

THE BOTANY OF BIHAR AND ORISSA.

PART II.

NOTE.—Part I, not yet issued, will contain the Introduction and General Remarks on the Botany of the Province.

The order of the Families is that of the 'Flora of British India,' except that the Samydacæ have been included with the Flacourtiacæ, the Aizoacæ have been placed next to the Portulacacæ, and the Euphorbiacæ have been introduced between the Malvales and the Geraniales. With the last exception the artificial group of the Apetalæ is being retained to facilitate reference with Herbaria, the 'Flora of British India,' and other Provincial Floras. The approximate positions of the apetalous families among their petalous allies will be indicated as far as possible in the Introduction.

Part II contains families to the end of Thalamifloræ as detailed below:—

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|--|----------------------|--------------------|
| 1. RANUNCULACEÆ. | 18. PORTULACACEÆ. | 36. RUTACEÆ. |
| 2. DILLENiaceÆ. | 19. AIZOACEÆ. | 37. SIMARUBACEÆ. |
| 3. MAGNOLIACEÆ. | 20. ELATINACEÆ. | 38. OCINACEÆ. |
| 4. ANONACEÆ. | 21. TAMARICACEÆ. | 39. BURSERACEÆ. |
| 5. MENISPERMACEÆ. | 22. HYPERICACEÆ. | 40. MELIACEÆ. |
| 6. BERBERIDACEÆ. | 23. GUTTIFERACEÆ. | 41. ICACINACEÆ. |
| 7. NYMPHÆACEÆ. | 24. TERNSTRÆMIACEÆ. | 42. OLACACEÆ. |
| 8. PAPAVERACEÆ. | 25. DIPTEROCARPACEÆ. | 43. ILACACEÆ. |
| 9. FUMARIACEÆ. | 26. MALVACEÆ. | 44. CELASTRACEÆ. |
| 10. CRUCIFERÆ. | 27. STERCULIACEÆ. | 45. HIPPOCRATACEÆ. |
| 11. CAPPARIDACEÆ. | 28. TILIACEÆ. | 46. RHAMNACEÆ. |
| 12. VIOLACEÆ. | 29. EUPHORBIACEÆ. | 47. AMPELIDACEÆ. |
| 13. BIXACEÆ. | 30. CALLITRICHACEÆ. | 48. STAPHYLEACEÆ. |
| 14. FLACOURTIACEÆ *
(WITH SAMYDACEÆ). | 31. LANACEÆ. | 49. SAPINDACEÆ. |
| 15. PITTOSPORACEÆ. | 32. MALPIGHIACEÆ. | 50. SABIACEÆ. |
| 16. POLYGALACEÆ. | 33. ZYGOPHYLLACEÆ. | 51. ANACARDIACEÆ. |
| 17. CARYOPHYLLACEÆ. | 34. GERANIACEÆ. | |
| | 35. BALSAMINACEÆ. | |

Where no synonyms are given the name is used in the same sense as in the 'Flora of British India.' Adherence to the International Rules has caused, unfortunately, several departures from the names used in that monumental work, and doubtless there are cases where changes should have been made in conformity with those rules, but have escaped attention. In a few cases, however, well-known names have been retained

in spite of those Rules. Several names have become familiar, not only to botanists, but to all Indian residents who take an interest in silviculture or gardening, and I have thought it preferable to retain these, provided, of course, that they are not incorrect, while adding the new name as a synonym.

FAM. 1. RANUNCULACEÆ.

Herbs or shrubs with alternate or (Tribe Clematidæ) opposite, usually exstipulate often compound leaves with sheathing petioles. Flowers regular or irregular. Sepals often petaloid. Petals hypogynous, variable, sometimes 0 or reduced or modified into nectaries. Stamens many, hypogynous, anthers usually adnate and dehiscing laterally. Ovary apocarpous (very rarely syncarpous, e.g. *Nigella*), carpels usually many, often spirally arranged on an elongate torus, 1-celled with 1 or more anatropous ovules on the ventral suture, ovules erect or pendulous. Fruit a head of achenes or follicles (connate in *Nigella*). Seed albuminous, embryo minute.

- I. (Clematidæ) climbing shrubs. L. opposite, sepals petaloid.
 Petals 0. L. with terminal leaflet (rarely simple) 1. *Clematis*.
 Petals linear. L. with terminal tendril 2. *Naravelia*.
- II. Herbs. L. radical or alternate.
 A. Sepals petaloid. Petals 0, or nectarial. Carpels few.
 Fls. very small paniced. Carpels 1-ovuled 3. *Thalictrum*.
 Fls. m.s. solitary. Carpels many-ovuled 4. *Nigella*.
 B. Sepals sepaloid. Petals usually 5. Carpels many 5. *Ranunculus*.

1. CLEMATIS, L.

Shrubs, usually climbing by means of their twisted petioles. Leaves opposite, usually pinnately compound and ending in a terminal leaflet. Stamens many. Carpels many, distinct in fruit, and ending in a long feathery persistent style or naked beak. Ovule 1, pendulous.

- A. L. compound. Filaments hairy.
 L. not tomentose. Fls. white or cream 1. *nutans*.
 L. tomentose beneath. Fls. yellow tomentose 2. *Wightiana*.
 B. L. compound. Filaments glabrous. Fls. white 3. *gouriana*.
 C. L. simple. Fls. purple 4. *smilacifolia*.

1. *C. nutans*, Royle. Bonga ghanti, S.

A climbing shrub with angled silky pubescent branchlets and 1-2-pinnate leaves with coarsely toothed simple or lobed leaflets and large cream-coloured flowers on axillary leafy branchlets, long peduncled.

Champan (Sameshwar Hills)! Singbhum, on Hamatite rocks, above 2000 ft.! Manbhum, 3000 ft. Grieve! Hazaribagh (Baragaou) Wood! Ranchi (Kerhang, 2500 ft.) Gamble! Fls., Fr. Nov.—Jan.

Larger leaflets, 2.5—3", ovate with cordate base, smaller ovate-lanceolate, acuminate, shortly hairy. Buds oblong acute, over 1", beautifully silky. Sepals suberect 1—1.5", with curled tips. Filaments villous.

Var. *patens* (F. C. N.).

Buds ovoid, under 1". Sepals spreading, 1" by .5", 5—7-nerved. Sundi Buru, Porahat!

2. *C. Wightiana*, Wall.

This is easily distinguishable by the pinnate leaves being yellowish-tomentose beneath. Leaflets usually 5-lobed and serrate. Flowers yellow brown-tomentose outside.

Flowers February—March.

Flowers small, racemed or paniced. Sepals 4—5, petaloid. Petals 0. Stamens ∞ . Carpels few or many. Ovule 1-pendulous. Fruit a small head of achenes.

1. *T. foliolosum*, DC.

A very graceful fern-like erect herb 3—4 ft. high with 3-pinnate leaves, the ultimate pinnæ with usually ternate roundish lobulate leaflets .25—7", rarely 1.5" diameter. Flowers small, green, white or purplish, on capillary pedicels in ample terminal panicles. Stamens exerted on filiform white or pink filaments. Carpels 4- (—5-1) ridged.

The higher hills of Chota Nagpur, 2500—4000 ft. Ichadag (Ranchi)! Neterhat (Palamau)! Sirguja, Clarke! Parasnath (Hazaribagh)!

Distribution: Temp. Himalaya, Khasia Hills, Upper Burmah, Delira-Dun (U.P.), Ganjam (?). * Fls. June-Aug., Fr. July-Sept. Perennial.

Stipules not distinct from the leaf sheath. Leaflets pale, glaucous beneath, venose. Pedicels .3—6". Petals .1", linear-oblong, minutely gibbous at base, caducous. Anthers yellow linear. Achenes .12", turbinate, 8-ridged.

2. *T. javanicum*, Blume.

A similar but less robust herb, easily distinguished by the better developed stipules, the club-shaped filaments, numerous carpels, and also, less generally, by the more ternate divided leaves and thicker, more venose leaflets.

Parasnath (Hazaribagh), J. D. Hooker.

4. NIGELLA, L.

Erect annuals with pinnately dissected leaves. Flowers moderate sized, terminal, white blue or yellowish, sometimes with an involucre of lacinate bracts. Sepals 5, imbricate, petaloid. Petals 5, transformed into nectaries, 2-fid, clawed. Carpels 3—10, connate, except sometimes at the extreme top. Ovules 2-seriate. Fruit sub-capsular, the follicles being only free above, splitting through the inner top and finally sometimes also through the style and down the back.

1. *N. sativa*, L. Syn. *N. indica*, Roxb. Mugrela, Kalajira, Vern.

A pretty herb 1—2 ft. high, with 2—3-pinnatisect leaves 1—2" long cut into linear or linear-lanceolate segments, and solitary long-peduncled pale blue flowers .8—1" diam. with ovate, acute, clawed sepals. Nectarial petals 8, geniculate, with a saccate gland in the knee, one on the face and one on the apex of each lobe. Carpels (3—) 5, styles .3—4" long, persistent, capsule .5" long.

Fls., Fr. Feb.—April. Sometimes cultivated and an occasional weed of cultivation in the Gangetic plains. Seeds pungent, aromatic and stimulant; used by the natives in their curries.

5. RANUNCULUS, L.

Herbs with simple, lobed or dissected leaves with sheathing petioles. Flowers small to large, often paniced. Sepals 3—5, sepaloid, imbricate. Petals usually 5, rarely 0, with often a gland near the base. Carpels ∞ styles very short. Ovule 1, ascending. Fruit of beaked or apiculate achenes.

* Specimens named *T. javanicum* in the *Cal. Herb.* collected by Gamble from Palamau and Mahendragiri (Ganjam) not in flower nor fruit appear to be *T. foliolosum*.

1. *R. pensylvanicus*, L.

An erect buttercup with fibrous roots, erect hairy stems, 1—2 ft. high, and yellow flowers 7—8" diameter. Heads of achenes large, up to 4" long, globose-ovoid. Achenes smooth and glabrous, not pitted, 12" long, distinctly margined.

Along streams in the higher hills of Palamau, especially abundant at Koorgee below Neterhat, elevation about 3000 ft. Fls. May-July, Fr. June-Aug.

Distribution: Upper Burma (Maymyo), Assam and Khasia Hills, Nepal, Oudh, also China and N. America.

Stems sulcate, branched. Radical and lower stem leaves 3-foliolate with 3-sect leaflets and petioles, 2—4"; uppermost sessile on a short sheath, ternatisect. Leaflets 1—1.5", hairy beneath and less so above, lobed and coarsely serrate. Peduncles corymbose, erect, stout. Receptacle oblong, hairy. Sepals at first spreading, then reflexed and membranous, oblong, 2", hairy. Petals 3—3.5", oblong, rounded, with an orbicular scale at base.

Differs from the usual type of *R. pensylvanicus* in the broader oblong leaf-segments.

2. *R. sceleratus*, L. Celery-leaved Crowfoot.

An erect, glabrous annual, 1—2, rarely 3 ft. high, much branched, with usually 3-partite leaves, the segments cuneate and again lobed. Flowers small, 2.5—3" diameter, numerous, terminating the branchlets and from the forks. Achenes many, rather turgid, not margined, glabrous on an oblong hairy receptacle.

In the northern tract, in wet places chiefly on the west. Champaran! Fl., Fr. c.s. to March.

Stems fistular. Lower L. petioled, 3-sect, upper sessile, uppermost often simple linear lanceolate. Sepals spreading and reflexed, somewhat pubescent outside. Petals scarcely exceeding the sepals.

The plant is very acrid. It is a common European plant near the sides of ponds and streams.

FAM. 2. DILLENIACEÆ.

Trees or shrubs with simple alternate, often large and strongly-nerved entire or toothed exstipulate leaves with sheathing base to the petiole. Flowers usually large, yellow or white. Sepals 5, rarely more, imbricate persistent. Petals 5, rarely fewer. Stamens many, hypogynous, sometimes connate below; anthers innate, dehiscing laterally or by terminal pores. Carpels 1 to many, whorled, free, or cohering in the axis with free styles. Ovules 1 to many, amphitropous, placentation various but raphe ventral. Fruit follicular, capsular or baccate. Seeds arillate, albumen fleshy, embryo minute next the hilum.

1. DILLENIA, L.

Trees with large leaves and very strong pinnate venation. Flowers solitary or fascicled. Stamens nearly free, filaments not thickened upwards, anthers linear, inner introrse, outer recurved extrorse. Carpels 5—20, cohering in the axis, styles stigmatose, ovules indefinite. Fruit composed of the enlarged fleshy imbricate sepals enclosing the ripe indehiscent carpels.

Fls. large white. Fr. 4" diam. 1. *indica*.
 Fls. large yellow, 3—4" diam. Fr. 2" diam. 2. *aurea*.
 Fls. moderate sized, yellow, 1—1.5" diam., clustered. Fr. .75" 3. *pentagyna*.

1. *D. indica*, L. Korkotta, K., S.; Chalta, Hargcza, Beng.; Oao, Or.

A rather small but beautiful tree with a dense crown; deep green leaves 8—10" by 2—4" and white solitary flowers 5—6" diameter.

Very frequently planted, but probably only wild in northern Purneah. In its undoubtedly wild state (as in the Duars) it is found along muddy streams. Wild in Hindol, Kalahandi and Bonai, *teste* Cooper. It does not thrive in dry districts. Fls. May—June. Fr. Sept.—Feb. Evergreen.

L. lanceolate, pubescent beneath, with 30-40* close parallel secondary nerves, each running into a strong tooth. Petiole 1—2". Carpels 20.

The large fleshy accrescent calyces which form the outer covering of the fruit are eaten before they are quite ripe, usually after cooking. The wood is not much used. Hamilton, who mentioned it as scarce in Purneah, says that it is used by the joiners.

2. *D. aurea*, Sm. Korkotta, K., S.; Aghai, Th.; Keringila, Karmata, Gond.; Rai, Or.

A small, crooked tree with obovate broadly oblong or elliptic leaves 12—20" by 4.5—7" with a distinct petiole 1—3" long. It bears large solitary beautiful yellow flowers terminating the leafless branches (when it has been repeatedly mistaken for *Cochlospermum*, though the habit and trunk are quite different.)

Throughout the province, from Bettiah! to Sambalpur! and Puri! in hilly districts. Very common in places on clay schists, trachyte or grit. Ascends to 3000 ft. at Neterhat! Fls. April-May. Fr. May-June. L. drop at end of Jan. and are renewed end of May.

Attains 3—4 ft. girth, with nearly smooth light-coloured bark. Blaze dark crimson, usually with a light crimson border inside and outside the darker belt. In leaf it is often confounded with *D. pentagyna*, from which it is distinguishable by both habit and habitat. The L. are usually smaller, when young beautifully silky above, tomentose beneath between the 25—50 close strong secondary nerves, spinulose-denticulate; adult pubescent or somewhat hairy beneath, with margin subentire except for the excurrent nerves. Peduncles lateral but close to the terminal bud, stout pubescent, 1—3" long, with 3—4 recurved bracts. Sepals .75—1". Petals obovate-lanceolate, 3" by 2". Styles 10, .5", spreading and recurved. Ovules many, 2-seriate in each carpel.

Wood reddish brown, only used as fuel; makes a good charcoal. Fruit edible and is greedily eaten by wild elephants, which destroy the trees to obtain them.

This is probably the tree called "Dengr" by Hamilton in his account of Purneah: "A fine species of *Dillenia* with a large fine yellow flower. Fruit about size of a large apple and used as an acid in seasoning." But I have never seen the fruit the size of a large apple, but rather a small one.

3. *D. pentagyna*, Roxb. Rai, K.; Sahar, S.; Aghai, Th.; Agor (Monghyr).

A moderate-sized often straight tree with elliptic or narrowly elliptic leaves 12—36" long, decurrent and amplexicaul, scarcely petioled. Flowers very numerous in umbels along the leafless branches.

Along the northern boundary, especially in Purneah! In the central and southern tracts confined to the valleys, especially at the higher elevations, and not very

* The number of secondary nerves always refers to the number each side the words "each side" being understood.

common, though occurring in all districts! Angul, common! Fls., March-April. Fr. May. Deciduous end of Feb. to May.

Attains 4—5 ft. girth. Blaze light crimson, or streaked light crimson and white. L. much as in last but adult nearly or quite glabrous between nerves beneath, margin repand crenate and together with the excurrent nerves forming teeth; base much more tapering than in *D. aurea*, most often forming a wing on the petiole, which hence appears absent or is under 1" long. Peduncles slender, 1—2", ebracteate. Carpels 5.

"The wood is reddish grey and durable but liable to warp and split" (*Gamble*). It gives an excellent charcoal. The fruit is eaten. The tree is sensitive to frost but is difficult to kill by girdling.

FAM. 3. MAGNOLIACEÆ.

Trees or shrubs with simple alternate entire leaves, usually with convolute stipules sheathing the bud and leaving a circular scar (resembling some *Urticacæ* and *Moracæ*) on falling. Flowers axillary and terminal, often showy, white, yellow or red, sometimes unisexual. Sepals and petals often subsimilar, arranged in trimerous whorls, free, hypogynous, soon falling. Stamens ∞ , free or monadelphous; anthers basifixed, cells adnate. Ovary apocarpous, carpels often on an elongate axis, sometimes partly cohering and in one whorl (*Illicium*); styles stigmatose on the inner surface. Ovules 2 or more on the ventral suture, anatropous or amphitropous. Fruiting carpels baccate, follicular or dry. Seeds 1 or few, testa single or double, albumen present, sometimes oily. Embryo minute, cotyledons spreading, radicle next the hilum.

Talauma (from the Himalayas) is occasionally cultivated in our area, as also are species of *Magnolia*. Oil of anise is obtained by distillation of the fruits of the Star Anise (*Illicium verum*)—an American species.

Carpels on a stalked gynophore. Ovules 2—12

1. *Michelia*.

Carpels on a sessile gynophore. Ovules 2.

Carpels dehiscent persistent

Magnolia.

Carpels indehiscent, deciduous.

Talauma.

1. MICHELIA, L.

Trees, sometimes flowering as shrubs. Stipules convolute, leaving a circular scar. Flowers solitary, white or yellow. Perianth leaves in 3 or more 3-merous series. Filaments flat with introrse anthers. Carpels spiral on an elongate axis which is on a gynophore, coriaceous and dorsally dehiscent in fruit.

1. *M. champaca*, L. Champa, Champaka, H., Or.

A large tree 60—80 ft. high and 6—7 ft. girth with rusty tomentose shoots, oblong-lanceolate or ovate-lanceolate long-acuminate leaves attaining 12" by 4", and sweet-scented yellow flowers 2" diam. Fruiting spike of sub-sessile carpels 3—4" long.

A rare and beautiful tree inhabiting deep valleys cooled by springs in the Saranda forests (especially Tholokabad and Karampada) in Singbhum! Palamau Neterhat, 3000 ft., rare! Common in Mayurbhanj above 2500 ft. in the valleys! Bonai (*Cooper*)! "Many very fine trees up to 10.5 ft. girth in the Korari valley (Bonai)" (*Cooper*). Khuldia, Nilgiri State, *Cooper*. Purneah, not very common

(Hamilton). Often planted! Fls., April-May. Fr. July. Evergreen. New L. in April.

Bark pale grey, smooth. Blaze hard, mottled cream and orange. L. softly tomentose when young, adult rusty-hairy on the strong secondary nerves beneath, very reticulate between; secondary nerves about 15 looped within the margin. Petiole .75--1". Peduncle with 2 coriaceous silky caducous bracts which sheath the young flower-bud and leave an annular scar below it. Ovules 10--12, 2-seriate. Seeds scarlet.

"Wood soft, even-grained, heart-light olive-brown. Very durable. Weight 37 lb. Experiments with Ceylon wood gave co-efficient of transverse strength 3.488 tons per sq. in. Co-efficient of elasticity 502.15 tons per sq. in." (Gamble).

This valuable tree has been neglected in the past and I have seen it removed in favour of Sal. than which it is much more valuable. It is very sensitive to frost and seedlings require protection.

FAM. 4. ANONACEÆ.

Trees or erect or climbing shrubs usually with lanceolate scaleless buds and alternate exstipulate, simple entire leaves, which are often pellucid dotted. Flowers often greenish and pendulous, sometimes bright-coloured and showy, perianth leaves in 3 (rarely 2, in *Anona*) 3-merous whorls, outermost "sepals" small. Stamens ∞ with adnate anthers, connective often produced or dilated. Carpels few or many, free (connate in *Anona*), on a rounded torus, usually stalked in fruit and resembling an umbel of distinct fruits, indehiscent, 1- or more-seeded. Seeds large with copious albumen and small embryo. The ruminant, often deeply laminate endosperm of the seeds is very characteristic of this family.

Quite small L. very frequently occur on the twigs below the normal-sized ones.

- A. Stamens closely packed with broad overlapping connectives which conceal the anther cells.
1. Tepals in two series, or those of third series very small. Carpels sub-connate; connate and fleshy in fruit. 1. *Anona*.
 2. Tepals in three series (or 2 in *Unona longiflora*), inner two series petaloid, subsimilar. Carpels free.
 - a. Petals with spreading limb but concave connivent bases hooded over the stamens 2. *Artobotrys*.
 - b. Petals without concave hooded bases.
 - Scandent shrubs. Petals orbicular, outer imbricate . 3. *Uvaria*.
 - Scandent shrubs or small trees. Petals valvate. Ovules 2--6 4. *Unona*.
 - Erect trees or shrubs. Ovules 1--2 . 5. *Polyalthia*.
- B. Stamens loosely imbricate, connective narrow, not concealing the anther cells.
1. Outer two series of tepals small sepaloid, third series "petals" larger petaloid.
 - Base of petals not saccate. Ovules 1--2 . 6. *Miliusa*.
 - Base of petals saccate. Ovules 6-many 7. *Saccopetalum*.
 2. Outermost series of tepals small sepaloid, inner two series "petals" petaloid. Ovules 4-many. 8. *Alphonsca*.

1. ANONA, L.

An exotic genus of which species have become naturalised in India. Leaves pellucid dotted. Petals (second series of perianth leaves) triquetrous with concave base. Carpels sub-connate, ultimately confluent into an ovoid or globose syncarpous fruit. Carpels 1-ovuled.

1. **A. squamosa**, L. Nenwa, Mandal, K.; Mandargom, S.; Sitaphal, Beng.; Saripha, H.; Ata, Or.; The Custard Apple.

A shrub or small tree with oblong or oblong-lanceolate leaves, the larger 4" by 1.25" to 6" by 2", acute, obtuse or sub-acuminate, nearly glabrous, pellucid-punctulate and slightly scented. Flowers drooping, yellowish green, .75—1.25" long; petals narrowly-oblong, third series of petals minute or 0. Fruit tubercled.

Completely wild now in the jungles of western Palamau, and on the scrub-hills of Hazaribagh and Manbhum. Also run wild over the northern hills of the Santal Parganas. Judging from the native names its introduction must be exceedingly ancient. Fls. March-May. Fr. July-Sept.

Cultivated largely, and is one of the fruits that thrive in Chota Nagpur. The root and L. are used medicinally and are a valuable insecticide.

2. **A. reticulata**, L. Gom., S.; Anta, Ramphal, H.; Barhial, Or. Bullock's Heart.

Leaves larger, 5—8", acuminate glabrous. Flowers 2—3, together, innermost tepals narrow-oblong. Fruit larger, areolate, but not at all tubercled. Occasionally cultivated, very common in Furneah.

Fruit December.

2. ARTABOTRYS, R. Br.

Sarmentose or scandent shrubs with shining leaves. Flowers solitary or fascicled, usually on woody hooked branches. Sepals 3, valvate. Petals 6, 2-seriate, with concave connivent bases and spreading limb which is flat, sub-terete or clavate. Stamens with dorsal anther cells. Carpels few or many with oblong or columnar style and 2 erect collateral ovules. Ripe carpels baccate.

1. **A. odoratissimus**, R. Br. Champa, H.

A large sarmentose glabrous shrub shining oblong or lanceolate leaves 2—8" long and solitary or paired green flowers turning yellow, on hooked or circinate ultimately woody peduncles. Petals 1—1.75" long. Ripe carpels large, green or ultimately yellow.

Fls. April—June and r.s.

Cultivated in gardens, and has a heavy Jasmine odour.

3. UVARIA, L.

Sarmentose shrubs, more or less stellately pubescent or scaly on the shoots. Flowers solitary, terminal or leaf-opposed, or 1—4 on abbreviated lateral branches, red (in our species). Sepals 3, valvate. Petals 6, large, orbicular or oblong, somewhat concave. Carpels many, linear oblong, when ripe ovoid or oblong, stalked, sub-baccate, more or less furrowed between the seeds.

L. soft pubescent or hairy. Buds tomentose

1. *Hamiltoni*.

L. glabrous and shining. Buds with scaly warts

2. *turida*.

1. **U. Hamiltoni**, H. f. & T. Selauli, K.; Lakankuli, Or.

A very large woody climber, often with circinate branchlets. Shoots rusty tomentose with elliptic or oblong-obovate, finely, but sometimes

shortly, acuminate strongly-nerved leaves stellately-tomentose beneath and deep scarlet flowers 2" diameter. Ripe carpels .5—1", oblong, tomentose, many-seeded, on stalks .75—1" long.

In damp, shady valleys and stony ravines. N. Champaran! Singbhum, frequent! Santal Parganas! Angul! Mals of Puri, common! Mayurbhanj! Monghyr, *Ham.*

Fls. May—July. Fr. sometimes persistent till Dec. Evergreen.

L. from 3" by 1.25" to 12" by 5.25" on the same twig, elliptic or mostly obovate, base somewhat cordate. Secondary nerves about 18. Peduncle 1—3", bracteate.

2. *U. lurida*, H. f. & T. Gaichiria, Or.

A large woody climber with black bark closely marked with white lenticels. Leaves 4—9", coriaceous, very polished above, oblong or elliptic-oblong acuminate. Flowers 1—1.5" diameter, crimson inside, reddish brown outside, solitary, leaf-opposed on stout peduncles .5—8" long, which together with the rounded pyramidal flower buds are closely covered with stout brown tomentose papillæ or tubercles.

Damp forests, Puri Division, frequent!

Fls. Jan.—May.

Young twig verrucose, with small stellate scales, when dry with netted striæ. Buds densely stellate-tomentose. L. larger, 8" by 2.5", spreading, with stellate brown hairs beneath when young. Secondary nerves 12—18, not strong and not reaching margin. Petioles .25", curved. Peduncles leaf-opposed or appearing terminal. Sepals 3, ovate, brown, .4—5", verrucose or submucronate. Petals concave, orbicular-obovate, scaly-tomentose outside and minutely tomentose within, united at the base. Stamens cuneate. Fr. carpels .7—1.2" long on stalks 1—3" long.

Branches sometimes root in the ground and send up a new erect stem.

NOTE.—This is the plant described as *U. Hookeri*, King, *U. Narum*, var. *macrophylla*, F. B. J., in Bengal plants from a solitary twig in the *Cal. Herb.*, from Baruni Hill, Orissa, without flower or fruit. I have collected it in the same locality. The strongly warted appearance of the calyx and peduncle is absent from all varieties of *U. Narum*. The Orissa *U. lurida* only differs from the N. E. Indian plant by the somewhat smaller flowers.

4. UNONA, L.

Small trees or sarmentose shrubs, the oblong minutely punctulate leaves with strong marginal and secondary nerves. Flowers solitary. Sepals 3. Petals 6 (or 3 only in *U. longiflora*), valvate or open in bud, more or less permanently cohering by their margins in *U. longiflora*. Stamens cuneate. Carpels numerous. Style ovoid or oblong, recurved. Ovules 2—8. Ripe carpels many, elongated and moniliform.

Spreading or sarmentose shrub. Petals 6, free

1. *discolor*.

Erect shrub or small tree. Petals 3, cohering

2. *longiflora*.

1. *U. discolor*, Vahl.

A large usually sarmentose shrub with finely striate slender twigs, oblong or oblong-lanceolate leaves 4—7" long, glaucous beneath, with fine prominent secondary nerves, green or yellowish odorous flowers with petals 1.5—2.5" long, and numerous moniliform carpels with 2—6 joints.

Damp forests of Puri Division (Khurda, Silingpara, Barberah)!

Fls. April—May. Fr. Sept.—Jan. Evergreen.

Innovations rusty hairy. L. sometimes only 2" at base of shoot, acute or acuminate, shining above, beneath finely appressed, hairy or glabrescent. Base rounded or sub-cordate. Secondary nerves about 10—13. Petioles 2—4", pubescent. Peduncles lateral, silky, slender, 7", woody, and 1.5" in fruit. Sepals lanceolate, 3". Petals narrow, lanceolate, inner shorter. Fruiting carpels sub-tomentose; joints 2—2.5" diameter, lowest shortly stalked.

The B. & O. specimens belong to var. *pubiflora* of the F. B. I., with beautifully silky flowers.

(Roxburgh, *Fl. Ind.*, ii, 669 is referred to this species in various works, but he describes it as a pretty large tree, and says that the wood is employed for various purposes, but chiefly for rafters!)

2. *U. longiflora*, Roxb.

A small tree with large oblong leaves attaining 10.5" by 4", dark and shining above, whitish beneath, slightly furfuraceous on the nerves, otherwise glabrous. Flowers remarkably long and pendulous, up to 6 in., yellow outside, reddish within, on filiform peduncles.

Damp forests of Puri Division (in the Mals)! Fls. April-May.

Twigs puberulous. Buds rusty tomentose. L. shortly cuspidate, rarely acuminate, base obtuse; secondary nerves strong, 10—13, with scalatiform tertiaries. Petioles stout, somewhat corrugate, 4—6". Fls. with linear-lanceolate acuminate petals, often cohering by their margins above. Ripe carpels about 14 3—4 jointed, but all joints except lowest often falling.

The flowers are described as deep purple in a Khasian specimen.

5. POLYALTHIA, Blume.

Straight-growing trees, rarely shrubby (*P. suberosa*), with distichously spreading leaves. Flowers clustered, rarely solitary, often on small tubercles and extra-axillary. Sepals 3. Petals 2-seriate, flat. Carpels indefinite, succulent and 1-seeded in fruit. Ovules 1—2. Seeds usually 1.

- | | |
|---|-------------------------|
| A. Branchlets soon glabrous. Petals linear. Trees. | |
| Cultivated only. L. narrow, lanceolate undulate | 1. <i>longifolia</i> . |
| Forest tree. L. oblong | 2. <i>simiarum</i> . |
| B. Branchlets pubescent. Petals ovate or oval. Small trees. | |
| Leaves caudate acuminate. Small tree | 3. <i>cerasioides</i> . |
| Leaves obtuse or rounded. Small tree or shrub | 4. <i>suberosa</i> . |

1. *P. longifolia*, Benth. & H. f. Deodar, Debdar, Asok, Vern.

A straight tree with narrowly-lanceolate glabrous long-acuminate undulate leaves 3—8" long, and numerous fascicled green flowers with lanceolate acuminate petals 3—5" long. In luxuriant specimens the flowers are racemed on short special lateral branches or elongated tubercles, with slender pedicels attaining 1" long.

Frequent in stations. Evergreen. Fls. and new L. March—April.

Grows best in the more humid districts, where it forms a fine avenue tree and it is often planted near temples.

Gamble says that in Madras it has been used for barrels, as it is tough and bends easily. Weight 37 lb.

2. *P. simiarum*, Benth. & H. f. Ojhar, Wojath, Or.; Dighi Bentia, S.; Champa, Bhuia.

A very straight, tall, handsome tree with elliptic or oblong-acuminate or cuspidate nearly glabrous leaves, 4—10" long, with 12—16 strong parallel secondary nerves. Flowers fascicled, with inner petals 1—1.2"

long, greenish. Carpels numerous, bright orange when ripe, 1.2—1.5" long, ellipsoid, on stalks as long.

Damp forests in the Mals of Orissa! Mayurbhanj! Bonai, *Cooper!* Fls. March-April. Fr. May-June. New shoots June. (In Burma and Duars Fls. June-July.)

Bark smooth, pale with brownish and yellow blaze. Buds and young twigs tomentose. L. usually elliptic-oblong, sometimes obtuse, base rounded, young somewhat hairy on nerves beneath, minutely punctate. Secondary nerves straight and then curved just within the margin, fine but very distinct and raised beneath, with numerous cross tertiaries; marginal nerve distinct. Petiöle .2", stout. Fls. usually from the previous year's branchlets on slender pedicels .8—1.2" long. Sepals short, orbicular. Petals linear, greenish-yellow to purplish (*King*), outer (in my specimen) .8", inner 1.1" long.

The bark is used as a cure for scorpion stings. Its timber is not known to be used.

3. *P. cerasioides*, Benth. & H. f. Sande Ome, *K.*; Panjon, Rida, *S.*; Kudumi, *H.*; Pormossu, *Or.*

A small tree 20—30 ft. with spreading branches, distichous, dark-green, lanceolate or oblong-lanceolate acuminate, more or less pubescent leaves 5" by 1.5" to 8.5" by 3", and usually solitary lateral greenish flowers .5" diam. on bracteate curved pedicels. Fruit an umbel of many slender-stalked, bright red, globose-oblong fleshy carpels .3" long.

Frequent in Singbhum valleys! Manbhum! Along ravines in Santal Parganas! Orissa, frequent! Mayurbhanj! Bonai, *Cooper!* Sambalpur! Hazaribagh and Gaya Ghats!

Fls. April—May. Fr. May—Aug. Renews L. April, nearly evergreen.

Bark not thick, rough, grey. Blaze deep brown, then yellow, only the yellow noticeable in young trees.

Young twigs tomentose. L. sometimes elliptic or ovate when young but always acuminate, base rounded, softly pubescent beneath, when mature softly hairy on the nerves beneath and somewhat hirsute on midrib above. Secondary nerves about 10, oblique and arching forward within the margin. Petiöles .2—2.5". Peduncles from old leaf scars or axillary on the new shoots, solitary (rarely 2—3 on short tubercle), with 2—3 foliaceous deciduous bracts, woody and about 1—1.5" in fruit. Sepals tomentosely hairy, ovate-acuminate, about .3", but sometimes only .15". Petals ovate, .25"—.27", somewhat pubescent, thick. Stalks of carpels .5"—.7". Seed brown, ovoid, .25".

Fruit sweet, eaten. "Wood, weight about 50 lb., said to be used in carpentry and for boat-building" (*Gamble*).

4. *P. suberosa*, Benth. & H. f. Bara Chali, *Beng.*; Burhi chamri, *Or.* (from the wrinkled bark); Lohania mossu, *Or.*

A small erect tree or shrub, often with a remarkably thick corky bark* on the branches, with oblong or oblong-lanceolate leaves 2—5", usually deep glossy green above and with very faint secondary nerves. Flowers green and yellow or reddish, .4—5" long on slender .5—1" peduncles, which are often 2—3 on extra-axillary tubercles. Ripe carpels pisiform red.

In shady forests and generally near streams. Singbhum (*Gamble*), very rare; Puri and Angul forests, common! Nilghiri! Probably in other Orissa States.

Fls. April—May (perhaps later). Fr. Sept.—Dec. New shoots March—April.

* The hypertrophy of the bark of the old branches is often given as a specific character, but this by no means always occurs. The bark is nearly *smooth* on some trees and not at all corky.

