be white while those of var. *tatula* are said to be always purple. This, however, is not the case, and I have seen undoubted *tatula* in our area with white flowers. *De Candolle* considered that *T. tatula* came from America, and indeed it scarcely seems indigenous in our area.

The plant yields the well-known poison, and there used to be a belief in Chota Nagpur that the powdered seeds of this and the next species were used for half stupefying coolies whom it was desired to take against their will to the Assam tea gardens.

2. *D. fastuosa*, L. Same vernacular names.

More shrubby than the last, 3—5 ft. high with leaves 3—6", sometimes entire or obtusely lobed or toothed, rarely teeth acute. Flowers purple or white 5—7", rarely less, with a more spreading mouth to corolla than in *tatula*. Fruit inclined or nodding, quite globose, sub-baccate, having a thick somewhat fleshy pericarp which breaks up irregularly and is armed with conical prickles, less pointed than in *tatula*. Fruiting peduncles up to 8".

In waste ground, frequent throughout the area! Fl. chiefly in the r.s. Sometime (always?) perennial.

It has nowhere in the province the appearance of an indigenous plant. Large double and treble flowers are often seen in gardens.

Calyx 2.2—3", lobes equal or unequal. Corolla-lobes sometimes .5" long.

3. *D. suaveolens*, Humb. & Bonp. Syn. *Brugmansia suaveolens*, G. Don.; Angel's Trumpet.

A very large handsome shrub, with entire ovate-oblong leaves and very large handsome drooping white flowers 9—12" long frilled at the mouth. Calyx inflated glabrous angular. Fruit baccate, unarmed.

Frequent in gardens. A native of Mexico.

8. CESTRUM, L. *Habrothamnus*.

Trees or shrubs, sometimes sub-scandent, with entire, usually evergreen leaves and somewhat small or m.s. flowers in umbelliform or racemiform cymes, axillary or terminating short branches, sometimes panicled. Calyx tubular or campanulate, 5-toothed or -lobed. Corolla tubular or funnel-shaped with the tube long, limb 5-lobed comparatively short, spreading or reflexed. Stamens inserted in the middle of the tube, usually adnate to the tube, base hairy or thickened. Fruit a berry, few—1-seeded. Seeds large, with straight or only slightly curved embryo, albuminous.

A large genus of tropical America of which several species are frequently met with in Indian gardens, the most common being the following:—

1. *C. hirsutum*, Jacq. Mexican Jasmine; Lady of the Night.

Sparsely branched, branches hairy, leaves oblong acute tomentose beneath. Flowers greenish or becoming yellowish, remarkable for their sweet smell of a night.

The name is that given in horticultural gardens, the correct description (so far as it goes) being given for that species, but I believe that our common "Mexican Jasmine" is rather 2. *C. nocturnum*, Murray, in which the leaves are glabrous both sides, the corolla yellowish-green, very sweet of a night. *C. hirsutum* belongs to the section in which the corolla is attenuate below the ovary and embraces its

stipes, globose round the ovary itself then gradually obconic-funnel-shaped. *C. nocturnum* on the other hand is obconic-funnel-shaped from the base, slender at the base, wide at the throat, but not embracing the ovary. I have kept no specimens.

9. NICOTIANA, L.

Erect, viscidly-pubescent herbs, rarely undershrubs, with entire or sinuate leaves. Flowers in cymose racemes of panicles, regular or somewhat zygomorphous. Calyx tubular or campanulate, 5-lobed. Corolla with long tube sometimes funnel-shaped above, and usually spreading 5-lobed limb. Stamens inserted low in the tube, usually one shorter than the others. Ovary 2—4-celled. Fruit a septical capsule, 2-valved, seldom 4-valved, valves 2-toothed or 2-fid. Seeds numerous small, scarcely compressed, embryo nearly straight in albumen. Natives of tropical America.

Corolla-tube narrow below, ventricose above, rosy	1. <i>tabacum</i> .
Corolla-tube campanulate, yellowish, lobes obtuse .	2. <i>rustica</i> .
Corolla-tube linear lobes acute, white or greenish-white .	3. <i>plumbaginifolia</i> .
Corolla-tube linear, slightly swollen above, lobes obtuse white	4. <i>alata</i> .

Other species are sometimes found in gardens.

1. *N. tabacum*, L.* Tamaku, H.; Sukul, K.; Tambali, Mal. P.

An erect glandular-pubescent herb with terete stem, large oblong-lanceolate acuminate sessile leaves, the lower semiamplexicaul and decurrent, and rosy or reddish pedicelled bracteate flowers 1·6—2" long in many-fid., usually paniced racemes. Calyx 4—5" oblong with lanceolate very acute unequal lobes. Corolla about 7" diam. with an inflated throat and acute spreading lobes, outside lanuginous. Capsule 6—7", a little longer than the calyx, which is slightly accrescent.

Grown in all districts, usually in small highly cultivated plots of land close to the owners' houses, but more widely in the northern area, especially north of the Ganges, which has been said to be one of the most important tobacco areas in India. There is (or was) a tobacco farm at Pusa.

Howard (*loc cit.*) says that the seeds are brown and retain their vitality even under adverse conditions for several years.

2. *N. rustica*, L. Bilaiti Tamaku, Kalkatiya Tamaku, Vern.; Yellow-flowered Tobacco; English Tobacco.

Stem terete more or less branched from the base, leaves petioled broadly ovate obtuse, sometimes subcordate quite entire glandular, flowers greenish-yellow 7—8" long, bracteate or ebracteate pedicelled, in terminal subpaniculate racemes. Calyx 3" cupular with very short triangular obtuse (long acute in one variety) lobes. Corolla tube broadly-tubular or subcampanulate 5" diam., pubescent-villous, twice as long as the calyx, limb 5" diam., glabrous with rounded or obtuse lobes. Capsule 5" subglobose obtuse, slightly exserted from the calyx.

Cultivated chiefly in Tirhut and Purneah but I have no exact notes of its distribution. Like the other it is grown in the cold season and the leaves removed or the plants cut about March. In Purneah it is said to be supplanting *tabacum*, being hardier and more quickly coming to maturity.

* For an account of cultivated varieties see Howard, *Studies in Indian Tobaccos* (*Memoirs of the Dept. of Agriculture*).

3. *N. plumbaginifolia*, Viv.

About 2 ft. high somewhat scabridly hairy, with spreading radical leaves and slender leafy stems. Leaves sessile entire, lower obovate-spathulate or elliptic-ovate subobtusely and glabrescent, upper oblong-lanceolate semiamplexicaul acute hairy. Flowers very slender white or greenish-white, in terminal subpaniculate racemes. Calyx 4—5" tubular 10-lined, with linear-lanceolate acuminate unequal lobes about as long as tube. Corolla salver-shaped with slender linear tube slightly widened above, usually greenish-white, about 1.5" long or three times length of calyx, lobes pure white within, spreading, ovate, acute. Capsule ovate, glabrous, as long as the calyx, .25". Seeds minutely rugose.

An occasional weed, introduced but not, I believe, cultivated. Fl. April—May. Native of Mexico and the West Indies.

4. *N. alata*, Link & Otto. Syn. *N. affinis*, nom. hort.

A clammy glandular-pubescent herb about 2 ft. high with lower leaves obovate to oblanceolate, obtuse or rounded, with the base sessile and decurrent as wings on the stem, rarely some sub-petioled through reduction of the lamina, upper smaller subamplexicaul often oblong and acuminate. Flowers glandular-pubescent outside white, pedicelled, in terminal bracteate or ebracteate simple racemes with sometimes a few lower branches from the axils of the upper leaves. Calyx 1", 10-ribbed with long-acuminate unequal lobes. Corolla-tube slender, 3—3.5", slightly dilated above, greenish-white, limb somewhat oblique spreading pure white, 2—3" diam. Capsule oblong.

Frequent in gardens. The flowers open in the evening and close next day and are beautifully fragrant at night. Native of Brazil.

FAM. 98. SCROPHULARIACEÆ.

Usually herbs (always in our species), sometimes semi-parasitic with opposite or whorled or alternate, often gland-dotted, simple exstipulate leaves. Flowers always more or less zygomorphic, solitary axillary or in simple or compound spikes or racemes or in axillary cymes or composite inflorescence. Calyx persistent 4—5-merous, valvate or variously imbricate in bud. Corolla sympetalous, 5—4-merous medianly zygomorphic, rarely actinomorphic, lobes alternating with the sepals, the upper two and lower three often respectively forming lips, imbricate never plicate in bud. Stamens rarely 5 perfect, usually 4, often didynamous, with the posterior rudimentary, or sometimes only 2, anthers 2—1-celled. Disc hypogynous, annular or unilateral. Ovary 2-celled with the cells median and placentation central axile; style simple or 2-lobed, stigma capitellate or on the margin or upperside of the style-lobes, one of which may sometimes be suppressed. Ovules many, rarely few, anatropous or amphitropous. Fruit a capsule, very rarely baccate (never in our species). Seeds usually numerous and small or fewer and larger, albuminous. Embryo straight or slightly curved.

The usually accepted separation of the series *Antirrhinoideæ* from the *Rhinanthoideæ* by the only positive character of the posterior petals or corolla-

lobes being exterior in bud is most unsatisfactory and, I find, often misleading. There may be other exceptions besides those indicated in the following key. Concerning *Dopatrium* I am somewhat doubtful. According to a field-note the large lateral lobes of the lower lip are exterior in bud, but more material is required. The æstivation in other genera requires further examination in the field with fresh specimens. The odd sepal is always median posterior and the odd petal or midlobe of lower lip is median anterior. But twisting of the pedicel apparently sometimes takes place in *Dopatrium*, bringing the large lower lobes uppermost in flower. The genus *Lindenbergia* scarcely seems to me to belong to the Tribe Gratioleæ.

I. Corolla 2-lipped or lobes 5, the 2 posterior lobes (sometimes connate in the upper lip) exterior in bud (exc. 8, 9 and 10).

Genera 1—18:—

- | | |
|--|---------------------------|
| A. All leaves alternate. Corolla rotate. St. 4 | 1. <i>Celsia</i> . |
| B. All leaves or the lower only opposite (Antirrhinoideæ. Gen. 2—18):— | |
| 1. Corolla 2-lipped, tube saccate or spurred, mouth closed:— | |
| Corolla spurred | 2. <i>Linaria</i> . |
| Corolla broad and saccate at the base | 3. <i>Antirrhinum</i> . |
| 2. Corolla neither saccate nor spurred, mouth open:— | |
| a. Cor.-tube very long and narrow. Fls. cymose, red | 4. <i>Russelia</i> . |
| b. Cor.-tube not very long. Fls. axillary or racemose:— | |
| i. St. 4 didynamous, anthers finally 1-celled:— | |
| Viscid herb. Lower leaves pinnatifid | 5. <i>Sutera</i> . |
| ii. St. 4 or 2, usually didynamous, anthers 2 or all 2-celled (Gratioleæ, Gen. 6—16):— | |
| † Anther-cells not divaricate or separated:— | |
| ! Stamens 4 perfect, included in the tube:— | |
| Leaves mostly radical. Fls. in subsecund racemes. Sepals often broad | 6. <i>Mazus</i> . |
| L. cauline. Fls. not secund. Upper sepal often very broad | 7. <i>Herpestis</i> . |
| L. radical and cauline. Fls. not secund. Sepals equal, narrow | 8. <i>Mimulus</i> . |
| !! St. 2 only perfect, staminodes 2 minute included:— | |
| Slender marsh herb with fls. in distant pairs | 9. <i>Dopatrium</i> . |
| †† Anther-cells, if perfect, divaricate or separate:— | |
| ! St. 4 perfect, all included in the tube:— | |
| * Capsule 2-valved. Lower lip exterior in bud | 10. <i>Lindenbergia</i> . |
| ** Capsule 4-valved:— | |
| § Sep. unequal, one anther-cell often imperfect | 11. <i>Adenosma</i> . |
| §§ Sep. equal, all anthers with 2 perfect cells:— | |
| Erect viscid-pubescent herbs. Seeds ellipsoid | 12. <i>Stemodia</i> . |
| Marsh herbs, habit various. Seeds angular | 13. <i>Limnophila</i> . |
| !! St. 4, 2 perfect in the tube, 2 in the throat perfect or reduced to staminodes:— | |
| * Calyx winged. St. 4 perfect. Fls. often showy | 14. <i>Torenia</i> . |
| ** Calyx not winged. St. 4 or 2 perfect. Fls. small:— | |
| Leaves with a single midrib or penni-nerved | 15. <i>Vandellia</i> . |

- Leaves 3—5-nerved from base
- ii. St. 2, anthers 1-celled, staminodes 0. Minute marsh herbs with minute axillary fls. (Limoselleæ):—
 Calyx tubular, angled, 5-fid .
 Calyx not angled, 3—4-lobed
- II. Corolla 2-lipped or lobes 4 or 5; 2 lateral or anterior exterior in bud (Rhinanthoideæ, Vide also 8, 9 and 10):—
- A. Corolla sub-rotate, 4-merous:—
 Stamens 2
 Stamens 4
- B. Corolla 5-merous with short broad tube, or tube ventricose above:—
 1. Calyx spathaceous
 2. Calyx not spathaceous, campanulate:—
 Anthers with one cell stipitate and empty
 Anther-cells parallel, both polleniferous
- C. Corolla 5-merous, tube long slender:—
 Cor.-tube not abruptly incurved, lobes equal
 Cor.-tube abruptly incurved, limb distinctly 2-lipped, lobes of upper lip small
16. *Lindernia*.
 (*Ilysanthes*).
 17. *Microcarpæa*.
 18. *Glossostigma*.
 19. *Veronica*.
 20. *Scoparia*.
 21. *Centranthera*.
 22. *Sopubia*.
 23. *Alectra*.
 24. *Buchnera*.
 25. *Striga*.

The family includes many well-known garden plants often grown in the province in the cold season and not described here; such are *Angelonia*, *Calceolaria*, *Maurandia* (a climber), *Collinsia*, *Pentastemon*.

1. CELSIA, L.

Erect, tomentose or woolly, usually tall and often unbranched herbs with all the leaves alternate, and yellow, rarely white or red, flowers in simple or paniced terminal racemes or spikes. Calyx 5-lobed or -partite, lobes imbricate. Corolla rotate, regular or slightly zygomorphic, lobes 5 broad, upper exterior in bud. Stamens 4, filaments hairy or glabrous, unequal, anthers transverse or oblique, cells confluent. Style top dilated, stigma simple. Capsule oblong or ovoid, septical. Seeds numerous, small rugose.

1. *C. coromandeliana*, Wall.

An erect hairy-pubescent herb 2—3 ft. high, unbranched except towards the inflorescence. Radical leaves lyrate-pinnatifid, cauline sessile ovate or oblong-ovate, toothed, passing into bracts upwards. Flowers yellow 5" diam. in simple or paniced racemes 6—10" long. Capsule sub-globose 25—3" long glabrous glandular

Not common generally. Champaran, a weed in fields! Chota Nagpur, occasional in river beds! Kalahandi, near rivers! Fl., Fr. Feb.—May. Annual.

Lower leaves 2—4" with a large terminal usually oblong obtuse toothed lobe. Flowers with pedicels 25—3" long, bracts ovate, very small at top of raceme. Sepals oblong or ovate. Filaments hairy. Seeds very small oblong-grey, longitudinally grooved and rugose between the grooves.

2. LINARIA, Juss.

Herbs with usually opposite (alternate in our species) leaves, sometimes whorled below or alternate above. Flowers axillary solitary or racemose or spicate, ebracteolate, 2-lipped. Sepals imbricate. Corolla spurred anteriorly, upper lip erect of 2 more or less connate petals, lower spreading of 3 more or less connate petals, throat usually closed

by a tumid palate. Stamens 4, didynamous, ascending, included; anther-cells distinct, parallel. Stigma minute. Capsule ovoid or globose, each cell or the anterior only opening by an apical pore. Seeds numerous.

Spur shorter than the corolla-tube:—

Leaves nearly glabrous .

Softly hairy all over

Spur longer than the corolla-tube. Whole plant hirsute

1. *ramosissima*.

var. *pubescens*.

2. *cabulica*.

1. *L. ramosissima*, Wall. Indian Ivy-leaved Toad Flax.

A pretty little trailing, rarely suberect, plant with slender stems many inches long spreading from the rootstock and small leaves, many of which are ivy-shaped and 5- or 6—7-lobed, others on quicker growing shoots elliptic entire or scarcely lobed. Flowers small yellow on capillary pedicels exceeding the leaves. Capsule .1—.15", globose-ovoid, opening on one side by a valve, on the other by a sub-apical pore.

Patna! "Common along the Ganges above Patna," *Kew Herb*. "In most of the provinces," according to *Beng. Pl.*, but this is probably in consideration of its general distribution and is not borne out by the material to hand. There are no specimens from Behar and Orissa in the *Cal. Herb.*, so that it is at any rate exceedingly rare in our area. Fl. Oct. and c.s. Fr. May—June.

Stems slender pubescent and glabrescent. Leaves in the Patna plant glabrous. The leaves are very variable, as also is the hairiness. Those on the plant in the hot season are often only .15—3" long, but those produced in the rainy season 1" or sometimes even 2" long. Petioles .2—4" slender. Pedicels .4—1.5". Calyx .12", nearly glabrous, sepals lanceolate slender. Corolla .2—3", tube puberulous, spur short, .08". Seeds minutely spinulose.

2. *L. cabulica*, Benth.

Habit similar to the last but more rigid, always softly hirsute. Leaves ovate sub-hastate and lobed or upper lanceolate sagittate. Pedicels longer than the leaves, spur longer than the corolla-tube, seeds scabrous.

Shahabad, Rhotas cliffs, J. D. H.!

But I take the Rhotas specimen to be also *L. ramosissima*. The stems, petioles, calyx and corolla are minutely pubescent only whereas *L. cabulica* is hirsute. The corolla is .2" with spur .08" only.

The two species are very closely allied, and as regards the length of the spur while *Bentham* says that is longer than the corolla-tube in *L. cabulica*, *Bossier* states that it is shorter. *Prain* also (*Beng. Pl.*) gives *L. incana*, Wall, from W. Behar. The above specimen from Rohtas was at first so named, but I can find no others. The species is a Himalayan one.

Antirrhinum majus, L., the common Snapdragon, is often grown in gardens. It is a native of southern Europe and northern Africa.

4. *RUSSELIA*, Jacq.

Shrubs or undershrubs with angular branches and often pendulous branchlets, opposite or whorled leaves often minute or squamiform. Flowers scarlet, in dichotomous cymes, or peduncles 1—3-fid. only. Calyx 5-fid. Corolla tubular. Stamens 4 fertile, subdeclinate at base, anther-cells divaricate at length confluent; fifth stamen rudimentary, minute. Capsule subglobose, septicidal, valves 2-fid. Seeds many, ovoid, mixed with long hyaline caducous hairs which arise from the placentæ.

Natives of Mexico.

Glabrous. Leaves on branchlets squamiform. Peduncles 1—3-fld. 1. *juncea*.
 Pubescent. Leaves all developed. Peduncles short many-fld. 2. *rotundifolia*.

1. *R. juncea*, Zuccar.

A very beautiful plant 3—4 ft. high with rush-like branches and upper leaves reduced to scales, though in the rains those on the new shoots are well developed linear, lanceolate or ovate. Flowers 5" long, very numerous scarlet on 1—3-fld. peduncles borne in great profusion on the drooping branches.

Very common in all gardens. Fl. most of the year.

2. *R. rotundifolia*, Cav. Syn. *R. floribunda*, Humb. B. & Kunth.

Erect, 2—4 ft. Leaves well-developed orbicular, 2—4", sessile, pubescent beneath. Fls. crimson-scarlet in close axillary cymes and very numerous.

Also a very handsome plant and common in gardens. Fl. most of the year.

5. SUTERA, Roth.

Viscid-pubescent herb with lower leaves opposite pinnatifid, upper alternate. Flowers small axillary and in terminal racemes, ebracteolate. Sepals narrow. Corolla-tube slender, not dilated above, lobes 5, small, 2 upper outer in bud and rather smaller. Stamens 4 didynamous, included, filaments slender. Style short, stigma obtuse or notched. Capsule ovoid-oblong, septicial, valves 2-fid. Seeds many, testa pitted.

1. *S. glandulosa*, Roth.

Erect or spreading with numerous branched stems 6—10" long, the whole plant glandular-viscid and collecting much dirt. Leaves somewhat resembling those of a *Pedicularis*, closely multi-pinnatifidly lobed, 2.5—5" long, lobes toothed. Sepals 12—14" equal with glandular dots. Corolla-tube exceeding the calyx, with small spreading limb, white or purplish with yellow. Capsule 2" ellipsoid-oblong.

River-sides and wet soil. Behar, J. D. H. Fl., Fr. Jan.—March.

6. MAZUS, Lour.

Small herbs, often with runners. Leaves rosulate or opposite below, opp. or alternate above. Flowers in terminal subsecund racemes with bracts and bracteoles minute or 0. Calyx campanulate 5-fid. Corolla-tube short, upper lip erect 2-fid, lower larger spreading 3-fid, throat with a 2-lobed palate. Stamens 4, didynamous, anther-cells contiguous, diverging, not confluent. Stigma 2-lamellate. Capsule included, globose or compressed, obtuse, loculicidal, valves entire. Seeds numerous, very minute ovoid.

1. *M. rugosus*, Lour.

A little herb with prostrate ascending leafy, usually pubescent or hairy branches and erect scapiform racemes. Leaves mostly radical obovate-spathulate, 1—3" long, tapering into a short petiole, those on the branches smaller. Flowers 25" pale-blue or white. Calyx equally

5-lobed, lobes $\cdot 12''$ in flower, oblong or ovate-lanceolate, becoming much enlarged in fruit, flat and spreading. Corolla upper lip concave with short linear lobes, palate brown-spotted and with clavate hairs. Capsule subglobose.

In wet or damp shady places. Purneah! Champaran, *Hieronymus*! Chota Nagpur, Singbhum, near rivers and on the plateaux, not uncommon! Fl. practically all the year.

Leaves more or less sinuate, crenate or dentate. Scapes 1.5—8" high, sometimes with alternæ leaves on the lower part. Pedicels $\cdot 1$ — $\cdot 3''$ or even $\cdot 75''$ in fruit. Calyx in fruit $\cdot 3$ — $\cdot 4''$ long and $\cdot 5''$ diam. Two lower stamens exerted, two upper in the tube, anthers conniving in pairs.

7. HERPESTIS, Gaertn. f.

Glabrous, often gland-punctate, herbs with often narrow entire or toothed, or submersed multifid, leaves. Flowers axillary or racemose, yellow blue or white, pedicels bracteolate or not. Sepals 5, sepals unequal, upper often large. Corolla with cylindric tube and spreading lips, upper outer in bud, notched or 2-lobed, lower 3-lobed. Stamens didynamous, included, anther-cells contiguous, distinct. Style dilated at top and 2-lobed or entire. Capsule 2-grooved, valves 2 or 4, separating from an entire columnar placenta. Seeds many very minute.

Slender, creeping. Flowers peduncled
Stout, erect. Flowers sessile

1. *monniera*.
2. *Hamiltoniana*.

1. *H. monniera*, H. B. & K.

A creeping sub-succulent herb with narrowly obovate-oblong or spatulate entire sessile obtuse leaves $\cdot 3$ — $\cdot 75''$ long and purplish-white or pink flowers $\cdot 3$ — $\cdot 45''$ long on pedicels $\cdot 25$ — $\cdot 5''$. Calyx lobes very unequal, 2 larger $\cdot 17''$ in flower enlarging to $\cdot 25''$, ovate-oblong. Capsule ovoid acute included.

A common marsh plant, but badly represented in herbaria. Behar, *J. D. H.*! Singbhum, common! Manbhum, *Camp.*; Chilka Lake, *Cal. Herb.*! Fl., Fr. June—Dec.

Glabrous, stems up to 12". Leaves with very obscure nerves. Peduncles sometimes lengthening to 1.3" in fruit and deflexed. Bracteoles small. Corolla $\cdot 3''$ diam.

2. *H. Hamiltoniana*, Benth.

A herb 6—12" high with 4-angled stems, linear-lanceolate leaves, 1—1.5" long and sessile flowers $\cdot 17''$ long. Capsule globose surrounded by the very unequal sepals, of which the upper is broadly ovate acute $\cdot 25''$ long and nearly as broad, lateral ovate or lanceolate, and the two inner linear-oblong shorter than the capsule.

Marshy ground. Singbhum! Fl. Sept.—Oct. Fr. Nov.—Dec.

Glabrous, erect. Leaves $\cdot 12$ — $\cdot 17''$ broad, tapering at base. Bracteoles setaceous, shorter than capsule. Corolla scarcely longer than the calyx in flower, upper lip 2-fid beyond the middle. Fruiting calyx somewhat venous. Capsule 4-valved. Seeds cylindric, truncate.

8. MIMULUS, L.

Erect or prostrate, usually glandular, herbs with opposite leaves and solitary axillary or subracemose irregular flowers. Calyx tubular,

5-angled and -toothed. Corolla 2-lipped, upper lip 2-, lower 3-lobed, throat usually with a swollen 2-lobed palate. Stamens 4, didynamous, anther-cells divergent subconfluent or confluent at the tips. Stigma 2-lamellate. Capsule compressed, loculicidal, valves separating from the placentiferous septum. Seeds numerous, minute, oblong.

Erect, leaves sessile, narrow oblong
Creeping, leaves petioled, orbicular

1. *gracilis*.
2. *orbicularis*.

1. *M. gracilis*, Br.

A erect herb 6—20" high with compressed and angular stems grooved each side, sessile narrow-oblong suberect or erect glabrous leaves, lower 1—2" long, gradually shorter upwards, gland-dotted beneath, base 3-nerved. Flowers white or pinkish .5" long, on slender stalks elongating to 1" or more. Capsule oblong compressed as long as the calyx.

Purneah! Santal Parg., Banks of Ganges, Kurzi Singbhum, Ranchi, and Palamau, near streams in the hills, also banks of rice-fields in the plains in r.s.! Fl., Fr. April—Jan.

Leaves sometimes slightly toothed, widest in middle, obtuse or acute. Calyx .25", lobes about one-fourth tube, keeled, acute. Corolla scarcely exerted, side lobes of lower lip external in bud, then the two short upper lobes, the middle lobe of lower lip innermost and inflected, side-lobes spurred, middle anterior lobe broadest papillose, calli of throat brown-spotted. Two lower stamens longest, all with 2 large reflexed anther-cells confluent at tip.

2. *M. orbicularis*, Benth.

Collected by Hooper on the shores of the Chilka Lake, but just outside our boundary.

Creeping with petioled orbicular fleshy nerveless entire leaves. Corolla .5—6". Capsule .3" exerted.

Several species are cultivated. *M. moschatus*, L., has a delicate smell and is usually called "musk." It is native of America.

9. DOPATRIUM, Hamil.

Very slender glabrous marsh herbs with few opposite leaves, upper remote and minute. Flowers small pink or purple axillary or in terminal pseudo-racemes, ebracteolate. Calyx 5-fid. Corolla-tube slender below, wide towards the throat. Upper lip outer 2-fid, lower 3-lobed. Stamens 2 upper perfect included, anther-cells parallel distinct, equal; staminodes 2 minute. Style short, stigma 2-lamellate or sub-peltate. Capsule loculicidal, valves placentiferous. Seeds very minute, tubercled.

1. *D. junceum*, Ham.

A slender herb with erect succulent stems which bear small opposite distant pairs of leaves or are quite leafless and end in a slender raceme of distant opposite pairs of small rose-coloured flowers .2—2.5" long on slender pedicels .5". Bracts small oblong rounded at tip, .05".

Marshy places, not very commonly collected. Singbhum! Manbhum, Camp! Ranchi! Also very common in rice-fields, etc., in the Jalpaiguri district bordering on Purneah, where it is no doubt common and probably is found in all districts. Fl., Fr. Aug.—Oct.

Stems striate 6—12". Leaves oblong obtuse .5—2" at base of stem, parallel-nerved, upper reduced to bracts. Calyx .06" very thin, tubular, teeth about half as long

as tube, lanceolate, black-tipped. Corolla glandular-puberulous, upper lip about .1" broad. Capsule brown glabrous .08" diam., polished, slightly grooved over the top.

The structure of the stem is peculiar; the striæ correspond to radiating septa within, which divide it up into about 10 separate cavities.

10. LINDENBERGIA, *Lehm.*

Herbs, sometimes woody at base. Leaves opposite or the upper alternate, toothed. Flowers axillary, spicate or racemed, yellow, bracteate, ebracteolate. Calyx campanulate, 5-fid. Corolla with cylindrical tube, upper lip short broad, innermost (according to *F. B. I.* it is the *outer*; perhaps it varies in different species) in bud, notched or 2-fid, lower larger 3-lobed, spreading, base with two plaits. Stamens 4 didynamous, included, anther-cells separate, stipitate, all polleniferous. Capsule 2-grooved, loculicidal with entire valves separating from the placentiferous axis. Seeds, numerous minute.

Tufted. L. sub-sessile, mostly under .5" 1. *polyantha*.
Erect, not tufted. Leaves .5—1.5", membranous, with slender
pedicels 2. *urticæfolia*.

1. *L. polyantha*, *Royle*.

A tufted herb with usually several erect, sub-erect and diffuse, rarely solitary glandular hairy stems 4—12" long. Leaves nearly uniform, small, broadly ovate or elliptic, crenate, under .5", rarely .75" long with very short petioles, upper usually somewhat narrower and bearing subsecund solitary flowers in their axils. Flowers very shortly pedicelled yellow .5" long. Stamens, two lower longer, all with purple anthers and distinct cells pendulous from the 2-fid connective. Capsule ovoid .25" with a laterally compressed very acute tip, slightly pubescent.

On old walls. Purneah! Monghyr, *Lockwood!* Fl., Fr. c.s.

The tufted appearance is sometimes due to single stems copiously branched at the base. Bracteoles 0. Calyx campanulate .25" with long lax white hairs, lobed about one-third way down, lobes oblong rounded. Corolla narrow erect, tube exceeding the calyx, lower lip .12" broad, lobes rounded with reflexed margins, upper lip lanceolate slightly hooded but with 2-lobed obtuse tip reflexed, both lips hirsute within, palate gibbous, brown dotted. Longer stamens finally exerted from the sides, one anther-cell higher than the other. Seeds ellipsoid with a loose delicately dotted testa, dots raised very close.

2. *L. urticæfolia*, *Lehm.*

An erect herb from 1" high with simple stem to 8" high, branched and hairy or nearly glabrous, not tufted. Leaves ovate serrate .5—2", lower larger with slender petioles, upper smaller or passing into bracts. Flowers small yellow about .3—4" long, 1—2 in the axils, shortly pedicelled. Anthers all perfect, cells distinct, one stipitate. Capsule .2" slightly exerted from the calyx, hairy, beaked.

Rare. On walls and banks. Shahabad (Rhotas), *Kew Herb!* Parasnath! Ranchi; Pitorea, *Wood!* Fl., Fr. end of r.s. and c.s.

Leaves larger and more membranous than in *L. polyantha*. Petiole .2—75" long. Fls. secund. Calyx .12—15" with 5 broad obtuse lobes, lobes recurved. Corolla sparsely hairy. Ovary pubescent.

11. ADENOSMA, Br.

Glandular herbs with opposite rugose crenulate leaves and flowers axillary or in leafy spikes, racemes or heads. Sepals 5, often sometimes greatly enlarged in fruit. Corolla-tube cylindric, upper lip erect entire or notched, lower spreading 3-lobed, base not plaited. Stamens didynamous included; anther-cells distinct, stipitate, one cell empty or of the two anterior anthers only. Style dilated at the tip, winged below the entire or 2-lamellate stigma. Capsule 2-grooved, loculicidal and septicial, 4-valved. Seeds many, minute, reticulate.

1. *A. capitatum*, Benth.

An erect, glandular-villous herb 1—2 ft. high with numerous opposite and decussate ascending branches gradually shorter upwards and short-petioled ovate or ovate-oblong serrate leaves 1—2" long. Flowers blue in dense cylindric or ovoid terminal bracteate heads, a few also sometimes axillary in the uppermost leaves. Usually deep brown when in fruit with capsules narrow-ovoid, thinly coriaceous and glistening, divided septicially into two halves and then loculicidally dehiscent, closely invested by the calyx.

Damp meadows, grass jungles, etc. Purneah, common! Chota Nagpur, frequent! Fl. r.s. Fr. c.s.

Somewhat with the habit of the English *Purnella vulgaris*. Leaves often reflexed, base more or less cuneate, tip obtuse or subacute, petiole up to .3" long. Heads .5—·75" or sometimes much longer, with an involucre of leaves of bracts, bracts between the flowers linear and hardly exceeding them. Calyx .25", sepals lanceolate, upper largest. Seeds smooth.

12. STEMODIA, L.

Hairy or glandular aromatic herbs. Leaves sometimes whorled. Anther-cells all polleniferous. Seeds most minute, ellipsoid. Other characters as in *Adenosma*.

1. *S. viscosa*, Roxb.

A herb 6—18" high resembling some of the larger semi-terrestrial *Limnophilas*, with leafy erect branched ridged stems, and viscidly pubescent all over. Leaves sessile oblong serrate or serrulate 1—2" long, or rarely all small and under .5", with amplexicaul cordate or auricled base. Flowers violet .4" long, long-pedicelled in nearly all the leaf (or bract) axils. Pedicels .5—·6" or upper .25" only in small plants. Calyx .17—·18" with narrow lanceolate sepals. Corolla-tube .25", limb .2" diam. Capsule as long as calyx acuminate.

Behar, near the Sone River, Griffith!

13. LIMNOPHILA, Br.

(*Ambulia*, Lam., in the *Nat. Pflanzenfamilien*.)

Herbs of very various habit, often aquatic, aromatic and with glands (visible as dots) in the leaves which may be submersed and multifid, or whorled, or opposite and toothed. Flowers axillary, solitary or racemose or spicate, bracteolate or not. Sepals narrow, subequal or the

posterior larger. Corolla-tube cylindric, upper lip outer in bud, sub-erect, entire or 2-fid; lower spreading, 3-fid, base not plaited. Stamens 4 didynamous, included, anther-cells usually separate and stipitate. Style deflexed at the tip, stigma shortly 2-lamellate. Capsule ovoid or oblong, septi- and loculi-cidal, valves bearing the placentiferous septa. Seeds angular reticulate (*F. B. I.*, I have not always found this).

The species are variable, the habit and foliage much depending on the depth of the water, etc., in which they grow. I think that nos. 2 and 3 are possibly forms of one species, 5 and 6 of another, and nos. 7—10 of another variable species.

- I. Leaves not whorled, nerved pinnatifid nor with capillary segments. (Mostly stout erect species with small diffuse forms in 2 and 3):—
- A. Flowers mostly in heads:—
Stems stout 1—2 ft. L. 2—3·5" long 7. *Roxburghii*.
- B. Flowers solitary axillary or becoming spicate or racemose:—
1. Flowers sessile or very shortly pedicelled:—
- a. Leaves with only one primary nerve (midrib):—
Glabrous or nearly so. Sec. n. scarcely visible 2. *conferta*.
Pubescent. Sec. n. visible. Fls. often shortly pedicelled 3. *diffusa*.
- b. Leaves with 3—5 primary nerves:—
Erect or decumbent, glabrous below, glandular-pubescent above 4. *hypericifolia*.
2. Flowers with pedicels exceeding the calyx:—
Erect, glabrous. Flowers 35—6" racemed 5. *gratissima*.
(See also *hirsuta*, var.).
- II. Leaves some or all whorled (rarely all opposite in 5 and 6), often pinnatifid or capillaceo-multifid:—
- A. Leaves 1-nerved, no pinnatifid leaves. Fls. pedicelled. Fruiting calyx striate:—
Glabrous. Flowers racemose 5. *gratissima*.
More or less hairy. Fls. more cymose (often in 3's) 6. *hirsuta*.
- B. Pinnatifid or capillaceo-multifid leaves always present, opposite leaves, if present, usually 3-nerved. Fruiting calyx membranous, not striate:—
1. Fls. with pedicels longer than calyx:—
Slender, glabrous or puberulous. Fls. pale-coloured 7. *gratioloides*.
Stouter. Pubescent or hirsute. Fls. purple or bluish 8. *racemosa*.
2. Flowers sessile:—
Habit of 7. Multifid leaves 0. Stems pubescent 9. *sessiliflora*.
Stouter. Multifid leaves present. Stems glabrous 10. *heterophylla*.

1. *L. Roxburghii*, *G. Don*.

Stems stout 1—2 ft. high from a creeping base, leaves opposite elliptic or ovate 2—3·5" long, narrowed at base into a petiole 25—1" long, crenate-serrate or crenulate, sec. n. 7—10 strong, running to close within the margin. Flowers blue-purple with yellow mouth, sessile in dense axillary heads. Capsule compressed oblong, grooved, 2—25" long.

Along streams, usually under shade. Monghyr, *Ham.*! Singbhum! Manbhum, *Camp.*! Ranchi, *Clarke*! Hazaribagh, *Cal. Herb.*! Fl. r.s. Fr. Nov.—Dec., old inflorescence remaining up to Feb.

Aromatic; pubescent or glabrous, petioles forming lines at the thick nodes. Leaves punctate beneath, obtuse or subacute. Heads globose or oblong, sessile or shortly peduncled with conspicuous bracts to the flowers. Calyx hairy or pubescent, 3" long (measuring along longest sepal), lobes acuminate, with strong midrib. Corolla 3". Seeds oblong angled, minutely dotted rather than reticulate.

2. *L. conferta*, Benth.

A scented nearly glabrous herb, variable in size, small and diffuse 4—8" or sometimes erect and up to 18". Leaves 2—3" long only or .75—1.5" long, always elliptic-lanceolate or elliptic-oblong sessile or subsessile, conspicuously punctate (gland-dotted) beneath, serrate or obtusely serrate, with obtuse tip and when fresh appearing nerveless except the mid-rib. Fls. purple .3—.5" long, arranged in axillary loose bracteate spikes or solitary axillary; bracteolate. Calyx .12—.2", glandular pubescent with linear acuminate lobes. Capsule .08—.1" ellipsoid shining papery or membranous, falling before dehiscing or very tardily dehiscent. Seeds short oblong angled, shining.

Rice fields and watery places. Purneah, common! Singbhum! Manbhum, Camp. Ranchi, Clarke! Sambalpur! Fl., Fr. c.s.

Leaves narrowed at the base; petiole occasionally .25" long, often 0. Spikes sometimes up to 2" in length and compound with lowest flowers sometimes shortly pedicelled, rhachis pubescent, bracts opposite or alternate, bracteoles shorter than the calyx, linear. Calyx deeply 5-fid, striate in fruit. Corolla tube nearly straight, slightly inflated below, 2 upper lobes exterior in bud, purple, throat yellowish and tube hairy within, lobes semi-orbicular.

3. *L. diffusa*, Benth.

Scarcely appears to be more than a variety of *L. conferta*, with pubescent more strongly nerved crenate-serrate leaves and often racemose flowers or flowers in short axillary cymes or long spikes or racemes.

Singbhum! Purneah, Kurz! Fl., Fr. c.s.

4. *L. hypericifolia*, Benth.

Erect, or decumbent below, 6—18" high, glabrous except the gland-pubescent inflorescence. Leaves opp. entire or denticulate, .75—1.5" long, half-amplexicaul, elliptic- or ovate-oblong, with 1—2 nerves from the base each side of the mid-rib. Flowers .5—.6" long, rose-purple, sessile in the axils of the floral leaves or bracts which are opposite or alternate. Calyx .2—.25", ribbed, with stalked glands, lobes linear or lanceolate (ovate, *F. B. I.*) acuminate, membranous in fruit. Capsule broadly elliptic.

Watercourses below Neterhat, 3000 ft. Palamau! Fl. Oct.

It differs from the description of the species in the *F.B.I.* by being glandular pubescent above and by the calyx-lobes being lanceolate, not ovate. Leaves punctate, rather thick, base broad, obtuse. Bracts with sub-cordate base, leaf-like but usually only .4—.5", very glandular. Bracteoles narrowly linear-subulate .2" long. Calyx-lobes with membranous margins. Corolla densely glandular, upper lip exterior in bud, posterior lobe largest broadly oblong, side lobes small rounded.

5. *L. gratissima*, Blume.

An erect glabrous species also a good deal resembling *L. conferta*, with opposite or some 3—4-nately whorled, scarcely petioled, very punctate, oblong leaves 1.5—2.5" long, half-amplexicaul and often attenuate at the base. Flowers .35—.6" long in axillary and terminal many-fld. racemes with pedicels .3—.4" long. Calyx .2—.25" long, striate with veins. Capsule .2" oblong acute.

Watery places. Hazaribagh, *Clarke!* Fl. Oct.

Leaf margin thickened, sharply serrate to shallowly serrulate. Bracteoles acicular, .04—.08".

6. *L. hirsuta*, *Benth.*

A pretty marsh herb with hollow purplish usually hairy stems 1—2 ft. high, opposite and 3—4-nate oblong or elliptic-oblong gland-dotted serrate leaves about 1" long, sessile or narrowed into a short petiole, and many 1—2-nate axillary pedicelled flowers .5" long, sometimes cymose or paniced at the top of the stem. Calyx .27—.3" long, thinly glandular-pubescent or hirsute, lobes narrowly lanceolate acuminate, striate in fruit. Corolla-tube exerted reddish, lobes violet small .15", expanded corolla .45—.5" diam. Capsule broadly ellipsoid.

Purneah! Ranchi, *Clarke!* Fl., Fr., c.s.

Stems hollow, terete, sometimes decumbent below. Leaves with broad amplexicaul base below, aromatic, widest about the middle. Sec. n. 3—4 faint unbranched. Floral leaves exceeding the slender .3—.5" pedicels, bracteoles one-third the calyx, filiform. Upper corolla-lobes rounded, lateral broadly oblong .15", anterior similar.

Var. *Clarkei*.

Glabrous with much broader elliptic leaves. This is placed under *L. hirsuta* by *Hooker*. The leaves are opposite and it is difficult to distinguish it from *L. gratis-sima* except by the more cymose inflorescence and, *Hooker* says, by the more orbicular capsule. Ranchi, *Clarke*.

7. *L. gratioloides*, *Br.*; Karpur, *Beng.*; Nanha Hemcha, *S.*

A common small marsh plant much resembling *L. sessiliflora* in habit, aromatic puberulous and glandular all over, or glabrous, with pinnatifid whorled leaves and pedicelled white or pinkish axillary flowers, the pedicels of which elongate in fruit, attaining .7—1" in length. Fls. .4—.5". Calyx with linear sepals .15—.2", in fruit hemispheric with broader acuminate sepals, midribs usually evident, but not striate.

Marshes, tanks, etc. N. Bengal, *Kurz!* Monghyr! Gya, *Cal. Herb.*! Manbhurn, *Camp.*! Singbhum, common! Sambalpur, *Griff.*! No doubt therefore in all districts. Fl., Fr. Sept.—Feb.

Lower leaves often capillaceo-multifid, uppermost rarely entire. Some of my specimens have 12—14 leaves in a whorl, cuneate-pinnatifid, .5", submerged much longer and multifid. Calyx glabrous or somewhat pubescent. Cor. white or pale-purple; I have never seen it dark purple in this species. Bracteoles linear. Fruiting sepals occasionally 3-nerved. Capsule broadly ellipsoid, .5".

8. *L. racemosa*, *Benth.*

Robust below and stems 10"—2 ft. (*F. B. I.*), pubescent or hirsute, sometimes glabrous (*F. B. I.*). Lower leaves very flaccid and capillaceo-multifid, uppermost oblong prominently 3—5-nerved and serrate .5—1.5" long, intermediate with intermediate characters. Flowers .4—.5", short-to long-pedicelled in erect terminal racemes. Calyx .15" (.25", *F. B. I.*); lobes with thick centre and slender points, ovate acuminate in fruit. Corolla bluish or purple, fragrant. Capsule almost globose.

Purneah, *Kurz!* Fl., Fr. Oct.—Jan.

9. *L. sessiliflora*, Blume.

An elegant little plant growing in masses in water or swampy places, smelling strongly of musk, with pubescent stems 4—8" long and 4—8-nately whorled lobulate and pinnatisect leaves 3—5" long, or upper leaves sometimes 7" and less divided, and opposite solitary axillary sessile light-purple flowers 4—5" long. Capsule orbicular turgid 17".

In watery places. Purneah, common! Sambalpur, Griff! Said to be common throughout India but these are the only specimens from our area. Fl., Fr. Sept.—Nov.

A variable plant and possibly a species composed of sessile-fl. forms of *L. gratioloides* and forms of *L. heterophylla* wanting the lower capillary leaves. When creeping on mud the lowest leaves only are pinnatifid with linear segments, the uppermost serrate or quite entire and 3-nerved and resembling somewhat those of *L. hirsuta*. Calyx 2—2.5" with linear or lanceolate acuminate lobes, in fruit hemispheric membranous not striate with lobes becoming ovate long-acuminate.

10. *L. heterophylla*, Benth.

A larger plant than the last with glabrous stems and with numerous leaves below cut into many capillary segments, intermediate leaves 4—6 in a whorl pinnatifid, and uppermost usually opposite (sometimes also alternate) small sessile half-amplexicaul oblong crenulate. Flowers similar to the last, but more often spicate, sessile or subsessile. Calyx 12—15", in fruit hemispheric membranous, not striate, and lobes ovate more shortly acuminate than in the last. Capsule broadly ellipsoid.

Purneah! Santal Parganas, Kurz!

14. TORENIA, L.

Herbs with opposite often crenate or serrate leaves and mod.-sized flowers axillary or in pseudo-umbels or racemes, pedicels ebracteolate. Calyx tubular, 3—5-winged or keeled or plicate, 2-lipped or 3—5-toothed. Corolla-tube dilated above, upper lip erect, concave, notched or 2-fid; lower larger spreading 3-lobed. Stamens 4 perfect, 2 upper included, 2 lower conniving under the upper lip and appendaged at base, anthers conniving or cohering in pairs, cells often confluent. Stigma 2-lamellate. Capsule linear or oblong, included, septicidal, valves separating from the placentiferous axis. Seeds many rugose.

Fruiting calyx 7—8" long, decurrent on the pedicel

1. *peduncularis*.

Fruiting calyx 3—5" long, often cordate, not decurrent

2. *cordifolia*.

1. *T. peduncularis*, Benth. Syn. *T. edentula*, Benth., in part (*D.C. Prod.*)

A branched herb 6—12" high with angular stems, thinly hairy at the angles and nodes with ovate or lanceolate-ovate crenate-serrate leaves 7—1" long (perhaps sometimes longer) and pretty blue or nearly white flowers with a dark purple-blue heart and usually violet blotches on the lateral lobes, on elongating pedicels winged by the decurrent calyx which is 5" long in flower and 7—8" long in fruit, narrow-ellipsoid in outline.

Singbhum, in moist places! Fl., Fr. Aug.—Nov. Annual.

Leaves puberulous on the rather strong nerves, obtuse or subacute, rounded or very obtuse at the base, which is decurrent on the .1—3" long petiole. Pedicels opposite, not subumbulate in my specimens (they may sometimes be so), .5—8" in fruit, patent. Corolla .8" long. Stamens toothless.

2. *T. cordifolia*, Roxb.

An annual brittle branched herb of similar habit to the last, 4—12" high, simple or 3-chotomously branched with sub-alate or sharply angled stems slightly pubescent at the angles. Leaves ovate to ovate-lanceolate .7—2.2" long, acute or sub-acuminate, serrate. Flowers pale blue, axillary and usually whorled or sub-umbellate at the tops of the branches, lower lip of corolla darker than the others. Calyx .25—3" in flower, .3—5" in fruit, wings on calyx with often a cordate base. Pedicels angled, but not winged by the decurrent calyx.

Damp shady places, common. Fl., Fr. Aug.—Dec. Chota Nagpur, all districts! Fl., Fr. Aug.—Dec.

Nervation of leaves as in the last, with about 3—5 rather strong oblique sec. n. giving out short branches to the teeth, usually puberulous beneath. Flowers sometimes very small, only .25" wide, at others much larger but smaller than in the last, especially the calyx. Fruiting pedicels .5 to .8" spreading and deflexed.

T. Fournieri, Linden, is a pretty species with blue flowers with dark purple patches and broadly winged calyx often cultivated in gardens. A native of Cochin China.

15. VANDELLIA, L., Mant. (1767)

(Inc. *Bonnaya*, Link.*)

Usually small annual herbs growing in moist places. Leaves penninerved. Flowers small, axillary or racemed, ebracteolate. Sepals free or connate, sometimes sharply angled or keeled, but not winged. Corolla with erect short broad concave notched or 2-fid upper lip and broader spreading 3-lobed lower lip. Stamens 4 perfect or 2 reduced to staminodes, anterior when perfect with sharply curved filaments,

* The genus *Vandellia* (Gen. Plant., ed. Schreb., n. 1040) has been sunk in *Lindernia* (Gen. Plant., ed. Schreb., n. 1031) in the *Nat. Pflanz. Fam.* and in the *Flora of Tropical Africa*. The genus *Bonnaya* differs from *Vandellia* as defined in the *Genera Plantarum of Benth. and Hooker* only by two of the stamens not bearing fertile anthers. But in view of the following considerations the separation of these two genera on this character alone appears to me artificial and untenable. In *V. molluginoides*, Hooker found in some specimens 2 filiform staminodes hooked near the top, and I have a specimen of *V. crustacea* in which the two anterior filaments appear to be without anthers. Some species of *Vandellia* can only be separated from species of *Bonnaya* by this one sexual character, e.g. forms of *V. angustifolia* and *V. verbenæfolia*. Finally the character of the barren stamens themselves differs and shows transitional stages. In *Bonnaya verbenæfolia* the anterior stamens in some specimens bear anthers but these are small and unfertile. In *B. veronicæfolia* there are no anthers, but the filaments are long and curved or hooked as in the case of some *Vandellia molluginoides*. In *Bonnaya brachiata* the barren stamens are short pubescent scales. I have therefore united the two genera, but transferred *Vandellia erecta* (*pyxidaria*) to *Ilysanthes* as suggested by Sir J. D. Hooker. But *Vandellia erecta* (= *Lindernia pyxidaria*) was the type of *Lindernia*. Hence the name "*Ilysanthus*" must disappear and "*Vandellia*" be retained. This arrangement has the incidental advantage of obviating many new combinations under *Lindernia*.

often appendaged anthers touching or cohering in pairs, cells divaricate. Stigma 2-lamellate. Capsule septicidal, short or elongate, valves separating from the placentiferous septum. Seeds rugose or granulate

- I. Calyx, at least in flower, only lobed one-third its length or less. Pedicels often sub-umbellate:—
 Flowers large. Calyx .2—3.2". Whole plant hairy 1. *stemonoides*.
 Flowers small. Calyx .1—1.6". Glabrous or hirtellous 2. *crustacea*.
- II. Calyx lobed three-fourths the way down or more. Pedicels axillary or racemose, never sub-umbellate:—
 A. Capsule not or scarcely longer than the calyx, ovate, oblong obtuse or orbicular:—
 Hispid all over. L. .4—8". Pedicels capillary, not racemose 3. *scabra*.
 Sparsely hairy. L. .5—2". Flowers racemose 4. *hirsuta*.
 Glabrous. L. .5—1.2". Flowers racemose 5. *multiflora*.
- B. Capsule much longer than the calyx, ellipsoid or linear-lanceolate, acute:—
 1. Capsule under .25". Sepals connate at base:—
 L. sub-orbicular, crenate-dentate. Fls. sessile and pedicelled 6. *sessiliflora*.
 Capsule very narrow, over .25" long. Sepals free or connate at base:—
 a. Leaves closely sharply and deeply serrate, broadly elliptic oblong. Erect rather rigid herb 7. *brachiata*.
 b. Leaves shallowly or obscurely serrate or entire:—
 * Both pairs of stamens fertile:—
 L. ovate or oblong-ovate .3—9". Fls. never racemose 8. *cordifolia*.
 L. linear or narrowly lanceolate. Fls. often racemose (angustifolia)*
 ** One pair of stamens only fertile:—
 L. broadly elliptic to ovate-oblong, lower shortly petioled. Calyx .2—3" 9. *veronicaefolia*.
 L. linear or narrow-lanceolate, scarcely serrate. Calyx .1—2" 10. *verbenaefolia*.
 L. oblong, serrate, thick. Calyx .1—2" 11. *oppositifolia*.
 Tufted slender erect. L. linear. Calyx .04—0.7" 12. *tenuifolia*.

1. *V. stemonoides*, Miq. Syn. *V. Hookeri*, Clarke.

A rather robust plant for the genus and resembling a *Torenia*, with sharply 4-angled hairy stems, up to 11" long, much diffusely branched. Leaves ovate-oblong, ovate or ovate-lanceolate, hairy, .7—1.5" long, serrate, sessile or with lower petioles up to .4", base decurrent on the petiole. Flowers blue-purple on spreading axillary and terminal sub-verticillate hairy pedicels. Calyx .2—3" in flower or up to .5" in fruit, hispidly-hairy, strongly ribbed but not decurrent nor winged, sepals often distinct to base in fruit, rarely calyx 5-cleft to middle in flower. Capsule .15—2.5". Seeds subglobose, pale-yellow, granulate-rugose.

Wet ground, ricefields, etc. Mountains of Chota Nagpur, Singhbhum! Ranchi and Palamau (Neterhat)! Parasnath, Clarke! Fl. Aug.—Oct. Fr. Nov.—Dec.

Easily distinguished by its hairiness. Pedicels .3—5", often deflexed.

2. *V. crustacea*, Benth.

A glabrous, or nearly glabrous, low often diffusely branched herb 2"—12" high with angled stems and branches, small ovate entire or

* For *V. angustifolia* see *V. verbenaefolia* = *Bonnaya verbenaefolia*.

serrate leaves .25—.75" long and axillary and terminal small purple or blue-violet flowers .26—.35" long with calyx .15—.17" long only, not divided more than one-fourth way down, sometimes splitting down one side, but not accrescent in fruit. Capsule equalling the calyx with two elliptic valves.

Very common in wet places, rice fields, damp ravines, etc. Singbhum! Manbhum, *Camp.*! Ranchi, *Clarke*! Probably in all districts. Fl., Fr. July—Dec.

Leaves sometimes crenate usually obtuse and with broad base, but sometimes suddenly contracted into the very short petiole which is .25" or under, sec. n. 3—4. Pedicels erect in type (see var.), slender, .3—1.5" long. Calyx distinctly 5-ribbed and angled, often hirtellous, teeth triangular or lanceolate. Corolla narrow, lower lip with a yellow blotch in the throat. Lower pair of stamens nearly exsert, with a geniculate knobbed filament or nearly straight. Seeds pale yellow granulate.

Var. *verticillata*. *Syn.* *V. molluginoides*, *Benth.*?

Much 3-chotomously branched with the pedicels spreading and deflexed sub-verticillate at the top of the branches.

Purneah! Ravines in Singbhum!

Except in its dwarf more rigid habit and less divided calyx this appears to be the same as *V. molluginoides*, *Benth.*

3. *V. scabra*, *Benth.*

A little plant of similar habit to *V. crustacea*, but easily recognised by its being hispidly-hairy all over or the leaves glabrous above. The flowers have a purplish or brown-veined upper lip, a light blue or white under-lip and yellow throat and are more spreading than in *V. crustacea*, being .25—.3" broad and long. Calyx divided nearly to the base and fruiting pedicels spreading and deflexed, not at all racemose or verticillate.

Wet ground, rice-fields, etc. Purneah, *Kew Herb.*! Ranchi, *Prain*! Singbhum! Chilka Lake, *Alcock*! Throughout India, *F.B.I.* Fl., Fr. Aug.—Jan. Also May.

Branches much spreading, often prostrate. L. small ovate or ovate-cordate, about .4", rarely .8" long, obscurely crenate, obtuse. Pedicels capillary. Calyx .08—.1" in flower, sometimes .12" in fruit, lobes lanceolate rather remote in fruit disclosing the spherical capsule, which is about .1" and glabrous.

4. *V. hirsuta*, *Benth.*

Erect succulent, sparsely clothed with spreading hairs, lower leaves petioled ovate or oblong obtuse entire or sinuate, upper sessile broader, flowers racemed, pedicels exceeding the calyx. Corolla pale yellow white, or bluish-white (*Griffith*). Sepals lanceolate, longer than the orbicular capsule.

This, which has been collected in the Sikkim Tarai as well as Bengal and the Deccan, no doubt occurs in the eastern parts at least of our area, almost certainly in Purneah.

5. *V. multiflora*, *G. Don.*

Similar in habit to *V. hirsuta*, but glabrous. Stems 3-chotomously branched 4—6". Leaves sessile or narrowed into a short petiole, oblong or ovate-oblong or obovate. Flowers in numerous racemes with minute bracts and pedicels mostly under .3". Calyx .08—.1". Capsule orbicular slightly exceeding it.

Monghyr, *Ham.*! Also Maldah, on the borders of our province! Santal Parganas, *Kurz!* Fl., Fr. May (and no doubt at other times).

6. *V. sessiliflora*, Benth.

A small erect strict or 2—3-choromously branched herb 2—6" high with puberulous angles to the stems and branches and sub-orbicular or broadly ellipsoid rounded crenate-serrate or dentate leaves 3—6". Flowers purplish not racemed, sessile and pedicelled, several together at the top of the stems, about 25" long. Calyx 08—1", sometimes lobed only half-way down. Capsule narrowly ellipsoid, apiculate, 23—25". Seeds granulate.

On damp rocks under shade. Ichadar (Ranchi), 3500 ft. Parasnath (Hazari-bagh)! Fl., Fr. July—Nov.

Leaves sometimes puberulous on midrib beneath and on the margins, sec. n. 1—2 faint. Pedicels 0—75" long (on same plant), deflexed in fruit or the shorter ones erect.

7. *V. brachiata*, comb. nov. Syn. *Bonnaya brachiata*, Link & Otto; *Gratiola serrata*, Roxb.

A rather rigid erect but diffusely branched herb, 3—10" high, glabrous. Leaves sessile broadly oblong obtuse or subacute sharply closely spinulose-serrate 5—15" long, sec. n. 4, very faint or not visible. Flowers 25" long, pink or white, in lax terminal racemes with rigid pedicels 13—25" long. Calyx 2" long, lobed almost to the base with linear-subulate finely aristate sepals. Capsule linear-oblong acute 5" long.

Frequent in damp pastures, rice-fields, etc. Singbhum! Ranchi, *Cal. Herb.*! Gaya, *Cal. Herb.*! Manbhum, *Camp.*! Hazaribagh, *Cal. Herb.*! Probably in all districts. Fl., Fr. r.s.

Stems, branches and peduncles 4-angled. L. sometimes very minutely hirtellous beneath. Bracts linear-subulate 17". Seeds usually truncate both ends. Corolla white with lilac spots on the lip.

8. *V. cordifolia*, G. Don. Syn. *Torenia diffusa*, Roxb. (exc. syn.); *Gratiola cordifolia*, Vahl (1805); *Vandellia pedunculata*, Benth. (1835); *Torenia diffusa*, Roxb.; *Bonnaya cordifolia*, Spreng.

A small glabrous diffusely branched herb with diffuse stems 2—12" long sometimes procumbent and rooting. Leaves subsessile and shortly petioled, 3—7" rarely 9" ovate or oblong-ovate obtuse or subacute, glabrous, crenate-serrate, base usually cordate. Flowers 3—35" axillary not racemed, with long-spreading pedicels 7—1" long. Calyx 15—17" glabrous. Corolla white or pale blue or with a pale violet margin, lower lip with a white or yellow spot. Capsule linear-lanceolate 3—4" long, very acute, often 1" broad at base.

Purneah, *Cal. Herb.*, J.D.H.! Sambalpur, *Cal. Herb.*! In rice-fields. Probably in all districts. Fl., Fr. May—Dec.

L. often very shallowly or obscurely crenate. Fls. up to 37" long in some specimens. Peduncles scattered erect in flower, spreading or reflexed in fruit. Sepals subulate.

Bentham says that it is scarcely distinguishable from *Bonnaya grandiflora* (vide *V. veronicæfolia*).

9. *V. veronicæfolia*, comb. nov. Syn. *Bonnaya veronicæfolia*, *Spreng* ;
Gratiola veronicæfolia, *Retz.* ; *Bonnaya grandiflora*, *Spreng*.

A herb with very numerous prostrate often rooting square branches 4—10" long. Leaves oblong or elliptic usually tapering somewhat at base into a very short petiole or subsessile above, distinctly but rather distantly serrate, .5—1.25" long. Flowers blue, pinkish or white axillary, .4—5" long. Calyx .2—25" in fruit. Stamens 2 upper perfect with fertile anthers, two lower longer with outwardly curved sterile filaments yellow. Fruiting pedicels divaricate .4—75". Capsule linear .5—6".

Wet ground. Bettiah, *Hieronymus!* Santal Parg., *Kurz!* Ranchi, *Clarke!* Singbhum! Fl., Fr. r.s. and c.s.

It has been stated that *V. cordifolia* (= *V. pedunculata*) can only be distinguished from this species by the two pairs of fertile anthers. If this be so it seems to me that they should be treated as sexual forms of the same species until physiological tests prove them to be distinct. In the present case, however, it seems to me that *V. cordifolia* is distinguishable from *V. veronicæfolia* as limited above by its more ovate leaves, shorter calyx, relatively longer pedicels and characters given below.

L. with very obscure lateral nerves, quite glabrous, acute or subacute. Flowers in my specimens not racemose (*Bonnaya grandiflora*, *Sprengel*), in others (*B. veronicæfolia*, *Spreng.*) they become racemose. The two species should perhaps be kept distinct, true *veronicæfolia* having also somewhat shorter flower .3" and sepals in flower .15—.2" as in the next species. Apart from the stamens other characters separating *V. cordifolia* and *V. veronicæfolia* appear to be as follows:—

- | | |
|--|---------------------------|
| L. mostly under .7" ovate cordate, shallowly crenate. Peduncles alternate. Capsule 1" wide at base, tapering | 8. <i>cordifolia</i> . |
| L. more or less elliptic or oblong or if ovate mostly over .7", serrate or crenate-serrate. Peduncles mostly opposite. Capsule slender uniform .07" wide | 9. <i>veronicæfolia</i> . |

10. *V. verbenæfolia*, comb. nov. Syn. *Bonnaya verbenæfolia*, *Spreng.* ;
B. veronicæfolia, *F. B. I.* (in part). Incl. *V. angustifolia*, *Benth.*

An erect glabrous herb 5—10" high with suberect slender branches. Leaves linear, linear-oblong or oblanceolate sparsely toothed or entire, sessile or subsessile .5—1.7" long. Flowers about .35" in terminal racemes. Pedicels divaricate in fruit .25—3". Calyx .1—2". Capsule linear, striate (with fine nerves), .4—5".

Near Purneah. *Kurz!* Maubhum, *Kurz!* Singbhum, common in wet places! Fl., Fr. r.s.—Nov. The form with two pairs of fertile anthers occurs in Ranchi and probably with precisely the same distribution so far as can be judged from herbaria.

L. acute or obtuse, sec. n. obscure or very fine. Colour of the flowers has not been noted. Pedicels rarely attain .8" (in *V. angustifolia*).

Under this species I include *Vandellia angustifolia*, *Benth.*, and *Bonnaya verbenæfolia*, *Spreng.* The former appears to differ only by having both pairs of anthers perfect. My specimens of *B. verbenæfolia*, instead of showing the anterior pair of stamens reduced to mere clavate filaments as in *V. veronicæfolia*, show distinct but infertile anthers smaller than the normal ones; the filaments are correct.

11. *V. oppositifolia*, comb. nov. Syn. *Bonnaya oppositifolia*, *Spreng.* ;
Gratiola oppositifolia, *Roxb.*

An erect closely branched rather stout little herb, sometimes only 2" high with angled branches. Leaves oblong, slightly serrate, sessile

·4—·6" (attaining 1·2", *Cooke*). Flowers ·25", blue (*Roxb.*), axillary and upper racemed with very short pedicels mostly shorter than the calyx which is ·2—·25" long with 1-ribbed narrow sepals. Capsule ·3" long.

Manbhum, *Clarke!* Fl., Fr. c.s.

I do not know this plant growing.

12. *V. tenuifolia*, comb. nov. Syn. *Bonnaya tenuifolia*, *Spreng.*

A tufted erect intricately branched herb with filiform branches and sessile linear nearly entire leaves 1—1·5" long, under ·2" broad. Flowers very small, pale blue (*Griffith*), axillary and upper racemed, about ·12" long. Calyx ·04—·07". Capsule ·25—·5" long slender.

Topchanchi (Manbhum), *Anders.!*

This also I do not know in a living state.

16. LINDERNIA, All. (1755).

(Including *Ilysanthes*, *Rafin*, 1820.)

Annual glabrous marsh herbs with leaves parallel-nerved not or usually faintly punctulate. Flowers small as in *Vandellia*, but imperfect stamens, if present, 2-lobed, one lobe glandular obtuse, the other glabrous variously shaped. Capsule and seeds as in *Vandellia*.

See remarks under *Vandellia* re inclusion of *Ilysanthes* in *Lindernia*.

Both pairs of stamens usually perfect

1. *pyxidaria*.

Anterior pair of stamens imperfect:—

Corolla twice or two and a-half times as long as the ·08—·1" long (in flower) calyx

2. *parviflora*.

Corolla 3—4-times as long as the ·1—·12"-long calyx

3. *hyssoptoides*.

1. *L. pyxidaria*, All. Syn. *Vandellia erecta*, *Benth.*; *Vandellia pyxidaria*, *Maxim.*

A small erect glabrous herb 4—8" much branched from the base with sessile 3—5-nerved elliptic, oblong or ovate leaves often somewhat tapering towards base, lower ·5—·75" long. Fls. ·2—·3" long white on very slender axillary suberect spreading or rarely deflexed pedicels ·5—·6" long or usually twice as long as their subtending leaves. Calyx ·08—·1" in flower, ·12—·15" in fruit, sepals linear, rather remote in fruit. Capsule broadly ellipsoid, as long as calyx or only very slightly longer.

Frequent in swamps. Behar, *J.D.H.!*

Sometimes purplish. Leaves obscurely punctate, entire or slightly crenate, obtuse. Sepals sub-obtuse. Both pairs of anthers fully developed.

Wettstein states that *L. pyxidaria* extends from Eastern Asia to Southern Europe, that the flowers in the temperate European and Asiatic zone are mostly cleistogamous (= *L. pyxidaria*, *All.*), in the Indian region only chasmogamous (= *Vandellia erecta*, *Benth.*), and in the intermediate regions flowers of both forms occur.

2. *L. parviflora*, comb. nob. Syn. *Ilysanthes parviflora*, *Benth.*; *Gratiola parviflora*, *Roxb.*

This is said to differ from *L. pyxidaria* only in the reduction of the shorter stamens and in the longer acute capsule (*F. B. I.*). Erect, slender, with sometimes very numerous slender and spreading stems

4—6". *L. ovate-lanceolate* 2—4" or lower more elliptic, and 7" sessile, with 3—5 nerves from the base. Flowers white (or blue, *F. B. I.*), 2"—22", on slender pedicels 5—7" long. Calyx 08—12" in flower, 15" in fruit, sepals linear-subulate, 1-nerved, acute. Capsule 15—2" long, acute, striate.

Apparently more common in our province than the last. Purneah! Singbhum, frequent! Manbhum, Clarke! Palamau, Gamble! Fl., Fr. r.s.—c.s.

The anthers of the longer (not shorter) stamens in my specimens are rudimentary.

3. *L. hyssopioides*, *comb. nov.* Syn. *Ilysanthes hyssopioides*, *Benth.*

Habit usually much laxer than in *I. parviflora*, erect, simple, or diffusely branched. Leaves in distant pairs sessile oblong, oblong-lanceolate or sometimes narrowly lanceolate, not punctate, usually entire, 1—3-nerved. Flowers pale blue, or purple (*Wood*), 35—5" long and 3" broad on axillary filiform pedicels 5—1.5" long. Calyx 12". Capsule 2" or rather less, rounded at end, minutely striate.

Sarguja, in water of small streams, elev. 1500-2000 ft., *Wood!*

17. MICROCARPÆA, *Br.*

A very small diffuse or creeping herb with opposite sessile entire narrow leaves. Flowers minute, axillary solitary sessile ebracteolate. Calyx tubular, 5-angled, 5-fid or -lobed. Corolla very short, tube broad; lobes 5, broad, spreading, 2 upper subconnate. Stamens 2, anthers confluent, 1-celled, staminodes 0. Style filiform, stigma capitate recurved. Capsule included, ovoid, 2-grooved, loculicidal; valves separating from the placentiferous septum. Seeds few, ovoid.

1. *M. muscosa*, *Br.* Syn. *Ammannia dentelloides*, *Kurz* (fide *Koehne*).

A very slender often tufted herb with numerous intricately branched angled creeping stems and branches 2—4" long; angles sometimes ciliolate. Leaves linear-oblong or linear 1—2.5" glabrous subobtusate. Flowers mostly in one axil only of each pair of leaves. Calyx 1", lobed about one-fourth to one-third down, lobes very acute ciliate, mid-ribs strong, making the calyx angled. Corolla-tube shorter than the calyx. Capsule 04—05".

Found with *Eriocaulon* and in damp places in general, probably quite common but not often collected. Sikkim Tarai and Northern Bengal and probably Purneah! Parasnath, *Kurz*. If this is the same, as it apparently is, with *Ammannia dentelloides*, the localities of that species (*q.v.*) should be added. Fr. Oct.—Dec.

I have not seen the corolla of either. It appears to be very evanescent. The capsule in specimen examined by me had as many as 25 seeds. *Clarke* says 12—15 subhemispheric but mine are oblong. The calyx is sometimes sub-2-lipped with the upper lip 2-toothed, the lower 3-lobed.

18. GLOSSOSTIGMA, *Arn.*

Very small creeping herbs with opposite or fascicled narrow entire leaves and minute solitary axillary ebracteolate flowers. Calyx campanulate, obtusely 3—4-lobed. Corolla with short tube and 5 sub-equal lobes. Stamens 2 or 4, anther cells diverging, tips confluent. Ovary perfectly or imperfectly 2-celled, stigma dilated spatulate recurved.