Bark brown. Blaze brown and red, hard. Buds and young twigs rusty, hirsutely tomentose. L. attaining 5.5" by 2.2", sometimes slightly obovate, obtuse both ends, shining both sides; young sparsely brown-hairy beneath. Petioles .15", pubescent. The peduncles are on a short extra-axillary branch, only distinguishable when young from a continuation of the peduncle by its colour and slightly greater thickness. Fls. densely silky. Outer petals .25", inner .4", oblong or oval. Drupels broadly ellipsoid, .25—3", reddish, flesh very thin. Stalks of carpels about .3".

6. MILIUSA, Leschm.

Trees. Deciduous in the hot weather and bearing on the new shoots greenish drooping flowers on long pedicels in extra-axillary scorpioid cymes. First and second series of tepals small sepaloid, third series "petals" longer ovate, valvate, not saccate. Stamens and carpels numerous. Carpels linear-oblong with 1—2 ovules, when ripe globose or oblong.

1. *M. velutina*, Hook. f. & Th. Ome, K. S.; Siarbhuks, Kharw.; Domsal, Kari, H.; Kariota, Tharu.; Gandha Palas, Or.; Domgaru, Khond (Angul).

A tree sometimes 4—5 ft. girth, usually branched low, with large or very large broadly ellipsoid or ovate leaves more or less permanently tomentose beneath, and green flowers on very long drooping pedicels in few-flowered extra-axillary scorpioid cymes. Fruiting carpels .6—.75, ellipsoid downy on short stalks. Fruiting peduncles woody, over 1.5", often 3—5".

Throughout the Province in the damper forests from Champaran to Orissa and Sambalpur; common in Chota Nagpur.

Fls. with new small L. in May—June. Fr. June—July. Deciduous end of April.

Bark grey, rather cracked, moderately thick to thick. Blaze dark brown, then thick light brown or dirty brown with lighter streaks. Bark often fluted. All young parts densely, often villously fulvous tomentose. L. 5.5" by 4" to 10" by 6". Sepals lanceolate, scarcely hairy, .15"—.20"; second series like the sepals but .3". Petals ovate to orbicular-ovate, .4—5" (sometimes more, *F. C. N.*, only .3", *F. B. I.*). Carpels many and villous, ovules 2.

Timber used for yokes and axles, "is easily worked and durable" (*Gamble*), and the fruit is eaten. "Wood yellow when fresh cut, grey or greyish-brown when dry, moderately hard. Weight 40 to 50 lb. P. about 835" (*Gamble*).

7. SACCOPE TALUM, Benn.

(Sometimes united with *Milusa*.)

Trees, deciduous in the hot weather. Flowers axillary or in short lateral cymes. First and second series of tepals sepaloid, third series "petals" much larger, petaloid, with saccate base. Stamens and carpels numerous, connective produced, ovules 6 or more.

1. *S. tomentosum*, H. f. & T. Ome, Ombc, K.; Charra, S.; Kirua, H.; Kari, Kharw.; Ione, Kheria; Patmosso, Gandhapalsa, Or.

A small or moderate sized tree with softly pubescent or tomentose shoots, and solitary dark purple flowers on slender pedicels nearly all lateral from the previous year's shoots. Leaves ovate-oblong, obtuse, or with short blunt acumen, aromatic.

Chota Nagpur throughout, but especially common in Palamau! Gaya! Sambalpur! Angul! Puril

Fls. May—June. Fr. June—July. New leaves in May or June.

Bark brown, nearly smooth, with numerous fine cracks in young trees, fluted in old. Blaze yellowish, slightly pink or brown, or in older trees banded brown and white. Attains 4—5 ft. girth, but usually a small tree, and frequently: flowering as a bush like the last, which in some respects it much resembles, and has been confused with it. The bark and blaze are very similar, but the matured leaves rarely exceed 6", usually 2.25" by 2" to 6" by 3.25", with obtuse rounded or sometimes cordate base, pubescent beneath, puberulous, or quickly glabrescent between the nerves above. Secondary nerves 5—10, omitting 'short intermediate ones, looped or branching some distance from the leaf margin. Fr. an umbel of roundish, black, fleshy carpels, .6—1" diameter.

The wood is strong and durable, and taken for house poles.

2. *S. longiflorum*, Hook. f.

A tree with puberulous branchlets, ovate-oblong or oblong-lanceolate acuminate leaves about 8" long by 3" broad, appressed pubescent beneath, and solitary short-peduncled flowers from the axils of the fallen leaves. Petals 1.3" long.

Only reported by Buchanan Hamilton from Purneah, and not since collected!

This tree, as I know it in British Bhoran, has lenticellate branches and large leaves up to 10", not unlike those of the Champak. It fruits there in Aug. and Sept.

8. ALPHONSEA, H. f. & T.

Trees with coriaceous very shining leaves. Flowers clustered or in short cymes, clusters tomentose, leaf-opposed or on old twigs. Tepals in 3 series, outer "sepals" small valvate, second and third series "petals" larger and subequal with saccate base. Anther cells dorsal, connective apiculate. Carpels 2—10. Ovules 4—15.

Tall tree. L. oblong, up to 9"

1. *ventricosa*.

Low tree. L. ovate or ovate-oblong, under 5"

2. *lutea*.

1. *A. ventricosa*, H. f. & T.

A tall straight tree (or small in Santal Parganas) with clean trunk and large oblong or oblanceolate-oblong leaves, 4.5 by 1.5" (at base of twigs) to 9.5 by 2.75", beautifully polished above. Flowers clustered in brown, velvety, sessile, leaf-opposed bracteate cymes. Ripe carpels very large, yellow-tomentose.

Ravines near water, Mayurbhanj (elevation 2500 ft.)! Santal Parganas, in Rajmahal Hills, rare!

Fls. Feb.—May. Fr. Aug. Evergreen. New shoots at time of flowering.

Bark smooth, grey, thin. Blaze thin, brown, then cream, hard. L. rather suddenly acuminate, base acute, obtuse or rounded. Secondary nerves 9—16, very fine, visible both sides, slightly hairy beneath, branched and looped. Petioles .25— .3" thick, hairy, as also is the mid-rib above. Cymes short and dense, mostly from the old wood. Pedicels .3", with a minute ovate bract near middle. Calyx .47" diameter, with 3 broadly ovate brown tomentose lobes. Petals .37— .44". Outer ovate-tomentose: inner white, ovate-lanceolate, suberect, acute, with saccate base, brown-pubescent. Filaments very short, broad, connective slightly produced. Carpels 8, tomentose-elongate, with about 15 ovules on the ventral suture. Stigma capitate. Fr. (in Eastern Bengal—I have not seen our specimens in fruit) like small tomentose yellow mangoes.

Gamble says it is used in boat-building and for native hoes in Chittagong and the Andamans. The description of the flower is taken from the Santal Parganas tree, which is branched low and has a somewhat different habit, but most Santal Parganas trees are suffering from the removal of the surrounding jungle.

2. *A. lutea*, *H. f. & T.*

A small tree up to 3 ft. girth with spreading crown, elliptic-lanceolate to broadly ovate glabrous leaves beautifully polished both sides, small greenish or yellowish flowers in 3—4-flowered brown velvety clusters or cymes. Outer petals slightly larger than the inner, .25", with recurved tips. Carpels 2—3, ripe not seen (oval, about 6-seeded, *Roxb.*, 1—1.5", with very short stalk, *F. B. I.*).

Puri Division, southern range, in semi-evergreen forest!
Fls. April—May. Evergreen.

Bark smooth, grey, streaked (with lenticels). Blaze moderately hard, cream or light brown. L. sometimes elliptic, subacute, or usually bluntly acuminate, base rounded or sub-cuneate. Secondary nerves 7—10, very fine. Petioles .2—3". Clusters opposite to leaves and on old twigs. Peduncles .3—4". Sepals short, rusty-tomentose. Outer petals appressed, yellow, silky outside, shortly pubescent within, somewhat saccate at base. Inner petals .2—2.5", erect, with spreading tips, broadly ovate, saccate at base. Stamens very short, about 16, connective, slightly apiculate. Receptacle cylindric, pilose. Carpels pilose, oblong. Ovules 5—6.

NOTE.—The B. & O. plant differs somewhat from the type, the flowers being only .3" instead of .6" to .75" diameter, and in longer pedicels. Carpels also fewer.

FAM. 5. MENISPERMACEÆ.

Herbs or shrubs, nearly always climbing, with alternate exstipulate palmi-nerved simple leaves with generally entire margins. Flowers minute dioecious, 3—5 merous (but see *Cissampelos*) in cymes or racemes. Petals rarely 0. Stamens as many as petals, opposite to and often embraced by them, or anthers connate in a ring round the top of a column. Female: Carpels 1—6, when ripe drupaceous with a very characteristic seed and endocarp, the latter being usually a curved, often thickened and tubercled tube containing the seed curved round a solid depressed centre; rarely seed subglobose. Albumen often ruminant. Cotyledons various.

- A. Fls. umbelled or cymose, or if racemose then clustered in the axils of large persistent bracts. Stamens connate in a column. Carpel 1.
Male Fls. 4-merous. Female tepals 2 1. *Cissampelos*.
Male sepals 6—10, petals 3—5. Female sepals and petals 3—5 2. *Stephania*.
- B. Fls. panicled, racemed or axillary, if racemed without large bracts.
1. Sepals 6, petals 0. Stamens connate in a column. Carpels 3.
L. large. Fls. in large panicles 3. *Anamirta*.
2. Sepals 6, petals 6. Stamens free.
L. deeply cordate. Fls. racemose. Style scar sub-terminal 4. *Tinospora*.
L. not cordate, rarely sub-cordate. Style scar sub-basal. Fls.
in axillary racemes or racemiform panicles, leaves glabrous 5. *Tiliacora*.
Fls. axillary or in capitate cymes, leaves villous or pubescent 6. *Cocculus*.

1. CISSAMPELOS, L.

A slender climber from a perennial root-stock. Male flowers cymose. Sepals 4, rarely 5—6. Petals connate into a peltate or 4-lobed cup. Anthers 4, connate round the truncate top of the staminal column and bursting transversely. Female flowers clustered in the axils of imbricating leafy bracts which are in racemes. Sepals 2, adnate to the bracts. Carpel 1. Stigmas 3. Drupe ovoid with style scar sub-basal. Endocarp horseshoe-shaped, compressed, margins tubercled.

1. *C. pareira*, L. Pitu-singh, Ranu-red, K.; Tejo mala, S.; Akanadi, H., Beng.; Batulpati, Tharu.

Stems usually annual striate, leaves usually peltate, deltoid or broadly ovate, rarely orbicular-reniform, 1.75" to 3.5" with 5—7 principal nerves. Male flower in axillary corymbose usually paniced cymes.

Frequent throughout the area, especially in open and rocky valleys. Fls. June—Nov. Fr. Nov.—Jan.

L. obtuse or retuse, mucronate, with straight or shallow-cordate base, somewhat glaucous beneath, more or less pubescent or hairy. Petioles 1—3.25". Male Fls. whitish, minute, in densely hairy cymes, in the axils of foliaceous bracts, on slender shoots, or 2-chotomously cymose on capillary .75—1" long branches of axillary panicles. Female racemes often 6", bracts .5—7" diameter. Drupe orange or scarlet, stone .19".

The plant has long, slender, cylindric, often branched rhizomes under .5" diameter. These are used in the fermentation of rice beer (Ili, K.) and in combination with *Ruellia* from the "Ili-ranu" of the Kols. "The Santals give the root in diarrhoea," *Camp.* Pelosin is derived from it. Pareira root is an allied Brazilian plant.

2. STEPHANIA, Lour.

Climbing undershrubs with usually peltate leaves. Flowers small, whitish, in compound cymose umbels. Male flower: Sepals 6—10, free. Petals 3—5, fleshy. Anthers 6, connate, dehiscence as in *Cissampelos*. Female flower: Sepals 3—5. Petals as in male. Stamens 0. Carpel 1 with 3—6-partite style. Drupe glabrous, endocarp horseshoe-shaped, compressed, margins tubercled.

1. *S. bernandifolia*, Walp. Syn. Akanadi, H., Beng.

A slender climber with peltate leaves and striate branches, sparsely pilose or glabrate, looking very like *Cissampelos* but easily distinguished by the inflorescence. The leaves are also less finely reticulate.

Bettiah, Cal. Herb.! Purneah! Fls. May—Oct. Fr. to Dec.

L. 1.5—5.5", somewhat glaucous floccose-puberulose or sometimes sub-tomentose beneath, rarely glabrous, ovate, with rotund base, often sub-acuminate. Primary nerves about 5. Inflorescence pubescent.

The root is used in fever, diarrhoea, urinary diseases and dyspepsia according to the Hindu materia medica, but as *Cissampelos Pareira* has the same vernacular name it is possible that the two are often confused.

3. ANAMIRTA, Colebr.

Shrub climbing by means of twisted petioles and shoots with flowers paniced from the old wood and large shining leaves. Sepals 6 with 2 appressed bracts. Petals 0. Male flower: Anthers sessile, 2-celled,

bursting transversely. Female flower with 9 staminodes and 3 carpels. Drupes on a 3-fid gynophore with sub-basal style scar. Endocarp spherical, deeply intruded from the base to the centre or further, the seed thus occupying a peripheral channel and being deeply hollowed out.

1. *Anamirta cocculus*, W. & A. Kalabiti Nai, Or.; Kakmari, H.

An extensive climber with stems up to 3" girth and large shining ovate or sub-orbicular leaves 4–10" on petioles 4–8" long which have a twisted thickened base. Panicles drooping from the old wood, attaining 1 ft. or more with numerous long patent branches.

Puri Division, especially in damp forests (Berbera, Kuburi, etc.)! Fls. April–May. Fr. June. Evergreen.

Bark light grey-brown, thick; wood very porous, with rings of bast and large medullary rays. Branches striate. Base of L. often sub-cordate, apex obtuse or acute. Primary nerves 3–5, strong, with few secondaries and transverse tertiaries. Fls. .25" diam. Drupes .5" diam.

Under the synonym of *Cocculus suberosus*, DC., I. P. and D. states that the poisonous berries constitute the *Cocculus indicus* of commerce which is the source of picrotoxin; they also contain 50 per cent of oil. The juice of the fresh fruit is a good application to scabies and foul ulcers.

4. TINOSPORA, Miers.

Shrubs with twining stems and sometimes twisted petioles and cordate leaves. Flowers in axillary or terminal racemes or from the old wood. Sepals 6, outer minute, inner larger. Petals 6, equal, smaller than the inner sepals. Male flower: Stamens 6, free, anther terminal on the thickened filament with 2 cells bursting obliquely. Female flower with 6 clavate staminodes. Carpels 3, with short style and lobed stigmas. Drupels 1–3, endocarp rugose, dorsally keeled, ventrally concave and intruded. Cotyledons foliaceous, ovate, spreading.

L. glabrous, not lobed

1. *cordifolia*.

L. tomentose, often 3-lobed

2. *malabarica*.

1. *T. cordifolia*, Miers. Gurach, H., Th. Gulancha, Gunchi, Beng.; Gursilai, Khond.; Sarasati lat, Mal P.

A climber with succulent corky stems, glabrous cordate leaves, 2–4" or rarely 5.5" by 4.75", and rather lax racemes, 2", elongating and ultimately often longer than the leaves; racemes of green and scarlet drupels in fruit.

Puri! Angul! Santa! Parganas! Champaran!

Fls. Aug.–Dec. (perhaps all the r. s.). Fr. c. s., deciduous March–May.

Branches in the forest sending down slender, pendulous, fleshy roots; terete, striate, with tubercled pale, sometimes shining or glaucous bark, which is finally loose. L. deeply cordate with large basal lobes, obtuse or more or less cuspidate; primary nerves 7–9, very reticulate between, with microscopic glistening glands beneath (not easily seen when dry). Petiole 1–3.5". Racemes shorter or longer than the leaves.

Male Fls. clustered in the axils of small subulate bracts. Sepals: Outer very small, inner broadly elliptical, .12–.15", rounded, yellow. Petals 6, equal, .08", broadly spatulate and concave round the stamens when young. Pistillode 0. Female Fls. usually solitary, similar to male, but the sepals are green, petals flat, staminodes short, linear. Carpels 3, widely separated on the short fleshy gynophore.

Drupels pistiform, 3, with sub-terminal style, juice very viscous. Stone broadly ellipsoid, with slender dorsal ridge and a ventral depression, slightly muricate.

Variety: The Khurda specimens have purple stems, rather thicker L., less reticulate, and the female racemes only 1—2.5". The L. are also very slightly puberulous beneath.

The entire plant is used in medicine. Said to be a valuable tonic and best given in infusion. There are many native Indian preparations (*J. P. and D.*, p. 111, under *Cocculus cordifolius*).

2. *Tinospora malabarica*, Miers. (*inc. T. tomentosa, Miers*). Bara Padma gulancha, *Beng.*; Bara Sarasati lat, *Mal. P.*

A large climber with large orbicular, ovate, or somewhat obovate deeply cordate leaves 4" to 9" by 8", frequently 3-angular or 3-lobed, and small yellowish-green flowers in racemes, usually from the old wood.

Rocky valleys, Santal Parganas! Rare.

Fls. Feb.—March. Fr. May—June. Deciduous Dec.—Feb.

Stems and thicker aerial roots lenticellate. Branchlets hairy. L. shortly suddenly caudate or acuminate. Primary nerves 5—7, secondaries 1—3, soon reticulate. Petioles 2.5—6". Male flower fascicled, inner sepals 3.5 mm. by 2.5 mm., petals membranous, about 2 mm. Drupels scarlet or orange.

(The description of the flowers is from Diels, who united *T. tomentosa* with *T. malabarica*). Perhaps more common than is thought, the L. are high up and are deciduous while the stems might be taken for those of *T. cordifolia*.

5. TILIACORA, Colebr.

A large woody climber. Flowers in racemes or narrow panicles, "sometimes polygamous" *F. B. I.*; females subsolitary, males clustered at the ends of the short panicle-branches. Sepals 6, 3 outer valvate, inner larger imbricate. Petals 6, minute fleshy quadrate or cuneate. Male flower: Stamens 6, anther dehiscence vertical, somewhat introrse, pistillode of 3 rudimentary carpels or 0. Female flower: Carpels 3—12, styles short, subulate. Drupels obovoid, laterally sub-compressed, with a narrowly horseshoe-shaped putamen enclosing a bony plate, the seed being in the horseshoe. Albumen ruminant.

1. *T. acuminata*, Miers. Syn. *T. racemosa, Colebr.*; Tiliakoru, *Beng.* Kalajati Noi, *Or.*

Santal Parganas, locally abundant in Rajmahal Hills (as at Barhait, Burio)! Puri division, central and southern ranges, common! Champaran!

Fls. April—June. Fr. June—Dec. Also seen in flower in Dec.

Bark striated. L. 3.5—7.5" by 1.5—3.75", broadly ovate to ovate-lanceolate acuminate, shining glabrous, base rounded or shortly cuneate on the petiole, rarely somewhat retuse. Primary nerves 1—5, but if only 1 then one or more secondary nerves close to base, other secondary nerves 1—2, all raised beneath and decurrent on the mid-rib, tertiaries finely reticulate. Petioles articulate at the base, .5—1" long. Inflorescence tomentose or pubescent. Female 1—2.5" long, male panicle sometimes longer. Fls. yellowish, 3—4 bracteolate. Drupels red, .5" long.

6. COCCULUS, DC.

Climbing shrubs or sub-herbaceous (in one species a small tree). Flowers axillary or in short cymes or panicles, rarely shortly racemose. Sepals 6, inner larger. Petals 6, smaller than the inner sepals, with

inflexed lateral auricles embracing the base of the stamens in the male, minute staminodes in the female. Anthers subglobose, cells bursting transversely. Carpels 3—6. Drupels compressed, endocarp shaped like an oblique corrugated horseshoe surrounding a central plate, style scar sub-basal.

1. *C. hirsutus*, Diels. Syn. *C. villosus* DC.

A slender villosely tomentose climber with deltoid to ovate-oblong obtuse mucronate leaves attaining 3" by 2", smaller upwards and oblong on the flowering branches. Flowers: Male in axillary short-peduncled small capitate cymes; female peduncle usually, 1—3-flowered, axillary, minute, greenish, 1" diam. Drupels dark purple.

Very common over bushes in the Sone valley, Palamau, and extending through Hazaribagh and the Santal Parganas! Manbhumi! Puri; common!

Fls. Nov.—April. Fr. March—May.

L. sometimes with large coarse teeth or with triangular obtuse or acute lobes. Petioles .08—5", primary nerves usually 5.

The plant when triturated with water is said to gelatinise it.

FAM. 6. BERBERIDACEÆ.

Usually shrubs with scaly buds. Leaves simple or compound. Stipules rarely present. Flowers often globose, regular, solitary or racemose, usually yellow or white. Sepals and petals free, hypogynous, caducous, 3-, rarely 4—6-merous, in 2 or several whorls, imbricate, or the sepals valvate. Stamens 3—6, opposite the petals; anthers erect, with adnate cells dehiscing by lids or valves, or by lateral or dorsal slits. Carpels 1—3, free, oblong, stigma dilated, or conic or oblong. Ovules anatropous, rarely orthotropous, basal, or on the ventral suture or parietal. Fruiting carpels dehiscent or baccate. Albumen copious. Embryo straight or curved.

1. *BERBERIS*, L.

Shrubs with yellow wood and simple or pinnate or mostly dimorphic leaves, those on the main branches converted into 3—5-partite spines, bearing in their axils abbreviated branchlets with simple coriaceous leaves. Flowers yellow, solitary, fascicled or racemed, with 2—3 appressed bracts. Sepals 3+3. Petals 3+3. Stamens 6, anthers dehiscing by valves. Carpel 1 with peltate stigma. Ovules, few erect, basal. Fruit baccate.

1. *B. asiatica*, Roxb.

A very pretty shrub with small 1—5-partite spines and coriaceous entire or spinose-toothed leaves 1—3". Flowers .25—3" in short corymbose racemes. Berry purple-blue, pruinose, .3".

Parasnath, 4000 ft. Fls. Feb.—April. Fr. May—June. Evergreen. Berries sometimes eaten. They are laxative.

FAM. 7. NYMPHÆACEÆ

Aquatics with often peltate leaves, the margins involute in bud. Flowers solitary from the root, sepals and petals 3—5-merous, or many and often spirally arranged, sometimes adnate to a fleshy disc or enlarged torus. Stamens ∞ . Ovary apocarpous or syncarpous, carpels whorled, in *Nelumbium* sunk in the enlarged torus, stigmas peltate or decurrent. Ovules parietal, anatropous or orthotropous. Fruiting carpels usually dry, but indehiscent, sometimes connate into a fleshy or spongy syncarp. The fruit sometimes matures beneath the water. Seeds sometimes arilled. Albumen flowery or 0. Embryo enclosed in the enlarged embryo sac.

- A. Carpels whorled, more or less connate into a syncarpous ovary. Leaves all floating.
 Ovary somewhat sunk in the torus, to which the upper tepals only are adnate. Unarmed
 Ovary wholly sunk in the torus inferior to the tepals and stamens. Prickly
- B. Carpels completely apocarpous, irregularly sunk in the torus.
 Tepals all inferior
1. *Nymphæa*.
 2. *Euryale*.
 3. *Nelumbium*.

1. NYMPHÆA, L. Water-lily.

Herbs with floating leaves rising from a perennial rhizome or corm. Flowers large, white, blue or red. Sepals 4, inserted almost at the base of the torus. Petals numerous, the inner gradually passing into stamens, spiral, the uppermost being almost superior. Carpels many whorled, sunk in the torus and forming a syncarpous ovary with concave top and radiating stigmas. Fruit spongy, maturing under water and irregularly breaking up.

- L. sharply sinuate-toothed. Sepals ribbed. Anthers not appendaged. Fls. red to white
 1. *lotus*.
 L. obtusely sinuate or entire.
 Sepals scarcely ribbed. Anthers scarcely appendaged. Fls. white
 2. *esculenta*.
 Sepals veined, not ribbed. Anthers appendaged. Fls. blue to white
 3. *stellata*.

1. *N. lotus*, L. Kumuda, Sans.; Koka, Koi, H. (the flower); Saluka, Beng.; the White Indian Water Lily; Raktopala, Sans.; Rakta Chandana, Sandaka, H.; Rakta-Kambala, Beng.; The Red Indian Water Lily.

Rhizome nodular, large, over 3" usually 4" diam. Leaves usually pubescent beneath, strongly veined, the veins repeatedly bifurcate. Flowers usually large and over 3". Connective of anthers not at all, or very slightly, produced beyond the cells. Carpels 10—20. Stigmatic rays clubbed.

Var. α . *lotus* proper. Flowers white or pink.

Var. β . *rubra*. *N. rubra*, Roxb. Flowers red or crimson. Throughout the province in fresh water, tanks, etc.

The tubers and seeds are eaten, the tubers sometimes eaten raw and the seeds after being parched.

2. **N. esculenta**, *Roxb.* *N. lotus* var. *esculenta*, *F. B. I.*; Chota Sundi, *Beng.*; Small White Indian Water Lily.

Corm small, ovoid, 2—3". Leaves somewhat pubescent beneath, nerves more reticulate and less strong. Flowers white, under 3.5". Connective of anthers usually slightly produced, but not foliaceous. Carpels 10—15. Stigmas incurved.

The tubers are considered superior to any other kind according to Roxburgh. This species seems intermediate between 1 and 3.

3. **N. stellata**, *Willd.* Syn. *N. cyanca*, *Roxb.*; *N. versicolor*, *Roxb.*; Nilotpala, *Sans.*; Bhengt, *H.*; Sundi, Nilpadma, Nilsaphala, *Beng.*; The Blue Water Lily.

Corm as in *esculenta*, not nodular. Leaves glabrous, entire or slightly sinuate, nerves beneath more reticulate and less strong than in *N. lotus*. Flowers usually blue, sometimes white or pink. Apices of the anthers appendaged or foliaceous, often coloured.

Var. α . **stellata** proper. Fls. azure, only 2" diam. Petals only 8 and stigma 8-rayed (*Roxburgh*).

Var. β . **versicolor**, *Roxb.* Fls. white or pink. Roxburgh says the sinus of the leaves is wedge-shaped and the fruit 15-celled.

Var. γ . **major**, *Voight*. Fls. pale blue, 4—5" diam. Petals 8—12". Fr. 10—12-celled. Ranchi, Singhum, etc.]

The species is found throughout the province. The description of the varieties is founded on Roxburgh. Their distribution has not been noted.

2. EURYALE, *Salisb.*

Very prickly aquatics with orbicular floating leaves, more or less corrugate or bullate above and with very prominent nervation beneath. Sepals 4, inserted on the torus above the level of the ovary, together with the many seriate petals, which pass gradually into the sepals and stamens; the latter are in bundles of 8, innermost stamens sterile. Carpels 8, many sunk deeply in the torus, connate in a single whorl. Ovules few. Fruit spongy. Albumen floury.

1. **E. ferox**, *Salisb.* Syn. *Anneslea spinosa*, *Roxb.*; Makhana, *H.*; Kanta Padma, *Or.*

Scarcely rhizomatous. Leaves deep purple beneath, prickly on the nerves. Petioles prickly. Flowers a lovely violet-blue, or bright red, under 2". Fruit 2—4", prickly, gradually irregularly breaking up. Seeds about 20, arilled.

B. & O., locality not noted, probably Purneah! Purneah, *Buch. Ham.* The plant was recognisable from the prickles but not in flower! Fls. most of the year. The farinaceous seeds are largely eaten (*Roxb., Ham.*). They are called *Makhanna* in *Sans.*, and are said to be suited for sick people (*Dutt.*).

3. NELUMBIUM, *Juss.* The Sacred Lotus.

A large, beautiful aquatic, with milky juice and stout creeping rhizome. Leaves floating and also raised high above the water, peltate. Sepals, petals and stamens spirally arranged, passing gradually into one another; anthers clavate at the end. Carpels many, irregularly sunk

in the flat top of the large fleshy obconic torus, laterally attached. Ovules 1-2. Fruiting torus spongy and dry, containing the dry, ripe, loose carpels in its cavities.

1. **N. speciosum**, Willd. Padma, Kamala, Sans. (Pundarik, the white variety. Kokanada, the red variety); Shwet Padma and Rakta Padma, Beng.

Peduncles and petioles often raised high above the water, sometimes with weak prickles. Flowers white or rose-coloured like immense roses.

On tanks, etc., throughout the province. Fls. April-July. Fr. Dec.-Jan.

This very sacred plant of the Hindus and Buddhists had various names given to its several parts; the whole plant was called *Padmini*, the flowers as above, the torus *Karnikara*, the filaments *Kinjalka*, etc.

Hamilton says the fruit is called *Chaka* in Purneah, the root *Mrinab*, and eaten raw or cooked. The plant is called *Bisangr* in H.

The internodes of the rhizome and the seeds are eaten; the leaves are used for plates.

FAM. 8. PAPAVERACEÆ.

Herbs with milky, often yellow juice. Leaves radical or alternate exstipulate. Flowers often showy, regular. Sepals 2 (or 3). Petals 2+2 (or 3+3). Stamens ∞ . Ovary 1-celled, with 2-several parietal, often lamelliform placentæ and many ovules. Stigmas many, radiating but often connate. Fruit capsular, dehiscing by pores or valves. Seeds many, small, with fleshy and oily albumen. Embryo minute.

Sepals 2. Petals 4. Capsules globose
Sepals 3. Petals 6. Capsules oblong

1. *Papaver*.
2. *Argemone*.

1. PAPAVER, L. Poppy.

Leaves lobed or cut, not prickly. Stigmas sessile, radiating, connate, peltate or pyramidal, with many short free lobes. Capsule short, opening by small valves under the lobes.

1. **P. somniferum**, L. Pasoo, Beng.; Aphiin (Opium), Vern.; The Opium Poppy.

A stout herb, 2-4 ft., glaucous, with oblong amplexicaul lobed, toothed and serrate leaves and large, usually white flowers. Sepals glabrous. Capsule large, 1" diam. Seeds usually white (or black, F. B. I.).

It used to be largely cultivated in the Northern Tract, and feral plants may still be found.

2. ARGEMONE, L.

An erect, thistle-like annual with yellow juice and bright yellow flowers. Sepals 2-3. Petals 4-6. Stigma 4-7-lobed on a very short style. Capsule oblong, usually with prickles, dehiscing by short valves alternating with the stigmas.

1. **A. mexicana**, L. Siyal-Kanta, Kari-Kanta, K., Beng.; Gokhula janum, S.; Deng Bejari, Sarpunî, Or.

A prickly herb 2—3 ft. with sinuate pinnatifid green and white leaves which are half amplexicaul. Flowers 2" diam. Sepals cuspidate. Capsules .75—1.5" long.

Naturalised (from America) and very common in waste ground. Fls. Feb.-June and more or less throughout the year.

The seeds, which are often found collected into little heaps by ants, yield an oil which is used for lighting and anointing purposes.

FAM. 9. FUMARIACEÆ.

Herbs with watery juice and usually lobed or dissected, alternate, rarely opposite leaves. Flowers *irregular* racemose. Sepals 2, very small and deciduous. Pet. 2+2, 2 outer larger, one or both gibbous or spurred, 2 inner erect, often coherent at the tip. Stamens 6, in two bundles opposite the outer petals, lateral in each bundle with 1-celled anthers. Ovary 1-celled, stigma simple or lobed. Ovules 2 or more, parietal. Fruit a 2-valved capsule or indehiscent and then only 1-seeded. Seeds albuminous.

1. FUMARIA, L. Fumitory.

Sometimes scandent. Leaves dissected with very narrow segments. One outer petal obtusely spurred. Stamens 6, diadelphous. Ovules 2. Fruit indehiscent, 1-seeded.

1. **F. parviflora**, Lamk. Pit papra, H.; Ban-salpa, Beng.

A diffuse much-branched annual glaucous weed, with flat linear leaf segments and small whitish or rose-coloured flowers, .2—.3" long with purple tips to the petals. Racemes .5—1". Sepals lanceolate. Fruit globose, rugose when dry with 2 pits at the top.

Cultivated fields, chiefly in the Northern Tract, Bettiah! Fls., Fr. c.s. to March.

This is one of the species of Fumitory which is found in England, and distinguished by the very small sepals and pedicels exceeding the bracts.

FAM. 10. CRUCIFERÆ.

Herbs with watery juice and simple or pinnate, entire or cut, exstipulate alternate leaves. Flowers regular or outer radiant. Sepals 4, free. Petals 4, hypogynous, spreading, imbricate or convolute. Disc glands usually 4, sessile opposite the sepals. Stamens 6, tetradynamous, 4 longer opposite the median sepals approximate in pairs, very rarely stamens only 4 or 2. Ovary syncarpous, of 2 lateral carpels, 1-locular, or most usually spuriously 2-locular by a longitudinal, membranous partition (*replum*) connecting the two parietal placenta, the edges of the replum itself being placentiferous, more rarely divided by transverse partitions. Ovules 1—2 or ∞ , campylotropous, or amphitropous.

Fruit usually elongate, pod-like and 2-valved (*Siliqua*), the valves breaking away from the replum, or short dehiscent or indehiscent. Seed exalbuminous. Cotyledons large, with the radicle turned up on the back of one (*incumbent*) or along their edges (*accumbent*).

A family of great economic importance with many well-known esculent vegetables (Cabbage, Cauliflower, Knolkohl, Turnip, etc.) not here described, and several garden plants, some of which may occasionally be found as escapes. Some cultivated forms of Brassica have more than 2 carpels and pod-valves, and the replum is then often absent.

- | | |
|--|------------------------|
| 1. Fr. a siliqua with broad replum (siliqua rather short in 2). | |
| a. Sepals gibbous at the base. Siliqua with a beak. Fls. usually yellow. | |
| Siliqua long. Seeds 1-seriate | 1. <i>Brassica</i> . |
| Siliqua rather short, turgid. Seeds 2-seriate | 2. <i>Eruca</i> . |
| b. Sepals not gibbous at the base. Siliqua not beaked. | |
| Fls. usually yellow. Sepals spreading. Pod turgid | 3. <i>Nasturtium</i> . |
| Fls. white or rose. Sepals erect. Pod flat . | 4. <i>Cardamine</i> . |
| 2. Fr. short and broad (siliculus) with broad replum. | |
| Glabrous. Fls. white or yellow . | 5. <i>Cochlearia</i> . |
| Hoary. Fls. white | 6. <i>Alyssum</i> . |
| 3. Fr. a siliculus, compressed, with narrow replum. Fls. white. | |
| Pods obcordate or cuneate, not winged | 7. <i>Capsella</i> . |
| Pods ovate or oblong, or orbicular, not winged | 8. <i>Lepidium</i> . |
| Pods winged or keeled | 9. <i>Thlaspi</i> . |
| 4. Fr. indehiscent. | |
| Racemes contracted, leaf-opposed. Fr. small, didymous | 10. <i>Senebiera</i> . |
| Racemes elongate. Pod large, often septate | 11. <i>Raphanus</i> . |

1. BRASSICA, L.

Leaves entire, lyrate or pinnatifid. Lateral sepals saccate or gibbous at base. Petals with long claws, yellow, rarely white. Pod with a seedless indehiscent beak, sometimes 3—4-valved (in cultivation), replum membranous. Seeds globose, cotyledons incumbent.

- | | |
|---|------------------------|
| 1. Cauline L. amplexicaul, base usually auricled. | |
| L. all, or young only, hairy, covered with a pale bloom | 1. <i>campestris</i> . |
| L. quite glabrous, a faint bloom only beneath | 2. <i>napus</i> . |
| 2. Cauline L. not amplexicaul, narrowed to their base | 3. <i>juncea</i> . |

There is much difference of opinion as to the best limitation of the species and varieties of this genus. The above characters of *campestris* and *napus* are after Prain, but I admit that I have not found them easy to work, and it is perhaps preferable to consider both as forms of one species, *campestris*, as in the *F. B. I.*

The common Turnip is *B. rapa*, L., var. *rapifera* (or *B. campestris*, sub-sp. *rapa*), Salgan, H., Beng.

Brassica oleracea, L., and its varieties include the Cabbage, Kobi, Vern.; Cauliflower, Phu-kobi, Vern.; Kohlrabi or Knolkohl, Band-kobi or Gol-kobi, Vern. They are largely cultivated in European gardens in the cold season.

1. *B. campestris*, L.

An erect rather stout herb often with a swollen tap-root; lower leaves lyrate hispid or hairy,* upper amplexicaul and auricled, oblong or lanceolate, covered with a glaucous grey bloom. Pod with a flat seedless beak.

Fls., Fr. c.s.

* But see under var. *sarson*.

Var. **oleifera**, DC. Rape, Colza.

Very stout, with stems as thick as the finger, ending in a swollen spindle-shaped root. L. up to 8" by 3" with large lobes 1.5". Pods slender, *beaded*. Appears to be cultivated at the Government farms only.

Var. **sarson**, Prain ('Bengal Plants,' p. 220). Sarson, H.; Swet-sarisha, swet-rai, Beng.

Stout but with slender roots. L. up to 10", lowest not amplexicaul; upper up to 5", auricled. Pods stout, 2" by .25", *not at all beaded*. Seeds white or black. Prain states that there are two races, *Natua sarson* (*Sinapis glauca*, Roxb.) with erect pods, and *Ulti sarson*, with pendant pods; that the first is generally cultivated (it is, however, rare in our area), and the second slightly cultivated in Eastern Behar and perhaps in Purneah. Roxburgh, however, says of his *S. glauca* or *Shwet Rai* that the leaves are everywhere glabrous (so that it should come under the next species!) and glaucous, lower lyrate, upper sub-lanceolate. Seed white.

Gives colza oil. Roxburgh says much used in the diet of the Hindus.

Var. **esculenta**, DC. Pods small, not beaded. The roots and leaves are eaten.

2. **B. napus**, L., var. **dichotoma**, Prain. Syn. *B. campestris*, sub-sp. *napus*; 'F. B. L.' in part; *Sinapis dichotoma*, Roxb.; Turi, Tori, H.; Sanchi, sarsi, sada rai, Beng.; Mani, K.; Indian Rape, Mustard.

A more slender plant than *campestris* and quite glabrous, rather glaucous. Radicle and lower cauline leaves lyrate pinnatifid, less lobed than in *campestris* and often only 3". Fls. 4—5" diam., pale golden yellow. Sepals erect or erecto-patent. Pods 1.5—2", including a beak 5—7", erecto-patent, on pedicels 6—7.5" long, glabrous. Seeds about 16.

The commonest cultivated species, especially in Chota Nagpur, forming fields of a beautiful yellow in the early part of the cold season. In all the districts!

There are two varieties—*Lotni Turi* (Lutni, S.) with seeds black, and *Taria Turi* (Thadia-turi, S.) with seeds yellow.

The young L. are eaten as a vegetable, but it is grown mainly for the oil, not locally for mustard. Mustard oil is said by Indians to promote the growth of the hair, and to keep the skin soft and wholesome.

The mustard of commerce is officially given as the seed of *B. nigra* and *B. alba*, both with only 1—3 seeds in the pod, though *B. juncea* is also used, and "white Indian mustard seed" is also exported, and is probably *B. campestris*.

Wood (*Plants of Chutia Nagpur*) records both *B. alba*, H. f. & T., and *B. nigra*, Koch, from Chota Nagpur with the vernacular name of Sirsu, but I have seen no specimens.

3. **B. juncea**, H. f. & T. *Sinapis ramosa*, Roxb.; Rai, H. S.; Rai sarisha, Beng.; Mustard.

Stout or slender with long-petioled leaves, not amplexicaul, attaining 12", but often quite small, especially in feral states; there are often small leaflets or auricles along the petiole. Glabrous, or a few soft white hairs near base of plant, and leaves sometimes scabrous, lower lyrate, upper lobate to entire. Flowers bright yellow, pedicels and calyx spreading. Pod 1—2", somewhat vertically compressed, and beak very short acuminate. Seeds dark brown, reticulate.

In all the provinces, including Chota Nagpur, f. Prain; not common in Chota Nagpur, Mandhum! Fl., Fr. c.s. from Sept.

The often very short beak well distinguishes the pod of this species. The seeds are used for the oil, and also exported for mustard. The seeds are rather larger and more oblong than those of preceding species. Campbell says it is largely cultivated on bari land.

2. ERUCA, Tourn.

Brassica-like herbs, but flowers sometimes white or lilac, petals veined. Seeds numerous, 2-seriate-globose.

1. *E. sativa*, Lamk. *Brassica crucoides*, Roxb; Swet sarish, Beng.; Taranuri, H.

A mustard-like herb with hairy or glabrescent stems, unevenly pinnatifid leaves 3—7" long, usually with linear-oblong segments, rarely sub-entire, sometimes twice pinnatifid. Flowers white or veined, .5" diam., on pedicels shorter than the calyx. Sepals erect, .38—4". Pods erect and appressed to the rachis, turgid, .75—9", including the flattened beak, which is half as long or more as the seeding portion.

Banks of the Ganges, T.T.! Possibly in the Northern Tract. Chota Nagpur, f. *Wood*.

Fls., Fr. Sept.

3. NASTURTIUM, R. Br.

Terrestrial or aquatic herbs, with entire lobed or pinnatifid leaves and small yellow, rarely white, flowers. Sepals short, spreading, not saccate. Petals short, scarcely clawed. Siliqua long or short, nearly terete. Stigma entire or two-lobed. Seeds small two-seriate or irregularly 1-seriate, cotyledons accumbent.

A. Fls. yellow.

L. lyrate-pinnatifid. Pods short-oblong

L. not lyrate. Pods linear-oblong

B. Fls. white. The water-cress

1. *palustre*.

2. *indicum*.

3. *officinale*.

1. *N. palustre*, DC.

Glabrous except a few small hairs on the auricles at base of leaves. Leaves lyrate-pinnatifid. Flowers small, yellow, in elongate racemes. Pods .25—3" long by .1—12" broad, on spreading or reflexed pedicels three-fourths to as long as themselves, often upcurved.

In wet places north of the Ganges, but not common! Fls., Fr. Oct.—May.

2. *N. indicum*, DC. Syn. *Sinapis divaricata*, Roxb.

Usually pubescent all over but sometimes glabrous. Leaves 2-pinnatisect or pinnatisect and pinnatifid or gashed and toothed, more rarely simple oblanceolate, coarsely toothed. Flowers small, yellow, racemed. Pods linear, rarely linear-oblong, .5—7" long, on spreading or erecto-patent short pedicels rarely half as long as the pod.

Common in Northern Area, also in gardens (Ranchi) as a weed in Central Area! Fls., Fr. Oct.—April.

3. *N. officinale*, Br. The common water-cress is cultivated in Chota Nagpur, *Wood*.

4. CARDAMINE, L.

Leaves entire, lobed or pinnate, often flaccid. Flowers usually white to violet. Sepals not gibbous. Petals clawed. Pod narrow-linear compressed, tapering both ends, but not beaked, valves with distinct midrib curling up elastically on dehiscence. Seeds 1-seriate, compressed, cotyledons accumbent.

1. *C. hirsuta*, L., var. *sylvatica*. *C. debilis*, Don, B.P.; *C. flexuosa*, Withering.

A small erect, or branched from the root, glabrous plant 3—9" high with pinnate leaves, very small white flowers in terminal racemes and linear pods, 6—9" long, erect.

Not very common. On damp walls, Ranchi! and probably in Northern Area. Fls., Fr. July—Nov.

Leaflets usually small and rounded, petiolated, often dentate or lobulate. Petals narrow, erect. Stamens 6.

5. COCHLEARIA, L. Scurvy-grass.

Glabrous, often fleshy, with entire or pinnatifid leaves. Flowers white, yellow or violet, shortly racemed or corymbose. Sepals spreading. Pods globose, ovoid or oblong, with convex turgid valves. Seeds compressed, cotyledons accumbent.

1. *C. flava*, Ham.

A diffusely-branched annual; branches 6—15", with pinnatifid and toothed leaves 1—3" long, and elongated racemes of very small white or yellow flowers and sub-globose pods 2" long.

Not uncommon in the Northern Area on river banks. Dehri-on-Soane! Patna! Soane, alluvial lands (J. D. H.)! Monghyr!

Fls. Fr. July—Feb.

Said to be used for fever.

6. ALYSSUM, L.

1. *A. maritimum*, L.

A diffuse herb with branches 6—10", sparsely clothed like the leaves with adpressed 2-partite hairs. Leaves linear-oblongate, entire, 1—2". Flowers small, white, in dense terminal racemes at the ends of the branches, sub-corymbose when young. Pods orbicular-ellipsoid, 1", cells 1-seeded.

Near gardens in the Northern Area. Fls. c.s.

7. CAPSELLA, Moench. Shepherd's Purse.

Small weeds with rosulate entire or pinnatifid leaves and very small white, racemed flowers. Pods obcordate-cuneate, much laterally compressed, so that the replum is very narrow. Seeds many, 2-seriate, narrowly-margined, cotyledons incumbent.

1. *C. bursa-pastoris*, Moench.

The well-known little European weed which is occasionally found in the northern area during the cold season. Height 3—12". Cauline

leaves amplexicaul auricled. Flowers .08" diam. Siliculus .25—3" on slender pedicels. Seeds oblong punctate.

Fls. c.s.

8. LEPIDIUM, L. Cress.

1. *L. sativum*, L. Halim, alevati, Vern. Common Cress.

Herb 1—3 ft. high, glabrous or slightly hairy. Lower leaves 1—2-pinnate, upper pinnatifid or lobed with oblong obtuse or linear lobes. Flowers very small, white, in elongating racemes. Pods .2", numerous, broadly-elliptic, compressed, with an apical notch containing the short style. Pedicels sub-erect, scarcely as long as the pod.

Cultivated and as an escape, but not common. Northern Tract; along Soane River (J. D. H.)! Chota Nagpur (Wood).

9. THLASPI, L. Penny Cress.

1. *T. arvense*, L.

An erect herb 6—18", usually single, with radical, rosulate, petioled leaves, soon disappearing, and cauline leaves, amplexicaul, suberect, sagittate, sinuate-toothed, glabrous. Flowers .2", white, in elongating terminal racemes. Pods suborbicular, laterally compressed, .5—7" long, somewhat broader upwards, winged, and with a deep notch containing the very short style; pedicels slender, patent.

A weed of cultivation, rare in the Northern Tract; Champaran!
Fls. Sept.

10. SENEBIERA, DC. Wart-Cress.

1. *S. pinnatifida*, DC. Syn. *S. didyma*, Pers.

A diffuse, branched, small leafy herb with finely-cut 1—2-pinnatifid leaves 1—2" long, very minute, white, usually apetalous and 2-androus flowers in numerous leaf-opposed racemes, .75—2" long and small, close didymous pods, consisting of two wrinkled indehiscent lobes which separate on falling. Seed, 1 in each lobe, reniform.

It occurs in Calcutta and in the United Provinces (at Banda), so will probably be found in Bihar and Orissa.

Fls., Fr. Jan.—Feb.

11. RAPHANUS, L. Radish.

Annuals or biennials with lyrate-pinnate or pinnatifid leaves and moderate-sized or large white, or purple, flowers in long ebracteate racemes. Sepals erect, the lateral saccate at base. Pods indehiscent, elongate, terete and swollen, with a long acuminate beak, 1- or several-celled within by transverse pithy septa. Seeds globose or ovoid, cotyledons conduplicate, retuse. Radicle incumbent.

The genus is closely allied to *Brassica*.

1. *R. sativus*, L. Morai, K.; Mula, Muli, Beng.; Purabi sarisha, Seuti sarisha, Tora, H.

It is frequently cultivated as a crop in our area! Fls., Fr. Jan.—Feb.

A herb 2—3 ft. with the radical and lower cauline L. usually lyrate pinnatifid, but sometimes terminal lobe not much larger than others, usually coarsely toothed and hispid; upper not amplexicaul nor auricled, linear. Fls. usually white. Sepals .25—.35". Petals narrowly obovate, rather persistent. Pods 1.5", suberect or spreading, 2—8-seeded jointed, usually filled with pith between the large seeds. Funicle of ovules short and flat.

Some forms resemble *Bruca* without the fruit. It can be distinguished by the long pedicels, .4" or more, and shorter sepals, as well as the 1-seriate ovules. The root in feral states is very hard. The root and seeds yield an oil for which it is chiefly cultivated in Purneah. Root largely eaten and also unripe fruits.

FAM. 11. CAPPARIDACEÆ.

Herbs, shrubs or trees, sometimes climbing by means of stipulary prickles; stipules sometimes 0. Leaves simple or digitate. Flowers solitary umbelled or racemed or in extra-axillary vertical rows. Sepals 4. Petals 4, hypogynous or on a large disc. Stamens 4— ∞ , sometimes on a gonophore. Ovary usually on a gynophore or gynandrophore, which may become long and woody in fruit, 1-celled, with 2—4 parietal placentæ and numerous campylotropous ovules. Style short or 0, stigma depressed or capitate. Fruit capsular or baccate. Seeds exalbuminous, embryo incurved, often spiral.

- | | |
|---|--|
| 1. Herbs with oblong or linear capsules.
Gonophore 0, gynophore short or 0
Gynandrophore with 6 stamens only | 1. <i>Cleome</i> .
2. <i>Gynandropsis</i> . |
| 2. Shrubs or trees, sometimes scandent. Fr. baccate.
Sepals open in bud, adnate below to disc
Sepals closed in bud, free, 2-seriate | 3. <i>Cratæva</i> .
4. <i>Capparis</i> . |

1. CLEOME, L.

Herbs with simple or digitate leaves and racemose yellow or red flowers. Gonophore 0. Ovules many on 2 parietal placentæ. Fruit an oblong or linear capsule with 2 valves, which separate from the seed-bearing placenta. Seeds reniform.

- | | |
|---|------------------------|
| L. simple | 1. <i>monophylla</i> . |
| L. digitate. | |
| Fls. yellow. L. glandular pubescent | 2. <i>viscosa</i> . |
| Fls. rose- or violet-coloured. L. not glandular | 3. <i>Chelidomi</i> . |

1. **C. monophylla**, L. Hurhura (viewed as a pot-herb), Kedar jhawar (as a medicine), S.; Chamani, K.

A pubescent and glandular branched herb 1—2½ ft. high with oblong or oblong-lanceolate or ovate-lanceolate leaves 1—2" long, of which the lower are petioled, and elongating leafy racemes of dull or pale purple flowers in the axils of petioled bracts. Sepals linear. Petals long-clawed, .25", stamens 6. Ovary glandular, elongating into a linear capsule, 2—4".

Common and probably found in all districts. Fl., r. s.

The L. are eaten as a pot-herb. The pounded root is put on the lips (by the Santals) to restore consciousness when in a faint (*Campbell*).

2. **C. viscosa**, L. Chamani, K.; Harhara, S.; Hurhuria, Beng.

An erect pubescent and glandular herb, 1—3 ft. high, with 3—5-foliolate leaves, ovate to obovate leaflets and long-pedicelled yellow

flowers in long racemes. Petals 5". Stamens 12 or more. Capsule 2—3", striate, glandular pubescent.

Very common throughout the area. Fl., Fr., r. s.

The seeds are said to have the same properties as mustard, and are regarded as anthelmintic, carminative and stimulant; externally they act as a vesicant. They give a fixed oil.

3. *C. chelidonii*, L. f. Syn. *Polanisia chelidonii*, DC.

A pretty species 2—3 ft. high, somewhat scabrid but without hairs. Leaves 5—9-foliolate, with obovate leaflets or upper 3-foliolate with linear leaflets (*Polanisia angulata*, DC.). Flowers 1" long-pedicelled. Stamens very numerous.

Watery places, not common. Santal Parganas! Orissa! Fls. July—Sept. The seeds are said to be used in curries.

2. GYNANDROPSIS, DC.

Differs from *Cleome* in that there is a well-marked gynandrophore. The aestivation also is open, whereas the petals of *Cleome* are imbricate in bud.

1. *G. pentaphylla*, DC. Chamani, K.; Seta kata arak, S. (f. *Campbell*); Sada hurhuria, Beng. (f. *Prain*).

A very common strong-smelling, somewhat foetid weed, 1—3 ft. high, with digitate long-petioled leaves, 5 sessile, unequal, obovate, glandular-hairy leaflets, and elongating corymbiform racemes of purple or white flowers 3—7" diam. and 3-foliolate bracts. Anthers purple.

Throughout the area. Fls. July—August.

It is eaten as a sag (arak) by the Santals and Kols.

3. CRATÆVA, L.

Trees with digitately 3-foliolate leaves and large white yellow or purplish flowers. Sepals cohering below with the lobed disc. Petals 4, long-clawed, open in bud. Stamens many, adnate to the base of the long slender gynophore. Ovary 1-celled, ovules many. Fruit baccate.

1. *C. religiosa*, Forst. Barun, Varuna, H., Beng., Or.

A small spreading tree, very handsome in flower when covered with its terminal corymbs of flowers, which vary in colour from white and cream to yellow and pink with purple stamens, and are 2—2.5" diam.

Chiefly along rivers and streams. Rare in C. N. (Salai, Dighia, etc.)! Puri and Cuttack frequent, becoming a dwarf shrub on the coast at Chandpur! Narsingpur jungles! Along the Mahanadi River! Frequently cultivated all over the province.

Fls. March—April, mostly with the L., but sometimes before the new L. Fr. June. Deciduous Jan.—March.

Twigs with white lenticels. Leaflets ovate to lanceolate, gradually or abruptly (var. *Nurvala*) acuminate, pale beneath, about 4.5". Pet. 7—1.25". Gynophore 2" or more. Berry yellow globose, 1" diam., or ovoid (var. *Nurvala*).

Wood used for combs, *Cooper*. Fr. sometimes eaten.

4. CAPPARIS, L.

Trees or shrubs usually climbing. Leaves simple, often with stipulary thorns. Petals not clawed. Stamens at base of the long gynophore.

Ovary on the gynophore 1—4-celled. Fruit baccate, but often hard. Seeds many, cotyledons spirally rolled.

- | | |
|--|------------------------|
| 1. Fls. solitary axillary. Thorns straight or curved. Branching shrubs. | |
| L. orbicular | 1. <i>spinosa</i> . |
| L. oblong or ovate-lanceolate | 2. <i>brevispina</i> . |
| 2. Fls. 1—several in vertical supra-axillary lines. Climber, thorns curved | 3. <i>horrida</i> . |
| 3. Fls. in terminal umbels or corymbs. Climbers (sometimes erect in S). | |
| A. Fls. large, 3" diam. L. 1.5—3.7" | 4. <i>Roxburghii</i> . |
| B. Fls. small, .25"—.5" diam. | |
| Corymbs simple. Stamens many | 5. <i>sepiaria</i> . |
| Corymbs paniced. Stamens few | 6. <i>floribunda</i> . |

1. *C. spinosa*, L. Var. *leucophylla*, DC. (sp.). The Caper Plant; Kabara, *H.*

A much-branched prostrate shrub, hoary, with a white pubescence, with orbicular or broadly ovate leaves, 1—2", and white solitary axillary flowers with purple filaments. Fruit 1.5—2", ovoid or oblong.

Stony valleys in Bertiah, rare. Fls., Fr. (not seen).

The pickled buds form the "capers" of commerce. The plant is more common in the Western Himalayas and Afghanistan, and is distributed to West Asia and N. Africa, also Europe and Australia.

2. *C. brevispina*, DC. Syn. *C. zeylanica*, *F. B. I.*; *Lephura*, *Niphura*, *Or.*

A rigid, much branched shrub with small straight stipulary thorns; oblong or narrow-elliptic, very coriaceous leaves, 1—2", and white and yellowish flowers about 2" diam. (with stamens) in the axils of the terminal leaves on slender pedicels, sometimes 1—3, terminating short shoots. Ovary lanceolate in outline, pubescent or tomentose.

Puri (Kuhuri Hill in forest! Protap and Krushnanagarh Block, usually in dry scrub, *Haslett!* Rocky shores of Chilka Lake!)

Fls. April—May. Fr. May (ripens probably June).

Branches stout, twigs covered with small warts or papillæ and young also flocculent or tomentose. Tufts of rigid setæ above the leaf axils are peculiar and may represent rudimentary shoots. L. sometimes somewhat ovate-lanceolate, base rounded, tip obtuse or acute and mucronate; both surfaces reticulate with raised nerves and strong marginal nerves, glabrous. Petioles .05—1.5". Spines .05—2". Pedicels slender, about .7". Sepals lanceolate, .3". Petals .8", oblanceolate. Fr. (young) 1.5", ovoid to fusiform. "Like a fat chilli, deep red when ripe and eaten after boiling," *Haslett*.

3. *C. horrida*, L. f. Syn. *C. zeylanica*, L.* *Gaterna*, *K.*; *Buru asaria*, *S.*; *Bagnai*, *Beng.*; *Bagnahim*, *Kharw.*; *Oserwa*, *Asadua*, *Or.*

A shrub, scrambling or climbing by means of its recurved thorns, densely brown tomentose on the shoots, with usually ovate leaves 2—3" long and white or pink flowers 1.5—2" diam., which are sub-solitary or in vertical lines above the leaf axils, sometimes appearing paniced

* According to *The Flora of Madras*, *C. zeylanica*, L., is the original name of this plant. Prain, on the other hand, says—"Not of Linn." In any case it appears very inadvisable to retain the name *zeylanica*, which has for so long been used for another plant.

from the leaves being undeveloped at the time of flowering, and occasionally on short lateral shoots. Ovary globose or broadly ovoid glabrous on a very slender gynophore over 1" long.

In hedges and thickets and along rocky nalas. Common throughout the province! Fls. March—May. Fr. Sept.—Oct.

L. from narrow elliptic to orbicular-obovate, attaining 2.5"; shining above, base usually narrowed, tip mucronate, venation reticulate. Petioles .2" or larger. Calyx brown or purple. Petals and filaments usually purple with age. Berry broadly ellipsoid to globose, 1.5" diam., red when ripe on a gynophore often 2" long.

4. *C. Roxburghii*, DC. Handiphuta, Or.

A very beautiful large woody climber with hoary branches, oblong leaves and pure white flowers, 3" diam. (with the stamens), in terminal corymbs. Buds and ovary globose and glabrous.

Puri, in rocky jungles, frequent! Fls. April—May. Fr. Sept.—Oct.

Trunk attains 3" diam. with light grey bark furnished with large conical geminate bosses tipped by a spine. Blaze brown. Branches with a minute ashy tomentum, unarmed or with small recurved spines. L. 1.5—3.7" by 1—1.7" sometimes somewhat obovate-oblong; tip rounded glabrous, above shining. Petioles .5". Lower flowers of corymb sometimes axillary with pedicels 1—1.5" long. Sepals very concave orbicular, .4", glabrous or ciliate. Petals .8", oblanceolate, villous within, unilateral. Stamens very many, 1.5", caducous. Gynophore 1.5". Fr. green globose, 2" diam.

5. *C. sepiaria*, L. Kaliakara, Beng.; Kantikapali, Or.

A large erect, sarmentose or sub-scandent wiry bush with grey-tomentose or hoary branches, sharp curved stipulary thorns, leaves .5—1.7" long, and small white flowers umbellate at the ends of the branchlets with very slender pedicels. Fruit globose, black, .2" diam.

Palamau and Shahabad, chiefly in the dry scrubby zone near the Soane! Scrub jungles of Puri district, common!

Fls. April—Dec. Fr. Nov.—Dec.

L. mostly elliptic-oblong, or obovate in Northern and ovate-oblong or ovate-lanceolate in Southern specimens; base obtuse rounded or sub-cordate; tip sub-acute or retuse, tomentose when young, old slightly pubescent. Petioles .05—1.5". Pedicels from uppermost axils and terminal .25—5". Sepals and petals .12". Stamens .2—3". Ovary very small.

6. *C. floribunda*, Wight.

A large woody climber with glabrous branches and coriaceous glabrous oblong leaves, 3.5", rounded at both ends, retuse and apiculate. Flowers .5" diam., white, in many flowered umbels, which are arranged in large panicles. Petals oblong. Stamens about 8. Ovary ovoid acute. Fruit globose, 1" diam.

Orissa, Cleghorn (f. F. B. I.); Kahuri Forest, Puri!

FAM. 12. VIOLACEÆ.

Herbs (in our area) with alternate, rarely opposite, entire or pinnatisect stipulate leaves. Flowers irregular, 2-bracteolate. Sepals 5, per-

sistent, imbricate. Petals 5, hypogynous, the lower dissimilar, often saccate or spurred. Stamens 5, hypogynous or slightly perigynous. Anthers erect, conniving in a ring round the ovary, connective often dilated and produced, cells dehiscing by a longitudinal slit or by apical pores. Ovary 1-celled, style 1, stigma entire or 3-lobed. Ovules many, anatropous, on 3 parietal placentæ. Fruit a 3-valved loculicidal capsule.

Sepals produced at the base

1. *Viola*.

Sepals not produced at the base

2. *Ionidium*.

1. VIOLA, L. Violet, Pansy.

Herbs, sometimes woody below. Flowers on 1—2-flowered peduncles, some sometimes cleistogamous and small, but ripening many seeds. Sepals produced at the base. Petals erect or spreading, lower largest, spurred or saccate. Anthers connate, two lower often spurred.

1. *V. Patrini*, DC.

Herb with a perennial rootstock and numerous leaves direct from the stock, sagittate or hastate, 1—3" long and crenate, the base cuneate on a very long petiole, which is winged above. Flowers lilac, the anterior petal with spur about 5" long, but small cleistogamous colourless flowers only 15", on peduncles often 6" long, direct from the stock.

Higher mountains of Chota Nagpur, Neterhat, 3000 ft.

Fls., Fr. May—Aug.

2. *V. tricolor*, L. The Heartsease.

This is said to occur wild in cultivated fields on the Pakripat, 3000 ft., but I have not seen it.

Both *V. tricolor*, L., the garden pansy, and *V. odorata*, L., the sweet violet, are largely cultivated in gardens. The first is annual. The violet is perennial, but is apt to be attacked by mildew in the rains and killed off.

2. IONIDIUM, Vent.

Herbs or undershrubs with alternate, rarely opposite leaves and axillary rose-, purple- or orange-coloured flowers. Sepals subequal, not produced at the base. Petals with lower larger clawed, saccate or spurred. Anthers free or connate, 2 or 4 of them gibbous or spurred. Ovary ovoid, style clavate, incurved, with oblique stigma. Capsule subglobose, few-seeded.

1. *I. suffruticosum*, Ging. *Viola suffruticosa*, Willd.; Tandi sol, bir suraj mukhi, S.; Ratanpuras, H.; Nunbora, Beng.

A diffuse perennial with often woody branches, alternate sub-sessile lanceolate leaves, subulate stipules and solitary rose-coloured flowers.

Throughout the province. Common in open pastures and waysides.

Fls. chiefly in c.s.

Usually pubescent. L. linear to oblanceolate, serrate or nearly entire, 7—1" long. Capsule 12", with ellipsoid striate seeds.

FAM. 13. BIXACEÆ.

Trees or shrubs with mucilage canals in the bark (and other places), palminerved or palmately-lobed large leaves with usually minute caducous stipules, and usually large flowers which are paniced, regular and 2-sexual. Sepals 4—5, free, hypogynous, imbricate. Petals 4—5, free, large and coloured. Stamens many. Anthers 2-celled, opening by short slits or pores. Ovary 1-celled, with parietal placentas, or, by the intrusion of the placentas, more than 1-celled (2—5). Ovules many, anatropous. Style slender with simple or lobed stigma. Fruit a 1—5-celled capsule opening by 2—5 valves, the thin dry inner layer of the pericarp separating from and sometimes dehiscing on different lines from the outer. Seeds many, sometimes with long hairs, sometimes outer layer of the testa ariliform and coloured. Albumen copious. Embryo usually curved with more or less foliaceous cotyledons, which are often palminerved. Germination epigeal.

Anthers straight. Capsule 3—5-valved, seeds cottony.

Tree with palmately-lobed leaves .

1. *Cochlospermum*.

Anthers horseshoe-shaped. Capsule 2-valved, seeds with aril-like testa. Large shrub. L. not lobed

2. *Bixa*.

1. COCHLOSPERMUM, *Kunth*.

1. *C. Gossypium*, *DC.* Hupu, *K.*; Hopo, *S.*; Galgal, *H.*; Golgol, *Beng.*; Ganiari, Kunto palas, *Or.*; Yellow Silk Cotton Tree.

A small, straight, very soft-wooded tree, with palmately 3—5-lobed leaves, 3—8" diam., and bearing, when leafless, large handsome yellow flowers, 4—5" diam., which are succeeded by large pear-shaped pendulous fruits.

Chiefly on dry hills from Shahabad and Gaya southwards; rare in the Santal Parganas and the coastal districts; very common from Chota Nagpur and Sambalpur to Angul.

Fl. Jan.—March. Fr. March—June. Deciduous Nov.—May.

Bark light-coloured, fluted. Blaze deep brown, then streaked brown and white. A deep orange-coloured juice exudes from near the cambium. Wood spongy. L. tomentose beneath when young, shining above. Petioles 2—8". Stipules linear caducous. Fls. in few flowered terminal panicles. Petals emarginate. Capsules 3—4" by 2½", 5-celled at the base. The coriaceous epicarp and papery endocarp dehisce on different lines. Seeds many, 25" long, reniform, brown, rough, clothed densely with a deciduous floss. Testa hard. Embryo curved.

The wood immersed in water for about 8 hours and the water strained off, mixed with flour and fried, forms a nutritious food in Sambalpur district (*Mudaliar*). The wood is also used for torches. The gum is known as Hog gum and the silk cotton from the seed is one of those known as *Kopok*.

2. BIXA, *L.*

1. *B. Orellana*, *L.* Latkan, *H.*, *Beng.*; Gulbas, Sakta, *Or.*; The Arnatto.

A small tree with cordate acuminate leaves, 4—8" long, glabrous and somewhat shining, with a slender petiole 2—3". Flowers white or rose, 1—2" diam., in terminal panicles. Ovary 1-celled. Ovules on 2 parietal placentæ. Capsule 1.5", ovoid, softly echinate.

Fl. July—Sept. Fr. Oct.—Nov.

Native of America; often cultivated and is very ornamental. The pulpy testa of the seed yields the Arnatto dye.

FAM. 14. FLACOURTIACEÆ.*

(Including Samydaceæ).

Trees or shrubs without mucilage or resin canals in the bark, with alternate, usually distichous, penninerved, rarely palminerved leaves, frequently with translucent dots or dashes, or punctate beneath due to resin cells. Stipules usually small and caducous. Flowers small, axillary, or in lateral or terminal cymes or racemes with small bracts, regular, 2-sexual, monoëcious or dicecious. Sepals 4—several, free, hypogynous or more or less perigynous, sometimes connate in bud and irregularly splitting. Petals present or 0, as many as or 2—3 times as many as the sepals or indefinite. Torus often concave and with variously formed glandular or scale-like or staminode-like appendages, which may be outside, inside, or between the stamens. Stamens more numerous than the petals, 1—many-seriate or in bundles opposite the petals, rarely as many as the petals and then alternating with the sepals. Anthers usually with lateral slits. Ovary sometimes half-inferior, rarely inferior, 1-celled, with 2—8 (usually 3—5) parietal placentas, which sometimes meet in the axis, making the ovary several-celled. Ovules usually many, anatropous. Styles as many as the placentas or more or less connate. Fruit capsular or baccate or with pyrenes. Seeds 1 or more. Testa sometimes with an ariliform outer layer. Albumen present. Embryo straight with generally foliaceous cotyledons. Germination epigeal.

A. Petals present and persistent.

Unarmed small tree with paniced inflorescence

1. *Homalium*.

B. Petals 0.

1. Stamens hypogynous, numerous, or flowers 1-sexual.

Ovary incompletely 2—6-celled, styles as many

2. *Flacourtia*.†

Ovary 1-celled, styles usually connate.

3. *Xylosma*.

2. Stamens perigynous (sometimes nearly hypogynous), 6—15, fls. 2-sexual. Ovary 1-celled

4. *Casearia*.

1. HOMALIUM, Jacq.

1. *H. nepalense*, Benth.

A small tree, 30—40 ft., with coarsely serrate, prominently nerved leaves, attaining 6.5 by 3—4", and axillary panicles of small white flowers, .2—2.5" diam.

Rocky hill jungles, but usually near valleys. Singbhum and Poranat, rare! Karo Block, Keonjhar, Grieve; Puri (see var.)! Angul (see var.)! Bonai, Cooper! Mayurbhanj, ascending to top of Meghasani, 3800 ft.! Fl. May—June.

* The Samydaceæ are closely allied to the Turneraceæ and other families placed at a considerable distance from the Bixaceæ merely on account of their *markedly* perigynous or epigynous ovary. *Vide* Introduction (Classification).

† The characters separating *Flacourtia* and *Xylosma* are not very good ones, and some species show a transition.

Bark light coloured. Young twigs puberulous. L. in ridge specimens only 3", elliptic or elliptic-ovate, sometimes crenate-serrate, each tooth with a gland at the end of the nerve, acuminate, nearly glabrous, narrowed into the .5—1" petiole. Secondary nerves 6—8, 1—2 from near the base. Panicles 2—5", dense, pyramidal, pubescent. Pedicels .05—06". Fls. densely hairy. Calyx tube funnel-shaped. Sepals 6—8, spreading, linear. Petals as many, linear-oblong, valvate, perigynous. Stamens as many, and inserted with and opposite to the petals, alternating with fleshy glands. Anther lobes very short. Ovary half inferior, hairy inside and out. Styles 3—5. Ovules about 6, parietal, anatropous. Fr. not seen.

Var. *a*. L. 2.5—5" ovate, acuminate, crenate-serrate. Fls. very small, only .12" diam., woolly. Top of the Khandabolo Ridge, 3100 ft., Puri!

Var. *β*. Twigs pubescent. L. 3—6", ovate-elliptic or broadly elliptic, minutely pubescent, margins crenate eglandular or glands inconspicuous. Bolong Block; Angul!