Capsule included loculicidal, valves separating from a columnar axis. Seeds small, ovoid.

1. *G. spathulatum*, Arn.

A minute weak flaccid tufted herb. Leaves linear-spathulate, lower tapering into a long petiole and including the petiole '5—'6", upper linear-spathulate '2—'3". Flowers '07" on long slender pedicels. Calyx in fruit '08" enclosing the globose capsule.

Behar, very abundant on the margins of tanks, *J.D.H.*! Fl. Jan.

I have not collected it. The corolla is said to be blue. Pedicels shorter than the leaves.

19. VERONICA, L.

Herbs or shrubs with opposite, rarely upper alternate, leaves. Flowers solitary or racemed, ebracteolate, white, blue or purple. Calyx 4—5-partite. Corolla rotate, lobes 4—5, lateral outer in bud and often broader. Stamens 2 exsert, anther-cells with confluent tips. Ovules usually many. Capsule 2-grooved, dehiscence various. Seeds various.

Leaves usually narrow. Flowers racemed
L. broad. Flowers solitary axillary

1. *anagallis*.
2. *agrestis*.

1. *V. anagallis*, L.

A glabrous perennial with erect or decumbent stems, 6—18" high and sessile, or lowest petioled, oblong to linear-oblong leaves 2—5" long, and pink or white small flowers in lax flowered slender bracteate racemes on spreading pedicels. Capsule '12—'17" diam.

Swamps, frequent below Maldah, *J.D.H.*! Extending into and more common in Oudh and Upper India! and therefore probably in all districts in our Northern Area. Fl., Fr. h.s.

Var. **punctata**, *J. D. H.* Syn. *V. punctata*, *Ham.*; var. *tropicalis*, *Clarke*.

A decumbent form with leaves all petioled, ovate, serrate, or the upper only linear-oblong sessile amplexicaul. Fls. white, only '12" diam.

Maldah, *Clarke*! Fl. Feb. This variety also extends to Benares.

The ordinary form is a common brookside and swamp herb extending as far as the British Isles.

2. *V. agrestis*, L.

An annual with numerous prostrate branches 4—12" long, with petioled ovate cordate or orbicular coarsely crenate-serrate leaves '3—'8", and solitary axillary blue or white flowers '17—'25" diam. Capsule compressed, 2-lobed, '25" diam., hairy or ciliate, on decurved pedicels.

This is abundant in the plains of northern India and will probably be found in our Northern Area. Fl., Fr. c.s. It also occurs commonly in Britain where it is known as the "Field Speedwell."

20. SCOPARIA, L.

Herbs or undershrubs, with opposite or whorled, entire or toothed, gland-punctate leaves. Flowers small, sub-regular, axillary, ebracteolate. Sepals 4—5, free or nearly so, imbricate in bud. Corolla rotate

4-fid, throat densely bearded, lobes obtuse, subequal. Stamens 4, subequal; anthers subsagittate, cells parallel or diverging. Style subclavate, stigma notched or truncate. Ovules many. Capsule globose or ovoid, septicial; valves separating from the placentiferous axis, valves with inflexed margins. Seeds many, obovoid, angled, scrobiculate.

1. *S. dulcis*, L.

An erect much branched foetid herb with 3-nately whorled, glandular, serrate leaves 5—1.5", rhomboid or elliptic with tapering base, serrate. Flowers 3—6 from each whorl on slender 3—5"-long slender pedicels. Corolla delicate white, .2" diam. Capsule very small, .1", sub-globose, valves ultimately 2-fid.

Waste ground. Very common in the rains, especially in the damper districts! Fl., Fr. r.s.

Stems nearly glabrous, 4—6-angled or -lined. Upper leaves often opposite. Petiole scarcely separable from the slender leaf base. Sepals 3-nerved, slightly shorter than the capsule. Corolla divided nearly to the base. Stamens as long. Style stout.

21. CENTRANTHERA, Br.

Rigid scabrid herbs, with leaves opposite or upper alternate, linear or oblong. Flowers axillary or in bracteate spikes or racemes, bracteolate. Calyx compressed, spathaceous, lobes coherent or free. Corolla with long curved tube, dilated above and oblique limb with 5 broad subequal spreading lobes, 2 upper innermost in bud. Stamens didynamous, anthers meeting in pairs, cells transverse, bases mucronate or spurred, one often smaller and empty. Stigma dilated acute. Capsule ovoid or subglobose, loculicidal, valves placentiferous along the centre. Seeds very many, oblong-cuneate, testa lax, reticulate.

Erect, hispid. Corolla purple	1. <i>hispid</i> a.
Diffuse, hispidulous or usually glabrous. Corolla yellow	2. <i>humifusa</i> .

1. *C. hispid*a, Br.

An erect slender slightly branched herb 1—2 ft. high with hispid stem, narrowly linear to linear-oblong leaves 5—1.5" long, and purple flowers 1" long in interrupted terminal sub-spicate racemes. Spathaceous calyx hairy, 2—3" long.

Common in the rains, usually in wet grass lands. Purneah, Kurz! Singbhum! Manbhum, Camp! Ranchi and Palamau, ascending to Neterhat! Hazaribagh, Clarke. Fl., Fr. Aug.—Oct.

Leaves hispid and scabrid. Flowers sessile distant sub-opposite or alternate, only one opening at a time, corolla about .3" diam., slightly curved, throat darker purple than the subequal lobes. Filaments hairy, anthers with one cell empty and spurred, the other with a smaller spur. Capsules .2" enclosed in the ovoid oblique-mouthed toothless calyx.

2. *C. humifusa*, Wall.

A smaller more delicate plant than *hispid*a, diffusely branched from the base, with linear to narrowly oblanceolate scabrid glabrous or hispidulous leaves .25—7" long and axillary yellow sessile flowers .4—5" long. Capsule subglobose.

Grassy places. Titalyah (near Purneah), Kurz! Ranchi, Prain! Singbhum! Manbhum, Campbell! Parasnath, Clarke! Fl., Fr. Aug.—Oct.

Calyx split in front, .17", ovoid acute. Corolla sometimes with purple markings in the throat, tubular, dilated above.

22. SOPUBIA, Hamilt.

Erect herbs with the leaves narrow or finely cut, upper sometimes alternate. Flowers axillary and racemose or spicate, bracteolate, with 5-toothed or -lobed campanulate calyx and rather large corolla. Corolla-tube short, dilated above with 5 broad spreading, subequal lobes, 2 upper innermost in bud or (? in *delphinifolia*) sometimes outermost in bud. Stamens didynamous, subincluded, anthers 2 or all meeting in pairs, one cell of each perfect ovoid, the other small stipitate empty. Stigma thickened sublinguiform, obtuse. Capsule ovoid or oblong, loculicidal, with entire or 2-fid valves separating from the placentiferous axis. Seeds numerous, testa lax.

Leaves cut into filiform segments. Fls. 1—1.5" long .

1. *delphinifolia*.

Leaves linear entire or sparingly cut. Fls. .3—5" long

2. *stricta*.

L. linear or 3-fid. Fls. as broad as long

3. *trifida*.

1. *S. delphinifolia*, G. Don. Dak-kadur, S.

A very pretty herb, 1—3 ft. high, much branched above with feathery foliage, the leaves 1—2" long, being cut into about 5 filiform segments. Flowers axillary racemose, 1—1.5" long, purple or rose-coloured. Calyx tube .25", with setaceous teeth .4—5" long. Filaments with short stiff hairs. Capsule oblong, .25—3".

Frequent throughout Chota Nagpur, especially on rice-bunds in the rains! Probably in all the Central and Southern Area except near the sea. Fl., Fr. r.s.

Stem grooved, smooth or hispidulous. Leaves often drying green, scabrid, segments sometimes again divided. Pedicels .1—2". Bracteoles filiform. Calyx 10-nerved. Corolla narrowly tubular then ventricose, puberulous outside on the lobes.

2. *S. stricta*, G. Don.

An erect rigid strict or branched herb 8—20" high with pubescent stems, narrowly linear entire, more rarely sparingly toothed or cut leaves .5—1.5" long, and subsessile or pedicelled purple flowers .3—5" long, axillary and racemose. Calyx .15" pubescent with acute lanceolate teeth. Corolla purple, campanulate, closely puberulous outside. Capsule subglobose compressed at the top, .15"—.2" long, 4-valved.

Neterhat 3000 ft.! Sambalpur, Griffith! Fl. Oct.—Nov. Fr. Nov.—Dec.

3. *S. trifida*, Ham., with linear or filiform mostly fascicled and 3-sect. leaves .5—8" long, and yellow flowers with sub-rotate corolla, is found on Mahendragiri in Ganjam and is likely to occur on Meghasani at the end of the rainy season. The calyx is woolly within, teeth very short triangular.

23. ALECTRA, Thunb.

Erect, rigid, usually scabrid herbs, black when dry. Leaves opposite or the upper alternate, toothed, or reduced to scales. Flowers in terminal spikes or racemes, bracteate and bracteolate, yellow or streaked with red or brown. Calyx campanulate, 5-toothed or -fid, valvate, or open in bud. Corolla with broad tube and oblique limb, with

5 spreading lobes, the lower outer in bud. Stamens 4, didynamous; anthers touching in pairs, cells parallel, bases mucronate. Style long inflexed, stigma elongate linguiform. Capsule subglobose, loculicidal, with entire or 2-fid valves. Seeds very numerous minute, linear with very lax reticulate testa and small nucleus.

Leaves ovate to lanceolate toothed. Flowers sessile
Leaves scale-like. Flowers racemose

1. *indica*.
2. *Thomsoni*.

1. *A. indica*, Benth.

An erect scaberulous simple or branched herb 8—15" high, with ovate, oblong or lanceolate sharply dentate leaves .5—1.3" long, and yellow flowers in rather close terminal spikes, or lower axillary and very shortly pedicelled. Calyx broadly campanulate, .25", green, sparingly hairy, with 5 ovate very acuminate lobes. Corolla rather longer, almost ribbed. Anthers yellow.

Singbhum and Palamau, elev. 3000 ft., wet places among grass! Parasnath, various collectors! Fl., Fr. Oct.—Nov.

The plant somewhat reminds one of the English Yellow-rattle. Leaves hispidulous above, with cuneate base and 1—2 sec. n. from close to base hispidulous. Petiole short or 0. Bracteoles acicular. Capsule shorter than the calyx, subglobose, 4-lobed. Seeds linear, nucleus very small in the centre of the transparent sausage-shaped testa.

2. *A. Thomsoni*, Hook. f.

An erect almost leafless herb 4—20" high, often with several erect branches from near the base. Stems pubescent with scattered small green or purple leaves or scales mostly under .25" long, minutely toothed. Bracts mostly alternate. Pedicels short, .2—.5" long, or in some plants hardly any. Calyx strongly 10-nerved, .2" in flower, subglobose in fruit and .3" long with triangular teeth. Corolla .25—.3" lobed about half-way down, yellow, with 15 red nerves. Filaments hairy above, anthers purple. Stigma large oblong-clavate recurved green. Capsule 2—4-valved ovoid .3". Seeds with loose striate testa (in my specimens when fresh), as in *A. indica*, but more minute and elongate-cuneiform (*Hook. f.*).

In a wet gully, Singbhum, *Clarke!* *Gamble!* Rajmahal Hills, *Kurz!* Parasnath, *T.T., Kurz!* My specimens were collected in the Vindhyan Hills but in the C.P. Fl., Fr. Oct.—Jan.

The plant has the appearance of a parasite and like several others of the family may be parasitic on roots, apparently of Acanthaceous shrubs, but it is not always easy to establish the connection.

24. BUCHNERA, L.

Rigid annual herbs, black when dry with lower leaves opposite, broad, upper usually alternate and narrow. Flowers sessile axillary or in bracteate spikes, 2-bracteolate. Calyx tubular, 10-nerved, sometimes 5-ribbed, 5-toothed. Corolla with a slender tube and 5 flat subequal spreading lobes, 2 upper inner in bud. Stamens 4 didynamous included; anthers 1-celled, vertical, dorsifixed. Style thickened or clavate above, stigma entire or notched. Capsule oblong, loculicidal; valves separating from the placentæ but bearing parts of the septum. Seeds very numerous, obovoid or oblong, reticulated.

1. B. hispida, Ham.

An erect, strict slender hispid herb, 15—30" high, with rather distant pairs of obovate or oblanceolate leaves 1—2·5", sometimes smaller and linear upwards. Flowers 4—5" long, small pretty blue or purple in ultimately lax elongate terminal, and sometimes also axillary, spikes one-third to one-half as long as the whole plant. Capsule oblong-ovoid, slightly shorter than the 3" long hairy calyx.

Frequent in grassy ground in the forests. Singbhum! Hazaribagh! Palamau, Gamble! Frequent at Neterhat, 3000 ft. Fl., Fr. Oct.—Nov.

Base of stem usually with a persistent rosette of broad leaves shorter than the cauline. Cauline leaves puberulous and hispid, slightly toothed, contracted into a sessile or subsessile base. Flowering part of spike dense. Bracts linear or lanceolate, lower sometimes exceeding the flowers. Flowers curved. Calyx almost 10-ribbed, teeth short subulate. Corolla with long slender tube, limb 2—2·5" diam. Anthers black. Capsule closely invested by the calyx.

25. STRIGA, Lour.

Herbs, usually scabrid and black when dry, with lower leaves opposite and upper alternate linear, sometimes reduced to scales. Flowers axillary or upper spicate, often 2-bracteolate. Calyx tubular, strongly 5—15 ribbed, 5-toothed or -fid. Corolla with slender abruptly curved tube and spreading 2-lipped limb; upper lip usually notched or 2-fid, lower larger 3-fid. Stamens didynamous, included; anthers 1-celled, vertical, dorsifixed. Style thickened above, stigma simple. Capsule loculicidal, valves carrying part of the septum but not the placentæ. Seeds very many, ovoid or oblong, reticulated.

Calyx 15-ribbed
Calyx 10-ribbed
Calyx 5-ribbed

1. *euphrasioides*.
2. *lutea*.
3. *densiflora*.

1. S. euphrasioides, Benth.

An erect herb with simple stems 4—6" high, or branched, and attaining 2 ft., with strigose slender branches, linear leaves 2—2·5" long and terminal spikes of rather pretty pure-white flowers 5—7" long. Calyx 2·5—3·5" long, strongly 15-ribbed, 5-fid with one lobe usually smaller. Corolla-tube pubescent. Capsule shorter than the campanulate fruiting calyx which has often spreading lobes.

Grassy places, common. Purneah, in dry pastures, Kurz! Singbhum, esp. on clay soils! Manbhum, Camp., Kurz! Ranchi! Hazaribagh, Clarke! Palamau, Gamble! Fl., Fr. July—Nov.

The commonest species and far less hispid than the next. Small states remind one of the English Eyebright (*Euphrasia*). Leaves often 1—2-toothed, with thickened margins, 1" broad. Calyx-lobes linear, 3-nerved, hispid, as long as the tube. Lower bracts often exceeding the calyx.

2. S. lutea, Lour.

A very slender usually strict herb 4—18", with hispid stems and slender scabrid or hispid linear leaves 4—5" long, the upper bractiform and alternate, each bearing a yellow, more rarely a red, blue or white flower 4—5" long, the slender corolla twice as long as the narrow tubular 10-ribbed calyx. Capsule 1·5" oblong, dark brown.

Not very common. Wet places in grass. Purneah, *Kew Herb.*! Patna to Monghyr. T.T.! Ranchi! Palamau, at Neterhat, elev. 3000 ft.! Parasnath, *Kurz!* Fl., Fr. Oct.—Nov.—Dec.

Flowers very shortly pedicelled in fruit. Calyx .25" with 5 ribs running into the teeth and intermediate portion membranous with 5 strong nerves, teeth setaceous, about one third as long as tube. Corolla yellow in our specimens, blue in a small specimen collected by *Prairie* in Ranchi.

3. *S. densiflora*, *Benth.*

Stouter than the last, 8—18", with very scabrid and sparsely hispid stems, and leaves .5—1.5" long. Flowers white .4—.5" long. Calyx .2—.24", with 5 strong scabrous ribs, intermediate portions membranous but without the 5 strong nerves found in *S. lutea*.

Balugaon, Puri, *Hooper!* It also occurs in Northern Bengal and probably therefore in Purneah. My own specimens were collected in the Central Provinces. It may therefore be expected to be found anywhere in our area. Fl., Fr. Aug.—Oct.

It turns black in drying whereas *S. lutea* often remains grey or green. Linear leaves with scabrid hairs often breaking off leaving the cystolith-like base when dry. Calyx lobes lanceolate or subulate. Lower lip of corolla .25" wide. Lower bracts leaf-like far exceeding the flowers.

FAM. 99. OROBANCHACEÆ.

Leafless, often fleshy or scaly, root-parasites or saprophytes, with usually a simple stem and irregular flowers, solitary, spiked or racemed. Calyx spathaceous or of 4—5 free or connate sepals. Corolla hypogynous with curved tube and 2-lipped limb; upper lip arched, lower 3-fid, throat often with 2 villous folds. Stamens 4 didynamous, anthers 1—2-celled, cells more or less spurred, dehiscent by slits or pores or one imperfect. Ovary of 2 connate carpels, 1- rarely 2-celled; style long, tip curved, stigma capitate 2-lobed. Ovules usually many, anatropous on 2 pairs of free or confluent parietal placentæ which sometimes meet in the axis. Capsule 1-celled, 2-valved, or subindehiscent, few- or many-seeded. Seeds minute, testa pitted or tubercled, rarely lax and reticulated, albumen fleshy. Embryo ovoid, simple or 2-fid.

Calyx spathaceous. Cor.-lobes subequal, spreading. Anther-cells unequal or one suppressed

1. *Æginetia*.

Calyx 4-fid or 2-partite. Corolla 2-lipped. Anther-cells equal 2. *Orobanche*.

1. *ÆGINETIA*, *L.*

Stems or scapes simple or branched, scaly or naked, bearing large solitary or few ebracteolate flowers with a spathaceous calyx split in front nearly to the base. Corolla-tube broad, constricted above the ovary, incurved, limb obscurely 2-lipped with 5 broad spreading lobes, 2 upper connate. Stamens included, anthers with 1 cell perfect spurred in the upper stamens and gibbous (the spur may represent the empty cell), gibbous but not spurred in the lower stamens. Ovary 1-celled with large 2-lobed or multifid placentæ ovuliferous all over and filling the ovary. Stigma large peltate. Capsule sub-2-valved or indehiscent. Seeds crowded, minute, pitted.

Scapes slender, naked. Corolla purple

Stem short stout, peduncles bracteate at base. Corolla with yellow tube and blue limb

1. *indica*.

2. *pedunculata*.

1. *Æ. indica*, Roxb.

Rootstock slender with fleshy fibrous roots and usually numerous erect 1-flid. purple striate scapes which are quite naked with the exception of 1—2 bracts at the base. Flowers solitary terminal cernuous, crimson, with a spathaceous beaked calyx .7—1" long and a tubular curved corolla about 1.5" long and .5" diam., sub-2-lipped with very short obtuse flat lobes. Capsule dehiscent by the rotting of the thin walls. Seed like brown dust.

In damp rotten vegetation under Sal and other trees, Purneah! Rajmahal Hills, Kurz! Manbhum, Camp! Parasnath! Singbhum! Angul, *Chattarjee*! Probably in all forest districts. Fl., Fr. July—Nov.

Short erect branches from the rootstock often bear 2—3 scapes 6—12" high. Calyx many-nerved. Placentas 4 parietal much branched.

I think this plant is a saprophyte, not a root parasite.

2. *Æ. pedunculata*, Wall.

A much dwarfer plant than *A. indica* but with larger flowers 2—6 on a peduncle 1—4" high. Calyx 1.5—1.6" yellowish. Corolla 2—2.5", tube yellow, limb a fine purple-blue or violet, segments uniform, minutely denticulate, anthers and stigma white.

On roots of grasses, Sikkim, *J.D.H.*! Bengal, Jheels, *T.T.*, without locality! Bengal, *Griff.*, without locality! As it extends from Moradabad on one side to the Darjeeling Tarai and Dacca on the other side of our area, it is probably found within. Fl. May—July.

In some Burmah specimens the peduncles and pedicels are unusually elongated and attain 4" with the purple-blue flowers 2.5—3" long.

2. OROBANCHE, L.

Parasitic herbs with stem or scape simple or branched, with acute scales. Flowers mod.-sized in spikes or racemes, bracteoles 2 or 0. Calyx unequally 4-fid or 2-partite with the segments entire or 2-fid, or sometimes 5-merous. Corolla-tube curved, dilated above, circumsciss at the base, limb 2-lipped, upper lip erect notched, 2-fid or crenulate, lower more spreading 3-lobed. Stamens included, anther-cells equal parallel, bases usually mucronate or spurred. Ovary 1-celled, placentæ 4, stigma funnel-shaped or peltate, more or less 2-lobed with the groove median. Capsule 2-valved, valves often cohering with the style. Seeds very numerous, globose.

Flowers bracteolate. Calyx split at the back only, 4-lobed or lobes sometimes 5

1. *ægyptiaca*
(*indica*).

Flowers ebracteolate. Calyx split into 2 2-fid segments

2. *cernua*.

1. *O. ægyptiaca*, Pers. Syn. *O. indica*, Ham.; Turi-sim, S.; Sarson-banda, H.

A brownish parasitic herb with one to many puberulous or usually pubescent scapes 6—10" high from a thickened base. Inflorescence usually dense with ovate acuminate pubescent bracts .2—3" long

subulate filiform bracteoles .25" long and blue flowers .7—1" long, with the campanulate calyx finally split behind and regularly 4—5-lobed, the lobes finely acuminate.

Frequent in mustard and tobacco fields in most districts! Behar, *J.D.H.*, in corn and *Carthamus* fields! Gaya, *Clarke*! Hazaribagh, *Gamble*! Fl., Fr. c.s.—Feb.

Stems usually much branched and pubescent, with few ovate or lanceolate bracts below the inflorescence, which usually occupies over half their total length. Calyx often 5-merous, .3—.35" long, lobes as long as the tube with setaceous tips. Corolla pubescent or puberulous. Anthers minutely spurred, unequally woolly. Capsule oblong, .2" long.

2. *O. cernua*, *Lafl.*

A much stouter and also dwarfer plant than *O. indica*, with stems sometimes .5" diam. puberulous or glabrate with conspicuous lanceolate bracts .4—6" long below the inflorescence. Inflorescence dense or lower flowers sub-solitary with lanceolate acuminate pubescent bracts similar to those on the stem, bracteoles 0. Calyx split to base behind and nearly to base in front into two 2-fid segments, but sometimes one segment entire and lobes of the segments often unequal, always finely acuminate and usually coloured blue. Corolla blue, .5—8" long, with very short orbicular or ovate lobes, glabrous.

On tobacco, not common. Patna, *Wall.*!

My specimens are from the Central Provinces. Fl. Sept.—Oct.

Stems or scapes simple, 6—10", the inflorescence occupying half or more of their entire length. Calyx puberulous and with few gland-tipped hairs, .4" long. Anthers glabrous minutely spurred, filaments sometimes thinly hairy at base. Capsule ellipsoid, .4" long.

I had noted that *O. cernua* closely approached *O. nicotianæ* in the Central Provinces. *Dr. Beck* in his monograph in *Bibliotheca Bot.* unites the two and includes them both under var. *desertorum* of *O. cernua*.

FAM. 100. LENTIBULARIACEÆ.

Small herbs, sometimes climbing, inhabiting water or wet places, with leaves either simple entire radical and rosulate or capillary multifid, or nearly or quite obsolete. Flowers small to mod.-sized, irregular on 1—many-fid. scapes, bracts small or 0. Calyx inferior 2—5-lobed. Corolla 2-lipped and spurred, upper lip entire or emarginate, lower usually larger entire or 3—6-lobed. Stamens 2 attached to the base of the corolla, alternate with the lobes of the lower lip, filaments broad curved; anther cells 2, ovate, transversely confluent. Ovary superior, globose, 1-celled; style short, stigma unequally 2-lobed. Ovules very many on a free basal placenta. Fruit a 2—4-valved capsule or irregularly breaking up. Seeds many, small, exalbuminous.

1. UTRICULARIA, *L.* Bladderwort.

Herbs growing on wet rocks or banks, in which case the leaves are entire or sometimes evanescent, and the plant is then reduced to a few small roots and a scape, or growing in still or running water with the leaves cut into capillary segments and often furnished with minute

bladders. Fls. solitary or racemose on the scape, bracteate and often 2-bracteolate. Calyx 2-partite, lobes entire or nearly so, often accrescent. Seeds ellipsoid or obovoid scrobiculate or glochidiate, rarely reticulate or comose.

Clarke states that some of the small scapose species with evanescent radical leaves on very short creeping branches may possibly sometimes grow in running water and produce elongate branched stems, longer linear leaves and reduced leaves with bladders.

The bladders of many, if not all the species which bear them, are adapted for the capture and digestion of minute aquatic animals. Bladders or recepts adapted for the capture of animalculæ are also found in the place of the leaves or on the under-side of the leaves in many land-forms.

- | | |
|--|-------------------------|
| I. Aquatic with elongate stems and very numerous multifid leaves. Pedicels stout in fruit. Capsule globose:— | |
| Large floating vesicles .8" long round base of scape. | |
| Fruiting sepals 3—4" long. Fls. yellow | 1. <i>stellaris</i> . |
| As above, but flowers white purple-streaked | var. <i>inflexa</i> . |
| Large vesicles not present, but very numerous bladders. Fls. yellow. Fruiting sepals .2—27" | 2. <i>flexuosa</i> . |
| II. Semi-aquatic with sparse filiform leaves and minute bladder-bearing branches. Scape slender 2—3-fld.:— | |
| Fls. yellow. Pedicels slender. Capsule globose | 3. <i>exoleta</i> . |
| III. Leaves simple at base of scape, obsolete at time of flowering. | |
| Erect or twining:— | |
| A. Scapes with spurred bracts:— | |
| Glabrous. Fls. purple subsessile. Capsule globose | 4. <i>cœrulea</i> . |
| B. Bracts not spurred:— | |
| 1. Flowers subsessile. Capsule globose:— | |
| Hairy. Fls. purple or blue | 5. <i>hirta</i> . |
| 2. Fls. pedicelled (exc. sometimes 9). Capsule ovoid:— | |
| a. Flowers purple or blue:— | |
| Bracteoles filiform. Sepals very decurrent on the pedicel in fruit, acute | 6. <i>reticulata</i> . |
| Bracteoles 0. Sepals not decurrent ovate obtuse | 7. <i>scandens</i> . |
| b. Flowers yellow. Very slender erect or twining:— | |
| Fruiting pedicels recurved, sepals .25", obtuse | 8. <i>bifida</i> . |
| Fruiting pedicels erect, sepals .2", acute | 9. <i>Wallichiana</i> . |

1. *U. stellaris*, L. f.

A beautiful little aquatic with the stems floating for several feet, many capillary leaves and racemes of yellow-lipped flowers surrounded towards base by a whorl of large floating narrowly-ellipsoid vesicles .7—9" long. Bladders on the leaf segments very minute. Racemes flexuose 2.5—4". Fls. .25". Fruiting sepals 3—4" long, decurrent into the short often deflexed .1—.25 pedicel.

Purneah! Said to be found throughout India and therefore probably also in other districts. Fl., Fr. c.s.

A very distinct species. Leaves 1—2" flaccid when removed from the water about 5-fld from the base, each segment cut into capillary lobes. The floating vesicles appear to be modified leaf rachises and end in capillary leaf-lobes; they support the inflorescence above the water. Sepals ovate glabrous .22" in flower. Lower lip of corolla with a projecting transverse yellow lamella and rounded yellow labellum with brown stripes at the margin, upper lip with concave base thickened round the edge and yellow margin with brown lines, spur obtuse green with brown lines.

A variety *inflexa*, *Clarke*, with white and violet striped corolla is said to be common.

2. *U. flexuosa*, Vahl.

Somewhat similar to the last inflorescence but without the large floating vesicles at base of peduncle. Short lateral branches of stem (or leaves?) rigid when removed from the water .5—1.5" long with very numerous bladders about .1" long. Fls. .3—4" from tip of spur. Pedicels longer clavate upwards .3—4" long and deflexed in fruit and fruiting sepals shorter, .2—3". Bracts very conspicuous (as they often are in *U. stellaris*), .1—1.5" long.

Common. Singbhum! Also near Purneah, *Clarke*! and in the Central Provinces beyond Sambalpur! Probably therefore throughout the whole area. Fl., Fr. c.s.

3. *U. exoleta*, Br.

A small species with numerous often intricate branches bearing small bladders .04—0.05" long and sparse filiform simple or divided leaves with capillary segments. Fls. .2—3" long from tip of spur, yellow (always?, I have no note of the colour in my specimens), 1—3 only with slender pedicels on a slender peduncle 1—4" long which nearly always have a minute barren bract near the centre. Capsule globose said to be distinctly larger than the sepals and .2" diam., but in my specimens (perhaps not fully developed) equalling them.

Jalpaiguri (close to but not actually within our area)! Throughout India. *Clarke*! Fl., Fr. r.s. and c.s.

Clarke says that the leaves are sometimes 2—3", but these seem to me to be branches. The scapes appear to be sometimes 2-chotomous, the slender pedicels .2—4" long. Bracts .02—0.05", obovate. Sepals .13" in fruit .1—1.2" in flower, scarcely enlarged in fruit.

4. *U. cœrulea*, L. Syn. *U. racemosa*, Wall., *U. filicaulis*, Wall.*

A very slender little plant consisting of single erect filiform scapes 2—8" high without any leaves at the time of flowering. Fls. sub-sessile purple or blue .25—3" (measuring from tip of spur). Bracts scattered along the scape and under the flowers .05—0.08" long with a slender spur often as long as the narrow acuminate blade. Fruiting sepals ovate .1—1.2" long.

Common in rice-fields. Singbhum! Manbhum, *Camp*! Hazaribagh, *Clarke*! Neterhat (Palamau), 2500 ft.! Fl., Fr. Sept.—Dec.

Easily distinguished by the bracts. Whole plant glabrous. In the type flowers numerous and often clustered, in var. *filicaulis*, *Clarke*, which is the commoner in our area, the flowers are sparse and distant.

Upper lip of corolla very narrow, lower 4-lobed, spur rather stout and exceeding the lips. Capsule ovate subglobose compressed.

5. *U. hirta*, Klein.

Very slender, erect, 3—8", pubescent or minutely villous, leafless at time of flowering. Fls. subsessile blue with dark veins, white or

* *Dr. Stapf* states that the confusion with regard to these names starts with *Linnaeus* himself, but there is no doubt that this is the original *U. cœrulea* described in the *Flora Zeylanica*. *U. cœrulea* of the *F. B. I.* is quite different, though the name is unfortunately much more applicable to it. It has beautiful sky-blue flowers and may possibly be found in the hills of our area as it occurs in those of the Central Provinces.

yellowish at throat, solitary and in few-fl. spikes, '2—'3" long. Bracts not spurred. Fruiting sepals orbicular '1". Capsule as long globose.

Giridih, Hazaribagh, *Clarke!* Manbhum, *Camp!* Fl., Fr. Oct.—Nov.

6. *U. reticulata*, Smith.

A comparatively stout glabrous species twining or in young states and in var. *uliginosa* slender erect and only 3—8", leafless when in flower. Flowers on '25—'3" long pedicels, very pretty, blue and sometimes '8" long, at other times much smaller, with narrowly conic nearly straight spur. Sepals in fruit '25—'3" elliptic acute veined decurrent on the pedicel.

Orissa, *Cal. Herb!* Singbhum! Fl., Fr. Aug.—Sept.

Lower lip of corolla broadly ovate, scarcely emarginate. Seeds obovoid scrobiculate (*Clarke*). Bracteoles 2, filiform.

7. *U. scandens*, Benj.

A very small glabrous twiner with small pale lilac or blue flowers '15" scattered along the upper three-fourths of the slender filiform stem. Pedicels '06—'1" deflexed in fruit. Calyx lobes ovate obtuse '1—'12" in fruit. Seeds yellow obovoid, very faintly striate (laxly scrobiculate, *Clarke*).

N. Bengal, *Kurz!* Rice-fields, Singbhum! Fl., Fr. Sept.—Oct.

8. *U. bifida*, L.

Slender glabrous 3—7" erect, "or will twine round a grass," *Clarke*. Flowers yellow or yellow with brown-yellow spur. Fruiting sepals '2—'25" usually rounded at the tip, very decurrent on the cernuous '1—'2" long pedicel. Bract oblong, bracteoles filiform.

Singbhum (rather doubtful; the sepals are cuspidate)! Sambalpur, *Griff!* Hazaribagh, *Clarke!* Fl., Fr. Sept.—Oct.

Before flowering it has, like several other species of the section, numerous erect linear leaves '6—'7" long on the filiform creeping stems.

9. *U. Wallichiana*, Wight.

Very slender and twining or reduced to a short erect filiform stem 1—2" high with only 1—few flowers. Flowers '2—'4" clear-yellow with nearly straight tapering pointed spur about as long as or longer than the lower lip. Pedicels 0—'25" erect or suberect in fruit and fruiting sepals '2" ovate, very acute or cuspidate, somewhat decurrent on pedicel.

Manbhum, *Campbell!* Wet ground alongside streams and on their banks, Neterhat, 3000 ft.!

Usually growing with minute sedges and often slightly twining on them. Bracts ovate acute, bracteoles filiform. Spur usually lying parallel to lower sepal and exceeding it and divaricate in a straight line with the upper obovate lip, lower lip broad, emarginate. Capsule lenticular.

FAM. 101. GESNERACEÆ.

Undershrubs or more usually herbs, sometimes reduced to a single leaf and inflorescence. Leaves opposite or alternate, simple, exstipulate. Flowers often showy and large but sometimes much reduced.

usually racemose, rarely cymose or clustered or solitary, bracteate and with usually small bracteoles, 2-sexual, more or less zygomorphic. Calyx 5-merous, sepals valvate or open in bud. Corolla with long or short tube and usually 5 imbricate lobes. Stamens on the tube, usually didynamous, often only 2 fertile, rarely 5 fertile, anthers 2-celled or cells confluent. Disc annular or unilateral or 0. Ovary superior or sometimes half-inferior (in American genera), 1-celled or more rarely 2-celled; style linear, stigma small capitate or 2-lobed; placentæ parietal 2-fid. Ovules very many, anatropous. Fruit capsular or baccate, dehiscent or indehiscent. Seeds very many, minute, fusiform or ovoid. Albumen 0 or scanty, embryo straight.

There is no hard and fast line between this family and the *Scropulariaceæ*; the habit is often very characteristic in the large leaves and short or obsolete stem, as also is the frequently 1-celled ovary and 2-fid placentas. Our species all belong to the tribe *Didymocarpeæ* in which the fruit is an elongate loculicidally 2-valved or finally 4-valved capsule, placentæ deeply intruded and seeds without hairs.

The well-known garden and greenhouse plants *Achimenes*, *Gloxinia*, *Gesnera* and *Streptocarpus* are typical of the family.

- | | |
|---|--------------------------|
| I. Capsule ellipsoid membranous, placentæ 2-fid bearing ovules on all sides:— | |
| Caulесcent with unequal-sided leaves. St. 2 perfect . | 1. <i>Rhynchoglossum</i> |
| II. Capsule linear. Placentæ not ovuliferous on their inner sides:— | |
| Stamens 2 perfect | 2. <i>Didymocarpus</i> . |
| Stamens 4 perfect | 3. <i>Didissandra</i> . |

1. RHYNCHOGLOSSUM, *Blume*.

Herbs with usually a leafy stem, rarely leaf only one in starved forms. Leaves alternate, unequal-sided, pinnate-nerved. Flowers in ebracteate racemes with minute bracteoles. Calyx campanulate, somewhat zygomorphous. Corolla with tube contracted at the mouth, 2-lipped, upper lip short 2-fid, lower longer 3-lobed. Stamens 2 perfect, included; anthers connivent 2-celled, slits ultimately confluent at the apex. Ovary ovoid; placentæ deeply intruded and 2-fid, the lamellæ bearing ovules on all sides. Capsule included ellipsoid, membranous, loculicidally 2-valved. Seeds narrowly ellipsoid with minutely reticulated testa.

1. *R. obliquum*, *Blume*. Var. *parviflorum*, *Clarke*.

A rather succulent herb varying from 3—4" high with a single leaf to 18" high with many leaves in the same locality. Leaves membranous 1—4.5" elliptic or ovate acuminate, with a semi-cordate base and many rather strong oblique nerves, nearly glabrous, petiole variable. Flowers blue secund in elongate many-fid. racemes, rhachis minutely densely pubescent up to 6" long in well-grown plants, bracteoles small linear.

Wet shady banks. Parasnath, Hazaribagh, chiefly above 4000 ft. Fl., Fr. Oct.—Nov.

Pedicels .05—15" long, curved. Calyx with 2-lobed upper lip and more deeply 3-lobed lower lip. Corolla twice as long, .3", upper lip blue somewhat reflexed 2-lobed, lower sub-entire, throat yellow closed. Capsule membranous easily dehiscent almost enclosed by the angular nearly glabrous calyx.

2. DIDYMOCARPUS, Wall.

Herbs, sometimes stemless, with opposite, alternate, 3—4-nate or crowded or sometimes solitary leaves. Flowers large or very small (in our species), cymose, sub-umbelled or sub-racemose in pairs, on axillary peduncles or pedicels few short and fascicled. Calyx small 5-fid or -partite. Corolla with cylindric or ovoid tube with oblique or sub-symmetric mouth, limb with 5 rounded lobes often 2-lipped. Stamens 2 perfect and 2—3 rudimentary, anthers cohering in pairs, ælls ovate soon confluent. Ovary sometimes stalked, narrow, stigma rarely 2-lobed, often peltate or unilateral, placentæ deeply inflexed then recurved and bearing ovules on their outer faces only. Capsule linear, loculicidally 2-valved or subfollicular, ultimately often 4-valved bearing the placentæ on the valves which are revolute and conceal the seeds. Seeds ellipsoid, minutely reticulate.

1. *D. pygmæa*, Clarke.

A curious little plant usually with a short straight or curved succulent weak stem 1—2·5" high and a single broadly oblong or ovate membranous sessile leaf 1·5—3" long. Flowers inconspicuous, 1—4, clustered, subsessile or with pedicels up to 3". Calyx-segments hairy 1" elongating in fruit to 25" linear. Capsule 4—5" linear acuminate.

On damp banks and rocks in the hills of Chota Nagpur, elev. 2000 ft. and over. Ranchi, several times collected; Jonha, Wood! Ormanjee, Clarke! and by me at nearly the same place in the Damuda Ghats! I have also collected it at Pachmari in the Central Provinces. Fl., Fr. Aug.—Oct.

Nearly the whole plant more or less covered with hyaline hairs and the leaves with a glistening surface when fresh. There is sometimes a short stem above the single leaf bearing 1—2 very small leaves or sometimes there are two sub-opposite or alternate principal but unequal leaves, or a small subsidiary leaf below the principal. Bulbils, sometimes borne instead of flowers, usually 3-gonous. Principal leaf with shallowly cordate base, sometimes crenate towards apex, sec. n. 6—9 of which several are near the base. Flowers appear to me to be cleistogamous with a colourless corolla 1" long or sometimes 25", tubular.

3. DIDISSANDRA, Clarke.

Characters of *Didymocarpus* but fertile anthers 4.

1. *D. lanuginosa*, Clarke, var. *minuta*, Haines.

A very small herb without appreciable stem but several elliptic or ovate or orbicular-ovate leaves 75—1·5" appressed to the substratum and a thinly hairy scape 2" high with 2—3 *lobelia*-like pale purple-white flowers 4" long. Capsule linear 7—9" inches somewhat 4-grooved, tapering to a short beak, 2-valved.

On damp rocks (laterite) under shade at 3000 ft., Neterhat! Fl. June—July. Fr. c.s. Very rare.

L. rounded at tip, base narrowed into a short broad petiole about 2" long, beneath pale and with long matted hairs on the 3—4 strong sec. n., above pilose with tubercled-based hairs and nerves impressed; sec. n. forked, their branches ending in the crenulate margin. Calyx-lobes linear oblong, 05—07". Cor.-tube somewhat inflated compressed with two lines on lower face hirsute, less hairy between the lines, upper lip with 2 short rounded lobes, lower much larger with 3 oblong obtuse lobes. Stamens included, 2 lower ascending distinct, two upper

inclined forward with anthers conniving under the stigma. Pedicels clavate beneath the fruit. Seeds minute brown, ellipsoid, smooth. Cotyledons (on germination) minute orbicular.

It differs from the type, which is a Himalayan plant, in the short simple scapes and very small leaves and flowers.

FAM. 102. BIGNONIACEÆ.

Trees or shrubs, often climbing (in exotic species), with opposite, rarely whorled or spiral, 1—3-pinnate, rarely simple leaves. Stipules absent (in indigenous species). Flowers large or moderate-sized, 2-sexual, zygomorphic in racemes or panicles with inconspicuous bracts (sometimes solitary or clustered on the old wood in exotic genera). Calyx spathaceous or 2—5-lobed. Corolla usually tubular below, then ventricose, subregular or 2-lipped, lobes usually sub-equal and imbricate, rarely valvate in bud. Stamens 4 didynamous, often with the 5th present as a staminode, rarely (*Oroxylum*) 5 perfect, usually inserted anteriorly in the corolla; anthers 2-celled, usually included, cells parallel or divaricate. Disc usually conspicuous, rarely 0. Ovary 2-celled (or, in *Crescentieæ*, which are all exotic, 1-celled); style long, stigma of 1—2 elliptic or linguiform lobes. Ovules many, 1—more-seriate in each cell, anatropous. Fruit elongate and capsular and 2-valved (in indigenous genera), the valves separating from the often swollen axis, rarely (some exotic genera) indchiscent. Seeds flat or trigonous, prominently winged, exalbuminous; cotyledons flat or folded.

Germination (in the few cases observed) epigeal with the expanded cotyledons deeply 2-lobed and petioled.

I. Ovary 2-locular. Fruit capsular, 2-valved (genera 1—9):—

A. Capsule septifragally dehiscent, the valves parallel to the compressed septum (*Bignoniæ*):—

1. Trees with 2—3-pinnate leaves:—

Small tree. Fls. dark red, corolla very broad. St. 5
Tall tree. Flowers white with long slender tube.

1. *Oroxylum*.
2. *Millingtonia*.

2. Exotic climbers with showy flowers, leaves 3-foliolate or 2-foliolate and the terminal converted into a tendril

3. *Bignonia*.

B. Capsule loculicidally dehiscent, the valves transverse to the septum, or septum (with placentæ) terete corky:—

1. Exotic climbers or with branches rooting at the nodes, leaves pinnate, never ending in a tendril

4. *Tecoma*.

2. Trees or erect shrubs:—

a. Leaves simple

4. *Tecoma*
(*Tecomella*).

b. Leaves compound:—

i. Staminodes short or 0:—

* Calyx not spathaceous:—

! Leaves 1-pinnate (rarely in *Tecoma* sub-2-pinnate):—

Exotics. Calyx equally 5-toothed. Septum compressed

4. *Tecoma*
(*Stenolobium*).

Indigenous. Calyx 3—5-lobed. Septum terete, seeds grooved between the wings

5. *Stereospermum*.

- !! Leaves 2—3-pinnate. Septum terete.
 Seeds flat, not grooved between the wings
- ** Calyx spathaceous:—
 Corolla with elongate tubular base white
 Corolla broadly campanulate, red, tubular base very short
- ii. Staminode very long, clavate at tip:—
 Exotic tree with pretty 2-pinnate leaves and blue flowers
- II. Ovary 1-locular or if 2-locular then flowers clustered on the old wood. Exotics (*Crescentiæ*):—
- A. Calyx spathaceous. Ovary 2-locular. Leaves 3-foliolate
- B. Calyx not spathaceous. Ovary 1-locular:—
 Leaves pinnate. Racemes on very long pendulous peduncles
 Leaves simple, alternate. Flowers clustered or solitary
6. *Radermachera*.
 7. *Dolichandrone*.
 8. *Spathodea*.
 9. *Jacaranda*.
 10. *Parmentiera*.
 11. *Kigelia*.
 12. *Crescentia*.
 (p. 692).

1. OROXYLUM, Vent.

Small trees with very large pinnately compound leaves and entire leaflets. Flowers large subregular in long terminal racemes. Calyx broad campanulate, coriaceous, scarcely toothed. Corolla campanulate with a short tubular base and subequal rounded lobes imbricate in bud. Stamens 5 somewhat exserted, with subparallel anther-cells. Disc prominent. Ovary compressed. Ovules numerous many-seriate in each cell. Capsule very large, flattened parallel to the septum, septicidally 2-valved. Seeds broadly ellipsoid with broad hyaline wing.

1. *O. indicum*, Vent. Saona, Th.; Sona, H.; Som Sonpatta, Kharw.; Rengebanam, K.; Bana hatak', S.; Dantkura, Mal Pah.; Phapni, Or.; Jai mangal, Gondi.

A small tree rarely over 25 ft. with but few branches and terminal clusters of very large ternately 2-pinnate leaves 2—4 ft. long and broad. Flowers large fleshy purple, but not showy, in terminal stout racemes. The tree is easily recognised when leafless by the large leaf-scars and immense flat pods 1—3 ft. long with woody valves and flat winged seeds 2—3" diam.

In the sub-montane grass of the Northern Area and throughout the province along streams and ravines and on the cool sides of the hills in the forest districts. Fl. July—Aug. Fr. Dec.—March. Deciduous Dec.—June.

Bark soft with pale yellowish-green blaze. Leaflets about 5" by 3" acuminate. Corolla 2—3" long and broad. Fifth stamen rather shorter than the others.

Seeds purgative. Wood. They are however sometimes eaten. Mr. Innes says that in times of famine they are parched and ground into flour.* The bark and fruit are sometimes used in tanning and dyeing according to Gamble. Weight about 30 lbs. per c. ft. No use is known for the wood. The growth of a tree sown by me at Chaibassa was 25 ft. in height and 20" girth in 16 years, but the locality was unfavourable to it.

2. MILLINGTONIA, Lf.

Tree with opposite 2—3-pinnate leaves and relatively small leaflets. Flowers white in terminal panicles. Calyx small campanulate with

* Appendix to *Indian Forester*, February, 1908.

five obscure teeth. Corolla with long slender tube, sub-2-lipped with 5 subequal subvalvate lobes. Stamens 4 perfect didynamous, anthers 1-celled with a second small hooked barren cell. Capsule linear, compressed parallel to the septum, septicidally 2-valved. Seeds thinly discoid with broad hyaline wing.

1. *M. hortensis*, L. Akas-nim, H.; Bakeni, Reali, Or.; Indian Cork Tree.

A tall handsome tree with narrowly pyramidal crown and 2—3 pinnate leaves 1—3 ft. long with ovate or ovate-lanceolate acuminate sinuate or crenate leaflets 1—3" long. Panicles usually inclined with very numerous pendulous white fragrant flowers 2—3" long and 1" diam. Capsule 12" by .75", acute both ends.

Very commonly planted in gardens and avenues and often self-sown. Fl. Oct.—Dec. Native of Burma.

It throws up very numerous root suckers. The great height of the tree renders it liable to be thrown by the wind.

3. BIGNONIA, L.

(Limited according to *Bentham* and *Hooker*.)

Usually widely scandent shrubs with opposite 3-foliolate leaves or the terminal leaflet converged into a tendril (rarely leaves ternately or sub-pinnately decomposed); leaflets nearly always entire. Stipules or a stipuliform leaflet rarely present (*Pantherpa*, Miers). Flowers large or mod.-sized, showy, in terminal or axillary cymes or panicles. Calyx campanulate or tubular, mouth straight or oblique, truncate or shortly 5-toothed or -lobed or sinuate, rarely shortly unequally split or the ribs produced into subulate teeth. Corolla-tube often elongate, usually widened above, straight or incurved with a more or less 2-lipped limb; upper lip 2-lobed, lower 3-lobed or -partite, lobes broad spreading. Stamens didynamous, inserted near base of corolla-tube, included or rarely shortly exsert, anthers glabrous, cells finally divaricate, rarely (*Pyrostegia*, Presl.) mature parallel. Disc pulvinate, annular or sub-cupular or 0 (*Cydista*, Miers). Ovary 2-celled, ovules 1- or densely sub-2—3-seriate. Capsule compressed parallel to the septum, septifragally dehiscent, often leaving a filiform portion of the wall detached or attached to the septum. Seeds 1- or scarcely 2-seriate on the margins of the septum, flattened with broad wing (sometimes wanting at the base and apex).

A large American genus which is now usually yet further split up into several genera such as are indicated in brackets above and in the following Key. I have collected no specimens, and the following is a very incomplete account of some of the most commonly cultivated in gardens in the provinces:—

- | | |
|--|-------------------------------------|
| I. Tendrils short 3-clawed (<i>Bignonia</i>) | 1. <i>unguis-cati</i> . |
| II. Tendrils slender, not clawed (sometimes 0 in lower 3-foliolate leaves):— | |
| A. Disc present, conspicuous:— | |
| 1. Corolla-lobes valvate in bud. Tendrils 3-fid (<i>Pyrostegia</i>):— | |
| Corolla tubular-funnel-shaped, lobes very short | 2. <i>ignea</i> (<i>venusta</i>). |

2. Corolla-lobes imbricate:—

a. Tendrils simple.

Capsule slender linear (*Arrabidea*)

None described.

Capsule broad, rough or echinate (*Clytostoma*):—

Flowers rose with darker stripes

3. *callistegioides*.

Flowers purple

4. *noterophilum*.

b. Tendrils repeatedly 3-fid (*Doxantha*)

None described.

B. Disc 0. Tendrils simple. Ovary scaly (*Cydista*)*:—

Flowers rose or purple

5. *æquinoctialis*.

Flowers flesh-coloured or pale lilac, darker-veined

6. *incarnata*.

Flowers primrose-yellow

7. *Chamoerlaynii*.

Flowers pale mauve to crimson, throat primrose

8. *magnifica*.*

1. *B. unguis-cati*, L. Syn. *B. gracilis*, *Lodd.*

A shrub extensively climbing by means of its 3-fid claw-like tendrils, with a pair of rich green shining broadly oval acuminate leaflets about 2" long and a profusion of bright-yellow flowers about 2" across or more.

Native of Central America to Southern Brazil and the Argentine. Flowers two or three times in the year.

2. *B. venusta*, Ker-Gawl. Syn. *Pyrostegia ignea*, *Presl.* (the correct but less familiar name).

A very large shrub with pinnately 2-foliolate leaves and a terminal 3-fid slender tendril. Lfts. sometimes 3 on the lower leaves, ovate, about 3" long. Flowers very numerous and showy, vermilion or orange, about 3" long with the corolla-tube 2.25", in axillary crowded drooping corymbose cymes.

Very common in gardens. Fl. Jan.—Feb. Better known under its horticultural name *B. venusta*, under which it was originally figured in *Botanical Register*.

3. *B. callistegioides*, Chamb. Syn. *Bignonia speciosa*, *Grah.*; *Clytostoma callistegioides*, *Bur.* (the correct name).

Branchlets, young leaves and petioles puberulous. Tendrils simple. Lfts. obovate-oblong acuminate, 2.5—3" long, shining, base subcordate. Flowers lilac or rosy red with darker veins, about two together only on the peduncles; the pedicels longer than the peduncle. Calyx obliquely campanulate with acute teeth. Corolla pubescent, lobes orbicular-obovate half as long as the tube which is about 2". Pod short oblong densely echinate.

Native of Southern Brazil and Argentine.

4. *B. noterophila*, DC. Syn. *Clytostoma noterophila*, *Kew Herb.* (correct name); *Bignonia purpurea* (usual horticultural name in Calcutta).

Quite glabrous. Tendrils simple. Leaflets oval acuminate, base acute, both sides reticulate-venose. Flowers rosy-purple 2" long on axillary 2-flowered peduncles with several ovate acute bracts. Calyx campanulate, minutely 5-toothed. Corolla glabrous outside, lobes orbicular.

* The correct sub-genus of *magnifica* is not known to me as material is not available to determine it.

Native of Brazil.

5. **B. æquinoctialis**, L. Syn. *Cydista æquinoctialis*, Miers; *C. spectabilis*, Miers?

An extensively climbing shrub with the slender green branches terete but subcompressed at the ends. Tendrils simple sometimes very short. Leaflets ovate or elliptic-lanceolate rich green, shining, obtusely-acuminate, reticulately nerved. Flowers purplish or rose with deeper-coloured veins never at all yellow (according to *De Candolle*) in copious axillary and terminal panicles. Calyx cupular, truncate. Corolla glabrous. Capsule long linear. Seeds almost spherical, winged.

Native of Guiana.

Corolla tubular-campanulate with two plaits on the lower side. Disc 0.

6. **B. incarnata**, Aubl. Syn. *Cydista incarnata*, Miers. Apparently reduced to *Cydista æquinoctialis* in Kew Herb. Includes also *B. spectabilis*, Vahl.

A large climber with 3-foliolate leaves of which the terminal leaflet is usually transformed into a simple tendril. Lfts. coriaceous, shining, lanceolate, 3—4" long. Flowers pale-lilac or flesh-coloured, sometimes veined with a deeper colour, 2—2.5" long and 1—2" wide, tube white inside.

Frequent in gardens. Native of Guiana. Fl. h.s.

Leaflets attain 6—7" in lower part of stem, ovate-lanceolate and often ternate. Calyx sub-truncate. Disc inconspicuous. *De Candolle* says that it differs from *B. æquinoctialis* by the 4-gonous branches.

7. **B. Chamberlaynii**, Sims. Treated as synonymous with *B. æquinoctialis* at the Agri-Horticultural Society's Gardens, Calcutta (probably following *Firminger*).

A glabrous scandent shrub with terete branches. Differs from the ordinary *æquinoctialis* by the primrose-coloured flowers and more distinctly 5-toothed calyx.

Native of Brazil.

Firminger says—"From the axils of the leaves are produced primrose-coloured thimble-formed flowers, with the tube 2" long, produced in great profusion nearly at all times."

8. **B. magnifica**, Bull in Gard. Chronicle.

Bull given merely a figure, uncoloured, and a short description from which it is not possible to determine the genus, and I find no specimens in the Kew Herb. *Mr. Sprague* tells me that this is not synonymous with *Cydista magnifica*, Miers. It is a very handsome plant with large-panicles of flowers up to 3.5" across, delicate mauve changing to rich crimson with throat of a light primrose.

Native of Columbia, U.S.

4. TECOMA, Juss.

Trees or shrubs often scandent or rooting at the nodes but without tendrils. Leaves opposite simple or digitately or pinnately compound,

leaflets often toothed. Flowers usually showy, most often yellow, red or orange, racemed or paniced at the ends of the branches or leafy shoots. Calyx tubular-campanulate, sub-equally 5-toothed. Corolla with long straight or incurved tube, slightly widened upwards or much dilated at the throat; limbs sub-2-lipped with 5 broad sub-equal spreading or sub-erect lobes. Stamens didynamous, included or exsert, anthers with cells at first often parallel finally divergent or divaricate. Disc annular. Ovules on each placenta 1—many-seriate. Capsule linear or narrowly ellipsoid, usually acute both ends, more or less compressed parallel to the septum but loculicidally dehiscent with the concave or cymbiform valves transverse to the septum. Seeds at margin of the septum, 1—many seriate, wing at both ends usually broad and membranous.

Tecoma, like *Bignonia*, is now usually divided into several genera (indicated in brackets in the following Key). Only one species, of the sub-genus *Tecomella*, is indigenous.

I. Erect trees or shrubs:—

A. Leaves simple or palmately divided:—

- | | |
|--|----------------------|
| 1. Wing of seed thick, only membranous at margin.
Leaves simple (<i>Tecomella</i> , Seem.) | 1. <i>undulata</i> . |
| 2. Wing of seed membranous. Leaves 3—5-nately divided (<i>Tecoma</i> proper). All American | None described. |

B. Leaves pinnate (rarely reduced to a single leaflet).

- | | |
|---|-------------------|
| Anther cells much expanded, often hairy (<i>Stenolobium</i> , Don) | 2. <i>stans</i> . |
|---|-------------------|

II. Climbers, without tendrils:—

A. Stamens exserted (*Tecomaria*, Fenzl.)

B. Stamens included:—

- | | |
|---|-------------------------|
| 1. Flowers in clusters. Fruit elongate (<i>Campsis</i> , Lour.):— | 3. <i>capensis</i> . |
| Calyx shortly lobed, glandular | 4. <i>radicans</i> . |
| Calyx deeply lobed without glands | 5. <i>grandiflora</i> . |
| 2. Flowers in panicles. Capsule oblong (<i>Pandorea</i> , Endl.):— | |
| Panicles large loose, corolla-lobes more than half as long as tube | 6. <i>jasminoides</i> . |
| Panicles dense, short, lobes not half so long as tube | 7. <i>australis</i> . |

1. **T. undulata**, G. Don. Syn. *Tecomella undulata*, Seem.

A shrub or small tree with narrowly oblong entire undulate leaves about 6" long and orange-red flowers in corymbs mostly terminating short lateral branches. Capsule 8" by 3", slightly curved. Seeds 1 by 3" including the wing, which is very narrow at the apex and absent at base.

Palamau, *Hendley*! Collected by Dr. J. P. *Hendley* on waste land "with every appearance of being wild." Fl. April. It is indigenous also in the dry country of western India.

Young shoots grey puberulous with stellate hairs. Leaves obtuse. Petiole 7" long. Pedicels 25—5". Calyx 3", lobes short broad obtuse. Corolla 1.5" tubular-ventricose with 5 rounded lobes. Stamens scarcely exsert, glabrous, anther-cells pendulous, narrowly oblong.

2. **T. stans**, L. Syn. *Stenolobium stans*, D. Don.

A very pretty small tree or large shrub with opposite decussate pinnate or sub-2-pinnate leaves and 7—11 lanceolate serrate or deeply

gashed leaflets 3—4" long. Flowers golden yellow in terminal corymbs or clusters. Corolla tubular-ventricose about 1.5". Capsules 6—9" linear, compressed.

Very common in gardens and easily raised from seed. Native of the West Indies. Fl. c.s.

Var. apiifolia, has even more graceful foliage with the leaflets deeply incised or sub-pinnatifid or forked.

As common as the last.

3. T. capensis, *Lindl.* Syn. *Tecomaria capensis*, *Spach.*

A glabrous climber with pinnate about 9-foliolate glabrous leaves with ovate serrate leaflets. Flowers orange-red about 2" long in dense peduncled racemes. Corolla tubular incurved. Stamens exsert, anther-cells divaricate.

In gardens and plant-houses. Native of the Cape.

4. T. radicans, *Juss.* Syn. *Campsis radicans*, *Seem.*

A spreading shrub emitting roots from its branches where they touch the soil or sub-stratum, with pinnate leaves and 9—11 ovate-acuminate dentate-serrate leaflets puberulous on the nerves beneath. Flowers in great profusion orange-scarlet tubular 1.25" long in drooping corymbs.

Flowers most of the year. Native of tropical America.

5. T. grandiflora, *Delaun.* Syn. *Campsis grandiflora*, *K. Sch.*

A handsome climbing shrub, also with numerous rooting branches, "graceful spray-like foliage of bipinnate leaves; seven leaflets roundish, saw-edged, about .75" long" (*Firminger*). Flowers orange-coloured, in large drooping clusters, corolla shorter and broader than in *T. radicans* with the tube scarcely longer than the calyx.

Fls. h.s., deciduous in c.s. Native of Japan.

Firminger seems wrong in calling the leaves 2-pinnate; they are odd-pinnate with 7—11 ovate acuminate dentate-serrate leaflets.

6. T. jasminoides, *Lindl.* Syn. *Pandorea jasminoides*, *K. Schuman.*

A scandent shrub with dark green pinnate leaves and 5—7 ovate shining entire leaflets. Flowers large rosy-white with dark purple centre, corymbose. Corolla tubular-campanulate with broad mouth.

A beautiful plant almost constantly in blossom. Native of New Holland.

Cooke says that it has pale bluish flowers!

7. T. australis, *R. Br.* Syn. *Pandorea australis*, *Spach.*

A large woody climber with pinnate glabrous leaves with 7—9 elliptic sub-entire leaflets and axillary panicles of heavily scented tawny yellow flowers more or less spotted with purple. Capsule oblong.

Native of Australia.

5. STEREOSPERMUM, *Cham.*

Trees with odd-pinnate leaves, opposite or clustered (and apparently spiral) at the ends of the branches, leaflets entire or toothed. Flowers mod.-sized in terminal ample lax panicles with opposite decussate branches. Calyx campanulate 2—5-lobed or -toothed. Corolla curved tubular-campanulate 2-lipped with very short narrowly-tubular base, lobes sub-equal, imbricate in bud; often crisped or toothed. Disc sub-cupular. Stamens included didynamous, with diverging or divaricate anther-cells. Ovary linear-oblong with many ovules 2-seriate in each

cell. Capsule terete or 4-angled elongate, often spiral, with a corky cylindrical septum in the excavations of which lie the nuclei of the seeds which have somewhat thick membranous wings separated by a groove. Embryo folded.

A. Corolla woolly at base of stamens:—

Leaves and panicles glabrous or nearly so. Lfts. elliptic, suddenly caudate. Capsule slender 4-angled or -winged 1. *tetragonum*.

B. Corolla not woolly at base of filaments, anterior surface within villous:—

Lfts. narrowly elliptic to oblanceolate-oblong. Panicle pubescent not very viscous. Pod 3" diam. 2. *angustifolium*.

Lfts. broadly elliptic or oblong. Panicle very viscous. Pod over 6" diam. 3. *suaveolens*.

Lfts. as in *tetragona* but tomentose when young, mature pubescent. Panicle hirsute, not viscous. Pod? 4. *chelonoides*.

1. **S. tetragonum**, DC. Syn. *S. chelonoides*, F.B.I.; non *Bignonia chelonoides*, L. f.; Parari, Th.; Patuli, Chui-patuli, Kogaripatuli, Or.

A large tree with leaves usually clustered at the ends of the branchlets 12—18" long with 7—11 glabrous elliptic caudate leaflets 3·5—5" long with slender petioles 3—7" long. Flowers yellow and rose-coloured in large glabrous or puberulous panicles with caducous linear bracts. Calyx glabrous 2—2·5", somewhat irregularly toothed or lobed, not apiculate in bud. Corolla 7—9" long with glabrous or thinly hairy tube outside, anterior surface within more or less villous and woolly round the base of the stamens, upper lobes glabrous or ciliate. Pod long slender 12—20" long, winged or subulate in the northern forms (*tetragonum* proper) and often 4—4·5" diam. (but with core only 2—2·5" diam.) or with 4 raised lines and 3" diam. in more southern forms. Seeds with their wings 1—1·2" long by 2", easily splitting through the centre, nucleus wedge-shaped.

Northern tract, Champaran and Purneah, i.e. not far from the foot of the mountains! Central tract, rather rare and is perhaps a variety or separate species with more slender pod. Valleys in Singbhum! Parasnath, Anders! Puri! Angul! Perhaps other districts but for long confused with the next species.

Fl. April—June. Fr. nearly up to next flowering period. Deciduous.

Bark usually a light brown exfoliating in lighter-coloured patches. Leaflets sometimes serrulate above, sec. n. 6—7 slender, soon reticulate, base rounded concave or oblique.

This is the tree usually known as *Stereospermum chelonoides*, DC. (see No. 4). Gamble states that the wood is moderately durable, elastic and easy to work and is used for building.

2. **S. angustifolium**, Haines. Syn. *S. chelonoides* var. *angustifolium*, Haines in C. P. List, p. 169; Chui Patuli, Or.

A small tree with usually very nodose branchlets and leaves clustered at their ends. All parts pubescent when young. Leaflets 7—9, oblong or lanceolate-oblong, acuminate but rarely caudate, 3—7" long or those at base of rachis very small, usually permanently pubescent on the nerves beneath, sec. n. 6—10 often reddish. Petiole 1—3·5" not

slender, nor as stout as in next species. Panicle brachiate, lax, pubescent but not very glandular-viscous (as in *S. suaveolens*), ultimate branches 3-flowered. Flowers about 1" long, purple or with some yellowish streaks. Calyx pubescent 2—3" long, 3—6-lobed or -toothed, apiculate in bud. Corolla nearly glabrous outside, inside densely villous anteriorly but without woolly scales at the base of the filaments. Filaments with very few gland-hairs towards base or glabrous. Capsule terete, 12—16" long and 3" diam. or less, brown and closely lenticellate. Seeds with obtuse or sublanceolate wings, much as in last.

Angul! Sambalpur! Fl. April—June. Fr. Oct.—Feb. Deciduous.

In flower (when leafless or nearly so) this is often taken for *S. suaveolens*, but the old capsules, which may nearly always be found underneath the tree if not on it, with their very slender septum 3" or less, easily distinguish it apart from the less glandular panicle and usually smaller flowers.

3. *S. suaveolens*, DC. Parar, *Th.*; Pader, *H., S.*; Hussi, *K.*; Panrar, *Kharw.*; Paroli, *Mal Pah.*; Parul, *Beng.*; Boro-patuli, *Padal, Or.*

A handsome large or mod.-sized tree with young parts tomentose and glandular. Large leaves with 5—9 broadly elliptic or oblong shortly suddenly acuminate leaflets 3—7" by 2.5—3" and dull crimson (yellow-streaked within) very fragrant flowers 1—1.5" long in large very glandular-pubescent panicles. Capsule 18" by 6—7.5" diam., terete, usually purple-spotted and closely lenticellate, often spiral (as also in other species).

In all districts, frequent. In the valleys in hill-districts. Fl. April—May. Fr. Sept.—Feb. Deciduous March.

Bark nearly smooth, grey; blaze pale yellow distinctly narrowly zoned into hard and soft layers. Leaflets sessile or very shortly stoutly petioluled, usually more or less pubescent to maturity, sec. n. 5—12 strong usually, irregular. Calyx .35—4", very glandular, mostly 3-lobed with lower lobe 2-toothed. Corolla villous within on lower side, not woolly at base of filaments, lobes crisped-crenate. Filaments with sparsely gland-hairy base.

Lfts. of the young plants are harsh and spinous-serrate, in quite young seedlings, simple. The difference in number of sec. n. is remarkable and suggests two species.

Frequently found in grass lands for which it is useful in afforestation. *Gamble* says that "the wood is durable, easy to work and good for building, but that the amount of heart wood is small. Is an excellent firewood and makes good charcoal." I used to find however that it was difficult to utilise it for fuel on account of its being difficult, like *S. tetragonum*, to split. The weight is given as about 40—50 lbs.

4. *S. chelonoides*, Haines, non De Candolle. Syn. *Bignonia chelonoides*, *L.f.*, *vide Kew Bulletin*.

Little is known of the true *Bignonia chelonoides* except from the specimen in the Linnean Herbarium collected at Tranquebar. It very possibly, however, occurs in our provinces, as a specimen very similar to it was collected by me in the Central Provinces.

It is a very pubescent tree with the young parts tomentose and panicle almost hirsute but with the leaflets shaped like those of *S. tetragonum*. The petiolules are not long or slender as in that species but rather short and stout. The fruit is unknown. The flower much resembles our *angustifolium*, which may indeed be only a variety of the Linnean species which should be looked for. The only way to satisfactorily determine the *Stereospermum*s is to mark down flowering trees and therefrom afterwards to collect the mature leaves and capsules.

6. RADERMACHERA, Zoll. and Moritz.

Trees with opposite 1—3-pinnate leaves and large flowers in terminal brachiate panicles. Corolla campanulate with very short narrowly tubular base not villous within, limb sub-2-labiate. Stamens didynamous, glabrous, anther-cells divergent or divaricate. Ovary elongate, ovules many-seriate in each cell. Stigma linguiform. Capsule linear, cylindric or sub-compressed, 2-valved, often spiral with coriaceous or woody valves and large sub-terete corky septum. Seeds flat not inserted in deep depressions of the septum, wings without a deep furrow between, cotyledons flat.

1. *R. xylocarpa*, K. Sch. Syn. *Stereospermum xylocarpum*, Wight; Khonda-Partoli, Or.; Pampani, Khond.

A large tree with very large 2—3-pinnate leaves 2—3 ft. long with elliptic to ovate shortly acuminate leaflets 2—6" long, entire or coarsely serrate, rather pale or silvery beneath. Flowers large, 1.5—2.5" long, white with yellow or pinkish, sweet-scented, in stout erect rigid ovoid panicles 3—7" long, the pedicels sub-capitately corymbose on the branches. Pod up to 3 ft. long, woody, tubercled, septum .5" broad. Seeds 1.2" long with the wings.

In the Southern area only and not common. Singbhum, near the Deo River, very rare! Gangpur, Prain's Collector! Mals of Puri! Angul (Raigoda, Purnakot and Jacobo forests)! Fl. April—May when leafless. Fr. up to the following April. Deciduous March—May.

Attains 8 ft. girth in favourable situations but usually smaller in our area, with thick light-grey rather smooth and flaky bark and rather thick brown and cream blaze, darkening on exposure. Twigs very stout marked with large leaf scars, leaf buds resinous. Leaves soon glabrous or permanently finely pubescent on rhachis and principal nerves; pinnæ 4—5 prs.; lfts. 3—11, petioluled, sec. n. 4—5, strong beneath, of which 1—2 near base, tertiaries rather strong. Panicle rhachis glabrous lenticellate at base, branches tomentose upwards. Bracts on panicle narrow 2—2.5", caducous. Pedicels tomentose, 4—5", articulate under the flower. Calyx campanulate, 3—5", puberulous 5-toothed, 2 upper teeth broader and more obtuse, all mucronate.

Gamble states that the wood is good and handsome, it is tough and elastic and takes a good polish. Weight about 42 lbs.