2. FLACOURTIA, Commers.

Trees or shrubs, usually thorny. Leaves toothed or crenate. Flowers small, usually dioecious. Sepals small, imbricate. Petals 0. Stamens many, anthers versatile. Disc lobulate and glandular. Ovary imperfectly (rarely perfectly) 2—8-celled, usually with 2—8 deeply intruded placentæ. Ovules 2 superposed on each placenta, styles or stigmas several, and stigmas usually notched. Fruit baccate, with several 1-seeded pyrenes. Germination epigeal, cotyledons sometimes palmi-nerved.

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|------|--|-------------------------|
| I. | L. nearly always under 4", orbicular to oblong-obovate, never acuminate. | |
| | Shrub with thorns, often longer than the L. and bearing fls. | |
| | L. 1—2". Fls. sub-solitary or racemes few flowered | 1. <i>sepiaria</i> . |
| | Small tree with thorns, mostly shorter than the L. and never bearing fls. L. 1.5—3.5". Fls. in pubescent racemes | 2. <i>Ramontchi</i> . |
| II. | L. mostly over 4", acute or acuminate. Racemes pubescent. Fr. red. | |
| | L. 3—6", ovate glabrescent. Petiole .4—5". Fls. in contracted racemes, short pedicelled | 3. <i>latifolia</i> . |
| | L. 4—7", elliptic-oblong, pubescent. Petiole .25". Fls. in short axillary racemes, long-pedicelled | 4. <i>montana</i> . |
| III. | L. 2—4", lanceolate, acuminate, and glabrous. Racemes glabrous. Fr. red to purple | 5. <i>cataphracta</i> . |

1. *F. sepiaria*, Roxb. Samu Bainchi, Or.

A very thorny small bush, with straight sharp thorns, attaining 1.25—2" long (but see var.), many of them bearing clusters of leaves or flowers and longer than the leaves. Leaves small, .5—7", very rarely 1—3", in luxuriant plants, usually cuneate obovate, or orbicular and with cordate base, crenate-serrate except at base, often fascicled.

Flowers small, usually solitary at the ends of the short shoots.

In the Northern tract common in Purneah! Common in the Orissa scrub jungles, especially on laterite from Balasore southwards. Cuttack! Khandpara! Nilghiri! Balasore! Puri (Maniband, Jaimangal, etc., forests)! Narsingpur!

Fls. March—April. Fr. April—May. Evergreen.

Much branched, often only 2—3 ft. high, rigid, thorns sometimes branched. Twigs pubescent. L. rarely oblong or oblanceolate, glabrous; secondary nerves 3—4 reticulate between, petiole under .1—2", often pubescent. Fls. dioecious, rarely in imperfect racemes. Female on pedicels .15—2" long. Styles usually

6—7, stigmas 2-lobed. Berry with about 6—7 pyrenes, .25—4" diam. Pyrenes rugose. Testa smooth. Cotyledons broadly orbicular, .1", base somewhat cordate; radicle excluded, straight.

Var. *innocua*. Almost unarmed and flowers in short fascicled racemes. Leaves 1—2". This is easily distinguished from *F. Ramontchi* by the rigid leaves and the very short racemes and pedicels being erect even in fruit.

Waste lands, Puri (Chattarbar). Fr. Dec.

Bark on large bushes grey, slightly flaky. Blaze hard light brown.

2. *F. Ramontchi*, L'Herit. Mehrle, K.; Merice, S.; Katahi, H.; Kakai, H. Beng.; Ohir, Beng.; Kontadhawra, Mamuri, Balihhaincho, Kontaikuli, Or.

A tree or shrub, usually thorny, with crenate-serrate usually obtuse or rounded, often olive-green leaves and yellowish-green flowers, .25" diam., either clustered or racemed, or some also solitary in the axils of scales or leaves. Pedicels articulate below the middle. Sepals 4—6, pubescent or hirsute, .06—'08" in the male, very early disclosing the yellow stamens. Disc-lobes 4—6, rounded, often lobulate. Styles usually 4—6, small capitellate. Ovules 2 superposed in each cell. Fruit a berry .3" diam., red.

Very common throughout the province, both in the valleys and on the hills and in second growth forest.

Fls. Dec.—March, chiefly March. Fr. April—May. Deciduous just before flowering; new shoots appear Feb.—March.

Bark nearly smooth. Blaze rather hard, pale brown.

The fruit is very palatable.

Very variable. The following forms occur:

a. Ramontchi proper. L. glabrous, 2—3", elliptic, ovate or oblong, coarsely crenate; racemes slender, nearly or quite glabrous. Chota Nagpur.

β. sapida, F.B.I. Twigs slender reddish pubescent. L. 2.5" by 1.5", oblong to obovate, glabrescent; secondary nerves 3—5, petiole .3", pubescent, racemes pubescent. Hills, frequent.

γ. occidentalis, F.B.I. Similar, but leaves often orbicular and permanently pubescent or tomentose. Chota Nagpur, Bihar.

3. *F. latifolia*, Cooke.* Syn. *F. Ramontchi*, var *latifolia*, F. B. I.

A small or moderate-sized tree, attaining 4—5 ft. girth, with few thorns. Leaves 3—6" long, ovate-lanceolate or ovate, and somewhat tapering at tip, glabrescent. Petiole .4—'5", rather slender. Flowers dioecious; males in very small clusters (contracted racemes), usually on leafless branches. Fruit .6" diam.

Sameswar Hills! Singbhum! Gangpur!

Fls. Feb. Fr. March—April.

Bark grey, flaking on old trees. Blaze hard, pale brown, with flow of water. Base of L. usually cuneate. Secondary nerves 5—7, slender, oblique, 1—2 from close to base; tertiaries very reticulate, not at all scalariform as in *F. montana*.

*I am not quite sure whether this is Cooke's *F. latifolia*, as he described it as having fruit only the size of a pea!

4. F. montana, Grah.

A small, sometimes thorny tree, with long thorns on bole, and a few on the branches; twigs softly pubescent. Leaves elliptic-oblong, elliptic or somewhat ovate, 4—7" long, shortly obtusely acuminate, crenate, permanently pubescent on the nerves beneath. Petiole .25", pubescent. Flowers dioecious (always?), in capitate racemes, axillary, and from leafless axils. Fruit brilliant red, .7" diam.

Angul, Bolong Block, rare! Fls. Feb. Fr. Oct.

L. usually glabrescent above and on the smaller nerves, but in the Angul tree more or less permanently pubescent. Secondary nerves 6—8, rather strong beneath, one from base. Tertiaries rather straight and regular. Calyx 4—5-partite, lobes pilose-pubescent. Disc fleshy, annular in female.

The fruit is edible.

5. F. Cataphracta, Roxb. Panialah, *H.*; Paniyara, *Uran*; Bunch, *Beng.*; Baincha, *Or.*

An erect, small tree with the young trunk covered with large compound thorns many inches long. Leaves oblong to oblong-lanceolate, acuminate, quite glabrous, crenate, serrate. Flowers in glabrous racemes. Fruit purple, .8—1" diam. when ripe.

Very common in northern Purneah! Orissa forests: Mayurbhanj! Tamna forest, Puril! Often cultivated.

Fl. June. Fr. Oct.—Jan.

Trunk quite smooth in old trees. Bark pallid. Blaze with chlorophyll, pale brown. L. 2—4", sometimes ovate-lanceolate, lower ones on the twigs less acuminate, base usually rounded; petiole .25—.5". Fls. .1—1.5" diam. Stigmas 4—6, capitate.

The cultivated fruit is like a small, round plum, with a small annulus at base and remains of the stigmas at the top. Epicarp somewhat coriaceous, endocarp fleshy, with 8—12 pyrenes compressed with sharp edges and about .25" diam. Flesh somewhat tart but of agreeable flavour when quite ripe. I have always seen the wild fruit red (not purple), .5—1" diam., but it may be often eaten before ripening.

The seed takes nearly one year to germinate. The seedlings and young plants have slender, simple axillary thorns.

Wood said to be uncommonly good in resisting friction, and might be used for block sheaves. *Ham.*

3. XYLOSMA, Forster.

Characters of Key. The *F. B. I.* states that there is one short style and a capitate stigma, but the stigmas are sometimes 2—3, and these are sometimes split nearly to the base. The ovary is also imperfectly 2—3-celled in many cases, just as in *Flacourtia*.*

1. X. longifolium, Clos. Suljara, Gara Sul, *Ho.*; Dandal, Katai, *Kharw.*; Katari, *H.*

A small, glabrous tree, often with long thorns when young, with lanceolate, acuminate, shallowly-toothed leaves 3—6" long, and small, greenish flowers in short axillary compound racemes. A pretty tree in fruit with innumerable deep-red, globose berries, .25" diam., on pedicels .17—.25" long, articulate near the base.

* As noted in the *C. N. Flora*, p. 160. The two genera are scarcely separable.

Ravines and along nalas in Singbhum and Porahat! Kochang, Gamble; Palamau, Neterhat! Evergreen jungles, Mals of Puri!

Fl. Nov.—Dec. Fr. March—April. Evergreen, renews leaves Nov.

L. (somewhat elliptic in the Puri specimen) narrowed both ends, with 6—8 pairs oblique secondary nerves; young somewhat gland-serrate. Petiole .25—3". Male racemes dense, 3—1" compound; Fls. with 10 fleshy red disc glands and about 26 stamens. Bracts linear-oblong (ovate-acuminate, *F.B.I.*). Stigmas 2—3, small, capitate (or 1 capitate, *F.B.I.*). Ovules few parietal. Berry 1-celled, with coriaceous pericarp and 3—6 angled seeds, seated, on the persistent calyx and disc.

4. CASEARIA, Jacq.

Trees or shrubs. Leaves distichous, often with dots or translucent dashes. Pedicels short, jointed. Calyx inferior, deeply 4—5-lobed; persistent. Stamens 6—10, united into a tube, with small petaloid staminodes or nearly free, hypogynous or sub-perigynous. Anthers introrse. Stigma capitate or 3-lobed. Capsule succulent, ellipsoid. Seeds many, with a fleshy, usually scarlet aril and straight embryo.

L. oblong, more or less tomentose

1. *tomentosa*.

L. elliptic, glabrous

2. *graveolens*.

1. **C. tomentosa**, *Roxb.* Rore, *K.*; Chorcho, *S.*; Churchu, *H.*; Beri, *Kharw.*; Maun, *Beng.*; Tondri, *Gond.*; Der, *Th.*; Benimanj, *Kokra, Or.*

A small tree, or flowering as a shrub, with pubescent or tomentose twigs. L. oblong, or the smaller ones somewhat ovate or elliptic, pubescent, especially on the ribs beneath. Flowers axillary on the new shoots, .25" diam., green. Capsules soft green, axillary, and from leafless axils oblong 6-angular.

Throughout the Province. Frequent in North Champaran! Very common in waste ground and river valleys in Chota Nagpur! Common on laterite in scrub jungles from Khandpara to Puri, and on cotton and other soils in Angul!

Fl. March—May. Fr. April—May. Sub-deciduous Feb.—March. L. turn red before falling.

L. from 2" at base of twigs to 7" by 2", obtuse entire or crenate. Stipules caducous, petioles .3—5". Sepals usually 5. Stamens 6—10, alternating with fleshy pubescent staminodes; tube short. Fr. .75—1.25". Seeds with a scarlet aril. There are often 2—3 cymes together on peduncles .3" long.

The fruits, pounded with mud, are thrown into dammed-up streams for killing fish. Campbell says that the pounded bark is applied externally in dropsy, fever, and snake-bite.

2. **C. graveolens**, *Dalz.* Reri, *K.*; Nuri, *S.*; Chilla, *H.*; Benchu (in *Kodarma*); *Kokra, Beni man and Jamurdhi (in Sambalpur), Or.*

A small tree with elliptic or elliptic-oblong or -ovate glabrous leaves. Flowers greenish, in dense clusters from the leafless axils. Fruits broadly ellipsoid or broadly oblong, .65—1" long, yellow.

Also distributed throughout the whole province from Northern Champaran to Sambalpur and Puri. More of a high level plant than *C. tomentosa*, but frequent in valleys. Ascends to nearly 3000 ft. in Palamau.

Fl. May—June. Fr. May—July. The tree is nearly or quite leafless at the time of flowering, the new L. appear on the barren branches about the same time, but not till later on the flowering branches. Old L. turn copper-coloured in Dec. and Jan.

Twigs glabrous. L. 4—8" by 2—3.5", with often smaller ones at base of the twig. Very shortly acuminate, entire or crenate, usually rounded at the base. Petiole .25—5". Sepals 5, gland dotted. Stamens 6—8, alternating with linear-oblong villous staminodes.

FAM. 15. PITTOSPORACEÆ.

1. PITTOSPORUM, *Banks.*

Trees or shrubs, sometimes epiphytic. Leaves alternate or subverticillate, entire and exstipulate. Flowers terminal or axillary. Sepals 5, imbricate. Petals 5, hypogynous imbricate, erect, with connivent or connate claws. Torus small. Stamens 5, erect, anthers versatile, 2-celled, introrse. Ovary incompletely 2—3-celled by the projection of the parietal placentæ, not on a gynophore. Style simple, stigma terminal, 2—3-lobed. Ovules 2—more on each placenta. Fruit capsular, 1-celled, 2—3-valved, with the valves placentiferous in the middle. Seeds smooth, imbedded in pulp, with copious rather leathery albumen.

1. *P. floribundum*, *W. & A.* Bagh-muta, *Kharw., Kisan.*

A small tree up to 25 ft. with branches and leaves often subverticillate. Leaves oblong to lanceolate or oblanceolate, shortly petioled, shining above. Flowers small, yellow, numerous, in subcorymbose fascicles. Capsule globose, 2-valved, 3—4-seeded. Seeds surrounded by viscid juice, with red testa.

Higher hills of Ranchi and Palamau on rocky ground, often epiphytic on rocks and in the hollows of other trees. Common along ravines at Neterhat, 2—3000 ft! Horhap Forest, common! Ranchi Ghats (Adar)!

Fla. June—July. Fr. Oct. Evergreen.

Bark smooth, lenticillate, slightly peeling. Blaze white, a very white layer between wood and outer bark. L. 4.5—7", or on flowering branches only 2.5—4.5", acute or acuminate, rarely obtuse, tapering at base into a slender .2" long petiole; margins often undulate. Secondary nerves 7—8, fine, very finely reticulate between. Panicle branches and slender pedicels articulate. Capsule rugose when dry, slightly appressed brown-hairy, 2—3" diam., slightly 4-grooved; inside of carpels horizontally striate. Seeds attached to mid-rib of carpels near the base, oblong, flat on two faces.

FAM. 16. POLYGALACEÆ.

Usually herbs, sometimes shrubs or rarely small trees (*non regionis nostræ*). Leaves alternate or rarely opposite, or whorled, simple entire, exstipulate. Flowers irregular, bracteate, axillary, or spicate or racemed. Sepals 5, free, imbricate, 2 inner (*wings*) often petaloid and larger. Petals 5 or 3, the anterior (*keel*) usually different and carinate. Stamens 4—5 or usually 8, hypogynous, monadelphous, rarely distinct, anthers opening by pores. Ovary free, 1—3-celled. Ovules 1 or more, anatropous. Fruit usually 2-celled and 2-seeded and loculicidal. Seeds usually strophiolate and albuminous.

Two inner sepals (*wings*) larger. Stamens 8.
All sepals petaloid, subequal. Stamens 4—5

1. *Polygala.*
2. *Salomonis.*

1. POLYGALA, L.

Herbs, rarely shrubs, with alternate leaves and racemose, irregular papilionaceous flowers, with the "wings" formed of the two inner, larger, usually petaloid and persistent sepals. Petals 3, united at the base with the staminal tube, inferior, tubular or keel-shaped and generally crested. Stamens 8, filaments united for their lower half into a split tube or sheath; anthers opening by pores. Ovary 2-celled; ovules 1 in each cell, pendulous. Capsule 2-celled, loculicidal, 2-seeded. Seeds usually strophiole and albuminous.

The L. in this genus are often exceedingly variable in one and the same species.

- | | |
|---|----------------------------|
| I. Shrubby. Fls. not yellow. Wings often scarcely petaloid.
Bracts persistent. Wings obovate | 6. <i>crotalarioides</i> . |
| Bracts caducous.. Wings hatchet-shaped | 1. <i>glomerata</i> . |
| II. Herbaceous. Bracts persistent or sub-persistent. Keel crested. | |
| A. Wings not petaloid, oblique or falcate. Strophiole 3-toothed.
Racemes short and dense, wings very oblique | 2. <i>chinensis</i> . |
| Racemes longer than the L., lax | 3. <i>elongata</i> . |
| B. Wings petaloid. Strophiole not toothed.
Racemes long, but dense, terminal and axillary | 4. <i>leptalea</i> . |
| Racemes very short, lateral, or flowers sub-solitary . | 5. <i>erioptera</i> . |
| C. Wings usually petaloid not oblique. Strophiole 3-fid.
Racemes rather short, axillary very dense | 6. <i>crotalarioides</i> . |
| III. Small herb. Flowers yellow. Keel hooded, not crested.
Racemes terminal | 7. <i>triphylia</i> . |

1. *P. glomerata*, Lour.

A twiggy undershrub, 1—2 ft. high, with pubescent branches, ovate or ovate-lanceolate, sub-distichous leaves 1—1.75" long, rarely attaining 2 by .3—.75", and greenish inconspicuous flowers in extra axillary racemes .3—.5" long. Wings .2" by .1", oblique, falcately-oblong, apiculate with scarious margins, nearly .25" in fruit, ciliate.

Singbhum valleys in the Latua Forest under shade, very rare, but locally abundant! Bandgaon, C. B. Clarke! Fls. Oct.—Jan. Fr. Jan.—Feb. Deciduous in the h.s.

Distribution: Sikkim, Khasia, Assam, Chittagong, Burma and Java.

L. sometimes (outside our area) oblong or elliptic-oblong or broadly lanceolate; ciliate and somewhat hairy both sides, acute with rounded base and 3—5 fine, rather obscure secondary nerves. Petiole pubescent, .1". Racemes pubescent, close-flowered, with very caducous bracts. Corolla white or upper portion purple, keel sub-saccate, .15", with small fimbriate crest. Petals oblong with small scale near base. Ovary sub-didymous and capsule ciliate. Seeds oval, silky, with 3-lobed strophiole.

2. *P. chinensis*, L. Syn. *P. arvensis*, Willd. Gaighura, S.

A herb with a slender or woody rootstock, stems hairy with curled hairs, and excessively variable leaves. Flowers sub-solitary or in many very short, lateral racemes, rarely exceeding .5", but sometimes proliferous. Bracts minute persistent acuminate. Wing-sepals herbaceous, .2", very oblique, acuminate, rather exceeding the broadly oblong, oblique-tipped, margined and ciliate capsule.

Rather frequent in open scrub jungles and grassy ground. Chota Nagpur, Singbhum! Manbhum! Palamau! Sambalpur! It extends to Bhotan and United Provinces on north, Dacca on east, and Madras on south, and occurs therefore probably throughout the Province.

Fls., Fr. July—Dec.

Branches usually procumbent, 4—12". L. from 3—2.5", orbicular, elliptic, obovate, oblanceolate or linear; the longer forms are usually narrow, generally ciliate, with small curled hairs; petiole minute. Fls. green, or "when young, yellow fading to pink" (C. B. Clarke). Wings usually straight on upper side, rounded on lower side, tapering at base. Capsule sometimes scarcely notched, margined, ciliate. Seeds ellipsoid, hirsute, and with hard, white, 3-toothed strophiole. Lateral teeth often longer than median.

The root is given in fever. *Campbell*.

3. *P. elongata*, *Klein*.

A herb somewhat resembling *P. erioptera*, 6—15" high, usually branched from the root. Stems with a curly pubescence or glabrous. Leaves 5—2.2", scarcely petioled, linear or linear-oblong with tapering base. Flowers yellow, in elongate lateral often lax racemes attaining 3—4". Wings 2—2.2", herbaceous, somewhat oblique, 5-nerved and usually apiculate. Capsule glabrous, very oblique at the usually retuse or notched top.

Behar, *Kurz*!

4. *P. leptalea*, *DC.*

A very slender, erect herb, sometimes from a woody stock but flowering its first year, 9—18" high, simple or branched with angled stems and linear leaves, 5—1", narrowed both ends. Racemes dense, terminal and axillary elongate, with small pink flowers 1.2—1.4" long. Wings petaloid, 3-nerved, narrowly obovoid, nearly symmetrical. Capsule oblong-obovoid, retuse and somewhat oblique above, margined, nearly as long as wings. Seeds densely hairy, strophiole galeate.

Chota Nagpur, very common on clay soils in thin jungle! Common at Neterhat, 3000 ft.! Santal Parganas! Orissa, on the hills!

Fls., Fr. Sept.—Dec.

5. *P. erioptera*, *DC.*

A herb with many suberect or diffuse pubescent branches from an often stout root, linear, linear-oblong or more rarely elliptic, leaves 3—1.2" long and yellow flowers, 1.7—2" long, with densely pubescent, elliptic, obovate wings in very few-flowered short racemes. Capsule oblong, pubescent, not at all winged.

Behar, *J. D. H.*! Darbhanga! Daltonganj, *Gamble*! Mayurbhanj, *Hooper*!
Fls. Aug.—March.

The whole plant is usually very pubescent and the leaves variable, but the B. & O. specimens seen have all narrow L. *The Flora of Madras* describes the "wing-petals" as triangular and falcate.

6. *P. crotalarioides*, *Ham.* Bijnori, *Gond*; Gaighura, Lilkathi, *S.*

A small shrub, or in var. *glaucescens*, herbaceous, from a woody stock. Stems and branches with spreading hairs, 6" to 2 ft. long. Leaves obovate or oblanceolate, 1—3.5", hairy, rounded or obtuse, scarcely petioled. Racemes 4—1.25", dense, with minute hairy subulate bracts and bracteoles, which persist long after the fruit has fallen. Flowers

·25—·3" long, lilac or white with purple tips, pedicel not exceeding the bract. Wings obovate, ciliate, rounded. Capsule half as long, orbicular margined, retuse, ciliate. Seeds dark brown, hairy. Strophiole thin, deeply 3-fid. Lateral segments oblong or obovate, rather shorter than the central.

Ramnagar Hills, in open forest on sandstone, very shrubby!
Fls. Fr. May—Sept.

Var. glabrescens.

Shoots herbaceous, 3—8", all parts much less hairy. Leaves more glaucous and glabrous on both surfaces, but ciliate. Bracteoles smaller.

Chota Nagpur!

L. lanceolate-obovate or oblong-obovate, somewhat shining beneath, 1·5—3·5". Fls. greenish or pink, wings ovate or ellipsoid, sub-petaloid with green veins, lateral petals oblong, curved, pinkish.

This has been confused with *P. chinensis* owing to the description of the strophiole in the *F.B.I.* being described as 2-appendiculate and that of *P. chinensis* as with 3 appendages. The *Bijnori* of the Central Provinces is this species. Its root-stocks are ·12—·3" diam., brown and wrinkled when dry, in which form they are sold in bazaars. A preparation is given for cough (*Camp.*), and it is used (*vide Haslett*) in the Santal Parganas in the preparation of country spirit.

7. P. triphylla, Ham.

A small herb with simple or branched stems 2—6", rarely 10" high, bearing generally a crown of approximate, membranous, elliptic, orbicular, ovate or spatulate leaves, ·5—2" long, and terminal racemes 1—3" long of small clear yellow flowers, fading pink. Seeds strophiolate.

Damp banks and rocks. Common in Chota Nagpur! Very common on Paras-nath!

Fls., Fr. Sept.—Jan.

In the more branched forms the L. are more scattered, 5—6-nerved and acute, in simpler forms rounder and obtuse and fewer-nerved, in all ciliolate and sometimes with minute hairs on surface. Calyx wings petaloid, deciduous in fruit. Keel hooded, not crested. The seeds are black and usually pubescent.

2. SALOMONIA, Lour.

Flowers minute, in terminal spikes. Sepals nearly equal, the two inner somewhat larger, all petaloid. Petals 3, not crested. Stamens 4—5, monadelphous below.

1. S. oblongifolia, DC.

A little herb, often quite simple, 3—8" high, with small sessile, linear-oblong to elliptic or ovate-lanceolate leaves, ·1—·3" long, and dense spikes of minute pink flowers ·08" long.

Common in damp places! Fls., Fr. most times of year.

FAM. 17. CARYOPHYLLACEÆ.

Usually herbs with opposite branches generally jointed or thickened at the nodes. Leaves opposite, entire or serrulate. Stipules scarious or 0. Flowers small or moderate sized. Sepals 4—5, free or connate,

imbricate. Petals 4—5 or 0, rarely perigynous. Stamens 10 or sometimes fewer, inserted with the petals on a hypogynous short disc or gonophore, or sometimes on a perigynous ring. Anthers 2-celled with longitudinal dehiscence. Disc sometimes of glands. Ovary free, 1-celled or imperfectly 3—5-celled, styles 2—5 or connate. Ovules 2—many on slender basal funicles, or funicles united into a column, amphitropous. Fruit capsular, often with thin walls, valves of teeth or splitting more or less to the base. Seeds often reniform; hilum marginal or central, albuminous. Embryo usually curved round the albumen, or nearly straight; cotyledons narrow, incumbent.

- | | |
|--|------------------------|
| 1. Sepals connate into a tube. Fls. moderate sized | 1. <i>Saponaria</i> . |
| 2. Sepals free or nearly so. Fls. small. | |
| a. Stipules 0. Styles free. | |
| Petals 2-fid or 2-lobed or 0 | 2. <i>Stellaria</i> . |
| Petals entire | 3. <i>Spergula</i> . |
| b. Stipules scarious. Style 2—3 fid. | |
| Diffuse. Petals 2-fid. | 4. <i>Drymaria</i> . |
| Diffuse. Petals entire | 5. <i>Polycarpon</i> . |
| Erect. Petals entire | 6. <i>Polycarpæa</i> . |

1. SAPONARIA, L. Soapwort.

Herbs. Flowers moderate sized, terminal on the dichotomously branched inflorescence with a tubular 5-toothed or -lobed calyx and 5 clawed petals. Stamens 10. Ovary 1— or imperfectly 2—3-celled. Ovules many. Fruit capsular, 4-toothed.

1. *S. vaccaria*, L. Syn. *S. perfoliata*, Roxb.; Tilothei, Vern.; Sabuni, Beng.; Musna, H., S.

Erect, 1—3 ft., branched above with cauline leaves, narrow, lanceolate to linear-oblong, amplexicaul, glabrous, and 2—3-chotomous panicles of pink flowers on erect 7—2" long pedicels.

Northern tract, frequent in cultivated fields. Bihar, J. D. H.† Champaran! Fls., Fr. Jan.—March.

Calyx 3" to 5" in Fr. Sepals keeled. Petals obovate. Capsule included in calyx, ovoid. Seeds large, globose, black, granulate. Campbell says it is cultivated for its oil in Manbhurn.

2. STELLARIA, L.

Herbs with white flowers, often small, in 2-chotomous or 2-chasial cymes, or solitary between the forks of the 2-chotomous branches. Sepals free, or connate at the base only. Petals usually 5, 2-fid or 2-partite or sometimes 0. Stamens 10 or fewer, hypogynous or subperigynous. Ovary 1-, rarely 3-celled. Styles 2—3, rarely more. Capsule short, splitting into as many entire or 2-fid valves as there are styles. Seeds compressed. Embryo annular.

- | | |
|---|-------------------------|
| Petals 0 or 5, 2-fid to base. L. ovate, upper sessile | 1. <i>media</i> . |
| Petals 4, long-clawed, emarginate or 2-lobed. L. petioled | 2. <i>Wallichiana</i> . |

1. *S. media*, L. Chickweed.

A small diffuse herb with a line of hairs on the branches and inflorescence often glandular, rather flaccid ovate leaves 5—1" long with

long, 3—5-nerved from the base. Inflorescence sometimes glandular-pubescent, panicle branches very slender. Flowers very small. Sepals with membranous margins. Petals very small, 2-fid to middle. Capsule 2—3-valved, with 1—2 brown, reniform, compressed seeds.

Parasnath! Fls. Aug.—Sept. Fr. Nov.—Dec.

5. POLYCARPON, L.

Diffuse herbs with opposite and pseudo-whorled leaves and scarious stipules. Flowers small and inconspicuous, in crowded, many flowered cymes, with scarious bracts or solitary in the forks of the branches. Sepals 5. Petals 5, small or 0, white or hyaline, entire or toothed. Stamens 3—5. Ovary 1-celled, style short, 3-fid.

1. *P. Lœflingiae*, Benth.

A prostrate, much 2-chotomously branched weed with hairy or pubescent (or glabrous, *F. B. I.*) branches 3—9" long, and small, pseudo-whorled, narrow, oblong, oblanceolate or spatulate leaves, .15—.6". Flowers in crowded cymes, with silvery bracts and sessile in the forks. Petals shorter than the obrusely keeled sepals, white, linear, delicate, inserted, with the delicate stamens in a slightly perigynous ring; sometimes petals absent. Seeds minute, brown, numerous.

Very common in old rice-fields and damp edges of ponds throughout the province. Singbhum! Purneah! etc.

Fl., Fr. Nov.—May.

The sepals are .1" long, with scarious margins, and somewhat boat-shaped in fruit.

6. POLYCARPÆA, Lamk.

Usually erect herbs. Leaves opposite, sometimes pseudo-whorled, stipules scarious. Flowers in cymes. Sepals 5, free, scarious, and often coloured. Petals 5, entire, 2-toothed or crose. Stamens 5, hypogynous or subperigynous, sometimes cohering and adnate to petals. Ovary 1-celled. Style slender, 3-fid or 3-toothed. Capsule 3-valved.

1. *P. corymbosa*, Lamk.

A much-branched herb, 3—6", very rarely 12" high, with very slender, tomentose, erect branches, opposite linear leaves, and terminal, silvery, paniced, dense, dichotomous cymes of very small flowers.

Rocky places. Behar, near the Sone, *J. D. H.*! Chota Nagpur, frequent! Puri! Fls. Aug.—Nov.

Rootstock woody, L. .3—.5", sometimes pseudo-whorled from the axillary leaf fascicles. Sepals lanceolate, very acute, .05—.08", brown and shining or silvery in fruit. Petals minute, red, entire free. Ovary sometimes only 4-ovuled. Capsule oblong, .04".

FAM. 18. PORTULACACEÆ.

Herbs, rarely undershrubs. Leaves opposite or alternate, entire, with scarious or bristly stipules, rarely stipules absent. Flowers regular, 2-sexual. Sepals (bracts?) 2, free or somewhat connate at base. Petals

4—6, very caducous. Stamens as many as the petals and opposite to them, or fewer through abortion, or very many in one or two whorls. Ovary superior or sunk somewhat in the torus, 1-celled, with 2—8-partite style. Ovules 2— ∞ campylotropous on a basal central placenta. Fruit capsular, opening by valves or circumsciss, usually many-seeded. Embryo more or less curved round the albumen or nearly straight.

1. PORTULACA, L.

Often rather fleshy herbs. Anterior sepal larger than the posterior. Petals free or somewhat connate. Stamens 4—many. Ovules numerous on the often 3—8-branched central placenta. Capsule circumsciss.

Rootstock thick, L. terete linear

1. *tuberosa*.

Root annual, L. not terete.

L. .25—1.5", with cuneate base, wider above

2. *oleracea*.

L. .2"—3", ovate-oblong to ovate-lanceolate

3. *quadrifida*.

1. *P. tuberosa*, Roxb.

A herb with numerous branches, 2—3" long, spreading from a thick fusiform root. Leaves sessile, linear, terete, fleshy, .5", with midrib decurrent on the stem and with tufted brown hairs at the nodes. Flowers yellow, in small terminal clusters, surrounded by about 8 leaves and tufted hairs. Fruit sessile, shining, .2—.25", ovoid, girt not quite half way up by the torus and calyx. Seeds minutely tuberculate.

Monghyr, Hamilton (*F.B.I.*). Fls., Fr. July—Oct.

It is entered in Camp. and Watts' Catalogue without remark.

2. *P. oleracea*, L. Dali ara, K.; Mota uric' alang, S.; Bara laniya, Vern.

A prostrate or erect, sub-succulent herb, 6—12", with cuneate-oblong or cuneate-obovate, usually truncate leaves, .25—1.5" long, whorled above, stipular hairs scarious, minute, or absent. Flowers yellow, sessile, solitary, or in clusters or cymes, supported by the whorl of leaves. Stamens 8—12.

Very common in open ground. Fls., Fr. r.s.

Is largely used as a pot-herb.

3. *P. quadrifida*, L. Suni ara, K.; Chota laniya, Vern.

A prostrate, creeping and rooting, sub-succulent herb, with numerous ascending branches, small, fleshy, narrowly elliptic or ovate or ovate-lanceolate opposite leaves, .2—3", with very short petioles and bristly stipules. Flowers solitary, terminal, yellow. Sepals hyaline, united at base. Petals 4, oblong, united below. Stamens 8—12, filaments hairy at base. Style long, 3—4-cleft.

Common everywhere in open places. Fls., Fr. r.s.

The flowers only open in bright sunshine like others of the genus. This is also used as a pot-herb.

4. *P. grandiflora* (the Sun Plant), is the beautiful little Brazilian species so often cultivated.

Campbell and Watts (Catalogue) describe a plant with 10 perfect stamens, which they say appears to be the cultivated plant gone wild, and is a troublesome weed on footpaths and roadsides in many parts of Chutia Nagpur. L. thick, fleshy, pale green, with dark green reticulations. Fls. pale purple, .25—5" diameter. Stem and flowering heads covered with long woolly hairs, especially at the nodes.

FAM. 19. AIZOACEÆ (Ficoideæ).

Herbs or undershrubs with simple, sometimes fleshy, opposite, alternate or pseudo-verticillate leaves with scarious or 0 stipules. Flowers from small and greenish to large and showy (but not in our area), in cymes or clusters, rarely solitary, 2-sexual, rarely polygamous, usually homiochlamydeous, 4—5-merous, or stamens fewer or more or less numerous, free or in bundles, or with filaments more or less connate in a ring below, hypogynous or perigynous, outer sometimes petaloid or converted into staminodes. Ovary free (in our species), 2—5-celled, with styles as many as the carpels. Ovules many, axile, or 1 basal, in each carpel. Fruit usually capsular, sometimes circumsciss or separating into cocci. Seeds many or 1 in each carpel, usually reniform, compressed; embryo curved or annular, surrounding the mealy albumen, radicle next the hilum. In *Mollugo* there is sometimes a very curious tail-like appendage to the hilum.

Stamens hypogynous. Capsule 3—5-celled, loculicidal
Stamens perigynous. Capsule 1—2-celled, circumsciss

1. *Mollugo*.
2. *Trianthema*.

1. MOLLUGO, L.

Branched herbs, sometimes dichotomous and prostrate, with pseudo-whorled or alternate entire leaves and fugacious stipules. Flowers small, clustered, or cymose, axillary. Tepals 5. Stamens 5—3, rarely many, hypogynous, staminodes sometimes present. Ovary 3—5-celled, styles 3—5. Ovules many, axile. Capsule membranous, included in the perianth, loculicidal. Seeds several, rarely 1 in each cell, often with a delicate appendage.

- | | |
|--|----------------------|
| A. Erect or sub-erect. Fls. in slender cymes | 1. <i>stricta</i> . |
| B. Prostrate. Fls. in axillary dense cymes or clusters. | |
| Glabrous or nearly so. Fls. pedicelled | 2. <i>spergula</i> . |
| Woolly or hairy. Fls. sessile or very shortly pedicelled | 3. <i>hirta</i> . |

1. *M. stricta*, L. Syn. *M. pentaphylla*, L.

A slender small herb, 3—10" high, with grooved or angled, usually much-branched erect stems and opposite, fascicled or pseudo-whorled leaves, .5—1.7" long. Flowers minute, greenish or white, in slender, dichasial panicles, or in uniparous scorpioid cymes on the branches of a dichasial panicle. Capsule oblong, slightly 3-sided, loculicidally 3-valved. Seeds several, bright chestnut, covered with close, very minute blunt spines or warts. Hilum minutely appendaged.

On bare walks, cultivated and waste ground, common in all districts (among rocks at Ranchi, Carter), frequent at Naterhat (3000 ft.). Fls., Fr. all the year round (but not the same plant).

L. sub-sessile, glabrous, sometimes rather fleshy, shining, linear-oblong to obovate, apiculate. Stipules minute, scarious. Sepals connate at base or free imbricate. .07" elliptic-oblong, obtuse. Stamens 3--5, very small, connate at base. Embryo curled.

2. *M. spergula*, L. Syn. *M. oppositifolia*, L. (teste *Flora of Madras*).

A small, diffuse or prostrate plant, with branches from the root up to 1 ft. long, pseudo-whorls of leaves, more rarely opposite, and long-pedicelled, greenish or white flowers, 1-several, axillary. Capsule ellipsoid, shorter than the sepals. Seeds many, covered with very close minute warts or points, as in the last, and with a minute subulate bristle with sometimes a second yet more minute bristle.

Darbhanga! Manbhūm, near Raniganj (which is just outside our area) in sandy soil round tanks, Kurz! Puri, in sand! Perhaps common in other districts, but the fls. are inconspicuous. Fls., Fr. May—July.

Nearly or quite glabrous. L. .2--.1" long, spatulate, lanceolate, elliptic or obovate, sub-sessile or shortly petioled. Secondary nerves obscure. Pedicels .12--.5", often exceeding the L. Sepals .12--.2" (.5", teste *Clarke*), often with scarious margins. Stamens 5--10. Stigmas 3, minute.

In a form found on the seashore, Puri, the branches are papillose on one side, L. only .15" long. Styles 3, stout.

3. *M. lotoides*, O. Kze. Syn. *M. hirta*, *Thunb.*

A stellately-tomentose herb, with woody tap-root and numerous pro-cumbent stems 1--3 ft. long, much branched, with orbicular or obovate leaves, .3--.5" diam., contracted into a more or less cuneate base and petiole, .2", fascicled or pseudo-whorled. Flowers green, with free, persistent sepals. .2" long in flower, .3" in fruit, stellate-tomentose, oblong-lanceolate or inner boat-shaped, mucronate, one margin scarious. Capsule 5-celled, with very numerous, brown, punctulate seeds.

The seed is remarkable. From the base of the funicle grows up a membranous jacket, loosely enveloping the funicle and supporting the seed, while the raphe is continued as a whip-like tail curling three-fourths round the seeds.

Usually in sandy places. Manbhūm, Campbell! Mahanadi River bed, Angul! Fls., Fr. Feb.—April.

L. sometimes only .2" long, but up to 1". Stamens 5, with long filaments from an annular, very minute hypogynous ring, alternating with ridges on the ovary, which they exceed. Styles short and stigmas 5, linear. The capsule is loculicidally septifragal (first splitting through the loculi, then separating with part of the septa and leaving the axis).

2. TRIANTHEMA, L.

Diffuse, prostrate, glabrous or papillose herbs, with opposite, unequal, entire leaves; petioles connected at their base by their dilated membranous margins, exstipulate. Flowers small, axillary, solitary, cymose or clustered, with a short or elongate hypanthium bearing 5 small, often coloured sepals. Stamens 5--10 or more, near the top of the hypanthium, perigynous. Ovary free, 1--2-celled, with 1--2 subulate styles. Ovules 1--many, basal. Capsule membranous or coriaceous, circumsciss, the lid sometimes with 1--2 seeds, the lower portion 2--many-seeded. Embryo annular.

1. **T. monogyna**, L. Syn. *T. portulacastrum*, L. (*Flora Madras*) *T. obcordata*, *Roxb.*; *Kechoa*, *K.*

A succulent herb with prostrate forked branches 8—18" long, opposite or sub-opposite, unequal, broadly obovate, oblong or elliptic leaves, .5—1", or attaining 2" by 1.75", somewhat lucid beneath and with usually undulate margins. Flowers solitary, sessile, white or pinkish from the forks of the branches. Ovary 1-celled, with several campylo-tropous ovules on a basal central column sometimes adnate to the side of the ovary. Capsule with a lower scarious or membranous portion and an upper, brown, more coriaceous portion, circumsciss. Seeds black with concentric lines.

A common weed in most districts. Fls., Fr. r.s.

Stems pubescent on one side. L. obtuse or retuse, base obtuse. Base of petiole sheathing with two small stipule-like appendages. Fls. sunk in the forks, sheathed by the base of the petiole. Sepals petaloid, with an excurrent herbaceous centre. .2". Stamens 15—24.

The plant is eaten as a pot-herb.

FAM. 20. ELATINACEÆ.

Herbs or undershrubs, sometimes very small or aquatic, with opposite or whorled, simple, stipulate leaves. Flowers small or very small, axillary, solitary or cymose. Sepals and petals 2—5, free, imbricate. Stamens isomerous or diplostemonous, hypogynous, free with versatile anthers. Ovary with 2—5 cells and styles, stigmas capitate. Ovules ∞ , axile, anatropous. Capsule septicidal, separating from the axis and septa or septifragal. Seeds straight or curved, albumen scanty or 0, embryo straight or curved, cotyledons small.

1. BERGIA, L.

Erect or prostrate herbs or undershrubs, with opposite or pseudo-whorled, usually serrate leaves. Flowers very small, solitary or fascicled, 3—5-merous. Sepals with green midrib and membranous margins.

Sepals and petals 5. Stamens 10 .

1. *verticillata*.

Sepals and petals 3—5. Stamens 3—5

2. *ammanoides*.

1. **B. verticillata**, Willd.

A herb with rather succulent, creeping stems, somewhat resembling an *Ammannia*. Leaves elliptic-lanceolate, .8—1.5" shallowly serrate with very short petiole. Flowers very small, crowded in the axils of the leaves, sessile, white, with 5 sepals and petals and 10 stamens. Capsule depressed, globose, .08" diam.

Plains of India, *Royle* (without locality)! Bengal, occasional, *Prain* (without locality). Rice fields and river banks, Madras! A native of various parts of India in wet places during the rainy season, *Roxb.* It probably occurs in Bihar and Orissa, but has so far not been collected there.

2. **B. ammanoides**, *Roxb.*

A diffuse or erect (*Roxb.*) annual with branches 4—8" long, lower decumbent, sometimes thinly pubescent. Leaves sub-verticillate

(opposite, with abbreviated shoots in their axils), '3—1" long, oblong-ob lanceolate, minutely sharply serrate, tapering to the sessile base. Flowers very small, crowded, rose-coloured, sepals, petals and stamens 3—5, isomerous.

Bengal, *J. D. H.* (without locality), very probably in Behar! Nuddea, C.B.C. Gangetic Plain! Doubtless in our province. Fls., Fr. Oct.—Jan., and during rains (*Roxb.*).

FAM. 21. TAMARICACEÆ.

Small trees or shrubs with alternate scale-like, exstipulate, sometimes amplexicaul or sheathing leaves. Flowers (in our species) in lateral or terminal spikes or racemes, white or pink, regular. Sepals and petals 5, rarely 4, imbricate, free or connate below. Stamens 4—10, inserted on the hypogynous or subperigynous glandular or lobed disc, free or connate; anthers versatile. Ovary free, 1-celled; styles 2—5, free or connate or stigmas sessile. Ovules 2— ∞ , on broad placentas, anatropous; raphe ventral, micropyle inferior. Capsule 3-valved. Albumen present or 0, embryo straight, cotyledons flat.

1. TAMARIX, *L.* Tamarisk.

Characters of the family. Ovary narrowed upwards; styles 2—4, short, dilated into the stigmas. Ovules many. Seeds plumose, exalbuminous. Embryo ovoid.

Stamens 10. Fls. '2"—'25" long

1. *ericoides*.

Stamens 5. Fls. under '13" long.

Fls. 1-sexual. L. tubular except at tip

2. *dioica*.

Fls. 2-sexual. L. appressed, sessile, but not tubular

3. *indica*.

1. *T. ericoides*, *Rottl.* Jhao, *H., K.*

A pretty shrub, 3—5 ft., with fastigiate branches, and sheathing, amplexicaul, shortly acuminate, glaucous, scale-like leaves, which are persistent and brown on old branches. Flowers pretty heath-like pink in dense erect racemes 1'5—6" long; perianth marcescent, '2—'25" long, the sepals only half as long as the corolla. Capsule '4—'5" long, 2—3-valved, opening and disclosing the silky coma of the seeds.

Along river beds in the Northern and Central Tracts, frequent! Southern tract, Sambalpur. The commonest species in the Province. Fl., Fr. Oct.—April. Evergreen.

The bracts are ovate-acuminate.

2. *T. dioica*, *Roxb.* Jhao, Lal Jhao, *Beng.*; Thar-thari, *Vern.*

A small tree with short trunk with very numerous spreading branches with drooping tips, and sheathing, amplexicaul, scale-like, obliquely-truncated acute leaves. Flowers dioecious, very numerous, pretty, pink, in drooping paniced spikes with triangular bracts. Petals linear-oblong, only about half the size of the last. Stamens 5; anthers purple in the male and 2-lobed, in the female sagittate and pale. Capsule 3-valved, not longer than the corolla.

Islands of the Ganges, *Roxb.*; Ganges near Rajmahal, *Hole*; Kalahandi, *Cooper*. I have not seen the specimens from our area, but from Oudh, not far off. Fl. Aug.

Bark dark coloured, cracked.

*3. *T. indica*, *König*. Jhao, jeora, *Vern*.

A small tree up to 2 ft. girth with habit of the last, but the scale-like leaves not sheathing or amplexicaul, although appressed to the twigs; imbricate on the young twigs. Flowers only .04—06", white or pink, in drooping paniced racemes, 2-sexual. Bracts spreading, lanceolate-acuminate. Sepals orbicular, not half as long as the petals. Stamens 5, twice as long as the petals. Anthers 4-lobed (*Roxb.*) and apiculate (as in the others). Capsules .12", 3-valved.

Sandy higher ground in the tidal forests of the Mahanadi! Beds of rivers, Champaran! But in neither case seen in flower. Fls. Aug.—Sept.

Bark dark or cracked as in the last.

FAM. 22. HYPERICACEÆ.

Herbs or shrubs, rarely trees. Leaves opposite, exstipulate, often punctate with glands, entire or gland-toothed. Flowers solitary or cymose, terminal or axillary. Sepals and petals 5—4, petals contorted in bud. Stamens ∞ , in 3—5 bundles, rarely quite free; anthers versatile. Ovary 3—5- or 1-celled, with 3—5 free or united styles. Ovules few or many, axile or parietal, on 3—5 placentas, anatropous. Fruit usually capsular. Seeds exalbuminous.

1. HYPERICUM, L.

Leaves usually sessile. Flowers yellow. Capsule septicidal, or dehiscing at the placentas in 1-celled ovaries.

Shrub with showy Fl. Styles free

Small herb with small Fl.

Cultivated shrub. Styles united except at top

1. *Gaitii*.

2. *japonicum*.

3. *chinense*.

1. *H. Gaitii*, *Haines* (*Journ. As. Soc.*, xv, p. 7).

A much-branched handsome shrub, 3—5 ft. high, with stems attaining 6" girth, with opposite-sessile somewhat glaucous leaves, 2—2.5", and short 3-chotomous cymes of showy yellow flowers, 2—2.25" diam. Capsule .7" long, conical.

Along streams, Neterhat Plateau! Fl. April—June. Fr. May—June (perhaps also r.s.).

Branchlets terete. L. elliptic-oblong, oblong-lanceolate or oblanceolate, gland-dotted, paler beneath, with 2—3 secondary nerves near the rounded base which reach far forward. Sepals .3—5", imbricate, ovate- or oblong-lanceolate. Petals obovate, 1—1.2" by .8—9". Stamens very many, in 5 bundles, .5—7" long. Styles .5," longer than the ovary, which is .3" in flower. Ripe dehiscent capsules somewhat shorter than before dehiscence from the contraction of the outer pericarp which causes the dehiscence. Seeds brown, polished, linear, 1 mm. long.

2. *H. japonicum*, *Thunb.*

A herb with erect tufted stems 3—5" high, or sometimes diffuse and nearly 12"; branches sharply 4-angled. Leaves .2—2.5" long, sessile,

erect, elliptic or oblong, pellucid-dotted, 3-nerved. Small yellow flowers, .25" diam., solitary in the forks or axillary and terminal. Sepals linear-lanceolate to ovate, 3—9-nerved. Capsules 3-valved, not exceeding the sepals.

Chota Nagpur, common, especially in elevated grass lands and damp places. Fl., Fr. April—June.

3. *H. chinense*, L.

A cultivated shrub, somewhat resembling *H. Gaitii*, with ovate leaves 2.5—3", somewhat amplexicaul (var. *Prattii*), or 1—2.5" and elliptic-oblong (in type), conspicuously dotted. Sepals very variable in length, often .5—6", elliptic-oblong, obtuse. Petals 1—1.2". Stamens .75—8". Ovary ovoid, with styles .7" long, united to near the top and then 5-cleft. Capsule only .25—3". Bettiah!

FAM. 23. *GUTTIFERACEÆ*.

Trees or shrubs with resin canals containing a greenish or yellow latex, and opposite usually evergreen and coriaceous leaves, generally with very close fine parallel secondary nervation. Stipules 0 or intrapetiolar. Flowers often showy, 1—2-sexual, sometimes dicecious. Sepals 2—6, imbricate, or in decussate pairs. Petals 2—6, imbricate or contorted. Male flower, stamens indefinite, hypogynous; filaments free or monadelphous or connate, in as many bundles as there are petals. Anthers dehiscing by pores or slits or circumsciss. Female flower with staminodes. Ovary 1—many-celled. Style 1 or 0. Stigmas free, or connate or peltate. Ovule 1—2 or many axile, or basal and erect. Fruit baccate. Seeds large, albumen 0. Cotyledons small and tigellus very large, or cotyledons thick, free or connate with small radicle.

I. *Garcineæ*. Ovary cells 1-ovuled. Style short or 0.

Calyx of 4—5-sepals

Calyx closed in bud, bursting into 2 valves

1. *Garcinia*.

2. *Ochrocarpus*.

II. *Callophyllæ*. Ovary cells with 1—4 erect ovules. Style distinct.

Ovary 1-celled, 1-ovuled

Ovary 2-celled, cells 2-ovuled

3. *Callophyllum*.

4. *Mesua*.

1. *GARCINIA*, L.

Trees with yellow resinous juice. Calyx of 4—5 sepals. Petals 4—5. Flowers polygamous. Male stamens many, free, or variously connate; anthers sessile on the staminal column or on short thick filaments. Female flowers with 8-many free or connate staminodes. Ovary 2—12-celled. Stigma peltate, entire or lobed. Ovule 1 in each cell, axile. Seeds arilled.

Sepals 4. Petals 4. L. 3—5"

Sepals 4—5. Petals 4—5. L. 6—14"

1. *cowa*.

2. *Xanthochymus*.

1. *G. cowa*, Roxb. Soroa, Ho.; Kowa, Beng.; Sarbana, Or.

An erect tree, 30—40 ft., with many slender and drooping branches from quite close to the ground and dark shining lanceolate or oblanceolate leaves, 3—5", with slender rather obscure secondary nerves

meeting in an intra-marginal one. Flowers yellowish, rather fleshy, 1—4 in the leaf axils or terminal and clustered. Fruit yellow, about 2" diam., 4—8-grooved and celled.

Along streams. Hills near Monghyr. *F. B. I.*; Saranda and Porahat Forests, Singbhum, rare! Athmalik State (Bamur)! Mayurbhanj! Mals, Puri!

Fls. March—April. Fr. May—June. Evergreen.

Blaze red, exuding small drops of yellow milky juice. L. membranous when dry, often oblong-lanceolate, rarely somewhat obovate, sometimes 6" long, acute or acuminate, tapering into the 3—5" long petiole; secondary nerves indistinct in fresh leaves, very fine oblique, about 12—16, reaching the intramarginal nerve. Stipules minute, fugacious, leaving a stipular line. Fls. axillary and in sessile terminal cymes, with the short pedicels at first fused, males usually terminal, and females axillary. Sepals .15—2". Petals 3—4". Stamens many, in a 4-rayed central mass, anthers sub-sessile, 4-celled.

The Fr. is eaten and is of pleasant flavour.

2. *G. Xanthochymus*, Hook. f. Syn. *Xanthochymus pictorius*, *Roxb.* Dampel, *Beng.* (fide *Prain*); Choro, Chiuri, Sitambu, *Or.*

A handsome, small or moderate-sized, straight (in the forest) tree, with spreading branches nearly down to the ground, and very large oblong or linear-oblong very coriaceous shining leaves attaining 13.5 by 4". Flowers cream-coloured, .5" diam., globose, clustered on woody bracteate tubercles from axils of fallen leaves. Fruit bright yellow when ripe, 1.5—2.5" diam.

In dense evergreen forest, near streams. Mals of Puri (Dhuanali)! Mayurbhanj (Meghasani, 3000 ft.)! Bonai, *Cooper*! Planted near the temple, Baruni Hill (Khurda), Cuttack, etc.

Fl. April—May. Fr. May (of following year?).

Blaze exuding scanty drops of a milky juice. Branches 6—8-angled, with a thick green cortex. L. with about 20 fine oblique secondary nerves arching within the margin; tip shortly sharply acuminate, base acute. Under surface with microscopic dots. Petiole .7—1", wrinkled, with an adnate, fleshy, intrapetiolar stipule, which covers the terminal bud. Bracts very short, sub-orbicular, bracteoles 2 minute, .05", similar. Pedicels .3—7". Sepals orbicular. Petals .25—3", orbicular. Stamens connate into 4 or 5 erect, flat, short spathulate bodies like single stamens with numerous didymous anthers at the top. Ovary globose, with large, sessile, peltate, 4—5-lobed stigma, 4—5-celled. Fr. with milky juice till ripe, on a pedicel 1.2" long.

Fr. eaten, and the tree is sometimes cultivated for the fruit. It is, however, very acid. It is mentioned in *Firminger* under the vernacular name of *Tumul*.

2. OCHROCARPUS, Thouars.

1. *O. longifolius*, Benth. & H. f. Churiana, *Or.*

A moderate-sized or small tree with handsome dense laurel-like foliage somewhat like that of *Garcinia Xanthochymus*; leaves oblong or linear-oblong to oblong-lanceolate, acute or obtuse, 5.5—8.5" by 1.7—2.8", thickly coriaceous; nervation of very numerous fine parallel secondary nerves copiously reticulate between and with distinct pellucid dots in the areoles. Flowers .7" diam., white or rose, in dense axillary fascicles, with numerous subulate bracts at base, at the axils of fallen leaves and from the trunk, pedicels 1". Calyx bursting into 2 valves reflexed during flowering. Petals 4. Fruit 1", ovoid, 1-seeded.

Khurda, cultivated, *Haslett*! This tree is stated in *Bengal Plants* to be found in Khurda, Orissa, and the vernacular names of Nagesar, *Beng.*, and Chiuriana,

Or., are given for it. It was doubtless a cultivated specimen, as the tree is known to have been introduced near Kùhuri by a former Raja and about 12 acres existed in 1881.

"A specimen near the Baruni Hill Temple recently died," *Haslett*.

"The Fls. are used like those of Nageswar in Hindu worship," *Haslett*.

3. CALOPHYLLUM, L.

Trees with opposite shining coriaceous leaves, with innumerable parallel very slender secondary nerves at right angles to the midrib. Flowers paniced. Sepals and petals 4—12, imbricate, in 2—3 series. Stamens very many, filaments slender. Ovary 1-celled, with slender style and peltate stigma. Ovule solitary, erect. Fruit a drupe.

1. *C. inophyllum*, L. Punang, *Or.*; Sultana Champa, *Beng.*; The Alexandrian Laurel.

An exceedingly handsome moderate-sized tree, with large glabrous, oblong, elliptic-oblong or obovate-oblong, obtuse or emarginate leaves, 4—8", shining on both surfaces, and axillary lax drooping racemes 4—6" long, of large white fragrant flowers 75" diam. Drupe globose, yellow and pulpy when quite ripe, 1" diam.

Orissa coast, extensively cultivated, but doubtfully wild. Is also much planted in Cuttack and other stations not far from the sea. Fl. May—June and again Oct.—Nov. Fr. Oct.—Nov. and April—May.

Juice (of the resin canals) bright green. Petiole 5—1.2". Pedicels of flowers 1—2". Sepals 4, inner petaloid. Petals 4. Stamens in 4 bundles.

The wood is sometimes known as Mast wood and is said to be good. Gamble says reddish-brown, moderately hard, and close grained. The seeds yield an oil known as Pinnay or Domba oil, used for burning, which has recently been recommended as a lubricant in place of castor. The seeds are collected twice a year (see above), *Haslett*.

The tree is being grown in the Casuarina Plantation on the Puri Sands.

4. MESUA, L.

Trees with opposite coriaceous leaves, with innumerable very slender secondary nerves at right angles to the mid-rib. Flowers polygamous, large, solitary, axillary or (apparently) terminal. Sepals and petals 4, imbricate. Stamens very many, with slender filaments. Ovary 2-celled, with long style and peltate stigma. Ovules 2 in each cell, erect. Fruit sub-capsular, 1-celled by absorption of the septum. Seeds ex-arillate.

1. *M. ferrea*, L. Nagesar, Nageswar, *Or.*, *Beng.*

A moderate-sized or large, very beautiful tree, with straight trunk branched to near the ground, with linear-lanceolate drooping leaves, 3—6.5 long, dark and shining above and whitish beneath, and white flowers from the uppermost leaf axils. Fruit ovoid, with conical pointed apex, 1—4-seeded, supported on the persistent calyx, almost woody, 1—2".

Purneah, *Ham.* Near streams, Mayurbhanj (Bhanjabasa), rare! Mallagiri Reserve, Palahara State, *Cooper!* Often planted! Fl. April—July. Fr. Oct.—Nov. Evergreen. New L. in March, brilliant crimson.

Attains 7 ft. girth. L. 1—1.75", broad, acute, or mostly acuminate; secondary nerves scarcely visible; marginal vein rather strong. Petiole 3—5". Fls. very

variable in size, fragrant, .75—3" diameter. Sepals orbicular, thick. Petals cuneate-obovate. Stamens bright yellow.

A form with L. green beneath is said to occur (*Gamble*), but has not been seen in our area. *Cooper* states that in the Mailagiri Reserve the tree is gregarious over an area of some 100 acres and up to 7 ft. girth. This gregarious habit is common to it in Eastern Bengal. The wood is dark red and durable, but almost too hard to work. Seed should be sown *in situ*, as it stands transplanting with difficulty.

FAM. 24. TERNSTROEMICEÆ.

Trees or shrubs with alternate, simple, exstipulate, usually coriaceous leaves. Flowers usually showy (small in *Eurya*), and subtended by 2 sepal-like bracts, axillary, solitary or clustered, rarely on many-flowered peduncles. Sepals 4—7, free or slightly connate. Petals 4—9, imbricate or contorted in bud, free or connate below. Stamens ∞ , free or connate, usually adnate to base of corolla. Anthers basi-fixed or versatile, opening by slits or pores. Ovary free, sessile, 3—5-celled, with as many free or connate styles. Ovules 2— ∞ in each cell, axile. Fruit baccate or capsular. Seeds few or many, albumen scanty or 0. Embryo straight or curved.

A specimen of *Eurya symplocina*, Blume was found in my herbarium labelled "Chota Nagpur"—almost certainly in error. It probably came from British Bhotan. *Eurya acuminata*, DC., occurs in the Sikkim Tarai close to, but has not been found in our area.

1. CAMELLIA, L.

Trees or shrubs with evergreen, coriaceous, serrate leaves and axillary, often large and handsome flowers. Sepals 5—6, graduating from the bracts towards the petals, which slightly cohere at the base. Stamens ∞ , outer more or less monadelphous and adhering to base of petals; innermost free. Ovary 3—5-celled; ovules 4—5 in each cell. Capsule woody, short, loculicidal. Seeds usually solitary in each cell or reduced to 1 or 2 altogether. Albumen 0. Embryo straight with large, thick cotyledons.

1. *C. theifera*, Griff. Cha, *Vern.*; The Tea Plant.

A large shrub or small tree, but usually kept pruned except in the "seed-baris." Formerly much cultivated on the Chota Nagpur plateau and on Parasnath, but the rainfall is scarcely sufficient, and the tea industry in Chota Nagpur has largely declined. Formerly also the plants were chiefly of the small-leaved China variety, but blanks are now filled in with the more prolific hybrid.

FAM. 25. DIPTEROCARPACEÆ.

Trees, rarely climbers, with resinous substances contained in cavities and canals in leaves, wood or bark. Leaves alternate, simple, entire, with parallel secondary nerves, stipules present, at least when young, often leaving an annular scar. Flowers in axillary or terminal racemes

or panicles. Torus usually broad and concave. Sepals 5, connate into a tube below, often unequal. Petals 5, contorted, sometimes connate at the base. Stamens 5 or in multiples of 5, often many, one or more seriate, hypogynous or sub-perigynous, sometimes connate or adnate to the petals; filaments short, anthers basifixed introrse, connective often appendaged. Ovary slightly sunk in the torus, 3-, rarely 2—1-celled, styles fused. Ovules 2 in each cell, anatropous, pendulous.

1. SHOREA, Roxb.

Flowers in axillary or terminal lax cymose panicles; bracts often caducous, sometimes 0. Sepals connate at base only and adnate below to the torus, imbricate, persistent and enlarged in fruit. Stamens 15 or ∞ ; connective of anther usually appendiculate. Ovary 3-celled, style subulate. Fruit indehiscent, 1-seeded, embraced by the bases of the accrescent wing-like sepals, of which 3 are sometimes larger than the others. Cotyledons fleshy, unequal, one embraced by the other; germination hypogeal.

1. *S. robusta*, Gaertn. Sal, H., Beng.; Sarjom, K., S.; Sakwa, Th., Kharw.; Salwa, Rengal, Or.; The Sal Tree.

A tree attaining 150 ft. and 12 ft. girth, but often low and stunted on the hills. Leaves ovate or ovate-oblong, cuspidate, with cordate base. Flowers cream-coloured, unilateral on the branches of tomentose panicles 5—9" long. Petals lanceolate-acuminate, 5". Fruit 5", ovoid, beaked with the style: wings 2—4", linear-oblong or spatulate, subequal, with three rather larger.

Throughout the Province, excepting the low-lying tracts of the Gangetic Plain, ascends to the tops of the highest hills, and also occurs not far from the sea on high ground in Cuttack and Puri. Fls. March—April, or in some years up to May. Fr. June—July. Nearly or quite leafless in March. The new L. appear with the Fls.

Bark dark brown, sometimes reddish, furrowed, or in old trees grey and nearly smooth. Blaze red, tough and fibrous. Shoots pubescent. Stipules .25—5", falcate, covering the young buds. Petioles short and stout. Panicles on the new shoots and direct from the old wood. Petals with a twisted acumen. Stamens with a very swollen base, but slender below the anthers and connective tailed, cells often apiculate.

On germination the radicle issues from the nut close to the base of the style, and with the hypocotyl is thrust far out of the seed by the rapidly elongating stalks of the cotyledons. These are very thick, somewhat crescent-shaped, but cuneate on the long petiole and the outer arc somewhat emarginate. The stalks of the cotyledons are not exactly opposite on the hypocotyl, but the first pair of leaves are opposite. Buds frequently arise serially in the axils of the cotyledons, and these give rise to new shoots when the stem is killed or broken. These buds may also account for the wonderful coppicing power of the young tree from the ground or below it even when cut rather high up, and for the fact that Sal coppiced too close to the ground frequently dies. The seed sometimes contains two embryos (teste Sen Gupta).

The wood of the Sal varies when freshly cut from reddish to nearly white. The white-timbered Sal is called *Sakwi* in Nepalese and Tharu, and is considered superior to *Sakwa* or red Sal. The best time for felling poles for rafters, etc., is said to be October, but the best time sylviculturally when coppice is required is in the hot season. The bark should be removed as soon as felled on account of borers. The seed should be sown immediately it falls as it soon loses the power of germination. The first to fall are usually bad.

Oil expressed from the seeds or obtained by simple boiling is used for cooking and burning in Sambalpur, and the seed is eaten in times of famine, and regularly by the Santals, but is unwholesome. The resin (dunra, K.; sarjam lore, S.) is used in medicine and for caulking. Before the reservation of the forests trees were killed in large numbers by resin tapping. The bark is employed as a tan. The leaf forms the covering of the Kol cigarette (fikr).

FAM. 26. MALVACEÆ.

Trees, or more usually shrubs or herbs, mostly with stellate hairs and with tough branches from the strength of bast fibres. Leaves alternate, stipulate, with palmate venation, simple or digitate. Flowers regular, often showy, nearly always with an epicalyx (bracteoles). Sepals usually 5, valvate, connate below. Petals 5, imbricate and twisted, often connate below. Stamens ∞ (15 in *Kydia*), more or less monadelphous into a tube, which is often adnate to the base of the corolla and branches into free filaments above, or pentadelphous, or some filaments quite free. Anthers variously shaped, ultimately 1-celled. Ovary 3—4— but usually 5—many-celled, capsular in fruit or breaking up into dehiscent or indehiscent cocci which fall away from a columella. Ovules 1—more, axile, curved. Albumen scanty or 0. Cotyledons foliaceous, usually crumpled or folded, and mostly palmately nerved. Germination epigeal (where observed by me).

The family abounds in mucilage and most of the species yield a fibre from the bast.

A. Stamens united into a long tube with free part of filament very short or 0 (exc. *Ab. polyandrum*). Shrubs or herbs, rarely small trees.

I. *Malvææ*. Carpels 5 to many. Styles as many as carpels. Fruit of as many cocci. Fls. usually yellow.

a. Ovule 1 in each carpel.

Bracteoles 3. Stigmas linear

Bracteoles 3. Stigmas capitate

Bracteoles 0

b. Ovules 2 or more in each carpel. Bracteoles 0

II. *Urenææ*. Carpels 5. Styles or stigmas twice as many.

Fr. of 5 cocci. Fls. usually red.

a. Fls. in dense heads intermixed with bracteoles

b. Fls. not in dense heads.

Bracteoles 5. Carpels opposite petals, often spinescent

Bracteoles 10. Carpels opposite sepals, smooth

III. *Hibiscææ*. Carpels 3—5. Stigmas as many as carpels or connate. Fr. capsular. Staminal tube truncate or 5-toothed.

a. Stigmas distinct. Bracteoles 5—more (exc. *Solandra*)

b. Stigmas coherent in a club-shaped mass.

Bracteoles 3—5, small

Bracteoles 3, large and usually cordate

B. Stamens united at the base only and pentadelphous or quite free. Trees.

IV. *Bombacææ*. Sepals coriaceous. Fr. capsular or indehiscent.

a. L. simple, lobed. Bracteoles 4—5, persistent

b. L. digitate.

Calyx cupular, slightly irregularly lobed

Calyx 5-cleft with 2 bracteoles

1. *Malva*.

2. *Malvastrum*.

3. *Sida*.

4. *Abutilon*.

5. *Malachra*.

6. *Urena*.

7. *Pavonia*.

8. *Hibiscus*.

9. *Thespesia*.

10. *Gossypium*.

11. *Kydia*.

12. *Bombax*.

13. *Adansonia*.

The well-known garden plants, Hollyhock (*Althæa rosea*) and Malope, also belong to this family. The bracteoles in *Althæa* are 6—9, connate at the base.

1. MALVA, L. Mallow.

Herbs with lobed palminerved leaves. Flowers axillary, clustered. Bracteoles 3, free. Ovary many-celled, styles as many as carpels.

1. *M. verticillata*, L.

Branches often woody below, 2—3 ft. high. Leaves suborbicular, 5—7-lobed and crenate, lower often 3—4·5" diam., upper sometimes only 5—1·5" Flowers pink, in dense clusters, with short pedicels. Corolla 5" long. Carpels 10—12, reticulate or pitted.

It occurs both sides of the province, in Oudh and N. Bengal, and will probably be found within it. Fl. June, July.

2. MALVASTRUM, A. Gray.

Herbs or undershrubs with simple or rarely lobed leaves. Flowers axillary or terminal. Bracteoles 3. Ovule 1, ascending in each carpel. Ripe carpels indehiscent, 1-seeded, sometimes beaked or awned. Otherwise like *Sida*.

1. *M. coromandelianum*, Garcke. Syn. *M. tricuspdatum*, A. Gray.

An undershrub or herb 1—3 ft. high, sometimes gregarious, with strigose branches, oblong-ovate or rhomboid-ovate serrate leaves 8—2" long, sparsely hairy both sides, and solitary yellow flowers 5—6" diam. Sepals acuminate, including tube 35" long, connate half-way up. Carpels 3-cuspidate, strigose.

An introduced weed! Fls., Fr. July—Nov. It much resembles a *Sida*.

3. SIDA, L.

Herbs or undershrubs with stellate hairs and simple or lobed leaves. Flowers rarely over 75" diam., yellow or straw-coloured or nearly white, *without* bracteoles. Sepals connate into a broad tube below. Staminal tube adnate to base of petals, dividing above into numerous filaments. Carpels 5—10. Ovule 1, pendulous. Fruit not depressed at the top (cp. *Abutilon*) and carpels usually 2-awned at the apex. Ripe carpels split ventrally and from between the awns. Seed solitary. The 5-angled or 10-nerved calyx is persistent long after the seeds have dropped.

The *Sidas* open about 10 a.m. or towards mid-day.

I. Lower petioles long, 75" or more, often three-fourths as long as the L. L. ovate to orbicular with cordate base, 5—9-nerved.

a. Carpels 5, awned or not.

Trailing or sub-erect amongst bushes, eglandular

Erect with numerous glandular hairs

b. Carpels 8—10, long-awned. Tomentose

1. *veronicæfolia*.

2. *glutinosa*.

3. *cordifolia*.

II. Petioles nearly always under 75". L. oblong, rhomboid or obovate, 3-nerved.

a. Carpels 5. Stipules shorter than the petiole. L. obtuse or rounded

4. *spinosa*.

b. Carpels 10—5. Stipules usually longer than the petioles.

L. hoary or stellate beneath, lower usually broadly rhomboid or obovate, peduncles often long

5. *rhombifolia*.

L. glabrous beneath, usually narrow, oblong or lanceolate, peduncles mostly as short as the petioles

6. *acuta*.

1. **S. veronicaefolia**, Lamk. Syn. *S. humilis*, Willd. Bariar, K., S.; Janka, Beng.