7. DOLICHANDRONE, Fenzl.

Trees with pinnate or sub-2-pinnate leaves and entire or obscurely toothed leaflets. Flowers usually white and opening at night, large or mod.-sized, in terminal corymbs or panicles. Calyx spathaceous, split down one side. Corolla funnel-shaped with the lower basal narrow-tubular portion well developed and much exceeding the calyx, limb sub-regular. Stamens included, anther-cells parallel. Disc expanded. Ovary oblong with many ovules several-seriate in each cell. Capsule long linear with coriaceous flat valves; septum narrow with a transverse broader false septum separating the placentæ of each cell, so that the capsule on dehiscence appears septifragal. Seeds almost rectangular with often a thick wing.

Leaflets sub-orbicular or broadly elliptic obtuse or suddenly acute, corolla 2" long.

Leaflets elliptic acuminate. Corolla 4—7" long

1. *falcata*.
2. *spathacea*.

1. *D. falcata*, Seem., inc. *D. Lawii*, Seem.; Karal, Or.

A small or mod.-sized hoary pubescent tree with pinnate or sub-2-pinnate (the secondary rhachis nearly obsolete so that the leaflets appear clustered on a node of the primary rhachis) leaves. Leaflets .5—1.5", rarely 2.5", long, broadly elliptic, obovate, or sub-orbicular, sometimes retuse, more often rounded with a very short acute tip. Flowers very pretty, white in short few-fl. corymbose racemes terminating the new shoots. Calyx .6—8", with stellate pubescence, deciduous. Corolla with slender part of tube .8—1" long then widening, limb 1—2" diam. with crisped rounded or oblong petals. Pod 12—18" usually much curved, acuminate, glabrescent.

Entering the western districts only in a few places from the Central Provinces where it is common. Sambalpur Range, scarce! Only seen in the Protected forests. Angul, rare, *B. K. Chattarjee*. Fl. April—June. Fr. Feb. Deciduous about Feb.—March.

Bark grey exfoliating in irregular scales. Leaf rhachis 2—5" with usually 5—7 or, in 2-pinnate leaves, up to 13 leaflets, pubescent or, beneath, often tomentose with forked or stellate hairs, secondary pinnae usually only from lowest node of primary rhachis and consisting of three leaflets only, petiolules 0—1" in lateral leaflets, longer in terminal. Corymbs pubescent, sometimes lateral on the old wood.

Beddome says that the wood is used for building and agricultural purposes. It is too scarce in our area to be of consequence.

Var. *Lawii*. Syn. *Dolichandrone Lawii*, Seem. (sp.).

This is considered by *Brandis* and also by *Sprague* (*vide Kew Bulletin*, 1919, *Dolichandrone* and *Markhamia*) as merely a glabrous form of *D. falcata* and so also it appears to me. It has only been collected in our province by *Kurz* in "Behar"! It is only puberulous on the new shoots and the pods are said to be less curved, but *Sprague* finds that the variation in the indumentum is not correlated with the degree of curvature of the pod.

2. *D. spathacea*, K. Schum. Syn. *D. Rhecdii*, Seem.

A large handsome tree with pinnate leaves about 12" long and 7—9 elliptic much acuminate leaflets 2—3" long, often unequal at the base. Flowers very large 4—7" long with the narrow portion of tube 3—5". Capsule 18" by 1" nearly straight. Seeds rectangular with corky wings.

Sometimes planted in Orissa and near Calcutta, and may possibly be found wild in the Mahanadi delta, where so many trees frequent in the Sunderbans have been found. Fl. h.s.

The ground of an early morning is often covered with the large white fallen corollas of this tree, which, like so many other species of the genus, is night-flowering. *Sprague* (*loc. cit.*) gives good reasons (especially the corky seed-wing) for supposing the tree to be disseminated by ocean currents, which makes it the more probable that it will be found in the Orissa swamp forests.

8. SPATHODEA, Beauv.

Closely allied to *Dolichandrone* and also has a large spathaceous calyx but differs in the short tubular portion of the corolla, which is very broadly campanulate and anteriorly ventricose above and (in our species at least) brilliantly coloured, and in the absence of the false septum from the capsule.

1. S. campanulata, Beauv.

A large tree with very pale bark, young parts and inflorescence more or less velutinous, leaves pinnate with about 9 lanceolate leaflets. A beautiful tree in flower, "deciduous for a few weeks in the hot season, after which it breaks into leaf and is subsequently covered for a long period or two long periods by a gorgeous display of large, well-shaped, orange-crimson flowers" (*Firminger*). Spathaceous calyx recurved. Corolla-tube above the short narrow portion very broad, almost ribbed, limb 3—3.5" diam. of 5 sub-equal ovate-oblong lobes.

Grows well in Chota Nagpur. There is a good specimen at Sakchi in Singbhum. Native of Africa. Fl. h.s. and (*vide Firminger*) also sometimes Sept.—Oct.

The following further field notes have been found: Bark sometimes white, smooth. Leaves about 19" with 11—15 leaflets with the 7—8 prs. of nerves prominent as seen from the ground (against the sky). Lfts. oblong opposite shining 2—4" long. Fls. 4—5" by 3—4" with spathaceous reflexed brownish calyx 2.5" long. Fls. March. Deciduous Feb. (Add. & Cor., 185 p.)

9. JACARANDA, Juss.

Large trees with generally twice imparipinnate leaves with very numerous more or less trapezoid or rhombic leaflets. Flowers large showy in long loose terminal panicles. Calyx small. Corolla tubular-campanulate with a moderately long narrow basal tube. Stamens included, anthers glabrous with divaricate cells, the staminode very long and clavate at the end with a short 2-lobed hairy tip. Capsule ellipsoid or almost orbicular, woody, compressed at right angles to the septum, loculicidal, each valve carrying with it half the septum.

1. J. mimosifolia, D. Don.

A very beautiful tree with foliage resembling that of the Albizzias or Acacias, except that the leaves are opposite. It bears panicles of beautiful blue flowers.

Native of Brazil and of somewhat recent introduction, but now becoming common in gardens.

10. PARMENTIERA, DC.

Shrubs or small trees with opposite 3-foliolate leaves and flowers clustered on tubercles on the old wood. Calyx spathaceous. Corolla sub-regular, tubular-campanulate. Stamens reaching to the throat of corolla, didynamous with a staminodial fifth. Disc obscure. Ovary 1-celled or at the base 2-celled. Fruit cylindrical, fleshy, indehiscent.

1. P. cereifera, Seem. The Candle Tree.

A small pretty tree with 3-foliolate leaves with somewhat winged petiole and elliptic leaflets acute each end. Flowers pretty, white or slightly pink. Fruit like drooping clusters of yellow candles hanging from all the branches.

Often grown in gardens. Native of Panama. Fr. h.s.

11. KIGELIA, DC.

Trees with odd-pinnate alternate leaves and large red flowers in very loose pendulous racemes from the old wood. Calyx irregularly splitting, coriaceous, 2—5-lobed. Corolla broadly campanulate sub-regular. Stamens 4 didynamous, the 5th present as a staminode. Ovary

1-celled with prominent parietal placentæ almost meeting at the base. Fruit gourd-like, indehiscent with many seeds embedded in pulp. An African genus.

1. *K. pinnata*, DC. Syn. *K. africana*, *Benth.*

A spreading tree with pinnate leaves and coriaceous obtuse, dark-green leaflets. Usually recognised by the racemes of dull liver-coloured flowers hanging by long rope-like peduncles, which sometimes attain 6 ft. in length, and in fruit by the one to four large gourd-like pods at the ends of these. Now frequently planted in gardens, but more curious than ornamental. Fl. h.s.

Crescentia cujete, L., is the Calabash Tree. It bears clusters of flowers on the stems and old branches. The leaves are alternate clustered and simple. The flowers campanulate, greenish-white with dull purple lines. Fruit large globose and the seeds wingless. It therefore departs very widely from the Bignoniaceous type. Sometimes grown in gardens.

FAM. 103. PEDALIACEÆ.

Herbs with the leaves opposite or the upper alternate, often deeply lobed or pinnatifid. Flowers zygomorphic, 2-sexual, solitary or clustered and usually axillary, or racemose. Calyx usually deeply 4–5-lobed. Corolla tubular ventricose, lobes imbricate. Stamens 4 didynamous, only 2 perfect in *Martynia*, a 5th often present as a staminode. Ovary 1–2-celled or finally 4-celled by the growth of a false septum, not deeply lobed; style filiform, stigma shortly 2-lobed. Ovules few or, if many, in one series in each cell, not scattered all over a broad placenta (as in *Scropulariaceæ*). Fruit capsular or drupaceous. Seeds wingless, albumen 0.

The genus *Martynia* is included in the *Nat. Pflanzenfamilien* in a separate family. *Martyniaceæ*.

- | | |
|--|-----------------------|
| I. Flowers axillary. Stamens 4 didynamous, perfect:— | |
| Ovules 2 in each cell. Fruit drupaceous, 4-spinous | 1. <i>Pedaliium</i> . |
| Ovules many in each cell. Fruit elongate capsular | 2. <i>Sesamum</i> . |
| II. Flowers in racemes. Stamens only 2 perfect:— | |
| Ovules many in each cell. Fruit drupaceous with dehiscent pericarp and crustaceous 2-clawed endocarp | 3. <i>Martynia</i> . |

1. *PEDALIUM*, L.

Herbs with opposite or alternate toothed leaves and solitary axillary yellow flowers with funnel-shaped corolla suddenly widening from a very small basal tube. Stamens 4 didynamous and a small staminode, included; anther-cells ovate separately pendulous from the top of the connective, opening above by short slits. Disc large oblique. Ovary superior 2-celled, ovules 2 in each cell. Stigma swollen, gibbous at base, acuminate at apex. Fruit drupaceous with 4 spreading spines near base, below which is a solid stipes, above 2-celled. Seeds 2 in each cell.

1. *P. murex*, L. Gokara, Or.; Bara-gokhru, Beng.

A sub-fleshy herb with ascending branches 6–18" long, repand-dentate alternate leaves 1–2" long and axillary primrose-yellow flowers

1" long. Fruit broadly pyramido-conical above the spines, .3" diam., succulent with crustaceous endocarp. There are 2 curious button-shaped glands at the insertion of the pedicels which secrete a drop of fluid.

Common on sandy soil near the coast. From Cuttack to Puri! Fl., Fr. Aug.—Oct.

Leaves with minute glistening glands beneath which give the plant rather a fœtid smell; these also occur on the young shoots, pedicels and calyx; otherwise glabrous. Calyx 5-partite, lobes lanceolate, .07—.08". Corolla-tube minutely gland-pubescent, broadly tubular beyond the calyx, limb spreading oblique .75—1" diam., 2 upper lobes exterior in bud, lobes-sub-orbicular, 2 upper outer in bud. Filaments thinly glandular-hairy.

The whole plant has the property of rendering water or milk mucilaginous, and the mucilaginous infusion is a valuable demulcent and diuretic, useful in many disorders of the genito-urinary system.

2. SESAMUM, L.

Herbs with leaves mostly opposite, upper alternate. Flowers axillary, solitary or few fascicled, short pedicelled. Corolla zygomorphic, tubular-campanulate, slightly gibbous at base, limb 2-lipped with 5 rounded lobes. Stamens included, anthers sagittate. Ovary 2-celled with false septa making it 4-celled when mature. Ovules many 1-seriate in each cell. Fruit a loculicidal 2-valved or finally 4-valved, 4-celled capsule. Seeds obliquely oblong.

1. *S. indicum*, L. Tilming, K.; Til, H.; Rasa, Or; The Gingeli-oil Plant.

Erect 1—3 ft. high, more or less fœtid and glandular, usually also pubescent. Leaves simple above, lanceolate or oblong or uppermost linear and alternate, lower opposite often lobed or pedatisect, intermediate usually ovate and gashed or toothed. Flowers purple or whitish with purple or yellow marks, suberect or drooping, 1—1.25" long, pubescent. Sepals narrow-lanceolate .2—.25", hairy. Capsule 1" long, oblong, bluntly 4-gonous, erect, dehiscent from above downwards, but rarely to the base.

Very widely cultivated in all districts. Fl. Oct.—Dec. Fr. Dec.—Jan. Native country not known with certainty; *De Candolle* thinks it was probably from the Sunda Islands.

Three varieties of seeds are known—black, white and red. The black yields the best oil and is best suited for medicinal purposes. Besides being used in cooking, the oil is emollient, demulcent and laxative. The plant is also mucilaginous and used in bowel affections, *Nadkarni*.

3. MARTYNIA, L.

Coarse glandular herbs mostly dichasially branched with opposite broad leaves and drooping red flowers in short racemes terminal and from the forks of the branches. Calyx unequally 5-lobed, slit in front. Corolla tubular-campanulate zygomorphic with broad lobes. Stamens 5 of which the anterior 2 only perfect with long filaments and confluent anther-cells, the others reduced to staminodes of which the 5th is very rudimentary. Ovary 1-locular with 2 parietal placentæ

which are divided towards the middle of the cell into two divaricate laminæ with many ovules 1-seriate on each lamina. Fruit obliquely ovoid, drupaceous with the pericarp finally dehiscent and falling, leaving a crustaceous sculptured endocarp with 2 sharp curved apical spines and a central channel opening between the spines.

1. *M. diandra*, *Glox.* Bilai sarsar, K.; Devil's Claw.

A handsome stout clammy-pubescent herb 3—4 ft. high with deltoid-ovate cordate-based sinuate-dentate leaves attaining 6—9" each way and terminal erect racemes 3—4" long of drooping pink and dark purple foxglove-shaped flowers 2.5" long.

In all districts, now thoroughly naturalised! Fl. r.s., Fr. r.s. and c.s. Native of Mexico.

Leaves sometimes broader than long. Corolla glandular-hairy with very oblique mouth; lobes unequal, anterior transversely orbicular-oblong, 1" wide, lateral semi-orbicular smaller, upper lip somewhat reflexed 2-lobed, anterior surface of corolla within yellow speckled, lobes with a deep purple blotch.

FAM. 104. ACANTHACEÆ.

Shrubs or herbs with opposite* exstipulate simple leaves, often entire, in many genera furnished with linear cystoliths which appear as translucent marks in the fresh leaves and as small raised lines (leaves lineolate) in the dried leaves. Flowers zygomorphous, rarely solitary, usually bracteate and bracteolate. Calyx 5-partite, rarely (*Thunbergia*) of several small teeth. Corolla lipped or subequally 5-lobed, lobes imbricate or twisted in bud. Stamens 4 or 2, inserted on the corolla-tube; anthers 2- or 1-celled, cells sometimes remote or superposed, pollen of very various form and sculpture.† Disc usually conspicuous. Ovary superior, usually elongate, always 2-celled, style filiform, stigma simple or 2-fid (or style shortly 2-branched). Ovules 1—many in each cell, if more than 1 then superposed except in *Thunbergia*, anatropous. Capsule loculicidal, valves often elastically recurved and placentæ sometimes rising elastically from the base when ripe. Seeds usually seated on the hardened curved funicles (*retinacula*) which are frequently produced beyond the hilum into an acute tip, ovoid or orbiculo-compressed, often clothed with elastic hairs which spread out when wetted (hygroscopic). Albumen 0 (exc. in the *Nelsoniææ*).

The venation is normally of several fine somewhat curved sec. n. not reaching but upcurved within the margin, raised beneath, connected by numerous finer nearly straight tertiaries. Glands in the leaf, other than glandular hairs, are very rare. Sessile glands occur in *Cardanthera* among our species. In germination the epigeal cotyledons are usually very well developed, usually broad and rounded and with basal nerves, base sometimes cordate, petiole present where observed.

* Leaves alternate in *Elytraria* and some *Staurogyne*, sometimes unequal with the smaller leaf rarely suppressed in a few other genera.

† The form and sculpture of the pollen grains is often indicative of tribes and genera. They are used in classification by *Lindau* (*Nat. Pflanz. Fam.*), but are difficult to describe briefly and are therefore not used here.

- I. Cystoliths 0. Seeds not laterally compressed, on papillæ (1 to 4):—
- A. Calyx truncate or with several minute teeth. Ovules 2 collateral in each cell:—
Usually scandent with palmate venation (exc. *T. erecta*)
- B. Calyx 4—5-partite. Flowers in bracteate spikes. Ovules 6—10, superposed:—
1. Stamens 2:—
Spikes slender. Bracteoles small
Spikes ovoid or cylindrical. Bracteoles 0. Sepals 4
 2. Stamens 4. Ovules very many in each cell
1. *Thunbergia*.
2. *Tubiflora* (*Elytraria*).
3. *Nelsonia*.
4. *Staurogync* (*Ebermaiera*).
- II. Cystoliths often present (leaves lineolate). Seeds laterally compressed on retinacula (exc. *Cardanthera*) (5 to end):—
- A. Corolla-limb 2-lipped or lobes 5 subequal. Lobes twisted in bud (Nos. 5—15):—
1. Corolla distinctly 2-lipped. Ovules many in each cell. Flowers in axillary dense cymes or clusters or whorls:—
 - a. Glandular herb. Funicles blunt conical. Leaves often pinnatifid or toothed
 - b. Leaves entire. Retinacula curved:—
Not spinose. Capsule 8—40-seeded
Spinose. Capsule 2—8-seeded
 2. Corolla sub-equally 5-lobed or 2 posterior lobes more connate:—
 - a. Ovules 3—12 in each cell:—
 - i. Calyx-lobes rounded. Stamens 2 exerted. Cor.-lobes short rounded. American shrubs or herbs
 - ii. Calyx segments acute. Stamens didynamous:—
† Flowers in axillary clusters or contracted cymes. Bracteoles small or 0
†† Flowers large, solitary or few together or cymose.
Bracteoles large foliaceous. Capsule clavate
Bracteoles elongate, narrow. Capsule linear
 - ††† Flowers in elongate sympodial cymes
Bracteoles minute subulate or 0
 - b. Ovules 2 in each cell:—
 - i. Cor. tubular-ventricose. St. 4 (exc. one section of *Strobilanthes*):—
† Fls. small (under .8" long), somewhat 2-lipped
†† Fls. large or mod.-sized (over .8" long):—
Bracteoles very large, reticulate. Anthers spurred
Bracteoles linear or 0 (in our species). Anthers muticous
 - ii. Corolla with very slender tube scarcely widened above:—
Stamens 2. Spikes not secund, often corymbose
5. *Cardanthera*.
6. *Hygrophilla*.
7. *Asteracantha*.
- Sanchezia* (p. 704).
8. *Hemigraphis*.
9. *Ruellia* (*Dipteracanthus*). (*Euruellia*).
10. *Echinacanthus*.
11. *Dyschoriste*.
12. *Petalidium*.
13. *Strobilanthes*.
14. *Dædalacanthus*.

- Stamens 4. Fls. clustered between pairs of bracts in secund spikes'
15. *Micranthus*.
(*Phayloopsis*).
- B. Corolla-limb 2-lipped or lobes 5 subequal. Lobes imbricate in bud (Nos. 16—32):—
1. Ovules 2 in each cell (Nos. 16—30):—
- a. Corolla not distinctly 2-lipped (posterior lobes sometimes somewhat smaller than anterior or more connate:—
- i. Bracteoles very large, far exceeding the calyx. Calyx-segments 4
16. *Barleria*.
- ii. Bracteoles linear or very small. Calyx-segments 5:—
- † Stamens didynamous, anthers 1- or 2-celled:—
- Spikes often lax, bracts shorter than calyx. Anthers 2-celled
17. *Asystasia*.
- Spikes with imbricating bracts exceeding calyx. Anths. 1-celled
18. *Crossandra*.
- †† Stamens 2, staminodes often 2. Flowers spiked
19. *Eranthemum*.
- b. Corolla distinctly 2-lipped:—
- i. Stamens didynamous. Bracts often 4-farious:—
- † Anterior anthers 2-celled, posterior 1-celled:—
- Calyx sub-2-lipped, posterior lip 3-toothed, anterior 2-lobed
20. *Neuracanthus*.
- Calyx subsequently 5-fid.
21. *Lepidagathis purpuricaulis*.
- †† Anthers all 2-celled (exc. *L. purpuricaulis*)
21. *Lepidagathis*.
- ††† Anthers all 1-celled
22. *Aphelandra*.
- ii. Stamens 2. Anthers 2-celled:—
- † Flowers in spikes or thyrses, rarely (*Jacobinia* spp.) clustered. Bracts often 4-farious:—
- ! Bracts membranous or hyaline 2- or 4-ranked in secund spikes, if 4-ranked dimorphous:—
- Diffuse herbs. Lower anther-cell tailed or mucous
23. *Rungia*.
- !! Bracts in cylindric or 4-farious spikes (exc. *Jacobinia*), homomorphous:—
- * Anther-cells superposed:—
- Shrubs or herbs. Fls. small or m.s. Lower anth.-cell white-tailed
24. *Justicia*.
- Shrubs.* Flowers large, corolla-tube short and broad. Lower anth.-cell obscurely mucronate
25. *Adhatoda*.
- ** Anther-cells parallel sub-equal or one only slightly higher:—
- § Cor.-tube slender. Staminodes 0:—
- Shrubs or robust herbs. Fls. usually red, often clustered or in dense cymes or thyrses
- Jacobinia*, p. 728
- Dwarf herb with prettily veined leaves. Fls. spicate, yellow
- Fittonia*, p. 728
- Undershrub. Flowers pale blue in dense bracteate spikes
26. *Ecboium*.

- §§ Cor.-tube widened upwards, stamino-
nodes small:—
Shrub with variegated leaves. Fls.
in thyrses 27. *Graptophyllum*.
- †† Flowers in 1—few-fl. cymules. Cymules
on the branches of a diffuse panicle or,
if clustered axillary, enclosed between a
pair of disparous bracts:—
Cymules minute paniced, bracts minute.
Fls. white 28. *Rhinacanthus*.
Cymules paniced or axillary, bracts ex-
ceeding calyx. Fls. rose or purple 29. *Peristrophe*.
Cymules usually in axillary cymes. One
of the unequal bracts large. Fls. rose or
purple 30. *Dicliptera*.
2. Ovules 3—many in each cell. Corolla 2-lipped.
St. 2:—
Flowers small in sympodial racemose cymes 31. *Andrographis*.
Flowers large red in terminal thyrses 32. *Phlogacanthus*.
- C. Corolla with a single 3-lobed spreading lower lip,
upper obsolete. Lobes inflexed imbricate in bud.
Ovules 2 in each cell. Corolla-tube often horny:—
Cor.-tube ovoid or globose. Anther below apex of
filament 33. *Blepharis*.
Cor.-tube subcampanulate. Anther at apex of
filament 34. *Acanthus*.

1. THUNBERGIA, *L.f.*

Climbers, rarely erect, with palminerved often angled and cordate leaves, axillary or racemed large or mod.-sized flowers and large bracteoles enclosing the flower buds. Calyx small annular, usually 10—16-toothed. Corolla with a ventricose curved tube, usually oblique mouth and 5 rounded petals twisted to left in bud. Stamens didynamous, anthers 2-celled, cells sometimes spurred at base, not divaricate. Disc conspicuous. Ovary-cells 2-ovuled. Capsule globose with a flat hard sword-shaped beak. Seeds 2 in each cell, glabrous, often hollowed at the base, sometimes scaly.

I. Climbers:—

A. Flowers axillary:—

1. Flowers white:—

Calyx-teeth lanceolate, .05—1.5"

Calyx-teeth filiform hairy, .2—3"

2. Flowers mostly yellow with dark throat. Garden species

1. *fragrans*.
[2. *tomentosa*].6. *alata*.

B. Flowers racemed (sometimes also in upper axils):—

1. Flowers blue:—

Leaves broad much dentate 5—7-nerved, pubescent
or scabrid 3. *grandiflora*.Leaves narrow 3-nerved, glabrous. Garden species 5. *laurifolia*.2. Flowers orange-scarlet 4. *coccinea*.II. Erect shrub. Flowers purple with white tube 7. *erecta*.1. *T. fragrans*, *Roxb.*

A slender twiner with glabrous or pubescent branches, ovate or oblong, sparsely toothed leaves 1—3.5" long with straight, cordate or hastate base, and white flowers 1.5" long, solitary or paired in the leaf axils. Calyx-teeth 14—20 lanceolate or subulate .05—0.7" long in

flower, equalling or slightly exceeding the tube. Capsule .75—1" with 4 rounded excavate seeds.

The type occurs in the Sikkim Tarai and probably therefore in Purneah. In it the flowers are fragrant, the capsule glabrous and shining.

Var. *lævis*, Clarke.

Glabrous or grey-puberulous or (in my specimens) distinctly pubescent on young leaves, pedicels, bracteoles and calyx. Pedicels often 2, sometimes 3 in an axil, 1" to (rarely) 3", much thickened upwards in fruit (*Clarke*) or uniform (in some of my specimens), flowers not fragrant, capsules grey-puberulous with the calyx teeth up to .1" and hardened.

Southern area, frequent. Singbhum, chiefly in Porahat! Angul! Fl. Oct.—Nov. and sometimes to March, fruiting soon after.

Var. *vestita*, Nees. See remarks under *T. tomentosa*.

[2. ***T. tomentosa*, Wall.**]

Similar, but calyx-teeth in flower filiform much longer than the tube, often .25—.3", hairy, and capsule villous, beak less flattened.

Chota Nagpur, *Prain*, in Beng. Pl. But *Prain* apparently regards the tomentose form of *T. fragrans* as *T. tomentosa*! There is one specimen only so labelled in the Cal. Herb. The calyx teeth appear to me to be only slightly more narrow than in *T. fragrans*, and even in fruit the whole calyx is only .15" long, the teeth being then lanceolate, whereas in *T. tomentosa* they are truly filiform, .25—.3" long and hairy. The capsule is shortly villous. It was collected at Bandgaon (Porahat) by *Clarke*, who called it both names, and it exactly matches another named *T. fragrans*, var. *vestita*, to which species and variety I assign it. *T. tomentosa* is a Nilgherry plant which, I may say confidently, does not occur in our area.

3. ***T. grandiflora*, Roxb.**

A large climber with pendant branches and orbicular or ovate, or uppermost lanceolate, leaves 3.5—7" long and broad, uppermost often passing into bracts. Flowers large light-blue, about 3" diam., axillary from the uppermost leaves and in racemes. Capsule upcurved on the pendulous branches, 1.5—2" long with 4-quetrous beak, on clavate pedicels, 1.7—2" long or pedicel of the axillary flowers attaining 4.5".

Jungles of northern Purneah! Santal Parganas, base of Rajmahal Hills, *Kurz*! Probably now extinct in the Santal Parganas. Fl. Sept.—Oct. Fr. Nov.—Dec.

Leaves, lower deeply cordate and with triangular lobes, 5—7-nerved, shortly hairy both sides, uppermost glabrous. Bracts, upper small and deciduous, bracteoles .75—1.5", falcate-elliptic, often connate on one margin. Calyx a subentire ring. Anthers bearded. Capsule thinly pubescent. Seeds plano-convex or doubly-convex, .3—.4" diam, convex side with triangular adnate scaly brown plates.

4. ***T. coccinea*, Wall.**

An extensive climber with long pendant branches, glabrous, elliptic or ovate acuminate entire sinuate or toothed 3—5-nerved leaves and handsome pendulous racemes of scarlet flowers 1" in diam., mostly fascicled at the nodes of the raceme. Capsule 1—1.6" long, .7—.8" diam., glabrous or minutely pubescent, on pedicels .5—1.5".

Damp ravines in the Sameshwar Hills, elev. 1000 ft. and upwards! Fl. Aug.—Jan., also April and perhaps at other times.

Leaves 5—7", obtuse rounded or cordate at the base. Petiole .5—2" or 0 in the uppermost leaves. Racemes often very long with clusters or pairs of flowers rather distant. Bracteoles .7" red-purple, often connate along one edge. Calyx a

crenulate rim. Corolla with reflexed lobes. Seeds .25—3" diam. sub-plano-convex but raised in middle of plane side, much thicker than those of *T. grandiflora*, somewhat rugose.

All the above are sometimes seen in gardens, more especially *T. grandiflora*. Besides these are found in gardens—5. *T. laurifolia*, *Lindl.*, with light blue flowers similar to those of *grandiflora*, but leaves lanceolate acuminate and up to 9" long, 3-nerved. Is a native of Burma and the Malay Peninsula.

6. *T. alata*, *Bojer*, which closely resembles *T. fragrans* but is softly villous and has winged petioles and usually yellow corolla with a brown or purple eye or sometimes shades of buff or orange, rarely white. Probably a native of Africa.

7. *T. erecta*, *T. Anders.* Syn. *Meyenia erecta*, *Benth.*

An erect bushy shrub 3—6 ft. high with rather small ovate acuminate glabrous nearly entire leaves about 1" long. Flowers purple-blue with white or yellowish tube about 1.5" long, occasionally white.

Very common in gardens. Fl. principally c.s.

2. ELYTRARIA, *Vahl.*

(*Tubiflora*, *Gmel.*, is the older name.)

Nearly stemless herbs with alternate crowded radical leaves and small flowers in rigid slender spikes closely covered with spiral imbricate bracts. Bracteoles smaller than the bracts. Calyx sub-4-partite, segments unequal. Corolla-tube linear, limb 2-lipped with 5 oblong lobes imbricate in bud. Stamens 2 perfect, cells 2, parallel sometimes with a minute spur. Ovules 6—10 in each cell, superposed. Capsule ellipsoid acute. Seeds minute, ovoid, reticulate and minutely papillose, not on retinacula.

1. *E. crenata*, *Vahl.* Syn. *Tubiflora acaulis*, *O. Kuntze* (the older name).

Stem or stock very short, woolly. Leaves obovate or elliptic-obovate 3—8" long crenate with rounded or obtuse tip, and narrowed at base without any or very short petiole, villous or pubescent on the nerves beneath. Scapes 5—10", clothed from the base with imbricate acuminate sub-aristate bracts, flowering part 1—3" with bracts more ovate woolly on the margins. Corolla white or pale coloured .25—3". Capsule .25".

It probably occurs in Sambalpur, having been collected by me on dry banks in Raipur (Central Provinces). *Prairie* gives Chota Nagpur as a locality, but the sole supposed record is a flowerless and fruitless specimen of *Premna herbacea* from Hazaribagh, the rootstock and venation of which are quite different. There is a specimen collected by *Griffith* marked "Bengal," but this may have been from the (present) United Provinces. Fl., Fr. Oct.—Dec.

Leaves with 4—10 sec. n. according to size, never looped, reticulate near margin and many branches entering the margin.

3. NELSONIA, *R. Br.*

Diffuse herb with opposite entire leaves and very small flowers in ovoid or cylindrical spikes with closely imbricate bracts and no bracteoles. Sepals 4 unequal. Corolla with slender tube inflated at base then deeply constricted and 2-lipped limb with 5 spreading lobes. Stamens 2, inserted above the middle of the tube, anther-cells more

or less divergent, or reflexed on a broad connective, sometimes minutely spurred. Ovules 8—10 in each cell. Capsule oblong, barren above. Seeds small, globose or broadly elliptic, not on retinacula.

1. *N. campestris*, Br.

A herb sometimes superficially resembling an *Ajuga* or *Prunella* with fleshy sub-tuberous roots, large elliptic-oblong lower leaves (sometimes absent), and pairs or one pair of smaller subsessile .5—2" long on the special flowering branches. Flowers blue (purplish rose or white, *Clarke*) or upper lip purple in ovoid or cylindric glandular and villous spikes .75—2.5" long. Corolla, throat and palate with curled villi. Capsule .25" narrowly conical. Seeds 5—1 in the lower part of each cell, closely minutely granulate.

Common in shady places, sometimes also on banks. Singbhum! Ascends to 2500 ft. at Neterhat, Palamau and Ranchi! Santal Parganas. Probably in all districts. Fl., Fr. Nov.—March.

Shoots densely villous. Stems sometimes 6" high with leaves attaining 8" by 3" or more (var. *vestita* of the Floras, but usually by shady streams and probably the effect of environment on the individual), with some 12—14 distinct slightly curved sec. n. nearly reaching then running parallel to margin and shortly hairy on the underside; in dry places large leaves are usually absent and those on the erect or diffuse flowering stems .5—2" long, hairy or villous both sides. Bracts herbaceous ovate glandular .25" obtuse. Lowest calyx lobes broadest. Corolla .12—.25" long, upper lip erect of 2 lanceolate or oblong lobes usually pale with red purple lines, lower spreading blue with 3 subequal rounded lobes.

4. STAUROGYNE, Wall.

(*Ebermaicra*, Nees.)

Herbs or small undershrubs with leaves opposite (or upper alternate in *E. glauca*). Flowers usually small (.5" or less) in terminal or also axillary spikes or racemes with large foliaceous or small bracts and smaller bracteoles. Sepals 5, subequal or one larger. Corolla long narrow with 5 short patent lobes. Stamens didynamous, included, filaments hairy (exc. *parviflora*), anther cells 2 separate muticous. Ovary with many ovules in each cell. Capsule small oblong with 15—30 globose or cuboid seeds in each cell, hilum a minute hollow, retinacula 0, unripe seeds glandular, finally smooth or with obscure pits.

Flowers sessile or subsessile in our species.

A. Flowers .4—.5" long not evidently spicate or in very short rounded spikes

1. *glutinosa*.

B. Flowers .2—.32" long in elongate spikes:—

Leaves all opposite. Bracts linear or oblong

2. *polybotrya*.

Leaves all or the upper alternate. Bracts exceeding the flowers, usually spreading, spatulate

3. *glauca*.

1. *S. glutinosa*, O. Ktze.

A diffuse and trailing herb with mostly opposite elliptic or upper oblong obtuse or rounded leaves tapering at the base into a very short petiole, lower attaining 2.75". Flowers .4—.5" long, mostly axillary but upper in very short or rounded spikes. Bracts and calyx viscid-pubescent. Corolla violet-blue with darker veins, pubescent

outside, inside with a ring of red hairs at the base of the stamens. Filaments white with red hairs.

In shady places. Akbarpur, Shahabad, J. D. H. Gaya, Prain (in Cal. Herb.). Probably also Purneah (Rajshayel).

Stems 12—18", trailing, pubescent. L. glabrous or sometimes minutely pubescent, petiole 0—25". Calyx nearly 2", hairy. Filaments white with red hairs, anther-cells remote on the very broad connective.

2. *S. polybotrya*, O. Kntze.

A diffuse and trailing herb with opposite elliptic ovate or oblong obtuse or subobtuse leaves .5—1.75", rounded at base or tapering with a petiole 0—25". Flowers .25—32" long, few axillary but mostly in spikes terminating the stems or on axillary branchlets almost bare of leaves at the base. Bracts and calyx more or less viscid-pubescent. Corolla purple with 5 sub-equal broadly-oblong purple lobes, deeper-veined, nearly glabrous. Filaments thinly hairy.

Singbhum, frequent in shady places! Fl., Fr. Nov.—Jan.

Branches adpressed-pubescent, 6—12". L. pubescent on the nervès beneath. Larger calyx-lobe .18" broader than the others, all gland-pubescent. Filaments thinly hairy. Flowers shortly pedicelled in my specimens (always?). Capsule glabrous narrow-oblong, grooved on two sides, .17—18" long.

3. *S. glauca*, O. Kntze.

Habit looks different from at least the upper leaves being alternate, and the lower alternate spreading bracts on the spikes far exceeding the flowers, linear-spathulate.

Found in the Darjeeling Tarai close to our area and may be found in Purneah. Fl., Fr. cs.

5. CARDANTHERA, Ham.

(Synnema, Benth.)

Herbs, often glandular hairy and aromatic or foetid. Leaves opposite, lower often pinnatifid or in water pectinate. Flowers 1—3 axillary or in whorls or spikes, the bract or bracteoles often suppressed. Sepals narrow often unequal. Corolla-tube shorter than calyx, limb 2-lipped, lobes twisted to left in bud, palate transversely plicate-rugose. Stamens didynamous, anther cells parallel, those of the posterior stamens often smaller. Capsule narrow, very many seeded. Seeds, small, ovoid, somewhat compressed glabrous or glandular-puberulous. Retinacula inconspicuous, very small and conical, not curved nor hardened.

Some species remind one strongly of Scrophulariaceæ.

1. *C. triflora*, Ham.

A glandular-hairy rather foetid herb 8—18" high with decumbent and rooting base, membranous broadly oblong-ovate crenate leaves 2—3" long somewhat decurrent on the short petiole, and purple flowers .5" long in axillary sessile 3-fld. cymes, the lateral flowers in the axils of the foliaceous bracteoles of the central flower. Capsule .25—3" long pubescent.

Swampy places, Purneah! Rice-fields, along the Grand Trunk Road (probably Manbhum) Anders! Fl., Fr. Aug.—Jan.

Lower leaves sometimes pinnatifid, glandular hairy both sides, lower sometimes pinnatifid. Calyx .3", sepals linear-subulate, gland-hairy and also villous at base. Corolla pubescent outside, shortly tubular, then ventricose; upper lip erect, inflated below the flat emarginate or shortly 2-lobed limb, pale; lower lip .35" broad, purple with darker veins, sparsely hairy within. Stamens inserted on 2 calli at base of lower lip, anther-cells mucronate at base. Ovary oblong, pubescent above.

It assumes two forms, one smaller with small orbicular or ovate crenate-serrate leaves only .5—1" long, the other much larger and coarser with oblong-ovate crenate leaves 2—3" long and membranous.

6. HYGROPHILA, Br.

Herbs. Leaves entire. Flowers sessile in heads or spikes or whorls, with bracts and bracteoles. Calyx 5-fid, teeth narrow. Corolla purple, tube ventricose at the mouth, limb deeply 2-lipped. Posterior pair of stamens sometimes smaller than the anterior or rudimentary, filaments glabrous, anthers oblong, cells equal. Ovary with hairy tip, style hairy, stigma simple linear. Capsule narrow, many-seeded. Seeds ovoid, compressed, elastically hairy when wetted on hardened curved or nearly straight acute retinacula.

A. Prostrate or ascending with small leaves and spiked flowers:—

- | | |
|--|------------------------|
| L. glabrous or puberulous. Posterior stamens rudimentary | 1. <i>polysperma</i> . |
| L. hairy. Posterior stamens with small anthers | 2. <i>serpyllum</i> . |

B. Erect herbs with narrow leaves and flowers in axillary whorls:—

- | | |
|--|--------------------------|
| 1. Glabrous or nearly so:— | |
| Bracteoles lanceolate acute. Calyx divided half-way down in flower, to base in fruit. Capsule .5—55" | 3. <i>angustifolia</i> . |
| Bracteoles oblong, obtuse. Calyx divided one-third way down in flower. Capsule .6—75" | 4. <i>quadrivalvis</i> . |
| 2. Hairy or villous. L. narrow 4—6" | 5. <i>phlomoïdes</i> . |

The first two species appear to me more distinct generically than is *Asteracantha longifolia*, which is very closely allied to *H. phlomoïdes*, and which I have only kept separate in conformity with *Nat. Pflanz. Fam.* and the Flora of Bombay.

1. *H. polysperma*, T. Anders.

A herb with creeping stems sending up erect shoots 4—6" or sometimes 12" high, every shoot terminated by a spike .5—1" long of elliptic or oblong hairy bracts and bracteoles, the upper bearing small lilac or pink flowers. Leaves at the time of flowering often few, linear-oblong, oblong or ovate, .5—8" or in the larger forms up to 1.5". Capsule linear-oblong .25—35", 20—30-seeded.

Very common and sub-gregarious in wet places in the damper districts, especially under river banks. Champaran! Purneah! Manbhūm, Balli Behar, J. D. H. Bengal (Santal Parg.), Kurzi! No doubt in other districts. Fl., Fr. Nov.—Feb.

Stems terete or somewhat angled above, closely puberulous. L. subsessile, usually tapering both ends, puberulous or glabrous, sec. n. 3—4 very fine looped. Bracts foliaceous .3" ciliate and puberulous, linear-oblong, tapering obtuse, bracteoles linear (lanceolate, F.B.I.), .2—25", pubescent, 1-nerved. Calyx .2" villous, lobes linear-subulate, 4 as long as the tube, posterior shorter. Corolla .3—32" pubescent. Two upper stamens reduced to teeth; anthers of perfect ones oblong or sagittate. Ovary oblong. Capsule exceeding the sepals, mostly pubescent towards the tip; retinacula nearly straight.

2. *H. serpyllum*, T. Anders.

A small procumbent herb not unlike *H. polysperma* in general appearance, villous at the nodes. Leaves sometimes pseudo-verticillate (from abbreviated axillary shoots) elliptic-ovate or lower broadly ovate, .6" rarely 1" long, upper lanceolate smaller, loosely pilose. Spikes dense with elliptic bracts .2—.25". Flowers .4", corolla very distinctly 2-lipped. Stamens with posterior anthers half as long as anterior. Capsule .17—.2", seeds 8—10.

Behar, Kurz! Sambalpur, Cal. Herb.! Fl. Dec.

Clarke states that the leaves of *H. serpyllum* vary very much in form and indumentum. Possibly too much importance is attached to the character of the anthers in these two species.

3. *H. angustifolia*, R. Br.

An erect or ascending rather strict herb 1—3 ft. high, glabrous below, with long narrow linear or linear-lanceolate leaves 2.5—5" long, minutely lineolate, tapering both ends, subsessile. Flowers pale purple .5" in dense axillary whorls with linear or lanceolate acute bracteoles and finely acuminate hispid-ciliate hairy-tipped sepals connate half-way in flower, divided nearly to the base in fruit, .35—.5" long. Corolla .5—.7", tube shorter than the calyx. Anthers subequal. Capsule linear .5—.55" long, somewhat compressed, 20—30-seeded.

Marshy places, Chota Nagpur, common. Singbhum! Hazaribagh, Clarke! Manbhum, Anders.! Fls. r.s.—Nov. Fr. Nov.—Dec., the old open capsules can be found in Jan.

4. *H. quadrivalvis*, Nees.

Very similar to the last but the leaves often elliptic, or somewhat obovate, bracteoles oblong obtuse, calyx in flower divided only one-third of the way down, strigillose tipped with silky hairs, often not deeply divided in fruit. Capsules erect in very dense clusters at every node, many of which are then leafless, linear .6—.7", usually stouter than in *H. salicifolia*.

Marshes, Topchanchi (on borders of Manbhum and Hazaribagh), Kurz! Many specimens from Bengal without precise locality! Possibly common, but often confused with the last. Fl., Fr. same time as the last.

Usually a rather coarse herb with 4-sided strigillose or glabrescent stems and leaves often only 1—3", hairy above. Flowers variable in size, .5—.7" long, pale purple. Capsules with 2 gland-like marks at the tip, as in other species but more pronounced.

5. *H. phlomoides*, Nees.

An erect rather stout herb 2—3 ft. high with square more or less pubescent or hairy stems, linear-oblong or lanceolate sessile pubescent leaves 3—6" long and deeply 2-lipped purple flowers .8" long in very dense villous whorls. Calyx .5", brown-hairy, teeth linear as long as the tube.

Marshes. Sikkim Tarai and Duars close to our area! Probably in Purneah. Fl. Oct.

Leaves with numerous slightly arched sec. n. as in the last two, but larger and distinctly hairy beneath, outer bracts ovate, .5". One sepal often larger than the others in fruit. Corolla-tube nearly as long as calyx, upper lip paler, shortly

2-lobed, lower broader, .25" diam., palate plicate, white with purple spots, hairy, very shortly 3-lobed. Capsule equalling the calyx, slightly compressed, 10—12-seeded.

7. ASTERACANTHA, Nees.

Herb, spinous at the nodes with narrow pseudo-whorled leaves and rather large whorled flowers with foliaceous bracts and narrow bracteoles. Calyx 4-partite, upper sepal broader. Corolla with upper 2-lobed lip and lower 3-lobed with 2 callosities on the palate. Stamens 4, anther cells parallel, glabrous, mucicous. Ovary with only 4—5 ovules in each cell. Capsule narrow compressed 4—8-seeded. Seeds hygroscopically hairy on hard retinacula.

1. *A. longifolia*, Nees. Syn. *Hygrophila spinosa*, T. Anders.; *Kanta-Kalia*, H.; *Gokhul janum*, S.

A robust, often gregarious, erect herb 2—4 ft. high with sparsely subhispidly hairy stems, whorled spines often 1" long, long willow-like leaves, and dense spiny whorls of purple lipped flowers 1.25" long. Capsule .3" linear-oblong, shorter than the sepals.

Common along ditches and in marshes, probably in all districts. Fl., Fr. Oct.—Dec.

Leaves sessile, about 6" by 6—7" or smaller, appearing whorled from the shortened axillary branchlets. Spines usually 6 in a whorl and straw-coloured, very sharp. Calyx silky, posterior sepal .75", lateral smaller, anterior 2-toothed. Corolla-tube .5—6", lower lip .5—6" broad with 3 large obtuse lobes, palate yellow with 2 orange ridges.

Sanchezia nobilis, Hook. f., is a handsome evergreen shrub with large oblong-obovate leaves 4—10" long conspicuous for the usually yellow nerves. Flowers 1.8" long in dense thyrses, yellow with long tube and short rounded lobes and with conspicuous reddish bracts. Common in the moister districts in gardens and plant-houses. Native of Ecuador.

8. HEMIGRAPHIS, Nees.

Shrubs, undershrubs or herbs with opp. toothed or sub-entire leaves, and small or moderate-sized flowers sessile in heads or spikes, rarely solitary. Heads terminal or on abbreviated lateral branchlets, with imbricate large 1-fl. bracts; bracteoles small narrow or 0. Calyx 5-partite, segments narrow. Corolla tubular-ventricose or funnel-shaped; tube long, limb sub-regular with 5 rounded lobes contorted to the left. Stamens didynamous, included or nearly so; anther-cells mucicous, bases acute. Style long with one linear and one short lobe. Ovules 3—8 in each cell. Capsule linear or linear-oblong, 6—20-seeded. Seeds compressed discoid, margined, densely hygroscopically hairy.

Leaves .5—1" long. Corolla tubular-ventricose

1. *hirta*.

Leaves 1.5—4". Corolla tubular-funnel-shaped

2. *latebrosa*.

1. *H. hirta*, T. Anders.

A small prostrate softly hirsute or villous plant with ovate crenate leaves .5—1.2" long and small few-flowered heads of pale-blue or lilac

flowers with sub-regular corolla .4—.5" diam. Capsule .3—.35" about 12-seeded.

Anderson describes it as occurring throughout Bengal in grassy places and spreading into the Gangetic plain. It should therefore occur commonly in our area. Yet the only specimens certainly collected inside the province are from Manbhum! and Monghyr, *Kew Herb.*! It is common near Calcutta and probably extends to Cuttack. Fl. March—Aug., expanded only in the early morning.

Generally grey in appearance from the numerous hairs. Leaves rather rugose, obtuse, sessile or subsessile, sec. n. 5. Bracts .5". Sepals linear, or spatulate in fruit. Corolla .5", ventricose portion nearly as long as the cylindrical. Longer filaments laxly hairy below, glabrous above.

2. *H. latebrosa*, *Nees*.

A diffuse or erect softly hairy herb attaining 12—18" in height with long-petioled coarsely toothed ovate leaves 2—4.5" long and pretty bright-blue flowers .3" diam. in capitate or subcapitate bracteate spikes. Corolla curved or nearly straight .7—.75" long. Longer filaments densely bearded by long white papillose hairs, shorter glabrous. Capsule .25—.3" "minutely patently hairy, 6-seeded" (*Clarke*).

Common, chiefly in rocky places under shade. Monghyr Hills, *Cal. Herb.*! Singbhum, Ilazaribagh and Palamau, common in rocky jungles! Santal Parg. I Puri! Sambalpur! Therefore probably the whole of the Central and Southern areas. Fl. Fr. Nov.—Jan.

Stems 4-angled, patently hairy. Leaves crenate-dentate acuminate, base suddenly contracted on the petiole, sec. n. about 6 distinct but fine. Petiole 1—2.5". Small axillary branchlets bearing terminal heads often have very small leaves. Bracts ovate or elliptic, petioled, about .3" but variable in size. Sepals .2—.25", linear-lanceolate, hairy, pale. Corolla-tube sometimes yellow, lobes of limb rounded, always pure blue.

Most of the Chota Nagpur specimens apparently belong to *Clarke's* variety *rupestris*, described as "more pubescent, often viscid aromatic, heads denser." It is said to be more rigid and growing in drier places.

9. RUELLIA, *L.*

Herbs or undershrubs with opposite, rarely 3-nate, entire or undulate, lineolate leaves and usually large, solitary, clustered (or cymose in some exotics) flowers subtended (Sect. *Dipteracanthus*) by two large foliaceous bracteoles (or bracteoles narrow in some exotic species), bracts 0 (in indigenous species). Calyx 5-fid or -partite with narrow segments. Corolla tubular-ventricose with the narrow portion of tube short or very long, lobes sub-equal rounded. Stamens didynamous, anthers subequal short with 2 oblong mucicous glabrous cells. Ovary glabrous, style long, hairy; stigma simple, the posterior lobe being suppressed or nearly so in indigenous species. Ovules 3—10 in each cell. Capsule clavate with solid base (Sect. *Dipteracanthus*), or linear and seed-bearing nearly the whole length. Seeds large, thinly discoid, marginate, densely hygroscopically hairy, on strong hooked retinacula.

The Indian species all belong to Sect. *Dipteracanthus*; some exotic species are, however, found in gardens.

I. Sect. *Dipteracanthus*. Bracteoles large foliaceous. Capsule

calvate with solid base:—

A. Creeping or rambling. Fls. .9—1"

1. *prostrata*.

B. Erect, or sometimes stemless:—

1. Corolla 1—1.5", white with pink or purple marks

2. *cernua*.

2. Corolla over 1·5", colour uniform:—

- | | |
|---|--------------------------|
| L. ell. or oblong rounded, petiole short. Fls. white | 3. <i>suffruticosa</i> . |
| L. ell. or lanceolate long acuminate, petiole slender | 4. <i>Beddomei</i> . |

II. Sect. *Eruellia* (*Cryphiacanthus*, Nees). Bracteoles narrow, capsule linear, seed-bearing throughout:—

- | | |
|---|----------------------|
| Root tuberous. Fls. cymose, large, blue. Exotic | 5. <i>tuberosa</i> . |
|---|----------------------|

1. *R. prostrata*, Poir.

Creeping and rooting at the nodes, scarcely suffruticose, or rambling (see var.) with ovate leaves mostly ½—1·5" long and axillary solitary pretty purple or white flowers ½—¾" diam. and about ⅑—1" long. Capsule ⅘" hairy pubescent or puberulous, empty basal portion about ⅓". Seeds over 12, ⅓" diam.

In moist shady places, banks, etc., throughout the area. Darbhanga! Purneah! Monghyr, *Cal. Herb.*! Chota Nagpur, all districts! Orissa! Kalahandi! Fl., Fr. chiefly r.s. and c.s.

Stems pubescent or nearly glabrous except at the nodes. L. obtuse or acute more or less hispid or hairy, especially on the 5—7 sec. n. beneath. Petiole short or lower ½". Flowers caducous sessile or subsessile with bracteoles very short-petioled like leaves ⅓—4" long. Sepals mostly ¼" in flower, sometimes ⅒ in fruit, subulate-setaceous, hairy. Corolla caducous, falling before mid-day, narrowly tubular for ¼", then ventricose. Ovary downy.

Var. *dejecta*, Clarke.

Rambling and clambering among bushes. Branches with very long internodes, sparsely pilose or upper side tomentose. L. 1—2", ovate or elliptic, acute, base rounded or narrowed into the ⅒—½" petiole, hairy.

Very common in the open scrub jungles of Puri! Fl. April—May (as well probably at other times).

2. *R. cernua*, Roxb.

Roxburgh's description is as follows: Shrubby, erect, polished. Leaves drooping, petioled, ovate-lanceolate, acuminate. Flowers axillary, subsessile. Bracts petioled. Capsule clavate, many-seeded.

Reared in the Botanic Garden at Calcutta from seed sent by *Dr. Buchanan* from Mysore, where the plant is indigenous. Flowering time in Bengal the rainy season.

Branches opposite, alternately smaller, suberect, smooth, obscurely 4-sided, the whole plant about 3 ft. high. L. alternately smaller, slightly repand recurved, smooth, size very various, the larger often from 2—4" long. Flowers axillary, from 1—3, subsessile, small, pale pink, their insertions surrounded with some opposite pairs of small floral leaves and lanceolate petioled bracts. Corolla campanulate, lower lip larger and more deeply coloured, the other four equal. Stigma clavate, curved.

Anderson, followed by *Clarke* in the *F.B.I.*, and also by *Prain*, identifies the plant described by me under *R. Beddomei* with the above. There is a good plate of *Roxburgh's* plant in his unpublished drawings, and the identification either by his description or the plate appears to me untenable, as I have before observed in my *Fl. Ch. Nag.* In the drawing further points of difference appear: the bracteoles are shown as toothed, tapering into a broad petiole, the flowers only ⅗" long, corolla under ½" diam., white with pink markings. The *Parasnath* plant never varies in this connection, and when fading to white it always does so uniformly without traces of pink or other markings. The specimen identified by *Anderson* with *Roxburgh's R. cernua* is in the Calcutta Herb. Although the shape of the leaves is similar, they are densely hairy when young and somewhat hairy when old.

3. *R. suffruticosa*, Roxb. Brunaia, Charpatu, K.; Chaulia, Ranuran, S.

A perennial herb, scarcely suffruticose, with many long slender tuberous roots. Stems 0—12", rarely more, high. Both stem and leaves with many white hairs. Leaves oblong or broadly elliptic, rounded or obtuse at the tip, 2—5". Flowers pale-purple or usually white 2—2.25" long and 1—1.25" diam., opening at night and soon falling in the morning. Capsule .6—.75" long with 12—14 thinly discoid marginate seeds.

Very common in the hills of the Central Area and Southern Area. Santal Parg. Chota Nagpur, all districts! Nilgiri and Mayurbhanj, common, and probably common throughout Orissa! As it occurs also in Oudh and the Central Provinces it will probably be found in Champaran and the whole of the western districts. Fl. May—Sept. Fr. Aug.—Oct. Dies down to the root in the cold season.

Often forming a rosette with scarcely any stem after jungle fires in May, the stem usually elongating in the rainy season but not usually over 8" (up to 2 ft., Clarke). Whole plant very hairy. L. often only 1.5—2" long when first flowering! Petiole .12—5". Peduncles shorter or longer than the leaves, the two foliaceous bracteoles at top .6—8" long, obtuse, sessile. Sepals 2—2.5". Narrow part of corolla-tube .7—1", lobes .3—4" diam., rounded.

It is one of the herbs known collectively as *Ili-ranu* (rice-beer medicine) by the Kols, by whom it is used in the process of fermentation of rice-beer (Ili, K.; Handi, Handia, S., Uran). The root is the part used; it is boiled and then mixed with *chunam*. Campbell says that the root is used in gonorrhœa, syphilis and renal affections.

4. *R. Beddomei*, Clarke.

A strict erect herb, scarcely suffruticose, 1—3 ft. high from a slender woody stock, with obtusely 4-gonous and grooved, smooth or minutely strigose stems, elliptic to lanceolate mostly long-acuminate, thinly hairy, leaves 2—5.5" long and light purple sessile flowers 2—3.3" long with petioled, elliptic or ovate, acute or acuminate leafy bracteoles. Capsule .7—1" clavate smooth. Seeds usually 4 (up to 8) in each cell, white-margined with dense felted hairs.

Common in the forests under light or moderately dense shade. Chota Nagpur, all districts, ascends to 3000 ft.! Sambalpur! Probably throughout the Orissa Mnts. Fl. Aug.—Dec. Fr. Nov.—Dec.

Stem sometimes sparsely hairy above. Leaves densely lineolate, base rather suddenly narrowed to and somewhat decurrent on the .5—1.2" long slender petiole, sec. n. 6—7 curved forward within the margin, raised beneath and united by numerous tertiaries. Bracteoles about 1" long including the petiole which is half to three-fourths as long as blade, sometimes lanceolate. Sepals nearly free, .6—7", with setaceous tips as long as the blade, strongly ciliate and lineolate, with strong midrib adpressedly hairy. Corolla pubescent except on the lobes within, narrow part of tube very slender and up to 1.5", limb up to 1.75" diam. with orbicular-oblong lobes.

5. *R. tuberosa*, L. Syn. *Cryphiacanthus barbadensis*, Nees.

About 1 ft. high, much branched from a rootstock of numerous fleshy tubers, nearly or quite glabrous. Leaves elliptic-obovate 2—4" often

undulate-crenate, shortly petioled. Flowers deep blue, handsome, in axillary and terminal cymes. Bracts and bracteoles narrow. Calyx .5", glandular, cut to base into subulate filiform tipped segments. Capsule linear .8".

Frequent in gardens and often spreading naturally. Native of tropical America. A very pretty plant but the flowers all fall off before mid-day.

10. ECHINACANTHUS, *Nees*.

Herbs or undershrubs with opp. sub-entire or toothed leaves. Flowers often showy, cymose, cymes axillary and forming a terminal panicle, bracts small, linear, bracteoles small or 0, pedicels short or 0. Sepals 5, long, linear. Corolla tubular-ventricose, narrow tubular portion about equalling the widened part, lobes 5 subequal, rounded. St. didynamous included; anther cells 2 oblong parallel, base spurred or mucous. Ovary with linear style and simple stigma. Ovules 6—8 in each cell. Capsule oblong or linear, 8—16-seeded, nearly from the base. Retinacula normal. Seeds compressed, discoid, densely hygroscopically hairy.

1. *E. attenuatus*, *Nees*.

A pretty perennial herb 1—2.5 ft., glandular-pubescent above, with subtuberous roots and with (or without when in flower and fruit) large radical leaves 6—9" long, cauline gradually smaller upwards and passing into the glandular-pubescent linear bracts of the inflorescence. Flowers violet 1.25" long in axillary paniced lateral spreading spiciform cymes, on the rhachis of which they stand vertically. Capsule .65—.75", narrowly oblong or linear-lanceolate with a solid base under .1" long, glabrous, 4-valved.

Common in Sal forest on white loam in the Northern Champaran forests! Fl. Nov.—Dec.

Stems glabrescent below. Leaves elliptic oblong below to lanceolate or oblanceolate above, glabrous, entire or mostly shallowly dentate or sinuate acute, base narrowed into the winged petiole; sec. n. about 12 looping at their ends. Spikes few-flowered, upper forming a terminal panicle. Sepals .5", erect. Corolla with slender part of tube included, venose, lobes ovate obtuse. Filaments and anthers hairy, cells tailed. Ovules 6—7 on each placenta.

11. DYSCHORISTE, *Nees*.

(*Calophanes*, *D. Don*.)

Perennial herbs or undershrubs. Leaves opposite. Flowers in axillary clusters or contracted cymes, bracteoles small. Calyx lobes 5 subequal, narrow. Corolla obscurely 2-lipped, lobes spreading, twisted to left in bud. Stamens didynamous, anthers similar, cells parallel, minutely mucronate or spurred, pollen globose, ribbed. Ovary glabrous, ovules 2 in each cell. Stigma linear, recurved, upper lobe rudimentary. Capsule oblong, base contracted, solid. Seeds 4 orbicular, much compressed, with hygroscopic hairs, retinacula strong.

Calyx .5—6". Corolla .75—8", blue
Calyx .25—3". Corolla only slightly longer, purple

1. *vagans*.
2. *depressa*.

1. *D. vagans*, O. Kuntze. Syn. *Calophanes vagans*, Wight.

A branched sub-diffuse undershrub 1—3 ft. with minutely strigose obtusely 4-angular stems, lanceolate or ovate acute or sub-acuminate leaves 1.5—3" long narrowed into a short petiole, and pretty blue-lipped flowers in axillary and subterminal clusters.

In the Central Provinces frequent up to our borders (!), which I believe it crosses in Sambalpur, though I can find no Sambalpur specimens. Fl., Fr. Nov.—Dec.

Leaves pale beneath and glabrous or puberulous, minutely hispidulous above, sec. n. 6—8 fine but distinct, running close up to margin. Clusters or cymes glandular-pubescent, often few-fl., bract and bracteoles linear, not half as long as calyx. Calyx .5" sub-2-lipped with subequal filiform-tipped teeth and stalked glands. Corolla .7—8" or tube not much exceeding the calyx, ventricose above with the ventricose part keeled beneath and transversely rugose, lobes subequal, oblong, truncate or slightly retuse, palate purple-bullate between the ribs, yellow in the tube or throat. Filaments and anthers shortly hairy, anther-lobes all spurred. Style simple, gland-hairy. Ovary oblong.

2. *D. depressa*, Nees. Syn. *Calophanes Nagchana*, Nees.

Stems somewhat woody at the base, numerous, often prostrate, 4-angular above, minutely pubescent. Leaves .5—1.5" obovate or elliptic, densely minutely lineolate above, attenuate at base into a 0—2" long petiole, sec. n. 3—4. Flowers much smaller than in *D. vagans* .3—4" long, clustered axillary or on very short axillary peduncles with a pair of small leaves, pedicels hardly any. Calyx .3—3.5" minutely strigillose or lineolate, sepals connate about halfway then produced into long setaceous tips of which midrib is decurrent on the tube. Corolla somewhat shorter than or only very slightly exceeding the calyx, purplish, tube about .15", lobes oblong rounded. Stamens didynamous, one short and one long filament from each pair united at the base into a flattened pubescent plate, anther-cells spurred. Capsule .34" long.

Rare in our area. Behar, J. D. H.! Patna, Ham. (Wall. No. 2396)! Fl. March.

12. PETALIDIUM, Nees.

Shrubs of undershrubs with entire or somewhat toothed leaves and large or mod.-sized (white, in our species) shortly pedicelled flowers axillary or in contracted spikes (or cymes?)* often crowded on abbreviated lateral branchlets, sometimes spikes (or cymes?) reduced to single flowers; bracts narrow or 0, bracteoles large ovate reticulate, at first foliaceous ultimately scarious. Calyx 5-partite segments subequal, very narrow. Corolla straight or curved, tubular-ventricose, narrow part of the tube short or (not in our species) longer than the ventricose portion; lobes 5 subequal. Stamens didynamous, anther cells 2 parallel, spurred or mucous; pollen ellipsoid, few-ribbed, opercula 3 with usually a tubercle above and below each. Ovules 2 in each ovary-cell. Style long, stigma-lobes 2 unequal. Capsule clavate, compressed. Seeds discoid, hygroscopically hairy, on placenta which separate elastically from the bottom of the capsule.

* The inflorescence is described usually as cymose, but it is, I think, always racemose.

1. *P. barlerioides*, Nees. Malpi, Or.; Divari, Gond.

A straggling shrub 2—5 ft. high with straw-coloured twigs and ovate, toothed or crenate acuminate puberulous leaves, often very few at the time of flowering, 2—4" long or up to 6" by 4" with the base suddenly decurrent on the long petiole. Flowers white 1·3—1·5" long sub-solitary or in opposite decussate pairs in dense or ubcapitate spikes (abbreviated lateral branches) with large green-veined bracteoles 7—8" long, scarious in fruit. Capsule 5—6" glabrous, clavate, cuspidate. Seeds "usually 2" (Cooke).

Common in the Central and Southern areas, especially in rocky jungles. North Champaran, rare! Singbhum, common! Hazaribagh (common in Koderma and on Parasnath)! Palamau! Santal Parg.! Rocky ghats, Narsingpur! Mals of Puri! Angul! Sambalpur! Patna State, Grieval! Kalahandi, Cooper! Fl. Feb.—April. Fr. April—May. Deciduous in the h.s. or nearly so.

Young shoots and leaves pubescent. Leaves with 6—8 sec. n. and fine cross tertiaries. Petiole about 2" in larger leaves. Calyx very glandular hairy 4—5". Corolla with narrow tube 3" long and very venose ventricose portion, strongly ribbed lower lip and fulvous hairs within. Anthers with long spurs.

13. STROBILANTHES, Blume.

Shrubs, undershrubs or herbs with opp. often unequal, toothed or subentire usually lineolate leaves. Flowers usually moderate-sized, spicate, capitate or paniced. Bracts and bracteoles large, small or 0. Calyx deeply 5-fid, segments narrow, usually subequal. Corolla tubular-ventricose, straight or curved, with 5 rounded subequal lobes contorted in bud. Stamens didynamous or (in one section) 2; anthers oblong, 2-celled, mucous. Disc small or prominent. Style linear, stigma of one linear-lanceolate lobe, the other obsolete. Ovules 2 in each cell. Capsule 4- or 2-seeded, placentæ rarely rising elastically from the base. Seeds much compressed, glabrous or hygroscopically hairy, on strong curved retinacula.

The genus is remarkable in several species which only flower periodically and more or less gregariously and then die. The nervation is fairly constant, consisting of many slightly arched secondary nerves running obliquely nearly to the margin and then turned up parallel to it for a short distance; the sec. n. are united by numerous scalariform tertiaries a good deal fainter than the secondaries.

Strobilanthes is a large genus not well represented in our area, but at least two species occur, one on the mountains of Mayurbhanj and one in the Ramnagar Hills, which I have not seen in flower and have been unable to identify. Several other species also occur in cultivation. One of these, *S. Dyerianus*, is remarkable for the purple and metallic bronze tints of the foliage.

A. Flowers in dense spikes:—

Fls. yellow. L. hard, tapering at base, ell. or obovate 1. *scaber*.
Fls. blue. L. soft, auricled at the base 2. *auriculatus*.

B. Flowers not seen. Determination uncertain:—

L. softly hairy, ovate, 3—6" long. Petiole 1—1·5" hairy 3. *jeyporensis* ?
L. glabrous, narrowly lanceolate, 3—5·5". Petiole 5—1" 4. ?

1. *S. scaber*, Nees (in part).

A somewhat harsh herb 1—3 ft. high with creeping rootstock, hispid or strigose stems, opposite rather stiff or hard entire or crenate elliptic or obovate scabrid leaves 2·5—6" long, and bracteate capitate spikes of yellow tubular flowers 1" long and about 6—7" diam. Spikes often

in short terminal panicles. Capsule .3" (nearly .5", *Clarke*), downy, usually 4-seeded.

Often sub-gregarious under shade and in wet places, along watercourses, etc. Purneah, probably (it occurs close by in Maldah!); Santal Parg.† Singbhum! Puri, very common in the Mals! Sometimes cultivated. Fl., Fr. Jan.—April.

Not very characteristic of the genus. Leaves hispid or scabrous beneath, lineolate with short raphtides above, rather grey above and glaucous beneath, tapering both ends; sec. n. 6—8, tertiaries rather reticulate. Petiole .3—8". Spikes 1—1.5" on hairy peduncles, lanceolate bracts .7—1.25" long, remarkable for their long tapering but rather blunt tips, very hairy. Bracteoles linear, .5". Sepals linear, .5", with long often glandular hairs. Corolla narrowly tubular for .25" then ventricose, villous within. Filaments hairy. Seeds discoid with broad margins and long silky hairs, "with very large glabrous areoles," *Clarke*. I have found the capsule rarely 6-seeded!

2. *S. auriculatus*, Nees. Hutid, K.; Gada Kalha, S.; Marmari-dara, Gond.

A shrub 2—6 ft. high, often gregarious, with sessile leaves auricled at the base, those in a pair usually unequal, the larger ones 5—10" long, soft, hairy, crenate. Flowers about 1" long, blue in axillary and terminal linear spikes 1—3" long with densely imbricate obovate obtuse bracts with recurved margins densely covered with stalked glands beneath. Corolla 1" curved so that the mouth is sub-lateral, the narrow tubular portion only .25—3" long then ventricose. Capsule .3" glabrous.

Frequent under shade in the forests and often forming a dense undergrowth under Sal in Singbhum. N. Champaran! Gaya Ghats! Jaspur, rocky hill tops, Wood: Singbhum, often gregarious! Manbhum, very common on the banks of nalas, *Campbell*! Hazaribagh! No notes of it from Orissa, though it surely occurs there. Fl. Nov.—Feb. Fr. March—April. But only flowers periodically, the periods about six years. I have records of a general flowering in 1898 and 1911, but an odd plant or so may be found in flower most years, especially near the six-year period. It is exceedingly beautiful when in full flower, colouring the shades of the forest with a sheet of blue, and it is sometimes cultivated in plant-houses.

Branches nearly glabrous, angled, angles obtuse below, acute above. Leaves often oblique or slightly falcate, lanceolate or oblanceolate (oblong or ovate, *Clarke*), acuminate, narrowed at the base and again slightly widened at the auricle, thinly hairy above and puberulous on the nerves beneath, sec. n. 9—12. Spikes very numerous, terminating short axillary branchlets. Bracts .25—3", broader than long, densely hoary pubescent or (Var. *Edgeworthiana*) with long spreading white cilia. Bracteoles 0.

The variety *Edgeworthiana* is more common in Chota Nagpur than the type. The sepals have also long white cilia at the tip.

A form with prettily white-variegated leaves is often met with (Koderma, etc.).

3. *S. jeyporensis*, Bedd.?

A gregarious shrub 4—6 ft. high with large softly hairy leaves often with a purple tinge. Flowers not seen.

Mayurbhanj, Simlipahar Mnts., elev. 4000 ft.!

Mr. *Gamble* has kindly matched this plants with a similar one collected by him on Mahendragiri, 4000 ft. (Ganjam), and identifies it as *S. jeyporensis*. The branchlets in our specimens are angled and nearly glabrous. Leaves 3—6" long, ovate or ell.-ovate, hairy and densely lineolate above, paler and hairy on the nerves beneath, crenate or crenulate-dentate, scarcely acuminate, rounded at base or suddenly shortly decurrent on petiole, sec. n. 9—12 distinct both sides, rather strong, running nearly to margin then upcurved for some distance parallel to it,

tertiary nerves numerous close parallel scalariform. Petiole of larger leaves 1—1.5", sparsely villous.

According to *Clarke* in *F.B.I.* the flowers of *S. jeyparensis* are white, in linear-oblong viscidly patently hairy spikes with lanceolate acuminate recurved bracts .7" long. Calyx .5" and more with segments linear from a short lanceolate base, patently hairy. Corolla nearly straight with ventricose portion of the tube much longer than the cylindrical. Ovary 4-ovulate in *Beddome's* figure.