A procumbent herb on open pasture land, or trailing or sub-erect 1—3 ft. high amongst bushes, hairy, with long spreading hairs as well as stellate ones. Leaves sub-orbicular or ovate, cordate, obtusely serrate or crenate-serrate, acuminate, .5—1" long, or attaining 3.5" by 2.75" in forest forms. Petiole and peduncles both slender, .5—2". Carpels mucronate, cuspidate or awned.

In all situations; throughout the province. Fls., Fr. chiefly at the end of the rains, but more or less all the year.

Sometimes almost woody below. L. 8—9-nerved from base. Fls. straw-coloured or yellow, .5" diam., 1—2-axillary, and loosely arranged in racemes or panicles from the reduction of L. Peduncles as long as or rather shorter than the petioles, jointed about half way.

The procumbent small-leaved form is often less hairy than the large one, but the species can by no means be limited to this; all gradations occur.

It yields a good fibre. L. are eaten, *Camp*.

2. **S. glutinosa** Cav. Syn. *S. mysorensis*, W. & A. Vernacular names as in last.

An erect, stouter and more hoary plant than the last, to which it is very closely allied. It is much more densely pubescent, and many of the hairs are glandular. Leaves 1—3", petioles less slender. Pedicels much more congested, usually forming a close glandular panicle towards the top of the stem.

Much less common. Chiefly in the Santal Parganas! Chota Nagpur! Bihar, *Prain*.

Fls., Fr. Oct.—Jan.

3. **S. cordifolia**, L. Bariala, Bariar, *Vern*.

An erect undershrub 2—4 ft., tomentose all over, and with thin spreading hairs on the stem. Leaves 7—9-nerved, ovate or ovate-oblong, cordate, acute or obtuse, crenate, 1.25" by 1" to 3" by 2.5," with petioles about $\frac{1}{2}$ to $\frac{3}{4}$ as long. Peduncles 1—2, axillary and sub-corymbose, with the lower ones attaining 1". Carpels 10—8, with 2 long retrorsely hispid awns.

Waste places throughout the area, especially in scrub jungles in Palamanu. Fls. Aug.—Dec. Fr. Oct.—Jan.

This species comes very close in some respects to *S. glutinosa* and it also has glands amongst the tomentum, but the plant is easily recognised by the L. being softly hoary-grey, tomentose both sides and never acuminate, while the calyx is very broad, 3—4" diam. in fruit, with triangular, not acuminate lobes. Corolla straw-coloured, .5". Carpels reticulate, with the awns nearly as long as themselves.

Var. **Burkillii**.

A woody procumbent form from the sandy banks of the Mahanadi near Cuttack. It has small L., .5". Collected August by Mr. *Burkill*.

4. **S. spinosa**, L. Syn. *S. alba*, L.; *S. alnifolia*, Roxb.; Bariat, H.

A small, erect, shrubby weed, about 1 ft. high, with small leaves always rounded at the end, rarely 2" long, crenate or crenate-serrate, hoary tomentose beneath, with the filiform stipules mostly shorter than their petioles. Flowers yellow or pale, usually fascicled on short shoots. Joint of peduncle usually above the middle, often obscure. Carpels not exceeding 5, either 2-awned or with only 2 short points.

Northern Tract, very common on railway embankments in Purneah! Chota Nagpur! Behar, *Prain*. Fls., Fr. c.s.

Appearance often exactly that of forms of *S. rhombifolia*, except for its greater compactness and rigidity, the short peduncles clustered on abbreviated shoots, and in the cold season the large L. usually drop off, leaving the small ones about .25" long only. The plant is then very weedy and unsightly as the small L. do not cover the numerous twigs. Two tubercles often occur at the sides of the old leaf-scars. Base of L. sub-cuneate to rounded and sub-cordate. Petioles very variable, .5—8" long, or under .2" on the shoots. Peduncles often as short as the petioles in flower, but usually .25—5" in fruit. Seeds smooth, without a prominent tongue near the micropyle.

Roxburgh figures his *S. alba* with small white Fls. only .3" diam., and awns up to .2", and *S. alnifolia* with Fls. deep yellow, .5—7", and carpels with 2 short points only. Our plant corresponds rather with the latter form.

5. **S. rhombifolia**, L. Syn. *S. rhomboidea*, Roxb.; Ipirpison, K.; Lal berela, Beng.

A herb or undershrub, 1—4 ft. high, with stellate hairs on the branches. Leaves narrowly or broadly rhomboid or obovate, always cuneate at the 3-nerved base (but wedge sometimes wide and its apex obtuse or emarginate), pale or hoary, and always more or less stellate pubescent or tomentose beneath. Peduncles slender, jointed at or below the middle, the lower (at least) far exceeding the petioles. Carpels 5—9, awns variable.

Very common in waste ground, roadside, forest glades, etc. Fl., Fr. Aug.—Dec.

It is very variable and the extreme forms look like distinct species, but numerous connecting links may be found. A separate species (*rhomboidea*, Roxb.) is sometimes founded on the peduncle being jointed at base and the carpels mucicous, but these characters do not always go together, nor do they coincide with any particular distinction of habit or leaf-form. Were it to be divided up, I should keep var. *obovata* distinct.

The following forms occur in our area:

a. *rhombifolia* proper.

Suffruticose, 2—6 ft. L. rhomboid-lanceolate serrate, or lower L. rhomboid and upper lanceolate to linear-lanceolate, crenate-serrate, pale or hoary, and thinly stellate beneath, 1.5—2.5". Stipules linear setaceous, hairy, about equalling the petiole, which is .15—28" long. Peduncles solitary, .8', jointed in the middle. Fruiting carpels 8—9, more rarely 10, with 2 long erect awns, slightly hairy at the back.

Roxburgh says "capsules 10, with one straight sharp horn," but I think that this must be an error. Chota Nagpur; Ichadag, 2500 ft. and other places!

β. As in the last 2—4 ft. high, but peduncles .2—5", axillary, and clustered towards the ends of the branchlets, and often jointed low down.

Damp localities in Singbhum, common!

γ. *rhomboidea*, Roxb. (Sp.).

L. narrow, rhomboid, peduncles solitary, carpels without awns. Maubhum!

δ *obovata*, F. B. I.

Stems often procumbent. L. broadly-rhomboid, obovate or rounded, crenate or crenate-serrate, sometimes only .5—1", and others 2.5" long, hoary beneath, with stellate tomentum. Fruiting calyx .25" or less. Peduncles often under .5", often densely clustered. Tongue over the micropyle of the seed very broad. Carpels only 5 (always?). Awn not one-fourth as long as carpels and sometimes obsolete.

In dry places, common. Bettiah! Hazaribagh! Also Parasnath!

Fibre of this plant was sold in London in 1913 at £36 per ton, but a larger sample in June, 1916, badly prepared, 2—6 ft. long, mostly 3—4 ft., was valued at £17—£18 per ton c.i.f. London, with Calcutta jute at £28. It was considered that even this would be suitable for mixing with jute when the price of the latter is high. (*Capital*, Oct. 5th, 1917.)

To obtain long staple fibre, and in sufficient quantity, the plant must of course be cultivated in close crops, but good seed could no doubt be obtained to start with from some of the tall forest varieties.

6. S. acuta, Burm. Syn. *S. carpinifolia*, F. B. I.; Ipirpijon, K.; Ipirpichig, M.; Bir miru baha, S.; Anchara, Or.

An erect undershrub, or herb, usually 2—3 ft. high, with very tough, sparsely stellate-hairy stems, lanceolate to obovate-lanceolate serrate glabrous leaves 1.5—3.5" by .5—1", and pale yellow flowers on jointed peduncles, which are mostly shorter than the .25" petioles. Stipules hairy linear, or one linear and one setaceous in each pair, .3—.5" or more long.

Waste ground throughout the area, common. Fls., Fr., Aug.—Dec.

Pale green or frequently variegated with yellow. L. gradually tapering, scarcely acuminate, base 3-nerved, sometimes rounded; secondary nerves, 5-8, extending nearly to margin. Peduncles jointed about the middle. Sepals acuminate ciliate. Carpels usually 5—6, reticulate, shortly 2-aristate.

Yields a good fibre, and I have seen it 5 ft. high. Plant used for brooms in Orissa.

4. ABUTILON, Gaertn.

Undershrubs more or less downy, with angled, palmately-lobed or entire leaves and orange cbracteolate flowers, usually 1" diam. or more, opening in the evening. Pedicels articulate. Petals connate below and adnate to the staminal tube, which is divided at the apex into numerous filaments. Carpels exceeding 5 (exc. *polyandrum*), in fruit separating as 2-valved usually 2—3-seeded, cocci from the persistent axis; apex of fruit depressed or truncate, awns or mucros, if persistent, on the shoulders. Seeds reniform.

1. Androecium only tubular at the base. Carpels 5—6

1. *polyandrum*.

2. Staminal tube long. Carpels 15 or more.

Not hairy except the fruits, peduncles slender, cocci truncate, shortly awned on the shoulders

2. *indicum*.

Hairy as well as pubescent, peduncles stout, cocci rounded mucous or mucronate

3. *hirtum*.

1. *A. polyandrum*, W. & A.

A tall suffruticose herb 5—6 ft. high, very glandular above and with a peculiar smell. Leaves long-petioled, orbicular or ovate, cordate,

in more or less leafless terminal racemes. Bracteoles 5, adnate to the calyx and sometimes connate below into a cup. Petals 5, connate and adnate to the staminal tube below. Anthers nearly sessile on the truncate or denticulate tube. Ovary 5-celled, cells 1-ovuled, stigmatic branches 10. Ripe carpels sub-indehiscent or dehiscent, separating from the axis when ripe.

Carpels echinate. L. angled or somewhat lobed	.	1. <i>lobata</i> .
Carpels echinate. L. palmatised	.	2. <i>sinuata</i> .
Carpels smooth. L. entire or slightly lobed	.	3. <i>repanda</i> .

1. *U. lobata*, L. Bhidi janetet, S.

Undershrub, 2—4·5 ft., with suborbicular, angled, or shallowly-lobed leaves, 2—4" diam., often broader than long, with a gland on 1—3 of the nerves beneath. Flowers pink, .75" diam., not racemose. Carpels glochidiate.

Throughout the province, in forest glades and waste lands, common.

Fls., Fr. Aug.—Dec.

L. cordate, or upper on flowering branches, rhomboid and acute at base; lobes 3—5 or more obscurely 7—9. Lower petioles long.

It yields a fibre.

2. *U. sinuata*, L. Mota bhidi janetet, S.; Kunguya, H.

Undershrub closely resembling the last, but easily distinguished by its leaves, being lobed beyond the middle into (usually 5) oblong or lanceolate segments, which are contracted at the base and often pinnatifid and serrate. Flowers 1" diam.

Associated with the last, but rather less common. Chota Nagpur! Angul! Probably throughout the province. Fls., Fr. Aug.—Nov.

Yields fibre like the last. Roxburgh says it is a strong and tolerably fine substitute for flax.

3. *U. repanda*, Roxb. Sikuar, S.

More shrubby than the last two, 2—4 ft., with stiff branches; densely stellate-hairy, roundish repand or somewhat lobed denticulate leaves 2·5—3·5" diam., and pink, axillary and racemose flowers. Carpels not glochidiate, easily dehiscent on slight pressure.

Chiefly in open ground. Champaran, common! Chota Nagpur, frequent! Sambalpur! Probably therefore throughout the province. Fls. Sept.—Oct. Fr. Nov.—Dec.

L. very reticulate beneath and mid-rib with a gland near the base. Stipules setaceous. Bracteoles united into a cup below, erect, linear-subulate above, 3—5". Calyx 3", lobes linear-oblong, connate three-fourths the way up. Corolla 5—1" diam. Staminal tube 1" long. Seeds .12", grey-brown.

7. PAVONIA, Cav.

Herbs or undershrubs with entire or lobed leaves. Flowers axillary or clustered or appearing paniced by the reduction of the upper leaves. Bracteoles 5—∞. Staminal tube truncate or 5-toothed at the apex. Ovary 5-celled, styles 10, ovules 1 in each cell. Ripe carpels separating from the axis, indehiscent or dehiscent, never glochidiate.

1. *P. odorata*, Willd.

An erect, suffruticose herb, 2—3 ft. high, glandular-pubescent all over, with simple, 3—5-lobed leaves, 5—2" long, rounded to ovate-lanceolate. Flowers pink. Bracteoles 10—12, erect, linear, hispidly hairy. Carpels not at all winged, smooth.

Orissa, Puri in dry open forests! Fls., Fr. Oct.—Jan.

Stems hispidly hairy. Lower L. often deciduous at time of flowering. Peduncles .5—1.5", axillary, and forming terminal panicles. Bracteoles .25", longer than the calyx and carpels. Corolla .3—4" long.

8. HIBISCUS, Medik.

Trees, shrubs or herbs, usually suffruticose annuals, or with a perennial root. Leaves more or less palmately lobed. Flowers axillary, or becoming racemose by suppression of upper leaves. Bracteoles 5 or more, rarely fewer or absent, free or connate at the base. Sepals connate at base, or combined into a 5-toothed or spathaceous calyx, valvate. Petals 5, adnate to staminal tube at the base. Staminal tube truncate, or 5-toothed at the top. Ovary 5-rarely 3-celled, ovules 3—more, style 5-fid above. Capsule loculicidal, with often a distinct endocarp. Seeds reniform, globose or obovoid.

I. Calyx spathaceous, circumciss at base. Bracteoles free. Indigenous species exc. 3 and 6. (Spp. 1—6.)

1. Fls. yellow with purple eye. Bracteoles many filiform.

a. Indigenous species. Branches often procumbent. Capsule .7—2".

Fls. mostly in terminal racemes. Capsule with dense spreading persistent hairs .

Fls. mostly axillary. Capsule with appressed deciduous hairs .

b. Cultivated species. Erect. Capsule 6—10"

2. Fls. yellow with purple eye. Bracteoles 4—7, lanceolate to ovate.

Stout, erect, strict, very bristly all over .

Branched from the base, hairs short, scattered

3. Fls. white or pink. Bracteoles lanceolate to linear, small caducous

II. Calyx 5-cleft, or sepals 5, nearly free. Indigenous species exc. 11 and 12. (Spp. 7 to 16.)

A. Herbs or undershrubs not woody, except in 15.

Bracteoles usually free, or only connate at base (7—15).

4. Fls. white or pink, under 1" diameter. Bracteoles 0, or small and linear.

L. over 2".

Herbaceous. L. not glandular

Suffruticose. L. glandular beneath

L. under 2"

5. Fls. yellow with purple eye. Bracteoles linear forked

L. under 2"

6. Fls. yellow (or white in 12), with purple eye, over 1" diameter. Bracteoles not forked.

a. Cultivated species. Bracteoles linear. Peduncles very short.

Bracteoles adnate to the base of calyx, accrescent

Bracteoles not adnate. Sepals with a large gland

1. *cancellatus*.

2. *Abelmoschus*.

3. *esculentus*.

4. *pungens*.

5. *tetraphyllus*.

6. *ficulneus*.

7. *Solandra*.

8. *hirtus*.

9. *micranthus*.

10. *furcatus*.

11. *Sabdariffa*.

12. *cannabinus*.

- b.* Indigenous species. Bracteoles free. Sepals eglandular.
 Bracteoles linear. Indumentum soft. Capsule winged
 Bracteoles linear-spathulate. Indumentum with pungent and glandular hairs.
7. Arborescent. Fls. pink. Bracteoles oblong.
- B.* Trees or large woody shrubs. Bracteoles connate at base into a cup. Capsule with secondary septa (due to the ingrowing endocarp at the margins of the valves).
- L.* orbicular crenulate. Fls. yellow.
- III. Calyx 5-cleft exc. in 20. Large garden shrubs grown for their showy flowers. Fls. rarely yellow.
1. Calyx 5-cleft. Bracteoles conspicuous.
- a.* Bracteoles 10. Fls. white or pink.
- b.* Bracteoles 6—8.
 Fls. of various colours, but never lilac or purple
 Fls. lilac, purple or bluish
2. Calyx spathaceous. Bracteoles minute. Fls. pendulous, red
13. *vitifolius*.
 14. *panduræformis*.
 15. *collinus*.
 16. *tiliaceus*.
 17. *mutabilis*.
 18. *rosa-sinensis*.
 19. *syriacus*.
 20. *schizopetalus*.

1. *H. cancellatus*, Roxb. Usungid, *Ho.*; Bera sanga, *M.*; Uskui, *Birja*; Berua, *Kharw*; Bir kaskom, *S.*

A very hirsute or bristly herb with very variable leaves, the lower usually sub-orbicular, the upper often narrow and sagittate. Large yellow flowers, with peduncles about 1" in terminal racemes, or few also axillary. Capsule sub-globose to oblong, 1—1.75", densely covered with yellowish spreading hairs, obtuse or cuspidate at tip. Bracteoles 10—15, filiform, very persistent, .75—1.75", with dense spreading stiff hairs.

In forests, especially in the hills. Champaran! Throughout Chota Nagpur, common! Santal Parganas! Sambalpur!

Fl. Aug.—Nov. Fr. Oct.—Jan. It dies down after flowering.

Root fusiform. Branches often procumbent. *L.* orbicular, deeply cordate and subentire, or 3—5-angled or lobed (but not half way down) or sagittate with very long linear oblong auricles, densely softly hairy or villous and often with bristles on the nerves above, hairy and with stellate bristles beneath. Racemes from few to several, and dense-flowered, with filiform, 2—several persistent bracts at the base of the short peduncles. Capsules hirsute inside and out. Seeds sub-reniform, grey-brown, .12", glabrous, with curved lines of minute tubercles.

There are several forms:

- a.* Capsules ovoid, 1—1.25", bracteoles much exceeding the capsules.
β. Capsules oblong, 1.25—1.75", often much longer than the bracteoles.
γ. *Abelmoschoides*. Branches glabrescent, *L.* cut into 3—5 narrow, lanceolate, or linear segments. Peduncles up to 1.3", bracteoles much shorter than the capsules and capsule somewhat glabrescent. Kodarma! Neterhat! This passes into the next species.

The root is eaten.

2. *H. abelmoschus*, L. Mushkdana, *H.*, *Beng.*

A hirsute or hispid herb with polymorphous leaves, often resembling varieties of the last, large yellow flowers with peduncles 2—3" long, usually axillary, more rarely in few-flowered leafless racemes. Capsule oblong, 2—2.25", beaked, with rather sparse adpressed stiff hairs.

glabrescent. Bracteoles 8—10, linear, 3—7", rarely more or longer, deciduous, not densely hairy.

A rare plant in Behar and Orissa. Hundrugagh (Ranchi), *Prain*.^{*} Fls. Aug.—Nov. Fr. Oct.—Jan. Hazaribagh, C. B. Clarke in *Kew Herb.* (Var. *sagittifolius*)†

L. often 3—5-lobed half-way down or more, lobes serrate, sometimes very narrow. Less hairy than the usual forms of *cancellatus*, hairs on the petioles and peduncles usually stiff and reflexed, a few stellate bristles on the leaves beneath. Peduncles clavate above in fruit. Seeds reniform striate (as in last), musky.

3. *H. esculentus*, L. Mindijinga, K.; Ramjinga, S.; Bindi, H.; Ochro; Lady's Fingers.

Stems stout, strict, erect, 3—7 ft., very bristly; leaves 6—10" diam., orbicular, cordate, mostly 5—7-lobed and nerved, coarsely toothed, both surfaces hirsute. Petioles 6—12". Stipules 1", erect, linear-subulate. Peduncles 5—7.5", much swollen above, with about 10 erect bracteoles, 5—7". Flowers 2—3.5" diam., axillary, pale yellow with purple centre, Capsule 5—10", young succulent, ribbed pubescent.

Generally cultivated for its unripe fruits, which owing to their demulcent properties can be safely eaten in cases where other vegetables are interdicted.

4. *H. pungens*, Roxb.

A stout, erect, scarcely branched herb, 6—12 ft. high, with bristly stem, palmately deeply-lobed or angled hairy leaves, 5—12" diam., and large yellow flowers, 4—5" diam., in terminal racemes. Bracteoles 4—7, broadly lanceolate, shorter than the large oblong, 2.25—2.75" long, hirsute capsule.

Humid valleys of Singbhum, Porahat and the Santal Parganas! Not common. Palamau (Pendra Valley, Neterhat)! Purneah! Fls. July—Oct. Fr. Nov.—Dec.

Stem hollow, often black or purple spotted. Lower L. 5—7 lobed, often deeply, and lobes coarsely toothed or serrate, upper 3-partite, serrate, hairy above, with scattered stellate hairs beneath. Lower petioles exceeding the blade. Raceme often 15". Bracteoles connate at base. Seeds black, striate, with curved, most minutely pubescent lines.

The Pendra Valley plant has reflexed bristles and 6—7 bracteoles, and is smaller than the type.

5. *H. tetraphyllus*, Roxb.

A herb or undershrub, branched from the base, with a thick tap-root. Branches with few short, hispid or prickly hairs, and deeply-lobed leaves with sparse, stellate (3-forked), hispid hairs beneath and very few above. Flowers primrose-yellow, 2.5—3" diam. Bracteoles 4—5, ovate, lanceolate or ovate-lanceolate. Capsule under 2".

Ravines in the Santal Parganas, on rocks. Fls. Oct.—Nov. Fr. Dec.—Jan. Perennial.

^{*} But I refer Prain's plant, labelled *H. Abelmoschus* in *Cal. Herb.* to var. *abelmoschoides* of *H. cancellatus*, which closely connects the two species. It is not in fruit. Peduncles very short, only .5", and at top of stem, bracteoles .7—9", but less filiform than in typical *cancellatus*. It is best distinguished by the indumentum on the peduncle, which is as in *H. cancellatus*, i.e. a close persistent pubescence with longer stiffer hairs, while that of *H. abelmoschus* is of reflexed stiff hairs or bristles, soon deciduous. Clarke's specimen has a glabrous but small capsule and sagittate leaves. It is also doubtful.

About 3 ft. high only. L. radical attain 8" diam., lobed more than half-way down, cauline usually about 3—4" diam., deeply or shallowly lobed; lobes usually 3 or 4 large and 2 smaller basal ones, elliptical or oblong, acute or cuspidate, sometimes again lobed, coarsely toothed. Petiole as long or three-fourths as long as the leaf. Stipules linear, .5—·75". Fls. axillary and in short terminal racemes with the bract-like stipules. Bracteoles persistent, .62—·75". Capsule oblong, 1.25—1.5", beaked, covered with glandular and pungent hairs, 5-valved. Seeds black, striate, with rows of minute raised dots, striations with thin brown hairs.

6. *H. ficulneus*, L. Ran bhendi, *H.*; Naita, *Ho.*

A branched herb, 3—4 ft., with large tap-root and stems scabrous with tubercle-based setæ or nearly smooth. Leaves sub-orbicular, upper deeply 3—5-lobed, with the rounded lobes constricted at their base. Flowers white to pink with darker eye in more or less leafless racemes, 1—1.5" diam. Seeds striate, with thin brown hairs.

Santal Parganas as an escape from cultivation! Cultivated in Chota Nagpur! and Behar (*Prair*). Not seen wild. Fls. Sep.—Nov. Fr. Nov.—Jan.

L. somewhat hispidly hairy, not stellate, variable from lobed to partite. Stipules caducous. Peduncles 1", swollen above. Bracteoles short, linear, caducous (lanceolate, *Masters*). Capsule ovoid, 1.25—1.5", covered with glandular and pungent hairs when green.

The plant yields an excellent fibre.

7. *H. Solandra*, L. *Her.*

Herbaceous, 2—3 ft., with cordate, ovate or sub-orbicular leaves, membranous, coarsely toothed, lower usually simple, upper usually with three acuminate lobes or 3-sect. Flowers small, .5—·75" diam., white, arranged in loose, terminal racemes on long pedicels. Bracteoles usually 0. Capsules slightly exceeding the .3" long calyx, somewhat pubescent, 5-valved, cuspidate, sutures ciliate with bristles.

Barasand Forest, Palamau! Fls. Sept.—Oct. Fr. Oct.—Nov. Annual.

8. *H. hirtus*, L. Syn. *H. phœniceus*, *Roxb.*

Suffruticose with herbaceous branches, ovate, strongly serrate leaves, 1—3", often with a gland on the mid-rib beneath and pretty red or white flowers, 1" diam., with spreading corolla and 5—7 subulate bracteoles. Peduncles and calyx with strong hairs and leaves stellately hairy beneath. Capsule globose.

Fls. Aug.

I have only seen it wild in the Central Provinces. Said to be frequent in Behar (*Prair*), probably as an escape from gardens.

9. *H. micranthus*, L.

A lax, weedy-looking undershrub, 3—6 ft., with slender erect branches, scabrid with stellate scattered bristles, and small ovate leaves, .5—1" long. Flowers .5" diam., axillary, white or pink, with corolla often reflexed. Capsule globose.

Chota Nagpur, not common! Puri, fairly common (Khandgiri sandstones! Baruni Hill forest, etc.).

Fls., Fr. Sept.—April (April—Sept.?).

L. crenate or toothed, simple or 3-lobed, with stiff stellate hairs. Stipules filiform, .1—·16". Peduncles long, slender articulate, far exceeding the leaves, usually on short lateral branches.

10. *H. furcatus*, Roxb. Piri-Pirika, Or.

An erect or trailing, suffruticose herb, 2—4 ft., with pungent, reflexed setæ on branches and petioles, and simple hairy undivided and 3-lobed leaves, 2—3.5" diam. Flowers axillary and upper becoming subracemose, distant, with 10—12 setose forked bracteoles; outer lobe ovate-lanceolate, shorter than the linear inner lobe. Capsule .5", beaked, covered with rigid deciduous hairs.

Chota Nagpur (Horhap Forest! Pitorea, Wood); Puri (Chandka Forest! Rampur Forest!). Fls. Sept.—Nov. Fr. Nov.—Dec. Annual.

Setæ prickly, with bulbous base, often red. L. rarely 5-lobed, crenate-dentate or crenate-serrate, softly hairy, except on the hispid nerves. Stipules .5", linear-lanceolate. Peduncles .2—25". Sepals 5, erect, lanceolate, rigidly acuminate, 3-nerved densely clothed with tubercle-based setæ, persistent and closing over the fruit, often red. Corolla 2" (4", *Masters*).

11. *H. Sabdariffa*, L. Arhaipila, Ho.; Arharjorjora, M.; Arak Kudrum, S.; Kudrung, Uran; Patwa, H.; The Rozelle; Red Sorrel.

Erect glabrous with often simple ovate leaves, especially below, but mostly deeply 3-lobed with the mid-lobe broadest, 3-nerved, rarely some 5-lobed, lobes dentate or serrate, acuminate. Stems and petioles often red, petioles about as long as leaf. Fls. yellow, 2.5". Bracteoles 8—10, linear, accrescent to the calyx, which is red and fleshy (or in one variety green) and usually muricate or setose.

Widely cultivated. Fls. r.s. Fr. Jan.

The calyces are made into a jelly, and the leaves are eaten.

12. *H. cannabinus*, L. Kudrung, H., S.; Dare kudrum, S.; Tapa, Kudrun Dora, Uran; Ji, Kotle, K.

A tall unbranched annual, 4—6 ft., rather prickly with bristles, large, very variable leaves, the lower usually entire and cordate, and the upper deeply 3—7-palmatifid, uppermost often entire lanceolate and curved on long slender petioles, all serrate. Flowers 3—4" diam., white or pale yellow with purple eye, axillary, sub-sessile. Calyx campanulate, tuberculate, with 5 large sessile glands.

Widely cultivated in Behar, Santal Parganas and Chota Nagpur as an accessory crop. Fls. Oct.

A very distinct species. Native of Africa. Mid-rib of leaf with a gland beneath. Stipules linear. Bracteoles 7—10, shorter than calyx, which has an appressed white tomentum and tubercled hairs. Sepals long, acuminate. Capsule globose, bristly.

Yields a very valuable fibre known as Bimlipatam jute, quoted in Dec. 1916, at £35 per ton.

13. *H. vitifolius*, L.

A straggling, weak, suffruticose herb, 3—7 ft. high, hoary or grey tomentose or villous, without bristles, with simple or deeply acuminately-lobed, long-stalked, ovate dentate leaves and yellow flowers, 1.5—2.5" diam., with purple eye. Bracteoles 6—12, linear, nearly free to base. Calyx large, with broadly lanceolate sepals. Easily distinguished in fruit by the winged, reticulately-veined carpels, which resemble those of a *Pavonia*.

Not very common, but distributed from Muzafferpur! to Angul! Manbhum, Campbell! In valley forests in Angul!

Fls. Oct.—Dec., and also found in flower up to March in cool localities. Fr. Nov.—March.

Lower L. usually 4—5" diam., with 3 large acuminate lobes and rounded cordate base, uppermost ovate to lanceolate, all more or less dentate, pubescent and with long stellate hairs. Petiole as long as the blade. Fls. axillary and sub-racemose with peduncles 1—1.5". Capsule short, sub-orbicular, 5-winged.

14. *H. panduræformis*, Burm.

A very tall herb, 10—12 ft. Stems pubescent and with pungent hairs. Lower leaves ovate and lobed, upper oblong-lanceolate, all coarsely irregularly toothed. Flowers solitary, axillary and sub-terminal, 1—1.25" diam., yellow with purple eye, on very short (.25—33"), stout, articulate peduncles. Ovary and capsule densely silky.

Waste ground, Palamau and Hazaribagh (near the boundary), rare! Fls. and Fr. Nov.—Jan.

L. hoary-tomentose both sides. Petioles 1—1.5", thickened above. Stipules and bracts filiform, caducous. Bracteoles 8, united into cup at base, linear-spathulate, adpressed to and much shorter than the calyx, which has oblong, acute, 3-nerved lobes. Seeds about 10 in each cell, brown, densely pubescent.

15. *H. collinus*, Roxb.

A small tree up to 3 ft. girth with leaves somewhat resembling those of a Maple, 4—6.5" long and broad, deeply 3-lobed, with shallow-cordate base. Flowers 2—3" diam., pink with dark centre. Capsule 1—1.3" diam., oblate, cuspidate, yellow tomentose and densely setose.

Hills, Mals of Purī! Fl. r.s.? Fr. April.

Bark pale and greenish, blaze somewhat hard, light. Shoots tomentose and twigs hoary with stellate hairs. Leaf sometimes 5-lobed, hairy beneath and thinly so above, hairs simple and stellate, lobes acuminate or caudate, sinuate-dentate or sub-lobed. Primary nerves 5—7 and secondary raised beneath. Petioles 3—4.5". Peduncles 3—4.5, axillary, jointed about .6—7" from top. Bracteoles 5 (8—10, *Masters*). Calyx-lobes lanceolate. Capsule 5-celled and angled, loculi with long bristles within. Seeds grey-black, sub-globose, .16" diam., glabrous.

Bark gives a fibre.

16. *H. tiliaceus*, L. Syn. *H. tortuosus*, Roxb. ; Baniah, Or. ; Bola, Beng.

A small much-branched tree, with orbicular cordate leaves, hoary beneath, 2—4" diam. (4—5", *F. B. I.*), and terminal, solitary or sub-panicled campanulate flowers, 3—4" diam., yellow with crimson eye. Capsule ovoid, closely tomentose, and with tufted scales, 5-valved, with the endocarp inflexed at the margins of the valves and making it 10-celled.

Tidal forests. Cuttack, Mahanadi delta. Very common! Balasore (Chandpur)! Fls. Mar.—April. Fr. April—May.* Evergreen.

Branched usually close to the ground. L. with a short cusp closely stellate beneath, minutely crenate. Petioles 1—1.5". Stipules .5", falcately oblong. Bracteoles 7—10, lanceolate, connate for half their length. Sepals twice as long, .7", lanceolate about as long as the capsule. Seeds black, glabrous, with pale dots.

Bark gives a strong fibre.

* According to *Roxburgh* it Fls. Mar.—May, and seed ripens three to four months afterwards. Early in May, however, I found ripe seed and no flowers, and apparently it flowers sporadically most of the year.

17. *H. mutabilis*, L. Thalpadma, *Beng.*

A large shrub or small tree, with leaves 4—9" long and broad, deeply cordate, 3—5 lobed, sub-tomentose beneath, lobes crenate, mid-lobe long acuminate. Flowers white or pink, 5" diam. from the upper axils, and sub-corymbose at the ends of the shoots.

Frequent in gardens. Fls. Sept.—Oct. Fr. Oct.—Nov. Deciduous.

The Fls. are usually double, open white and turn pink, but this is *not* always the case, and in some varieties they are pink from the first. Capsule sub-globose, .8" diam., hirsute, endocarp with dense white hairs. Seeds brown, densely bearded on the side away from the raphe.

It is a native of China (*Roxburgh*), but even the double flowers seed freely in this country.

18. *H. rosa-sinensis*, L. Common garden Hibiscus; Chinese Shoe-flower.

A well-known ornamental shrub. L. 2.5—3", ovate, acuminate, coarsely serrate, sometimes lobed, glabrous and shining, base 3-nerved. Stipules ensiform. It includes very numerous single and double varieties, varying from very large brilliant crimson fls., often 5.5" diam., through red to salmon-coloured and yellow fls. Fls. from the upper axils, all agreeing in the linear-lanceolate, bracteoles connate at base and shorter than the calyx; campanulate calyx cut about half way down into 5 lanceolate lobes which close over the oblong fruit.

This attains .75" in length, but never seems to ripen, and the seeds are abortive. It flowers practically all the year round. The Fls. were used at one time for blacking shoes (f. *Roxburgh*).

19. *H. syriacus*, L. Gurhul, *Vern.*

Usually of taller and more slender habit than the last, with upright branches. L. sub-rhomboid, often 3-lobed, dentate or coarsely crenate, nearly or quite glabrous, about 2" long, with very short petiole. Stipules filiform. Fls. axillary, usually lilac with a purple eye. Bracteoles 6—8, linear.

Common in gardens.

20. *H. schizopetalus*, Hook. f.

Sarmentose, with narrowly ovate or sub-rhomboidally elliptic shining L., 2—3.5", 3—5 nerved at base, crenate-serrate except at base, with minute, subulate, caducous stipules. Fls. axillary, drooping and fuchsia-like, on long slender jointed peduncles. Bracteoles about 7, minute subulate. Calyx spathaceous and 2-lobed, .7". Petals scarlet, deeply laciniate and reflexed. Staminal column long, filiform, pendulous. Style branches long.

Common in gardens, and a very distinct species. Native of Africa.

9. THESPESIA, Corr.

Trees or shrubs with entire or lobed leaves. Flowers large, axillary or terminal, sometimes in few flowered panicles. Bracteoles 5—8, deciduous. Distinguished from *Hibiscus* by the styles being connate into a 5-furrowed club-shaped entire or 5-toothed column.

1. *T. populnea*, Corr. Pares, Paras-pipal, *Beng*; Habali, *Or.*; The Portia Tree.

A small tree with roundish or ovate, cordate acuminate, entire glabrous leaves 3—5" long, and with long petioles. Flowers 2—3" diam., yellow, fading to pink or purplish, often on peduncles 2—3"

long. Capsule globose, 1" diam., drooping, black when ripe, 5-valved, but not opening widely.

Wild in the delta of the Mahanadi, Cuttack! Often planted by roadsides, etc. Fls., Fr. all the year round, but chiefly in the r.s. and c.s.

Young shoots scaly. L. coriaceous, 5—7-nerved, with small peltate scales when young; axils of principal nerves glandular.

NOTE.—Roxburgh makes two species of this tree—*Hibiscus populneus* and *Hibiscus populneoides*. The former, he says, has not glands in the axils and a single integument to the capsule, while the latter has a double integument to the capsule. I have not examined these characters in the field.

2. T. lampas, Dalz. & Gibs. Reke, Ho.; Bir Katsom, K., S.; Ban-Kapsi or Ban-Kapus, Beng.

A stout undershrub, 4—6 ft. high, with palmately 3-lobed or entire leaves, 4—5" diam., and terminal solitary or 2—3-nate large yellow flowers, 4—5" diam., with crimson centre. Capsule 3—5-valved, girt at the base by the calyx-tube.

Very common in the forests throughout the area. Perennial and deciduous, or often dying down to the root and shooting out again with the May storms. Fls. Aug.—Oct. Fr. Oct.—Dec.

Young parts covered with brown tomentum. L. softly pubescent beneath, hairy above, base cordate or rounded, mid-rib with a gland near the base beneath. Peduncle swollen above, with 4—8 subulate or setaceous deciduous bracteoles.

There are two varieties:

a. Upper L. usually simple. Capsules 4—5-valved, globose, woody, only slightly dehiscent. The common form in our area.

β. L. all broad and 3-lobed. Capsule oblong or ovoid cuspidate, often only 3-valved, less woody, much more widely dehiscent, and more resembling that of a *Hibiscus*. Sambalpur!

It yields a strong fibre. The root and Fr. given in gonorrhœa. *Camp.*

10. GOSSYPIUM, L.*

Tall herbs, shrubs or small trees, with 3—9-lobed more rarely entire leaves, and large yellow or purple flowers, with 3 large cordate bracts, which, as well sometimes as the leaves and other parts, are often nigropunctate, incised, toothed or entire. Calyx truncate or shortly 5-toothed. Ovary 5-locular. Style clavate at the apex, with 5 furrows and 5 stigmas. Capsule loculicidal. Seeds sub-globose or angular, densely woolly. Cotyledons strongly folded with auricles at the base enclosing the radicle, sometimes with black glands (like the bracteoles).

There are usually two coats on the seed, an inner short pubescence or hairiness known as the fuzz, and the outer adherent or easily removable floss or cotton. The capsules are called *bolts*.

* For this genus I have closely adhered to Sir George Watt's arrangement in the *Wild and Cultivated Cottons of the World*, 1907. I have also consulted Mr. G. A. Gammie's *Indian Cottons* in the Memoirs of the Department of Agriculture in India, vol. ii., September 2nd, 1907. Mr. Gammie's views differ radically from those of Sir G. Watt, and in my endeavour to give his synonymy I may not always have been successful. The vernacular generic names for all cottons are *Kapas* (for the plant), *Rui* (for the floss), *H.*; Katsom, Kaskom, K., S.; but each variety has its vernacular name.

- I. Bracteoles united. Seeds with a fuzz.
- a. L. two-thirds palmately 3—7-lobed, base cordate, midrib only with a gland.
 - L. glabrescent, smooth, bracteoles entire or slightly toothed. Fls. purple. 1. *arboreum*.
 - L. broader, bracteoles gashed. var. *sanguinea*.
 - L. pubescent or hairy, bracteoles entire or toothed, Fls. yellow, with purple claw or purple flush. var. *neglecta*.
 - L. rough, lowest lobes somewhat reflexed and shorter, Fls. relatively small with purple claws, white or yellow, or with pink tinge. var. *rosea*.
 - b. L. half palmately 3—5-lobed; when 5-lobed usually broader than long, base not or scarcely cordate, gland on 1—3 ribs.
 - L. pilose, lobes ovate-oblong, almost obtuse, bracteoles large, purple, acute, with usually 3 teeth. Fls. yellow. 2. *nanking*.
 - L. thin, softly pilose, lobes undulate, bracteoles large, purple, entire, or with a few pointed teeth, Fls. yellow with purple base. var. *bani*.
- II. Bracteoles quite free. Seeds with a fuzz.
L. hirsute. Bracteoles pectinate. 3. *hirsutum*.
- III. Bracteoles free, or nearly so, with conspicuous glands. Seeds without a fuzz.
L. nearly glabrous, half or more segmented into 3—5 spreading-oblong acuminate lobes. 4. *barbadense*.

1. *G. arboreum*, L.

A small tree or large shrub with very slender, often purple, almost glabrous branches, except that the younger parts are more or less woolly. Leaves firm, smooth, cordate, 5—7-lobed two thirds of the way down, lobes oblong-lanceolate, often with small, supplementary teeth in the sinuses, apex with minute bristles, midrib with a gland. Flowers few on short abortive shoots, bracteoles rather small, usually entire, purple-green. Flowers large, deep, shining, purple. Seeds with greenish-grey fuzz, cotton adhering, white, silky.

Not found, except as an ornamental garden plant in our area, but *Watt* considers the following varieties derived from it, and states that when grown as a field crop it may become bushy and annual. Those hybrids characterised by hardness, soft silky flosses, and which often throw back to purple flowers, he considers possess strains of this stock.

Probably a native of Africa, *Watt*; but it is the cotton which Brahmans select for preparing the sacred thread.

Var. α *sanguinea*, *Watt*. Syn. *G. sanguineum* (*Gammie*, loc. cit.).

A red-flowered field cotton. Capsule almost linear. Fuzz less green and more grey.

Bengal, *Buch.*, *Hamilton*, who stated that it occurred everywhere in his time. It is now rare (if it occurs at all) in our area.

Fls. late and does not bear cotton till the hot weather.

Var. β *neglecta*, *Watt*. Syn. *G. herbaceum*, *F. B. I.* (in part); *G. intermedium*, *Tod.* (*Gammie*, in part?); and *G. neglectum*, *Tod.* (*Gammie*, var. *vera*); *Deshila*, *Deshi*, *Jethi*, *Beng.*; *Deshi Kapas*, *Or.*; *Kherdya* (*Ranchi*); *Bengal Cotton*; *Kharia kapa* (*Mayurbhanj?*).

A pyramidal bush from 1.5"—3.5 ft. high with often reddish stems. Leaves somewhat coriaceous, lobes often furrowed and corrugated, 3—7, with supplementary lobules in the sinuses, linear-lanceolate, lowest pair patent or reflexed, acute, hairy and stellately tomentose. Flowers 2—4 on short lateral shoots or (in my specimens) sometimes solitary, yellow with purple centre or yellow or white with a purple tinge, usually campanulate. Bracteoles ovate, acute, toothed, half or more the length of the corolla. Boll ovate, acuminate, 3—4-celled. Seeds with brownish or greenish fuzz and much coarse woolly, short-stapled cotton.

The commonest cotton of the province, especially on jhumed lands in jungle districts! Fls. Jan.

It is an inferior but easily grown cotton.

NOTE.—*G. intermedium*, according to the report of the Cotton Specialist (1909—10), is represented by two forms in Bengal, one *Deshila* with small bolls, which is probably this species, and the other *Bhogila*, with larger bolls, which is probably *G. nanking*, Meyen. They are grown as a mixture with Rahar in North Behar.

Var. γ *rosea*, Watt. Syn. *G. neglectum*, *Tod.*, var. *rosea* (*Gammie*); *Nurdki, Beng.*; *Varadi Cotton*.

Leaves deeply palmatipartite with narrow lobes. Flowers very short, erect, white, or white-yellow with a pink tinge, bracteoles as long as the corolla.

Said to be grown in Bengal and I think in our area, but have seen no herbarium specimens. It is a very inferior cotton according to *Watt*.

2. *G. nanking*, *Meyen.* Syn. *G. intermedium* (*Gammie* in part?); *G. neglectum*, var. *vera*, sub-var. *kokatia*, *Gammie* (probably); *Chinese Cotton*.

Leaves often glabrescent above and pale green, usually very wide, broader than long, with scarcely any cordature at the base.

Var. α *bani*, *Watt.* *Jethi, Deshi* (Behar); *Bhogla, Beng.*; *Bhoga kaskom, S.* (is probably this); *Berar Cotton*.

A bush with sparsely-branched stems which, with the petioles, are purplish below the numerous spreading hairs, young twigs, petioles, L. and peduncles, also with close, short, adpressed, stellate hairs. L. hairy, coriaceous, and often glabrescent with age, very conspicuously gland-dotted, three prominent ribs with large glands beneath, usually 5-lobed, 1.5—2.75", very broad and often broader than long, lobes broadly-oblong or ovate-oblong, acute or suddenly cuspidate, the outermost usually small, arching upwards from the usually very shallowly cordate base. Petiole as long as blade. Stipules narrow, linear-acuminate, but upper broad and unequal, one oblique and toothed, the other linear. Fls. mostly solitary, axillary, bright yellow with purple spots on the base, pinkish in bud and after maturity. Bracteoles large, .9—1.5", purple, with few apical or also several marginal long-pointed teeth, deeply cordate, auricled. Capsule somewhat angled, ovate acuminate, 3—4-celled. Seeds large, irregular, densely coated with rufous velvety fuzz and with a good silky white or khaki floss.

N. Behar, *Gammie* (see note above); South Bihar, **Ham.*! *Manbhum*, largely cultivated, *Campbell* (if the *Bhoga Kaskom* is this).

3. *G. hirsutum*, *L.* = *G. hirsutum*, *Mill.* (*Gammie*); *Budhi, Burhi, Vern.*; *Upland Georgian Cotton*.

A coarse, stunted, rounded bush, much branched, yellowish-green or greenish-red, usually covered with dust from the character of the

numerous hairs on the shoots, petioles and leaf-veins. Leaves rather thin, 3-lobed (sometimes simple to 5-lobed), lobes short, triangular, with straight margins. Base rounded, cordate. Bracteoles rounded, 1.3—1.6", with numerous caudate teeth, terminal often very long. Flowers light yellow without a dark eye (though this is present in Miller's type, *teste Watt*). Bolls large, spherical, usually 4-celled. Seeds large, ovate, truncate one end and with a pronounced greyish rusty or green fuzz. Cotton white.

Singbhum, at Chaibassa! Manbhum, *Camp.*; Mayurbhanj (probably the Budhi cotton referred to by *Cobden Ramsay* in *The Gazetteer*). Fls. Dec.

"Appears to have adapted itself admirably to the natural conditions of the higher lands of Bengal," *Gammie*.

This cotton was well spoken of by the Cotton Specialist in his report for 1907. It is an early maturing variety.

4. *G. barbadense*, L.

Sub-arboreous. Branches angled above, dotted. Flowers very large, 2.5—3" long, with large pectinate bracteoles half as long, teeth finely acuminate.

Cultivated in Bengal, *Prair*. I have only seen isolated plants.

11. KYDIA, *Roxb.*

Trees with stellate pubescence and palminerved, usually lobed leaves. Flowers paniced, polygamous, with 4—6 bracteoles connate at the base, spreading accrescent in fruit. Staminal tube divided to about the middle into 5 arms, each bearing 3—4 anthers, which are imperfect in some flowers. Ovary 2—3-celled, style deeply 3-cleft with peltate stigmas, imperfect in some flowers. Ovules 2 in each cell, ascending. Capsule sub-globose, loculicidally 3-valved. Seeds reniform, furrowed.

1. *K. calycina*, *Roxb.* Bita-goinr, *K.*; Poska Olat, *S.*; Derki, *Kharw.*; Pula, Baranga, *H.*; Patar, *Th.*; Ban Kopasia, *Or.*; Bur Kapa, *Gond.*; Pola, Jara Baranda, *Vern.*

A moderate-sized tree or flowering as a shrub, very handsome when bearing its pure white, large panicles of flowers, .75" diam. Leaves sub-orbicular, palmately 5—7-nerved, stellate pubescent or tomentose, and always with a large gland on 1—3 of the nerves beneath. Bracteoles .25—5" in fruit, oblong or oblong-spathulate.

Throughout the province in valleys and on hill slopes. Fls. Sept.—Nov. Fr. Dec.—May. Deciduous March.

Bark pale. Blaze white, faintly pink at the margins. L. 4—6" diam., sinuate, angled or somewhat lobed, with strong parallel secondary nerves. Petioles 2—3". Petals obcordate, very long clawed, densely pubescent (at least in the shrubby form). Capsule small, enclosed in the calyx, mealy with stellate hairs. Seeds one in each cell, brown.

The wood is scarcely used. The tree coppices freely and grows fast and might sometimes be useful as a nurse.

12. BOMBAX, L. Silk-Cotton Tree.

Trees, often very large and sometimes with verticillate branches. Leaves digitate. Flowers very large, solitary or clustered. Bracteoles 0.

Calyx leathery, capsular. Stamens in 5 groups, opposite the petals, anthers reniform, 1-celled. Ovary 5-celled, style clavate, stigmas 5. Ovules many. Capsule loculicidally 5-valved, valves woolly within. Seeds woolly.

1. **B. malabaricum**, DC. Edel, K., S.; Simal, H.; Simli, Simuri, Vern.; The Red Silk-cotton Tree.

A large tree with a prickly trunk and branches when young, 5—7-digitate leaves and large scarlet flowers, which mostly appear when the tree is leafless. Capsule ovoid, 5—7".

Throughout the area, attaining its largest size in cool valleys. Fls. Jan.—March. Fr. March—May. Leafless Dec.—March or even to April.

Attains 12 ft. girth and more above the large buttresses to the stem in favourable situations. Bark white. Blaze thick, soft, dark pink, streaked with pale pink and white.

The first leaves of the seedling are simple, ovate, acuminate; these are followed by 3-foliolate leaves. Cotyledons expand and are broadly ovate, 8", 3—5-nerved with petiole 1". The tree is very easily grown from seed and easily transplanted. I have done this successfully in the cold season. It is used for the "jamots" of wells in Hazaribagh (Thomson), and is often sawn into planks for cheap, light boxes. If badly stored it soon discolours, with a very bad smell. Immersion in water improves its durability. The growth is very rapid.

Gamble gives the weight as varying from 17—32 lbs. The cotton is used for stuffing pillows, razais, etc. "From its trunk proceeds an exudation called Mochras, much used by the natives in diarrhoea; when dry it is dark brown." Ham.

13. ADANSONIA, L.

1. **Adansonia digitata**, L. The Baobab.

A moderate-sized tree with a very swollen trunk, smooth bark and widely spreading branches. Leaves resembling those of a Bombax, digitate, with 5 sub-sessile, obovate, cuspidate leaflets. Flowers very large, 6—7" diam., white, pendulous, on long peduncles. Calyx leathery, gamosepalous below. Staminal tube naked below, the free ends of the stamens forming a large truncately globose head, 2—2.5" diam. Ovary 5—10-celled. Fruit large, gourd-like.

Sometimes planted. Several trees near the Dorunda Bridge, Ranchi. Fls. April—June. Fr. Aug.—Oct. Native of Africa.

Kew Bulletin 8 of 1916 records the use of these trees as water reservoirs in Kordofan.

FAM. 27. STERCULIACEÆ.

Herbs, shrubs or trees, with the general characters of Malvaceæ, but flowers often 1-sexual or polygamous, with often a tendency to irregularity; petals sometimes 0, stamens sometimes definite and anther cells always 2, parallel or divergent. Ovary sessile or stipitate, of 2—5 carpels loosely united and follicular in fruit, or connate into as many cells and fruit capsular, rarely carpel 1 (*Waltheria*). Ovules anatropous.

- I. Fls. 1-sexual or polygamous. Petals 0. Anthers in a ring on a column.
 A. Anthers many. Fruiting carpels dehiscent 1. *Sterculia*.
 B. Anthers 5. Fruiting carpels indehiscent 2. *Heritiera*.
- II. Fls. 2-sexual. Petals present, without long appendages.
 A. Anthers in a ring on the top of a column.
 Fls. panicled. Capsule bladderly 3. *Kleinhovia*.
 Fls. axillary, moderate-sized, irregular. Capsule elongate, sub-follicular 4. *Helicteres*.
 Fls. axillary, large, regular. Capsule large, woody 5. *Pterospermum*.
 B. Anthers on an antheriferous tube, often with long filaments, numerous 6. *Eriolæna*.
 C. Anthers on the margin only of tube, 15 only, in groups alternating with staminodes 7. *Pentapetes*.
 D. Stamens 5, only tubular below.
 Ovary 5-celled 8. *Melochia*.
 Ovary 1-celled (of one carpel) 9. *Waltheria*.
- III. Fls. 2-sexual. Petals curiously shaped and often with long appendages.
 Fls. large, 2" 10. *Abroma*.
 Fls. very small. Anthers grouped between staminodes 11. *Guazuma*.
 Fls. very small. Anthers solitary between staminodes 12. *Buettneria*.

1. STERCULIA, L.

Trees or shrubs with simple, palmate or digitate leaves, palmately-nerved. Flowers polygamous, panicled. Calyx tubular, lobed, often coloured. Petals 0. Stamens united into a column bearing a head or ring of sessile anthers. Ovary of 4—5 carpels, opposite the sepals. Styles connate at the base, stigmas radiating. Fruit of distinct follicles, woody or membranous. Seeds in each follicle 1—many, sometimes arilled or winged. Cotyledons flat and thin, adhering to the albumen, or thick and fleshy. Germination epigeal.

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|--|----------------------|
| 1. L. digitate | 1. <i>foetida</i> . |
| 2. L. mostly cut into 5 or 7 acute or acuminate lobes, villous or tomentose beneath when young. Capsules woody. Leaf lobes usually simple. Bark greenish or white, papery. Leaf lobes usually again 3-lobed. Bark not papery. Panicles rusty | 2. <i>urens</i> . |
| 3. L. mostly 3-lobed (rarely simple in old, or 5—7-lobed in very young trees). Capsules membranous. | 3. <i>villosa</i> . |
| Fls. scarlet. L. glabrescent | 4. <i>colorata</i> . |
| Fls. yellow. L. tomentose (even when old) | 5. <i>fulgens</i> . |
| 4. L. simple, entire, glabrous | 6. <i>alata</i> . |

1. *S. foetida*, L. Badam, Vern.

A straight tree, much resembling a Simal (Bombax), with very stout twigs and leaves crowded at their ends with 7—9 elliptical or elliptic-lanceolate, acuminate leaflets, smaller 4", larger 6—7" (on same leaf). Panicles many, sub-terminal, 4—6" long from below the opening leaves bearing numerous racemes of green or purplish flowers, densely woolly within. Follicles scarlet, 3—3.5" long, very stout, ultimately woody, recurved and boat-shaped.

Rather widely planted. Jharsuguda, Sambalpur (*Mudaliar*). Purulia station! Gaya station! Ranchi station! Found on Paraspath according to Anderson. Fls. March. Fr. ripens following Feb. Deciduous. New L. appearing just after the flowering.

Bark smooth. L. distinguishable from those of a *Simal* by the very short petiolules, which are only .2" long. Leaflets coriaceous with 14—20 prominent spreading secondary nerves. Young viscid-glandular with unpleasant smell. Petioles 5—9". Calyx 5-fid, lobes .4—5", lanceolate. Column long, curved, hairy. Anthers whorled. Seeds slate-coloured, ellipsoid, oblong, .6—7", with rudimentary yellow aril, epidermis thin and inner testa brown, coriaceous.

In the seedling there is a massive hairy and glandular hypocotyl and large oblong cotyledons, 1—1.5", with many basal nerves and very broad petioles. The first leaves are digitately 3—4-foliolate.

The seeds are eaten and have a taste of filberts. They are usually roasted. The raw seeds are said to bring on nausea and vertigo (*J. P. & D.*).

2. *S. urens*, Roxb. Teley, *K.*, Telhec', *S.*; Kanuji, *Kharw.*; Keunji, *Uran.*; Kulu, Gulu, *H.*; Gendule, *Khond.*; Girungila, *Or.*

A large or moderate-sized tree with thin papery bark which appears white in the distance, and gaunt spreading branches marked with large scars. Leaves 5-lobed, tomentose glabrescent beneath with entire lobes. Panicles 4—7", densely viscidly pubescent. Flowers .16" diam. Follicles pungent with bristles.

A conspicuous feature of the dry rocky hills of the hill country south of the Ganges, extending to Sambalpur, Angul and Puri! Especially common in the dry hills of Chota Nagpur but rarer in the Santal Parganas! Gaya Ghats! Ascends to 3000 ft. at Neterhat! Not seen north of the Ganges.

Fls. Dec.—Feb. Fr. April. It drops its leaves in Nov. or Dec. and often remains leafless until the May storms.

Outer bark very thin with chlorophyll beneath it. L. 9—16" both ways, not deeply lobed (never half way down), but usually broadly 5-cuspidate, base deeply cordate, rounded. Petiole 6—12". Fls. reddish-brown, tomentose outside, green inside the oblong acute lobes, which are bearded within at the base and crimson inside the tube.

It yields a gum, "Katila," used by the Santals in throat affections (*Camp.*). The seeds are eaten. The bark yields a fibre. *Gamble* says "wood very soft, reddish-brown, with an unpleasant smell, used to make native guitars and toys." It used sometimes to be cut into planks in the C.P. Weight 42 lb.

3. *S. villosa*, Roxb. Sisi, *K.*; Ganiher, *S.*; Walkom, Pironja, *M?*; Sisir, *Oraon*; Udal, *Kharw.*, *H.*; Baringa, *Gond.*; Chop, *Th.*; Kodalo, *Or.*

A large tree with grey or brown, often pale, but not papery outer bark. Branches with large leaf scars. Leaves deeply 5—7-lobed, tomentose beneath, lobes again 3-lobed, rarely entire. Panicles pendulous, 9—12", rusty, pubescent. Flowers .5" diam., membranous. Ripe follicles tomentose, scarlet inside.

Essentially a tree of the valleys as *S. urens* is of the exposed hills. On both sides of the Gangetic valley and throughout the whole province, but nowhere abundant. Found on cool sides of hills, e.g. Parasnath (Hazaribagh)! Meghasani (Mayurbhanj)! Neterhat, 3000 ft.!

Fls. Jan.—March. Fr. May—June. Leafless Dec.—May.

Blaze hard, red or crimson. L. adpressed, villosely-tomentose beneath, 9—16" both ways, usually cut to the middle, base deeply cordate, lobes caudate or again 3-partite. Petiole as long as leaf. Fla. .5" diam., yellowish with pink centre. Seeds several, brown with a black shining aril, .3—5".

A very strong fibre is obtained from the bast, which accounts for the scarcity of the tree in some places. The wood is now used for tea boxes in the Duars; it is a very bad fuel. The tree coppices freely; the seeds germinate soon after falling in June.

"Growth fast, 3—6 rings per inch of radius. Weight 15—22 lb." *Gamble.*

4. *S. colorata*, Roxb. Sisi, *K.*; Udal, *S.*; Sisir, *Uran*; Kodalo, *Or.*; Pani Kodal (*Angul*), *Or.*

A large or moderate-sized tree, very beautiful in flower, when the numerous panicles resemble masses of scarlet coral. In fruit it is easily distinguished by the very membranous green or rosy follicles which open widely, bearing one seed on one or both of the margins.

Widely distributed throughout the province. Attains 6 ft. girth in the Ramnagar forests (N. Champaran)! Valley and cool sides of hills in Chota Nagpur, frequent! Kodarma! Not specifically noted from Sambalpur. Angul, frequent! Mayurbhanj! Bonai, *Grieve*. Fls. March—April. Fr. April—May. Leafless Jan.—May.

Bark grey or brown, roughish. Blaze rather thick, pale, with streaks of cream and yellow or yellow in old trees. L. 6–12", with only scattered stellate hairs beneath. In young plants very deeply 7-lobed or partite, in old trees usually with only 3 caudate lobes and deeply caudate base. Fls. 75", clavate, orange-scarlet, stellately tomentose, with pedicels and rachis of panicle of the same colour.

Yields a strong fibre. "Growth fast, 3 to 4 rings per inch of radius." *Gamble*.

5. *S. pallens*, Wall.* Syn. *S. pallens*, *Wall.*; *S. fulgens*, *F. B. I.* (in part); Phap, *Th.*

A moderate-sized or very large tree with nearly smooth grey bark and a dense crown of broadly orbicular-oblong leaves, 6–10" wide, rather broader than long, cordate, and with 3 terminal lobes, persistently softly velvety beneath with dense stellate hairs and with shorter more sparse stellate hairs above. Flowers resembling those of *S. colorata*, but yellow instead of scarlet. Follicles membranous, opening before maturity.

Bettiah and Ramnagar forests from the foot of the hills up to 2000 ft.! Fls., Fr. h.s. Deciduous h.s.

This, which is usually described as a small tree, attains 8 ft. in girth and fully 60 ft. in height, but it is often forked or slightly buttressed below. Bark with small exfoliations in large trees. Blaze white with a little green and yellow. L. with 7–9 principal nerves. Petiole 6–12", stellately tomentose. Fls. 5–8", buds globose, calyx campanulate, yellow tomentose, lobes ovate or lanceolate acute.

The wood is said to resemble that of the Simal. "Weight, 31 lb." *Gamble*.

6. *S. alata*, Roxb.

A tall, large tree, with smooth grey bark and a dense somewhat narrow crown of large, simple, cordate, ovate or broadly oblong, quite entire, 7–9-nerved leaves 4–10" long. Flowers in simple or compound racemes from the axils of fallen leaves, green and yellow, tomentose outside, inside streaked and dotted purple.

Rather extensively planted as an ornamental tree, and although a native of the damp forests of the Duars, Assam and Chittagong, it succeeds well in quite dry localities. Ranchi Station! Chaibassa—Chakradharpur Road, etc., etc.!

Fls. March—June, both before and with the L. Fr. Nov. Deciduous Feb.—March.

Young parts only with rusty stellate hairs or scales. Racemes 2–5". Fls. campanulate with unpleasant smell. Sepals 5–6, 7–8". Anthers in male fls. about 5 in a ring at top of column, in Herm. fls. in 5 sessile groups in the sinuses formed by the carpels. Follicles large, woody, sub-globose, 4–5". Seeds winged, cotyledons not separable from the albumen.

* First described by *King* in *Journal of As. Society*, ix, ii, 73.

2. HERITIERA, *Alton.*

Trees with coriaceous leaves, closely covered with minute flat scales beneath. Flowers small or very small, 1-sexual, in lateral panicles. Calyx 5- (4-6-) toothed or -cleft. Petals 0. Stamens united into a column with anthers in a ring at the top. Carpels 5-6, almost free, style short, stigmas 5, thick, ovule 1 in each carpel. Fruit of woody indehiscent, 1-seeded, keeled or winged carpels. Cotyledons thick, fleshy. Albumen 0.

1. *H. minor*, *Roxb.* Syn. *H. Fomes*, *F. B. I.*; Sundri, *Or., Beng.*

A small tree with brown branches and narrow elliptic leaves, 2.5-5" (4-6", *F. B. I.*), silvery-scaly beneath like an *Elæagnus*, entire and pinnerved with about 6-9 secondary nerves faintly looping inside the margin. Flowers pinkish or orange, campanulate, .15-.18" long, with 4-5 triangular lobes, males very caducous. Fruit (ripe carpels) 1.5" diam.

Mahanadi delta in tidal forests! The well-known Sundri of the Sunderbans. Fls. Jan.-May. Fr. August.

Roots with pneumatophores. Branchlets scaly, scales with a minute rust-coloured centre. L. with tapering acute or rounded base, and obtuse rounded or sub-acute apex, not acuminate. Usually 2 very slender secondary nerves from base. Petiole stout, .3-.8". Panicles short, lax, pubescent, 1-2.5". Ripe carpels, roughly resembling two unequal sphere segments, placed face to face with a rim at their line of junction, an oblique keel on the lower (or inner face) ending in the scar of attachment, and a larger keel on the upper (or outer) face or segment.

I have picked up the Fr. from the beach at Puri!

3. KLEINHOVIA, *L.*1. *K. hospita*, *L.*

A small tree with smooth bark, broadly ovate or sub-orbicular leaves with retuse or cordate 7-nerved base, acuminate, glabrous, 4-5" (or 6-12" in luxuriant specimens, *Roxb.*), with strong cross tertiary nerves and long petiole. Flowers about .7" diam., pink, in ample terminal panicles. Sepals 5, nearly free, narrow oblong, .32", tomentose. Petals 5, zygomorphic, posterior sub-tubular. Stamens on a gonophore in a ring round the apex, which is cupular and 5-cleft, each division with 3 anthers. Ovary tomentose, 5-celled. Capsule loculicidal, membranous, inflated, 5-winged, each cell with 1 black seed.

Often planted. There is a small avenue of it at Daltonganj. Native of the Moluccas according to *Roxburgh*. Fls. Oct. Fr. Dec.

4. HELICTERES, *L.*

Trees or shrubs. Leaves simple. Flowers axillary, often zygomorphic. Calyx tubular, 5-fid. Petals 5, claws often auricled. Staminal column adnate to the gynophore, 5-toothed, with anthers in groups between the teeth; anther cells divergent. Ovary 5-lobed and -celled, ovules many. Fruit sub-follicular, sometimes follicles spirally twisted. Seeds tubercled. Cotyledons leafy, folded round the radicle. Albumen scanty.

1. **H. isora**, L. Poto-porla, sinkari, K.; also called Goinr from a confusion with *Grewia*; Petcamra, S.; Aitem, aita, Kharw.; Murad, Maraphal, H.; Muri-muri, Murmuria, Or.; Pita Baranda, Khond.

A shrub or small tree with oblique usually cordate, broadly oblong or rounded, pubescent, 5—7-palmi-nerved leaves, scarlet lateral zygomorphic flowers, 1.5" long, and a woody fruit of 5 spirally rolled carpels on a very elongated gynophore, tardily follicular when ripe, and dehiscent along their inner edge.

Distributed throughout the whole province from Champaran southwards. Very common and often gregarious both in the valleys and especially on northern aspects in the hills. Fls. April—Dec. Fr. Oct.—Jan., but the open carpels may be found up to June. Deciduous in March and renews leaves in April.

Shoots softly villous. L. rarely symmetrical, bifarious, 3—6", often scabrous above, densely stellate pubescent beneath, often somewhat lobed, serrate. Petiole .25—5". Peduncles axillary or extra axillary, 2—4 together, short. Calyx .5—75", oblique, stellate. Petals reflexed.

The root, bark and fruit are given for colic. Powdered and fried in ghee and sweetened it is used for bowel complaints in various districts—possibly a case of the Law of Signatures, the use being suggested by the shape of the fruit.

5. PTEROSPERMUM, Schreb.

Trees or shrubs lepidote or with stellate hairs. Leaves usually oblique, simple or lobed. Flowers large, axillary and terminal, bracteoles sometimes lacinate. Sepals 5, more or less connate. Petals 5. Staminal column short, with 5 forked or 5 pairs of staminodes, and 3 slender stamens with linear anthers between each or each pair. Ovary inserted within the top of the column, 3—5-celled, style 1, with 5-furrowed stigma, ovules many. Fruit a woody capsule, loculicidally 5-valved. Seeds winged above, 2-seriate in the inner angle of the cells. Cotyledons plaited or corrugate. Albumen thin or 0.

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| L. very broad, 7—12-nerved. Fls. 4—5" | 1. <i>acerifolium</i> . |
| L. oblong-acuminate, 4—5-nerved. Fls. 3—4" | 2. <i>Heyneanum</i> . |
| L. oblong-lanceolate, 5—7-nerved, with a large basal auricle | 3. <i>semisagittatum</i> . |
| L. oblong, 3—5-nerved. Fls. 1—1.5" | 4. <i>suberifolium</i> . |

1. **P. acerifolium**, Willd. Muchu kundi, K.; Machkunda, S.; Machkan, Th.

A large, handsome tree with large palmately-nerved cordate leaves, white tomentose beneath, and large fragrant white flowers. Capsule oblong, woody, 5-valved.

Indigenous in the Ramnagar hills (N. Champaran), but rare! Doubtfully indigenous elsewhere. Messrs. Campbell and Watt believe it to be so in the Tundi forest. It is commonly planted near villages throughout the area. The name "Muchokunda" is Sanskrit and is also the Hindi and Bengalee name for *P. suberifolium*, Lam.

Fls. March—July. The capsules open at the time of flowering in the following year. Evergreen.

Rusty tomentose. L. 6—15", lobed, entire or coarsely toothed. Fls. regular or sub-regular. Sepals 4—5. Petals 3.5—4.5", linear-oblongate. Stamens 15, shorter than the staminodes, with filiform filaments and linear anthers. Staminodes 5, 3.4—3.75" long (including tube), pubescent, filiform, slightly clavate. Capsule rough.

2. P. Heyneanum, Wall. Giringa, rarely Machkunda, Or.

A handsome small tree with oblong repand, coarsely dentate or lobed, rarely entire leaves, 3—6.5", white beneath between the raised brown nervation, base subcordate. Flowers pure white, fragrant, 3.5—4.5" diam. Capsule 2—3", oblong, but slightly narrowed upwards, and base suddenly acute.

Orissa, frequent, on sandstone and conglomerate in the Chândka forest in the plains, and also in the hill forests on metamorphic rocks in Puri! Mayurbhanj! Angul! Rare in Sambalpur (on the red shales in the Bargat nala)!

Fls. Oct.—Dec. Fr. April—May. Evergreen.

Twigs, petioles, nerves beneath, peduncles and sepals densely covered with rusty stellate hairs or scales. L. usually wider upwards and then suddenly acuminate or caudate, lobes or teeth usually very acute. Secondary nerves 5—8, of which 1 or 2 (each side) strong ones from the base, tertiaries scalariform. Petioles .25—4". Bracteoles stipitate, 4—6, narrow elliptic to broadly cuneate, .7", irregularly toothed and gashed. Sepals linear, 1.7—2.5", white villous within. Petals obliquely cuneate, with white stellate pubescence. Stamens filiform. Capsule obtusely 5-angled, rusty stellate-tomentose, apiculate. Seeds about 4—5 in each row, with broad wings.

3. P. semisagittatum, Ham.

A very handsome tree with large handsome flowers with broad petals. Easily recognised by the large auricle on one side only of the leaf base. Capsule terete.

It is sometimes planted in gardens. Fls. April—May.

4. P. suberifolium, Lam. Makai Champa (*teste Ham.*).

A handsome tree with the oblong leaves 2.5—4" long, subregular, rounded or oblique, or subcordate at the 3—5-nerved base, never auricled, very hoary beneath. Flowers only 1—1.5" diam. Capsule oblong terete, sometimes beaked, 2—2.5".

Purneah, very rare, Ham. Found in Ganjam, and may be found wild in Orissa, where it is sometimes seen in gardens.

6. ERIOLAENA, DC.

Trees or shrubs with palmately-nerved leaves and regular yellow flowers, axillary or paniced, bracteolate. Calyx spathaceous, 5-toothed or partite. Staminal tube short with many anthers, cells parallel. Staminodes 0. Ovary sessile, 5—10-celled. Style with as many spreading stigmias as there are cells. Ovules many. Capsule woody loculicidal, axial angle of valves villous. Seeds winged above. The woody peduncles are often sharply flexed in fruit.

Bracteoles laciniate.