4. *S. sp.?*

A shrub 3—4 ft. high. Branchlets glabrous 4-grooved. Leaves lanceolate tapering both ends 3.5—5.5" by .8—1.3", acuminate entire glabrous except on midrib beneath which is minutely pubescent, sec. n. 9—10 oblique nearly to margin then running parallel within it for some distance, tertiaries sub-scalariform not very strong. Petioles .5—1" slender.

Ramnagar Hills! Probably flowers in the r.s.

14. DÆDALACANTHUS, *T. Anders.*

(*Eranthemum*, *L.*, in *Nat. Pflanz. Fam.*)

Shrubs or undershrubs, more rarely herbs with usually 4-angled branches opp. entire or obscurely toothed lineolate leaves and usually showy flowers in spikes, heads or corymbs. Bracts usually large, bracteoles narrow, shorter than the calyx. Calyx lobes narrow. Corolla with slender tube, widened only near the mouth; lobes obovate, rounded, twisted to left in bud. Stamens 2 glabrous. Anthers narrowly oblong, 2-celled, exserted or subincluded; pollen spherical, honeycombed. Style long, glabrous or sparsely pubescent, stigma simple, linear. Capsule clavate, with solid terete base. Seeds compressed discoid, hygroscopically hairy on acute retinacula.

Lindau includes this genus in *Eranthemum*, which it very closely resembles, and can only be distinguished by the twisted (not imbricate) corolla lobes in bud, and usually by the bracts much exceeding the calyx.

I. Bracts imbricating, foliaceous, often white, very nervose:—

Bracts .5—.75", cuspidate. Flowers blue 1. *nervosus*.
Bracts .6—1", long-acuminate. Flowers lilac or purple 2. *purpurascens*.

II. Bracts rather distant, linear or lanceolate-linear:—

Bracts .5—.6". Flowers blue-purple or slate-coloured 3. *montanus*.

Several species (including *nervosus*) are cultivated. One of these, *D. splendens*, *T. Anders.*, with brick-red curved flowers, is common in the lower Himalaya close to our area.

1. *D. nervosus*, *T. Anders.*

A handsome shrub 2—6 ft. high with 4-angled puberulous branches, large soft deep-green leaves 5—9" long, elliptic to ovate, acuminate, with tapering base. Flowers pure blue 1—1.25" long and .75" diam. in ternately sub-corymbosely paniced terminal spikes with mostly white, green-veined imbricating bracts about .5—.75" long, mostly oblong-obovate obtuse with a sharp cusp. Capsule .6" long, glabrous, with short point.

Forests of N. Champaran, under shade! Singbhum, in ravines, not uncommon! Mountains of Mayurbhanj, under shade! Fl. Jan.—March. Fr. April—May.

Leaves sometimes obscurely crenate-dentate, with a curly pubescence on the strong oblique sec. n. when young, sec. n. 7—12. Petiole .5—1.5". Spikes 1—3" long. Bracteoles and calyx scarious, .25—3" long, minutely pubescent. Corolla-lobes .25—3", broadly elliptic. Anthers exerted.

2. *D. purpurascens*, T. Anders. Gulsham, H.

An undershrub 2—4 ft. high with 4-angled stems and minutely pubescent branches, large elliptic or ovate acuminate leaves up to 7" by 4.5" with the base decurrent on the petiole. Flowers lilac or rose-purple 1.25—2" usually in numerous dense long-peduncled axillary spikes or terminal spikes ternate but not in corymbs. Bracts close ovate or rhomboid tapering into a long acumen, usually pale, very prominently veined. Capsule .5—7".

In hilly tracts throughout the area from the Monghyr hills southwards! Chota Nagpur, common in the valleys but does not demand such dense shade and moisture as the last species! Angul! Sambalpur! Kalahandi, Cooper! Fl., Fr. Jan.—June.

Leaves glabrous or somewhat pubescent beneath, closely lineolate, sometimes distinctly crenate-dentate, usually sub-entire, sec. n. 6—9 rather strong, arched. Petiole sometimes hardly any in upper, up to 1.5" in lower leaves. Terminal peduncles often 3—4" long. Spikes 1.5—3". Bracts usually pubescent beneath and ciliate, but an eciliate variety occurs, lower sometimes interrupted and 1.5" long but usually all imbricate, often whitish between the green nerves. Calyx .25". Corolla-tube pubescent, anthers sub-included.

3. *D. montanus*, T. Anders.

An undershrub 2—3 ft. high with 4-angular branches usually closely puberulous and glandular upwards (white-hairy, Clarke). Leaves broadly ovate or ovate, shortly acuminate, 2—5" long, decurrent on the petiole from a broad base, minutely pubescent on the nerves beneath. Flowers blue-purple or often almost slate-coloured, in numerous linear spikes 3—4" long, solitary lateral and frequently in terminal panicles. Whole inflorescence densely covered with stalked viscid glands with a strong aromatic smell. Bracts linear or linear-lanceolate .5—6", bracteoles linear about half as long. Corolla-tube 1.2" long, limb 1" diam. Capsule .5—1". Seeds 1" long, round-elliptic, brown, margined.

Chota Nagpur, rare. Tongo (Ranchi), Bresser! Puri jungles! Narsingpur! Fl., Fr. Oct.—March.

Easily distinguished from the other wild species by the very narrow laxer spikes and bracts and the aromatic glands. Clarke (F.B.I.) states that it is very variable.

15. PHAYLOPSIS, Willd.

Micranthus, Wendl.

Perennial herbs with opp. entire or obscurely crenate leaves and small flowers in dense terminal secund spikes consisting of pairs of imbricate bracts with a sessile cyme or cluster of 3—4 flowers between each pair; bracteoles 0. Sepals 5, one large ovate, nerved; the others smaller, narrow. Corolla with slender tube, lobes 5 slightly unequal, rounded, contorted in bud. Stamens didynamous, anther-cells 2 parallel shortly oblong, minutely mucronate at base. Style long hairy, upper lobe of stigma small or rudimentary. Ovules 2 in each cell. Capsule clavate, compressed parallel to the septum. Seeds discoid,

hygroscopically hairy; placentæ separating elastically from the base of the capsule.

1. *P. parviflora*, Willd. Syn. *M. oppositifolius*, Wendl.

Herbaceous undershrub with somewhat creeping slender rootstock and ascending angled stems 1—3 ft. high, sometimes prostrate, divaricately branched and thickened at the nodes, whole plant somewhat hairy. Leaves in unequal pairs, elliptic or ovate acuminate, larger 3·5 by 1·5", thinly hairy and lineolate, tapering into a very slender petiole. Spikes 5—2", very glandular-hairy bracts in unequal pairs, one usually like an ordinary foliage leaf larger about 1·5" and smaller 5—6", the other or sometimes both distinctly bractiform broadly cordate 5" broad becoming scarious in fruit; smaller sometimes only 2". Flowers 3—4 together. Larger sepal leaf-like reticulate elliptic ovate 3". Corolla white 3". Capsule 2", 4-seeded. Seeds 06—08" diam.

Only in the damper districts. Purneah (probably; it occurs in Rajshaye alongside)! Angul, in ravines! Fl. Dec.—Jan. Fr. Feb.—March.

16. BARLERIA, L.

Shrubs or herbs, sometimes spinescent, with opp. entire leaves and showy sessile flowers usually in spikes, rarely solitary. Bracts and bracteoles large, small or 0. Sepals 4 in decussate pairs, outer pair very much the larger, anterior sepal often 2-fid. Corolla with elongate tube, funnel-shaped upwards; lobes 5 subequal, imbricate in bud. Stamens 2 perfect, 2 rudimentary and often a rudimentary 5th; anthers of perfect stamens oblong 2-celled. Disc large, often cupular. Style long, shortly 2-fid or sub-entire. Ovules 2 in each cell. Capsule ovoid or oblong, 2- or 4-seeded below the middle. Seeds compressed, ovate with silky adpressed hairs.

I. Spinescent. Flowers yellow:—

Bracts linear or linear-oblong, spine-tipped 1. *prionitis*.
Bracts sub-orbicular, closely imbricate, mucronate 2. *lupulina*.

II. Unarmed. Flowers blue, rose or white:—

A. Corolla-tube under 2" long, funnel-shaped above:—

1. Spikes dense, secund with imbricate oblong or elliptic bracteoles 3. *strigosa*.

2. Spikes often few-fid., not secund. Bracteoles linear:—

a. Corolla 2". Outer sepals ovate, entire 4. *montana*.

b. Corolla under 2". Outer sepals spinulose-dentate:—

Undershrub. Proper bracts 0. Leaves subsessile 5. *cristata*.

Shrub. Proper bracts linear. L. with petiole 1—3" 6. *dichotoma*.

B. Corolla-tube 2—3" long, slender 7. *longiflora*.

1. *B. prionitis*, L. Kanta-phul, S.; Kanta-jati, Beng.; Daskerenta, Or.

A thorny and prickly undershrub 2—5 ft. high with elliptic, often spine-tipped leaves 1·5—4" long and yellow flowers, one to three together in the axils and in terminal spikes with elliptic or linear-oblong spine-tipped bracts 5—1" long, bracteoles converted into linear-lanceolate spines (very small bristles or 0, *Clarke*). Sepals 4" spine-tipped

(acuminate, *Clarke*), outer ell.-oblong, inner linear. Capsule .5—7", with a solid beak. Seed one only, near the base of each cell.

Not common and doubtfully indigenous in the Northern and Central Areas, more frequent in the Southern Area. Monghyr Hills, *Kurz*! Gangpur, near the Brahmini River! Santal Parg., near villages! Manbhun, near villages! Puri, frequent, on rocky ground near the Chilka Lake! Sambalpur, *Griff.*! Often seen in gardens.

Shoots and young leaves pubescent and strigose. Leaves sometimes 2" broad in vigorous plants; in dry situations these are deciduous and those on the shoots are usually oblong-lanceolate and the whole plant dwarfer and more prickly with flowers chiefly axillary (as described for *B. cuspidata*, *Heyne*), lower leaves with petioles .5—1" or those on the secondary shoots sessile, mature sometimes strigose on the nerves, minutely punctulate both sides, obscurely lineolate. Corolla 1—1.5", pubescent outside (glabrous or puberulous, *Clarke*).

True thorns occur in this plant, being metamorphosed axillary shoots or inflorescences with decussate spines instead of leaves or bracts. Descriptions by different authors of the bracts, bracteoles and sepals vary widely, but these seem to depend much on the luxuriance and position in the inflorescence: a bract may bear a single flower or a small inflorescence, and sometimes a bracteole, even, will bear a fine axillary thorn.

2. *B. lupulina*, *Lindl.*

A thorny shrub 2—4 ft. high with glossy linear or lanceolate mucronate red-veined leaves 4—5" long and yellow flowers in dense strobili-form spikes with imbricate suborbicular mucronate bracts which are usually coloured brown.

Often grown in gardens, where, if closely clipped, it forms a small hedge or edging. Fl. most of the year.

3. *B. strigosa*, *Willd.* Raila-baha, *S.*; Dasi, *Beng.*; Banmalli, *Or.*

An undershrub 2—4 ft. high with large ovate acuminate leaves 4—8" long decurrent on the petiole and large handsome azure blue flowers 2" long and 1.3" wide in dense bracteolate secund spikes. Two larger sepals imbricate in a row on the upper side of the spike and the bracteoles in two lateral rows. Capsule .75", 4-seeded.

In moist shady places. Probably in all the forest districts. Purneah! Gaya Ghats! Singbhum! Bonai! Puri, *Lace*! Sambalpur! Kalahandi! Fl. Sept.—Nov. Fr. Feb.—May.

Branches fulvous-strigose. Leaves up to 2—5" in width, acute or acuminate, strigose on the nerves beneath, lineolate above. Petiole 0—2" long. Spikes 1—3". Bracteoles often recurved .4—7" lanceolate or ovate-lanceolate. Outer sepals ciliate 1—1.2". Corolla 2-lipped, lobes .6—75".

4. *B. montana*, *Nees.*

A handsome undershrub 3—4 ft. high with long erect branches from the root, ovate-lanceolate or lanceolate sub-acuminate leaves 5—6" long below, smaller upwards, glabrous, pale-glaucous beneath, sessile or very shortly petioled. Flowers rose-coloured, axillary and in dense terminal spikes 3—8" long with foliaceous bracts and linear bracteoles .25—1" long. Outer sepals .75—1.2", ovate entire, glabrous or nearly so. Corolla nearly 2" long and 1.5" broad. Capsule 1". Seeds 4, with wavy silky yellowish hair, .25" diam.

Along valleys and shady sides of hills. Rare in our area. Behar, *Kurz*! Probably from the western hills. My own specimens are from the Central Provinces. Fl. Oct.—Nov. Fr. Jan.

5. *B. cristata*, L. Syn. *B. ciliata*, Roxb.; Jati, Beng.; Raila baha, S.; Ban-siriali (Bonai); Ban-patoli, Or.

An erect or diffuse undershrub 1—3 ft. high with elliptic to oblong-lanceolate leaves 2—5·5" long and bright-rose-coloured or sometimes white flowers usually borne in great profusion, solitary or paired in the leaf axils or forming dense capitate spikes on the branchlets. Bracts foliaceous or 0. Bracteoles ·5", linear or linear-oblong shorter than or equalling the large elliptic or rhomboid shortly pectinately-toothed outer sepals, which are ·75—1" long and strongly nerved. Corolla-tube 1·5" long, sometimes limb sub-2-lipped, the upper lip with 4 lobes, the lower with one ·5—·75" long. Capsule ·5—·6", glabrous shining compressed, without a solid beak.

Hills of N. Champaran! Gaya Ghats! Santal Parg.! Very common throughout Chota Nagpur on rocky hills! Bonai, Cooper! Puri, on the dryer hills! Sambalpur! Kalahandi. It is often cultivated in gardens. Fl. Sept.—Nov. Fr. Oct.—Jan.

Stems sub-terete strigose. L. sub-sessile, sub-acuminate both ends, thinly strigose on the nerves, both sides sometimes also with fulvous hairs, sec. n. 4—6. Bracts (leaves) and bracteoles often deciduous in fruit, bracteoles about ·5" or sometimes ·55—·7" in the same plant, strigosely-hairy. Sepals scarious in ripe fruit, outer very venose, the spinulose teeth tipped by a hair, inner very small linear. Imperfect stamens 2. Seeds 2 in each cell, one at base and one near middle, sub-orbicular, ·15" diam.

The colour of the flowers is quite different to that of the Himalayan plant, which has purple-blue corolla.

A very variable plant. The Linnean type is rather fragmentary. It has ell-ovate or oblong leaves only 2" long (but only the upper ones are present), hairy-pubescent beneath, acute from an obtuse tip or shortly cuspidate. Bracts long-spinose-ciliate, hairy. Fls. 1·5", apparently blue.

Var. *albida*. Stems and leaves beneath white. L. narrow oblong or oblong-lanceolate, more hairy and more lineolate, base obtuse, petiole very short. Fla. mostly 2 to each bract. Corolla pure white glandular-pubescent.

Neterhat. Elev. 3000 ft.! Fl. Oct.

6. *B. dichotoma*, Roxb.?

A shrub 4—6 ft. high with strigose and pubescent branches more distinctly quadrilateral than in the last species. Leaves oblong, tapering somewhat at base and acuminate, 3—5" long, setulose above and strigose on the nerves beneath. Petioles ·1—·3". Flowers bright rose-coloured like those of *B. cristata*, but axillary spikes peduncled and pairs of flowers usually on a short stalk in the axil of the leafy bracts, one or both bearing each a proper linear bract in addition to the two bracteoles. Outer sepals white between the nerves, ·7—·8", with the spinose-teeth up to 1" long, dorsally with numerous stalked glands. Corolla-tube 1—1·3" glandular-puberulous.

In gardens on the Ranchi Plateau, sometimes forming a good hedge as at Government House and very handsome in flower. Fl. Oct.

Each leaf of the spike may bear one or two flowers on a short stalk on the same inflorescence. If two flowers each has a linear bract ·5" long and two bracteoles, or sometimes only one bears the proper bract; in a few cases it is the bracteoles which fall.

I am unable to determine satisfactorily this very handsome species, but it appears to agree well with Roxburgh's description of *dichotoma* except that the flowers of his plant were white. Roxburgh's plant has been reduced to *B. cristata*, but this is quite distinct, and, like his plant, its native country is unknown.

7. B. longiflora, L.f.

A grey velvety pubescent shrub 2—4 ft. high with small ovate leaves .75—1.75" long and very slender-tubed white flowers 2—3" long, solitary axillary and in short dense but few-flowered spikes. Bracteoles .5—1" linear laxly patent, softly pubescent. Sepals outer ovate obtuse pubescent, scarious and very reticulate in fruit. Capsule .7", 4-seeded.

Puri, on dry rocky places near the Chilka Lake, *Gamble!* Fl. Nov. Far. Jan.—Feb. Young parts tomentose. Leaves rounded at base, tomentose. Petiole .25—5". Spikes mostly 1—4-fl. Corolla-lobes .3—5", ovate.

17. ASYSTASIA, Blume.

Herbs or undershrubs, sometimes rambling, with entire leaves and opposite or alternate mod.-sized flowers in lax or dense usually secund simple or compound spikes or racemes. Bracts and bracteoles linear, usually shorter than the calyx. Sepals narrow. Corolla with a short or long tube, narrow or funnel-shaped or ventricose above, lobes 5 subequal imbricate in bud. Stamens didynamous, subequal, anthers all with 2 parallel, approximate cells, minutely spurred or with the bases only obscurely whitened. Ovary very hairy. Stigma minutely 2-fid or subcapitate. Ovules 2 in each cell. Capsule elliptic with contracted solid base. Seeds compressed rugose or tubercular, glabrous.

Rambling undershrub. Leaves elliptic to lanceolate, 2.5—4" 1. *macrocarpa*.
Diffuse or rambling herb. Leaves ovate or rhomboid, 1—2" 2. *gangetica*.

1. A. macrocarpa, Nees.

A tall rambling weak shrub with elliptic lanceolate or narrowly oblong leaves pubescent beneath 2.5—4" long and secund racemes of light-purple flowers 1.5" long. Corolla thinly pubescent, narrow part of tube only .3" long, then funnel-shaped. Anther-cells distinctly spurred at the base. Capsule 1.3", pubescent, with seedless cylindrical base .6—7" long.

Sikkim Tarai and Jalpaiguri, to the north and east of Purneah and adjacent to it so that it will probably be found in Purneah. Fl. Dec.—Feb.

Leaves puberulous or glabrate above with 5—7 very oblique sec. n. and tapering into a petiole .1—3" long. Racemes rather lax, 2—3" (sometimes dense, *Clarke*). Calyx pubescent, .25".

2. A. gangetica, T. Anders. Syn. A. coromandeliana, Nees.

A pretty procumbent herb or sometimes subscandent among bushes with puberulous stems, ovate or rhomboid-oblong leaves 1—2" long and blue, purple or pink flowers 1—1.5" long and 1" diam. (sometimes with a yellow or greenish tube), in terminal racemes 2—5" long with very short pedicels. Capsule 1—1.2" long pubescent with seedless portion below .3—5" and shortly beaked above the 4 seeds which are corrugated at the edges and tubercled on the faces.

Climbing in *Pandanus* hedges at the south end of the Chilka Lake, *Alcock!* It is also common near Calcutta! so is likely to be found in other parts of Orissa. Fl. Nov.—Dec. and again from end of March to May.

Leaves slightly hairy with slender petiole .5" long. Calyx .2", hairy. Narrow tubular portion of corolla only .3" then ventricose, puberulous, lower lobes sometimes more deeply coloured than the posterior.

18. CROSSANDRA, *Salisb.*

Undershrubs with entire or undulate subdentate leaves and orange or yellow mod.-sized flowers in linear-oblong spikes with imbricate bracts. Bracteoles linear. Sepals 5 ovate, 2 inner smaller. Corolla with narrow tube curved at the mouth, limb with 5 subequal elliptic lobes imbricate in bud. Stamens didynamous, all with 1-celled anthers, connective mucronate. Stigma minutely 2-lobed. Ovules 2 in each cell. Capsule oblong. Seeds 4, orbicular compressed, adpressedly scaly, the scales consisting of connate hairs, the tips of which become free when moistened.

1. *C. undulæfolia*, *Salisb.* Syn. *C. infundibuliformis*, *Nees.*

A small shrub 1–3 ft. high with ovate or lanceolate undulate leaves 3–4" long, tapering both ends, and pubescent spikes 1–4" long of orange or orange-scarlet flowers. Bracts .5" elliptic acute. Sepals imbricate, outer .3". Corolla-tube slender, .75", lobes .5".

Common in gardens and sometimes self-seeding. Native of India. Fl. r.s.

19. ERANTHEMUM, *L.*

Glabrous shrubs or undershrubs with entire rarely serrate leaves and rather small or mod.-sized flowers situated 1–3 together in the axils of opposite bracts of terminal spikes. Bracts and bracteoles small and narrow. Calyx 5-fid or -partite, segments narrow. Corolla-tube linear, rarely ventricose at the throat, lobes 5, sub-equal. Stamens 2 with perfect 2-celled anthers, cells equal, parallel; 2 staminodes usually present. Stigma entire or minutely 2-lobed. Ovules 2 in each cell. Capsule and seeds as in *Asystasia*.

The cultivated species have often handsome coloured or variegated leaves.

1. *E. palatiferum*, *Nees.*

An undershrub about 3 ft. high, with stems pubescent above. Leaves broadly lanceolate, acuminate, up to 8" long, tapering at base, not or obscurely lineolate, sec. n. 8–10. Petiole .3". Flowers purple, with often a yellowish spot on mid-lobe of lower lip, secund on branched pubescent racemes often 12" long. Calyx .2" with linear pubescent sepals. Corolla-tube 1.25–1.3", limb 1–1.25" diam., obscurely 2-lipped. Capsule .9", pubescent.

Comes close to our area (Purneah) in the forests of Terai. Fl. April.

E. bicolor, a species very common in gardens, has broadly lanceolate leaves with a slender petiole up to 1". Corolla white with purple spots on lower lip, tube 1.25", limb 1" diam. Native of Malay Archipelago.

20. NEURACANTHUS, *Nees.*

Perennial herbs or undershrubs with entire leaves and small blue flowers in axillary or terminal elongate strobilate or capitate spikes with often strongly-nerved, sometimes 4-ranked elliptic or ovate bracts. Bracteoles 0 or minute. Calyx sub-2-lipped, posterior lip 3-toothed, anterior 2-toothed or -partite. Corolla with a short tube, then suddenly

ventricose or funnel-shaped, limb plicate 2-lipped with 5 sub-similar segments or obscurely lobed. Stamens didynamous, anterior anthers 2-lobed, posterior 1-lobed, the other lobe rudimentary or 0, lobes ovoid distinct sometimes hairy. Style 2-branched at the apex, one branch obsolete. Ovules 2 in each cell. Capsule oblong, glabrous. Seeds 4, ovate, much compressed, densely silky.

1. *N. tetragonostachyus*, Nees.

Scarcely suffruticose, with a perennial creeping rootstock, subterete usually inclined or nodding strict stems 1—2.5 ft. high with two lines of hairs, elliptic membranous leaves attenuate both ends and bright blue flowers .3" long in 4-gonous spikes which are solitary erect at the nodes and terminal, 1—1.5" long. Bracts elliptic-ovate or elliptic .3—.35" long, concave, with 5 very strong raised nerves meeting at the aristulate tip.

On trap in the Rajmahal Hills (Sant. Parg.)! The only record from India, all other specimens being Burmese. Fl. Jan.—Feb.

L. acuminate, hispid-pubescent on the 5—6 sec. n. beneath and more shortly so between, base attenuate into a very short petiole or petiole 0. Spikes sessile, linear-oblong, about .3" broad. Bracts pale, thinly pilose, ciliate and muriculate on the edges and principal nerves. Calyx .25", minutely tubercled and densely white-villous, segments linear-lanceolate. Corolla-tube conical at base, limb 2-lipped hairy, .25" diam., upper lip darker-blue-veined. Capsule .25" oblong compressed with a short solid beak or very acute.

21. LEPIDAGATHIS, Willd.

Herbs or undershrubs with entire or crenate or serrate leaves and small sessile flowers mostly in dense bracteate usually secund often fascicled spikes or heads; sometimes spikes aggregated near the base of the stem. Bracts usually exceeding the calyx, bracteoles narrower than the bracts. Calyx with unequal segments, the two anterior more or less connate into one. Corolla tubular or tube sometimes sub-globose at the base, then suddenly constricted, always again suddenly ventricose about the middle and limb 2-lipped, upper lip notched or 2-lobed, lower spreading 3-fid, usually spotted. Stamens didynamous, all 2-celled or one pair 1-celled,* one cell often attached higher up than the other, cells often bearded. Stigma capitellate, minutely 2-fid or entire. Ovules 2 in each cell. Capsule elongate, conoid or oblong. Seeds 2—4 compressed, ovate-oblong or orbicular hairy.

A. Flowers chiefly aggregated in masses at the base of the stem or on rootstock:—

Bracts lanceolate spinescent, not squarrose. Sepals spinescent. Spikes in dense cushions .

1. *Hamiltoniana*.

Bracts ovate or obovate, suddenly spinose-cuspidate with the cusp subsquarrose. Sepals not spinescent. Spikes more or less distinct

2. *trinervis*.

* The character of one pair of anthers sometimes 1-celled is not found in other works, which nevertheless include *L. purpuricaulis* in the genus, in which it invariably occurs according to my observations. This brings the genus very close to *Neuracanthus*, the only other character left to distinguish it being the presence of bracteoles. In the very congested inflorescences of the *Hamiltoniana* section even these seem to fall in some flowers, but the corolla is much more decidedly 2-lipped than in *Neuracanthus*.

B. Flowers in axillary solitary or clustered spikes:—

1. Capsule 2-seeded, thin. Spikes clustered, often some also radical. Leaves linear 2. *trinervis*.
2. Capsule 4-seeded, oblong:—
 - a. Leaves entire or undulate:—
 - One pair of anthers 1-celled. One sepal much broader than the other 4 3. *purpuricaulis*.
 - All anthers 2-celled. One sepal only slightly broader 4. *hyalina*.
 - b. Leaves crenate or crenate-serrate 5. *fasciculata*.

1. *L. Hamiltoniana*, Wall. Agui-Khair, M.

A herb with a perennial rootstock, erect or several diffuse 4-angled stems 6—18" high and linear leaves 2—4", or attaining 6" by 4", acute, subsessile, nearly glabrous except the minutely scabrid-ciliate margins. Flowers 5" long in very congested spikes forming prickly cushions at the base of the plant. Bracts, bracteoles and sepals all lanceolate acuminate and ending in a spine. Corolla 2" to the ventricose part, nerved, lower lip nearly 5" diam. with the midlobe somewhat shovel-shaped.

Common on dry slopes, banks, etc. Shahabad, J. D. H.! Bhagulpur, Ham.; Chota Nagpur, common! Angul, Chattarjee! Sambalpur (under *L. cristata*), Griff.! Probably in all districts of the Northern and Southern Areas. Fl. Dec.—Feb.

Angles of stem usually much raised, sub-alate, nodes sometimes pilose. Leaves with strong midrib and 4—7 very oblique sec. n. which run nearly parallel to margin but except towards tip scarcely form an intramarginal nerve (as in *trinervis*). Spikes 1-sided, their bases sheathed by ovate or lanceolate acuminate-spinose bracts. Bracteoles 37", membranous below, ciliate upwards; sometimes a bracteole bears a flower to which it becomes a bract and this flower is ebracteolate. Longer sepal about 37", ell.-oblong or lanceolate acuminate-spinose, villous. Corolla silkily-hairy. Capsule 26", narrowly conical or lanceolar in outline, glabrous, acute, somewhat compressed, with the wider (compressed) sides membranous, the other sides firm; enclosed in the somewhat enlarged fruiting sepals.

Used in Chota Nagpur for the capture of evil spirits.—Rev. S. L. Thompson.

2. *L. trinervis*, Nees.

A herb with numerous tough stems 6—15" high from a very woody rootstock. Leaves sessile linear, or when small often oblong or elliptic, 5—2.3" long. Flowers white in short ovoid often 1-sided spikes 3—5" long, axillary and often aggregated at the base of the plant, with ovate or obovate-oblong spinose-cuspidate bracts 5—7.5", the subsquarrose cusp as long or nearly as long as the blade. Capsule 25".

Shahabad; Rhotas-ghar and summit of Kymore hills, J. D. H.! Chota Nagpur, teste Clarke, but the specimens referred to this in the *Cal. Herb.* are possibly *L. Hamiltoniana* and I have seen no others from Chota Nagpur. The locality in Wood's List is probably also on the strength of these specimens. Pathra Forest, Gaya!

Although sometimes aggregated at the base of the plant the individual spikes are distinct, not merged uniformly into a cushion as in *Hamiltoniana*, and there are nearly always additional spikes on the branches. Leaves 3-nerved, much more distinctly so than in *L. Hamiltoniana*; those in the Gaya plant are very distinctly 3 nerved but are up to 4" long, and as the plant was not in flower its determination is somewhat doubtful, sec. n. very inconspicuous, horizontal between the midrib and the lateral nerves. Bracteoles linear-lanceolate, membranous. Calyx segments not spinose. Corolla 3".

3. L. purpuricaulis, Nees.

A diffuse branched suffruticose herb with stems 2—3 ft. high, sometimes rooting at the lower nodes. Leaves in each pair very unequal, lanceolate or ovate-lanceolate, acuminate, 2.5—4" long. Flowers in dense glandular spikes .5—7" long congested on small lateral branches (peduncles) with oblong-lanceolate .3"-long acuminate strongly-nerved gland-hairy bracts. Corolla .3—4" tubular below then somewhat ventricose, upper lip rounded notched, lower lip spreading deeply 3-fid, longer, white spotted purple, hairy outside. Stamens didynamous, upper pair shorter with 1-celled anthers, *the second cell replaced by a knob.*

Singbhum, Saranda forests on shady banks! Parasnath, Thoms. and Anders.! Fl. Feb.

Branches flexuous 4-angled and swollen below the nodes and with puberulous stipular lines. Smaller leaf in each pair often less than half the larger, both attenuate at base, scarcely petioled or petiole winged, pale beneath, membranous, glabrous or minutely ciliolate or young hairy, deciduous on the older branches but with tufts of smaller leaves and glandular spikes at the nodes. Bracts with subaristate tips, bracteoles linear, .35". Calyx sub-2-lipped, densely glandular hairy, sepals very unequal, dorsal prominently 7—8-nerved, two anterior 3—4-nerved oblong-lanceolate, innermost (lateral) linear 1—3-nerved, all subaristately acuminate. Stigma simple.

4. L. hyalina, Nees.

A much-branched herb 1—2 ft. high with root of fleshy fibres, stems subterete with 4—2 raised green lines decurrent from the base of each leaf. Leaves variable in shape, oblong, ovate or linear, 2.5" in some forms to 7" long in others, always decurrent on the petiole, rather strongly nerved. Spikes numerous dense, 2—10 together, fascicled secund, on very short axillary peduncles and forming dense terminal heads, .5—1.5" long. Flowers .3" long distinctly 2-lipped, white with mottled-brown palate or upper lip brown. Bracts very dense 4-farious imbricate, .3—4", ovate-oblong or lanceolate acuminate with a strong midrib excurrent as an awn or point, bracteoles similar or narrower. Outer sepals nearly as long, oblong sub-aristate, strongly 3-nerved, margins long ciliate and glandular, inner narrow. Capsule .22—25" oblong with a short beak, sides parallel to septum rather thin.

Usually in damp places, among rocks in the Sal forests, or on banks along nalas and firelines. Throughout Chota Nagpur! Angul, *Chattarjee!* Sambalpur, *Griff.!* As it also occurs in the Sikkim Tarai and Duars it will probably be found throughout our area. Fl., Fr. Dec.—April. Perennial.

Stems often reddish. Branches more or less pubescent, especially near nodes, with the 4 green lines sometimes much raised. Leaves often light-coloured or yellowish along centre and main nerves, varying from .25—3" broad to 2.25" broad; margins entire or undulate, slightly pubescent on nerves beneath and with small scattered hairs above or hairy both sides or (in Angul specimen) glabrous above but densely shortly lineolate, beneath often shiny; sec. n. 7—9. Petiole .1" (in uppermost leaves) to 1.5". Dorsal bracts of spikes barren, all with marginal nerve and long cilia and glandular. Cor. .3—3.5" long, tubular below, suddenly ventricose, upper lip emarginate or 2-lobed, concave; lower patent. Beak of capsule puberulous. Seeds .04".

5. *L. fasciculata*, Nees. Serendri-dumbu, Bile-mata-a; K.

A highly aromatic viscous hairy herb 1—2 ft. high, much branched from the creeping rootstock, with crenate or serrate ovate acuminate leaves much decurrent on the petiole and small white-lipped flowers in numerous subcapitate spikes rarely exceeding 5" in length.

Among rocks in the Sal forests and in grass near nalas. Si2gbhum, common! Sambalpur, Griff. Kalahandi! Fl., Fr. Jan.—April.

Stems hairy and glandular with 4 raised green lines. Lower leaves attaining 5" by 2" or sometimes 6" by 2" including the short petiole on which the blade is decurrent nearly to its base, sometimes quite coarsely toothed, at other times shallowly crenate, hairy or glabrescent both sides; sec. n. 7—9 curved strong beneath with sub-scalariform tertiaries. Spikes usually very many and congested at the ends of the branches, very short with oblong or elliptic 3-nerved hairy bracts .25" long, acute, but not at all aristulate, bracteoles narrower. Sepals hairy, upper broad oblong or lanceolate .2—22", 3-nerved acute, anterior also 3-nerved, linear-oblong, lateral almost setaceous. Corolla .25—3", tubular or subglobose for .1" then constricted and suddenly ventricose, upper lip shortly 2-lobed. Anther-cells wide apart, one a little above the other, slightly hairy, mucronate at the base. Capsule .2" long or very slightly exceeding the calyx, compressed with broader sides thin pubescent and grooved on the narrower sides and short beak. Seeds 2—4 light brown, yellow-hairy when wetted. If the capsules, when ripe, are wetted they burst violently, scattering the hygroscopically-hairy seeds in all directions.

22. APHELANDRA, R. Br.

Shrubs or tall herbs with entire or toothed leaves and showy yellow orange or scarlet flowers in terminal simple or branched conspicuously bracteate spikes. Bracts imbricate often coloured, entire, ciliate or spinose. Bracteoles small. Calyx with posterior segment usually broadest, others equal or somewhat unequal in width. Corolla with long straight or somewhat curved tube cylindrical or somewhat widened upwards, 2-lipped, upper lip entire or more or less 2-lobed, lower lip with the mid-lobe spreading and recurved, the lateral lobes sometimes obsolete or small at the base or sides of the mid-lobe, or as large and spreading. Stamens 4 inserted near the base of tube, subequal, anthers exerted, dimidiate, 1-celled, sometimes cohering by their bearded tips when young, ultimately often mucicous, pollen oblong subterete with a fine line (or fissure?) on one side. Stigma oblique or truncate, or minutely 2-lobed. Ovules 2 in each cell. Capsule oblong, often shortly contracted at base.

A tropical American genus of which several handsome flowering shrubs or undershrubs are now common in Indian gardens.

1. *A. pectinata*, Willd.

A shrub 3—4 ft. with coarse rusty pubescence on twigs, obovate or oblanceolate entire leaves 3—5" tapering to a very short petiole and with very prominent sec. n. beneath which are depressed above. Flowers narrow, scarlet, in sessile elongate spikes from the uppermost leaf axils (thus appearing terminal). Bracts usually spinulose-serrate towards the apex.

In gardens. Fl., Fr. Aug.—Oct.

L. acute or obtuse with about 12 sec. n. Spikes 2—5" long with opp. decussate oblong acuminate silkily hairy bracts .5" long. Fls. 1.5". Bracteoles .3", narrowly

lanceolate silky. Sepals .35", similar but rather broader, imbricate. Cor. hairy, tube constricted above ovary, lower lip entire .5", ultimately revolute, linear-oblong; upper lip erect straight or recurved with 2 short acute lobes. Fil. hairy below, anther boat-shaped dorsifixed.

2. *A. tetragona*, Nees. Syn. *A. cristata*, Lindl., non *R. Br.*

A shrub with large elliptic leaves acute or acuminate both ends or ovate and cuncate on the petiole. Flowers scarlet in clustered spikes. 4—8" long, the rhachis and base of calyx densely woolly. Bracts velvety-pubescent quite entire ovate acute. Corolla 1.5"—2", nearly glabrous, upper lip 2-fid, mid-lobe of the lower lip lanceolate, the lateral very short.

In gardens. Native of Central America.

3. *A. cristata*, R. Br.

A shrub about 3 ft. high with lanceolate leaves 7—8" long and numerous large orange-scarlet flowers in paniced spikes. It lacks the dense tomentum of the last. Other species are sometimes found in gardens.

23. RUNGIA, Nees.

Herbs, rarely shrubs, with entire leaves and small usually blue sometimes white flowers in dense secund bracteate spikes with the bracts 2- or 4-ranked, usually with scarious margins, dorsal sometimes barren, bracteoles similar to the bracts or narrow. Calyx small with 5 linear-lanceolate segments. Corolla with short tube; upper lip emarginate, shorter than the 3-lobed lower lip. Stamens 2, anther cells 2, subequal parallel or usually superposed with the lower cell mucicous or white-tailed. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule ovoid or oblong, placentæ with the retinacula rising elastically from the base scattering the seeds. Seeds normally 4, compressed, orbicular, glabrous, minutely or strongly concentrically verrucose.

Flowers under .15" long. Spikes 1-sided, bracts .12—'.17" . . . 1. *parviflora*.
Flowers .3". Spikes with 4-farious bracts .2" long, less 1-sided . . . 2. *repens*.

1. *R. parviflora*, Nees. Hasa-arak', S.

A diffuse or erect herb with stems 6"—2 ft. long, terete below, faintly 4-angled above, with recurved pubescence at the angles. Leaves from linear or narrowly lanceolate to narrowly elliptic, 1—2.5" long, narrowed both ends, nearly glabrous except on the nerves, very lineolate. Flowers very small, blue or purple, in clustered secund spikes .25—'.6" long with two rows of imbricate barren ovate to lanceolate bracts and two ventral rows of suborbicular or obovate flowering bracts .12" diam. including the wide scarious margins. Capsule .08" compressed with the flattened broader faces thinly membranous, the lateral narrow faces coriaceous and elastically spreading from the apex and falling off at the same time as the placentæ rise from the base.

A common weed throughout the province, erect in open grassy places in the forests or prostrate in pastures. Fl., Fr. most of the year, chiefly c.s.

All specimens from our area appear to belong to the variety *pectinata*, Clarke (*R. pectinata*, Nees), in which the flowering bracts are hairy and the barren bracts mucronate or cuspidate.

L. sometimes slightly pubescent beneath, sec. n. very oblique, 4—7. Petiole .2—3". Dorsal bracts .17", often sub-aristate with white or reddish scarious margins, 1—3-nerved; anterior and bracteoles with the membranous margin often with a sinus at the tip and the green centre mucronate or sub-aristate. Calyx .1", segments silky. Corolla .12", upper lip usually colourless simple acute, shorter than the spreading purple or blue obtusely 3-lobed lower lip.

2. *R. repens*, Nees.

A procumbent branched herb with strigillose stems 6—12" and rather small lanceolate leaves .3—1.5" long. Flowers .3" blue, or pale rose (*Ritchie*), in spikes 1—2.5" long, conspicuous from the closely regularly imbricated 4-farious large broadly-elliptic scarious-bordered bracts which are .2" long. Capsule .25—3", minutely thinly hairy (*Clarke*).

Said to occur throughout India, *Clarke*; but the only specimens seen from our area are from the Rajmahal Hills. Rajmahal, *Wallich*; Sahibganj, *Kurz*! Fl. Dec.—Jan.

Branches sometimes rooting at the nodes. Bracts sometimes hairy, the green part lanceolate in shape apiculate or aristate, sometimes hairy. Filaments white, anthers blue.

24. JUSTICIA, L.

Shrubs or usually herbs with entire leaves and sessile or sub-sessile small rarely mod.-sized flowers usually in spikes with conspicuous bracts and small bracteoles, rarely axillary or in dense cymes without a terminal spike (and not in our area). Bracteoles sometimes 0. Calyx 5- or 4-partite, segments narrow. Corolla 2-lipped with tube equalling or shorter than the limb; upper lip 2-lobed or subentire, lower 3-lobed, anterior lobe outermost in bud. Stamens 2, filaments often dilated, hairy near the base; anthers 2-celled, cells round or oblong, more or less discrete, lower with a white spur. Style filiform, stigma 2-fid. Ovules 2 in each cell. Capsule oval or ellipsoid, sometimes with a long cylindrical seedless base. Seeds ovoid more or less compressed, tubercular, scaly or glochidiate-hispid, not with hygroscopic hairs.

A. Calyx-segments 5, equal or nearly so:—

1. Bracts broad, ovate or obovate:—

Suffruticose, bracts ovate white, green-nerved

Herb, bracts green, obovate, often patent

2. Bracts narrow. Undershrub, bracts linear

1. *betonica*.

2. *glauca*.

3. *gendarussa*.

B. Calyx-segments 4, very rarely a minute fifth present:—

1. Glabrous or nearly so. Bracts and sepals linear obtuse:—

Erect or ascending. Leaves linear or lanceolate, sub-acute or subobtuse

Diffuse. Leaves broadly elliptic or obovate, rounded

4. *quinqueangularis*.

5. *peploides*.

2. More or less hairy. Bracts and sepals usually lanceolate, very acute:—

Spikes very slender, .1—1.5" wide, hairs short

Spikes stout, .4—7.5" broad, often hirsute or hairy

6. *diffusa*.

7. *simplex*.

1. *J. betonica*, L. Had-pat, K.

Erect, suffruticose, usually with many striate stems 2—4 ft. high from a perennial rootstock, ovate-lanceolate entire or somewhat crenate-dentate leaves attaining 4.5" by 1.75", smaller upwards, mostly acuminate both ends. Flowers small white rose-spotted in mostly

terminal 1—3-nate spikes conspicuous from the closely imbricate white green-veined ovate or narrowly ovate acute or mucronate bracts .5—.6" long and bracteoles resembling the bracts. Capsule .3—.5", stout clavate pubescent.

Mostly in rocky forests, especially towards ravines. Singbhum, common! Hazaribagh! Palamau! Puri! Angul! Fl., Fr. Nov.—March.

Stems puberulous to subtomentose, swollen above the nodes, terete. Leaves glabrous or pubescent both sides, sec. n. 6—8 fine raised. Petiole of lower larger leaves .5—.75", of uppermost 0. Spikes often panicled 2—6" long, bracts with the sec. n. meeting in an intramarginal one. Calyx .25", sepals subulate or linear-lanceolate, pubescent. Corolla hairy, upper lip .2", lower .4" broad. Anthers long-spurred (in Angul and in Puri specimens). Seeds 2—4 with a corrugated or rugose testa.

The plant is used as a cure for diarrhœa.

Var. α , villosa, Clarke.

Stems and leaves very hairy or tomentose but scarcely worthy of varietal rank. *Clarke* says "flowers salmon-coloured," but they only have pink or buff markings where I have seen them.

Singbhum, frequent! Parasnath!

Var. β , ramosissima, Clarke.

Stems diffuse decumbent, bracts rather narrower.

Palamau, *Gamble*! Puri!

2. *J. glauca*, Rottler. Syn. *J. orixensis*, Roxb.

An erect or somewhat diffuse herb 1—2 ft. high with tough purple stems and pubescent branches with much swollen bases. Leaves ovate or elliptic 1—3", pubescent or puberulous on the nerves beneath. Spikes with pubescent rhachis 2—4" long, well characterised by the foliaceous .25" long bracts which are rounded-obovate but suddenly contracted into a semi-petiole base, somewhat lax and patent, not imbricate except in the young spikes. Capsule .25" clavate.

Puri, Haripur forest! Fl., Fr. Nov.—Dec.

Cauline leaves usually acute both ends, those on the branches often smaller and rounded, lineolate above; sec. n. 4—5. Petiole in larger leaves .3—.4". Bracts ciliate when young. Calyx .15" with linear acuminate sepals .15" long. Cor. .3", tubular portion included in the calyx, upper lip oblong, slightly notched, white, purple spotted, lower broad with 3 obtuse lobes, palate spotted purple and transversely plicate or rugose. Filaments flattened. Seeds 4 brown-black, closely covered with large very pointed tubercles. Retinacula very long.

3. *J. gendarussa*, L. f. Syn. *Gendarussa vulgaris*, Nees; Jagatmadan, *Beng.*

An undershrub 2—4 ft. high, the subterete branches with sometimes raised lines or a line of pubescence. Leaves lanceolate or linear-lanceolate 3—5" long, glabrous except when very young. Flowers white, spotted purple within, interrupted spikes 2—5" long from the uppermost leaf axils and often forming a terminal panicle. Bracts linear about .12" only. Calyx .15—.2" with nearly glabrous linear segments. Corolla .5". Capsule .5", clavate, glabrous.

Prair says "in all the provinces," but it is nowhere wild in our area, the nearest district where it is undoubtedly wild being at the foot of the Himalayas in Jalpaiguri in stony forests under shade! It is, however, very frequently cultivated as an edging to walks and flower-beds and kept pruned. Fl. April—May. My specimens show no fruit, and according to *Clarke* the seed is very rare in cultivation.

Lines of pubescence on the branches alternating in position between the nodes. L. entire or undulate. Spikes with puberulous rhachis. Flowers mostly in clusters on the rhachis. Lower anther-cell orbicular, spurred.

4. *J. quinqueangularis*, *Koen.*

Erect, or ascending from a geniculate base, with 5-sided stems 12—20", internodes long nearly glabrous. Leaves in distant pairs linear or linear-lanceolate subacute or subobtuse .5—2.5" long, minutely lineolate above. Flowers .32" long, white with a few pink markings, in terminal, rather lax (internodes visible) spikes 1—4" long with linear glabrous scarious-margined bracts and bracteoles about .17" long. Calyx .15—.2" long in flower, sepals linear-oblong with green centre only, obtuse. Capsule .25—.3", stout.

Santal Par. (Rajmahal), *Wall.*! Singbhum! Ranchi, common! Manbhum, *Camp.*! Burdwan, *Clarke!* Fl., Fr. Sept.—Nov.

Leaves sometimes .3" broad. Spikes often long-peduncled. Fruiting sepals sometimes .25—.3" long. Lower lip of corolla .17" broad. Seeds slightly concentrically tubercular-rugose, *Clarke.*

5. *J. peploides*, *T. Anders.* Syn. *J. quinqueangularis*, var. *peploides*, *Clarke*; Mathom-ara, *S.*

Very diffusely branched from near the base with numerous spreading 4—5-sided branches 3—6" or sometimes 15" long. Leaves broadly elliptic or broadly oblong with rounded tip and base suddenly contracted, rarely oblanceolate, .6—1.3" long and up to .75" broad. Petiole slender .2—.3" long. Spikes shorter than in last and often subovate when young, but attaining 1.8" with usually the lowest pair or pairs of flowers axillary. Bracts linear or linear-spathulate with rounded tips and scarious margins, bracteoles .17—.18" long, similar but more slender, sepals as in last, sometimes only .12" in flower and subobtuse. Capsule .25—.3" elliptic-oblong mucronate glabrous.

Purneah, *Kurz!* Santal Par., *Kurz!* Monghyr, *Cal. Herb.*! Plains of Behar, *J. D. H.*! Fl., Fr. Aug.—Oct.

Clarke is probably right in considering this only a variety of the last, but owing to the habit and different-shaped leaves it is easily recognised.

6. *J. diffusa*, *Willd.*

A herb 6—15" with more or less 4-angled and grooved stems strigose with reflex hairs, elliptic, narrowly-ell., or ovate-lanceolate leaves not exceeding 2.5" by .8" (often much smaller), very lineolate both sides, and very slender spikes 2—4" long and .1—.15" wide (in flower), of small pinkish or white flowers, the bracts towards base somewhat distant and shorter than the sepals, hispidly-hairy. Bracts, bracteoles and sepals membranous with green midrib. Capsule glabrous or hairy oblong .18"—.2" with very short solid base. In fruit the spikes are somewhat wider owing to the opening of the capsules and spreading

of the bracts and sepals, but they are always more slender, less dense, and with the hairs on the inflorescence less spreading and shorter than in *J. simplex*.

Monghyr, *Ham.*, *Kurz*! Rajmahal Hills, *Kurz*! Singhum, frequent! Hazari-bagh, *Clarke*! Ranchi Ghats, *Gamble*, *Wood*! Sambalpur, *Griff.*! Ganjam (just outside our area), *Cal. Herb.*! Probably therefore throughout the province. Fl., Fr. June—Jan. 9

Leaves glabrous or with scattered hairs along the nerves, or sub-hispidly hairy beneath, sec. n. 6—8. Petiole .25—3". Bracts linear-lanceolate or linear or sometimes (in same spike) ovate with a long acumen, sometimes only one third to one-half as long as the sepals, rarely three-fourths, ciliate and sometimes also pubescent. Bracteoles subsimilar to bract. Calyx .2—2.5" long, sepals 4 linear or shorter in upper part of spike and relatively shorter to bracts. Corolla .25—3", white, spotted pink, hairy.

Var. **orbiculata**, *Clarke*. Syn. *J. orbiculata*, *Wall.*

Leaves broadly ovate .3—1", petioled, hairy, especially beneath.

Parasnath, *Cal. Herb.*! Manbhum, *Thoms.*! Fl. Nov.

Var. **Vahlia**, *Clarke*.

L. narrowly lanceolate or linear, bracts lanceolate white-margined, sepals lanceolate subacute with minutely scabrous tips.

Chota Nagpur, common, *Clarke*.

7. *J. simplex*, *Don.*

A herb of rather lax but erect growth 8" to 2.5 ft. high with angular and grooved hairy stems swollen above the nodes, elliptic or elliptic-oblong (ovate, *Clarke*), markedly lineolate and sometimes strigose leaves 1—2.5" or 3" long by .4—75" broad, and very small rose-coloured flowers in axillary and terminal dense sessile hairy spikes .75—3" long and .3" diam. Bracts 4-ranked and bracteoles and 4 sepals all membranous with green centres or green midribs and hirsutely hairy or ciliate. Capsule ell.-oblong .16" with solid base and hairy tip.

Frequent in valleys in Chota Nagpur. Singhum! Ranchi, *Clarke*! Hazari-bagh, on Parasnath! Palamau, Neterbat, 3000 ft.! Fl., Fr. Oct.—Jan.

Stems quadrilateral with the two of the opposite angles with a groove so that, according to the width of the groove and the nature of ridge on either side of it, the stem is variously described as 4-angular or 6-angular, hairs on lower parts reflexed, more spreading above and at the nodes. Leaves slightly tapering both ends to a subacute or sub-obtuse tip, hairs few on the nerves both sides and some times shortly ciliate. Sec. n. 5. Petiole .2—2.5". Bracts narrowly obovate or lanceolate or oblanceolate, .18—2.2", strongly ciliate. Bracteoles as long linear or oblong-linear hispidly hairy. Sepals 4, more narrowly linear, .16—1.8", hirsute or hairy. Corolla .2", hairy, upper lip concave below, subquadrate entire or notched above, lower lip with 3 rounded lobes. Anthers sometimes with the lower cell reduced to its spur. Seeds not much compressed, suborbicular-cordate, brown-black, granulate or concentrically rugose.

Var. **serpyllifolia**, *Benth.*

About 6—8" only closely branched with elliptic to suborbicular leaves .5—7" and spikes about 1" long and .17" broad. Bracts .08" long, fulvous hirsute.

Manbhum, *Clarke*! Parasnath, *Clarke*!

25. ADHATODA, *Nees.*

Shrubs with entire leaves, and large flowers subsessile in the axils of opposite bracts of axillary and terminal, sometimes thyrsiform, spikes. Bracts larger than the calyx and bracteoles sub-similar, not membranous. Calyx-lobes 5 imbricate or 2 lowest subconnate. Corolla 2-lipped, tube short, upper lip galeate, subentire, lower spreading 3-lobed. Stamens 2, near top of corolla-tube, anthers 2-celled, cells minutely apiculate at base. Stigma entire. Ovules 2 in each cell. Capsule clavate-oblong with a long solid base. Seeds 1—2 suborbicular, compressed, rugose.

1. *A. vasica*, *Nees.* *Vasaka*, *Beng.*; *Arusha*, *H.*

A bushy shrub 3—8 ft. high with large minutely pubescent elliptic or ell.-lanceolate acuminate leaves 5—8" long with a foetid smell, and large white flowers 1.3" long. Spikes 1—3" often several together at the ends of the branchlets with ovate, elliptic or obovate bracts .75" long and bracteoles .5". Calyx .3—5" with equal lanceolate lobes. Cor.-tube with a short basal portion then inflated; throat transversely barred with rose or yellow; lips about .75" long. Filaments hairy at base only. Capsule .75", pubescent.

Nowhere certainly wild in our province; possibly so in northern Purneah! Common in villages or near villages, Balasore! Angul! Sambalpur! Often seen in gardens in all other districts. Fl. Feb.—March and also at the end of the r.s.

Said to be a good insecticide. "Leaves and root expectorant and antispasmodic, and considered serviceable in phthisis." *Dutt.*

Jacobinia Gheisbreghtiana, *Benth. & Hooker*, is a handsome under-shrub with scarlet flowers in terminal panicles. Gardens.

Fittonia spp. are pretty little low trailing plants with beautifully coloured veined leaves and rather inconspicuous flowers in bracteate spikes. They are natives of Peru and commonly seen in grass green-houses.

26. ECBOLIUM, *Kurtz.*

Shrub or undershrub with entire leaves and blue flowers in terminal dense spikes with large imbricate bracts and small narrow bracteoles. Calyx sub-5-partite, segments equal or rather unequal, narrow. Corolla with long almost filiform tube and 2-lipped limb, upper lip narrow slightly 2-cleft, lower 3-lobed. Stamens 2 inserted near top of tube, anther-cells 2 oblong parallel approximate, muticous. Stigma shortly 2-fid. Ovules 2 in each cell. Capsule ovoid compressed with long barren base. Seeds 4—2, large, compressed, orbicular, tubercular-scabrous.

1. *E. Linneanum*, *Kurtz.* *Var. dentata*, *Clarke.*

An undershrub 2—4 ft. with tough green branches, lanceolate or ovate-lanceolate leaves, acuminate both ends, 4—9.5" long, and steel-blue or greenish-blue rarely white flowers, only opening one or two at a time, in dense spikes 1—3" long. Corolla with a very slender tube

1" long. Capsule .7" sub-spathulate with an ovate upper portion very acute or cuspidate compressed at right angles to the long lower barren base.

Moist shady places. Hills of Puri! Fl., Fr. Sept.—April.

L. tapering at base into a short winged petiole, tip sometimes caudate, pale beneath, puberulous or pubescent on the 5—6 sec. n.; tertiary n. faint. Bracts herbaceous, pale-green, ovate-elliptic, .75" long, dentate or denticulate and with a fine short cusp, somewhat glandular-hairy. Calyx segments .15" long, linear-subulate. Cor. softly hairy, lower lip wrapping round the very slender upper lip in bud. Anthers purple. Seed usually 1 in each cell, with lines of strong papillæ.

27. GRAPTOPHYLLUM, Nees.

Glabrous shrubs with entire or spinous-toothed, usually variegated leaves and red pedicelled flowers in sessile cymes collected into terminal thyrses. Bracts and bracteoles small. Calyx short, equally 5-partite. Corolla 2-lipped, tube with a wide rather deep throat, straight or bent, upper lip with two somewhat reflexed toothed lobes, lower lip 3-lobed. Stamens 2 fertile exerted, inserted in the throat; anther-cells equal parallel, base mucicose; staminodes 2, small. Capsule long-pedicelled. Ovules usually 2.

1. **G. pictum**, Griff. Syn. *G. hortense*, Nees; *Justicia picta*, L.; Caricature-plant.

A shrub 3—5 ft. high with large-elliptic or broadly elliptic subsessile leaves 3—8" long, variegated with white. Flowers dark red 1.5" long in thyrses 2—4" long.

Common in gardens. Native of Polynesia. "Tree up to 15 ft. with edible leaves." Rev. Commins.

28. RHINACANTHUS, Nees.

Shrubs or undershrubs with entire leaves and mod-sized white flowers solitary or in small contracted cymes on the branches of dense or divaricate panicles. Bracts and bracteoles small linear-lanceolate. Calyx small 5-partite, segments linear-lanceolate. Corolla 2-lipped with long slender tube, upper lip narrow acuminate entire or shortly 2-lobed, recurved or twisted, lower broad 3-lobed. Stamens 2, inserted near the top of the tube, anther-cells 2 superposed, mucicous. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule clavate with long solid basal portion. Seeds 4—2, ovoid, somewhat compressed, obscurely rugose or tuberculate, glabrous.

1. **R. communis**, Nees.

A slender divaricately-branched undershrub 3—4 ft. high with large elliptic, obovate or ovate-oblong leaves 3—9.5" long by .75—3.3" broad narrowed into a petiole 1.5—2" long (in the larger leaves). Flowers pure white, 1—1.3" long, in clusters at the ends of the branchlets of large spreading, nearly naked, grey-pubescent, 3-chotomous panicles.

Singbhum, rocky ground under shade (Karampoda and Porahat forests), often on ridges 2500 ft. elev.! Ranchi (wild?), Wood! Hazaribagh (Koderma), Gamble!

Puri! Nayagarh Ghats, Narsingpur! Sambalpur, *Cal. Herb.*! Fl., Fr. Dec.—April.

Branches striate, pubescent above. Leaves narrowed both ends, usually acuminate, puberulous or pubescent beneath; sec. n. about 5 very distinct. Bracts .04—.06", and deeply partite 1—12"-long calyx almost tomentose. Corolla-tube 1", pubescent, upper lip 3—4", shortly cleft recurved and with revolute margins, lower .5—6" long with broad lobes .3" long. Capsule .7—8". Seeds 4—2, .17" diam.

29. PERISTROPHE, *Nees.*

Erect herbs with entire leaves and small or mod-sized deeply 2-lipped rose or purple flowers in 1—few-fld. small capitate cymules with 1—few pairs of decussate bracts longer than the calyx. Cymules often in spreading lax panicles. Bracteoles linear or lanceolate shorter than the bracts. Calyx small 5-partite, segments subequal, linear lanceolate. Corolla-tube slender, often twisted (as in *Dicliptera*), so that anterior shortly 3-lobed lip becomes uppermost, posterior lip subentire. Stamens 2, filaments pubescent below, anther cells 2 muticous, one higher than the other or distant. Stigma minutely 2-fid. Ovules 2 in each cell. Capsule ellipsoid, stalked (with narrow base), more or less pubescent, placentæ *not* elastically rising from the base when ripe. Seeds ovoid, compressed glabrous, minutely glandular-papillose.

1. *P. bicalyculata*, *Nees.* Barge Khode baha, S.; Nasa-bhaga, *Beng.*

A laxly paniculately branched herb 3—6 ft. high with swollen nodes and sharply 6-angled stems, ovate acute or acuminate hairy leaves attaining 4.25" by 2.75" in lower part of stem, smaller upwards, and rather small bright rose-coloured or purple flowers in copiously-branched lax panicles, final branches bearing cymules of 2 sessile flowers, of which one is usually abortive. Capsule .3" oblong compressed with short solid stipes, beaked, glandular and puberulous.

Common in hedges and often a weed in compounds. N. Champaran! Chota Nagpur, all districts! Probably throughout the province. Fl., Fr. Dec.—March.

Stems hispid or hairy. L. hairy beneath or both sides, base somewhat decurrent on the 1.5—2" long (lower) petioles, sec. n. about 8, upper leaves gradually passing into spreading setaceous bracts. Cymule bracts, larger linear-spathulate, .3—5", smaller usually linear. Calyx .17" long, segments subaristate or setaceous upwards. Cor.-tube .2—2.5", lips about .25—3", oblong.

30. DICLIPTERA, *Juss.*

Erect or diffuse herbs with entire or undulate leaves and small or m.s. sessile or subsessile flowers collected, often together with imperfect flowers or their bracts, into fascicled capitate cymes in the axils of the leaves; fascicles also sometimes on short axillary branches. Ultimate cymes (cymules) enclosed between a pair of usually unequal dorsi-ventral bracts (cymule bracts)* and consisting of 1—2, rarely

* NOTE.—In the axil of the main bract or floral-leaf there are one to several pairs of laterally placed bracts; these pairs each enclose a series of pairs of bracts (cymule bracts) placed posteriorly and anteriorly (or dorsally and ventrally in respect of main axis); these bracts which immediately subtend the cymule Clarke calls "proper bracts," but the bracts proper to each flower appear to me to be the narrow ones within the cymule itself or they may be altogether absent. The cymule perhaps normally consists of decussate pairs of flowers.

more, perfect flowers together with 2 or more imperfect flowers. Perfect flowers with narrow or setaceous proper bracts and bracteoles or these absent, imperfect flowers consisting of an empty calyx or reduced to bracteoles. Calyx 5-partite, segments sub-equal narrow, more or less pubescent. Corolla white, pink or red, purple-spotted; tube slender, upper lip narrow entire or emarginate, lower 3-lobed recurved. Stamens 2, anther cells 2 ovoid, superposed, mucicous. Stigma shortly 2-fid. Ovules 2 in each cell. Capsule clavate, with solid base, placentæ rising elastically from their base. Seeds ovoid compressed, verrucose or glandular-papillose, not hairy.

- A. Flowers .5—6" long. Proper bracts and bracteoles present:—
 L. lanceolate 1—3", glabrous beneath. Cymule bracts mostly obovate, glandular-pubescent. Calyx .2—3", glandular 1. *Roxburghiana*.
 L. ovate, attaining 3.5", hairy beneath. Cymule bracts nearly parallel-sided, shortly aristate, hairy. Calyx .15—18", shortly hairy, not glandular 2. *bupleuroides*.
 B. Flowers .25" long. Proper bracts absent:—
 Cymule bracts oblanceolate, densely white-ciliate 3. *micranthes*.

1. *D. Roxburghiana*, Nees.

A tufted herb from a stout woody rootstock (in old plants), with erect puberulous or strigillose stems 6—18" high, rhomboid-lanceolate or narrowly- to broadly-lanceolate, acuminate leaves 1.5—3", nearly glabrous beneath, thinly hairy or puberulous above. Flowers numerous rose-purple .5—6" long in axillary peduncled bracteate capitate cymes. Cyme internodes above the first pair of bracts usually nearly obsolete. Bracts, bracteoles and calyx all glandular-pubescent not hairy. Cymule-bracts variable, from obovate to oblanceolate and linear, .3—5", those in each pair unequal, acute or obtuse but not aristulate nor cuspidate. Calyx .25—3" with filiform sepals in the perfect flowers. Capsule .2—2.5", pubescent, not hairy.

Hills of Chota Nagpur. Ranchi! Palamau! Fl., Fr. March—June. Forest and waste-ground, coming up abundantly from the woody stocks after jungle fires and soon flowering.

Leaves cuneate at base, margins pubescent, sec. n. about 6, fine raised above. Petiole .2—3". Axillary peduncles 1—3, .2—5" long, bearing about 2 decussate pairs of foliaceous bracts or again ternate above the first pair, from linear to obovate on the same inflorescence. Cymule bracts 1-fid. or central pair 1—3-fid. Bracteoles linear .3". Cor. pubescent, tube .25", three-toothed anterior lip becoming uppermost, .4", posterior (lower in actual position) entire subequal, ovate-lanceolate with recurved margins. Seeds usually 2, large discoid glandular-papillose, scarcely verrucose. Embryo large blue.

Var.

Habit of last. Leaves in a pair often very unequal, one with petiole attaining .7". Inflorescence more elongated. Pair of cymule bracts often connate at base, larger .4—5" by .08" but very unequal. The cymule contains 3—5 fls. each with a slender bract and bracteoles and very shortly pedicelled. Bracteoles .27—28" slenderly subulate.

Calyx .2—'.3", all glandular-pubescent as in the last. Style very slender .6—'.7" long.

Appears to be a form of the same species with the cyme less contracted. Ranchi and Palamau, elev. 3000 ft.†

2. *D. bupleuroides*, Nees. Syn. *D. Roxburghiana*, var. *bupleuroides*, Clarke.

A tufted herb or undershrub about 18" to 2 ft. high. Stems 4-angled or grooved and striate with swollen nodes, usually pubescent on two sides and at the nodes. Leaves in a pair often unequal and one of a pair (subtending) the inflorescence often deciduous, larger 3.5 by 2", ovate acuminate, very hairy beneath but hairs more or less deciduous with age, thinly pubescent or hairy above. Petioles .5—1.2". Fls. rose-purple in very compound axillary sessile cymes and terminating short axillary (or leaf-opposed, owing to fall of leaf) branchlets .5—1.5" long from the axil of the smaller (often deciduous) leaf. Cymule (pairs of) bracts in several transverse series, each series with 5—7 cymules enclosed between a pair of lateral bracts, the cymule bracts being anterior and posterior to the cymule. Larger bract .4—'.5", 3-nerved, slightly linear-oblong, slightly wider upwards, cuspidate or shortly aristate, smaller bract similar but narrower and one-nerved, both with very long hairs. Bracteoles of perfect flowers .27", pubescent, setaceous. Calyx .15—'.18" with the subulate-setaceous segments rather unequal. Corolla-tube .23" long, lips sub-equal, .25—'.3", very pubescent or hairy. Capsule .2—'.25", pubescent and villous excepting the short glabrous base.

Among hæmatite-schist rocks, on the mountains of Chota Nagpur. Singbhum† Fl., Fr. c.s.

L. sometimes with cuneate base and almost tomentosely hairy beneath when young, sec. n. strong beneath, 6—7. Corolla .5" long, hairy without, throat inflated, lips purple spotted with darker purple within, upper (anterior) minutely 3-toothed recurved, lower .17" broad entire. Anther-cells superposed, filaments hairy. Seeds 4 densely papillose.

Possibly intermediate forms between *D. Roxburghiana* and this species occur which induced Clarke to unite them, but in our area they appear to be quite distinct.

3. *D. micranthes*, Nees.

A herb with tough or sub-woody usually decumbent and rooting stems, somewhat angular above and with pale longitudinal lines. Leaves usually small, .75—2", ovate or rhomboid acute and apiculate or acuminate, cuneate at base; which tapers into a slender .3—'.5" long petiole, very lineolate, glabrous or sometimes somewhat hispid beneath. Flowers in dense whorls or contracted cymes (fascicles) at nearly every node. Ultimate cymules mostly of one perfect flower and 4 barren flowers or bracts enclosed between a pair of somewhat unequal oblong-obovate or oblanceolate hairy and densely white-ciliate bracts .2—'.3" long with sub-squatrose awned tips. Calyx .15" with 5 narrowly subulate acuminate segments. Corolla .25", tubular part only .1—'.15". Capsule shortly beaked. Seeds minutely hispid or glochidiate, .06" diam.

A weed of waste and cultivated ground. Behar, *J. D. H.*! Gya, *C. B. Clarke*! Ranchi, common, *H. G. Carter*! Manbhum, *Clarke*! Probably in most districts. Fl., Fr. c.s.

Leaves up to 3.5" in some Bombay specimens, in ours always smaller, sec. n. 4—5. Sometimes several fascicles in an axillary vertical series with the inner shortly peduncled and sometimes fascicles also in interrupted spikes on short axillary branches. Outer lateral bracts shorter than the cymule bracts. Barren bracts or flowers usually .22", oblanceolate with scarious margins, hairy, and with straight sub-aristate tips. Corolla white (always?). The proper bracts and bracteoles, unless a pair of the barren bracts represent the latter, appear to be absent in this species.

31. ANDROGRAPHIS, *Wall.*

Herbs or small undershrubs with entire leaves and small flowers, usually erect on the branches of a spreading lax or very dense panicle or on axillary racemes, rarely racemes subcapitate or reduced to a single flower. Bracts small, and bracteoles minute or 0. Sepals equal, narrow. Corolla 2-lipped, white or pink or spotted, or lower lip purple, usually pubescent; upper lip sub-entire or deeply 2-lobed, lower 3-lobed. Stamens 2 (rarely 4 in *A. elongata*), filaments ciliate or setulose, rarely glabrous, anthers exerted with 2 oblong parallel, mucous subequal cells bearded at the base. Ovary thinly hairy, stigma minutely 2-fid. Ovules 3—9 in each cell. Capsule compressed transversely to the septum. Seeds 6—18, bony, oblong or subquadrate, not compressed, rugose-pitted, glabrous. Retinacula sometimes dilated at the tips.

The anterior lip of the corolla is usually perfectly erect in flower, the posterior spreading! In exceptional cases 4 perfect stamens may be found on the same plant with 2-staminate flowers.

A. Erect symmetrical herbs. Posterior lip of corolla entire or sub-entire, tube half as long as flower or more, or only little less:—

Flowers all pedicelled. Leaves glabrous narrow acute
Flowers sessile. Leaves hairy, oblong, obtuse

1. *paniculata*.
2. *echioides*.

B. Straggling, unsymmetrical. Posterior lip of corolla deeply 2-lobed, tube one-third or less length of flower:—

Nearly glabrous. Flowers shortly pedicelled

3. *elongata*.

1. **A. paniculata**, *Nees*. Kalmeg, *K., S., H.*; Chiretta, *Beng.*; Bhunimo, *Or.*

An erect herb 1—3 ft. high with square stems glabrous below, glandular hairy above, linear-lanceolate or lanceolate glabrous leaves 1.5—2.5" long, and distinctly pedicelled white or pale-purple flowers, spotted purple, solitary and erect on the slender spreading sometimes compound branches of a large pyramidal panicle, of which the lower branches are from the axils of ordinary foliage leaves. Pedicles .1—'.4" slender glandular-pubescent. Sepals .1—'.15", subulate-linear, glandular. Corolla .3—'.5", tube half as long as whole corolla, or little less. Anthers purple. Capsule .7—'.8", very sparsely gland-hairy, finally glabrous.

Common, especially on cleared stony lines in the forests. Patna, *T.T.*! Monghyr Hills, *Cal. Herb*! Chota Nagpur, all districts, frequent! Santal Parganas!

Angul! Sambalpur! Probably in all the districts in Central and Southern Areas. Fl., Fr. Sept.—May.

L. pale beneath microscopically punctulate and sometimes minutely puberulous, sessile or subsessile, sec. n. 2—3 exceedingly slender. Racemes divaricate, 2—4" long with acicular bracts under .1". Posterior lip often appearing the lower, entire or minutely 2-toothed, anterior lip often erect and 3-lobed half-way down. Filaments very hairy. Seeds subquadrate, rugose.

In a form collected in the Santal Parganas the stems are narrowly sub-alate, leaves under 1.5", pedicels all under .1" and capsule only .5" long.

The whole plant is very bitter and a decoction is used in fever and an extract as a medicine for the liver. *Campbell* says it is also given in diarrhœa, convulsions and epilepsy by the Santals. Its use is very general.

2. *A. echioides*, *Nees*. Bir-kubet, *S*.

An erect symmetrical herb 8"—2 ft. high with pubescent stems, sessile oblong rounded or obtuse leaves 1.5—3.5" long pubescent or hairy both sides and pale, purple spotted, flowers .5—.65" long, sessile erect on divaricate simple or branched racemes from all the axils, the whole forming sometimes a large pyramidal but leafy panicle, but in early stages only lower leaves bearing racemes. Capsule ellipsoid-oblong, compressed, .3—.4", slightly hairy, sharp both ends.

Behar, *Hope*! Throughout Chota Nagpur, in similar localities to *A. paniculata*! Sambalpur, *Griff*! Probably throughout the area and common, but not always recorded. Fl., Fr. July—Jan.

Stems 4-angular. Branches sometimes villous with long white hairs. Leaves with usually broad rounded base, rarely some with cuneate base, sec. n. 5—7. Racemes ultimately exceeding the leaves, glandular-hairy, bracts minute. Lowest flowers sometimes shortly pedicelled but with pedicels shorter than the calyx, sepals glandular-hairy, linear, .2—.3" or sometimes .4" in fruit. Corolla like that of *A. paniculata*. Filaments thinly hairy, anthers dark-purple, densely white-bearded. Seeds somewhat oblong, rugose.

3. *A. elongata*, *T. Anders*.

A straggling herb 3 ft. long, with glabrous 4-angled stems 2—4 ft. long, ovate to lanceolate acute or obtuse leaves .6—1" long (or lower longer), glabrous, or above very minutely puberulous; and irregular lax branched racemes of 2-lipped flowers .3—.4" long and as broad. Pedicels shorter than the .1—.12" long glandular-pubescent calyx. Corolla with very short tube, posterior lip deeply 2-lobed, anterior deeply 3-lobed. Filaments dilated glabrous purple .5" long, anthers not or very slightly hairy. Capsule linear .6—.7" by .09" thinly glandular puberulous, 12—18-seeded.

Scrub jungles near the sea. Puri, in the south! Fl., Fr. March—April.

Angles of stem sub-alate or beaded. Leaves paler beneath with 2—3 sec. n. Petiole .1—.2" (those of fallen lower leaves were perhaps longer?). Racemes elongating to 6", rachis glabrous. Bracts mostly under .1" subulate or setaceous and usually a pair of smaller bracteoles at base of pedicel. Sepals narrowly subulate. Corolla-tube only .1—.2" long, broad at base, pubescent, lobes .25—.3" oblong 3-nerved. Stamens exerted, occasionally 4 (in same plant with 2-staminate flowers). Ovary pubescent, style hairy, stigma simple or minutely lobed. Seeds pale brown or yellow, somewhat shapeless, rugose, glabrous. The retinacula dilated at the ends.

Identified somewhat doubtfully with *A. elongata*, but the corolla-tube is shorter and the specimens of *A. elongata* do not appear to be glandular.

32. PHLOGACANTHUS, Nees.

Shrubs or tall herbs with entire, rarely obscurely crenate, usually large leaves and orange red or pink showy flowers in thyrses or narrow panicles, rarely simply racemose or in axillary cymes. Bracts small, bracteoles small or 0. Calyx deeply 5-fid with narrow segments. Corolla tubular⁹ curved so that the limb is oblique, limb 2-lipped, segments connivent patent or recurved, imbricate in bud. Stamens 2 and sometimes 2 small staminodes, anthers 2-celled, oblong, mucous, glabrous. Style simple and attenuate into the stigma, stigma pointed. Ovules 5—8 in each cell. Capsule elongate, sub-4-angled, many-seeded from the base. Seeds ovate-lenticular, glabrous or densely shortly hairy.

The *F. B. I.* and *Bengal Plants* give "bracteoles 0" as a generic character, but our species has bracteoles wherever collected by me from Dehra Dun to Bhotan!

1. *P. thyrsiflorus*, Nees. Chuhar, *Th.*

A handsome shrub 5—12 ft. high with large dark green glossy leaves and terminal thyrses of dark orange flowers. All parts of the inflorescence villously-tomentose or densely pubescent. Bracts and bracteoles linear. Calyx 3" with setaceous segments. Corolla 5—7" long with broad tube, tomentose.

Along the northern boundary, in the foothills. Bettiah! Ramnagar! Fl. Jan.—April.

Branches quadrangular. Leaves 6—9" or sometimes up to 12" long, oblanceolate, acuminate, tapering at base into a short petiole, sec. n. 10—12. Thyrses 6—10" long, bracts 5—7" long linear-acuminate, bracteoles similar, one-third to half as long. Flowers very shortly pedicelled. Upper lip curved, 1.5—2" long with two short rounded lobes; lower lip spreading with 3 short more oblong lobes. Filaments stout, slightly pilose at base, anthers exerted from throat, shorter than upper lip, large. Capsule 1.25", sub-4-angled, 12—14-seeded.

Leaves ground up with pepper are used for fever by the Tharus.

2. *P. curviflorus*, Nees, is a very handsome species with larger leaves than the last, often exceeding one foot in length. The thyrses are also stouter, 4—8" long with the brick-red flowers 2" long. It is sometimes cultivated in gardens. Native of the Khasia Hills.

33. BLEPHARIS, Juss.

Herbs or undershrubs, often rigid or prickly, with opposite or whorled sub-entire, sometimes unequal, toothed or spinose leaves. Flowers small or mod.-sized in 1—few-flowered, short or capitate spikes with opposite decussate bracts. Spikes terminal, often clustered on abbreviated axillary shoots. Sepals 4, unequal, paired, one of the outer pair emarginate or 2-lobed. Corolla with ovoid or urceolate tube and lipped limb, upper lip sub-obsolete, lower large 3-lobed. Stamens didynamous; anthers 1-celled, anterior below apex of filament, margins densely bearded, small rudimentary second cell sometimes present. Ovules 2 or 1 in each cell. Capsule oblong or ellipsoid. Seeds-echinate by thick papillæ, their tips sometimes of free hairs when moistened, or hairs sometimes free from the base.

The hairs on the seeds are of interesting structure. *Vide F.B.I.*, p. 478; *Nat. Pflanz. Fam.*, "Acanthaceæ," p. 317.

The pair of bracts under the terminal flower are often termed bracteoles, their position (decussate with previous pairs, anterior and posterior to the flower) appears to connote them as bracts.

L. acute or obtuse, 1.5—3.5". Corolla .7—8" long
L. obtuse .3—1". Corolla .25—3" long

1. *boerhaaviaefolia*
2. *molluginifolia*.

1. *B. boerhaaviaefolia*, Pers.

Undershrub or herb with creeping rootstock and diffuse stems 2—3 ft. long. Leaves mostly 4 in a whorl 1—3.5" long, elliptic or ell.-oblong, subacute, acute or acuminate, rarely obtuse, cuneate at base, mostly remotely serrate or with few small teeth. Flowers white .7—8" long, fascicled or solitary on abbreviated many-bracteate spikes conspicuous by the long marginal setæ of the bracts. Capsule broadly ellipsoid .3" long. Seeds 2, densely covered with stout white papillæ .05—08" long branching into their component hyphæ at the tips.

In shady places, on rocky hills or along ravines. Monghyr hills, Kurz! Bihar, J.D.H.! Singbhum! Palamau! Angull! Fl., Fr. Aug.—March.

Stems attain .25" diam. with thickened nodes and often with a reflexed sub-hispid pubescence on the branches. Leaves sparsely hispid-hairy above, sub-strigosely hairy on the nerves beneath, sometimes in unequal pairs below. Petiole .15—25". Bracts oblanceolate or spatulate, lower often only .2", uppermost .3—5", 3-nerved, bristles often .1—15" long retrorsely hispid. Outer sepals oblong, upper .6" long, inner and lateral shorter. Cor.-tube almost horny bulbous white, .15—17" long with rim sub-truncate above, lower lip pubescent with pink veins, mid-lobe sometimes with 3 crenatures of which the central is emarginate.

2. *B. molluginifolia*, Pers.

A much smaller plant than the last with diffuse patently hairy stems 3—8" long and narrow-elliptic (linear-oblong in some Bundelkhand specimens) to obovate rounded entire leaves usually only .3—7", sometimes up to 1" long. Heads sessile dense ovoid .4" with spinose-ciliate or awned bracts shorter than the bracteoles. Flowers usually only one in a head, .25—3" long with corolla-lip only .15" broad, minutely pubescent.

Rare in our area. Purulia (Manbhum), Clarke! Fl. Sept.—Dec. It is found frequently to the west of our area in the United Provinces and Bundelkhand, so that it very probably occurs also in Shahabad and other dry western districts in our area, especially as it penetrates as far as Purulia.

34. ACANTHUS, L.

Shrubs or herbs with pinnatifid, toothed or spinous leaves, rarely scandent with entire (*volubilis*) leaves. Flowers subsessile usually large in dense strobiliform or interrupted terminal spikes with opp. and decussate spinescent bracts, and large lanceolate (rarely 0) bracteoles. Sepals in decussate pairs, 2 outer larger. Corolla with short ovoid horny tube, limb lipped, upper lip obsolete, lower elongate obovate, shortly 3-lobed. Stamens didynamous, shorter than the lip, curved below the anther, anther-cell one, apical on the filament, oblong, bearded. Disc 0. Style very shortly 2-fid. Ovules 2 in each cell. Capsule ellipsoid, compressed shining dark-brown, 4-seeded. Seeds compressed, glabrous.

- A. Erect, leaves spinous or spinulose-serrate:—
 Shrub, leaves rigid glabrous shining. Cor. 1.5" 1. *ilicifolius*.
 Herbaceous, leaves soft. Corolla 1" 2. *leucostachyus*.
 B. Twining, leaves not spinose nor spinulose, entire 3. *volubilis*.

1. **A. ilicifolius**, L. Harkanchi, Or.; Harkat, Beng.

A very handsome small shrub 2—5 ft. high, with holly-like spinous-rigid shining leaves mostly 2—4" long and beautiful sky-blue flowers 1.5—2" long in terminal spikes 3—6" long or more. Capsule 1—1.5".

Maritime marshes and ditches along the Orissa coast. Balasore! Mahanadi delta, Cuttack! Fl., Fr. April—June (perhaps also at other times).

L. subsessile, oblong, slightly contracted at base, sec. n. running out into spines. Bracts ovate, 3—5", spinous-tipped, bracteoles similar but rather smaller. Large anterior sepal .7", nerves sometimes excurrent as two teeth. Lip oblong-elliptic entire, pubescent within. Anthers .4—5" long, very shaggy.

The seedlings of this plant have linear entire leaves.

2. **A. leucostachyus**, Wall.

A stout herb 1—2 ft. high with somewhat decumbent woolly stems and short-petioled oblong serrate and spinulose-serrate leaves 4—8" long and terminal hairy spikes of pale purple or white flowers about 1" long (.7", *F. B. I.*).

I have found this plant in wet ground in evergreen forest in the Jalpaiguri district and it may therefore occur in Purneah. Fl. March.

3. **A. volubilis**, Wall.

This has not been found in our area, but very probably occurs in the Mahanadi delta. It occurs in the Sunderbans twining among reeds (*Prain*).

FAM. 105. VERBENACEÆ.

Trees, shrubs or more rarely herbs, sometimes scandent by means of their sarmentose shoots, often foetid or aromatic from minute glands, frequently with forked or stellate hairs. Leaves opposite or sometimes whorled, simple or rarely (*Vitex*) digitate, exstipulate. Flowers zygomorphic or sub-regular, small or mod.-sized, often showy, in variously formed inflorescence. Calyx gamo-sepalous, persistent and often accrescent, sometimes 2-lipped, rarely truncate, usually 4—5-lobed or -toothed (6—8-toothed in *Symphorema*). Corolla usually 2-lipped and 5-lobed, or two posterior lobes connate into one, sometimes subregular (many-lobed in *Symphorema*). Stamens usually 4, rarely 2 or (*Symphorema*) more than 4. Ovary of 2 or (*Duranta*) 4 connate carpels and 2-celled, or more usually each carpel divided more or less completely by a dissepiment into 2 cells, rarely only 1-carpellary by suppression or 2-carpellary with a free or nearly free central 4-winged column (*Avicennia*); never deeply divided as in the *Labiatae*. Style usually slender with a 2-fid stigma. Ovules 2 to each carpel, usually laterally affixed to the infolded walls, more rarely near the base or pendulous from the apex (between the wings of the central column in *Avicennia*), micropyle always inferior. Fruit usually drupaceous with a 4 (1 by suppression).

-celled stone or 4—1 pyrenes or partially connate drupels, more rarely quite dry, rarely 4- or 2-valved. Seeds as many as the ovules or fewer, exalbuminous in our genera.

The germination is epigeal in all cases observed, the cotyledons usually broadly oblong.

- I. Inflorescence centripetal: spicate, racemose or rarely narrowly paniced. Ovules basal or lateral. (Genera 1—7):—
- A. Fls. sessile. Spikes simple:—
1. Pyrenes or drupels 2 or 1, 1-seeded:—
 - a. Spikes capitate. Fruit subglobose:—

Calyx truncate or sinuate-dentate. Fruit succulent	1. <i>Lantana</i> .
Calyx 2—4-fid. Fruit dry	2. <i>Lippia</i> .
 - b. Spikes elongate. Fruit dry, oblong or linear. St. 2

3. <i>Stachytarpheta</i>
4. <i>Verbena</i> .
 2. Pyrenes 4. Spikes elongate or capitate. Herbs
- B. Flowers pedicelled. Racemes simple or paniced:—
1. Ovary 1-carpellary, sub-2-celled. Frt. 2—1-seeded:—

Scandent introduced shrub with blue flowers	5. <i>Petræa</i> .
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 2. Ovary 2-carpellary, 4-celled. Pyrenes 2, 2-seeded

6. <i>Citharexylum</i> .

 3. Ovary 4-carpellary, 8-celled. Pyrenes 4, 2-seeded

7. <i>Duranta</i> .

- II. Inflorescence centrifugal or composite, with partial inflorescences cymose (Genera 8—end):—
- A. Ovules lateral, amphitropous. Ovary more or less incompletely 4-celled:—
1. Fruit drupaceous, sometimes dry but not capsular:—
 - a. Flowers regular or nearly so:—

Fls. 4-merous. Cymes axillary. Drupe with 4 (—1) pyrenes	8. <i>Callicarpa</i> .
Fls. 4—6-merous. Panicles terminal. Drupe with 4—3-celled endocarp	9. <i>Tectona</i> .
 - b. Fls. distinctly zygomorphic. Stamens didynamous:—
 - i. L. digitate. Drupe with 4 (—1)-celled endocarp

10. <i>Vitex</i> .

 - ii. Leaves simple:—

* Drupe with 4 (—1)-celled endocarp:—	
Fls. small white. Drupe small, under .3"	11. <i>Premna</i> .
Fls. 1", yellow. Drupe over .5"	12. <i>Gmelina</i> .
** Drupe with 4 drupels or pyrenes:—	
Cor.-tube slender. Drupe exserted, usually succulent	13. <i>Clerodendron</i> .
Cor.-tube widened upwards. Drupe dry included in entire calyx. Large scandent shrub with red membranous calyx	14. <i>Holmskiöldia</i> .
15. <i>Caryopteris</i> .	
 2. Fruit sub-capsular, dry. Fls. zygomorphic

16. <i>Symphorema</i> .
17. <i>Avicenna</i> .
- B. Ovules apical, pendulous, orthotropous. Fls. sub-regular:—
- Cymes with an involucre of large bracts. Cor. 6—16-merous, white
- Cymes not involucre. Corolla 4-merous, yellow

1. LANTANA, L.

Pubescent, scabrous or prickly shrubs, rambling or climbing, with 4-gonous branches and simple petioled, crenate, often rugose leaves. Flowers small, in peduncled capitate ovoid or cylindrical spikes. Bracts exceeding the calyx, bracteoles 0. Calyx small, membranous, truncate or sinuate-toothed. Corolla with slender tube and 4—5 spreading lobes.

Stamens didynamous, included. Ovary 2-celled, style short, stigma oblique, subcapitate. Ovules 1 in each cell. Fruit drupaceous with 2 bony 1-seeded pyrenes. Seed without albumen, radicle inferior.

Branches strigosely-hairy, erect. Spikes elongate. Bracts obovate or ell.-ovate, outermost sub-involucriform . . . 1. *indica*.
Branches mostly aculeate, spreading. Spikes in flower sub-umbelliform, not elongate. Bracts lanceolate . . . 2. *camara*.

1. *L. indica*, Roxb.

A shrub 3—8 ft. high with long rambling 4-angular strigose branches. Leaves mostly ovate coarsely crenate, 1—3.5" long, rugose with impressed nerves and hairy with somewhat bulbous-based hairs above, beneath with usually matted hairs or sometimes nerves villous. Flowers light purple, scentless, in close heads .3" long, soon becoming ovoid or cylindrical and elongating up to 1" or 1.5", on axillary peduncles rarely under 1" in flower, up to 4" in some cases in fruit. Bracts obovate, ovate lanceolate or ovate acuminate, hairy all over, less conspicuously fringed at the margins than in *Lippia geminata*, lowest often .5" long forming a kind of involucre to the spike. Fruit .15—2" diam., purple when ripe.

Clarke says "on the river-banks of Bengal one of the commonest weeds"; Prain says "in most of the provinces" of Bengal, but he appears in this statement to have followed Clarke, as there is not a single genuine specimen of the plant from any of his provinces included in Behar and Orissa, and only very doubtful ones from other parts of Bengal! Clarke states that when not in fruit it is difficult to distinguish it from *Lippia geminata* (1). I can only conclude that contrary to his usual discrimination he often took the *Lippia* for this species and that *L. indica* is very rare in our area. Fl., Fr. Sept.—Jan.

L. sometimes ternate (as also in *Lippia*), rarely lanceolate but usually broadly ovate or subcordate (as never in *Lippia geminata*) and suddenly cuneate on the .3" long petiole, teeth in old leaves often .1—1.5" broad, sec. n. 3—6. Calyx tubular, truncate, .07", densely pubescent. Cor.-tube .25—35", pubescent, limb .3" across (back to front), lobes 4, all oblong rounded, anterior as long as posterior. (Both calyx and corolla quite different from *L. geminata*, *q.v.*) The large drupes are quickly evident in the spikes, which also easily distinguishes it from *L. geminata*.

2. *L. camara*, L. Syn. *L. aculeata*, L.; *L. scandens* (Ind. For., Jan., 1901); Putus, K.

A straggling or scandent shrub with small recurved prickles on most of the branches. Leaves 2—3.5" long, ovate or ovate-oblong with cordate or sub-cordate base cuneate or decurrent on the short petiole, rugose above. Flowers usually orange, varying to white or purple, with a strong smell of black-currant, in short spikes appearing superficially subumbellate when young. Cor.-tube very slender, .4", pubescent; limb .3" across (back to front), upper lip sub-quadrate, similar to lower lip, side lobes rounded. Drupe greenish-blue.

Running wild in Horhap and a few other places. Native of Central America and very commonly planted as hedges. In parts of India (Berar, Coorg, etc.), the plant has proved a terrible pest.* Fl., Fr. nearly all the year round.

* See *Indian Forester*, Jan., 1901, also Nov., 1919, where the leaves have been suggested as a substitute for tea.

A form with the stems more aculeate constituted *L. aculeata*, L., while some forms have the prickles very minute. L. scabrid above, shortly villous on the nerves beneath. Peduncles equalling or exceeding the leaves. Bracts lanceolate strigose equal, shorter than the corolla.

2. LIPPIA, L.

Shrubs or undershrubs, rarely herbs, with opposite or whorled, rarely alternate, often aromatic, leaves and usually small or very small flowers sessile in the axils of small bracts in axillary heads or spikes. Bracteoles small or 0. Calyx small, with 2—4-cleft or 4-toothed or with 2-ribbed or 2-winged tube. Corolla with straight or curved tube often somewhat widened upwards, limb somewhat 2-lipped, 4-lobed. Stamens 4 didynamous. Ovary 2-celled (formed of one carpel). Ovule one in each cell. Fruit dry, small, and included in the calyx, with hard pericarp and 2, 1-seeded, easily separable pyrenes.

Flowers in dense spikes or capitula with persistent bracts:—

Shrub with aromatic leaves 1. *geminata*.
Creeping herb with cuneate-spathulate serrate leaves 2. *nodiflora*.

Flowers in lax paniced spikes with caducous bracts:—

Sweetly lemon-scented shrub. Cultivated 3. *citriodora*.

1. *L. geminata*, H.B. & Kunth. Naga-ajeri, Or.; Wild Sage (of English denizens).

A gregarious shrub with numerous erect weak scarcely angled hairy branches 3—5 ft. high and also long procumbent ones, and aromatic, mostly lanceolate or oblong, closely crenulate or crenate-serrate leaves 1.5—2.5" long with impressed nerves and thinly hairy and punctate above. Flowers pink, scented, in capitate spikes .3" long elongating to .7", rarely to .75" on axillary peduncles .3—5", very rarely 1" long (under shade). Bracts ovate acuminate white-villous at the edges, lowest .2—3" long. Fruit .08" diam., globose with sub-succulent green pericarp when unripe, ultimately dry and splitting into 2 pyrenes.

Along muddy river banks and wet places. Very common in the eastern districts of the Northern Tract! Along the Ganges at Bankipur, etc.! Rivers on the Ranchi plateau! Sand-dunes and mud-banks, Balasore! Puri! Fl., Fr. March—Dec.

Branches with numerous minute glands and spreading hairs. L. rarely ovate or suddenly cuneate on petiole (cp. *Lantana indica*), usually narrow with gradually tapering or cuneate base, somewhat hoary beneath, teeth 1—3 to .1"; sec. n. 6—7 conspicuous beneath with many intermediate, villous. Petiole .2—5". Bracts closely hairy. Calyx of 2 oblong obtuse concave silky lateral lobes, free on the anterior face, slightly connate at base above. Corolla hairy, tube .2", throat yellow, limb .15" from back to front, upper lip with 2 small rounded lobes much shorter than the lower lip, which has a shovel-shaped blade.

"Used as sage in cookery." *Tweedie*.

2. *L. nodiflora*, Rich.

A prostrate herb with opposite cuneate-obovate serrate obtuse leaves .5—1" long and axillary peduncled bracteate heads of small white flowers. Fruit .08" diam. of 2 pyrenes, embraced by the two-fid calyx and bracts.

A weed of wet ground, probably occurring in most districts. Darbhanga, Cal. Herb. Singbhum. Balasore. Puri. Fl., Fr. practically all the year round.

Strigose with short hairs. L. with few appressed hairs beneath, sec. n. obscure, petiole hardly any. Peduncles .25—3" long. Heads .12—25" diam., at first very short, finally elongating to .3—5". Bracts obovate or sub-orbicular, shortly acuminate. Calyx 2-fid, shortly pubescent. Corolla .1" long, sub-2-lipped with 5 short lobes, lowest largest, 2 upper smallest. Style short, stigma oblique.

3. *L. citriodora*, Kunth.

is the well-known Lemon-scented Verbena (Syn. *Aloysia citriodora*, Ort.), of horticulturalists. Leaves and paniced spikes and fls. ternate.

Native of South America.

3. STACHYTARPHETA, Vahl.

Shrubs or herbs with toothed leaves and rather small flowers in long slender terminal bracteate spikes. Bracteoles 0. Calyx tubular, shortly 4—5-toothed. Corolla with cylindric, straight or curved, slender (or towards the top widened) tube and oblique patent equally or unequally lobed limb. Stamens 2 included with ovate anther-cells vertically divaricate; staminodes 2 small posterior. Ovary 2-celled, of one carpel, each cell 1-ovuled. Style elongate with terminal somewhat capitate stigma. Fruit elongate, dry, included in the calyx, of 2 hard 1-seeded pyrenes.

Herbaceous. Flowers blue
Shrub. Flowers red

1. *indica*.
2. *mutabilis*.

1. *S. indica*, Vahl. Syn. *S. jamaicensis*, Vahl; Jalajali, Or.

A herb 1—3 ft. high with terete stems and somewhat 4-sided branches, mostly dichotomous. Leaves nearly glabrous, elliptic, sub-obtuse or acute, 2—4" long. Flowers blue, rather pretty in young plants but becoming very weedy with the elongation of the spike which often attains 12" or more, with lanceolate bracts as long as the oblique 4-toothed calyx. Fruit .12—17" long.

Often occurring as a weed and sometimes a pest after ploughing a compound. Ranchi. Singbhum. Purulia, Milne. Naturalised in the open laterite forests of Puri. Fl., Fr. r.s. Native of America.

Leaf base decurrent. Flowers sunk in the rhachis of the spike. Calyx .2", 4-nerved. Corolla .3—5".

2. *S. mutabilis*, Vahl.

A shrub 3—5 ft. high with 4-angled tomentose-villous branches and ovate or ovate-oblong acuminate rugose leaves 2—4" long, sparsely villous and scabrid above, densely villous or woolly beneath. Flowers scarlet and rose, sunk in the rhachis of spikes which attain 2 ft. in length. Bracts acuminate.

Often grown in gardens. Native of tropical America.

4. VERBENA, L.

Herbs or undershrubs with opposite or ternate toothed or pinnatifid leaves and small or mod.-sized flowers in simple or corymbose terminal spikes with small bracts and bracteoles. Calyx tubular, 5-

toothed. Corolla with straight or curved tube and weakly 2-lipped limb with 5 spreading lobes. Stamens didynamous, included, anthers ovate 2-celled. Ovary 2-carpellary, more or less 4-lobed and 4-celled, each cell with 1 ovule attached laterally near the base. Fruit included in the calyx breaking up into 4 (or fewer by abortion) oblong pyrenes.

The beautiful garden *Verbenas*, of which especially the scarlet one *V. chamædrifolia*, Juss., grows well in Chota Nagpur, consist of several species and their hybrids and varieties obtained by inter-crossing. They are mostly Argentine and Brazilian.

1. *V. officinalis*, L. Vervain, Eng.

A decumbent and erect herb 1—2 ft. high with 4-angular branches and oblong or ovate toothed, or lower pinnatifid, leaves 2—4" long and elongating spikes of small lilac flowers 1/7" diam. Pyrenes truncate, granulate on the inside, smooth dorsally, 3-ribbed.

Occasional. Santal Parganas, Roxb. Chota Nagpur! Fl., Fr. c.s. Rootstock woody. Branches and leaves hispidly pubescent. Leaves mostly 3-partite with obtuse or acute lobes, upper narrower. Spikes elongating to 10".

This little plant is very widely distributed and is frequent by waysides and on rubbish-heaps in England. The plant was held in great veneration by the ancients (in Europe), being used in sacrifices and at other religious ceremonies.

5. *PETRÆA*, L.

Scandent rarely erect shrubs with opposite coriaceous entire leaves and violet, purple or blue flowers, shortly pedicelled in the axils of bracts scattered on the rhachis of long terminal racemes. Calyx turbinate at the base, 5—15-costate with 5 spreading equal beautifully-coloured lobes longer than the tube, persistent rigid and reticulate after flowering; scales in the throat opposite the sinuses. Corolla with short cylindric tube and oblique broadly spreading 5-fid limb with obtuse usually unequal lobes. Stamens didynamous, included. Ovary on an elevated disc, imperfectly 2-celled, cells 1-ovuled. Fruit coriaceous sub-fleshy, indehiscent, included in the calyx-tube.

1. *P. volabilis*, Jacq.

Very beautiful when in flower with ovate elliptic or oblong rather harsh leaves 3—5" long and racemes of star-like flowers with spreading pale blue calyx exceeding the deep violet corolla. Calyx-lobes linear, tube with pubescent scales at the mouth. Anterior corolla-lobe with a white spot at base.

Frequent in gardens. Native of tropical America. Fl., Feb.—April, also sometimes in October.

6. *CITHAREXYLUM*, L.

Trees or shrubs. Flowers rather small racemose or pedicelled axillary. Calyx truncate or shortly 5-lobed, spreading under the fruit or cupular and shorter than the fruit. Corolla limb 5-fid. Ovary sub-4-celled with one ovule in each cell. Fruit a succulent drupe with 2 hard 2-celled pyrenes.

1. **C. subserratum**, Swartz. Fiddle Wood.

A small tree with glabrous ovate elliptic or obovate petioled leaves, shining above and remotely shallowly serrate towards the apex. Flowers small white very fragrant in long drooping racemes.

Often planted. Native of America. Fl. r.s.

7. **DURANTA**, L.

Shrubs, sometimes very large, with opposite or whorled leaves, often bearing axillary thorns, and small flowers in the axils of small alternate bracts in terminal racemes, rarely axillary. Calyx tubular or subcampanulate, truncate or minutely 5-toothed, accrescent in fruit and including it, and often constricted at the apex. Corolla with straight or incurved tube and spreading oblique or equally 5-fid limb. Stamens didynamous, included. Ovary almost perfectly 8-celled (4—2-celled carpels), each cell 1-ovuled. Style short, stigma unequally 4-fid. Fruit a drupe with succulent pericarp and 4 hard 2-celled, 2-seeded pyrenes. Seeds exalbuminous.

1. **D. Plumieri**, Jacq.

A large shrub or sometimes almost a tree with weeping branches, usually thorny. Leaves obovate or elliptic with cuneate base tapering into a short petiole, entire or serrate above the middle, about 1" long. Flowers blue or white, in terminal and axillary sometimes subpanicked drooping racemes. Calyx teeth triangular-subulate. Drupe globose yellow about .25" diam.

Very commonly planted and makes an excellent hedge, especially in the damper districts. Fl., Fr. most of the year. Native of Mexico and the West Indies.

D. Ellisia appears to be a white-fl. variety with the branches often unarmed.

8. **CALLICARPA**, L.

Trees or shrubs with the young parts stellately tomentose. Leaves usually large. Flowers small, often glandular, in axillary usually corymbose dense peduncled cymes. Calyx very small, 4-lobed. Cor. subregular, tubular with 4 (—5) lobes, lilac, purple or red. St. 4—5 exerted. Ovary imperfectly 2-celled with long style and capitate subentire or 2-lobed stigma. Drupe small, with 1—4 free pyrenes.

Tree. Leaves entire. Drupe purple
Shrub. Leaves crenate. Drupe white

1. *arborea*.
2. *macrophylla*.

1. **C. arborea**, Roxb. Bomud, Bodudn, K. ; Dam Kotokoi, S. ; Bagodi, Kharo. ; Sakarla, Mal Pah. ; Boro, Or.

A small or mod.-sized tree with compressed 4-angled densely tomentose branchlets, large ovate to ovate-lanceolate or ovate-oblong acute or sub-acuminate entire leaves 5.5" by 2.75" to 12" by 5.5", densely stellate-tomentose beneath (both sides when young), and small lilac-purple flowers in 2-chotomous corymbose cymes 3—5" diam. on peduncles 1—2" long which exceed the petioles. Drupe purple.

In the damper districts and hills of the drier ones. Champaran! Purneah! Hills, on north aspects or ravines, in Singbhum, Ranchi, Manbhum and Palamau in Chota Nagpur, but only scattered! Dhadka (Manbhum), Wood! Common on the northern slopes of the Parasnath range! Rajmahal Hills, frequent! Bhuyia Hills, Keonjhur, *Grieve*; Bonai, *Cooper*! Mals of Puri, frequent! Fl. Oct. and April—June. Fr. Aug.—Nov. and Dec.—Jan. Evergreen.

Attains 3—4 ft. girth, but of small height, crown spreading. Bark light or sand-coloured; blaze soft, white with yellowish streaks. L. usually, above 6—9", the stellate hairs not stipitate nor with a second whorl of branches below the top as in the Deccan *C. lanata* (but a specimen from the Puri Hills showed a tendency towards hairs³ of this character and *C. lanata* may occur in Kalahandi), margin rarely slightly toothed, base rounded; sec. n. 8—12 with strong scalariform tertiary. Petiole 6—1.5", those of a pair often unequal. Cor. 12" diam. Drupe 1—12" diam., seated on the small spreading calyx, finally black.

Wood only used for fuel and charcoal. "Growth fast, 5 rings per inch (but probably slower in our area). Wt. about 35 lbs." *Gamble*.

2. *C. macrophylla*, Vahl. Bundudn, K.; Buddhi-ghassic', S.; Mathara, Beng.

A stout shrub with the branches, leaves beneath and inflorescence densely stellately woolly. Leaves 5—10" long, elliptic, rarely ovate-lanceolate, long acuminate, crenate or crenate dentate. Flowers rose-coloured in dense 2-chotomous cymes about 1" long and 2" diam., peduncles 3—1" long. Drupe 12—18" diam., white.

Edges of forest, steep slopes and ghats, open jungle and waste land. Champaran! Purneah! Ranchi ghats and Porahat plateau, frequent! Singbhum, rare! Palamau! Manbhum, *Camp.*! Fl. Aug.—Nov. Fr. Oct.—Dec. Evergreen.

L. 1.7—4.5" broad, base usually rounded, upper surface more or less stellate; sec. n. strong, 10—15. Petiole 5—1.5". Calyx .05" with 4 minute teeth. Corolla .06".

9. TECTONA, L.f.*

Large trees with stellate and simple tomentum, and opposite or ternate large entire leaves. Flowers small in many-flowered 2-chotomous cymes disposed in large terminal panicles. Bracts minute. Calyx campanulate, shortly 5—6-fid, in fruit accrescent, bladderly or ovoid-urceolate with the mouth closed. Corolla with short tube and spreading 5—6-fid limb, lobes subequal, short. Stamens 5—6, inserted almost at the base of the corolla, equal, exsert. Ovary of 2 2-celled carpels, each cell with one lateral ovule. Fruit sub-drupaceous, exocarp nearly dry, endocarp bony 4-celled with a central lacuna. Seeds erect, oblong, exalbuminous, with membranous testa.

The endocarp, like some other genera of the family, is supplied with lateral valves to the cells, not reaching the apex of the seed, which are thrown off on germination. Germination epigeal.

1. *T. grandis*, L. Sagun, H.; Rang, K.; Singuru, Sagwan, Or.; Teka, Gondi; Teak.

A large tree, but rarely over 50 ft. high and 4 ft. girth in our province, with 4-sided and channelled branches and large elliptic or obovate leaves 1—2 ft. long, scabrid above, with close stellate tomentum beneath. Flowers white, short-pedicelled, in large erect terminal brachiate panicles 1—2 or sometimes 3 ft. long, with short lanceolate

* For a most excellent short account of teak see *Brandis, Forest Flora*, p. 353.

bracts. Calyx .12—.17" in flower, large inflated and 1—.15" diam. in fruit. Corolla .2—.25" long, throat glabrous. Drupe with a thick spongy covering composed of matted hairs, endocarp with 1—4, usually 1—2 seeds.

Indigenous teak only just enters our province in the south-west, and is confined to the west of Kalahandi and south-west corner of Patna State, *Grieve, Cooper!* There is also about 80 acres of natural teak in the Baud State on the banks of the Tel River, *Cooper*. Whether it was ever indigenous in Orissa proper is doubtful. If so it was completely destroyed. There are, however, plantations in Puri and small ones in Angul, and the former are fairly promising. Fl. July—Aug. Fr. Nov.—Jan. Deciduous Dec.—April.

Small glands occur in most parts especially in the seedling. The cotyledons after germination are somewhat fleshy, broadly elliptic-ovate, about .5—.6" long with a short petiole. The young seedling leaves are hispid, denticulate or crenate, hairy beneath.

The uses of teak are too well known to need description. The leaves contain a red pigment which gives rise to the Kol name.

10. VITEX, L.

Trees or shrubs, often glandular and aromatic or foetid, with opposite or 3-nately whorled digitately 3—5- rarely 1-foliolate leaves and rather small lipped flowers in paniced or dichasial cymes. Calyx campanulate or tubular-camp., shortly toothed or truncate, usually enlarged in fruit. Corolla with upper lip 2-lobed, lower 3-lobed with mid-lobe larger. Stamens didynamous. Ovary 2—5-celled, style filiform, stigma unequally 2-lobed. Drupe with 1—4-celled bony putamen.

I. Panicles mainly terminal, primarily centripetal, lateral branchlets cymose:—

A. Panicles rather dense, lower cymose branchlets elongate, so that the panicle is pyramidal or subcorymbose:—

L. 3-foliolate, lfts. sessile. Panicles fulvous-tomentose

1. *pubescens*.

B. Panicles or their main branches linear-oblong, usually lax; cymose branchlets all short subequal and few-fl.:—

L. 3—5-foliolate, central lfts. petioluled, hoary tomentose beneath

L. 1—3-foliolate, Lfts. all sessile, hoary beneath

L. 3-foliolate. Lfts. shortly petioluled, glabrous

2. *negundo*.

3. *trifolia*.

4. *peduncularis*.

II. Panicles axillary, wholly cymose and dichasial:—

Lfts. 3—5, narrowly-ell.-lanc., 1—4.5" Fls. white

Lfts. 5, ell. or obovate, 3.5—8". Fls. purplish

5. *leucoxydon*.

6. *glabrata*.

1. *V. pubescens*, *Vahl*. Muria, *Or*.

A small or mod-sized tree with 3-foliolate (3—4-foliolate, *F.B.I.*) leaves, sessile ovate or elliptic-lanceolate acute or acuminate leaflets 3—6" long, minutely closely pubescent and strongly-nerved beneath; and mod-sized blue or purplish glandular and tomentose flowers in rather dense pyramidal or sub-corymbose cymose panicles. Drupe black, .4" diam., somewhat depressed-globose.

Puri forests, frequent, often on laterite or sandstone! Fl., Fr. Oct.—Dec. Ever-green.

Crown rather spreading. Branchlets closely minutely pubescent or tomentose. Lfts. rarely 8" by 3", coriaceous, upper surface closely puberulous; sec. n. of terminal lft. 12—18, strong almost to the margin, and with sub-parallel cross close

tertiaries. Petiole 1·3—2" (3", *F. B. I.*). Panicle minutely tomentose with sub-foliaceous ovate or obovate persistent bracts ·25—·5" long. Calyx tomentose, ·3—·4" diam. and often unequally split in fruit. Corolla ·4—·5", upper lip ochroleucous (*F. B. I.*) or purplish (in my specimens). Endocarp very thick, 4—1-celled, usually 1-seeded.

Gamble states that the wood is durable and is used for various purposes in South India. He gives the weight as 52 lbs. It does not appear to be much used in Orissa except for the usual purposes of petty construction and fuel, for which it is well suited as it is a good coppicer.

2. *V. negundo*, L. Bigana, Sursiang, *Ho.*; Huri, *M.*; Sindware, *S.*; Sinoar, *Kharw.*; Shivari, Sambhalu, *H.*; Nishinda, *Beng.*; Begunia, Nirgundi, *Or.*

A large strongly-scented shrub, 6—12 ft., or sometimes subarborescent, covered with a fine hoary tomentum, with 3—5-foliolate leaves and white or lavender flowers in oblong panicles 2—8" long. Leaflets lanceolate or narrowly lanceolate acuminate, entire or crenate. Drupe globose, ·12" diam.

Frequent in waste ground and hedges in all the districts and sometimes near river-banks! Usually near villages and perhaps introduced? Fl., Fr. most of the year. Evergreen.

Lfts. 2—6" long, puberulous or glabrescent above, lateral sessile or subsessile, others with petiolules ·5—1" long. Cymules usually distant on the strict short branches of the panicle, ·5—·75" long. Calyx hoary ·1" long. Corolla ·25—·3" across long diam., puberulous or tomentose outside, palate hairy.

Var. *incisa*, *Clarke*. Syn. *V. incisa*, *Lamk.*

Lfts. cuncate-serrate or sub-pinnatifid. Occasionally mixed with normal form.

Var. *densiflora*, L. all 3-foliolate. Lfts. smaller, 1—3", more broadly lanceolate. Panicles almost thrysiform. Corolla very tomentose, only ·25" on long diameter.

Along the Sone, Palamau!

The root is tonic, febrifuge and expectorant, and the leaves tonic and vermifuge. A decoction with long pepper is given in catarrhal fever. *Dutt.*

3. *V. trifolia*, L. f.

Differs from *V. negundo* in the leaves only 1—3-foliolate, lfts. all sessile obovate or obovate-oblong entire, subobtusate. Calyx ·12—·17". Corolla ·3—·5" diam., tomentose.

Scattered throughout India, *Clarke*. There are no specimens from our area.

4. *V. peduncularis*, Wall. Simjanga, *K.*; Mara-kata (Peafowl's foot), Bhadu, *S.*; Mado-chulia, *Or.*

A small or mod.-sized tree, with pubescent shoots and 3-foliolate leaves, leaflets narrowly elliptic or lanceolate, 3—7" by 1·25—2", glabrous, concolorous both sides, minutely gland-dotted beneath, punctulate above. Petiole often winged (always in the young plants). Flowers white with yellow palate, cymose in narrowly oblong or lanceolate slender lax panicles 6—11" long and exceeding the leaves. Drupe somewhat obovoid, ·35—·4" long and ·3" diam. with 3—4-celled endocarp.

Central and Southern Areas. Valleys and on northern rocky slopes. Gaya ghats! Singbhum, frequent in the moister forests! Manbhum! Hazaribagh, attaining large size on the northern slopes of Parasnath! Koderma! Palamau! Santal Parg., frequent! Puri, not very common! Angul! Sambalpur! Mayurbhanj! Fl. April—June. Fr. Aug.—Sept. Evergreen.

Usually about 3 ft., but attains 5 ft. girth and about 50 ft. in height with light-brown nearly smooth bark. Blaze with chlorophyll in young trees, light yellow or cream and sometimes streaked with brown, rapidly turning darker on exposure. Lfts. acuminate with 12—20 very slender sec. n. Petiole 1.5—3". Petiolules .15—2". Lateral branches of panicle 1" or less long, lower dichasial, upper 3-flowered, minutely appressed pubescent. Bracts subulate .05—.07". Calyx campanulate .06—.08" only in flower, minutely pubescent or sometimes with 5 pubescent lines and glandular with yellow glands, very minutely toothed. Corolla-tube .1", puberulous and with minute yellow glands, upper lip very short erect with 2 oblong obtuse lobes, lateral lobes rather longer, anterior lobe four times as long, shovel-shaped with short base, pubescent.

Wood good for yokes. Wt. about 60 lbs. Col. Vaughan believes that an infusion of the leaves of this plant he has found a specific for black-water fever. If so it will become of great importance.

The form with winged petioles is called var. *Roxburghiana*, but all seedlings have winged petioles and these persist sometimes to maturity.

5. *V. leucoxyton*, L.f. Chirai-gori, *Bhuia* (Bonai).

A large shrub or a mod.-sized tree with pubescent or silky shoots and 3—5-foliolate nearly glabrous leaves with narrowly-elliptic-lanceolate acute or acuminate leaflets, 1—4.5" by .3—1.5" entire or (in very young plants) serrate, dark and shining above, paler beneath. Flowers white, .5" on the greatest diameter, in divaricate dichasial axillary long-peduncled glabrous cymes 2—4" wide. Drupe ellipsoid, .6—.75" long, seated on the scarcely-lobed accrescent .3—.4" diam. calyx.

Along river banks only. Hazaribagh, near Pachamba! Gangpur! Bonai, Cooper! Sambalpur! Fl. May—June and Oct. Fr. Feb. Evergreen. Planted in Purneah.

Bark dark-coloured. Petioles 1—3" slender. Lfts. sometimes narrowly oblong-lanceolate, coriaceous, usually woolly or hairy each side of the midrib, sec. n. scarcely raised beneath, 8—12. Petiolules slender .25—8". Cymes with usually 2 linear bracts .75" long at the first fork only, peduncle 1.5—3", slender glabrous. Fls. often sub-sessile in the forks. Calyx .12—.14" in flower, slightly pubescent, teeth broadly triangular. Corolla densely appressed silky outside, about twice as long as the calyx, mid-lobe of lower lip .25", villous.

Said to be in demand in the Madras Presidency as a useful wood. Wt. 42 lbs. Gamble.

6. *V. glabrata*, R.Br. Syn. *V. bombacifolia*, Wall; Bhadu, S.

A tree, often large and attaining 6 ft. girth, with thinly pubescent shoots and tomentosely hairy buds, mostly 5-foliolate leaves very like those of a *Simul* tree, with large leaflets permanently sparsely appressed-hairy or finely puberulous beneath. Flowers purplish-blue or white with a bluish lip, .3" long, .6" diam. in very regular dichasial panicles, each fork with a shortly pedicelled flower. Drupe oblong-obovoid, .5—.75" long.

Rajmahal Hills, usually along streams but ascending to the tops of the hills in favourable situations! Mayurbhanj Hills, elev. 2—3000 ft.! Fl. May—June. Fr. June—July. Evergreen?

Bark smooth grey; blaze white, yellowish on the wood. Twigs light-grey somewhat 4-sided. Petiole 2.5—6". Lfts. elliptic, broadly-ell. and obovate, 3.5" by 2" to

8" by 4", mostly suddenly acuminate or caudate, glabrous and shining above, base usually cuneate, sec. n. 8—14 rather strong, tertiaries obscure; petiolules .6—2". Panicles 4—6", peduncles 2—4". Flowers with pedicels .12—17" long. Calyx campanulate in flower, .12", deeply saucer-shaped and .25—3" diam. in fruit. Corolla densely grey-pubescent, throat and base of lip villous with often purplish hairs, upper lobes rounded, reflexed, midlobe of lower lip shortly quadrate then concave orbicular.

The timber of this tree is said to be good and is largely used in Assam. In our province it has hitherto been given no protection.

11. PREMNA, L.

Trees or shrubs or (*P. herbacea*) a low herb with usually distinctive foetid or aromatic smell, opposite or ternate entire or toothed, often unequally paired leaves and small, often polygamous, greenish or white sub-regular or 2-lipped flowers in pubescent usually corymbose cymose panicles. Calyx small, 2—5-toothed or sub-entire, sometimes lipped. Corolla tubular, throat hairy, petals 4—5. Stamens didynamous, usually exserted. Ovary of 2 completely or incompletely 2-celled carpels. Fruit a small drupe with 1—4-celled stone, seated on the usually cupular calyx; endocarp usually rugose or verrucose, often with a central lacuna and with usually two basal cavities in connection with it; these may be filled with soft tissue.

I. Large woody climbers, calyx truncate:—

L. mostly oblong or lanceolate, finely caudate, 3—7".

Fls. .08. Sub-Himalayan species.

1. *scandens*.

L. broadly oblong or ovate, shortly caudate, 5—10".

Fls. .1". Peninsula species

2. *coriacea*.

II. Erect trees or shrubs, calyx more or less lipped or toothed:—

A. Calyx 2-lipped (see also 8):—

1. Calyx tubular-campanulate, lips entire rounded or one with 2 rounded or shortly linear lobes:—

a. Unarmed trees, sweetly aromatic with small glands:—

L. 5—10" entire, closely villous-pubescent beneath

3. *flavescens*.

L. 7—12", often toothed, not closely pubescent

var. *gmelinoides*.

b. Small thorny tree. L. 1—4", entire or crenate

4. *integrifolia*.

2. Calyx with one lip 2-lobed or -toothed, the other with 3 smaller lobes or teeth:—

Small thorny tree. Leaves obtuse.

4. *integrifolia*.

Small unarmed tree. L. 4—6", serrate, acuminate.

Calyx-lobes rounded, venose in fruit.

5. *calycina*.

B. Calyx not lipped, with 4—5 equal teeth (sometimes lipped but teeth equal in 8):—

1. Leaves more or less serrate (rarely quite entire in 6):—

Calyx with 4 linear or oblong teeth. L. drying green

6. *barbata*.

Calyx with deltoid teeth. L. drying blue or black

7. *latifolia* (var.).

2. Leaves entire:—

a. Not stellately tomentose:—

L. drying blue or black. Unarmed tree or shrub

7. *latifolia*.

L. drying more or less green. Thorny when young

var. *Gamblei*.

b. Stellately tomentose, especially the panicles:—
L. elliptic, base not cordate. Corymbs 6—8"
diam.

8. *bengalensis*.

L. ovate with cordate base. Panicles pyra-
midal 2—4" diam.

9. *tomentosa*.

III. Shoots herbaceous with spreading leaves appressed to
the ground

10. *herbacea*.

1. *P. scandens*, Roxb. Syn. *P. coriacea* var. *oblonga*, Clarke.

A large woody climber, with membranous young leaves growing coriaceous with age, oblong or lanceolate, seldom ovate-oblong, always long very finely caudate, quite entire, glabrous, 5—10" long. Flowers very small, green, in irregular corymbose very slender-branched corymbose panicles which are pubescent or villous or sometimes glabrous below. Calyx subentire truncate or faintly 2-lipped cupular, about .04—.05" long only. Corolla segments 4 equal oblong obtuse, soon reflexed, throat white bearded. Drupe oblong or obovoid, .14—.15" or (*vide* Roxburgh, and when riper?) round and the size of a pea, succulent, black.

Purneah, near the Nepal boundary! Fl. May. Deciduous March—April.

Attains 1 ft. girth in our area with nearly smooth bark and rather hard cream-coloured blaze with deep yellow streaks. Leaves with obtuse or usually rounded base, the leaf-buds with a deciduous tomentum, mature in our area about 4—7" by 1.7—3.2", with scarcely any smell; sec. n. 4—7 very oblique, of which 2—3 from or from close to the base, nervules minutely reticulate, enclosing pale areoles beneath and with no visible glands. Petiole 1.2—1.7", slender glabrous. Corolla .08", segments reflexed.

I assign all the sub-Himalayan specimens of *P. coriacea* to *P. scandens*, including Hamilton's specimen from Nathpur (quoted by Clarke under *P. coriacea* and Wallich's *P. ramosa*, No. 1774). It is significant that all the fruiting specimens are classed under *P. coriacea* at Kew, but the leaves being older are naturally more coriaceous.

2. *P. coriacea*, Clarke.

A huge woody climber with oblong, broadly oblong or ovate, caudate leaves 3—7.5" long, rounded or cordate at the base, youngest only slightly puberulous and with glistening evanescent glands, sec. n. 5—7, tertiaries and nervules very finely reticulate. Flowers very small white in strong-smelling pubescent corymbose panicles, 1.5—6" diam. with brachiate branches. Bracts filiform, soon falling (and nearly always absent in herbarium specimens). Calyx cupular truncate. Corolla-tube .1" long with 4 reflexed oblong segments .05" long, throat bearded. Drupe .2", narrowly obovoid, 1-seeded.

Bonai, Copper! Mayurbhanj, elev. 2000—3000 ft.! Fl. May. Fr. June. Deciduous, renewing leaves at time of flowering.

Blaze yellow, streaked orange-red. Old leaves coriaceous, caudation .5—9", not as fine as in the last. Petiole 1.25—2" long. Stamens far exserted.

I have kept this distinct in deference to Clarke's opinion, but the points of difference appear to me not sufficient even to constitute it a variety of *P. scandens* and can all be explained by age of the specimens and the different locality. The only doubtful point is the character of the ripe fruit in the two species. I have not seen fruit in the field and all herbarium specimens appear to have immature fruit.

3. *P. flavescens*, Ham. Syn. *P. gmelinoides*, Haines (*List. Cent. Prov.*)? Aria-Kasmar, K.; Buddhi-Kasmar, S.

A variable (if our varieties are the same species) large or small tree, sometimes mistaken for *Gmelina arborea*, with large ovate or elliptic or ovate oblong, acute or shortly acuminate, very sweet-smelling leaves 5—10" by 2.5—7", entire or (var.) coarsely toothed, densely or tomentosely pubescent (not stellate) beneath, and both surfaces dotted with minute yellow glands. Flowers .1—12" long in closely pubescent or tomentose corymbose panicles, 5—7" diam., with filiform bracts .25—.75". Calyx tubular-campanulate very shortly 2-lipped or mouth undulate, .06—.07", upper lip rounded entire, lower lip shortly 2-lobed or both lips rounded entire very short. Drupe globose, .12—.2", seated on the glandular and somewhat pubescent enlarged calyx, which then appears 2-irregularly 3—4-lobed. Endocarp longitudinally fluted or at base rugose.

Not uncommon in hilly tracts, especially near streams and on northern slopes. Singbhum! Palamau! Hazaribagh! Ranchi ghats! Santal Parganas! Angul! Fl. July. Fr. Aug.—Jan. Evergreen.

Trunk up to 4.5 ft. girth with light nearly smooth bark slightly flaking when old; blaze pale with yellow or brown streaks. Innovations tomentose. Twigs light-brown. L. often 3-nate on very young shoots, and often unequal when paired, pubescent on the nerves above with simple or forked hairs, base cordate or rounded, sec. n. 6—8 strong beneath, as also are the sub-parallel tertiaries which are often hidden by the indumentum. Petioles usually unequal, 1.25—5", joined by a villous and glandular line. Corymbs short-peduncled. Corolla-tube exerted, .08—.1", lobes 4, oblong rounded subequal, nearly as long as tube, throat densely villous.

Var. *gmelinoides*, Haines (sp. *Fl. Cent. Prov.*). Leaves 7—12" by 4—8", usually ovate, cordate, coarsely-toothed, not closely pubescent beneath but nerves minutely pubescent. Flowers not seen. Fruit similar to above, i.e. with 4—3 cells and often a central lacuna (sometimes filled with tissue).

Rocky ravines in Palamau and Rajmahal Hills!

4. *P. integrifolia*, L. Ganiari, Beng.

A small tree or large shrub, more or less thorny on the trunk and larger branches, with oblong, oblong-obovate or oblong-ovate leaves 2—4" long, shortly suddenly obtusely cuspidate and frequently crenate towards the tip, glabrous, or youngest slightly pubescent beneath. Corymbs 1.5—3.5" diam., minutely pubescent or sparsely strigose, with filiform or subulate small bracts .1—.15" long. Calyx glabrous or puberulous, sub-2-lipped toothed, one lip with 2, the other with 3 minute teeth or sub-entire. Corolla with 1 white and 3 green petals, .1—12" long, throat villous.

Orissa, on ground periodically covered by the tide, Mahanadi delta! Fl. April—May. Fr. Aug.

Bark light-coloured. L. sometimes only 1—2" (but this form not seen in our area), base rounded or obtuse, sec. n. 3—4 of which one from near the base. Petiole .4—5". Corolla 2-lipped .15" long (with the lip), one lip oblong rounded longer than the other which has two rounded lobes, tube included. Drupe .2" seated on the patelliform calyx, endocarp slightly verrucose.

Gamble states that the wood is pleasantly scented, but not so aromatic as Sandal, of a light creamy brown moderately hard, even-grained. Wt. about 50 lbs.

5. *P. calycina*, Haines. *Kew Bulletin*, 1922, 3, p. 122. Syn. *P. barbata*, F.B.I., in part.

A small, usually laxly spreading tree, with ovate-lanceolate or elliptic-oblong, more rarely ovate, obovate or lanceolate, always acuminate and more or less serrate or dentate leaves 4–8" long by 2–4" broad, glabrous or puberulous beneath or nerves persistently somewhat pubescent. Corymbs of small white flowers usually short-peduncled and under 3" diam., puberulous or pubescent, with very small filiform few and caducous bracts. Calyx 2-lipped, .08" long, sparsely glandular, upper lip with 2 rounded sometimes imbricate lobes, lower lip with three shallow rounded lobes, sometimes obscure, in fruit calyx .1" very venose, often irregularly deeply split. Fruit globose .1", endocarp verrucose, 3–4-celled, 1–2-seeded.

Rajmahal Hills, common! Singbhum in ravines! Bonai, *Cooper*! Mayurbhanj! Puri! Angul, frequent! Fl. April–May. Fr. May–June. Evergreen.

Bark pale, on twigs yellow-brown, smooth; blaze white. L. usually quite glabrescent, always some on the tree toothed, base usually rounded or obtuse, usually 2–5 nerved at or near the base with 4–6 sec. n. above the basal each side, which are usually markedly decurrent on the midrib, tertiary nerves minutely reticulate; margin thickened. Petioles often unequal .75–2.5" long, pubescent on upper surface when young. Peduncles .7–1.5". Calyx often ciliolate, otherwise glabrous. Corolla .25" long, tube .12", lobes broadly oblong rounded subequal, upper lobe sometimes retuse, throat and base of lower lobe villous. Anther cells divaricate. Fruit 3–4-celled, 1–2-seeded.

The plant dries green.

6. *P. barbata*, Wall.

A small tree with pubescent shoots, oblong oblong-lanceolate or ovate-oblong, entire or very slightly serrate, acuminate or shortly acuminate leaves 3–6" long, pubescent beneath, at least when young, and with small pubescent corymbs 1–3" diam. Flowers .15" long. Calyx lobed half-way down or nearly to the base into 4 equal linear or oblong obtuse lobes, not enlarged, or lobes slightly broader in fruit, pubescent or glabrate. Drupe globose or pyriform, slightly rigid and verrucose.

Along the northern boundary only. Chiefly a tree of the lower Himalayas! Fl., Fr. May–June.

Leaves sometimes permanently pubescent beneath, base rounded or obtuse, sec. n. 3–5 of which I usually from base, nerves minutely reticulate. Petioles .7–1.5". Calyx .04–.05" long, lobes sometimes obtusely deltoid in fruit. Corolla-tube .08–.09", throat densely villous. Style arms more slender and acute than in *P. calycina*.

7. *P. latifolia*, Roxb. Gineri, *Nep.*, Sande-Sabar, *K.*; Dandra-sea, *S.*; Bakar, *H.*; Dankaroni, *Gondhona*, *Or.*

A low bushy tree with trunk up to 4 ft. girth, or shrubby with usually ovate, sometimes elliptic, leaves 2–6.5" long, entire, pubescent beneath or both sides when young, and often permanently pubescent on the nerves beneath. Panicles 3-chotomous 2–5" diam., hairy-pubescent, with short oblong or lanceolate bracts, or upper bracts very small linear. Calyx pubescent or strigose, 5-toothed, not or scarcely 2-lipped. Corolla distinctly 2-lipped, .15–.2" (including the lobes)

long, upper lip oblong rounded entire or emarginate, lower longer with three spreading obtuse or rounded lobes. Drupe .25", depressed globose, seated on the saucer-shaped or patelliform .2—·5 diam., sub-entire calyx.

Northern Champaran! Purneah! Rajmahal Hills, frequent on trap! Ranchi ghats! Hazaribagh! Manbhum, "a common bush" *Camp.*! Gangpur, along streams! Fl. April—May, on the new shoots. Fr. May—June.

Bark thin light-grey or brown; blaze white. Shoots pubescent. Leaves somewhat fœtidly aromatic (characteristic *Premna* smell), shining above, and both surfaces sometimes with minute erect hairs, sec. n. 4—8. Petiole .25—·75 or rarely up to 1.5". Cyme branches ascending, not branchiate. Cor.-tube exserted. Endocarp ridged or verrucose, 4-celled, usually 1-seeded.

It dries blue or black (exc. in var. **Gamblei**).

Var. latifolia, *propre*.

Roxburgh's plant, a native of the Coromandel coast, has the leaves orbicular-cordate or "oval," pointed or obtuse, about 2.5" each way, a little downy, according to his description. He adds: "Bracts minute, falling. Fls. of a dirty yellow. Corolla upper lip 3-cleft, under one emarginate. Drupe the size of a pea, twin, juicy. Nut wrinkled, 4-celled. The leaves have a pretty strong though not disagreeable smell." A specimen in Herbarium marked "Hb. Roxb." has leaves rather densely pubescent beneath.

This form is perhaps not found in our area though the Rajmahal plant is a mere bush with the leaves rounded or shortly cuneate only at the base. The corymbs are very villous with brachiate branches and the bracts linear, sometimes persistent. A Puri specimen has small leaves with the tip sometimes obtuse, but the base is acute or rounded. The drupe is sometimes shortly cuspidate. This Puri form, also, has the leaves sometimes (not always in the same plant) slightly toothed. Our plants have all white flowers, though they may turn yellowish with age. It is not understood what *Roxburgh* means by the drupe being twin.

Var. mucronata, *Clarke*. Syn. *P. mucronata*, *Roxb.*

Leaves tapering both ends, entire, slightly villous beneath. The acumination is sometimes very fine and the leaves sometimes nearly or quite glabrous beneath.

Most of the north Indian forms are now usually called *P. mucronata* and it is common in our area. Purneah! Champaran! Gangpur! and possibly the Chota Nagpur plant; but specimens from Ranchi appear to come equally well under var. **cuneata**, *Clarke*, with leaf-base rhomboid or cuneate, calyx strigose, leaves often very pubescent when young. Some of these (var. **cuneata**?) have the leaves 4" broad!

Var. Gamblei, *Haines*. Syn. *P. integrifolia*, *Gamble*, in *Darjeeling List*; *Gineri*, *Nep.*

A tree attaining 5 ft. girth, often with long straight thorns on young stems and branches. Bark dark grey, blaze soft, dead white. Twigs brown, brittle, younger pubescent. Leaves broadly lanceolate or elliptic 2.5—6", acuminate and with cuneate base, drying green or somewhat bluish, puberulous on midrib beneath when mature. Fruiting inflorescence as in *P. mucronata*, endocarp rigid, 4-celled and -seeded.

Northern Purneah, common! Fr. Dec.

This may be a distinct species, but flowers are not available. There is even a little doubt as to whether the fruiting panicle belongs to the same tree as the green-drying one; although the tree from which it was taken was noted as thorny the specimen looks very like one of *mucronata* which has dried somewhat more green than usual.

8. *P. bengalensis*, Clarke.

A small tree with large narrowly elliptic to oblong or ovate acuminate leaves 4—9" long by 2·5—6" broad, closely stellately pubescent or tomentose beneath when young and thinly so when old. Flowers white or yellowish or greenish white, ·12" long, in large terminal panicles 6—8" diam. Calyx distinctly 5-toothed but often 2-lipped with the upper lip 2-toothed, lower 3-toothed. Drupe globose or obovoid, ·17—·2", endocarp smooth or slightly verrucose.

Tundi Hills, Manbhum. *Camp. Herb.*! Also common not far from Purneah, where it is also likely to be found. Fl. May—June. Fr. June—July.

Leaves with 7—12 strong sec. n. Petiole about 1". Panicles not very dense, stellate-pubescent or tomentose, lowest bracts sometimes ·5" linear-oblongate acuminate, upper ·12" only. Throat of corolla with a row of hairs.

9. *P. tomentosa*, Roxb. Moria, Or.; Jhandakai, Or.

A small tree with the shoots, leaves and inflorescence densely clothed with a tawny-yellow stellate tomentum. Leaves 3·5—7" (rarely up to 10" by 6·5" on coppice and pollard), ovate acuminate with obtuse cordate or sub-cordate base, mature stellate beneath and with minute glands between the hairs and with the characteristic *Premna* odour. Panicles pyramidal compact 2—4" diam. with small greenish-yellow flowers. Calyx sub-globose tomentose, shortly equally 5-lobed. Drupe ovoid or sub-globose, 2" diam., endocarp smooth.

Puri district, Mendasal and Baruni-hill forests and common in the Mals! Fl. March—April with the new leaves. Fr. May.

Bark light-brown. L. with 6—8 sec. n. of which 2 from the base, almost palmi-nerved, tertiaries strong. Petiole 1—2". Cor. 2-lipped, upper lip with 2 short rounded lobes, lower 3-lobed longer, pubescent and glandular outside. Ovary stellate-pubescent as well as the young fruit.

10. *P. herbacea*, Roxb. Ote-chamba, K.; Kada-met, S.

A curious little plant with herbaceous shoots 1—4" high from a woody stock. Leaves usually closely appressed to the ground, sessile, obovate, 2—4", sometimes 6" by 4", coarsely serrate and sometimes repand. Flowers very small white, in small corymbs 1·5" diam, on a short peduncle. Drupe ·25" diam.

On clay in open ground, fire lines, etc. Common probably throughout the whole area. Fl. May—June. Fr. June—July. The shoots are apparently annual and the new ones appear after the jungle or grass fires.

Leaves with 3—5 distant sec. n., reticulations large with a slender nervule to each tooth, teeth acute or rounded.

12. GMELINA, L.

Trees or shrubs with tomentose shoots and opposite leaves. Hairs often stellate. Flowers large yellow or brownish in small or paniced cymes with narrow bracts (large in *G. hystrix*, outside our area). Calyx campanulate, shortly 5-toothed or subentire, unaltered in fruit. Corolla lipped with tube contracted below and slender ventricose above, and 5- (4-) lobed limb. Stamens didynamous, subexserted, anther-cells oblong pendulous. Ovary 4-celled, with slender style and shortly 2-fid stigma. Ovules 1 in each cell. Drupe succulent with hard 4—2-

celled endocarp which opens by small caps on germination of the seed. Seeds oblong.

Seedling with oblong fleshy cotyledons.

Arboreous. Leaves large ovate

1. *arborea*.

Shrubby. Leaves under 2". Often thorny

2. *asiatica*.

1. **G. arborea**, *Roxb.* Kasuar, *K., S.*; Gambhar, Gambhari, *H.*; Kumar, *Or.*

A large or mod.-sized tree with broadly ovate acuminate or caudate, usually cordate leaves 4—9" by 2.5—8" usually glaucous beneath with petioles 2—6" long, often unequal in a pair. Flowers 1—1.5" long, reddish or brown and yellow in lateral or terminal panicles 3—8" (or attaining 12", *F.B.I.*) long. Drupe obovoid .75—1" diam., usually 2—1-celled and -seeded.

Throughout the whole province, esp. on the cool sides of hills, but nowhere very abundant. Fl. Feb.—April, when more or less leafless. Fr. May—June.

Bark light-grey exfoliating in lighter coloured patches when old; blaze thick, a chlorophyll layer just under the outer bark, then pale yellow, white inside. L. (in the type) stellately-hairy beneath (*teste C. B. Clarke*), *base strongly 3—5-nerved and usually shortly cuneate on the petiole, some or all with one or several large glands at the base between the primary nerves; sec. n. 4—6 above the basal, tertiaries more or less parallel. Panicles tomentosely yellow-hairy with subulate caducous bracts 2—3" long. Calyx .2—25", campanulate. Corolla tomentosely-hairy outside up to 2" on the long diameter, upper lip much shorter than the lower, anterior lobe shovel-shaped.

The first leaves on the seedling are strongly toothed and such toothed leaves are sometimes found on mature plants.

Var. α **glaucescens**, *Clarke (F. B. I.)*.

L. 6—10" glabrous and glaucous beneath, the glaucous appearance being due to dense microscopic glands or scales, which are hidden in the pubescent forms. Tertiary nerves not raised or only slightly raised. Panicle usually large.

Throughout its distribution and commoner than the type in our area! Indeed I believe the type is only found in the extreme north of the province, if at all.

Var. β **canescens**, *Haines (Fl. Ch. Nag.)*.

L. 3—6" subcoriaceous, grey-pubescent beneath with simple not stellate hairs. Tertiary nerves strongly raised beneath. Panicle 3—4", strict.

Santal Parganas!

The wood is largely used for making drums. It is white, easily worked and does not warp or shrink. It should be more widely propagated. *Roxburgh* says that it is very durable under water and in general stands the weather well. *Gamble* says that it is highly esteemed for planking, furniture, door-panels, etc. He gives the weight as about 35 lbs. The average of 6 trees sown by me was 42 ft. 8" in height and 2 ft. 9.9" girth after 16 years, and *Gamble* says that his specimens show about 4 rings per inch of radius, so that growth is very fast.

Cattle and deer are very fond of the fruit and deer also browse the shoots.

The fruit is said to be sweetish-bitter and cooling and the root as bitter, tonic and stomachic and useful in fever and indigestion. *Dutt.*

* *Fl. Br. Ind.*, iv, p. 581. I have not seen the type, and *Roxburgh* merely says hoary beneath in *Flora Indica* without allusion to stellate hairs.

2. G. asiatica, L. Nag-phul, H.

A large shrub, with yellow, often spinescent, branchlets, small ovate to obovate or rhomboid entire or usually lobed obtuse leaves .5—1.5" long, cuneate on a slender petiole, and yellow flowers 1.5" long in short tomentose racemes 1—2" long. Drupe .75" ovoid or obovoid, 2-seeded.

Wild or, probably, escaped on the sandstones near Rairakhol, not far from the town! Often grown in gardens. Fl. April—June.

Leaves in the Rairakhol plant somewhat fleshy. Calyx and corolla with small glistening glands as well as somewhat pubescent.

13. CLERODENDRON, L.

Trees or shrubs, sometimes rambling, or subberbaceous, with opposite or 3-nate, often palminerved and glandular, simple leaves and large or mod.-sized usually showy flowers in axillary or terminal paniced cymes. Calyx campanulate, persistent, often accrescent and brilliantly coloured in fruit. Corolla zygomorphic with a slender usually filiform tube and a more or less oblique 5-fid spreading limb. Stamens 4, exerted. Ovary imperfectly 4-celled. Fruit usually a succulent, more rarely nearly dry, drupe, frequently depressed and 4-grooved, separating into 1—4 pyrenes or drupels.

I. Corolla-tube under 2" long:**A. Straggling subscandent shrubs with white flowers:—**

L. obovate rounded fleshy. Calyx .1—2" in flower

L. ovate or rhomboid. Calyx .3" in flower

1. *inerme*.2. *phlomidis*.**B. Compact or rigid shrubs or undershrubs:—**

1. Panicle large spreading, usually red in fruit. Leaves broadly ovate, usually cordate. Calyx deeply lobed:—

Corolla white with pink. L. 4—8"

Corolla scarlet. L. 6—12"

3. *infortunatum*.4. *squamatum*.

2. Panicle narrow. Leaves narrow. Calyx very shallowly lobed. Fls. usually blue

5. *serratum*.**II. Corolla-tube 3" and over:—**

L. narrow, usually whorled. Fls. white

6. *siphonanthus*.

Besides the above there are several species of *Clerodendron* commonly grown in gardens. One of these, *C. Thomsoni*, is a climber with pure white calyx and crimson corolla.

1. C. inerme, Gaertn.

A straggling shrub, with a very strong rutaceous odour from the numerous glands, with grey very lenticellate, patent, minutely closely pubescent twigs. Leaves .75—1.5" elliptic or obovate with rounded or retuse tip and cuneate base, glabrous, closely punctulate with glands beneath. Flowers white with bright red filaments, mostly in axillary 3-flowered cymes from the uppermost leaves. Corolla-tube slender 1" long. Drupe pyriform .5" by .4", somewhat 4-grooved, base embraced by the accrescent calyx.

Near the sea, from Balasore! to Puril! Fl. April and Dec. (perhaps Dec.—April). Fr. Dec. and old fruits found in April, mostly insect-punctured and oblique. Evergreen.

Leaves somewhat fleshy, young minutely pubescent. Petiole .15—2". Peduncles .5—.75", sometimes up to 7-fid. Calyx .1—2" in flower with 5 short equal triangular teeth, enlarging to .25" or .3" in fruit with a thickened pedicel. Cor.-lobes .25" oblong. Drupe ultimately hard and splitting into 3—4 pyrenes.

2. C. phlomidis, *L.f.* Syn. *C. phlomoides*, *Willd.*; Panjot, *S.*; Urni, *H.*; Donkari, *Or.*

A large, often rambling shrub, with a close short hoary pubescence on the branchlets, broadly ovate or sub-rhomboid entire or coarsely crenate-dentate leaves usually about 2" by 1.5", and axillary and terminal cymose panicles of white flowers with tube .75—1" long and limb .75" diam. Calyx campanulate .3" long in flower with triangular caudate acuminate lobes, slightly enlarged in fruit. Drupe broadly obovoid depressed, ultimately nearly dry .3—5" separating into 4 pyrenes.

Usually in hedges and near villages, but doubtfully indigenous. Singbhum! Palamau! Santal Parg.! Angul! Narsingpur! Often seen in gardens all over the province. Fl. Sept.—March and perhaps at other times. Evergreen.

L. attain 3.5" each way below, but very small ones occur on and near the panicle young puberulous both sides, quite mature glabrous or nearly so, acute or sub-acuminate; sec. n. 4—5, of which one from the base. Petiole slender .5—1". Cymes 1.5—3", each 3—12-fl., but often the whole top of the branch converted into a large leafy panicle. Calyx green or purplish, lobed half-way down. Cor. glandular-pubescent, fragrant at night.

It is given to cattle for diarrhoea and worms. The fruit of this is also frequently insect-punctured, which converts it into an oblong fleshy mass closely invested by the (then) marcescent glandular-pubescent corolla.

3. C. infortunatum, *Gaertn.* Biant, *Th.*; Kula-marsal, *Changar*, *Ho.*; Barni, Varni, *S.*; Gokhol, *Kharw.*; Biant, *H.*, *Beng.*; Anguti, Kunti, *Or.*; Komuti, *Khond.*; Bania-ganta (Mayurbhanj).

A robust shrub or undershrub 4—6 ft. high with densely fulvous-hairy branches, large ovate and usually cordate leaves 4—8" long and broad, and large terminal subcorymbose panicles of white and pink or pink-spotted flowers on their cymose branches. Conspicuous in fruit from its large red accrescent calyces, and often reddening panicles. Drupe bluish-black, at first enclosed by the calyx, which, however, opens widely towards maturity.

In all the districts, especially the moister ones. Along streams and in shady places and edges of glades in the forest in the drier ones. Champaran, common! Purneah, common! Muzaffarpur! Chota Nagpur, often gregarious in the places indicated! Puri! Athmallik! Angul, common! Sambalpur! Fl. Feb.—May. Fr. May—July.

Occasionally attains 10 ft. L. persistently hairy, entire or dentate, with numerous minute glistening glands beneath; sec. n. very strong, 5—7, of which one strong, and often also one weaker one, from the base. Petiole 1—4". Panicle tomentosely hairy, often leafy below. Calyx .4—5" long in flower, 5-fid, with acuminate lobes, 1.25—1.5" diam. in fruit. Cor.-tube .7—75" long, rather slender, pubescent; lobes .5—6", one posterior and the other 4 declinate or obliquely spreading. Stamens 1.5—2" long (their changes in position with regard to the style very well marked in this species). Style unbranched. Fruit usually of a single globose drupel .25—3" diam., finally black.

The flowers are scented in the evening. The leaves warmed with ghee are applied to the head for catarrhal colds.

4. C. squamatum, *Vahl.*

A very beautiful shrub when in full flower, 2—4 ft. high, with rich green roundly ovate and cordate leaves 6—12" long and broad, and large terminal panicles of which every part is scarlet. Corolla-tube

·75—1" very slender, lobes ·3—·5". Drupe ·3—·5" diam. blue-black, seated on the enlarged fruiting calyx which is very broad, ·7—1·5" diam.

Found wild close to our area in the lower hills and Terai and frequently seen in gardens. Fl., Fr. April—Aug.

Leaves spinulosely-denticulate with petioles up to 1 ft. long. Calyx nearly ·5" in flower, 3-fid or -partite. Corolla brilliant scarlet.

5. *C. serratum*, Spreng. Barangi, H.; Sarom-lutur (Sambhar's-Ear), S.

An irregularly branched perennial shrub, or, in areas annually burnt, with tall straight subherbaceous stems 3—6 ft. high from a perennial stock. Leaves opposite or 3-nate, subsessile, linear-oblong to elliptic, obovate or oblanceolate, coarsely serrate leaves ·3—6" long. Flowers over 1" diam. blue or sometimes pale pink or white on the lateral cymose branches of large terminal pubescent panicles with persistent ovate, obovate or lanceolate bracts. Calyx campanulate ·2", pubescent, lobes 5 very shallow; slightly enlarged in fruit. Cor. tube ·25—·3" (—·5", *F. B. I.*). Drupe of 1—3 (rarely more) succulent connate drupels. ·15—·2" long, each drupel about ·15—·2" diam.

Throughout the province, more especially in damp places in the moister districts. Grass tracts of Purneah, common! Santal Par! Chota Nagpur, chiefly in valleys and shady slopes, not very common, but general, more frequent at about 2—3000 ft. Fl., Fr. r.s. to Nov. or April—Nov.

Branches 4-angled above. Leaves often very fleshy especially in unburnt plants, whitish beneath, glabrous or very nearly so, somewhat foetid in smell. Petioles ·1—·3". Whole panicle sometimes coloured pink, sub-pyramidal (in the sub-Himalayan forms) or narrowly oblong. Lower lip of corolla usually deeper-coloured than upper, ·75" long with a large nectary at base, mouth very oblique and constricted. Stamens very long and declinate, bluish.

Root given in fever and also used in the fermentation of rice-beer in the Santal Parganas.

6. *C. siphonanthus*, Br. Bharangi, H.; Bamanhati, Beng.

Shrubby, or herbaceous with tall annual strict hollow stems 3—6 ft. high. Leaves 3—5-nately whorled, rarely opposite, narrowly lanceolate or linear, rarely elliptic or oblanceolate, 5—8" long by usually ·5—1·5" broad only, glabrous, entire or sinuate, rarely sparsely coarsely toothed above. Flowers pretty, white or cream in axillary cymes and forming a large terminal panicle easily distinguished by the very long slender tube of the corolla, which is 3—4·5" in length. Drupe blue of 1—4 connate drupels, each about ·35" long and ·25" diam., seated on the large red accrescent calyx.

In grass tracts and near watercourses, especially in the moister districts. Champaran! Purneah, common! Santal Parganas! Singbhum! Ranchi! Palamau! Fl. June—Aug. Fr. Aug.—Dec.

Occasionally attains 20 ft. when not burnt with stems 1 ft. girth (as in the compound of Litipara Rest House, Santal P.). L. with tapering base, sessile or subsessile, with 6—10 oblique fine sec. n. Panicle usually narrow, lateral cymes few-ld. Bracts linear or linear-lanceolate, ·5". Calyx ·5" in flower, 1·3" in fruit, cut more than half way down into lanceolate acute segments.

The root is considered useful in asthma, cough and scrophulous affections. *Dutt.*

14. HOLMSKIOLDIA, Retz.

Shrubs (scandent in our species) with opposite leaves and showy flowers in short axillary cymes with small bracts. Calyx broadly obconic or sub-patelliform, membranous, coloured, with entire or sub-entire margins. Corolla with curved tube and oblique limb with 5 short lobes. Stamens didynamous exerted, anther-cells ovate parallel. Ovary of 2 2-celled carpels, each cell with one lateral ovule (as in *Clerodendron*). Fruit drupaceous included in the contracted base of the accrescent calyx, depressed 4-lobed nearly half-way down, separating into 4—1 pyrenes.

1. *H. sanguinea*, Retz. Jhimbria, S.

A large climbing or rambling shrub with angular drooping branches, ovate crenate-serrate or sub-entire leaves 2—6" long by 1.25—3.5" broad. Very handsome when in flower. Cymes very numerous and often paniced at the ends of some of the branches. Calyx orange or scarlet, patelliform or somewhat oblique, very venose, 6—7.5" diam. in flower and 1" in fruit. Corolla scarlet tubular curved .75—1" long.

Champan! Purneah! Rocky ravines in Bandgaon and Porahat! Ranchi (Pitorea Hill, Wood)! Manbhurn, Campbell! Hazaribagh, chiefly on the ghats! and on Parasnath, Camp. Fl. Nov.—Jan. Sometimes seen in gardens.

Leaves puberulous and pubescent on the nerves beneath, minutely glandular beneath, base rounded or cordate, acuminate; sec. n. 3—5. Petiole .5—2". Drupe .25—3".

15. CARYOPTERIS, Bunge.

Small trees or shrubs with opposite toothed or sub-entire leaves minutely glandular beneath. Flowers often showy in small dense many-fld. cymes with small bracts, sometimes running into thyrsiform panicles at the ends of the branches. Calyx deeply 5-fld, segments triangular or lanceolate. Corolla-tube short cylindric, limb zygomorphic with anterior lobe largest (often crisped or fimbriate in non-indigenous species). Stamens didynamous exerted, anther-cells divaricate, confluent above. Ovary of 2 2-celled carpels, or 1-celled above, with two placenta with incurved margins, each bearing a lateral pendulous ovule with thickened funicle. Fruit small globose, capsular, separating into 4 pyrenes (or valves with more or less inflexed margins),* each pyrene or valve with 1 seed.

1. *C. Wallichiana*, Schauer.

A large laxly branches shrub or sometimes a small tree with 4-angled subtomentose shoots and lanceolate serrate or sub-entire leaves 2—4" long with numerous yellow glistening glands beneath. Flowers blue or light purple in small cymes crowded into thyrsiform elongated

* I am not quite clear on the fruit structure. From my specimen the valves appear quite closed by a coriaceous wall on the inner two sides and each to inclose a seed, but the *Nat. Pflanz. Fam.* states that the margins are infolded and inclose a stone (pyrene). The *F.B.I.* states that the edges are incurved and enclose a seed. The *Fl. C. N.*, probably founded on a field-note, says the valves embrace a slightly winged pyrene, thus agreeing with the *Nat. Pflanz. Fam.*

panicles. Calyx .1—'.17" in flower, .2—'.25" in fruit, densely pubescent, with linear-lanceolate lobes. Corolla with tube .25" long pubescent above, midlobe of lower lip .3", blue, other lobes about .25", paler. Capsule .15—'.17" diam., pubescent.

Northern Champaran, frequent! Palamau, river banks in the hills, rare! Santal Parg., *Gamble* (in *S.P.* list). Fl. Dec.—April. Fr. April.

Bark brown in long narrow strips. L. acuminate, base cuneate, ashy pubescent beneath. Petiole .3". Cymes very short, pubescent, lateral, the shoot growing through the thyrse and leaving them distinctly axillary.

16. SYMPHOREMA, *Roxb.*

Rambling or scandent shrubs with leaves opposite (or floral sub-whorled), entire or toothed. Flowers small white, nearly regular in involucrate capitulate cymes; involucre of 6 oblong or foliaceous bracts. Calyx obovoid, 4—8-toothed, somewhat accrescent. Corolla with cylindrical tube and 6—16 subequal narrowly oblong lobes. Stamens as many as the corolla-lobes, exerted, anthers ovate with parallel cells. Ovary of 2, deeply divided, more or less 2-celled carpels, each cell with one apical pendulous almost orthotropous ovule. Fruit nearly dry, included in the calyx, 1-seeded. Embryo fleshy with somewhat concave cotyledons.

Corolla and stamens 12—16-merous. Floral l. ell.-obovate
Corolla and stamens 6—8-merous. Floral l. lanceolate

1. *polyandrum*.
2. *involucratum*.

1. *S. polyandrum*, *Wight*. Badichand, *Or.*

A large scandent or subscandent shrub with ovate, sub-orbicular or broadly elliptic leaves mostly 4—5" long, repand or coarsely toothed, villosely tomentose beneath. Easily recognised in flower by its pseudo-whorls of grey involucreal leaves 1—1.5" long surrounding the contracted cyme of delicate white flowers. Calyx .25—'.4" long, rather larger in fruit. Corolla 12—16-partite with an equal number of exerted stamens.

Dry Sal forests in Singbhum! Bonai, *Grieval*! Narsingpur! Sambalpur! Angul! Kalahandi! Fl. March—April when it is more or less deciduous.

Shoots very closely grey-stellate-tomentose. L. attaining 8—9" by 4" with usually a rounded or very obtuse base, sec. n. 3—4 of which 1 is close to the base. Petioles .5—'.75". Invol. bracts elliptic-obovate or obovate, often toothed above. Fruit included in the .5" long calyx.

2. *S. involucratum*, *Roxb.*

Similar to the last in habit, with ovate or rhomboidly-elliptic leaves 3—5" long, less densely tomentose beneath and sometimes quickly sub-glabrescent, acute or acuminate. Involucreal bracts about 6, .25—'.9" long, oblanceolate membranous. Calyx .2" long, tubular, about 8-toothed. Corolla and stamens 6—8-merous.

In dry rocky places and dry forests (but usually in the damper districts!) Monghyr Hills, *Ham.*; Angul, Bhurkundi forest! Narsingpur, on the ghats, mixed with *S. polyandrum*! Puri! Fl., Fr. with the last and like it, deciduous.

Bark pale, lenticellate. L. usually narrower and more acute and less tomentose compared with *S. polyandrum*, base often cuneate. Cymes mostly 7-flowered, but appearing much smaller from the less paniced cymes and the smaller bracts, which are usually only .25—'.4" in flower, enlarging in fruit to 1 or more.

17. AVICENNIA, L.

Shrubs or small trees with coriaceous opposite entire leaves and small sessile subregular flowers (yellow in our species) in capitate or contracted peduncled cymes, sometimes forming terminal 3-chotomous panicles. Bracts small. Calyx 5-partite, not accrescent, segments more or less ovate, imbricate. Corolla with short cylindrical or campanulate tube and spreading 5-4-lobed limb. Stamens 4, on the corolla-throat, shortly exserted, ovate. Ovary of 2 carpels, 4-celled or 2-celled, below with a central 4-angled or -winged column, free above. Ovules 4, orthotropous, pendulous from the apex of the column between the wings. Fruit a compressed somewhat succulent capsule, dehiscing by 2 valves. Seed 1. Embryo with plicate cotyledons and hairy radicle.

Shrub or small tree. Leaves acute or acuminate. Capsule less than 1" long. Stamens included. Style short or 0. 1. *alba*.

Small tree. Leaves very obtuse. Stamens included. Capsule 1" or more. Style long 2. *officinalis*.

1. *A. alba*, Blume. Bani, Or.; Safed Bani (the tree form), Or.

A large shrub or a tree up to 3 ft. girth, with lanceolate leaves, white beneath, 2-3" or up to 5.5" long, acute (tree) or long acuminate (shrub). Flowers yellow .2" diam. in contracted cymose panicles 1-2" long. Sepals nearly free, ell.-oblong to obovate, rounded, .1-.12". Corolla .18" long, pubescent outside, tube half as long as the ovate-lanceolate lobes. Stamens shorter than the corolla-lobes. Ovary oblong, woolly at the tip, style 0, stigma of 2 triangular lobes. Young fruit lanceolar, .75" long, tomentose.

Tidal forests of the Mahanadi delta! Fl. May. Fr. Aug.—Sept.

The tree form looks to me a distinct species, but I have not found it in flower (in itself significant as the shrub was in flower), the leaves are more elliptic, not long acuminate, often only acute, the petioles less markedly articulate at base. The bark is white with white blaze as in next.

2. *A. officinalis*, L. Kala Bani, Or.

A large tree with oblong or elliptic or obovate leaves with very rounded tip 2-5" long, white beneath, base acute or subobtuse, mid-rib dark, sec. n. fine rather irregular, 7-10, very reticulate between, large glands sometimes at the apex of petiole, petiole 4-8" long. Flowers yellow in axillary and terminal peduncled 3-chotomous panicles 2-3.5" long, in bud with numerous imbricating bracts, which are elliptic rounded and white ciliate but glabrous and shining on back, in strong contrast to the white branches of the panicle. Fruit opaque green, wrinkled, especially at the base, ovoid, 1.3" long, with large fleshy cotyledons. Hypocotyl densely fulvous hairy.

In the mangrove swamps of the Mahanadi delta, common! Fl. June—July. Fr. Aug. Also often germinates on the tree in August; the hypocotyl densely fulvous-hairy.

Bark smooth pale grey. Blaze very white. Shoots white-tomentose. The leaves less white beneath than in *A. alba*, with which however no confusion is possible.

FAM. 106. LABIATÆ.

Herbs or undershrubs, rarely shrubs, usually with sweet or aromatic smell due to ethereal oils, which are secreted in several different forms of glandular hairs often sunk in small pits in the epidermis and in the leaf often giving rise to translucent dots. Stems very often 4-angular or 4-sided (with rounded corners). Leaves opposite and decussate or sometimes whorled, simple or very rarely pinnatisect (*Lavandula*), exstipulate. Flowers more or less zygomorphic, often evidently 2-lipped, often small, solitary or in contracted cymes in the axils of leaves or bracts forming false "whorls," which sometimes are crowded into heads or spikes, rarely cymes effuse. Calyx more or less tubular, persistent. Corolla with tubular base and 4—5 subequal lobes or 2-lipped, lobes imbricate in bud. Stamens inserted in the corolla-tube, 2 or 4 perfect, subequal or didynamous; anther-cells sometimes confluent. Disc prominent, often irregular. Ovary free 4-lobed or 4-partite, consisting of 2, 2-celled and -lobed carpels, style arising from between the lobes, 2-fid or one arm suppressed. Ovules 1 in each cell, erect, anatropous. Fruit of 4 dry (rarely fleshy in genera outside our arca) indehiscent "nutlets" attached by a small basal or oblique or a larger ventral areole. Seeds erect, albumen scanty or 0, radicle inferior.

I. Ovary 4-partite with gynobasic style. Nutlets with small basal or dorso-basal areole (Genera 1—23):—

A. Stamens 4 declinate (lying on the lower lip or enclosed by it); anther-cells confluent (Genera 1—9):—

1. Disc lobes, if developed, alternating with ovary lobes. Areole very small, basal:—

a. Anterior corolla-lobe scarcely longer than posterior, neither deeply concave nor constricted at base:—

i. Posterior calyx-lobe broader than the others, decurrent on the tube and enlarged in fruit:—

Style with 2 equal subulate lobes. Cor.-tube included or only slightly exerted

Style undivided, often clavate. Corolla-tube exerted

ii. Posterior calyx-lobe larger than the others but not decurrent on the tube:—

Whorls in terminal spikes. Fruiting calyx transversely ribbed or pitted

Fls. in small terminal heads. Fruiting-calyx with gibbous base not transversely ribbed nor pitted

b. Anterior corolla-lobe deeply concave in front or constricted at base:—

i. Anterior lip of corolla elongated, not sharply deflexed:—

* Filaments free:—

Calyx mouth oblique, upper lip usually deflexed over the mouth in fruit. Fls. in dense spikes

Calyx 2-lipped or 5-toothed. Fls. in whorls or lax cymes

1. *Ocimum*.

2. *Orthosiphon*.

3. *Geniosporum*.

4. *Acrocephalus*.

5. *Anisochilus*.

6. *Plectranthus*.

- ** Filaments connate below. Whorls usually distinct
- ii. Anterior lip of corolla short, sharply deflexed.
2. Disc-lobes opposite to ovary-lobes. Stamens included. Areole small, dorso-basally oblique
- B. Stamens not declinate, anther-cells 1—2 (Genera 10—23):—
1. Stamens suberect, diverging and distant. Cor.-lobes flat:—
- a. Anthers subglobose, 1-celled, widely expanded after shedding pollen. Cor. subequally 4-fid or lower lobe larger:—
- i. Calyx 5-toothed, lobes not plumose. Filaments bearded:—
Inflorescence of paniced sub-capitate cymes. Calyx tubular-ovoid. Corolla sub-2-lipped
Infl. spicate. Calyx minute ovoid. Cor. subequally 4-fid
- ii. Calyx 5-fid, segments finally plumose. Shrub .
- b. Anthers 2-celled, at least when young. Corolla often weakly 2-lipped. Filaments not bearded:—
Fls. minute, spicate. Corolla 4-lobed, sub-2-lipped
Fls. small, whorls axillary or spiked. Calyx campanulate 5-toothed. Corolla subequally 4-lobed .
Fls. small, racemed. Calyx 2-lipped. Corolla-lobes 5
2. Stamens ascending, usually in unequal pairs. Anther-cells distinct. Corolla lipped:—
- a. Corolla-lobes flat, small. Calyx mostly 13-nerved:—
Calyx 5-toothed, regular
Calyx distinctly 2-lipped, one lip 2- the other 3-toothed
- b. Upper corolla-lip erect, concave or hooded, lower spreading —
- i. Perfect stamens 2, connectives slender, jointed on the filament
- ii. Perfect stamens 4, didynamous:—
* Posterior pair of stamens longer.† Upper lip not galeate:—
Anthers all 2-celled, cells diverging
Upper pair of stamens with 1-celled anthers
- ** Anterior pair of stamens longer, ascending under the galeate upper lip:—
! Anterior pair of stamens with 1-celled anthers:—
Calyx 2-lipped, closed after flowering, upper with a broad plate
- !! Both pairs of stamens with 2-celled anthers. Upper (galeate) corolla-lip pubescent or villous (*Lamiæ*):—
Leaves deeply cut. Calyx teeth 5 spinescent
Calyx 8—10-toothed. Lower cor.-lip large.
Fls. white
Calyx 8—10-toothed. Lower cor.-lip small. Fls. red
7. *Coleus*.
8. *Hyptis*.
9. *Lavandula*.
10. *Pogostemon*.
11. *Dysophylla*.
12. *Colebrookia*.
13. *Elsholtzia*.
Mentha (p. 778).
14. *Perilla*.
15. *Micromeria*.
16. *Calamintha*.
17. *Salvia*.
18. *Nepeta*.
19. *Anisomeles*.†
20. *Scutellaria*.
21. *Leonurus*.
22. *Leucas*.
23. *Leonotis*.

† All works consulted, following *Bentham*, place *Anisomeles* under the "*Lamiæ*" with the characteristic "lower pair of stamens longest" without remark. In 1893 I noted in Bengal specimens that the posterior pair are the longer and I have repeatedly confirmed this observation in other districts.

- II. Ovary 4-lobed, style not gynobasic. Nutlets with a large oblique or ventral areole. Upper cor.-lip not galeate:—
 All corolla-lobes combined into a large lower lip and stamens ascending exerted. Nutlets minute 24. *Teucrium*.
 Corolla with short 2-lobed upper lip and lower large 3-lobed spreading lip. Nutlets up to .1" long 25. *Ajuga*.

1. OCIMUM, L.

Herbs or undershrubs with the leaves copiously pitted with minute glands yielding a strong, usually very sweet smell. Fls. purple or white in 6—10-fl. whorls in terminal spikes or racemes, tips of the pedicels recurved, bracts small or minute. Calyx 10-nerved with a broad upper lobe, the two lowest teeth acuminate or sub-aristate. Corolla with short tube, not annulate within, upper lip subequally 4-fid, lower hardly longer, declinate entire. Stamens 4, declinate, exerted, filaments naked or upper toothed or hairy below, anther-cells confluent. Style long with 2 subequal slender stigmas. Disc entire or lobed. Nutlets smooth or sub-rugose, more or less mucilaginous when moistened.

- I. Shrubby. L. 2—4". Lower calyx-teeth shorter than upper lip 1. *gratissimum*.
 II. Herbaceous or only slightly woody below. Leaves rarely 2".
 Lower calyx-teeth longer than the upper lip:—
 A. Pedicels shorter than the calyx:—
 Corolla .3—5" 2. *basilicum*.
 Corolla .17" 3. *canum*.
 B. Pedicels mostly longer than the calyx 4. *sanctum*.

1. *O. gratissimum*, L.

An undershrub 2—4 ft. high with very woody base (sometimes attains 8 ft. in other provinces) and a very sweetly aromatic smell. Leaves 3—4.5" below, ovate, decurrent on the long petiole. Flowers white inconspicuous, whorled in racemes 4—5" long with pedicels about half as long as the calyx and lanceolate-acuminate shortly stipitate bracts. Calyx pubescent outside, glabrous inside. Filaments bearded at the base.

Waste ground near villages and doubtfully indigenous. Hazaribagh, on a shoulder of Parasnath! Santal Parg. Angul! Fl. Oct.—Dec. Fr. March.

L. coarsely crenate or crenate-serrate, acute, sparsely hairy on the nerves beneath and slightly shortly pubescent with hyaline hairs on midrib above. Lower petioles 1.5". Racemes densely pubescent. Calyx with the upper lip much longer than the lower, upper lobe .12" (from base) in flower, large broad obovate obtuse, .2" in fruit; lateral lobes with an obtuse tooth and lower mucronate tooth; lower lip with 2 very small mucronate teeth shorter than the lateral. Corolla barely exerted, upper lip .05", lower slightly saccate and slightly acuminate. Nutlets subglobose red-brown, .05" diam., with oblong basal scar, minutely verrucose.

2. *O. basilicum*, L. Lo:—ba, Ho.

An erect, much branched, strongly scented herb 8—18" high, less slender and usually more branched from the base than *O. canum*, with pubescent stems hairy at the nodes, usually ovate, entire or cut, glandular leaves 1—3" long and white or pale-purple flowers in numerous close racemes, the large patellate upper calyx lobe becoming

horizontal in fruit from the deflection of the pedicel. Lower two calyx teeth sub-aristate, longer than the upper lip. Corolla 3" long or more, lower lip usually white or rose, longer than the 4-lobed upper lip. Bracts petioled. Pedicels about 12" long.

Chiefly in cultivated ground. Patna to Monghyr, T.T. Bihar, Hope! Gya, Prain! S.P. Chota Nagpur, frequent! Probably throughout the province Fl., Fr. c.s.

The plant is very variable. The leaves in some cases are exactly like those of *O. canum*. In var. *difforme* they are deeply cut; in var. *thyrsiflora* they are larger and attain nearly 3", are distinctly serrate and have longer petioles. In general the leaves are about 1—1.5" long only, with slender petiole 2—3". The racemes are often 6" long with the whorls usually closer (scarcely .25" apart) than in *O. canum*, the fruiting calyces .18" diam., often contiguous all round the axis, upper calyx-lip ciliate, dorsally glabrous, few long hairs at base, 3-ribbed and very venose in fruit; sides lobe ovate mucronate. Two filaments villous at base Nutlets .07" oblong, slightly glandular, otherwise smooth, black.

3. *O. canum*, Sims. Lo:—ba, Ho.

Erect slender herbaceous and often strict 12—20" high; 4-angled stems densely pubescent upwards and sometimes almost villous. Leaves elliptic or usually ell.-lanceolate or rhomboid, 1—1.7" by .4—7", entire or shallowly serrate with long slender sparsely pilose petioles. Flowers about 6 in a whorl in terminal elongating racemes 2—4" rarely elongating to 8" in fruit, the short pedicels erect and often closely appressed to the rachis so that the flowers on their decurved tips appears sessile. Calyx densely villose inside, pilose or villose below with spreading hairs outside, .07—14" measured along upper lip, .1—17" along lower lip. Corolla .14—17" long or sometimes up to .25" long, white or pale-purple with tube .05—1". Filaments glabrous, anterior on throat much exerted, upper sometimes with a tooth at base. Nutlets oblong-ellipsoid, black when quite ripe, 0.5".

Common, especially near cultivation. Singbhum Ranchi! Manbhum, Camp! Angul! No doubt throughout the province. Fl., Fr. Aug.—March. Annual.

Leaves very thin when dry, with the numerous glands sunk on the under surface, glabrous or with a few long villi on the nerves; base tapering. Petiole .2—75". Pedicels .06—07", erect, pubescent. Upper calyx-lobe .1—15" each way in fruit, glabrous above on the back, teeth of lower lip aristate, of side-lobes mucronate. Nutlets become very gelatinous in water.

4. *O. sanctum*, L. Tulsi, H., Beng.; The Sacred Basil.

An undershrub 2—4 ft. high much branched, the whole plant often of a purple colour. Twigs pubescent or with short, rather hispid, and long soft hairs. Leaves 1—1.5" or 2" ovate, ovate-oblong or elliptic-oblong, hairy or pubescent both sides and very glandular between the nerves beneath. Flowers very small, purplish or crimson, .15—17" long, whorled in racemes 3—8" long which are often paniced. Calyx glabrous within, villose and very glandular without, in fruit about .14" measured along upper and .18" along lower lip. Bracts sessile or shortly petioled, broadly cordate, finally reflexed. Nutlets reddish, or yellow with small black markings (the red and white varieties), broadly ellipsoid, smooth or nearly so, .05" long.

Grown in the courtyards of every Hindu house, often in pots. Occasionally seen apparently wild, e.g. near the Bansloi River in the Santal Parganas! Also waste ground, Purneah and Angul. Fl., Fr. c.s.

Twigs somewhat 4-angular. Leaves crenate-serrate, rarely entire in our area, acute or obtuse, sometimes nearly glabrous between the nerves beneath. The inflorescence of very different appearance from *O. canum* on account of the slender pedicels usually exceeding the calyx, and not being appressed vertically to the rhachis but more or less patent and the tip less reflexed and the fruiting upper lips not regularly touching one another in fruit, .08—1" broad. Lower calyx-lobes aristate, lateral more shortly aristate. Disc very prominent on upper side. Calyx often with few very long hairs and whitish shorter ones. The nutlets do not become much swollen and mucilaginous in water like those of *O. canum* and *O. basilicum*.

Sacred to Vishnu. A domestic remedy for catarrh, cough (infusion of the leaves), etc., and, applied externally, for cutaneous diseases. It is also believed to drive away mosquitoes. Rosaries are made from the stems.

2. ORTHOSIPHON, *Benth.*

Shrubs or herbs with a woody rootstock or roots sometimes tuberous; much less aromatic than *Ocimum*, which it often closely resembles, but differs in the calyx being often relatively longer in the tube and with several nerves between the principal 10, in the usually more slender corolla-tube, in the filaments toothless and glabrous, and, especially, in the minute simple capitate or clavate stigma. Nutlets usually sub-globose.

A. Stamens included:—

- | | |
|---|---|
| 1. Leaves small, under 2":—
L. elliptic or ovate, .7—1.5". Fls. .3" | 1. <i>pallidus</i> . |
| 2. Leaves 2—4" long, oblong or elliptic-oblong:—
L. rounded or subacute at apex. Petiole 0—25"
L. acute or sub-acuminate. Petiole .7—1" | 2. <i>rubicundus</i> .
3. <i>incurvus</i> .
4. <i>glabratus</i> . |
| 3. L. 2—3" long, broadly ovate. Petiole 1—1.7", slender | 5. <i>grandiflorus</i> . |

B. Stamens far exerted. L. ovate, 2—3.5"

1. *O. pallidus*, *Royle*.

A small scarcely woody plant 4—12" high with many more or less erect or diffuse branches from near the rootstock, sharply 4-angled and puberulous above. Leaves ovate or elliptic .7—1.3" (—2", *F.B.I.*), attenuate at the base, crenate-serrate with teeth often few, pale beneath. Flowers racemed, about 6 in a whorl, .3" long, deflexed with pedicels erect or subpatent in fruit. Calyx glabrous within, many-nerved, without long hairs but hispidulous outside, .25" long in fruit with 2-awned lower lip about as long as the broad upper. Nutlets pale globose (*F. B. I.* says compressed subglobose; perhaps these were not quite ripe).

Shahabad, *Hope!* Singbhum, frequent! but not recorded from Chota Nagpur in *Bengal Plants* and probably often mistaken for an *Ocimum*. The Central Provinces may also be added to the distribution recorded in *F.B.I.* Fl., Fr. r.s.—Oct.

Leaves glabrous except on the nerves beneath (or finely pubescent, *F. B. I.*), mostly obtuse punctulate with glands, but nearly odourless, base narrowed into a petiole .25—4" long. Racemes 2—4", whorls often dense. Calyx .12" along both upper and lower lips in flower, upper lobe in fruit .12" broad, broadly-oblong rounded, those in a whorl often meeting one another as in *Ocimum canum*. Corolla white.

2. *O. rubicundus*, Benth.

A herb with stems 8"—20" high from a woody rootstock, which has also the roots swollen into turbinate tubers 1—3" long. Leaves sessile or shortly petioled, oblong or elliptic-oblong, 2—4" long, crenate or serrate coarsely puberulous or glabrate above, paler and glabrous or hispidulous on the nerves beneath. Flowers white, lilac or rose in rather distant 6-fld. whorls on long terminal racemes 4—12" long. Calyx .2" in flower, .3" in fruit, minutely pubescent, upper lobe subpetaloid, purple. Corolla twice as long as calyx or up to .5", tube about .3", pubescent. Nutlets suborbicular compressed, punctulate.

Common in the forests of the Central Tract. Monghyr, *Ham.*! Santal Parg. ! Throughout Chota Nagpur ! Probably throughout the Southern Tract, but specimens only collected from Kalahandi ! A specimen from Mayurbhanj, *Hooper* ! is referred to *O. incurvus*, *Benth.*, in the *Cal. Herb.* The flowers are .6" long, but it is, I think, this species. Fl. April—June, the shoots springing up after the jungle fires.

Stems sometimes tomentose, at others slightly pubescent only, 4-angled. Leaves rarely 4.75" long, rounded or subacute at the tip, never acuminate, base usually cuneate. Petiole 0—25" on same individual. *Bentham's* variety *rigida*, however, is characterised solely by "leaves petiolate." Calyx over 12-nerved at base in fruit, upper lobe of lip only slightly decurrent on the tube, not forming a large shield on it as in *Ocimum*, .1—12" broad in fruit; lower lip with 2 awns projecting beyond upper, side lobes with shorter awns. Bracts sessile ovate or oblong reflexed, .05—1". Stamens 2, upper not as long as the lip, 2 inferior included in the tube, filaments glabrous.

3 *O. incurvus*, Benth.

Closely resembling *O. rubicundus* but the leaves acute or almost acuminate tapering both ends, 3—4", coarsely crenate, sec. n. 4—6. Petiole .7—1". Flowers larger, .6—8". Calyx .25" in flower, .3—5" in fruit, lower lip awned. Corolla blue or purple-red.

Native of the sub-Himalayas, Assam and Silhet. Fl. July—Oct.

A specimen from Mayurbhanj, collected by *Hooper*, is called *O. incurvus* in the *Calcutta Herbarium*. The flowers are .6" long and leaves shortly petioled, but it is, I think, *O. rubicundus*.

4. *O. glabratus*, Benth. Syn. *O. tomentosus*, Benth. Var. *glabrata*, F. B. I.

Slender, 2—3 ft. high, scarcely woody below, much branched, branches 4-angled, grooved and striate, nearly glabrous. Leaves broadly ovate, crenate or dentate-serrate, 2—3" and nearly as broad, puberulous along the nerves beneath, otherwise glabrous, base nearly straight or very slightly cuneate on petiole, which is 1—1.7" long and slender. Flowers .3—4" long about 6 in a whorl in slender racemes 3—7" long with small ovate cuspidate reflexed bracts .05—0.7". Fruiting calyx deflexed .3" to end of awns of lower lip (which project beyond upper), thinly pubescent, upper lobe .14" broad in fruit, somewhat coloured. Nutlets broadly-ellipsoid brown, smooth (not quite ripe).

Mais of Puri ! Fl., Fr. Nov.—Jan.

L. very acute, pale beneath, sec. n. 4—6, of which one from base, fine but clear. Racemes with pubescent rhachis. Pedicels .1" suberect. Calyx with the nerves between the three main ones of upper lip not as clear as in most *Orthosiphon*,

upper lobe somewhat apiculate, decurrent at sides, lateral scarcely aristate. Corolla-tube 2—25", puberulous. Stamens shorter than lower lip, upper pair sub-included. Stigma minutely 2-lobed.

5. *O. grandiflorus*, nov. comb. Syn. *Ocimum grandiflorum*, Blume (1825); *Orthosiphon stamineus*, Benth. (1830).

A very pretty species 1—2 ft. high with 4-angled nearly glabrous stems, petioled ovate acuminate coarsely obtusely serrate leaves 2—3.5" long and pubescent purple flowers with corollas .5—75" long, and declinate stamens exerted to 1" beyond the corolla. Seeds (not seen by me) broadly oblong compressed, rugulose (J. D. H.).

Shady places, Latua Forest, Singbhum! Fl. Aug.—Sept.

Herbaceous. L. cuneate at the base, puberulous on the 4—5 sec. n. beneath, not very clearly punctulate. Petiole .5—1". Pedicels about .15", longer or shorter than the .13—2" long tubular calyx, of which the lower teeth are subulate, but not awned and upper lobe not as broad as in other species.

3. GENIOSPORUM, Wall.

Herbs with small or minute flowers in many-fld. whorls in dense or lax spikes or racemes with the bracts often white or coloured. Calyx ovoid in flower, tubular and strongly transversely ribbed or pitted in fruit, suberect or declinate, 5-toothed, upper tooth broadest but not decurrent. Corolla 2-lipped, tube short, upper lip 4-fld, lower declinate entire. Filaments free, exerted. Disc tumid, gibbous. Style arms short flattened. Nutlets ovoid or oblong, smooth or sometimes punctulate.

Erect, 1—3 ft. high:—

Leaves 2—4", ovate or lanceolate, petioled

Leaves linear or narrow-lanceolate, 1—2", sessile.

Fruiting-calyx .2"

Prostrate, with leaves narrow, sessile, very unequal. Fruiting-calyx .1"

1. *strobiliferum*.

2. *elongatum*.

3. *prostratum*.

1. *G. strobiliferum*, Wall.

An erect, little-branched herb 2—3 ft. high with puberulous stems and ovate or lanceolate serrate leaves 2—4" long and small white flowers in dense spikes 2—4" long, often supported by a pair of white leaves, and the bracts white or greenish-white. Fruiting calyx erect, tubular, .12" long, pubescent with 2 black glands on the upper lip (F. B. I. says lower).

Northern Champaran, in the Ramnagar Hills! Perhaps also in Purneah. (I have collected it in the adjacent Sikkim Tarai.) Fl. Aug.—Oct. Fr. Nov.

L. with short scattered hairs, shortly acuminate, base acute or rounded and cuneate on the petiole which is .25—75" long, sec. n. 8—10 distinct. Bracts broadly rhomboid ovate. Pedicels very short. Calyx pubescent, throat glabrous. Corolla hairy with purple veins. Nutlets ellipsoid black, hispid towards the top (J. D. H.).

2. *G. elongatum*, Benth.

A herb 20—30" high with 4-angular somewhat hispidly retrorsely hairy strict stems, distant pairs of linear or linear-lanceolate pubescent leaves 1—2" long and terminal dense spikes .75—2" long of small pale-purple and white flowers. Bracts orbicular-obovate decussate,

often white or pale, .25—.3" long, .3" broad, villous beneath. Fruiting-calyx closely ribbed, sometimes pitted from the raised close transverse nerves.

Palamau, Pendra Valley, 2000 ft. Fl., Fr. Sept.—Nov.

L. tapering to the sessile base, serrate, thinly strigose above, gland dotted between the nerves beneath, sec. n. about 6 prominent and hairy beneath, depressed above. Fls. many, shortly pedicelled, reaching to the margins of the bracts. Calyx .12" naked within with villose or woolly tube shorter than the upper lip, very unequally toothed, upper lobe oblong, lateral teeth lanceolate, lower minute. Corolla .15—.2", hairy, 2 central lobes of upper lip purple, 2 side-lobes purple-veined, lower lip white, not longer than upper, flat, oblong acute. Fruiting calyx tubular .2" long, suberect and teeth erect enlarged hispid, 10-nerved, not pitted (pitted in Circars specimen, J.D.H.). Nutlets ellipsoid-oblong white smooth.

3. *G. prostratum*, Benth.

A diffuse or prostrate herb with slender stems 4—15" long from a somewhat woody rootstock and rhomboid or elliptic sharply distantly serrate leaves .3—.5" long narrowed into the petiole, or (var. *gracilis*) narrow linear-lanceolate or linear-oblong leaves .3—1.3" long. Flowers very small, somewhat like those of wild Thyme, on slender pedicels in cymose whorls racemed at the ends of the branches; racemes 2—6" long with ovate or narrow-ovate acute reflexed bracts. Fruiting calyx .1", tube ribbed, about as long as the teeth, glandular and thinly hairy outside, throat closed with hairs, 2 anterior teeth narrower and sharper than the others.

This is recorded from Orissa in *Bengal Plants* and it possibly does extend as far as the Puri coast but the specimens are not from Bengal Orissa but from Ganjam in Madras, i.e. Orissa in the older and wider sense. It is a common sea-side plant in Ceylon. Fl. June—Sept.

4. *ACROCEPHALUS*, Benth.

Annual herbs with whorls of small flowers in dense heads with imbricating bracts. Calyx ovoid in flower, tubular in fruit with gibbous base, upper lip flat, entire, lower entire, 4-fid or 4-toothed, throat naked. Corolla-tube very short, subequally 4-lobed. Stamens 4 with the anthers scarcely exerted, filaments free. Disc small, gibbous. Style 2-fid. Nutlets smooth.

1. *A. capitatus*, Benth.

A small plant only 6" high in fruit, or attaining 2 ft. Stems pubescent. Leaves ovate or lanceolate, .5—1", dentate or coarsely serrate, base narrowed into the petiole, nearly glabrous. Flowers minute, pink (with the lowest petal pale), in dense sub-globose heads .3—.6" long. Bracts .17" long and broad, cuneate at the base and very obtuse at the tip. Calyx hairy, in fruit tubular, .12—.17" long, with lobes one-third or one-quarter as long as tube, upper oblong or linear-oblong flat, 4 lower linear hispid; the upper lobe closes the calyx in young fruit but again opens with maturity. Seeds oblong, smooth, dark-brown, .03".

Damp or shady places in the forests. Singbhum, common! Angul, *Chattarjeel*. Judging from its general distribution it will be found in all the hilly districts of the area in damp forests. Fl., Fr. Oct.—Dec.

The normal plant is erect, often with the heads sub-panicled above. Upper India specimens have elliptic leaves 1.5" long, coarsely toothed with attenuate base. The Angul plant appears to be diffuse and has narrowly lanceolate leaves and the small heads are only .25" diam. Fruiting-calyx .1" flask-shaped with one oblong upper lobe and 4 small subulate lower lobes. Corolla .07" long. It is perhaps a distinct variety.

5. ANISOCHILUS, *Wall.*

Herbs or undershrubs, often fleshy. Flowers small in dense oblong 4-gonal or cylindrical spikes. Calyx suberect, inflated below the middle, mouth oblique 2-lipped or 5-toothed, rarely 1-lipped, upper lip entire and deflexed or short and 3-crenate. Corolla with slender decurved tube, short entire or 3-4-fid upper lip and elongate concave lower lip. Stamens 4, declinate, filaments free, anther-cells confluent. Disc lobed.

A. Fruiting calyx with the upper lip entire deflexed over and concealing the mouth, lower truncate or obscurely toothed:—

Calyx glabrous, shortly pubescent and ciliate

1. *carnosus*.

Calyx villous or woolly

2. *eriocephalus*.

B. Fruiting calyx split in front, mouth very oblique, 1-lipped, lip decurved 5-toothed, not closing the mouth

3. *polystachyus*.

1. *A. carnosus*, *Wall.*

An erect herb 2—3 ft. high, variable in indumentum, with long-petioled ovate crenate rather fleshy leaves and panicled long-peduncled short spikes, 1—1.5" long of pale purple flowers, conspicuous in bud by the 4-ranked, subsequently deciduous bracts. Whole inflorescence covered with small red glands. Lower lip of calyx truncate, upper ovate acuminate erect in flower but deflexed in bud and in fruit, .1" long.

Singbhum, in rocky places, especially on limestone rocks! Palamau! Ranchi, similar localities Fl. Oct.—Nov.

It is said to be very variable. The following details belong to the Chota Nagpur specimens. Stem very stout below, 4-gonous, villous, sparingly branched. Lower leaves 4.5 by 3.25", base rounded, apex obtuse or subacute more or less villose and with minute red glands (which are not noticed by the *F. B. I.*). Petioles 2—3". Spikes pyramidal (elongating to 3", *F. B. I.*) on peduncle 2—4" long, the lower sometimes with a small pair of leaves and branched. Pedicels very minute, red with glands. Bracts 2". Calyx very shortly pubescent and ciliate. Corolla .42, upper lip purple erect, lower constricted at base elliptic concave .12", pubescent and red-glandular in bud.

2. *A. eriocephalus*, *Benth.*

As stated by *Hooker*, probably only a variety of *A. carnosus*, than which it is more slender, glabrous or puberulous, leaves broadly ovate or cordate, crenate. Peduncles slender, spikes many ovoid or cylindrical, calyx villous or woolly, upper lip broadly ovate acuminate, deflexed as in the last.

Kymore Hills, *J. D. H.* Ranchi, Neterhat? My specimens had short heads .5—7" and a sub-aristate upper lip. They were old and leafless (December).

3. *A. polystachyus*, Benth.

Of very different appearance from the last two species, being a robust herb with erect strict hoary stems 3—8 ft. high with subsessile lanceolate acuminate leaves 3—6" and paniced spikes 1—1.5" long of white or cream reflexed flowers.

Common in Savannah tracts of Jalpaiguri and will probably be found in the grass tracts of Purneah. Fl. Nov.

6. PLECTRANTHUS, L'Herit.

Herbs or undershrubs with usually square stems, opp. or ternate leaves and small flowers in paniced or racemed 6—8-fld. cymes or whorls. Calyx 2-lipped, 5-toothed, sometimes unequally, enlarged in fruit. Corolla-tube exerted, long or short, straight or decurved, limb equal or gibbous or spurred, 2-lipped, upper lip short broad, 2—4-fld recurved, lower much larger, longer, entire, boat-shaped, narrow or stipitate at the base. Stamens 4 declinate; filaments free, anther-cells usually confluent. Disc usually produced in front, large. Nutlets orbicular ovoid or oblong, smooth granulate or punctate.

A. Calyx-teeth sub-equal and similar:—

Calyx-teeth rounded. L. lanceolate 2—7" hoary

Calyx-teeth lanceolate acute. L. ovate

B. Upper calyx lobe broadly ovate:—

Leaves ovate, cordate. Cymes 2—3-fld. only

1. *ternifolius*.

2. *menthoides*.

3. *incanus*.

1. *P. ternifolius*, Don.

An undershrubs 3—5 ft. high, densely white-tomentose all over, with strict erect branches, opposite or 3-nately whorled lanceolate, acuminate, serrate, rugose leaves 2—7" long, and sub-sessile white flowers in dense whorls on the spiciform branches of long narrow hoary panicles. Fruiting calyx erect, tubular, equally 5-toothed. Corolla .2" with decurved tube only .05", gibbous above the base. Nutlets 3-gonous, ovoid-oblong, acuminate.

In grass tracts and thin forest. Purneah, very common! Chota Nagpur, on the pats 3000 ft. and above, and Parasnath 4000 ft. Fl. Nov.—Jan.

Stems villosely tomentose. Leaves sometimes oblong-lanceolate, green and shortly hairy above, hoary-pubescent beneath. Petiole .2—3". Calyx in fruit .2", straight, teeth rounded. Upper lip of corolla with pink spots at the base, 2-fld with the segments again 2-lobed.

2. *P. menthoides*, Benth.

A tall robust herb 5—8 ft. high with square densely pubescent stems up to .3" diam., often grooved on the faces. Leaves opposite, rugose above, ovate acuminate, dentate, base decurrent on petiole, larger 4" by 2" with petiole .5". Flowers 2—3" long, blue in terminal thyrroidly paniced stalked 2-chotomous cymes in the axils of the leaves or bracts. Calyx .12" campanulate, pubescent, sub-2-lipped, teeth sharply lanceolate; in fruit decurved. Corolla hairy, tube .15—.16", equalling or exceeding the lower lip, declinate, suddenly swollen above the very short base, gibbous above.

In wet grassy places, also on cool hill sides but then less tall; Neterhat, 3000 ft. Fl., Fr. Oct.—Dec.

Very aromatic. Leaves pubescent both sides. Cymes divaricate, .5" long. Upper lip of corolla with 4 rounded lobes and violet markings, lower boat-shaped, pale blue. Filaments declinate, 2 lower longer. Nutlets oblong.

This, as *Clarke* states, is probably only a variety of *P. cœtsa*. I class it under *P. menthoides* because the corolla-tube in *P. cœtsa* is much shorter than the lower lip.

3. *P. incanus*, *Link.*

An erect coarse herb or undershrub 3—4 ft. high with square stems, long-petioled velvety ovate cordate crenate leaves 2—4" by 1.75—4" with a strong smell, and terminal racemes or panicles of small pale-lilac flowers .3" long, arranged mostly in opposite peduncled 2-fl. cymes in the axils of small green bracts .15—.25" long. Calyx .12" long, enlarged to .45" in fruit with an upper broadly ovate lip and a lower lip with 4 long subulate teeth. Seeds grey-brown subglobose with sparse small dark warts.

Waste ground near villages under shade, or among rocks or in the open on the pats. Singbhum! Ranchi plateau, common! Parasnath, *Kew Herb.*! Fl. Aug.—Sept. Fr. Oct.

The name is not a very happy one as the plant, although shortly softly pubescent, is scarcely grey or hoary. L. acute, deeply cordate, gland punctate beneath. Lower petioles 3—4" long. Cymes of 2—3 fls. on a short common peduncle with pedicels .3—.5". Corolla pubescent, tube only slightly exerted, boat-shaped lower lip about .2".

7. COLEUS, *L.*

Characters of *Plectranthus* but flowers often large and filaments combined below into a sheath round the style.

A. Indigenous species:—

Whorls 6—10-fl. Fruiting calyx decurved, hairy in throat. 1. *Forskohlii*.

B. Cultivated species. Calyx glabrous within:—

1. Whorls dense globose. Fruiting calyx suberect:—

Leaves very thick, sweetly scented 2. *amboinicus*.

2. Whorls loose, laxly cymose. Fruiting calyx decurved:—

L. membranous, rounded at base. Calyx glabrate 3. *scutellarioides*.

L. often variegated, acute at base. Calyx hirsute 4. *Blumei*.

1. *C. Forskohlii*, *Briq.* Syn. *C. barbarus*, *Benth.*; *Plectranthus Forskohlii*, *Willd.*

A herb 1—2 ft. high with decumbent and ascending stout villous stems and rather fleshy ovate crenate obtuse leaves 3—4" long. Flowers pale blue .75—.9" long in rather distant 6—10-fl. whorls in villous racemes 5—10" long. Calyx villous in the throat, .3" in fruit with the lower subulate-subaristate teeth half as long as the stout tube, upper lip ovate rounded broadly ovate, cuspidate. Corolla with large stipitate boat-shaped lower lip.

Top of Parasnath! Fl. Nov.

2. *C. amboinicus*, *Lour.* Syn. *C. aromaticus*, *Roxb.*; *Pathar-chur*, *Vern.*

Shrubby below, villous, with short petioled orbicular cordate crenate very thick, crenulate, slightly hairy leaves about 1—2" long and broad. Flowers very small blue or pale purple in very dense distant whorls; in bud with 4 rows of caducous bracts. Common in gardens. Fl. May—June.

3. *C. scutellarioides*, Benth. Syn. *Ocimum scutellarioides*, L.

A tall slender plant 2—3 ft. high with petioled ovate or ovate-lanceolate acuminate crenate membranous leaves 2—3" and flowers .5" with abruptly decurved tube. Racemes elongate slender. The leaves are usually purple beneath.

Common in gardens.

4. *C. Blumei*, Benth. Syn. *Plectranthus scutellarioides*, Blume.

Briquet states that this is the parent of most of the beautifully variegated-leaved *Coleus*, sometimes crossed with its congeners *C. bicolor*, Benth., and *C. laciniatus*, Benth. All are natives of and cultivated in Java. The whorls are secund in elongate racemes, the lower lip of the hirsute calyx is 3-fid with the middle segment longer and 2-lobed. *C. laciniatus* has the leaves inciso-serrate.

Very common in Indian verandahs, often with the last.

8. HYPTIS, Jacq.

Herbs or shrubs with (in our species) small flowers disposed in dense cymose whorls and these in paniced spikes or racemes, cymes sometimes capitate when young. Calyx campanulate, ovate or tubular, equally 5-toothed, often accrescent in fruit. Corolla with cylindric or somewhat widened or ventricose tube, 2-lobed upper lip, abruptly deflexed saccate lower lip contracted at the base and the side lobes united either with the lower or upper lip or free. Stamens 4 declinate, anther-cells confluent. Style sub-entire or 2-fid.

A very large American genus with some 300 species.

1. *H. suaveolens*, Poit. Ganga Tulsi, S., Or; Purudo, Mal Pah.

A tall, coarse, branched, very sweet-smelling herb, varying in stature but attaining 6 or 7 ft. in congenial situations, with obtusely 4-angled stems often .5" diam. Leaves ovate sinuate and crenate-denticulate, lower 4.5" by 3.5", slightly cordate, hairy, upper smaller not cordate. Flowers small blue, when young often capitate 2—4 together on an axillary peduncle (in globose heads, *J.D.H.*), or in bracteate axillary racemiform cymes or, in luxuriant specimens, cymes collected into thyriform almost leafless panicles one foot or more long. Filaments hairy. Calyx compressed sub-2-lipped somewhat deflexed, tube .25" long in fruit 10-nerved meeting in a marginal nerve and with an inflexed ring of hairs in the mouth, teeth subulate-aristate strong. Nutlets compressed ovoid oblong, emarginate at tip, pointed below, ribbed, .12" long.

Completely naturalised in most parts of the province in open waste ground. Singbhum! Ranchi! Very common in the coalfields of Manbhum! Santal P., very common! Puri, local! Angul, *Chattarjee*! Sambalpur! Athmallik! Fl. Oct.—Nov. Fr. Nov.—Jan.

Very glandular. Calyx hairy and glandular. Corolla .2", upper lip shortly 2-lobed, lower (including side-lobes) 3-lobed.

The plant, pounded, is applied in parasitical cutaneous diseases, *Camp.*

9. LAVANDULA, L. Lavender.

Herbs or shrubs with entire or sometimes pinnatisect leaves and blue, violet or lilac flowers in 2—10-fid. whorls, collected into simple or branched spikes. Calyx erect, 13—15-nerved, 5-toothed. Corolla

with 2-fid upper and 3-partite lower lip, lobes spreading. Stamens 4 declinate, included, free, anther-cells confluent. Disc-lobes opposite the ovary-lobes. Style 2-fid. Nutlets smooth, areole slightly dorsally oblique.

The species of Lavender are chiefly Mediterranean.

1. *L. bipinnata*, Roth. Syn. *L. Burmanni*, Benth.

A pretty, slender, erect herb 2—3 ft. high with 1—2-pinnatisect leaves with linear segments, and capitate spikes 3—1.25" long of lavender-coloured and -scented flowers.

Pats of Chota Nagpur: Ranchi Palamanu, Neterhat, 3000 ft. Fl. Nov.—Jan.

Leaves 3—4" long, segments very narrow. Spikes sometimes paniced, bracts 1-fid., ovate-acuminate (subulate, *F. B. I.*), shorter than the tubular 15-nerved pubescent, 2"-long calyx. Corolla sometimes white, .45" on long diameter with tube 3—4" slender, inflated above, throat hairy. Lower lip deeply 3-lobed with midlobe largest obovate, upper lip paler notched, outside pubescent. Stamens with lower pair longer, anthers rounded, pubescent. Nutlets oblong .06" long with a broad dorsal groove in continuation of the oblique areole not quite reaching to the rounded apex.

10. POGOSTEMON, Desf.

Herbs or shrubs with small flowers in subcapitate whorls or cymes arranged in solitary or densely paniced spikes or contracted racemes. Calyx sub-equally 4—5-toothed. Corolla sub-2-lipped with exerted or included tube and spreading limb of 4 lobes, lower usually longest. Stamens 4 exerted, straight or declinate, filaments usually bearded, anther-cells confluent. Disc regular sub-entire. Style 2-fid. Nutlets smooth ovoid or oblong.

1. *P. plectranthoides*, Desf. Jin, Beng.; Ishwar-jata, Khond; Poksunga, Or.

A suffruticose herb or shrub 4—6 ft. high; stems with 4 rounded corners glabrous or hairy with adpressed hairs. Leaves ovate, rarely lanceolate acute or subacuminate with straight or very obtuse or shortly suddenly cuneate base, 3—5" but smaller towards the inflorescence, coarsely doubly serrate. Flowers white or pale but appearing pink from the conspicuous light-purple bearded stamens and style, in capitate secund bracteate spikes, which again are arranged in dense secund paniced villous racemes. Bracts 2—.25" long, ovate, ell.-ovate or oblong-rhomboid, villous, overtopping the flower-buds.

In shady forest or along streams, sometimes forming a dense thicket. Champan! Santal Parg! Singbhum, local! Parasnath, *Kew Herb!* Angul, common! Kalahandi! Fl. Jan.—Feb. Fr. April.

Branches often purple. Shoots and young leaves beneath hoary pubescent, mature leaves sometimes with a short mealy pubescence and minutely glandular beneath and very sparsely shortly hairy above, generally glabrescent, nearly scentless but inflorescence with a strong smell, sec. n. rather strong 4—6 very oblique. Petiole 1—2". Calyx .15—.17" long, sub-2-lipped, two teeth rather broader than the other three, half to two-thirds as long as tube, villose-pubescent and minutely glandular. Upper corolla-lip with 3 rounded lobes, lower entire lanceolate acute. Villi on stamens jointed.

2. *P. parviflorus*, Benth.

This plant, which is distinguished from the last by the much more slender spikes and narrower bracts, occurs from Kumaon and Nepal to Sikkim and Assam. It may therefore possibly occur along our northern frontier especially in the Champaran Hills. In the *F. B. I.* it is stated that it may be distinguished by never being hoary as in *B. plectranthoides* but the last is very frequently not at all hoary in the field.

11. DYSOPHYLLA, Blume.

Herbs with opposite or whorled leaves and minute flowers sessile in close whorls collected into dense terminal spikes. Calyx very minute, ovoid, equally 5-toothed, throat naked. Corolla minute, tube exerted or included, limb nearly equally 4-fid with the upper lobe entire or 2-lobed, lower spreading. Stamens 4 exerted, somewhat unequal, straight or subdeclinate, filaments very long-bearded, anther-cells confluent. Disc regular, subentire. Style 2-fid. Nutlets smooth or rough, ovoid or oblong.

A. Calyx not angled and furrowed:—

1. Leaves in pairs (rarely a few ternate in 2), hairy:—

Stems with spreading hairs. L. 2·5—3" mostly serrate.

Spike 2·5—3" diam

1. *auricularia*.

Stems with adpressed hairs. L. 1—1·5" mostly entire.

Spike 4—5" diam.

2. *Andersoni*.

2. Leaves 3—5-nately whorled, or a few upper paired:—

a. Stems and leaves tomentosely hirsute or villous:—

Branched above. L. lanceolate, serrate, 1—4"

Strict with solitary spikes. L. linear, entire, 7—2"

3. *quadrifolia*.

4. *cruciata*.

b. Glabrous or nearly so, often decumbent at base:—

L. 1—3" spreading and deflexed. Calyx teeth stellately spreading in fruit. Spikes mostly under 2" diam.

Calyx teeth erect in fruit. Spikes over 2" diam

5. *verticillata*.

6. *crassicaulis*.

B. Calyx with 5 alternate furrows and ridges:—

Calyx pubescent all over. Ridges obtuse

7. *pentagona*.

Calyx only pubescent at tip. Ridges acute

8. *Griffithii*.

1. *D. auricularia*, Blume.

A very hairy herb 18"—2 ft. high, scarcely scented, with distant pairs of ovate-oblong or ovate-lanceolate, hairy obtusely serrate leaves 2·5—3" long below, and terminal dense spikes of white or pale lilac flowers with bearded exerted filaments. Calyx 0·6", campanulate, teeth equal triangular half as long as tube. Fruiting calyx turbinate with mouth closed by the inflexed lobes. Corolla subregular with 4 rounded lobes. Nutlets pale brown, smooth, ellipsoid.

In grass near streams on the pats of Chota Nagpur. Neterhat, 3000 ft. Fl., Fr. Sept.—Nov.

Stem with spreading hairs, terete below, slightly angled above. Leaves gland-punctate beneath, sec. n. oblique, about 8. Petiole 1—2". Spikes 1—1·5" long in flower but elongating to 4" or more in fruit with a nodose villous rhachis, about 2·5—3" diam. Bracts under 1" oblong or spatulate-oblong ciliate. Flowers 17".

2. *D. Andersoni*, Prain.

An erect strict stoutish herb with appressed hairy stems, about 6" high, leaves opposite or sometimes 3 in a whorl 1—1·5" by 3" tomentosely hairy lanceolate or narrowly oblong with shallow

distant serratures or entire, and a much stouter spike than in the last 1.5—2" long by .5" diam. after fall of the flowers.

Singbhum in the Tirilposi savannah, 2000 ft.! Also recorded from the Duars, and the type was collected by *T. Anderson* in the Sikkim Tarai; it may therefore be found in northern Purneah. Fr. March.

The following is the description of the type in the *Journal of the As. Soc. Bengal*:—Dwarf stout erect 8—15 cm. branched, branches erect stoutish woody, stems and leaves both surfaces adpressed pubescent. L. opposite, sessile, 3—4 cm. long, lanceolate or oblong-lanceolate acute entire. Spikes short, stout, 15—20 mm. long, 10 mm. wide, softly tomentose. Whorls confluent. Calyx short glabrescent, in fruit 2 mm. long, teeth erect, bluntly triangular, half as long as tube, hirsute, tube glabrous externally. Corolla-tube included, lobes sparingly hairy. Nutlets globose smooth, shining, red-brown, not trigonous.

3. *D. quadrifolia*, *Benth.*

Stems 2—4 ft. high, tomentosely hirsute upwards, from a thick root-stock. Leaves opposite and 4 in a whorl, narrowly lanceolate or linear-oblong, 1—4" long, tomentosely hairy, strongly nerved, serrate, petiole 0—2". Spikes very dense 3—6" long by .25—3" diam. with sometimes detached whorls below. Bracts linear as long as the calyx. Calyx campanulate in flower hirsute or villous, equally 5-toothed, tubular in fruit and .08—1" long. Nutlets minute brown ovoid with small areole.

Singbhum, on the Keonjhur boundary, elev. 3000 ft.! Angul, *Lace!* Mailagiri Hill, Palahara State, *Cooper!* Fl. Dec.—Feb. Fr. March—April. Percania!, new shoots appear in April.

The spikes are sub-panicled. Calyx with small glistening glands, teeth erect in fruit.

4. *D. cruciata*, *Benth.*

A very pretty herb often growing gregariously with erect strict densely villose stems 12—20" high, whorls of 3—5, usually 4, sessile sub-erect linear leaves .7—2" long with revolute entire or slightly toothed margins and terminal solitary spikes 1—3" (rarely 5") long of lilac or pale-purple flowers with purple-bearded stamens.

Frequent in rice fields and wet places in the hills, often amongst grass. Champaran! Purneah! Ranchi, elev. 2000 ft.! Singbhum, elev. 2000 ft.! Sambalpur, *Griffiths!* Fl., Fr. Oct.—March.

L. densely hirsutely villous both sides, slightly narrowed upwards and sometimes also towards the base, obtuse or subacute. Spikes with a peduncle .8—1.5", about .4" diam. when with flower or .3" diam. in fruit. Bracts linear slightly exceeding the villous calyx. Corolla white, lobes glabrous. Fruiting calyx tubular-campanulate with erect teeth, .06—08" long, villous and with glistening glands. Seeds minute, black, polished, broadly elliptic oblong with minute attachment point.

5. *D. verticillata*, *Benth.*

Usually branched, hollow-stemmed below with often decumbent base, 12—20" high or flowering when simple and only 3—4" high, glabrous or very sparsely hairy. Leaves linear or linear-lanceolate, 4—5 or up to 10 in a whorl, entire or crenate-serrate, 1—3" long, spreading and deflexed, glabrous or nearly so. Spikes rarely over 2.5" long and under .2" diam. in fruit, very dense, the widely open fruiting calyx looking like large holes in a solid spike and very

characteristic, the lobes stellately spreading and disclosing the pale brown nutlets.

Purneah, Kurz! Gya, Cal. Herb.! Manbhum! Fl., Fr. Nov.—Dec.

The peculiarity of very small slender plants flowering in company with very large stout ones is quite characteristic of this and of the next species.

6. *D. crassicaulis*, Benth.

Habit of the last with lower decumbent parts of stems sometimes as thick as the fingers. Leaves linear-lanceolate or nearly linear, mostly 4—5 in a whorl. Distinguished by the larger spikes 1—4.5" long and .3—4" diam. Flowers larger, calyx .09—1" in fruit, campanulate, shortly hairy with the teeth erect or contiving so that the fruiting spikes have a very different appearance. Nutlets very small, orbicular, compressed pale grey or black.

In rice-fields and swamps. Purneah! Fl., Fr. Nov.—Jan.

Our specimens have serrate leaves with rounded (sometimes acute, *F. B. I.*) sessile base. Bracts exceeding the buds, linear. Calyx purple.

7. *D. pentagona*, Clarke.

A small plant 4—8" high or attaining 18", growing gregariously in wet places with nearly glabrous stems and leaves, the latter linear 4 in a whorl .3—1.5" long, and with minute pink flowers in terminal slender pubescent spikes .75—3" long. Calyx in fruit sub-globose, densely pubescent, only .06" long, deeply 5-grooved, with obtuse ridges between the grooves and mouth closed by the minute obtuse teeth.

Singbhum, elev. 1000 ft.! Rare, but also collected by Clarke at Bandgaon, which is in Singbhum close to the Ranchi boundary elev. 2000 ft.! Fl., Fr. Oct.—Nov. Annual.

Leaves sessile, obtuse, glabrous, margins somewhat revolute, base obtuse or acute, beneath gland-dotted. Corolla segments white, flat, obtuse. Stamens pink. Fruiting calyx glandular in the furrows, teeth closing over the small oblong brown seeds. (*N.B.*—Clarke says nutlet solitary, linear-oblong. This was probably exceptional.)

8. *D. Griffithii*, Hook. f.

A copiously branched erect glabrous or nearly glabrous herb with linear obtuse or subacuminate leaves .5—1" long, 4 in a whorl or uppermost opposite and slender pubescent spikes .75—2" long, .15—2" broad. Calyx in fruit obconic only .06" long, broadly 5-grooved with acute ridges between the grooves, glabrous except for the tip and minute incurved densely shortly villous subacute teeth.

Rocky ground. Angul, B. K. Chattarjee! Sambalpur, Griffiths! Fls., Fr. Jan.—Feb. Annual.

Leaves sometimes tapering both ends, gland-punctate beneath, with one oblique slender nerve from near the base either side of the midrib, but other nerves obscure. Bracts linear, exceeding the flowers. Fruiting calyx sometimes brown, shining below the villous tip. Nutlets 2—4, minute, dark brown, suborbicular.

12. COLEBROOKIA, Smith.

Shrub with opposite or 3-nate leaves and small white flowers in dense whorls aggregated into paniced spikes. Calyx-tube very

short; teeth long, subulate, in fruit elongating and plumose. Corolla minute, limb sub-equally 4-fid. Stamens 4, very short, included, equal, divergent, with small orbicular anthers with confluent cells. Disc regular. Style 2-fid with subulate lobes. Nutlets hairy, obovoid.

1. C. oppositifolia, Sm. Bhainsa, S.

A large spreading softly woolly shrub 5—10 ft. high with stout whitish branchlets, large white-tomentose crenate or crenulate leaves and very small white flowers in paniced spikes 2—4" long. Calyx in fruit villous, deeply furrowed with plumose teeth 1/2" long.

Purneah! Valleys or rocky ravines in the hills in Chota Nagpur. Singbhum! Ranchi! Palamau! Hazaribagh (on Parasnath and valleys in Koderma forest)! Santal Par.! Fl. Dec.—Feb. Fr. Feb.—March.

L. sometimes 3-nate, 4—8", elliptic or ell.-oblong acuminate with about 12 rather strong oblique sec. n. Petiole 5—1.25".

A preparation of the root is given in epilepsy, *Camp.*

13. ELSHOLTZIA, Willd.

Herbs or undershrubs, often beautifully scented. Flowers minute in whorls aggregated into simple or paniced, sometimes secund, spikes. Calyx 5-toothed, erect and often enlarged in fruit. Corolla with straight or incurved tube and oblique or sub-2-lipped limb, upper lobe or lip notched erect, lower spreading. Stamens 4 divergent or distant, sometimes unequal, filaments naked, anther-cells divaricate or finally confluent. Disc produced behind the ovary. Style subequally 2-fid, lobes subulate. Nutlets smooth or tubercled.

1. E. incisa, Benth.

An aromatic annual herb 8"—3 ft. high with square stems puberulous with adpressed hairs and deltoidly or rhomboidly ovate, very coarsely serrate leaves 1—2.5" long. Flowers very small white, lipped, in dense terminal slender terete spikes 1.5—3.5" long, or shorter on the lateral branches. Bracts subulate acuminate. Fruiting calyx tubular-urceolate, 1" long, 10-nerved, pubescent, with 5 subequal subulate teeth. Nutlets oblong-ellipsoid, brown, shining, attached by a very minute base.

Sunny slopes, parts of Chota Nagpur. Neterhat, 3500 ft. Fl. Oct. Fr. Nov.—Dec.

Smell of Thyme. Stem angles rounded. L. with very conspicuous glands beneath, acute or acuminate, decurrent on the slender 4—2"-long petiole, puberulous above and on nerves beneath, sec. n. 4—5, strong oblique and curved, tertiaries prominent. Spikes pubescent with decussate subulate bracts, 1—2" long, slightly exceeding the flowers. Cymes 4—7-fid., sessile, fls. minutely pedicelled. Calyx .05—0.07", campanulate, hairy and gland-dotted, upper tooth slightly longer. Corolla .1", densely pubescent, tube funnel-shaped, slightly curved, upper lip very short sub-truncate emarginate, lateral very short, anterior rather longer, half-orbicular. St. erect, 2 upper 2-celled, scarcely exerted, lower sometimes imperfect, sometimes one larger than all the rest.

Distrib.: Temperate and sub-tropical Himalaya and Chittagong.

Z. E. blanda, *Benth.* Syn. *Aphanochilus blandus*, *Benth.*

A slightly aromatic herb 2—4 ft. high with lanceolate leaves 1·5—3" long acuminate both ends, base attenuate into a very short petiole, nearly glabrous beneath with conspicuous glands, puberulous above, margin coarsely serrate. Flowers very small, white, in slender unilateral panicled spikes, terminal spikes 3—4" long, bracts acicular. Fruiting calyx 1" long, the subulate teeth exceeding the tube or not. Nutlets yellow ellipsoid-oblong compressed, '02—'03" long, attached by a minute mucronate base.

Rajmahal, Ham.1 Probably in the hills. Fl. Oct. Fr. Nov. A native of the mountains of Sikkim, Assam, Khasia and Burma.

A stouter plant than *E. incisa* and easily distinguished by the lanceolate leaves and shorter petioles and secund flowers. Petiole up to '5—'6" long. Cor. 1" long, with numerous yellow glands and curled white hairs, minutely hairy and with a ring of long hairs within. Fruiting spikes up to '3" diam. (Add. & Cor., 186 p.).

Species of the genus **Mentha**, *L.* (Mint), are found in most Indian kitchen-gardens, and are well known under the vernacular name of *pudina*. The flowers in *Mentha* are often polygamo-dioecious and many hybrids occur. I do not remember having seen any Mint in flower in our area, and the plants are propagated by division of the roots or underground stolons. The one commonly used in flavouring is usually referred to as *M. viridis*, *L.*, but the leaves are not lanceolate as in that species but orbicular-ovate or orbicular. It is more probably a form of *M. sativa*, *L.*, itself believed to be a hybrid between *M. aquatica* and *M. arvensis*.

14. PERILLA, L.

Herbs or undershrubs with small flowers in 2-fld. whorls (fls. solitary in the bracts) collected into axillary and terminal secund racemes. Calyx campanulate 5-toothed, greatly enlarged in fruit and 2-lipped with gibbous base and dilated 3-toothed upper lip; lower lip with 2 lanceolate-subulate teeth. Corolla with short tube campanulate above, limb 5-fid with lobes unequal (lower usually larger than the 4 upper). Stamens 4 subequal erect distant, hardly exerted; anther-cells distinct, at first parallel, afterwards diverging. Disc large with a large posticous oblong lobe or gland. Style equally 2-fid. Nutlets subglobose, coarsely reticulate.

1. P. ocimoides, L. Ban Tulsi, *Beng.*

A strongly scented bush about 4 ft. high with villosely hairy 4-gonous and grooved branches, ovate coarsely serrate acuminate leaves 2·5—4" long and small white hairy flowers 4-ranked in axillary and terminal secund spiciform racemes 1—3·5" long. Bracts ovate or rhomboid rigidly acuminate. Calyx in flower '1—'12", hairy, with subulate teeth about equalling the sub-globose tube, in fruit '28—'3" long, broad upper lip with 3 oblong lobes, each 1-nerved, lanceolate lower teeth as long as upper lip and equalling tube.

Champanan. At the foot of the Ramnagar Hills! Fl., Fr. Oct.—Dec.

L. hairy on the nerves both sides and sparsely so between them above, gland-punctate beneath, base rhomboid or cuneate, sec. n. 6—7 oblique, very distinct but slender. Petiole .75—1.5" long, closely villous. Corolla white, hairy, .15" long, slightly exerted, with 4 subequal rounded lobes and a broader lower subtruncate lobe. Stamens erect, just reaching the throat of the villous corolla, anthers 2-celled. Fruiting calyx declinate, villous or nearly glabrous outside, but throat with a ring of long erect hairs. Nutlets .07".

15. MICROMERIA, *Benth.*

(*Satureia*, *L.*, in *Nat. Pflanz. Fam.**)

Herbs or undershrubs with usually small, entire or toothed leaves and small flowers in axillary whorls, sometimes whorls spicate or paniced. Calyx 10—13-nerved, 5-toothed or 2-lipped. Corolla 2-lipped, upper lip erect flattish, entire or notched, lower spreading 3-lobed. Stamens 4, lower longer ascending, incurved with diverging tips; anther cells distinct, parallel, at length diverging, connective usually thickened. Style-lobes equal or upper very short, lower recurved flattened.

Leaves .5—1" mostly serrate. Whorls dense-flowered
Leaves .17—25", entire. Whorls 2—few-flowered

1. *capitellata*.
2. *biflora*.

1. *M. capitellata*, *Benth.* *Buru-pudina*, *S.*

A herb with strong mint odour, long slender erect, 4-angled, pubescent stems 1—2.5 ft. high, ovate or ovate-oblong mostly crenate-serrate leaves .5—1" long, and small purplish flowers in axillary, usually stalked, capitate cymes or uppermost running out into interrupted spikes, the leaves passing gradually into small lanceolate then linear bracts. Calyx tubular hairy .08—1" (in fruit) with erect subulate hairy teeth half as long as tube, throat with a ring of hairs. Corolla very slightly exerted, straight, upper lip 2-fid, lower 3-lobed, with mid-lobe purple broader notched. Stamens included.

Pats of Chota Nagpur. Neterhat, elev. 3500 ft! Parasnath, *Clarke!* Fl. March—April.

Leaves puberulous above, hairy on the nerves beneath, obtuse or subacute, base rounded, obtuse or cuneate. Petiole slender .05—13". Lower whorls often slender-peduncled, distant. Nutlets elliptic-oblong, brown, minute, smooth.

2. *M. biflora*, *Benth.* Syn. *Satureia biflora*, *Briq.*; *Thymus biflorus*, *Ham.*; Indian Wild Thyme.

A small much branched wiry herb with numerous pubescent stems 3—10" long from a woody rootstock, small sessile or subsessile elliptic or ovate or oblong gland-dotted leaves .17—25" long and axillary short 2—4-fid. cymes of small pink flowers .3" long.

Rocky places and fire-lines, Chota Nagpur. Neterhat, 3000 ft. Fl., Fr. April—June. Perennial.

Stems pubescent in our specimens, sometimes glabrous (*F.B.I.*). Leaves with thickened entire margins and 3—4 very oblique fine sec. n. Petiole sometimes very short, with several long hairs at the base. Calyx .12", teeth setaceous, ribe strongly nerved. Corolla with straight notched or 2-lobed upper lip and spreading 3-lobed lower lip. Stamens ascending, 2 lower longer, slightly exerted beyond the upper lip, anther-cells widely divaricate.

* See note under *Calamintha*.

16. CALAMINTHA, *Mench.**

Herbs or shrubs with entire or toothed leaves and axillary, spiked or paniced whorls of flowers. Calyx 13-nerved, 2-lipped, upper lip 3-toothed, lower 2-fid, teeth narrower than of the upper; throat raked or villous. Corolla-tube straight, throat villous, upper lip erect, flattish; lower spreading 3-lobed. Stamens 4, 2 sometimes imperfect, ascending under the upper lip, anther-cells parallel or diverging. Style-lobes equal or the lower larger. Nutlets minute, subglobose, smooth, dry.

1. *C. umbrosa*, *Benth.*

Prair records this in *Bengal Plants* from Chota Nagpur, but I doubt the identification. A supposed specimen is on the right-hand side of the same sheet as one from N. W. India, and is marked "top of Parasnath." It is *not in flower* and is not in my opinion at all like *Calamintha umbrosa*, but is a flowerless specimen of *Micromeria capitellata*. The only other specimen similarly identified is one collected by *Campbell*, probably also on Parasnath, and is likewise *not in flower*. Although superficially more like *Calamintha umbrosa* than the first, this is also probably *Micromeria capitellata*.

17. SALVIA, *Linn.*

Herbs or shrubs. Flowers often large, red, blue or yellow, rarely white, in usually interruptedly racemed or spicate whorls. Calyx tubular or campanulate, with entire or 2-toothed upper, and 2-fid lower lip; throat naked. Corolla-tube naked or with a ring of hairs inside; upper lip erect, lower 3-lobed, lateral lobes spreading. Stamens 2 perfect, filaments short, jointed on a slender connective which bears 1 or 2 perfect cells. Disc tumid behind. Style ascending 2-fid. Nutlets 3-quetrous, smooth.

1. *S. plebeja*, *Br.*

An erect copiously regularly branched herb with square stems 1—2 ft. high, wrinkled sage-like ovate, oblong, or ovate-lanceolate crenate leaves 1—3" long and terminal often paniced racemes of small or minute white-lipped flowers in 6-fid. whorls. Upper calyx-lobe decurrent on the tube as in *Ocimum* but elliptic, lower 2 teeth longer acute, others obsolete. Stamens ascending under the upper lip, cells widely separated by the lever-like connective, one imperfect.

* *Bentham* distinguishes *Micromeria* from *Satureia* mainly by the calyx being 13-nerved. But this is not always the case in our species, which may be only 11—10-nerved! This observation supports *Briquet's* view that *Micromeria* and *Calamintha* should be reduced to *Satureia*. He charges *Bentham* with inconsistency in splitting up *Satureia* while not similarly treating *Salvia*, *Hyptis* and other genera. But *Briquet* seems quite as illogical in reducing *Calamintha* to *Satureia* while maintaining distinct *Mosla* and *Perilla*—groups of the most striking generic similarity. The reduction of a pair of anthers in *Mosla* is a very insufficient character under the circumstances, rendered the poorer in that the degree of reduction is variable even in the same individual, while the only other character, that of a hairy throat to the calyx, occurs in some of his species of *Satureia* but not in others. *Calamintha* seems separable from *Micromeria* by the more zygomorphic calyx, though it would be perhaps better to include them both in *Satureia* were it not that that genus becomes unwieldy.

Usually in gravel near streams. Champaran! Purneah, *Cal. Herb.*! Singbhum! Manbhum, *Cal. Herb.*! Fl. Feb.—March.

Stems grooved on the sides, pubescent with short reflexed hairs. L. narrowed into the rather long petiole, lower usually obtuse, upper more acute. Racemes 2—4", glandular. Bracts oblong or lanceolate and smaller ones under the lateral flowers. Corolla 12—17" only, upper lip concave 2-toothed, lower spreading 3-toothed with the central much larger, white with few brown dots, all teeth rounded, throat with a small ring of hairs within.

Several beautiful species are in cultivation but most of them only thrive in the hills. *S. coccinea* L., is commonly grown in gardens in the plains. It has long lax erect spikes of scarlet flowers about 1" long and will often seed itself.

18. NEPETA, L.

Herbs. Flowers often small, blue, white or yellow in axillary and terminal sometimes spicate or racemed whorls. Calyx tubular, 15-ribbed, regular, equally 5-toothed or 2 lower teeth narrower. Corolla-tube not annulate within, throat inflated, upper lip straight, notched or 2-fid, lower 3-fid, midlobe largest. Stamens 4, ascending under the upper lip or exserted, upper pair longer; anther-cells diverging. Style-lobes subulate. Nutlets smooth.

1. *N. hindostana*, *comb. nov.* Syn. *Glechoma hindostana*, *Roth.* (1821); *N. ruderalis*, *Ham.*

An aromatic herb with one or many stems 6—18" high from the root, obtusely 4-cornered and pubescent. Leaves somewhat nettle-like but small, lower about 1.25 by 1" ovate or broadly ovate, coarsely crenate-serrate with petiole .5—.75". Flowers blue-purple .25", in stalked axillary dense cymes aggregated at the top of the stem into dense spiciform thyrses .8" diam., peduncles of lower cymes often .3". Fruiting calyx .25" ribbed, slightly curved, with oblique mouth, 2 lower subulate teeth rather smaller and narrower than the three upper. Nutlets oblong, light brown with white dots, and small basal attachment areole.

In damp places! Darbhanga, *Cal. Herb.*! Patna, *Madden!* Behar, *Kurz!* Palamau, *Gamble!* Sant. Par., *Wall!* Ramgarh Ghats (Hazaribagh), *Prain!*

My description is taken from specimens collected on the Vindhyan Plateaux lands west of our area where it is frequent, and it will therefore be almost certainly found on the Chota Nagpur *pats.* Fl., Fr. March—June.

Leaves on small plants sometimes only .5" long, on large ones 1—2", usually hoary-pubescent, usually very obtuse, base sometimes cordate, both sides hairy. Bracts setaceous. Flowers hairy pedicelled. Corolla lower lip .2" with a large shovel-shaped emarginate and slightly obtusely crenate midlobe and narrow paler-coloured 2-fid side lobes, throat purple spotted. Longer stamens with very divergent anther-cells slightly exceeding the flat pale-coloured 2-fid oblong hairy upper lip.

19. ANISOMELES, Br.

Erect branching coarse herbs. Flowers purplish in axillary whorls or lax flowered branched paniced cymes. Calyx ovoid or tubular, straight, equally 5-toothed. Corolla with short tube annulate with a

ring of reflexed hairs within, upper lip erect entire, lower broad, spreading, midlobe notched. Stamens exserted, anthers conniving, of the longer pair 1-celled, of the shorter 2-celled, cells transverse parallel. Style subequally 2-fid. Nutlets smooth.

1. *A. indica*, O. Ktze. Syn. *A. ovata*, R. Br.

A strong smelling softly pubescent herb 3—6 ft. high with ovate coarsely crenate acuminate leaves 1—3" long and purplish flowers in axillary dense-flowered whorls and terminal spikes, or whorls laxly cymose elongate.

Champan to Purneah, common! Santal Par., common! Chota Nagpur, frequent! Angul, *Chattarjee*! Probably in all districts. Fl., Sept.—Nov. Fr. Dec.—Jan.

Leaves from sparsely pubescent to woolly beneath. Calyx .3" hirsute within and without, teeth acuminate. Corolla with pale or greenish nearly flat entire upper lip and lower purple spreading 3-lobed lower lip with the midlobe laterally compressed and notched. Filaments purple-bearded or only slightly hairy. Nutlets .05—.16" black, polished.

20. SCUTELLARIA, L.

Herbs or undershrubs. Flowers in axillary whorls, or whorls spiked or racemed, sometimes only 1—2-fid. Calyx 2-lipped closed in fruit, upper lip with a broad peltate or concave scale on the back and finally deciduous when the nutlets are ripe. Corolla with a long tube, usually sharply recurved from the base and erect, not annulate within, upper lip entire or notched, lower broad 3-lobed. Stamens 4, anthers conniving, ciliate, lower 1-, upper 2-celled. Disc elongate. Ovary oblique; upper style-lobe short. Nutlets very minute, smooth granulate or hispidulous.

1. *S. discolor*, Colebr.

Leaves chiefly radical or subradical, petioled, rosulate orbicular or oblong, crenate, rounded at apex, cordate at base, larger 3" by 2.5", pubescent on the strong nerves beneath and often purple. Stem with raceme 6—15" with few distant pairs of sessile orbicular cordate or elliptic leaves .5" long, sometimes with an axillary branch or raceme. Flowers violet-blue with lighter coloured lip, ascending, .5" long. Upper corolla-lobe hooded, concealing the anthers; lateral erect with revolute margins, lower lip subquadrate retuse .2" long. Nutlets disclosed after fall of the upper calyx lip, 4, brown, turbinate, granulate and minutely glochidiate seated on the oblique receptacle and anterior side of the elongated disc.

Wet banks. Neterhat, elev. 3000 ft.! Fl., Fr. Sept.—Jan.

Stems and racemes minutely pubescent, glandular above. Racemes very lax. Flowers solitary or opposite, subsessile, pedicels about .1" equalling the linear-oblong bract. Calyx-lips entire rounded, shield exceeding the upper lip.

21. LEONURUS, L.

Erect leafy stout herbs with the leaves cut or lobed. Flowers in axillary dense-flowered whorls with subulate bracts. Calyx 5-nerved,

turbinate with 5 spreading spinescent teeth. Corolla-tube naked or annulate within, upper lip entire erect, hooded or flattish; lower 3-fid with obcordate midlobe. Stamens 4, anthers conniving, cells transverse. Style-lobes obtuse or subulate. Nutlets 3-quetrous, truncate, smooth.

I. *L. sibiricus*, L.

Rather a handsome herb 3—5 ft. high, with square stems and long-petioled pinnati-partite or palmi-partite leaves with linear-lanceolate segments again incised, lobes linear. Flowers red, .5" long, with spinescent calyx .25" long and upper lip of corolla hooded tomentose; mid-lobe of lower lip spreading, side-lobes erect, tube not annulate within.

Chiefly in the North-West districts, in hedges. Bettiah! Muzafferpur! Fl., Fr. Dec.—March. Doubtfully indigenous. Annual.

Stems and branches (in our area) hoary tomentose. Leaves hoary beneath. Bracts acicular. Nutlets .1" long, glabrous.

22. LEUCAS, Br.

Herbs or undershrubs, nearly always pubescent or villous. Flowers usually white in axillary whorls rarely crowded and terminal. Calyx 10-nerved, striate, or ribbed (at least above), with regular or oblique mouth, equally or unequally 6—10-toothed. Corolla-tube included, sometimes annulate within, upper lip erect concave or hooded, villous on top; lower spreading, 3-fid with very large midlobe. Stamens 4, ascending under the upper lip, anthers conniving, cells divaricate, finally confluent. Style subulate, the posterior lobe being obsolete. Nutlets ovoid, 3-quetrous, obtuse.

- I. Calyx membranous reticulate, mouth split above, oblique:—
Erect with pubescent stems and coarsely serrate leaves 1. *urticæfolia*.
- II. Calyx neither membranous (at least above) nor reticulate, mouth not split:—
- A. Calyx-mouth regular, not villous, teeth small. Bracts inconspicuous, setaceous, villous. Whorls all axillary:—
1. Hairs suberect and spreading:—
Stems and leaves tomentosely-hairy. Leaves ovate 2. *lanata*.
Stems and leaves with short erect and long spreading hairs; leaves oblong-lanceolate 3. *helicterifolia*.
2. Hairs reflexed:—
L. subsessile or short-petioled. Whorls densely 6—20-fld. Fls. subsessile 4. *montana*.
L. with slender petioles. Fls. 1—3 distinctly pedicelled. 5. *procumbens*.
- B. Calyx-mouth oblique. Bracts mostly as long as calyx:—
1. Calyx-mouth with erect villi (few and short in 10), teeth .05—2" long, usually slender (exc. in 9):—
- a. Whorls terminal only or few also axillary in upper axils:—
- i. Hairs both short deflexed and longer spreading:—
- * Bracts filiform .3—4" long, hairy:—
Calyx .4", teeth .06—2" 6. *stricta*.
Calyx .25", curved, teeth .1" 7. *Clarkei*.
- ** Bracts lanceolar, .25—3" long:—
Calyx .3—4", sharply curved; teeth .05—06" 8. *nutans*.

- ii. Hairs uniform, spreading:—
 Whorls 1—2" diam., terminal. Upper calyx-teeth projecting far beyond the very minute lower
- b. Whorls numerous. Hairs short reflexed:—
 Leaves lanceolate 1—3". Calyx curved .5—7"
2. Calyx-mouth not villous, lower part of tube sometimes membranous. Teeth mostly under .05":—
 Calyx glabrous .2—25", teeth very minute 9. *cephalotes*.
 Calyx membranous below, ribbed and hispid above, .3—45", upper teeth .03—05" 10. *martinicensis*.
 Calyx scarcely ribbed upwards, glabrous, or slightly pubescent above, .2—3", teeth very small, sometimes only 7 11. *hyssopifolia*.
 12. *aspera*.
 13. *linifolia*.

1. *L. urticæfolia*, Br.

An erect hairy herb with square pubescent stems 1—2 ft. high and nettle-like ovate to lanceolate coarsely obtusely serrate leaves 1—2.5" long. Flowers white in very dense globose whorls .7—1" diam. supported by linear or subulate-lanceolate hirsute bracts .3—5" long. Calyx membranous, reticulate, .4—5" long with very oblique mouth, split above, ribs produced into spinulose teeth.

Patna, Madden! Fl., Fr. Dec.—March.

A very distinct species. L. softly pubescent beneath with 4—5 raised sec. n., base sometimes shortly suddenly cuneate on the .3—8" long petiole.

2. *L. lanata*, Benth.

Woody below with many stems 8—18" from a stout stock, densely woolly-tomentose all over or (in our variety) indumentum of longer less woolly hairs, always spreading or suberect (cp. *montana*). Leaves 1—2" ovate, rounded or obtuse, crenate, base sometimes subcordate. Lower petioles up to .5" long, uppermost leaves sessile. Whorls sessile dense. Calyx .22—25", ribs excurrent as linear unequal teeth .09" or less, tube shortly finely sericeous within except at base. Corolla .3—35", tube included, lower lip .2".

The typical plant has not been found in our area and is Himalayan. Var. *nagpurensis* occurs on Parasnath (see below). Var. *candida* occurs on the hills of the Central Provinces, and is easily distinguishable by the beautiful dense pure white tomentum and broadly ovate rounded leaves, larger flowers and calyx-teeth up to .09. It appears to me to be separate from true *L. lanata* and also from the Parasnath plant. It possibly occurs on the higher Sirguja mountains. Fl., Fr. Oct.—Dec.

Var. *nagpurensis*, C. B. Clarke.

Stems sometimes .2" diam. at base. Leaves ovate to lanceolate-ovate subacute densely sericeous-tomentose beneath and less so above, rather coarsely and obtusely serrate or dentate-serrate, sec. n. 3—5. Whorls 10—20-fl. Calyx with minute subulate teeth only .01" long. Corolla .3", upper lip contracted at base, sub-orbicular above, shorter than the lower. Calyx sericeous within one-third of the way down.

Except in the direction of the indumentum this looks more like a variety of *L. montana* than of *L. lanata* or *L. candida* (*mihi*).

3. *L. helicterifolia*, Haines. *Kew Bulletin*, 1922, 6, p. 188.

A herb with suberect 4-angled stems 2—3 ft. long densely covered with erect and spreading hairs. Leaves oblong-lanceolate 1.5—2.5"

long by 4—7" broad, distantly serrulate or denticulate, closely appressed-villous both sides, subsessile or with petiole up to 2". Flowers white, 5" long, sessile, in dense 4—10-fl. whorls with filiform villous bracts 1—2" long. Calyx obconic 3" long, appressed-villous outside, thinly hairy within on the upper third, 10-ribbed, ribs ending in minute triangular very acute or sub-spinulose teeth. Corolla-tube exerted 1", upper lip densely bearded on the margins about as long as the glabrous lower lip.

Common on the sandstones of the Ramnagar Hills! Fl. Nov.—Dec.
The hairs have swollen bases.

4. *L. montana*, Spreng. Syn. *Phlomis montana*, Roth. Inc. *L. mollissima*, Wall.; *L. Hamiltoniana*, Wall.; *L. pilosa*, Wall., in part (2058 B); *Giril a: or arak*, K., S.

A herb with stems sometimes woody below, usually numerous from a woody rootstock, 8"—2 ft. long, suberect or diffuse or climbing through undergrowth to a height of 4 ft., softly tomentosely-hairy with reflexed hairs or thinly reflexed-hairy. Leaves ovate or broadly ovate, more rarely lanceolate-ovate, crenate or serrate, usually sericeo-lanuginous beneath, villous above, 1—1.5" long, usually very shortly petioled. Whorls rather dense of 6—14 sessile white flowers. Bracts very inconspicuous. Calyx 25" obconic, densely hairy, with regular mouth and 10-ribbed tube terminating in as many minute linear or subulate teeth.

Very common in rocky jungles and waste ground, especially in the hills, in all districts of the Central and Southern Areas! Fl. Fr. c.s. and h.s.

Bentham describes the flowers as "white? but oftener purple," but they are *always* white. The calyx is sometimes glabrous within but usually more or less shortly silky in the upper third. Corolla 4—5", tube exert in the type, often included, lower lip with lateral small recurved lobes and large broad terminal spreading centre lobe.

There are all manner of transitions between the following forms, which can scarcely even rank as varieties:—

(a) *montana*, proper (*Wall. Cat.* 2056, 2525).

Branches tomentose, leaves shortly petioled, under 1.2", ovate, very obtuse, crenate, sericeo-lanuginous beneath, villous above. Calyx sericeo-tomentose.

Parasnath, *Clarke!* Kalahandi plateau, but with leaves less obtuse!

(b) Var. *mollissima*, Syn. *L. mollissima*, Wall. (No. 2054).

Rootstock very woody. Branches diffuse reflexed hairy (*Wallich, As. Pl. Rar.*, i, p. 62, calls it tomentose). Leaves subsessile, ovate, 7—1.5", rugose, crenate, densely lanuginous or hairy beneath. Whorls many-fl. or rarely few-fl., bracts minute, setaceous. Calyx 24", the setaceous teeth up to 4" villous. Corolla-tube exert, upper lip 15", lower 2".

The type is from Nepal, and probably occurs in our Northern Area.

(c) Var. **pilosa**. Syn. *L. pilosa*, var. *pubescens* Benth. (Wall. 2058 B).

Differs from var. *mollissima* in the larger acute leaves 1—2.5", tomentosely hairy beneath, thinly hairy above, hairs with thickened bases, coarsely dentate-serrate and somewhat tapering. Petiole .1—3". Calyx .3—35" with teeth the longest of all the varieties .05—1".

Rajmahal, Wall!

(d) Var. **Hamiltoniana**, Wall. (No. 2525).

Stems retrorsely hairy. Leaves 1—1.5", lower with petioles .35" long, ovate to ovate-lanceolate, crenate to serrate, sericeous beneath, hairy above. Calyx .25", sometimes slightly curved, teeth very minute. It is less diffuse than *mollissima*. Wallich says that it differs by the much larger leaves (1), by the whorls scarcely 6-fld., by the longer calyx sub-incurved.

Monghyr Hills, Ham.!

(e) Var. **scaberula**, J.D.H. Syn. *L. mollissima*, var. *scaberula*, F.B.I.

Not at all tomentose and calyx somewhat hispid-hairy. Hairs on leaves thin and sparse. L. 1—2.5" coarsely dentate-serrate. Calyx teeth up to .04".

All districts of Chota Nagpur, a common form!

(f) Var. **parvifolia**, Haines.

A very pretty form with lanceolate or ovate-lanceolate leaves only .4—75" long, hairy both sides and very numerous whorls. Fls. 8—10 in a whorl shortly pedicelled. Calyx .2" long nearly glabrous within with deltoid, spinulose-tipped teeth.

Angul, Chattarjeel

The leaves of *L. montana* and its varieties are eaten as a pot-herb.

5. *L. procumbens*, Desf.

A laxly branched procumbent herb with stems 2—3 ft. long from a woody rootstock, slender, nearly glabrous. Leaves lanceolate (elliptic-ovate, F.B.I.), .75—1.5", rather membranous, entire or remotely serrate, base cuneate on a slender petiole one-third as long as the blade. Flowers white in whorls of 1—3 only, pedicelled. Calyx .3" obconic, 10-nerved and with 10 equal subulate small teeth .05" long, tube nearly glabrous, teeth pilose or glabrescent.

Waste ground, Palamau! Not common. Fl., Fr. Oct.—Dec.

Angles of branches thinly appressed hairy or puberulous. Leaves substrigose or puberulous on the nerves beneath and very thinly hairy above, sec. n. 2—4 slender. Pedicels of flowers slender .15—25" long, often abruptly curved.

6. *L. stricta*, Benth.

Erect or diffuse with 4-grooved and -angled stems clothed with long and very short hairs, with very distant pairs of linear to elliptic leaves .5—1.5" and several leaves close to the inflorescence. Whorls in a terminal and sometimes also one median head. Bracts many long

linear-filiform rigid, long-ciliate, '3—'4". Calyx '4" with the teeth '06—'2", longer than the villi at the mouth.

Orissa, sand dunes near the coast, *Beng. Pl.* But this appears to be one of the species included in Orissa from occurring in Ganjam (Madras Presidency).

Leaves with long hairs both sides, beneath also pubescent and glandular. The two forms with narrow linear and shorter elliptic leaves are superficially very different. Calyx shortly closely pubescent in flower, somewhat glabrescent.

7. *L. Clarkei*, *Hook. f.*

Very similar to the linear-leaved form of *L. stricta*, but calyx shorter, '25", curved and closely densely pubescent, teeth '1" hispid, mouth very densely villous.

Parasnath, *Clarke!* Fl. Nov.

Leaves sometimes remotely toothed. Seeds oblong '1".

8. *L. nutans*, *Spreng.*

Very diffuse and not unlike the broader-leaved form of *L. stricta*. Hairs long spreading and shorter deflexed. Leaves '5—1'5" oblong or narrowly-oblong, closely serrate or subserrate, obtuse, with long hairs on the nerves beneath and short ones between. Petiole very short. Whorls often 2—3 on a branch, terminal with a crown of leaves. Bracts lanceolate, '25—'3". Calyx hispid-hairy on the teeth, '3—'4" long, sharply curved about the middle, teeth subulate '05—'06".

Parasnath, *Clarke!* Topchanchi (Hazaribagh, and near Parasnath), *Wood!* Fl. Nov.

9. *L. cephalotes*, *Spreng.* Andia durap arak', *S.*

An erect herb 1—2'5 ft. high with 4-grooved patently hairy stems, elliptic-lanceolate (ovate or ovate-lanceolate, *F.B.I.*) remotely crenate-serrate leaves 1'5—2'5" long, and dense subglobose terminal (or sub-terminal, being usually surmounted by a pair of leaves) whorls 1—2" diam., closely invested by a large rather membranous lanceolate or elliptic and acuminate aristate bracts '5—'7" long which are rigidly ciliate and with a few stiff hairs on the back.

Exceedingly common in cultivated fields, less so in waste land. Darbhanga, *Cal. Herb.!* Santal Par. All districts of Chota Nagpur! Probably throughout the whole area but, as in the case of many common weeds, not often recorded. Fl., Fr. Sept.—Dec. Annual.

Leaves softly shortly pubescent and with longer hairs beneath and more evidently punctulate than in many of the genus, sub-strigosely hairy above, sec. n. 3—5. Petiole '1—'3" long. Bracts strongly nerved. Calyx tubular '6—'75" long, hairy above, mouth bearded, oblique, ribs 10 ending in 10 sub-aristate hispidulous teeth '04—'06" long. Corolla-tube shortly exserted, lower-lip '22" slightly longer than the densely white-bearded upper lip.

The leaves are eaten as a pot-herb. "The seeds yield a medicinal oil," *Campbell.*

10. *L. martinicensis*, *Br.*

Usually leafy 2—3 ft. high with many heads. Stems with numerous reflexed short hairs. Leaves lanceolate 1—3", slightly serrate, closely hispid-hairy both sides. Whorls numerous globose '6—1" diam. with linear spinulose-tipped hairy bracts. Calyx sigmoidly curved '5—'7"

long, nearly glabrous or finely pubescent below, pubescent above and with spinescent teeth, the uppermost much the longest, .15—2".

Hazaribagh, *Clarke!* Sirguja, *Clarke!* Fl. Oct.—Nov.

11. *L. hyssopifolia*, *Benth.*

A very hispid herb from a woody stock, with linear leaves in distant pairs below, closer above, upper pairs each with a dense globose whorl .5—7" diam. (without corollas) supported by narrowly linear hispid-ciliate spinulose bracts .2—25" long. Calyx glabrous .2—25" long with minute mucroniform teeth.

Sambalpur, *Criffith!* Chota Nagpur (*Bengal Pl.*) is apparently an error copied from the *F.B.I.* Fl., Fr. May—July.

Stems with stiff spreading or suberect hairs. Leaves 1—2.5", stiffly hairy both sides especially on the midrib beneath, subsessile, margins sometimes recurved and sec. n. *nil* but sometimes a slender nerve parallel to midrib. Calyx with wide mouth, obconic. Corolla-tube scarcely longer than calyx, pubescent above, upper lip .15—2", lower lip .4".

12. *L. aspera*, *Spreng.*

Annual, erect or diffuse with stems much branched 8"—2 ft., deeply grooved, thinly hairy; shoots densely hairy. Leaves linear, narrowly oblong, lanceolate-oblong or rarely narrowly elliptic, 2—3", tapering to a short petiole, crenate-serrate or subentire, thinly pubescent or shortly hairy both sides, sec. n. 2—4. Whorls terminal and axillary, often a single terminal or two close together, .7—1" diam. with numerous linear hispid-ciliate bracts .3—5" long, sub-spinulose tipped. Calyx .3—45", tubular with very oblique mouth and teeth .03—05" long, only ribbed above, smooth below, throat pubescent or glabrous. Corolla lower lip .35", upper .15".

In cultivated fields. Behar, common, *Hope, Hooker!* Patna, *Madden!* Ranchi, *Gamble!* Manbhurn, *Clarke!* Fl. Fr. July—Jan.

13. *L. linifolia*, *Spreng.* Gumar, Dulphi, *Vern.*

Erect 1—3 ft. high with 4-grooved usually much branched softly pubescent (or "hispid," *F.B.I.*) stems, linear or linear-lanceolate, entire, or remotely shallowly crenate-serrate, leaves 2—4" long and dense axillary and terminal whorls of white sessile flowers with linear setaceous bracts .15—25" long. Calyx .2—25" (—3", *F.B.I.*) with very oblique mouth, the upper part projecting far beyond the lower, teeth very small, sometimes spinulose, tube not or only faintly ribbed.

A common field weed, also in pastures and waste ground. Purneah! Darbhanga. Burkill! Chota Nagpur, common! Probably in all districts, but badly represented in herbaria. Fl., Fr. c.s. Annual.

Stem lined. L. usually about .15—3" broad (rarely .75", *F.B.I.*), minutely pubescent both sides or somewhat scaberulous above, acute or obtuse, sec. n. 3—4. Petiole 0—3" passing gradually into the base of the leaf. Whorls towards the ends of the branches, .5—75" diam. Calyx somewhat obovoid, glabrous or closely puberulous, teeth about 7 or sometimes (*vide F.B.I.*) calyx 2-lipped with upper 3-toothed lip and lower 2-fid lip. Corolla-tube included. Nutlets dark-brown, .08" oblong, 3-quetrous.

23. LEONOTIS, Br.

Tall herbs or shrubs with scarlet or yellow flowers in dense axillary whorls with many slender, sometimes spinescent, bracts. Calyx 10-nerved, often incurved with oblique mouth and 8—10 rigid teeth, the upper largest. Corolla-tube exserted, upper lip long concave with villous crown; lower very small, spreading, concave, midlobe largest. Stamens 4, ascending; anthers conniving, cells divaricate. Disc regular. Style subulate, upper lobe very short. Nutlets oblong or ovoid, 3-quetrous, obtuse or truncate, glabrous.

1. *L. nepetæfolia*, Br. Dar-dhomp, Janum-dhomp, S.; Kontosidho, Or.

A rather handsome tall herb 4—7 ft. high, rather strict, with thick 4-angled and -grooved puberulous stems, large ovate crenate leaves 4—8" long below, smaller more lanceolate and deflexed under the whorls, and large distant globose whorls 2—3" diam. of scarlet flowers with spinescent bracts and calyx-teeth.

Usually near villages and not indigenous in our area. Frequent in Chota Nagpur! Angul! Fl. Oct.—Jan.

Petiole 1—3", winged above. Bracts slender, linear. Calyx .75", upper lip .25" long spinescent, lower with 3 spinescent teeth, throat glabrous, outside pubescent. Corolla 1" long with slender exserted tube, villous. Nutlets linear oblong, widening upwards, truncate.

24. TEUCRIUM, L.

Herbs or shrubs. Flowers in 2—6-fld. axillary whorls or terminal spikes, racemes or heads. Calyx 10-nerved, teeth 5 equal or the upper larger. Corolla-tube not annulate within; limb 1-lipped, the 2 upper and lateral lobes cuneate and very short or obsolete, lower lobe very large. Stamens 4, exserted, anther reniform, cells short, at length confluent. Disc regular. Style-lobes subequal. Nutlets minute reticulate, smooth or rugulose with large oblique or lateral hilum.

1. *T. stoloniferum*, Roxb.

Erect from a creeping base rooting at the nodes, with finely pubescent stems 12—22" high, ovate coarsely deeply crenate leaves 2—3.5" and numerous simple and terminal paniced racemes of small flowers .2" long. Corolla white tinged with purple.

It occurs in Oudh and Northern Bengal, *i.e.* both sides of and close to our area. It will probably therefore be found within it. Fl. Jan.—May.

Sweet-smelling. Leaves finely pubescent beneath, sec. n. 5—6, oblique. Calyx in flower .1—.14", pubescent; globose in fruit (upper part withering), .08" diam.

25. AJUGA, L.

Herbs with whorls 2—more-fld., axillary or in terminal leafy spikes. Calyx 10- or more-nerved, teeth 5 subequal. Corolla-tube often annulate within, upper lip very short 2-fld lower spreading 3-fld, midlobe usually the largest and notched or 2-fld. Stamens 4, ascending, exserted or included; anther-cells diverging, distinct or at length confluent. Disc

regular, or produced behind. Ovary shortly 5-lobed with subequal style lobes. Nutlets obovoid, rugose when dry with the hilum lateral.

- A. Corolla-tube widely cylindrical then suddenly bent or geniculate:—
 L. usually serrate. Calyx-lobes obtuse. Lateral lobes of lower cor.-lip nearly as long as terminal 1. *macrosperma*.
- B. Corolla-tube globose round the ovary or nutlets, then narrowed, straight. Calyx-lobes lanceolate:—
 Spikes terminating in a woolly tip without conspicuous bracts. Cor.-tube shortly exerted 2. *densiflora*.
 Spikes terminating in long foliaceous bracts. Cor.-tube sometimes twice the calyx 3. *bracteosa*.

1. *A. macrosperma*, Wall.

Stems 1—2 ft. long procumbent and often rooting, terete, shortly appressed-hairy or hairs thin spreading. Leaves elliptic or ovate with tapering base 2—6" long including the petiole which is .5—1.5" (passing gradually into leaf base), coarsely usually doubly or unequally obtusely or subacutely serrate, rarely crenate membranous. Flowers .27—.28" long (to tip of upper cor.-lip) and .16—.17" wide (to tip of lower lip). Calyx .22" long, lobed not quite to middle, lobes rounded or obtuse, lower slightly longer. Corolla scarcely or not exerted with broadly tubular base to some distance above the ovary then suddenly humped and bent forward, lower lip with obdeltoid scarcely emarginate midlobe not much longer than the side lobes.

Growing in shady beds of nalas. Near Purneah! Singbhum! Parasnath! Fl., Fr. Jan.—March.

Stems usually villous towards inflorescence, usually grooved. Leaves shortly thinly hairy both sides, subobtusely. Spikes 3—9", at first very dense, subsequently interrupted, bracts oblong reflexed, lower foliaceous, upper inconspicuous. Calyx thinly hairy, delicately 10-nerved. Corolla hairy and glandular, azure blue or violet, upper lip with two short oblong lobes. Stamens decurved then erect, exerted. Nutlets oblong, nearly .1" long and about half as broad, rugose and reticulate when dry.

2. *A. densiflora*, Wall. Syn. *A. bracteosa*, var. *densiflora*, F.B.I.

Stems decumbent and ascending 6"—1 ft. high from a very woody rootstock, obtusely 4-sided, with dense spreading pubescence. Leaves mostly elliptic-oblong, .3—6", base usually somewhat tapering, repandly or sinuately dentate or lobulate or subentire, lower petioles .2—3", upper leaves often sessile. Flowers .25—.27" long to tip of upper lip (or nearly .5" if measured to lower lip) and .25" wide (to tip of lower lip). Calyx .18—.2" long, lobed halfway, lobes lanceolate acuminate. Corolla slightly exerted, base globose round the ovary or fruit but contracted immediately above them and tube straight or only slightly bent; lower lip with broadly obovate 2-lobed midlobe .2—.25" broad and .25" long, side-lobes oblong shorter inclined forward.

Moist places. Higher hills of Chota Nagpur. Neterhat! Fl., Fr. May—Oct. Bettiah (see next species)?

Stoloniferous from the woody stock. Whole plant often with a purple tint. Indumentum said to be variable. Leaves in our area velvety or pubescent

beneath especially on the nerves, sparsely hairy (gradually glabrescent) above, tip rounded. Spikes 3—8", at first very dense, lower whorls finally discrete, dense bracts 4—5" or lower foliaceous, upper rhomboid pubescent and hairy. Calyx campanulate, hairy, rather membranous and indistinctly nerved, often pink. Corolla sparsely hairy outside, pink, or white with pink veins, upper lip short erect 2-lobed or subentire. Stamens exserted, tip of filaments incurved. Nutlets globose-oblong, .06—·1" long and nearly as broad, smooth and shining when fresh, rugose and pitted when dry.

3. *A. bracteosa*, Wall.

This differs from *A. densiflora*, which, however, is perhaps correctly reduced to a variety of it in the *F.B.I.*, by the very long spreading bracts of the spike which exceed the whorls and terminate the spike. It also differs in the much more exserted corolla-tube, which is sometimes nearly twice as long as the calyx. Upper lip of corolla erect 2-fid.

A specimen from Bettiah, *Hieronimus!* is named *A. bracteosa* at Kew, but I think it is *A. densiflora*; it is somewhat fragmentary.

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

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PART V

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BOTANICAL SURVEY OF INDIA
CALCUTTA

DIVISION III.—APETALÆ.

FAM. 107. NYCTAGINACEÆ.

Herbs, shrubs or trees with usually opposite, entire, exstipulate leaves. Flowers small or mod.-sized, sometimes showy or often showy from being subtended by an involucre of coloured leaves, at other times minute in heads, cymes or umbels, which are sometimes paniced. Perianth or calyx gamophyllous, petaloid with the tube persistent and accrescent, limb 3—5-lobed, plaited in bud. Petals 0. Stamens 1—30, hypogynous, sometimes unilateral, filaments usually unequal, inflexed in bud, anthers didymous. Ovary free, 1-carpellary, 1-celled, style involute in bud with simple or multifid stigma. Ovule 1, erect, between anatropous and campylotropous. Fruit a thinwalled achene, enclosed in the hardened perianth-tube. Seed erect, albuminous, with the embryo curved or spiral, or straight with folded cotyledons, radicle inferior.

- I. Flowers dioecious, 1-sexual. Embryo straight with crumpled cotyledons:—
 Shrubs with opp. or alt. leaves and greenish cymose fls. 1. *Pisonia*.
- II. Flowers 2-sexual. Embryo hooked:—
 A. Climbing shrubs with alt. leaves and tubular fls. with a coloured involucre of large bracts 2. *Bougainvillea*.
 B. Herbs:—
 Fls. showy, 1—3 in a calyx-like involucre . 3. *Mirabilis*.
 Fls. small or minute in heads or umbels, bracts minute 4. *Boerhaavia*.

1. PISONIA, L.

Trees or shrubs, sometimes spinous. Leaves opp. or alternate. Flowers inconspicuous, green, usually dioecious and 2—3-bracteolate, in corymbose cymes. Perianth 5—10-toothed, funnel-shaped in male, tubular in female. Stamens 6—10, exserted. Ovary sessile, oblique with capitate or feathery stigma. Fruit with the hardened perianth nut-like. Embryo with crumpled cotyledons enclosing a scanty soft albumen.

1. *P. aculeata*, L.

A stout sarmentose shrub (sometimes climbing) with stout recurved thorns and opposite or subopposite sometimes fascicled leaves 1—3" long, thinly pubescent beneath. Flowers green or greenish-white, males in close corymbose cymes, females in fruit in lax divaricate cymes easily recognised by the long-pedicelled 5-angled glandular-glochidiate clavate-oblong nuts 3" long.

Only in the south of Puri district and not far from the sea! Fl., Fr. Feb.—May. Bark pale, smooth on the branches. L. obovate to narrowly elliptic and orbicular on same plant, shortly bluntly acuminate, sec. n. 3—5 weak, obliquely spreading. M. fl. 1—12", funnel-shaped with 7—8 far exserted stamens. Fem. ovoid obscurely toothed. Fruiting pedicels 5" long. Nuts tomentose between the ribs.

2. BOUGAINVILLEA, Comm.

Large scandent thorny shrubs (or erect outside our area) with alternate leaves. Flowers somewhat coloured but rendered very conspicuous

by each, or clusters of three, being supported by an involucre of 3 usually brilliantly coloured large bracts; when fls. 3-nate midrib of bract adnate to the pedicel, bract persistent and acting as a wing to the fruit. Perianth tubular with a spreading but small 5-lobed limb and a somewhat wider basal part which hardens into the leathery wall of the achene (nut or anthocarp), while the upper part becomes spirally rolled. Stamens 5—10, very unequal, scarcely exsert. Stigma linear. Cotyledons somewhat unequal.

A South American genus of which several varieties are now common in Indian gardens.

1. *B. spectabilis*, Willd.

Branchlets and leaves both sides pubescent. Leaves orbicular-ovate acuminate. Flowers and bracts ternate at the ends of every branchlet and forming immense panicles of a deep magenta colour. Perianth greenish-yellow.

This and the next are the commonest *Bougainvillea* found in nearly every large Indian garden and often climbing over tall trees. Fl. Feb.—April.

2. *B. glabra*, DC.

Branches and leaves glabrous, spines shorter. Leaves lanceolate. Bracts of a less deep magenta, sometimes said to be pale-pink. It flowers two or three times in the year.

Horticultural catalogues also distinguish between *B. lateritia* with brick-red flowers and *B. splendens* with pinky-purple flowers. These are not entered in the Kew Index and appear to be merely garden varieties of *B. spectabilis*.

3. MIRABILIS, L.

Herbs often with tubercous roots and m.s. or somewhat large flowers clustered on the branches of large leafy panicles, each or clusters of 2—10 surrounded by a calyx-like involucre of 4—5 connate bracts. Perianth brightly coloured, salver-shaped to campanulate. Stamens 3—5, rarely 6, somewhat exserted. Nut ellipsoid or ob-pyramidal, often ribbed or rugose. Cotyledons large suborbicular on germination.

Chiefly Central American plants, or if the genus *Oxybaphus* be included, then one Himalayan species.

1. *M. jalapa*, L. Marvel of Peru; Four o'clock Plant.

A well-known herbaceous plant 1—2.5 feet high with large perennial tuberous roots, rather fleshy stems and cordate leaves. Flowers usually purple but very numerous colours are found and the perianth is sometimes variegated. There is only one flower to the involucre in this species, which latter therefore is apt to be mistaken for a calyx.

Very common and often spontaneous in Indian gardens.

2. *M. longiflora*, L. Sweet-scented Marvel of Peru, has white flowers with a very slender tube over 3" long.

4. BOERHAAVIA, L.

Herbs with opposite leaves and small or minute flowers jointed on their pedicels, capitate, umbelled or paniced. Bracts small, rarely forming

a minute involucre. Perianth with long or short tube and funnel-shaped 5-lobed limb. Stamens 1—5, exserted. Ovary oblique, stipitate, stigma peltate. Nut small glandular. Cotyledons broad, thin, incumbent, enclosing a soft scanty albumen.

Fls. sessile or subsessile in heads. Leaves in the pairs unequal 1. *diffusa*.
Fls. in umbels with slender pedicels. Leaves equal in each pair. 2. *repanda*.

1. **B. diffusa**, L. Syn. **B. repens**, L. Ohoic' arak', S.

A rather succulent diffuse herb with rusty-puberulous stems and broadly ovate leaves, usually whitish beneath, in unsymmetrical pairs, the larger attaining 2" by 1.75". Flowers very small, rose-coloured, sessile or nearly so in heads or small umbels on slender peduncles from the leaf axils and in axillary and terminal panicles. Perianth with limb plaited in bud, campanulate, tube constricted above the ovary and glandular, lobes emarginate. Stamens 2—3. Fruit .12" long, clavate, 5-ribbed, glandular.

Very common in grassy waste places! Probably in all districts. Fl., Fr. r.s.

Somewhat resembles *Trianthema monogyna* (to which it may be allied). L. with obtuse or subcordate base, apparently green beneath in typical *diffusa*, white beneath in forms *repens* and *procumbens*. The latter form is said to have glabrous branches 2—3 ft. long with larger, broader, more rounded leaves and more paniced inflorescence than in *repens* which has branches 6—10" only, appressed-pubescent, leaves small, ovate or oblong, often acute.

Leaves eaten as a pot-herb, and the root given in diarrhœa, dysentery and cholera, *Campbell*. Root laxative, diuretic and stomachic, *Dutt*.

2. **B. repanda**, Willd.

A diffuse or subscandent herb with long pale glabrous (in our specimens) or, pubescent (*F.B.I.*) branches, and ovate repand or lobed or sinuate, acute or acuminate leaves 1—2.5" long. Flowers pink, .3—4" diam. with slender pedicels .3—5" long in long-peduncled axillary umbels mostly from one axil of the pair only. Fruit narrowly clavate, .25—3" long, ribbed, glandular.

Monghyr, *Ham.*! Puri! Khandpara State! Fl., Fr. Aug.—April.

Leaves sometimes unequal in the pairs with rounded, truncate or subcordate base. Petioles .5—1.5". Peduncles slender, exceeding the leaves, 3—6-fl. Perianth-tube .25—35" long, only part round ovary swollen and with minute white hairs, limb only .17" diam. according to *F.B.I.* Stamens far exserted.

FAM. 108. AMARANTACEÆ.

Herbs, rarely shrubs or undershrubs with opposite or alternate exstipulate simple and usually entire leaves. Flowers small, green or coloured, of chaffy consistency, sometimes polygamous or 1-sexual and usually collected into dense heads or spikes, the outer in a cluster or head sometimes imperfect and altered, heads or spikes often paniced, bracts and 2 bracteoles nearly always present and chaffy or scarious like the perianth. Tepals 5 persistent, imbricate in bud. Stamens, 1—5 opposite the tepals, filaments free or connate below or united with intervening membranous staminodes into a hypogynous cup; anthers 1—2-celled, pollen spherical with numerous pores. Ovary superior, usually free, rarely fused with

the perianth in fruit, formed of 1—3, rarely more carpels but always 1-celled. Styles 0—3, rarely 4, stigmas capitate or feathery. Ovules 1, rarely (*Celosia*) several, campitropous, erect basilar or pendulous from a slender basilar funicle. Fruit a utricle, rarely a berry or capsule or a nut, sometimes enclosed in the perianth. Seed compressed, testa crustaceous. Embryo annular or horseshoe-shaped, albumen mealy.

- I. Ovary 2—many-ovuled. Leaves alternate:—
 Sarmentose shrub. Fruit baccate 1. *Deeringia*.
 Herbs. Fruit a membranous utricle 2. *Celosia*.
- II. Ovary 1-ovuled. Leaves alternate or opposite:—
 A. Ovule erect. Leaves alternate:—
 1. Flowers 2-sexual:—
 Flowers capitate. Fruit circumsciss 3. *Allmania*.
 Flowers spicate. Fruit a nut 4. *Digera*.
 2. Flowers 1-sexual:—
 Flowers in axillary and spiked clusters 5. *Amarantus*.
- B. Ovule suspended from a slender basal funicle:—
 1. Anthers 2-celled:—
 a. Flowers without staminodes, in clusters of 1—3 perfect and several imperfect and altered. L. opposite 6. *Pupalia*.
 b. Flowers with staminodes, without accessory deformed and imperfect ones:—
 Sepals hyaline woolly. L. alt. or opposite. 7. *Ærua*.
 Sepals shining, one or all spinescent, fls. deflexed 8. *Achyranthes*.
2. Anthers 1-celled. Leaves opposite:—
 St.-tube short. Stigma capitate, sessile 9. *Alternanthera*.
 St.-tube long. Stigma 2-fid on long style 10. *Gomphrena*.

1. DEERINGIA, Br.

Rambling or climbing shrubs with alternate leaves and small 1—2-sexual flowers, in simple or paniced spikes. Tepals 5, scarcely scarious, spreading in fruit. Stamens 4—6, connate at the base, anthers 2-celled. Ovary sessile or shortly stipitate with a short style and 2—4 stigmatic branches. Ovules many on long funicles. Fruit baccate. Seeds few or many.

1. *D. baccata*, Moq. Syn. *D. celosioides*, Br.; *Celosia baccata*, Retz (1779); *Gaulmauri*, Beng.

A rambling or subscandent shrub with long arching branches, ovate or ovate-lanceolate acuminate petioled leaves 2—5" long and small greenish-white flowers in numerous paniced spikes 3—6" long. Very pretty in fruit when it bears an abundance of small scarlet globose somewhat 3-gonous berries, each with a few black seeds.

Champan, common in open riverain mixed forest! Purneah, common! Monghyr, Ham! Palamau, scarce, near the Sone River! Fl. Sept. Fr. Nov.—Jan.

Glabrous. L. with rounded or acute base and 7—9 arching sec. n. Flowers 2-sexual (in my specimen) with small subulate bracts about as long as the very short pedicels and ovate bracteoles. Tepals linear-oblong, .08" long. Disc annular. Stigmas 2—4. Berry .2" diam.

The berries have a somewhat bitter taste.

2. CELOSIA, L.

Herbs with alternate leaves. Flowers white or pink, shining; clustered or spicate. Perianth of 5 scarious striate or ribbed tepals. Stamens connate into a cup at the base, anthers 2-celled. Disc very short. Ovules several. Fruit a circumsciss utricule. Seeds erect, lenticular.

Spikes usually tapering. Fls. over .25". Leaves linear or lanceolate.

Spikes often fasciated Fls. under .25". L. often ovate.

1. *argentea*.

var. *cristata*.

1. *C. argentea*, L. Inc. *C. cristata*, L.; Sirgit-arak¹, S.; Sirwari, *Kharw.*

An erect glabrous herb 1—3 ft. high with linear or lanceolate acuminate leaves mostly 1—2" but attaining 6", and peduncled cylindrical, ovoid or lanceolate shining pink or white spikes mostly 1—3" long, sometimes attaining 8" (*F.B.I.*). Tepals mostly .25—3" long, very scarious, with the similar but smaller bract and bracteoles often aristulate. Seeds several small black shining.

Usually in cultivated fields. Purneah, frequent! Monghyr, *Kurz!* Ranchi and other districts of Chota Nagpur, frequent and ascending to the top of Parasnath! Angul, *Lace!* Very widely distributed in India and probably occurs in all districts of our province. Fl., Fr. Aug.—Dec. Annual.

Stem and branches angled and striate. L. with base cuncate or tapering into the slender petiole; sec. n. 5—7 very slender. Spikes at first usually acute and tapering with short peduncles, subsequently peduncles elongating, often branched, and old spikes often obtuse or rounded or sometimes even branching into a cock's-comb form.

Var. *cristata*. Syn. *C. cristata*, L.

Leaves often broad, sometimes up to 9" by 2". Flowers smaller. Spikes very often excessively developed and monstrous as in the well-known garden "Cock's comb," which in cultivation gives also yellow flowers.

3. ALLMANIA, Br.

Herbs with alternate leaves, and flowers in axillary and terminal globose or ovoid dense heads. Tepals 5, scarious, acuminate, striate. Stamens 5, connate below into a cup, anthers 2-celled. Ovary ovoid with slender style and capitellate stigma. Ovule 1 erect. Fruit a circumsciss utricule. Seed erect with a small cupular aril and annular embryo. Cotyledons linear flat.

1. *A. nodiflora*, Br.

A diffuse branched sub-succulent herb with stems 12—18" long, linear or linear-oblong, sessile or shortly petioled, leaves and sessile leaf-opposed yellowish-green heads of flowers .5—75" diam. Stamens 5 erect with pink anthers. Capsule membranous, circumsciss and disclosing the single black shining minutely puberulous seed seated on an inflated membranous aril.

Ranchi and Hazaribagh (Damuda Ghats)! Manbhum, *Camp!* Angul, *Chattarjee!* Fl., Fr. Aug.—Sept. (see variety).

This is apparently the type or *Hooker's* variety *angustifolia*. The leaves are 2—4" long and sessile, acute or obtuse. The heads are congested cymes with the flowers subsessile, tepals .2" long sharply or pungently acuminate, scarious with green pubescent midrib. Bracts linear aristate, hispid.

Var. **Roxburghii**, J.D.H.

A procumbent herb with obovate leaves only .5—1" long. Heads as above. On sand. Balasore! Fl. May. Probably at other times also.

4. **DIGERA**, Forst.

An annual herb with alternate leaves and small flowers¹ in spikes, or in reality very contracted panicles, each bract bearing in its axil a flower and 2 bracteoles and the bracteoles again mostly bearing an abortive flower in their axil. Tepals 4—5, outer larger 5—9 nerved, inner 2—4-nerved. Stamens 5, rarely 4, free or scarcely connate at the base, anthers 2-celled. Ovary broadly oblong truncate, style filiform with 2 short recurved stigmas. Ovule erect. Fruit hardened. Seed globose with thin crustaceous testa adhering to the albumen. Embryo annular, cotyledons linear.

1. **D. alternifolia**, Aschers. Syn. *D. arvensis*, Forst.; *Achyranthes alternifolia*, L.; Kari-gandhari, S.

An erect or prostrate herb 1—2 ft. high with glabrous or very thinly minutely hairy branches. Leaves mostly ovate or elliptic or some lanceolate 1—2", rarely 3", obtuse or acute rather pale and somewhat ciliolate on the nerves beneath. Spikes of small pink flowers axillary, slender, becoming rather lax in fruit, 1—5" long, long-peduncled. Bracts boat-shaped, .07—'08" long, bracteoles nearly as long, keeled. Outer 2 tepals covering the rest, lanceolate-oblong acute, .13—'15" long. Nut .075" diam., globose, slightly compressed, rugulose, falling with the perianth and bracteoles together with the accrescent abortive florets, but leaving the somewhat reflexed bracts.

A common weed in Singbhum! and Manbhum, Camp.! Possibly in all districts. Fl., Fr. r.s.

Leaves variable in shape and often with very small ones on the lower part of the stem or from the axils of the larger; sec. n. 6—9, distinct beneath, arched, usually 2 from base. Petiole slender somewhat hairy .5—2". The abortive flowers are small rather fleshy 2-fid scales during the flowering period, they then increase in size, become bifurcate with each branch again forked or toothed, and then attain .1". It is in this state that they have been described as "crested scales."

The plant is used as a pot-herb.

5. **AMARANTUS**, L.

Annual herbs, sometimes spinous, with alternate leaves and green or red small 1-sexual flowers in clusters which may be axillary or in erect or drooping, sometimes paniced spikes. Tepals 5 or 1—3. Stamens 1—5, free, anthers 2-celled. Ovary compressed, style short or 0, stigmas 2—3 filiform or subulate. Ovule 1 erect. Utricle compressed indehiscent or circumsciss, tip sometimes 2—3-toothed. Seed orbicular, compressed, testa crustaceous. Embryo annular with linear cotyledons.

- I. Spinous. Tepals of *M.* acuminate, of *F.* obtuse apiculate 1. *spinosus*.
 II. Unarmed. Tepals of *M.* and *F.* usually similar:—
 A. Flowers 5-merous. Styles 2—3. Utricle circumsciss:—
 1. Bracts longer than the tepals:—
 L. acute or acuminate. Tepals oblong-lanceolate, 2. *paniculatus*.
 acuminate

- L. with obtuse tip. Tepals obovate-mucronate
2. Tepals longer than the bracts:—
L. obtuse or emarginate. Tepals acute or subaristate
- B. Flowers 2—3-merous:—
1. Bracts and tepals awned, longer than the circumsciss utricule:—
Erect, usually stout. L. up to 5" and more. Clusters sometimes in terminal spikes
Diffuse. L. .25—1.7". Clusters all axillary
2. Bracts and tepals not awned:—
- a. Erect. Clusters often spicate. Utricle prominently rugose or sub-echinate, circumsciss
- b. Erect or diffuse. Clusters all axillary. Utricle not or slightly rugose, often indehiscent:—
L. under 2", ovate to ell.-lanceolate. Tepals 3. Utricle globose with obtusely conical tip
L. .3—7", obovate. Tepals 3. Utricle ovoid rugose
L. .2—5", narrow-oblong. Tepals 2. Utricle longitudinally furrowed, indehiscent
3. *caudatus*.
4. *giganteus*.
5. *gangeticus*.
6. *mangostanus*.
7. *viridis*.
8. *blitum*.
9. *polygamus*.
10. *tenuifolius*.

1. A. spinosus, L. Januma, Ho.; Janum-ara, M.; Kanta-natia, Beng.

An erect glabrous copiously branched weed, 1—2 ft. high, armed with sharp axillary spines. Leaves .25—4" long, ovate, lanceolate or rhomboid. Flowers green, in axillary clusters and clusters also in long terminal erect and also axillary more or less spreading spikes.

Waste ground and cultivation, very common! Throughout the province. Fl. Fr. most of the year.

Stem smooth, green, red or striped. Leaves with base narrowed into a slender petiole, margin often crisped or waved. Spines attaining 1", very sharp. Bracts narrow, shortly awned, exceeding the sepals. Sepals with a green midrib and scarious margins, of male acuminate, of female obtuse apiculate. Stamens 5. Fem. fl. with 2—3 distant stigmas. Seed dark brown or black.

The leaves are eaten. The ash of the plant is used as a dye, *Camp*.

2. A. paniculatus, L. Syn. *A. frumentaceus*, Ham.; Larka baha, S.

A large variously-coloured robust annual with stems often 1" diam. or more at base, erect with very numerous erect branches, 2—7 ft. high with a panicle of one foot or more. Leaves ovate, elliptic or sub-rhomboid-elliptic, 2—5" long, scarcely acuminate, minutely dotted beneath; sec. n. fine but prominent, about 10, not including the shorter intermediate. Spikes .3—4" diam., the centre one 4" and more with innumerable shorter lateral ones spreading at right angles, and with those of the branches together forming a large thyrsoid panicle, with acicular recurved bracts very much longer than the oblong-lanceolate sharply acuminate sepals.

Frequently cultivated! Bhagalpur (*Wall*, 6903 a)! Manbhun, *Camp*!

The perianth and stems are often a bright claret-purple. Stems glabrous, usually deeply channelled and ridged. Utricle somewhat rugose. Seeds black or (in var. *frumentaceus*) white. *Roxburgh* describes them as pellucid with a callous white margin.

3. A. caudatus, L. Syn. *A. cruentus*, Willd.; Inc. *A. alopecurus*, Hochst.; Gandari, Ba Leper a.; Kol.; Love-lies-bleeding.

Less robust than the last with stems more regularly grooved, very long-petioled narrowly elliptic or elliptic obtuse leaves 2—5" long, with

7—10 sec. n. Panicle far less dense, branches or spikes 1—3", distinct, '15—2" wide, or if the panicle is thyrsoid branches subequal 3—4" (exc. var. *alopecurus*). Bracts acicular, longer than the obovate mucronate sepals.

Singbhum! Sambalpur, *Cal. Herb.*! Fl., Fr. r.s.

Stems often reddish striate. Leaves sometimes rhomboid, sometimes concave, midrib often excurrent. Petiole often as long as the blade. Perianth segments hyaline, '04". Utricle hyaline circumsciss about the middle. Seeds in the type usually white or yellow with thick rounded border.

Eaten as a *sag*.

Var. ***alopecurus*** ; Love-lies-bleeding.

Whole panicle inclined or drooping with a very long drooping terminal and innumerable small subequal lateral spikes. Crimson or yellow. Seeds usually lenticular and pitch-black with a compressed border.

The well-known garden plant, often cultivated. The two kinds of seed are said to be found on both varieties.

4. ***A. giganteus***, König, ? Marang leper a: , K.

A very stout coarse herb attaining 8 ft. with striate, slightly appressed pubescent stems and ovate or ovate-lanceolate leaves often 9" by 4.5" obtuse or emarginate and apiculate, base acute or rounded, nearly glabrous, sec. n. about 10 strong. Petiole 3—5", slightly scabrid. Flowers crowded in axillary and terminal dense spikes '75—1" long, these in narrow panicles 3—9", the short spikes spreading at right angles from the main rhachis. Male flowers 5—6-merous, tepals acute or sub-awned, longer than the bracts.

Cultivated in Singbhum! Fl. r.s.

The above is from my notes, but I have kept no specimens. It may be Roxburgh's third variety of *A. oleraceus*. It can hardly, however, be a variety of *A. gangeticus*. The short bracts preclude its being *A. paniculatus* or *caudatus* unless it is a variety of one of these.

5. ***A. gangeticus***, L. Syn. (according to the *F.B.I.*) *A. tristis*, L.; *A. tricolor*, L.; *A. oleraceus*, Roxb.; *A. polygamus*, Roxb.; *A. lividus*, Roxb.; Khara, Vern., Ara-leper-a: (when red), naguri-leper-a: (when white), K.; Lal Sag, H.; Dengua, rakna-shak, etc., Beng.

An erect, often stout herb 1—3 ft. high or sometimes up to 5 ft., green, bright-pink or (esp. in the garden *A. tricolor* variously) often brilliantly coloured. Leaves long-petioled broadly deltoid-ovate, or some also oblong or lanceolate, the lower often 5" by 4", sometimes larger; base suddenly narrowed and decurrent on the 2—3" -long petiole, apex obtuse or emarginate. Clusters of minute green flowers congested in the axils, rarely also in a few simple spikes, never in large panicles. Bracts '12—'17" long, hyaline lanceolate to oblong-oblancoate (or subulate, *F.B.I.*), awned. Tepals usually 3 in the male and 2 in the female, awned like the bracts. Utricle smooth circumsciss.

Largely cultivated. Singbhum! Manbhum! No doubt in most districts, but not recorded. Fl., Fr. Sept. Feb., May, probably all the year.

Tepals mostly narrowly lanceolate with green midrib excurrent as the awn, nearly always 3 with 3 stamens in the male and 2—3 styles united at base in the female. Seeds black with acute border.

If the synonymy given by the *F.B.I.* (reproduced above) is correct, the plant is very variable, the following being distinguished by *Roxburgh* as species:—

Var. α . **tristis**. Syn. *A. tristis*, *L.*

Erect, very ramous near the ground. L. rhomb.-oval, emarginate. Clusters axillary and in terminal spikes. Tepals subulate, ending in an awled joint, longer than the utricle.

Annual, cultivated and held in great esteem by the natives. It differs from *oleraceus* in having long diffuse branches from the base. It may be cut several times while *oleraceus* only yields one crop. *Roxburgh*.

Var. β . **lividus**. Syn. *A. lividus*, *Roxb.*; *Gobura-nati*, *Beng.*

Erect, smooth, simple, 2–3 ft. L. sub-ovate, retuse. Clusters axillary and in a terminal spike. Tepals 3–5, obtuse, shorter than the round compressed utricles.

I doubt this being a variety of *A. gangeticus*. The short obtuse tepals are quite different.

Var. γ . **oleraceus**, Syn. *A. oleraceus*, *Roxb.*; not *L.*; *Sada-natia*, *Beng.*

Erect with a few branches above the middle. L. from broad-rhomboidal to ovate-lanceolate. Clusters axillary and on a terminal spike. Tepals cuspidate and rather longer than the rugose utricles.

Roxburgh enumerates a red and a white variety of this and also a variety which he says is *Konig's A. giganteus* 5–8 ft. high and as thick as a man's wrist (see species 4).

Var. δ . **tricolor**. Syn. *A. tricolor*, *Willd.*

L. variously coloured, rhomb.-lanceolate. Clusters axillary, half amplexicaul. Tepals cuspidate, longer than the utricles. Fl., Fr. whole year.

Var. ϵ . **melancholicus**. Syn. *A. melancholicus*, *Willd.*

Erect, ramous, 6–12 ft. high. L. remote, rhomb.-ovate, coloured. Fl. and Fr. of last.

Var. ζ . **polygamus**. Syn. *A. polygamus*, *Roxb.*, non *L.*; *Chamli sag.*, *H.*; *Champa natia*, *Beng.*

Diffuse or erect in good soil. L. rhomb.-ovate emarginate. This is possibly *A. mangostanus* (*q.v.*).

6. A. mangostanus, *L.* Syn. *A. polygamus*, *Roxb.*?

Diffuse with rhomboid often very small leaves 25–1.7", tapering at the base, rarely attaining 2.3", obtuse, sec. n. about 6. Petiole slender, as long as blade. Clusters of flowers all down the stem, rarely forming a feeble terminal spike.

Ranchi, *Clarke!* Gya, *Nusker!*

Fresh plant all green according to *Clarke*. It is very distinct in its general habit and appearance. Bracts awned. Tepals lanceolate awned, longer than the utricle.

7. A. viridis, *L.* *Jangli-chaurai*, *H.*; *Huring lepera a.*, *K.*

A slender herb 1–2 ft. with somewhat the habit of *A. spinosus*, green, glabrous. Leaves ovate, rhombic-ovate or rhomboid, 7–3.5", but usually 1–2.5", with base somewhat decurrent on the slender petiole. Flowers very minute in spikes 2–3" long and 2–3" broad, often few and distinct on the panicle, in other cases fairly numerous and forming

a denser panicle. Tepals 2—3 linear to oblanceolate (ovate-oblong, *F.B.I.*), hyaline with a green keel not at all aristate, mostly quite mucous, .05—.06" long and bracts even shorter. Utricle very rugose, .06—.07" long, acute, indehiscent.

Patna, *Wall.* (No. 6901a)! Monghyr, *Ham.*! Ranchi, *Wood*! Singbhum, common! Probably in all districts. Fl., Fr. r.s., March, May, possibly throughout the year. Cultivated like the others as a *sag*.

The markedly rugose fruits and mucous tepals easily distinguish it.

L. not or very indistinctly dotted, sec. n. about 5.

Roxburgh says eaten but not cultivated. His *A. fasciatus* is a variety with a pale crescentic band across the leaf.

8. *A. blitum*, *L.*

Stem grooved, erect or procumbent with more of the habit of *A. mangostanus*, the lower part of the stem being often leafless and ending in a terminal crown of leaves without terminal spikes or panicle. Leaves small, .5—1.5", rarely 2", dotted, ovate to elliptic-lanceolate, obtuse retuse or emarginate, long-petioled with 5—7 sec. n. Clusters of flowers cymose. Flowers minute. Tepals 3, linear-oblong or lanceolate, mucous or apiculate, .06" long, hyaline, bract scarcely longer. Utricle globose with short obtusely conical tip, membranous, circumsciss. Seed orbicular, deep red or shining black, margins acute.

Throughout India according to the *F. B. I.* and in the Western Provinces of Bengal according to *Bengal Plants*, but I see no specimens either at the Calcutta Herbarium or at Kew from our area.

The *F. B. I.* also gives a variety (*A. oleraceus*, *L.*) described as tall, succulent, with ovate, oblong or rounded leaves, clusters axillary and in terminal spikes, utricles indehiscent.

9. *A. polygamus*, *L.* Syn. *A. polygonoides*, *Roxb.*

A small species with many erect and diffuse branches 4—8" long. Leaves obovate or oblanceolate rounded, .3—.7" long, tapering at the base into a slender petiole, dotted beneath or not, sec. n. 5—6. Clusters all axillary. Tepals 3, ending in a fine point. Utricle ovoid rugose, about equalling the tepals, dehiscent or not.

Gya, *Clarke*! Fl. Dec. A widely spread species occurring commonly in upper India, in Northern Bengal and in northern Madras. It is therefore probably frequent in our province although so little collected.

Roxburgh says that the branches are often coloured on the upper side, the leaves often emarginate with a minute bristle in the sinus, apex of utricles red, seed shining black. It is a wild species, but like others, used as a pot-herb.

10. *A. tenuifolius*, *Willd.*

A small species having somewhat the appearance of *Polygonum plebejum*, with very many diffuse branches from the rootstock 3—9" long and narrow-oblong small leaves .2—.5" long, rounded at the apex and tapering into the slender petiole, sec. n. 2—3. Clusters all axillary, very small. Tepals 2 in the male, *Roxburgh* says 1—2 and often irregular in the female. Utricle as long as tepals, coloured and longitudinally furrowed, not dehiscent. Seed lenticular with obtuse border.

Patna, *Ham.*! Fl. April—June.

6. *PUPALIA*, *Juss.*

Herbs or undershrubs with opposite leaves and perfect and imperfect flowers mixed together in spiked (contracted paniculate) clusters, the imperfect reduced to awns with stellately spreading hooked bristles. Sepals 5, herbaceous, acuminate, 3—5-nerved. Stamens 5, nearly free below; anthers 3-celled. Ovary ovoid, with slender style and capitellate stigma. Ovule 1, pendulous from a long basal funicle. Utricle membranous ovoid, compressed, indehiscent, top areolate.

Herbaceous. L. nearly glabrous. Hds. small under .5"
Undershrub. Leaves tomentose. Fruiting hds. .5"

1. *atropurpurea*.
2. *lappacea*.

1. *P. atropurpurea*, *Moq.*

A herb with long straggling branches, distant pairs of petioled shining leaves 1—4" long and about 2 perfect flowers in a cluster .25—.3 diam. in fruit, together with imperfect flowers developing in fruit into stellately spreading red hooked bristles.

Waste ground, edges of fields and grassy jungles, common. Purneah! Chota Nagpur, all districts! Puri, *Hooper*! Probably in all districts but not often collected. Fl., Fr. Nov.—Jan.

Stems often decumbent and rooting.

Branches glabrous or roughly pubescent. L. ovate, rhomboid or elliptic acute, apiculate, narrowed into the .2—1"-long petiole, shining both sides, often thinly hairy above; sec. n. 4—6 slender and reticulate. Spikes with woolly rachis, reaching 1 ft. in fruit, bracts pungent. Short pedicels and base of sepals woolly. Sepals also woolly at sides, sparsely hairy on back, pungent, 3-nerved ovate-lanceolate .17—.2" long. Seeds .1", oblong-ellipsoid with sub-truncate ends.

2. *P. lappacea*, *Moq.*

A pubescent or tomentose, scarcely woody, undershrub with long straggling branches, softly pubescent or tomentose ovate, ovate-oblong or lanceolate leaves 1—4" long. Conspicuous in fruit from the barbed heads attaining .5" diam. which tenaciously adhere to the clothes and consist of few perfect flowers and about 3 imperfect with stalked stellate spines, the whole on a tough pedicel in the axil of a bract. Imperfect flowers yellowish.

Chiefly in rocky places. Monghyr Hills, *Kurz*! Santal Parg.! Palamau! Fl. Sept.—Oct. Fr. Nov.—Dec.

Branches tomentose. L. acute, obtuse or rounded, often apiculate, mature usually thinly hairy above but persistently sub-tomentose beneath, sec. n. about 4 or 5. Petiole .1—.25" only. Spikes tomentose 2—8" long, with ovate aristate bracts persistent after the fall of the cymes (clusters). Imperfect flowers with about 4—7 spines in a whorl. Tepals .2" lanceolate, aristate, 3-nerved, woolly. Seed .1" ellipsoid compressed, smooth, shining, black.

7. *ÆRUA*, *Forsk.*

Woolly herbs or undershrubs with alternate or opposite leaves and small or minute flowers in woolly solitary clustered or paniced spikes, 2-sexual or often polygamous. Tepals 4—5 short membranous, all or the inner only woolly. Stamens 4—5, connate below together with alternate staminodes into a cup; anthers 2-celled. Style with capitellate or 2-fid stigma. Ovule 1 pendulous from a long basal funicle. Utricle

indehiscent or the coriaceous crown circumsciss. Seed inverse, testa coriaceous, embryo annular.

Spikes axillary and terminal, often paniced. L. 1—6" long 1. *scandens*.
 Spikes all axillary. L. .5—1" long. Broad 2. *lanata*.
 Spikes all short terminal. L. acicular .5—1" 3. *Monsonia*.

1. *Æ. scandens*, Wall. Naria, Beng.; Silwari, Kharw.

A straggling, scarcely scandent herb or undershrub, rarely more than 4 ft. high. Leaves mostly alternate, membranous, attaining in robust forms 6" by 2.25", sometimes only 1", elliptic, elliptic-lanceolate or lanceolate and usually tapering both ends, appressed-silky or shortly hairy beneath and more thinly so above. Fls. white in dense oblong paniced ovoid heads or cylindrical spikes .25—2" long, or terminal sometimes up to 4". Tepals 2 mm. long, densely white-villous, outer white, inner with green centre. Stamens united below into a green cup with yellow anthers, staminodes shorter than the stamens. Style slender, stigmas capitellate.

Rocky jungles. Singbhum! Ranchi! Hazaribagh! Palamau! Angul, *Chattarjee*! Kalahandi! Probably throughout the Central and Southern Areas. Fl., Fr. Oct.—May. Perennial.

I have never seen this truly climbing though it sometimes clammers a few feet among bushes. The stems are often rather woody below and attain .5" diam. in exceptional specimens. Branches striate, often reddish on one side, minutely white-hairy or pubescent or sub-tomentose upwards, or those of the panicle villous. Leaf base usually decurrent on a short petiole rarely attaining .5", sec. n. about 8 on the largest leaves. Inflorescence generally of many short sessile irregularly placed spikes lateral on a leafless rhachis which terminates in a more elongated spike, sometimes lax below. Flowers often 4—5 on short lateral branches of the spike (which is really compound), each subtended by a hyaline shortly awned bract .08" long exactly resembling the woolly or villous ovate imbricate tepals. Flowers 2 sexual (or polygamous?). Staminodes often reduced to teeth. Style about as long as ovary, together about .04—.05" long. Capsule thin, rupturing irregularly more or less transversely.

2. *Æ. lanata*, Juss. Chaya, Beng.; Lopong arak', S.

A suberect, diffuse or prostrate herb with branches more hoary-villous than in the last species, and small obovate or rounded leaves .25—1", hairy or villosely tomentose both sides. Spikes .25—.5", usually clustered at the axils and only appearing spicate where crowded at the ends of new branches with immature leaves. Sepals 1.3 mm. as in the last species or (*teste F.B.I.*) obtuse. Stigmas minute oblong.

A common weed, usually in open village lands. Monghyr, *Ham.*! Gya, *Clarke*! Chota Nagpur! Probably in all the drier districts of the province, but very poorly represented in herbaria. Fl., Fr. Nov.—Jan.

The leaves are eaten as a pot-herb. Roots used medicinally, *Camp.*

3. *Æ. Monsonia*, Mart.

An erect or somewhat diffuse herb with woolly or cottony grooved and ridged stems and opposite branches and opposite or fascicled filiform or acicular 3-nerved leaves .5—1" long. Flowers rose-coloured in short cylindrical spikes solitary and terminating all the branches, the main stem also ending in a solitary spike. Perianth .08—1" long, woolly at

base, tepals lanceolate-subulate. Utricle with small circumsciss top. Seed brown shining.

Open ground under Sal, Hazaribagh! Sambalpur, Griffith! Fl., Fr. Nov.—Jan.

Very rarely somewhat diffuse in our area, but in other provinces it is sometimes very diffuse with stems 2—3 ft. long from a long flexuous woody root. Spikes 3—7" long, regularly disposed. Tepals usually 4. Stigma capitate subsessile.

8. ACHYRANTHES, L.

Herbs with opposite leaves and green or purplish flowers which are soon deflexed, in simple or paniced spikes with spinescent or awned bracts and usually also awned bracteoles. Tepals 4—5, subulate-lanceolate, one or all aristate, shining, hardened and strongly ribbed in fruit. Stamens 2—5, filaments connate at the base with intermediate quadrate staminodes which are toothed, or have a toothed dorsal scale, anthers 2-celled. Ovary oblong subcompressed with filiform style and capitate stigma. Ovule pendulous from a long basal funicle. Utricle indehiscent, top areolate or rounded. Seed inverse, oblong, testa coriaceous. Embryo annular.

- A. Outer (upper) sepal distinctly longer and narrower than the others, aristate, others mucous. Bracteoles not spinescent 1. *aquatica*.
 B. Sepals subequal. Bracteoles spinescent:—
 Bracteoles ovate, awn not more than twice as long as blade 2. *aspera*.
 Bracteoles reduced to their awn which may be minutely auricled each side 3. *bidentata*.

1. *A. aquatica*, Br.

A stout aquatic with thick decumbent and rooting stems and erect striate strigose branches terminating in the floral spikes. Leaves 2—6", linear-lanceolate to elliptic-lanceolate, strigosely tomentose. Spikes with villous (or pubescent, J.D.H.) rhachis elongating to 8" or 18". Perianth with a thickened basal callus, outer (upper) tepal in fruit linear-subulate spinous-tipped, 3—35" long, exceeding the 4 lanceolate shining coriaceous unarmed inner tepals. Fruit brown ovoid truncate, 16" long.

Jheels and tanks, Purneah! Prain says also Tirhut and Northern Bengal, but as there are no specimens in the *Calcutta Herbarium* he perhaps judges from its general distribution (Nepal Tarai to Assam, etc.). Fl. Sept.—Nov., Fr. Dec.—Jan. It is also a native of Coromandel, "straggling to a great extent about the edges of sweet water." Roxburgh.

Bracts ovate or ovate-lanceolate, 13", scarious. Bracteoles orbicular, membranous, short, embracing the hardened base of the perianth, not aristate. The flowers which fall with the bracteoles leave a hard callus at base of bract. Embryo enclosing a very mealy or granular albumen.

2. *A. aspera*, Sitir-Kadn, M.; Chipchirit, S.; Chirchira, Latjira, H.; Chirchiri, Kharw.; Apang, Beng.

An erect or subscaudent herb with elliptic, obovate, or suborbicular, usually shortly suddenly acuminate leaves 1—5" long, generally with close appressed hairs beneath, and long spikes of green polished deflexed flowers. Exceedingly troublesome in fruit from the spinous bracteoles and pungent pointed perianth which run into the hand and adhere to the clothes. The fruiting perianth, 18—2" long, becomes detached, as in other species of the genus, together with the bracteoles, but leaving

the reflexed bract. Bracteoles in flower with thickened base and broadly ovate membranous blade, the sharp excurrent awn not projecting more than the length of the blade, or at least the length of blade and base together. Tepals all lanceolate, outer with very pungent tips, base not hardened in fruit. Utricle broadly-oblong or slightly wider above, .05", top circumsciss.

Common, especially in the vicinity of villages, probably in all districts. Fl., Fr. Oct.—Jan.

Var. **porphyristachya**, *Wall.*, is subscaudent and common in the forests with larger broadly elliptic acuminate more membranous leaves 3—6" long, sometimes glabrous and therefore uniting this with the next species. Whether it is really a variety or the differences only the result of its forest habitat is uncertain.

The leaves are eaten as a "sag" (pot-herb) when young. The ashes contain much potash. The plant is given in renal disorders.

3. *A. bidentata*, *Blume*.

A rambling herb distinguished from *A. aspera* (of which it appears to me to be merely a variety) by the blade of the spinous bracteoles being reduced to two minute auricles each side of the base of the spines, by the leaves being often much narrower elliptic to linear-lanceolate and glabrous or pubescent. The staminodes also are said to be toothed instead of fringed as in *A. aspera*.

Chiefly a hill plant. Parasnath, *Thomson!* But I have also seen it in the Duars and it may be in Purneah.

L. (of Parasnath specimen) narrowly elliptic acuminate up to 5.5" long, thinly shortly hairy. Auricles of bracteole distinct.

9. ALTERNANTHERA, *Forsh.*

Herbs, usually prostrate, with opposite entire or denticulate leaves and small white flowers in axillary often clustered heads. Tepals unequal, anterior and 2 posterior flattened, 2 lateral, innermost, concave. Stamens 2—5, filaments short, connate into a short cup with or without alternating staminodes; anthers 1-celled. Ovary with sessile capitellate, rarely 2-fid, stigma. Ovule pendulous from a long basal funicle. Utricle compressed, ovoid, orbicular or obcordate, margins often winged or thickened. Seed inverse, lenticular with coriaceous testa. Embryo annular with narrow cotyledons.

1. *A. sessilis*, *Br.* Carundi arak', S.

A prostrate and rooting much branched herb, or sometimes subscaudent among bushes and 3—4 ft. high, youngest branches with 2 lines of pubescence. Leaves narrow elliptic, linear-oblong, oblong-lanceolate or sometimes rhomboid .5—2", rarely in the damper districts up to 3", sometimes denticulate, obtuse or rounded or in the rhomboid leaves acute. Clusters of flowers white or pinkish, the flowers when open up to .1" diam. pink at base and pearly white above. Tepals 1-nerved, glabrous, rigid, acute or very acute. Stamens 5 (always?), of which 2—3 only or sometimes 5 are anther-bearing. Utricle compressed .1—.12" diam. obcordate with thickened margin.

In wet places. Purneah! Singbhum! Palamau! Manbhum, *Camp. Fl., Fr.*
July—Jan.

Leaves narrowed at base into a short petiole. Nodes hairy, sometimes slightly hairy both sides, often rather fleshy, the larger-leaved form only seen in Purneah. Spikes or clusters .25--3" long, rhachis and base of flowers woolly, and in the large-leaved form (possibly a distinct species) the sepals are hairy.

The leaves are eaten as a pot-herb.

FAM. 109. CHENOPODIACEÆ.

Herbs or shrubs often fleshy with simple alternate mostly entire exstipulate leaves, and small, often dimorphic 1—2-sexual flowers. Bracts occasionally absent. Perianth herbaceous or membranous, persistent, often accrescent, of 3—5 free or connate tepals, imbricate in bud. Stamens usually one opposite each tepal in the male or 5, or sometimes fewer, hypogynous or perigynous, free or connate at the base, anthers 2-celled. Ovary 1-celled usually produced into a style with generally 2, more rarely 3—4, very seldom 5, stigmas which are usually narrow, seldom capitate. Ovule 1 campotropous, with 1—2 integuments on a long or short basal funicle. Fruit usually a utricle, often enclosed in the enlarged sometimes fleshy perianth. Seed horizontal or vertical with coriaceous, crustaceous or membranous testa. Albumen floury, fleshy or 0. Embryo curved, annular or spiral.

Especially characteristic of desert or saline vegetation and often covered with silvery scales, but not well represented in our province.

I. Stem not twining. Bracteoles free from the perianth:—

A. Stem not or not very fleshy. Leaves flat:—

1. Flowers clustered, all similar:—

Perianth 5-partite, not thickened at base

1. *Chenopodium.*

Perianth 5-lobed, base thickened fleshy

2. *Beta.*

2. Flowers dimorphic. M. ebracteolate, 3—5-merous.
Fem. enclosed in a pair of bracts usually without perianth:—

Fem. fl. enclosed in a pair of bracts. Perianth 0

3. *Atriplex.*

Fem. fl. ebracteate. Perianth 3—4-toothed

4. *Spinacia.*

B. Stems fleshy or woody, leaves 0, or subterete and fleshy.

Flowers very minute:—

Flowers immersed in the fleshy jointed stem or spike

5. *Salicornia.*

Stem not jointed. Fls. axillary

6. *Suaeda.*

II. Stem twining. Bracteoles 2 broad adnate to the perianth

7. *Basella.*

1. CHENOPODIUM, L.

Herbs with angled stems and alternate, entire lobed or toothed leaves, sometimes strong-smelling. Flowers very small, 2-sexual, in axillary clusters, spikes or cymes. Tepals 3—5. Stamens 1—5, hypogynous or subperigynous, free or connate below. Disc 0. Ovary free, depressed or compressed with 2—3 styles or stigmas. Utricle membranous, included in the scarcely altered perianth. Seed horizontal or vertical with crustaceous testa and floury albumen. Embryo annular.

Glabrous or with scurfy scales. Spikes dense axillary and in terminal thyrses. Stigmas 2

1. *album.*

Aromatic glandular. Spikes slender leafy. Stigmas 3

2. *ambrosioides.*

1. *C. album*, L. Betua-sag, *Vern.*; Bhatua-arak', *S.*; Khartua-sag, *H.*

An erect or ascending herb 1—3 ft. high, green or in our area covered with minute scurfy scales. Leaves very variable, sometimes all under 1" long, more or less oblong-lanceolate or rhombic-lanceolate; in some cultivated forms the lower ones attain 4—6" long and rhombic deltoid or lanceolate, usually more or less toothed or lobulate, often irregularly. Petiole slender and generally as long as the blade. Flowers .04—'05" diam. in short axillary spikes and often forming also a terminal thyrses, mealy in our specimens. Tepals only slightly keeled, nearly covering the utricle. Seed black depressed with an obscure horizontal keel.

Champan! Purneah, *Wall* (No. 6952 d)! A weed of cultivation in Manbhum, *Camp.*! Also seen in gardens in Singbhum, but it is also a European weed and may possibly be imported with vegetable seeds. Fl., Fr. March. Annual.

2. *C. ambrosioides*, L. Mexican Tea.

An erect pyramidal herb 2—4 ft. high with sulcate gland-hairy and minutely cobwebby pubescent stems. Whole plant with a peculiar rather strong subaromatic semi-pungent smell due to the glands. Leaves oblong or lanceolate, obtuse, lower sinuate-toothed. Flowers innumerable, minute, green sessile clustered and scattered along the numerous branchlets or slender spikes, and in the axils of small oblanceolate leaves, 4—5 or rarely 6-merous. Whole top of plant often converted into a leafy panicle.

Maldah, close to Purneah, *Clarke*! Banks of Ganges, *Kurz*! Edges of tanks, Ranchi! Fl., Fr. April—Aug. and perhaps other times.

Lower leaves 2.5", coarsely toothed, oblong or lanceolate, smaller upward. Perianth 1.5 mm. diam. Tepals elliptic acute, connate at base, valvate, incurved. Stamens 4—6, hypogynous, 1.5 mm. long, filaments hyaline, anthers square. Ovary globose minutely papillose above, very minutely pedicelled. Stigmas 3—5 very minute. Two outer tepals with granulosic glands, closed valvately over fruit. Seed depressed globose brown with copious albumen and embryo in a half-circle with linear cotyledons.

There has recently been a demand for this plant on account of the oil.

2. BETA, L. Beet.

Succulent herbs with alt. subentire leaves and 2-sexual flowers axillary and in axillary spikes or cymose clusters. Perianth urceolate, gamophyllous, 5-lobed, cohering in fruit by the enlarged hardened bases. Stamens 5. Disc fleshy, annular. Ovary depressed, sunk in the disc with short style and 2—4 subulate stigmas. Utricle adnate to disc and base of perianth. Seed horizontal with thin testa and floury albumen. Embryo annular.

1. *B. vulgaris*, L. Chakanda, *Vern.*

The well-known vegetable developing a large red root in cultivation with ovate or oblong obtuse leaves with cordate or cuneate base, cauline smaller upwards and often rhomboid or lanceolate. Spikes paniced, clusters of flowers distant with narrow acute bracts.

Widely cultivated in the cold season. The leaves are also used as a spinach. It is probably the same species as *B. maritima*, common as a sea-coast plant in Europe.

3. SPINACIA, L. Spinach.

Annual herbs with alternate leaves and dioecious ebracteate flowers, the males in terminal spikes, the females in axillary clusters. Male sepals 4—5 herbaceous, free. Stamens 4—5. Fem. with sub-globose 2—4-toothed perianth, coriaceous in fruit and sometimes with 2—3 dorsal spines. Stigmas filiform, connate below. Utricle enclosed in the perianth and adnate to it, hard, compressed. Seed vertical, testa thin, albumen floury. Embryo annular.

1. *S. oleracea*, L. Syn. *S. tetrandra*, Roxb.; Palak, isphani, pinnis, Vern.

There are two varieties of Spinach commonly grown in India. The prickly fruited with triangular or hastate variously lobed leaves and the smooth fruited usually with more ovate or rounded leaves. The first is Roxburgh's *tetrandra*, the second perhaps always from European seed. Native country unknown but is believed to be derived from *S. tetrandra*, Stev., which is indigenous in the Caucasus. Commonly cultivated in C.S.

4. ATRIPLEX, L.

Herbs or shrubs usually covered with silvery or scurfy small scales. Leaves alternate, rarely also lower opposite. Flowers monoecious or dioecious, sometimes with a solitary 2-sexual intermixed, in clusters which usually form simple or compound spikes. Males without bracteoles, perianth 3—5-partite herbaceous or membranous, stamens 3—5. Fem. with 2 broad flat usually triangular sometimes toothed bracteoles, dilated in fruit and forming a 2-valved covering to the utricle; perianth 0. Stigmas 2. Utricle membranous enclosed in the hardened bracteoles. Seed erect, rarely otherwise. Albumen floury, embryo annular.

1. *A. hortensis*, L. Orache; Mountain Spinach.

A stout erect annual with striate glabrous stems, ovate obtuse, or upper sometimes triangular, leaves 2—2.5" and slender panicles of greenish flowers, very conspicuous in fruit from the dry venose appressed orbicular-ovate or orbicular bracts 3" long.

Said to be cultivated in many parts of Bengal, but I find no specimens from our area either at Calcutta or Kew. Fl., Fr. Sept. 9

Leaves not mealy, lower sometimes triangular-cordate and sinuate-denticulate.

5. SALICORNIA, L.

Fleshy leafless jointed shrubs or herbs with minute 2-sexual flowers, 2—3 together sunk in pits at the joints of the branch-like spikes. Perianth turbinate or flask-shaped, 3—4-lobed or -toothed, spongy in fruit. Stamens 1—2. Utricle included, membranous, stigmas subulate. Seed erect, compressed, testa hispid with hooked hairs, albumen 0. Embryo conduplicate, radicle inferior, parallel to the folds of the cotyledons.

1. *S. brachiata*, Roxb.

An erect branched undershrub 12—18" high. Branches many decussate with the joints clavate or showing an expansion at the tip, the

floriferous branches or spikes very fleshy linear-spindle-shaped (not clavate) at the short joints, with 3-nate flowers on each side of all the nodes. Stamen 1 to each flower, extruded. Stigma 2-cleft.

On saline marshes or ground covered by the tides. Common near Calcutta, *Kew Herb.* and the Chilka Lake, *Cal. Herb.* Probably also in the intermediate Cuttack district. Fl. August.

6. SUÆDA, *Forsk.*

Herbs or shrubs, stem not jointed. Leaves fleshy usually terete. Flowers minute, axillary and running out into spikes, usually 2-sexual, bracteate and 2-bracteolate. Perianth short, 5-lobed or -partite, segments sometimes gibbous or subulate, equal or unequal. Stamens 5 short. Utricle included, membranous or spongy; stigmas 2—5, minute, subulate, recurved. Seed erect, oblique or horizontal, with crustaceous or coriaceous testa; albumen scanty or 0. Embryo plano-spiral.

Undershrub. Styles 3

1. *nudiflora*.

Herb. Styles 2

2. *maritima*.

1. *S. nudiflora*, *Moq.* Syn. *Salsola nudiflora*, *Willd.*

A woody branched undershrub 10—15" high with branches spreading close to the ground, fleshy leaves .25—.5" long and very numerous flowers in clusters running out into terminal often paniced spikes bracteate in the lower parts. Styles 3.

Salt, barren lands near the sea from Calcutta southwards. Chilka Lake, *Cal. Herb.* Fl. May—Aug.

2. *S. maritima*, *Dumort.* Syn. *S. indica*, *Roxb.*

A much more slender plant than the last scarcely woody below, with more slender leaves .5—1" long by .05" broad, semiterete, fleshy. Inflorescence leafy to the top. Styles 2.

Salt marshes near the sea. From the Sunderbans southwards, but there is no actual specimen from our area. Fl. May.

7. BASELLA, *L.*

A fleshy twiner with broad entire leaves and small white or coloured 2-sexual flowers in spikes, each with a small green bract and 2 adnate fleshy bracteoles. Perianth fleshy, 5-fid, becoming baccate in fruit, lobes short incurved. Stamens 5 perigynous, anthers versatile. Utricle globose thin, adhering to the seed, included in the fleshy perianth, stigmas 3. Seed erect, subglobose with crustaceous testa and scanty albumen. Embryo plano-spiral with large thin involute cotyledons.

1. *B. rubra*, *L.* Utu ara, *K.*; Pui, *H.*

Stems fleshy usually red. Leaves ovate to orbicular, often cordate or with straight or rounded base, 1.5" each way or sometimes attaining 5—7" in length, shining, slightly acuminate. Petiole .5—1". Spikes .5—3" long with fleshy rhachis. Flowers pinkish or purple, urceolate.

Bracteoles coloured like the perianth. Fruit '25" diam. ovoid, black, with deep purple juice.

Grown on trellises and hedges throughout Chota Nagpur! Fl., Fr. March—Dec.
A pot-herb.

FAM. 110. PHYTOLACCACEÆ.

Shrubs or herbs with alternate entire leaves and small or 0 stipules. Flowers mostly small in racemes, bracteate and 2-bracteolate. Tepals 4—5 imbricate, sepaloid or petaloid, sometimes unequal. Stamens 4, equal in number and alternate with the tepals or twice as many, rarely more, subhypogynous or hypogynous, with usually persistent filaments and deciduous anthers. Carpels 1 or more, free or connate, superior, 1-ovuled, stigmas usually sessile and recurved. Ovules amphitropous or campylotropous. Ripe carpels baccate or utricular, nutlike or samaroid. Seeds erect, often arillate with fleshy or floury albumen and peripheral embryo usually annular. Cotyledons narrow and flat or broad and unequal with the outer embracing the inner, or foliaceous and convolute.

1. RIVINA, *Plum.*

Shrubs or undershrubs with entire or faintly crenulate penninerved leaves with minute deciduous stipules, and small 4-merous hermaphrodite flowers in simple terminal racemes finally becoming leaf-opposed or extra axillary. Perianth 4-partite, segments sub-petaloid, equal. Stamens 4 or 8 subhypogynous, 4 exterior alternate with the tepals. Ovary 1-carpellary, unilocular. Style elongate, sublateral or 0. Stigma capitate or penicillate. Fruit baccate, subglobose. Embryo annular. Cotyledons unequal, conduplicate with their edges involute, obscurely 3-nerved.

1. *R. lævis*, *L.* Incl. *R. humilis*, *L.*

A pretty bushy undershrub with sulcate glabrous or pubescent branches, ovate acuminate entire or subcrenulate glabrous or pubescent leaves 1—4" long and small rosy-white flowers in racemes longer than the leaves. Tepals obovate or elliptic-obovate, longitudinally venose. Berries bright scarlet, compressed globose. Seeds rugosely pitted.

Frequent in gardens and sometimes self-sown! Native of America.

FAM. 111. POLYGONACEÆ.

Herbs, rarely shrubs with alternate, rarely opposite, simple entire or serrulate, very rarely lobed, leaves, often gland-dotted and with stipules usually sheathing the stem (ochreate) and often membranous. Flowers usually 2-sexual, jointed on the pedicel, usually clustered with the clusters often spicate or paniced. Perianth green or coloured of 3—6 free or connate persistent tepals, imbricate in bud. Stamens 5—8, rarely more or fewer, opposite the tepals. Disc, if present, annular or glandular. Ovary free, superior, 2—3-gonous with 1—3 styles, stigmas various.

Ovule 1 basal, orthotropous. Fruit a nut, usually enclosed in the perianth which may be accrescent. Seed erect with membranous testa and floury or horny albumen. Embryo various, radicle superior.

- A. Herbs or sometimes suffruticose below, ochreæ large:—
 Fls. acyclic. Perianth 3—5-merous. Stamens 1—8 1. *Polygonum*.
 Fls. cyclic, each whorl 3-merous. Stamens 6 2. *Lumex*.
- B. Shrubs, erect or climbing by tendrils. Ochreæ small:—
 Climber with white or pink perianth, dry in fruit 3. *Antigonon*.
 Erect with flattened branches. Perianth fleshy in fruit 4. *Muchlenbeckia*.

1. POLYGONUM, L.

Herbs, rarely suffruticose with alternate entire, rarely lobed leaves and tubular membranous stipules. Flowers small or minute, shortly pedicelled, clustered, the clusters axillary or terminal or in spiciform racemes. Bracts and bracteoles ochreate. Disc glandular or 0. Perianth 4—5-, rarely 3-cleft, tepals acyclic, 2 outer usually smallest. Stamens usually 5—8, perigynous. Ovary compressed or 3-gonous; styles 2—3 or combined below, stigmas usually capitellate. Nut included in the more or less accrescent perianth, 3-gonous or biconvex. Embryo lateral, radicle long, cotyledons flat, accumbent, rarely incumbent.

- I. Bracts tubular (sometimes only at base in 13—15):—
 A. Flowers all in axillary clusters 1. *plebejum*.
 B. Flowers all in spiciform racemes (subcapitate in 14 and 15):—
1. Cotyledons incumbent. Stipules mostly with dilated mouth or a distinct limb. Stout herbs:—
 L. softly pubescent or hairy, ovate 2. *orientale*.
 L. scaberulous, lanceolate 3. *limbatum*.
 2. Cotyledons accumbent. Stipules without dilated mouth or limb (exc. in 14). Leaves narrow:—
 a. Hairs, if present, neither retrorse nor prickly. Racemes many-fld.:—
 i. Styles mostly 2. Nut biconvex (rarely few 3-gonous):—
 † Stipules eciliate (at mouth):—
 Whole plant glabrous 4. *glabrum*.
 Whole plant white tomentose or cottony 5. *lanigerum*.
 †† Stipules more or less ciliate:—
 L. elliptic-ovate to lanceolate, ciliolate 6. *lapathifolium*.
 L. narrow-lanceolate to linear, glabrous 7. *minus*.
 - ii. Styles mostly 3. Nut 3-gonous (rarely few 2-convex). Stipules ciliate (exc. sometimes in 12):—
 † Racemes dense:—
 † Branches above, bracts and peduncles glabrous:—
 L. glabrous, or nerves strigillose, usually tapering to a rounded base, stipular setæ not longer than tube 8. *serrulatum*.
 L. shortly appressed-hairy and ciliate, base acute or acuminate. Stipules with long setæ (3—5") usually exceeding the tube 9. *barbatum*.
 †† Branches above and peduncles strigose, bracts more or less hairy:—
 L. as in *barbatum* 10. *stagninum*.

†† Racemes with lower bracts distant, peduncles glabrous:—

L. strigose beneath. Stipules strigose and ciliate

11. *flaccidum*.

L. glabrous beneath. Stipules glabrous, sometimes eciliate

12. *hydropiper*.

b. Hairs, if present, rigid, retrorse or prickly. Bracts often somewhat expanded above:—

i. Flowers in very lax few-fl'd. racemes

13. *prætermisum*.

ii. Flowers in short oblong or capitate racemes:—
Stipules oblique at mouth, shortly ciliate. Nut 2-convex

14. *pedunculare*.

Stipules truncate with long cilia. Nut 3-gonous

15. *strigosum*.

II. Bracts flat. Flowers capitate. Leaves broad, often lobed or auricled at base:—

L. .5—2", contracted below into the broadly winged petiole. Stipules obliquely truncate

16. *alatum*.

L. .5—1.5". Petiole .12—17", auricled. Stipules short cupular

17. *capitatum*.

L. 1—6". Petiole .3—1", usually auricled. Stipules long, obliquely truncate

18. *chinense*.

1. P. plebejum, Br. Muniara, K.; Muic', S.; Raniphul, Vern.; Indian Knot Grass.

A diffusely branched prostrate herb, in some forms much resembling the English *P. aviculare*, with usually many stems from the root, varying from 2" to 18" in length at the time of flowering. Leaves linear, linear-oblong or in the shorter ones obovate-oblong, .1—7" long, acute or obtuse, often with revolute margins. Stipules short or longer than the leaves, fimbriate with excurrent nerves. Flowers small, green to pink with green midrib, 3—4 or crowded in the axils, under .1" long, subsessile, sunk among the stipules or exsert. Nut .06—07" long, somewhat spindle-shaped, but sharply 3-quetrous, brown, shining.

A very common weed on banks, in waste ground, cultivated ground and pastures. In all districts! Fl., Fr. mostly Feb.—May.

Stems and branches grooved, smooth or scaberulous. In var. *Griffithii* very short with very short internodes and appearing almost woolly from the very white-fimbriate stipules. L. sometimes only .25" and under. Perianth lobes acute or obtuse.

The plant is eaten as a sag and it is also eaten by horses. The root appears to be always annual or short and woody, whereas that of *P. aviculare* is long fleshy and perennial and becomes a great pest in gardens and fields.

Hooker in the *F. B. I.* enumerates 10 varieties of the plant according to relative length of internode, length and shape of leaves, degree of exsertion of the flower, acuteness of the tepals, etc.

Gage (*loc. cit.*) suggests that vars. *indica* and *brevifolia* form a second species, var. *Griffithii* a third, and var. *polynura* a fourth species. The following skeleton key based on his work is adapted accordingly:—

A. L. linear or subulate, more than 4 times as long as broad or sometimes dilated upwards from a narrow base (pedicels short in *plebejum* proper)

a *plebejum* proper
and var. β *effusa*.

Probably in all districts.

B. L. not 4 times as long as broad:—

1. Fl. pedicels long, exserted well beyond the stipules

var. β *effusa*.

2. Fl. sessile or pedicels very little or not exerted:—
- a. Stipules nerveless or 1—2-nerved:—
 Branches not very numerous. L. oblong. Stipules
 fimbriate, not woolly-looking vars. γ *indica* and
 δ *brevifolia*.
- Chota Nagpur, common!
 Branches very numerous. L. orbicular, apiculate
 with a distinct median ridge. Stipules very
 crinite and woolly-looking "
 Behar, Kurz.! var. ϵ *Griffithii*.
- b. Stipules many-nerved. Nut polished var. ζ *polynura*.

2. *P. orientale*, L. *P. pilosum*, Roxb.; Bara-pani Mirich, Beng.

A tall branching annual 3—10 ft. high with hollow branches; softly pubescent, densely hairy or villous all over. Leaves ovate 3—8" by 1.5—4.75" acuminate, lower usually cordate at base, closely nerved, hairy or pubescent both sides, sec. n. 14—18, petiole 1—4". Stipules short hirsute truncate ciliate with often dilated or recurved mouth without long excurrent bristles. Flowers 1" subglobose, white, green or pink in cylindrical racemes 2—5" long, .15—2" diam. which are laxly paniced. Bracts .15" crowded strigosely tomentose and ciliate. Stamens 7—8. Nuts orbicular, .12" diam., flattened with rounded margins and rather concave faces, black, shining.

In wet places extending along the foot of the Himalayas. Sikkim Tarai and probably therefore in N. Champaran and Purneah. Santal Parg., Maddox! Fl., Fr. r.s.

The ends of the branches when moistened become thickly glutinous. Roxb.

3. *P. limbatum*, Meissn.

Stems stout erect 2—4 ft. strigosely hairy and glabrescent unbranched. Leaves 3—7" long, lanceolate acuminate, scaberulous or hispid on both surfaces, base tapering, shortly petioled, sec. n. 7—12 fine. Stipules loose, strigose, truncate with a spreading or reflexed scabrid ciliate limb. Flowers white (always ?) in erect stoutly shortly peduncled paniced racemes 2—4" long, .25—3" diam. Bracts obovate crowded hispid .15—2", 6—8-fld. Stamens 7—8. Nut orbicular, .12" diam. flattened with rounded margins and convex faces, black, shining. Cotyledons incumbent.

Ponds and rice-fields. Purneah (probably; it occurs in Maldah close by!). Manbhum, Milne, Clarke! Fl. Oct.—June.

The very stout stems and expanded or auricular herbaceous mouth of the stipules are very characteristic; the indumentum easily distinguishes it from the last, which also has sometimes a dilated stipular mouth.

4. *P. glabrum*, Willd. Sauri-arac'. S.

A stout erect herb with the stems up to .3—5" diam. and woody below, strict, rather swollen at the nodes. Leaves lanceolate or linear very tapering, dotted, glabrous, shining, mostly 3—5.5" long. Petiole short with sheathing base and tubular stipules 1—1.3" long, neither ciliate nor with excurrent nerves, truncate. Flowers pink in rather dense paniced spiciform racemes 1.5—3" long, about 5—6 distinctly

pedicelled in the axils of the tubular truncate or oblique rounded, glabrous bracts. Nut brown-black orbicular-ovoid compressed bi-convex or rarely obtusely 3-cornered, polished. Cotyledons accumbent.

Common on the edges of tanks and water-courses, growing in mud. Purneah! Gya, *Cal. Herb.*! Shahabad (Dumraon), *Cal. Herb.*! Ranchi! Hazaribagh, *Clarke!* Sant. Parg., *Gamble!* Palamau! Manbhum, *Camp!* Singhbhum! Fl. Sept.—Dec. Fr. Nov.—Feb.

Stems usually brown or reddish below. Leaves often attaining 6.5" by 1", tapering at the base, quite glabrous, glands usually conspicuous, sometimes obscure; sec. n. about 25 spreading slightly arcuate. Pedicels .1—1.2" long, conspicuous after the fall of the flowers, with prominent articulation. Perianth tubular-campanulate, .1" long, tepals elliptic concave, stamens 6—8 (usually 7) often slightly exsert. Style-arms 2 (presumably 3 in the very rare cases where 3-sided nuts occur).

Eaten as a sag.

5. *P. lanigerum*, Br. Syn. *P. lanatum*, Roxb.

Stems 2—5 ft. procumbent and rooting towards base, much branched, with erect branches clothed with white cottony tomentum. Leaves 3—7" narrowly lanceolate acuminate, woolly or thickly cottony beneath, tapering into a short petiole or sessile. Stipules short truncate membranous, mouth unequal or lacerate, not ciliate. Fls. small white or red dense in slender paniced racemes, 1—3.5" long on cottony divaricate slender peduncles. Bracts very small, crowded, glabrous or tomentose, not ciliate. Nut orbicular, much compressed, small, brown or black, shining.

Ditches, etc. In the eastern moister parts of the province. Purneah (Kissenganj), *Kurz!* Santal Parg., *Kurz!* Fl. May—Sept.

Stems sometimes .5" diam. below, deep red within (*vide* Roxb.). Leaves usually quite white beneath, rarely glabrous above, sessile or shortly petioled. Stamens 6.

6. *P. lapathifolium*, L. Var. *laxum*.

Erect, branched, annual, with glabrous stems, subsessile elliptic-ovate to lanceolate or linear leaves, glandular beneath and with ciliate margins. Stipules sparingly ciliate or eciliate. Racemes cylindric, erect or nodding. Bracts ciliate. Pedicels usually glandular. Perianth greenish, glandular, strongly nerved. Stamens usually 6.

Hooker says "from Bengal to the Sutlej" and (possibly on this account) *Prain* says "Behar." But I can find no specimens from Behar. It is at any rate very rare. *Madden* says "ubique Ganges from Fettehgarh to Calcutta," but then *Madden* mixed this species up with *P. glabrum*, from which it only appears to me to differ in its glandular perianth and subsessile leaves. *Gage* gives no Behar or Orissa locality.

Leaf base contracted, papillose, strigillose or hispidulous on the nerves beneath and margins. Racemes lax, paniced, peduncles papillose, glandular or hispidulous.

7. *P. minus*, Huds.

Stems very slender ascending, glabrous, 6—10" long, often simple, with linear sessile leaves tapering each end, .75—1.5" long, with minute appressed bristles along the margin and usually on the nerves beneath. Stipules sparsely or densely strigosely bristly and bristle-ciliate, cilia shorter than the tube. Flowers very small, white or pinkish turning deeper pink in fruit, in very slender erect racemes .3—1" long. Bracts

·06—·1" glabrous, mouth subtruncate or rounded bristle-ciliate. Style-branches 2, stigmas papillose capitellate. Nut broadly ellipsoid, biconvex, polished brown, ·06".

Wet ditches, Purneah! Fl., Fr. Nov.—Jan.

Resembling a very delicate form of *P. serrulatum*, from which it is distinguished by the small size of all its parts, the appressed bristles of the stipules (strigosely-hairy in *P. serrulatum*), and especially the 2-fid. style and biconvex nut. Pedicels included in the often coloured bracts. Perianth ·06—·07" in flower, slightly larger in fruit. Stamens: 5 included.

8. *P. serrulatum*, Lagasc.

Stems decumbent below, 10—20" high, branches glabrous as well as the peduncles. Leaves narrowly linear to linear-oblong, 2—5" long by ·1—·6" broad, subsessile, glabrous or slightly strigillose on margins and nerves. Stipules and bracts with bristle-cilia from half as long to as long as the somewhat strigose tube, stipules somewhat strigose. Flowers white in slender erect racemes ·5—1·5" long. Stamens 5—8. Nut deep purple 3-gonous polished ·07" long.

Marshes. Ranchi! Palamau! Singbhum! Fl., Fr. Sept.—Jan.

This is like a large *P. minus* with 3-quetrous nuts and is perhaps only artificially separated. Leaves tapering each end or sometimes subcordate at the base. Ovaries sometimes filled with the spores of a parasitic fungus (smut), and the raceme then swollen and much larger than normal.

9. *P. barbatum*, L.

This appears to me to be merely *P. stagninum* without the strigose peduncles and probably *P. stagninum* should be reduced to a variety of this. Sir J. D. Hooker says: "The nearly or quite glabrous stems and peduncles, the long bearded stipules, long weak slender but erect racemes, and shorter weaker cilia of the bracts, best distinguish this from *P. stagninum*; but none of these characters holds good by itself." The slender racemes are 2—4" long and leaves 4—7".

Purneah, Burkill! Ranchi, Clarke! Hazaribagh, Clarke! Manbhum, Wood! Palamau, Cal. Herb.! Banks of Soane, abundant, J.D.H.! Fl. Oct.

L. sessile, linear-lanceolate, tapering both ends, strigose on nerves beneath and on margins, sessile or subsessile. Excurrent setæ of stipules longer than the tube. Racemes panicled, narrow, with glabrous setose-margined bracts.

10. *P. stagninum*, Ham.

Erect or ascending 2—3 ft. high with branches above the stipules (by which they are closely sheathed) glabrous or with a few stiff hairs in the lower parts, upper parts and peduncles densely strigose. Leaves lanceolate thinly shortly appressed hairy both sides and ciliate, base tapering into a very strigose petiole ·1—·3" long. Stipules membranous ·6" strigose and nerves excurrent into long bristles ·3—·5" long. Peduncles strigose, short. Racemes ·6—1" with usually coloured pectinately ciliate bracts, mouth rounded. Perianth campanulate ·1" long, white. Tepals rounded. Stamens 8 (always?), disc-glands prominent oblong, connate at base. Styles 3 slender, longer than ovary, connate at base. Nut 3-quetrous with subacute angles, pitchy-black (*F. B. I.*) or brown-black.

Watery places. Purneah! Fl., Fr. Nov.—Jan.

Var. *a.*

Leaves 3—5.5" long, linear or linear-lanceolate, very acuminate, sometimes nearly glabrescent, more sparsely and more shortly hairy. Bristles of stipules sometimes as long as tube. Racemes .7—2" long. Perianth green, greenish-white or tinged pink. Pedicels .07". Nut .07", obtusely or sub-acutely 3-gonous, brown-black.

The commoner form. Frequent throughout Chota Nagpur! Santal Parg., Kurz! Cuttack, Cal. Herb.!

This is probably only a variety of *P. barbatum*, differing in the strigose peduncles. The variety also comes very close to *P. serrulatum*, which is yet more glabrous and more slender.

11. *P. flaccidum*, Meissn.

Resembling *P. hydropiper* in general appearance, usually larger, 2—3 ft. high with red stems and branches very thinly strigose or glabrous and with gland dots, much swollen at the nodes. Leaves lanceolate, reaching 4.5" by 1" usually 2—3", dotted, somewhat fulvous-strigose beneath and on the midrib above, sometimes also with a few short appressed hairs above. Stipules strigose and bristle-ciliate with the cilia long and often half as long as the tube. Flowers bright pink or white with green base in very lax, very slender, paniced inclined or decurved racemes 3—6" long. Flowers only 2—3 to a bract, bracts often .75—1" apart in the lower parts of the raceme, tubular, obliquely truncate, glabrous, ciliate, cilia mostly long. Nut 3-quetrous, ovoid.

Similar localities to the last. Purneah, *Burkill!* Ranchi! Palamau! Singhum, common! Fl., Fr. Sept.—Jan.

Rootstock creeping. Leaves tapering at base and with a short petiole, petiole of lower leaves .3", sec. n. numerous, distinct beneath. Fls. .1". Perianth glandular, tepals broadly elliptic or ovate. Peduncles and rhachis glabrous, somewhat angular. Stamens 8. Style deeply 3-fid with capitellate stigmas.

12. *P. hyropier*, L.

Stems decumbent at base and ascending, more rarely quite erect, 12—20", glabrous, very slender above, nodes below swollen. Leaves linear-lanceolate, copiously gland-dotted, 1.5—3.25", glabrous or scabrous on margin, subsessile. Stipules glabrous, with few and usually deciduous bristles mostly under .1" long. Flowers pink in rather lax, very slender or filiform racemes which are erect, flexuous, or decurved. Bracts glabrous, gland-dotted or not, truncate with very small, often deciduous cilia, or eciliate. Pedicels mostly exerted to the length of the flower. Perianth glandular. Styles sometimes 2 only. Nut usually trigonous, opaque, granulate, occasional ones flat.

Wet places and streams. Purneah! Damodar River (between Ranchi and Hazaribagh), Kurz! Ranchi! Singhum! Fl., Fr. May—Dec.

13. *P. prætermisum*, Hook. f.

A rather delicate species with creeping stems and erect stems up to 10" high, glabrous or with reflexed bristles especially near the nodes, oblong or linear-oblong or linear leaves 1.5—4" long, sagittate or hastate at base with large obtuse lobes or auricles, beneath often purplish and quite glabrous or with a few deciduous reflexed hairs on midrib, margin minutely ciliate. Petiole .2—4" smooth or with bristles. Stipules

narrow with thin deciduous hairs, ciliate at apex. Racemes almost capillary, once or twice bifurcate, 2—4" long, glabrous or somewhat glandular. Flowers very few at the ends of the branches, distant, bracts only 3—5, glabrous except at the shortly ciliate tips, 1".

In wet ditches, N. Purneah! Fl. Dec.—Jan. Fr. not seen in our specimens, said to be globose 3-gonous.

The very slender characteristic forked nearly glabrous axillary racemes with few distant flowers bring this under *P. prætermisum* in spite of the greater hairiness than in the type. The Sikkim specimens in the *Cal. Herb.* have often densely glandular inflorescences.

14. *P. pedunculare*, Wall.

A weak herb with stems decumbent at base, 2—3 ft. high, angled and hispid above with short retrorse bristles or prickles or unarmed. Leaves linear, or somewhat lanceolate-linear, acute or acuminate, 2—4" long by 2—4" broad, glabrous with hispidulous or scabrid margins, contracted into a very short petiole .05—.25" long. Stipules long tubular with dilated very oblique shortly ciliate mouth. Flowers small white in heads or oblong racemes .15—.4" long, the heads in 2-chotomous lax panicles with glandular-hispid peduncles and scarious stipuliform bracts at the forks. Flowers 1 (or more?) exerted from the lanceolate acuminate, nerved and pectinately ciliate bracts which are .15" long or basal ones up to .2" long. Perianth broadly campanulate .1—.12" long with rounded tepals. Stamens 5 (—3). Style 2-fid as long as the ovary. Nut thickly biconvex, orbicular or broader than long, .07—.08" broad, brown, not polished.

Along river-banks, parts of Chota Nagpur; Neterhat 3000 ft.! Fl., Fr. Sept.—Nov.

As many as six varieties are described in the *F.B.I.* I have only described the form (var. *angustissima*) occurring in our area. The densely and many-flid. heads easily distinguish it from *P. prætermisum*.

15. *P. strigosum*, Br.

Widely creeping (suberect, *F. B. I.*) with angular stems, the angles beset with small reflexed or recurved barbs. Leaves linear-oblong 2—4" acuminate with rounded or subcordate base, midrib and margins with reflexed small barbs or hispid and upper surface scabrid-hairy. Flowers pink in very short oblong or subglobose heads or racemes .25—.5" long, with aculcate or glandular-hispid slender peduncles. Bracts ovate or oblong, ciliate and strigose. Nut globose 3-gonous.

Creeping over rocks. Neterhat, 3000 ft.! Fl. July—Nov. My specimens not in flower.

Nodes (base of stipules) with a ring of reflexed setæ .1—.2" long. Petioles .2—.5" long, closely aculeate. Stipules long tubular truncate .8—1", with many excurrent nerves terminating in erect setæ. Racemes in 2-chotomous panicles. Tepala obtuse. Stamens 6—8.

Hooker states that all the north Indian specimens are 3-gynous, all the Peninsular digynous; the absence of flowers in our specimens unfortunately precludes our determining to which group they belong.

An allied plant of this group, *P. perfoliatum*, L., found from Kumaon to Central Bengal, but chiefly along the base of the Himalayas, may possibly occur in our area. It is very easily recognised by the long-petioled broadly ovate sagittate leaves with the petioles and angles of the stem with recurved prickles.

16. P. alatum, Ham.

A much branched weak rambling herb with slender branches glabrous or sparsely hairy, sometimes glandular-hairy upwards. Leaves 5—2" (including the so-called winged petiole, here described as part of the leaf), sessile, elliptic or spatulate-obovate and auricled at the base, membranous, obtuse, sparsely shortly hairy above. Stipules very short obliquely truncate. Flowers .09" long in small bracteate heads of which the lower bracts far exceed the flowers, on slender glandular-hairy peduncles. Bracts not tubular, ovate to ovate-lanceolate, glabrous, not ciliate. Nut trigonous or biconvex.

Only recorded from Parasnath, T. Thomson, Kurz, etc.! Fl. r.s.—Nov.

17. P. capitatum, Ham.

Perennial, with many 6—8" long stems from a short rootstock, ovate or broadly elliptic acute or obtuse leaves .7—1.3" long, with the base suddenly contracted to a very short petiole with 2 auricles at its base, margins of leaves and auricles closely ciliate. Stipules 2—3". Heads globose, pink, 1—3 terminal, .15—2" diam. or sometimes ovoid and .3" long.

Manbhūm, Campbell (teste Gage). It is a hill plant found on rocks and walls, and must have been collected on Parasnath. Fl. May—Aug.

18. P. chinense, L.

A diffuse herb scrambling among bushes to a height of 5 ft. or 6 ft. with broad ovate to deltoid or oblong leaves, usually suddenly cuneate on a slender petiole the base of which is more or less expanded, or with a large auricle. Stipules very membranous. Flowers white or pink capitate; heads 2—3" diam. in axillary and terminal divaricate pubescent and slightly glandular panicles. Bracts scarious, open and shortly tubular, glabrous, acute. Fruiting perianth often fleshy.

Purneah, in cool damp localities! Parasnath, scrambling among rocks! Meghasani, elev. 4000 ft. in shady places! Fl., Fr. Nov.—Jan.

The plant is very variable and two varieties occur in our area:—

Var. α chinense, proper.

Branchlets glabrous except near the nodes. Leaves deltoidly-oblong, mostly 1—3", larger 4.7" by 2.2", membranous, acute or acuminate, base straight except for a short wedge on the petiole, membranous, pellucid-dotted, midrib beneath hairy. Petiole .3—.75" long, basal auricles unequal, often .4" broad. Panicles pubescent and glandular.

Purneah!

Var. β ovalifolia, Meissn.

Branchlets glabrous. Leaves large, ovate acuminate, cuneate on one or both sides of the base, 4—6" by 2—3", margin sometimes ciliolate, otherwise glabrous. Petiole .5—1", auricles small or 0. Stipules over 1" long, but the upper half or more breaking off, base often glandular. Peduncles glandular-hispid.

This is the mountain form, occurring only at elevations of over 3000 ft. in the Central and Southern Areas.

2. RUMEX, L. Dock.

Herbs, usually perennial with stout roots. Radical leaves usually large. Stipules tubular, often disappearing with age. Flowers 1—2-sexual, in paniced or racemed whorls, rarely axillary clusters. Tepals 6 in two series, inner enlarging entire or toothed and often with a tubercle on the midrib in fruit. Stamens 6, anthers basifixed. Ovary 3-gonous, styles 3, stigmas fimbriate. Nut included in the accrescent inner tepals, 3-angled. Embryo lateral, nearly straight; cotyledons linear or oblong.

A. Styles terminal. Flowers 2-sexual. Inner fruiting tepals coriaceous:—

1. Inner fruiting tepals not broadly alate, not much toothed:—

L. narrowed into the petiole, lanceolate

1. *maritimus*.

L. contracted above the cordate base, linear-oblong

2. *nigricans*.

2. Inner fruiting tepals broadly alate, wings irregularly toothed

3. *dentatus*.

B. Styles on the angles of the ovary. Flowers polygamous:—

Inner fruiting sepals membranous, orbicular, reticulate, 2-lobed each end, not tubercled

4. *vesicarius*.

1. *R. maritimus*, L. Golden Dock.

A stout erect annual 1—4 ft. high with angled and deeply grooved stems, lanceolate leaves 3—10" long with the base always narrowed into the slender petiole. Flowers green, yellow-brown in fruit, in few—many-fl. whorls in a leafy panicle. Fruiting tepals, inner 1", rhombic- or oblong-ovate erect, with a lanceolate tip and a large oblong tubercle on the midrib, leaving only a narrow margin, teeth when present long needle-like, several times as long as the tubercle with the tip sometimes hooked.

Marshes. Banks of the Ganges, Santal Parg., Kurz! Fl., Fr. c.s.—h.s.

This plant occurs in Europe. My English specimens have the racemes very dense with the whorls confluent and the acicular teeth are much more numerous. The panicle as in the Indian one has many very narrow leaves nearly to the top.

Lower leaves often oblong-lanceolate 12" by 2.5", waved, petiole 2", upper gradually smaller, becoming linear.

2. *R. nigricans*, Hook. f. Black dock.

An erect less robust annual 6—18" high with angled and grooved stems, more or less narrowly panduriform leaves 6—8" by 1—1.5" with cordate base and leafy or leafless rigid divaricate flowering branches. Fruiting tepals, inner 1.6" lanceolate venose, densely crowded in globose distant or confluent whorls turning black when dry, with very large oblong dark tubercles and lanceolate tips, margins very narrow entire or often with 1—2 short straight teeth or spines. Pedicels short.

Purneah, Cal Herb. Behar, J.D.H. Fl. r.s.

Lower leaves oblong, 6—8" by 1—1.5". Tepals more reticulate than in *maritimus* and teeth less fine; tubercles occupy two-thirds to three-quarters of whole length of tepal.

3. *R. dentatus*, L.

A stout erect herb 2—3 ft. high with habit of *nigricans*, angled and ridged stems and oblong obtuse leaves 2—4" often contracted above

the rounded or cordate base, or the upper ones oblanceolate or linear, often waved or crisped and sometimes papillose beneath. Fruiting tepals $\cdot 17''$ — $\cdot 2''$ long triangular, acute or obtuse, with broad closely reticulate wings and strong unequal spreading teeth, tubercle large oblong smooth.

Behar, *Kutai*! Banks of Soane and Ganges, *J.D.H.*! Palamau, *Wood*! Banks of the Mahanadi, *Angul*! Probably in all districts. Fl., Fr. h.s.

The whorls in my specimens are dense and almost confluent, brown when dry. Panicle not much branched, somewhat leafy. Pedicels about as long as the fruiting tepals with articulation near the base. Reticulation of tepals much raised leaving minute areoles between. Tubercle occupies less than half to two-thirds length of tepals, which have broad uncovered margins. Pedicels much thickened beneath the fruit.

4. *R. vesicarius*, L. Palak, Palang-sag, *H.*; Delali, *Vern.* (Purneah); Chuka-palang, *Beng.*; Bladder Dock.

A pale green annual 6—12'' high, dichotomously branched from the root and rather fleshy. Leaves long-petioled elliptic-ovate, broadly ovate or oblong, 1—3'' long, 3—5-nerved from the cuneate, cordate or hastate base. Flowers mostly geminate in short terminal and leaf-opposed racemes only 1—1.5'' long, polygamous (2-sexual according to *Roxburgh*) on slender pedicels. Inner fruiting tepals large, not tubercled orbicular $\cdot 4$ — $\cdot 5''$ diam. very membranous and reticulate, white or pink, 2-lobed each end, without teeth or marginal nerve.

Cultivated. Bettiah, *Hieronymus*! Purneah, *Burkill*! Manbhumi, *Camp.*! Used as a *sag* as well as medicinally. Native of the Punjab hills.

3. ANTIGONON, *Endl.*

Climbers with the branchlets and rhachis of the inflorescence often passing into tendrils. Leaves with amplexicaul petioles and small stipules, often reduced to a stipulary line. Flowers mod.-sized, coloured pink, white or red in small fascicles which, owing to the reduction of the leaves on the flowering shoots to small bracts, appear in more or less zigzag racemes and panicles. Pedicels articulate. Perianth 5—6-merous, cyclic or acyclic, 3 outer tepals in fruit dry accrescent forming wings. Stamens 7—9 connate at base into a ring with short teeth between the filaments. Ovary 3-gonous with 3 free styles and capitate papillose stigmas. Ovule on a long funicle, at first pendulous, subsequently erect. Nut 3-angular.

1. *A. leptopus*, Hook. & Arn. Sandwich Island Creeper.

A beautiful climber, woody below, with ovate cordate or deltoid somewhat rugose leaves and beautiful pink or white flowers in paniced racemes.

Commonly cultivated. Fl. r.s. and c.s. Native of Mexico.

4. MUEHLENBECKIA, *Meissn.*

Shrubs or undershrubs, in our species with compressed soon leafless green branches and small caducous fleshy leaves, nodes with a stipulary line. Flowers polygamous. Perianth deeply 5-fid, more or less fleshy in fruit. Stamens 8—9, reduced to staminodes or 0 in the female.

Ovary 3-gonous with 3 often very short styles and broad lobed or fimbriate stigmas.

1. *M. platyclada*, Meissn.

An interesting shrub with all the branchlets converted into phylloclades but bearing in the rains small rather fleshy rhomboid leaves. Flowers green and white small in clusters at the nodes. Fruits (including the fleshy perianth) baccate.

Frequently cultivated. Native of the Solomon Islands.

FAM. 112. PODOSTEMONACEÆ.

Aquatics, sometimes moss-like, growing on stones in tropical streams. Stem almost always dorsiventral, branched with leaves or with these confluent into thalloid or frondose laminae. Leaves when differentiated simple distichous, sessile or stalked, generally with a sheath which may be stipuliform. Flowers mostly terminal, often in a many-fl. scape or dichasial shoot-system, naked or arising from a sheath, mostly 2-sexual, sometimes 1-sexual or dioecious. Perianth usually reduced to small ovate or linear scales or altogether absent in which case the young flower entirely enclosed in a spathe (spathella). Stamens hypogynous, 1—many, whorled, or sometimes perigynous, free or connate. Anthers with vertical dehiscence. Ovary free, sessile or stalked, 1—3-celled, with a stout central placenta and very thin septa. Styles 2—3 or one and columnar; stigmas 2—3 or one capitate. Ovules many anatropous, axile (only in one genus parietal). Fruit capsular, septicidal or septifragal, valves 2—3. Seeds many minute with mucilaginous testa and no albumen. Embryo straight, radicle inferior.

1. *LAWIA*, Tulasne.

(*Terniola*, Tul.).

Stems confluent into a lobed thallus appressed to the substratum (filiform and floating in one species not in our area), leaves minute linear or setaceous. Base of peduncle often surrounded by a raised ring or cylinder closely covered with leaves; flower without a spathe. Flowers 2-sexual with 2-lyaline 3-merous perianth, 3 free stamens and 3-celled ovary with very delicate partitions and 3 spreading linear or subulate styles. Placentæ thick forming an axile column with very numerous ovules. Capsule septicidally 3-valved, the septa evanescent.

1. *L. zeylanica*, Tul. Syn. *Terniola zeylanica*, Tul.

A minute lichen-like or moss-like plant with branched thalloid stems closely adpressed to the rocks on which it grows and bearing tufts of papillæ-like or linear leaves on its surface and aggregated round the short cup-shaped flowering branches. Pedicels 3—4" erect bearing a .08—.01" long flower. Tepals 3 oblong rounded .06—.07". Anthers exerted, filaments very slender, flattened. Stigmas subulate. Capsule oblong-ellipsoid, .08" long, slightly 3-grooved, not at all ribbed nor angled until dry, when it appears 3-ribbed.

Forming patches on wet rocks in the rivers of Angul where these flow through shady forest! Fl., Fr. Jan.—Feb.

Branches of thallus not more than .15" broad. Leaves .02—.12".

Willis* reduces all the first six species in the *F.B.I.* to *Lawia zeylanica*; all have leaves over .1" and the shorter-leaved varieties have ribbed capsules. In *Journal of As. Soc. Bengal*, xv, 1919, No. 7, I stated that our plant had not ribbed capsules, but I find that, on drying these become ribbed! No *Lawia* has previously been discovered this side of the peninsula.

FAM. 113. ARISTOLOCHIACEÆ.

Herbs or shrubs, often climbing. Leaves alternate simple entire or lobed, often palminerved, exstipulate.† Flowers often large solitary racemose or cymose, 2-sexual, bracteate or not. Perianth corolline superior, regular or often very zygomorphic, variously shaped, gamo-phyllous with valvate lobes. Stamens 6 or more, subsessile in a ring round the base of the style with which they are often combined into a column or gynostemium, if free filaments short and thick, anthers with longitudinal dehiscence. Ovary inferior, rarely almost superior, 4—6- but rarely 5-celled, stigma rayed. Ovules many, anatropous on parietal placentæ which are free or meet in the axis or placentæ axile. Fruit capsular or coriaceous and bursting irregularly. Seeds many with copious albumen and small or minute embryo.

1. ARISTOLOCHIA, L.

Leaves entire or lobed, often with a stipule-like bract in their axils. Perianth-tube inflated at the base, then contracted and above with a dilated oblique 1—2-lipped limb (very large in some garden species). Anthers 6, rarely 5 or more than 6, column very short, 3—6-lobed above. Capsule septicidally 6-valved or splitting through the placentas, thin-walled and the dehiscence frequently carried down into the pedicels which become 6-partite. Seeds flat (in our species) often with the remains of the placenta attached.

Flowers solitary. Bracts large orbicular:—

Stems prostrate. Leaves glaucous beneath 1. *bracteata*.
Flowers mostly in 1—many-flid. racemes or clusters. Bracts
small:—

L. linear to panduriform, not deeply cordate, 2—4" long 2. *indica*.
L. lanceolate to lanc.-ovate, deeply cordate, 3—10" long 3. *tagala*.

1. *A. bracteata*, Retz.

Stems slender, prostrate, 12—18" long with reniform or broadly ovate leaves 1.5—3.5" both ways, cordate at base with a broad shallow sinus, glaucous beneath, finely reticulate. Flowers 1.3—1.75" long (excluding the .2" ovary), solitary, with a large orbicular bract at the base of the peduncle. Perianth subglobose at the base, then cylindric with a trumpet-shaped mouth and dark-purple linear lip as long as the tube. Capsule .6—.75", oblong-ellipsoid, 12—ribbed. Seeds deltoid slightly cordate at base, .25".

* *Annals of the Royal Botanic Gardens, Peradeniya*, vol. i, pt. 4, Sept., 1902.

† The intrapetiolar stipule-like appendages of many species of *Aristolochia* are strongly developed bracts of suppressed or finally developed axillary shoots.

West Behar, *Bengal Plants*. But there are no specimens either at Kew or Sibpur, and it is possibly recorded on the basis of its general distribution: Bundelkhand, etc. Fl. Aug.—Nov.

2. *A. indica*, L. Bai-bolena, Oyidi, Or.; Isharmal, H.; Isror (Gaya); Gad, S.

A glabrous herbaceous or shrubby perennial with a woody rootstock, slender sulcate branches and usually panduriform leaves 2—4" by 1—2" with acuminate apex and 3—5-nerved base. Flowers 7—1.5" long, 2—7 in a very short raceme or sub-clustered, with lanceolate acuminate bracts .07" long. Perianth globose at the base .25" diam. and slightly 6-grooved, then narrowly tubular for 5—6" and bent nearly at right angles to previous axis, with a purple dilated or obliquely trumpet-shaped mouth 3" diam. notched in front and produced obliquely behind into an oblong strap-shaped brown-purple appendage or lip 5—7" long with revolute margins. Capsule subglobose or broadly oblong and narrowed into pedicel, 1—1.8" diam. at broadest part, dehiscing from the base, after dehiscence parachute-like, the dehiscence being continued into the clavate pedicel which divides into 6 strands continuous with the midribs of the valves which remain united above. Seeds deltoid or triangular, flat, winged, .03", wings membranous.

In open jungles. Gaya Hills! Manbhum, Kurz (near Raneeganj)! Santal Parg., *Hastlett*! Puri, frequent on the sandstones! Angul! Mayurbhanj! Fl. June—Oct. Fr. Nov.—March, but the parachute-like old capsules may be found up to the end of the hot season. Deciduous and sometimes dying back to the root.

Leaves sometimes vary from linear to obovate, but in our specimens they are always sub-panduriform (constricted above a broad base) and broadest above the middle. Petiole slender .25—5". Pedicels 2—3" thickened upwards. Hypanthium .2—2.5", 6-ridged, with a solid beak .1—1.5" long. Limb of perianth somewhat villous with a recurved villous margin and lip with revolute margins, throat and lip puberulous below, glabrous above the middle. Stigmas 6 fleshy, sessile on the top of the column in a ring round a depressed centre.

Roxburgh says that the root is nauseously bitter. A decoction is used for fever in Gaya. The plant is supposed to ward off snakes by the Oriyas and to be a cure for snake-bite by the Santals. This is probably from the fancied resemblance of the flower to the head of a serpent and is interesting, inasmuch as several species have enjoyed a similar reputation in both North and South America (f. *Solereder*).

3. *A. tagala*, Cham. Syn. *A. Roxburghiana*, *Klotzsch*.

A more robust twiner than the last, with large lanceolate or ovate-lanceolate leaves 3—10" long (on same plant) finely acuminate at apex and with deeply cordate 5-nerved base. Flowers very similar to those of the last species 1—2" long, in 1—2-nate short several-fl'd. racemes with ovate-acuminate small bracts. The tubular portion of the perianth is usually oblique to the globose base and curved, but not at right angles to it, lip deep purple (sometimes described as pale green). Fruit as in the last but larger. Seed flat triangular with rounded corners, wings thick and pithy, nucleus verrucose on one face; but *Hooker* states that they are very variable.

Frequent in open jungles in the Sikkim Tarai and Duars, and probably occurring therefore in Purneah. Fl. April—May. Fr. May (of succeeding year?)

The embryo is only .02" long and the very minute linear cotyledons much shorter than the tigellus.