Peduncles 1-flowered. Larger leaves 8—12"

Peduncles 1—few-flowered. Larger leaves 4—6"

Bracteoles entire or lobed.

Flowers sometimes paniced. Larger leaves 3—4"

1. *Wallichii*.

2. *Hookeriana*.

3. *quinquelocularis*.

1. E. Wallichii, DC.

A large stout shrub or small tree, with ovate or broadly orbicular, cordate-based leaves of very variable size, mostly about 8" each way, irregularly crenate, with acute or obtuse apex, rugulose and thinly

hairy above, permanently shortly stellate beneath, with very prominent raised nervation. Peduncles 1-flowered, stellately pubescent. Sepals 8—1.2" long, lanceolate acuminate. Capsules oblong ellipsoid, 1.25—1.5", with apex rounded apiculate, about 8-valved, stellately scurfy, nearly smooth.

Sandstone hills, Ramnagar forests! Fls. r.s. Fr. Nov.—Dec.

Shoots shaggily tomentose. L. when in flower 3—6" long, mature ovate, and sometimes only 3" at the base of the shoots, attaining 12—14", and orbicular-ovate on the same branch or individual; young densely tomentose beneath, mature hoary between the rusty stellate-pubescent nerves, base deeply or shallowly cordate with 7 primary nerves. Petioles 1—3", never quite glabrescent, stout on the larger leaves. Bracteoles pinnatisect. Fls. 2—5" diam. Sepals densely stellate-tomentose outside, villous within. Petals orbicular. Column glabrous. Seeds 7—9 in each cell, with a broad scimitar-shaped wing.

2. *E. Hookeriana*, W. & A. Bundum, Uidbulung, Hakehomo, K.; Ganguli, S.; Ponra, Uran; Bonta, Or.

A shrub or small tree with the new shoots densely stellately scaly, leaves 3—6", orbicular, cordate acuminate, white or grey tomentose beneath, more or less glabrescent. Flowers yellow, 1.5—2" diam. 1-few on axillary or extra-axillary long peduncles. Sepals 6—8". Capsule ovoid, corrugate or tubercled.

Hill tracts south of the Ganges from Shahabad and the Santal Parganas to Sambalpur and Angul! Probably also in Puri, but not noted.

Fls. April—June. Fr. Nov.—Jan. Deciduous. New leaves at time of flowering.

L. toothed or crenate, often with alternately round and smaller triangular teeth, mature usually entirely covered beneath with thin stellate tomentum, glabrescent above, base 5—7-nerved; petiole 1—2.5", rather stout. Bracteoles lacinate, pinnatisect, 3—5", usually deciduous after the flower opens. Buds ovoid, beaked by the tips of the valvate tomentose sepals. Sepals as in *E. Wallichii*, but smaller, and spreading more directly from the base. Capsule usually 8—10-valved, about 1" long.

Var. *viridis*.

L. green beneath with minute, distant, stellate hairs only; petiole slender. Capsule 6-valved, closely covered with yellowish-green felt, broadly ovoid and apiculate and nearly smooth. Orissa!

This may be an undescribed species, but without Fls. it is not possible to describe.

The wood of *E. Hookeriana* is strong and used for axe handles. The bark is said to yield a good fibre.

3. *E. quinquelocularis*, Wight.

A small tree much like the last, easily distinguished in flower by the slender 2—5-flowered peduncles, and minute very caducous, entire or only lobed bracteoles, and in fruit by the less tubercled narrow capsules, 1—1.25" long, lanceolate in outline and sharply pointed. In leaf it is very similar, but the under surface is white and more thinly stellate and the petioles relatively longer, being often as long as the blade.

Behar 1—4000 ft. (Parasnath), J. D. H., but I have seen no undoubted specimens from our area; that marked *E. quinquelocularis* in the *Cal. Herb.* I regard as *E. Hookeriana*.

NOTE.—Two other species of *Eriolæna* are recorded from Behar and Orissa in the *Cal. Herb.*, viz.:

4. E. Stocksii, H. f. & T. T.

Rajmahal Hills, Kurz.; Manbhūm, Campbell.

The specimens appear to be distinguished from *E. Hookeriana*, W. & A., by the very narrowly ovoid buds, much longer than the laciniate bracteoles, and by the stellate tomentum on the underside of leaves being thinner. It seems to represent a variety of *E. Hookeriana*.

5. E. spectabilis, Planch.

Behar, 1—4000 ft., J. D. H.

This is only a leaf specimen with a broken capsule, with valves 1" long and tubercled. It might be *E. Hookeriana*.

7. PENTAPETES, L.

Flowers axillary, with 3 caducous bracteoles. Sepals 5, lanceolate persistent, connate at base. Petals 5. Stamens 20, in 5 groups of 3 each, alternating with 5 staminodes, which are nearly as long as the petals. Ovary 3—5-celled, cells many-ovuled. Capsule loculicidal. Seeds 8—12, 2-seriate in each cell. Cotyledons plaited, 2-partite.

1. P. phœnicea, L. Bare baha, S.

A pretty branched herb, 2—5 ft. high, glabrous, or with a few scattered hairs, easily recognised by its long, lanceolate, sharply toothed or crenate-serrate leaves, 3—5" long, with only 1 primary nerve. Flowers large, red, nodding on short 2-flowered peduncles. Sepals stellate and bristly. Capsule sub-globose, bristly, axis woolly. Seeds sub-globose, dotted.

In wet places, not common. Purneah! Santal Parganas, Wood.

Fls. Aug.—Oct. Fr. Nov.—Dec. The root is used medicinally, Camp.

8. MELOCHIA, L.

Herbs or undershrubs more or less pubescent. Flowers small, clustered or paniced. Petals spatulate, marcescent. Stamens 5, connate below. Ovary 5-celled, cells 2-ovuled. Capsule loculicidal. Embryo straight, cotyledons flat.

1. M. corchorifolia, L. Thuiak', S.

An undershrub with oblong-ovate serrate plaited leaves, 1—3" long, with rounded or cordate base. Flowers small, white or pink, collected in dense heads. Calyx tube 12", surrounded by 4—5 bracteoles 25—33" long. Capsule depressed globose, pubescent, 5-grooved.

Common in waste places, bunds of rice fields, etc. Fls. and Fr. r.s.

The L. are eaten as a vegetable and the stem yields a fibre.

9. WALTHERIA, L.

Herbs or undershrubs. Flowers small, clustered. Petals oblong-spatulate. Stamens 5, tubular below. Ovary 1-celled, ovules 2. Capsule 2-valved, 1-seeded. Embryo straight, cotyledons flat.

1. W. indica, L.

A perennial, hoary-tomentose undershrub, 2—4 ft., partially dying down in some situations, and shooting out again in May and June.

Leaves velvety, ovate or ovate-oblong, sub-plicate, toothed, with 5-nerved base, larger, 2·8" by 1·12", rarely 3" long. Flowers yellow or pink, in axillary, sessile, or stalked dense capitate cymes, with small lanceolate bracts, and also running out into leafless spikes. Petals ·16—·25", narrow oblong, with a long claw. Staminal tube with 5 oblong anthers without staminodes. Capsule ·08", ovoid, villous, 2-valved, with 1 black seed.

Especially on rocks in open dry jungles, also common in waste land. Fls. r.s.

10. ABROMA, Jacq.

Flowers 2-sexual. Petals curiously shaped and often with long appendages. Flowers large, 2".

A. augusta, L.

A large shrub with cordate, ovate-oblong leaves, 4—6", and large purplish-yellow flowers; is occasionally seen in Indian gardens. It yields a good fibre.

11. GUAZUMA, Plum.

A stellately tomentose or pubescent tree with small flowers in axillary cymes. Sepals 5, nearly free, sometimes two or more coherent in pairs. Petals 5, clawed, hooded, and apex terminating in two slender ligulate appendages. Staminal tube with 5 lanceolate lobes (staminodes?), alternating with 5 groups of 3-fertile anthers, nearly sessile, on a short knobbed filament. Ovary 5-lobed and -celled, sunk in the staminal tube. Ovules numerous. Fruit oblong, woody tubercled. Seeds many, albuminous, 2-seriate, embryo curved, cotyledons leafy folded.

1. G. tomentosa, Kunth.

A moderate-sized tree with lanceolate or oblong-lanceolate, often falcate, very obliquely cordate-based acuminate serrulate leaves 2—4·5", which are closely covered with stellate hairs both sides, those on upper surface very short. Base 3—7-nerved. Petioles ·2—·3". Flowers yellow. Sepals ·15", stellate tomentose. Seeds ovoid, grey.

Often planted. Manbhum, *Campb. Herb.*! Very common in Cuttack station! where it grows into a fairly large tree, and is sometimes called "Bastard cedar." Fls. April—July. Fr. Feb.—June.

The fruit, though capsular in appearance and deeply 5-grooved, is not dehiscent. It remains on the tree and falls at the next flowering period.

12. BUETTNERIA, L.

Trees, shrubs or herbs, sometimes climbing, with simple, entire or toothed leaves. Flowers purplish, small or minute, cymose, cymes often umbellate and panicled. Petals with a hooded base and variously shaped horns or appendages. Staminal tube short, with 3 fertile anthers and 5 staminodes. Ovary 5-celled, cells 2-ovuled. Capsule globose, more or less echinate, septifragally 5-valved. Cells 1-seeded. Albumen 0. Cotyledons folded round the radicle, plumule lobed.

1. B. herbacea, Roxb. Idel sanga, K.; Deku sindur, S.

A branched herb with a perennial woody rootstock, distant ovate-lanceolate, acuminate, toothed leaves 1—2·5" long, and axillary cymes

of small purplish flowers, remarkable for the long slender tips and 2-fid appendages of the petals. Capsule softly spiny, .25" diameter.

Throughout the hill area south of the Ganges, chiefly on rocky ground in the forests. Fls. June—Oct.

The rootstock is ground and rubbed on swellings of the legs by the Kols. It is also used in combination with Bael fruit, hesel gum and Banyan root in cholera and diarrhœa. "It is given in the female complaint, known in Santali as pordhol," *Camp.*

2. *B. aspera*, *Colebr.*

A large woody climber with large, cordate, sub-orbicular or oblong leaves, with 6 basal nerves, and the minute flowers in axillary, hoary cymose panicles.

Rajmahal Hills, *Prain.* Fls. May—June.

I rather doubt this plant being now a native of the province. It is described as a tree in the *F. B. I.* and *Bengal Plants*, but all the herb. sheets I have seen which bear remarks as to its habit describe it as scandent. I am unable to find any specimens from the Rajmahal Hills or elsewhere from B. & O. either at Calcutta or at Kew. The flora of those hills has, however, become terribly impoverished within the last fifty years.

FAM. 28. TILIACEÆ.

Trees, shrubs or herbs, with the general characters of Malvacœ but leaves rarely deeply lobed, flowers often small without an epicalyx. Sepals 3—5, usually free. Petals as many, rarely 0, free, usually imbricate. Stamens (sometimes few in *Triumfetta* and *Corchorus*), free, or sometimes 5-adelphous, but not united into a tube, often on a gonophore; anthers 2-celled. Ovary 2—10-celled. Ovules anatropous. Fruit various, often drupaceous or deeply lobed. Seeds 1 to many, exarillate, usually albuminous. Embryo straight or slightly curved.

1. Small trees, shrubs or herbs. Anthers opening by slits, usually very short.
 - A. Sepals connate below. Anthers subglobose.

Small tree or shrub, scaly	1. <i>Brownlowia.</i>
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 - B. Sepals free.

Herbs or undershrubs. Fr. small, dry, echinate	2. <i>Triumfetta.</i>
Herbs. Fr. capsular, not echinate	3. <i>Corchorus.</i>
Trees or shrubs. Fr. drupaceous with 1—4 pyrenes	4. <i>Grewia.</i>
2. Trees. Anthers opening by terminal pores, linear.

Petals incised. Fruit drupaceous	5. <i>Elæocarpus.</i>
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1. BROWNLOWIA, *Roxb.*

Trees or shrubs with scaly or stellate indumentum. Leaves entire with 1—2 secondary nerves from near the base. Flowers small, in terminal and lateral panicles. Calyx campanulate, 3—5-cleft. Petals 4—7. Stamens many, united at base into 5—7 bundles, filaments free. Staminodes 5—7, within the stamens, ligulate or petaloid. Anthers subglobose. Ovary of 4—5 nearly free carpels. Ovules 2 in each cell, collateral. Styles long, free or coherent. Fruit sub-follicular, follicles 2-valved, 1-seeded. Albumen 0. Cotyledons thick, fleshy.

1. *B. lanceolata*, *Benth.*

A small tree or shrub with lepidote twigs, narrow lanceolate acuminate leaves, 4—6" long, whitish, scarcely silvery beneath, and small

flesh-coloured 2-sexual flowers, in short axillary and terminal cymes, covered with brownish scales.

Tidal forests of the Mahanadi Delta, common! Fls. May—June.

L. closely lepidote beneath, lateral basal nerves oblique, very slender and short, other secondary nerves spreading, fine, scarcely distinguishable from the reticulate intermediate. Petioles .3—4". Cymes .5—1.5". Calyx .15—2" long, cleft about half-way down, lobes obtuse, lepidote. Petals scarcely clawed, narrowly obovate, .25—27". Torus scarcely elongated. Staminodes linear or linear-lanceolate, .1—1.5", sometimes with rudimentary anthers. Follicles (very old) coriaceous, .4", widest at top, truncate.

2. TRIUMFETTA, L.

Herbs, undershrubs or shrubs, with simple, serrate or lobed leaves, and small yellow flowers in dense cymes or fascicles, which are axillary or run out into interrupted spikes or racemes. Stamens 8—15, on a fleshy glandular torus. Ovary 2—5-celled, ovules 2 in each cell. Style filiform, stigma 5-toothed. Fruit with spines or bristles, usually hooked, indehiscent or tardily dehiscent. Seeds 1—2 in each cell.

Flowers open in evening and remain open till following morning, rarely during mid-day.

1. *L. lanceolate* or *ovate-lanceolate*, tapering at apex.

Shrubby. Fr. densely hairy, spines with patent hairs	1. <i>pilosa</i> .
Herbaceous. Fr. glabrous, spines glabrous or with few hairs	2. <i>annua</i> .
2. *L.*, some or all orbicular, apex rounded or 3-lobed.

A. <i>L.</i> hairy, but not tomentose beneath, open lobed.	
Herbaceous. Spines of fruit hispid-ciliate	3. <i>neglecta</i> .
Herbaceous or suffruticose. Spines glabrous	4. <i>rhomboidea</i> .
B. <i>L.</i> white, tomentose beneath, not lobed	5. <i>rotundifolia</i> .

1. *T. pilosa*, Roxb.

A shrub, 3—6 ft. high, with stellate-hairy stems, and simple, ovate-lanceolate, subcordate leaves, softly stellate-hairy both sides. Conspicuous in fruit from the heads of hooked spines, .75—1" diam., including the .25—3" long hairy spines.

Shady moist woods in Singbhum and Palamau!

Fls. Sept.—Nov. Fr. Nov.—Jan.

The flowers open in the evening.

Stellate hairs on stem with red bulbous bases. L. attain 6" by 2.75", pale and densely hairy beneath. Petiole .5—2". Stipules .25". Sepals .3—4", linear, stellate-hairy, apiculate. Petals linear-oblong or oblanceolate, .25", spreading. Stamens 10. Fr. 4-celled, 8-seeded.

2. *T. annua*, L.

A herb with the stems and branches usually pubescent on one side only; leaves smaller than in *T. pilosa*, and often more ovate and glabrescent, except for a few hairs on the nerves beneath. Fruiting heads smaller and quite glabrous between the spines, which are glabrous or ciliate.

Behar, Kurzi!

It is a species of moist regions and the Behar specimen was probably from Purneah.

3. T. neglecta, W. & A.

A herb often flowering when 4" high, but attaining 2 ft., when it closely resembles *rhomboidea* with the leaves ovate or rhomboid, simple and 3-lobed, densely stellate-hairy beneath. Fruits ellipsoid, pubescent, with the spines hispid-bearded, usually on one side only, straight, or some hooked.

Frequent in Chota Nagpur, Singbhum! Hazaribagh!

Fls., Fr. Sept.—Dec.

Fls. sometimes found open in the afternoon. It is perhaps scarcely more than a variety of the next species.

4. T. rhomboidea, Jacq. Chikti, H.

A stouter herb than the last, or an undershrub, 3—4 ft., with more or less pubescent branches, and mostly 3-lobed, 5—7-nerved leaves, hairy beneath, but simple hairs usually predominating. Fruits ellipsoid or subglobose, .25" diam., including the minutely-hooked glabrous spines.

Very common everywhere, attaining its largest size in damp shady places. Fls., Fr. Oct.—Jan.

Stems usually more pubescent on one side. Lower L. with rounded bases attaining 5.5" long and broad, 3-lobed and coarsely toothed, with a petiole up to 4" long; upper L. gradually smaller and uppermost lanceolate. Fls. fascicled, axillary and running into terminal spikes. Sepals linear, .17—2", apiculate. Petals oblong or spatulate, somewhat shorter.

Yields a soft glossy fibre. Mucilaginous.

5. T. rotundifolia, Lam.

An undershrub, 3—4 ft. high, with sub-orbicular, scarcely lobed leaves, .5—1.5" diam., white tomentose beneath. Fruits globose or ellipsoid, .2—2.5" long, including the small hooked spines.

Open waste ground, in dry places. Western districts of the northern area only. Behar, Kurz! Fls., Fr. Sept.—Dec.

3. CORCHORUS, L.

Herbs or undershrubs with simple leaves and small yellow flowers, on axillary or extra-axillary, often leaf-opposed peduncles. Stamens free, diplostemonous or indefinite, on a short gonophore. Ovary 2—6-celled, with short style and concave stigma. Capsule linear or globose, 2—5-valved, sometimes transversely septate. Seeds many, embryo curved.

A. Capsule globose. L. usually tailed

1. *capsularis*.

B. Capsule much longer than broad.

1. Capsule without distinct horns or beaks.

Stamens many, some or all the L. with a pair of tails near the base, capsule smooth

2. *olitorius*.

Stamens many, L. rarely with basal tails, capsule rough

3. *trilocularis*.

Stamens 5—10. Capsule softly pubescent

4. *fascicularis*.

2. Capsule with 3 spreading or erect horns.

Capsule 3-winged and 3-angled

5. *acutangulus*.

Capsule terete

6. *tridens*.

1. C. capsularis, L. Pat Sanpat, Vern.; Kaskomrau, S.; Jute.

A herb 2—4 ft., or attaining 6—7 ft. in cultivation, with lanceolate or oblong acuminate, rarely ovate-lanceolate, serrate leaves, 1.5—3.5",

(or 3—6" in cultivation) long. Base of leaves sometimes tailed as in the next species. Capsule depressed, globose, muricate, 5-valved.

Wild in most districts. In the forest at Beriah (*Palamau*)! Usually in the open. Manbhum, *Campbell*! Fls. r.s. Fr. Oct.

This appears to be the species most generally cultivated, but except in Purneah and parts of Orissa the rainfall is in general not sufficient for it, and it is nowhere grown on a large scale as in Eastern Bengal.

2. *C. olitorius*, L. Hatempa, *Ho.*; Bir narcha, *S.*; San-pat, *H.*; Jute.

A herb, in its wild form only 1—3 ft. high, taller in cultivation, with glabrous stems, elliptic to ovate, rarely ovate lanceolate leaves, 2—4" long, serrate, and with two of the serratures near the base of some or all the leaves produced into long, very slender tails. Capsule usually 5-valved, 1·5—2·8" long, glabrous or nearly so, angled, the tip usually 5-lobed but not horned, cells septate between the seeds.

A very common wild plant, occurring in open lands in all districts in the rains! but not widely cultivated in the province. The principal centres of cultivation are Purneah and parts of Orissa. In Mayurbhanj two varieties known as Sirajganji and Deshi Jute are grown. Fls., Fr. r.s., chiefly Sept.

L. nearly glabrous or hairy, base rounded, 5—6-nerved, secondary nerves 5—6, fine and distinct. Petiole ·75—2". Stipules ·35—·45", subulate, with filiform tips. Fls. 2—3, on a very short peduncle. The flower buds are broad, obovate, beaked with the sub-aristate tips of the petals. Young Fr. hispidulous.

The young plant is eaten as a vegetable.

3. *C. trilocularis*, L.

A herb with linear-lanceolate, linear-oblong, or more rarely elliptic-oblong leaves, ·75—3·5", crenate-serrate, sometimes with slender basal tails, usually very pubescent. Petioles short but slender, ·25—·4". Capsule very slender, 2—2·5", scabrous, septate on the valves between the seeds, usually 3—4-valved.

Not common. Gaya! Parasnath! Fls., Fr. June—Oct.

4. *C. fascicularis*, Lam.

Suffruticose, 3 ft. high, with narrowly oblong or oblong-lanceolate leaves, ·5—2·3", serrate or serrulate acute, and leaf opposed clusters of linear, densely pubescent, or pilose subterete capsules, ·5—·75" long.

Singbhum! Saidope Forest, Palamau! Santal Parganas! Fl. r.s. Fr. Oct.—Nov. Branches glabrous or with a few hispid hairs above. L. somewhat tapering to the 3-nerved base, nearly glabrous, with 5—10 oblique secondary nerves raised beneath. Petioles hispid on upper side, 2—3". Stipules linear acuminate, ·15—·2". Fls. ·17" diam. Peduncle ·05" in Fr., 3—5-flowered, sometimes lateral or sub-axillary. Pedicels hardly any. Capsules fascicled, shortly beaked, 3-celled, beak minutely 3-lobed. Seeds about 8 in each cell, ends truncated.

5. *C. acutangulus*, Lam.

A species more closely allied to *C. olitorius* than are the last two. Erect or diffuse with broadly-ovate to oblong-ovate leaves, ·7—2", rarely 3" long, with the base occasionally tailed as in *olitorius*. Capsule ·5—1", 6-angled, of which 3 of the angles are alate or sub-alate, apex with 3—4 suberect or spreading beaks or horns.

Prefers shady places, and often found among rocks. Singbhum! Hazaribagh! Manbhum! Fl., Fr. r.s. to Nov. There appear to be two varieties.

α. Suberect with L. broadly ovate crenate, 1—3", often rounded at apex. Petioles .4—1", hairy above.

β. Diffuse with lanceolate-ovate L. .5—1.3", crenate, serrate or serrulate, acute. Petiole .2—3", hairy.

6. *C. tridens*, L. **

Said to be found in Tirhut (B.P.). I have seen no specimens from our area. According to F. B. I. the L. are linear-oblong or lanceolate, 1—3" by .5—1", with petiole .17—25". Capsule 1—2", cylindric, terminated by 3 spreading points.

4. GREWIA, L.

Trees, shrubs, or rarely undershrubs, with stellate pubescence, simple 3—7-basal-nerved, serrate or serrulate leaves and yellow or white flowers in axillary, sessile or stalked clusters or umbels, rarely paniced. Sepals free, often white or yellow within. Petals shorter than the sepals, usually with a large gland with a pubescent rim at the base, or almost wholly reduced to a nectary.* Stamens hypogynous, usually on a short gonophore.* Ovary 2—4-celled. Style 1, with a more or less deeply-lobed stigma. Ovules 2-several in each cell. Fruit often lobed, of 1—4 pyrenes, enclosed in a succulent or ultimately fibrous mesocarp. Pyrenes 1—2-seeded. Seeds albuminous, with large, flat, thinly-fleshy cotyledons. Germination epigeal, cotyledons nearly nerveless, sub-sessile.

A. Fls. white, or sepals first white then becoming dull yellow inside. Shrubs (except sometimes 6 and 7). Gonophore usually with a cornice which is hirsute or densely ciliate.

- | | |
|---|------------------------------|
| 1. Climbing or straggling shrub. Fls. large, 7—8" long, terminal and becoming leaf-opposed | 1. <i>rhamnifolia</i> . |
| 2. Erect (or straggling in 4). Fls. axillary. | |
| a. L. very broad. Fr. large, globose. | |
| Sepals .25"—3". Fr. green or yellowish, coriaceous | 2. <i>aspera</i> . |
| Sepals .5"—7". Fr. purple, epicarp finally crustaceous | 3. <i>sclerophylla</i> . |
| b. Straggling, L. oblong. Sepals .3—5". Stigmas 4, linear spreading. Fr. stellately hairy | 4. <i>flavescens</i> . |
| c. Erect shrubs or undershrubs. L. narrow or oblong. | |
| Sepals .25—3" long. Stigmas capitate with radiating papillæ. Fr. depressed, more or less lobed. | |
| L. linear to oblong or oblong ovate. Peduncles very short | 5. <i>hirsuta</i> . |
| L. linear, white beneath. Peduncles slender | var. <i>helicterifolia</i> . |
| d. Trees or large shrubs. L. lanceolate or narrow elliptic. Fr. didymous or 4-lobed. | |
| L. 1.5—4". Sepals .2—3" long | 6. <i>multiflora</i> . |
| L. 3—9". Sepals .5—6" long | 7. <i>disperma</i> . |

* The nectary may be present or absent in one and the same species, though apparently it is constantly present in some. Its presence or absence is usually correlated with the length of the gonophore, the latter being very short or absent when the nectary is absent.

B. Fls. bright yellow, always axillary. Gonophore present or absent, pubescent or tomentose above.

1. Trees.

a. L. ovate or oblong, very oblique or auricled, or cordate at base, glabrescent. Petioles over .5" long, slender. Stipules mostly falcate and auricled. Fr. didymous

8. *tiliæfolia*.

b. L. ovate or oblong, rarely orbicular, oblique or sub-regular at base, persistently tomentose or hoary beneath, or if green, then petioles short, stout and tomentose. Fr. not didymous.

Bark dark, rough. L. grey-green when adult.

Petals 2—2.5"

9. *rotundifolia*.

Bark light, smooth. L. white, tomentose beneath.

Petals under .2"

10. *elastica*.

L. green beneath

var. *vestita*.

c. L. very broadly ovate or suborbicular, green beneath. Petioles stout. Peduncles long. Fr. purple, .3—5" diam.

11. *Hainesiana*.

2. Shrubs. Peduncles slender in all.

L. orbicular, cuspidate, white beneath, not cuncate

12. *asiatica*.

L. rounded at tip, mostly with cuneate base, green, rarely hoary beneath

13. *supida*.

L. lanceolate, always white beneath

14. *Rothii*.

1. *G. rhannifolia*, Heyne. Syn. *G. orientalis*, F. B. I.

A large climbing shrub with leaves mostly 2.5—4", pale green, ovate-lanceolate, acuminate, serrulate or crenulate, nearly glabrous. Flowers large with sepals 7—8" long, white or yellowish in terminal and leaf-opposed, few-flowered umbels. Drupe .5—6" diam., depressed, globose, faintly 2—4-lobed, hairy and yellow-tomentose.

Puri, in rocky forests! Fl. May—June. Fr. Sept.—Dec.

L. attain 5 by 2.2", few stellate hairs beneath, base rounded or obtuse, 3-nerved, but sometimes with two small additional nerves, secondary nerves above basal 3—5. Petiole .2", densely stellate. Peduncles .25—4", bracts linear, .3". Buds ovoid, strongly ribbed, tomentose and hirsute. Petals .17". Gonophore short, top 5-ridged. Style very stout, and stigma 4-lobed. Stones of fruit several-seeded. Pedicels in fruit stout, .5—7" long.

2. *G. aspera*, Roxb. Syn. *G. abutilifolia*, *Indian Trees*, F. B. I. (?); *G. sclerophylla*, F. C. N.

A coarse bushy shrub, about 4 ft. high, rarely with long sarmentose branches, twigs densely stellate. Leaves large, roundish or broadly elliptic, often somewhat 3—4-lobed, serrate or denticulate, closely stellate-pubescent, especially beneath. Flowers .5—7" diam., white in *subsessile* axillary umbels. Petals .08—1" long. Fruit globose, .75—1" diam., with 2—4 rugose pyrenes.

Chota Nagpur, occasional: Singbhum, on wooded slopes! Manbhum, *Camp.* (under *G. villosa*)! Orissa: Khurda! Kuhuri Forest!

Fls. April—Aug. Fr. Sept.—Feb. More or less evergreen. Young l. appear with the fls., or somewhat before.

Innovations very tomentose. L. about 3" at time of flowering, attaining 4—8", stellately scabrid above, base rounded with three strong and two weaker principal nerves, tertiaries strong, scalariform. Petioles .5—1", often slender. Pedicels .1—1.5". Fl. buds short ovoid, .2", densely stellate tomentose. Peduncles .25" or less. Sepals yellowish with age, .3"—4". Petals with large gland, entire or

notched. Gonophore long with hirsute tufts above. Ovary densely hirsute. Stigma stellately 4—5-lobed, the lobes deciduous, leaving it capitate.

N.B.—The old, dry fruit remains long on the branches. It is much shrunk in herbarium specimens, and usually described as only 3—5" diam.

3. *G. sclerophylla*, Roxb. Syn. *G. scabrophylla*, Roxb.; Dapher, *Th.*; Phalsa, Beng.

A shrub or undershrub usually sending up many erect, strict, villosely-tomentose branches 3 $\frac{1}{2}$ high, from a perennial woody stock with large elliptic, ovate or obovate leaves, 4—9" long, densely stellately tomentose or villous beneath and with very thick stout petioles. Flowers large, white, 2—3, umbelled on short peduncles. Fruit globose, 7—9" diam., purple globose, ultimately with crustaceous rind, hairy.

Common in high grass lands, especially those fit for Sal, along the foot of the hills, Champaran! Fls. April—June. Fr. Oct.—Nov. Shoots, where I have seen it, annually burnt.

Much more softly and persistently hairy than in *G. aspera*, and habit different. L. with three very strong and usually two less strong basal nerves, venation much as in *aspera*, margin with small sub-glandular and hairy unequal teeth, upper surface rugulose, more or less glabrescent, hairs less stellate and scabrid than in *aspera*. Petiole 3—7", mostly with some large glands at the top. Peduncles 3—5". Sepals 5—7", tomentose. Petals about half as long, obovate. Gonophore short or long, densely hirsute above. Stigma with four large lamelliform lobes. Hairs on fruit, though stellate, have the branches parallel, not radially spreading. The fruit is eaten. It is said to be cooling.

4. *G. flavescens*, Juss. Syn. *G. pilosa*, Lamk. (*F. B. I.*, etc.).*

A large straggling shrub or sub-scandent, with sharply 3—4-angled stems. Branches, leaves and inflorescence hirsute, with stellate hairs, not villous. Leaves oblong or sometimes broader upwards, but suddenly narrowed at the tip or more rarely acuminate. Flower buds oblong, mostly constricted in the middle, 3—5" long before opening. Stigmas 4, linear, spreading. Fruit closely covered with very short stellate hairs.

A rare plant in our area. Hazaribagh, Pachamba, Camp.† Parasnath, Anderson.‡ Ranchi, Wood. Fls. July—Oct. Fr. Dec.—Jan.

Easily distinguishable in flower, similar to some states of *hirsuta* in leaf, from which, however, it may be distinguished by the habit, the stiff not softly villous hairs on the branches and fruit, which break off with age, leaving a stellate base, also by the remarkable short medianly-constricted, terminally, dilated and cup-shaped gonophore, which is recognisable in fruit and after this has fallen.

L. 2" by 1" to 4" by 1.5", with rounded or subcordate base, often doubly serrulate. Secondary nerves 4—5. Petiole .12". Peduncles few, .25". Sepals .5—7". Petals more than half as long, bifid. Anthers with a few long hairs. Ovary hirsute.

5. *G. hirsuta*, Vanb., inc. *G. helicterifolia*, Wall. Syn. *G. polygama*,‡

* *G. pilosa* is sometimes called a small tree. Our plant is never arboreous. A specimen in *Cal. Herb.* in bud called *G. pilosa* is *Guazuma tomentosa*.

† The plant from Parasnath included under *G. flavescens* at Kew is not this in my opinion, but rather one of the numerous forms of *G. hirsuta*.

‡ *G. polygama*, Roxb., is not the narrow-leaved shrub described under that name in the *F. B. I.*, and by others. Roxburgh's original drawing shows broadly lanceolate leaves and short peduncles. Nor can I follow the new determination of *G. polygama* in the *Flosa of Madras*, as in my very complete series of these

F. B. I., etc.; *G. pilosa*, *Roxb.*; *Gursukri*, *H.*, *Kharw.*; *Kukur bicha*, *H.*; *Seta kata*, *seta andir*, *seta beli*, *S.*, *K.*; *Sonaranga*, *Or.*

A shrub, usually 1·5—3 ft. high, with many stems from the root, tomentose or stellately villous all over, with leaves varying from linear to ovate-lanceolate or broadly oblong, serrulate, very shortly petioled, usually acuminate, stellate tomentose beneath and also closely stellate above when young. Flowers polygamous or diœcious, buds ovoid, under ·25". Flowers depressed, more or less lobed, ·25—·4" diam., yellow, pilose, with long deciduous hairs or (var. *helicterifolia* sometimes) nearly glabrous.

Throughout the whole province, chiefly in open forest, common. Fls. July—Sept. Fr. Nov.—Jan.

Very variable. The following forms occur:

a. *G. hirsuta* proper (*G. hirsuta*, *Roxb.*, and perhaps *G. pilosa*, *Roxb.*). L. lanceolate to ovate lanceolate, hoary or pale velvety and densely clothed with stellate and pilose-stellate hairs beneath; hairs deciduous above leaving a simple base (*cp. flavescens*). Peduncles few or clustered, equal to petiole. Pedicels as long. Fls. opening white, turning yellow, and finally brown.

Sepals ·25" to nearly ·3". Petals ·1—·14", oblong entire, blade not much longer than the gland. Male gonophore cylindrical, but slightly expanded into a sinuous cornice, the top of which is densely pilose. Stamens 45 or more, much longer than the hairs. Herm. fls., gonophore without a cornice, and hairs exceeding the stamens. Ovary hirsute. Fr. deeply 2-lobed, and each half slightly lobed. In fruit the hairs of the gonophore spread beneath it. Common.

β. *polygama*. L. large and rather membranous, often 4·5—5" by 1·6", green beneath, with 3—4-nerved base. Peduncles very short. Fr. scarcely lobed. A very distinct form. Palamau! Hazaribagh!

γ. *helicterifolia*, *Wall.* Syn. *G. angustifolia*, *Wall.*; *G. polygama*, *F. B. I.*, not *Roxb.*

Stems very slender, L. very narrow, white, with a very fine tomentum between the raised nerves beneath, 2·5—4" long, under ·75" broad. Peduncles 1—4, slender, attaining 1·2", but usually shorter. Male stamens about 30 only. Stamens in herm. fls. slightly exceeding the hairs. Fr. sometimes green and shining when young, smaller and without hairs, or with very short, delicate, stellate hairs, but at other times more as in type, usually subequally faintly 4-lobed above.

Ramnagar hills of N. Champaran (typical *helicterifolia*)! Scrub jungles in the west of Palamau (slightly more hirsute)! Many other forms may be found; even broad-leaved ones with long peduncles were collected by me in the Central Provinces.

The fruit of all varieties is pleasant eating, with a yellow or brown crustaceous rind when ripe. It is given in diarrhœa and dysentery. A decoction of the leaves is also said to be used.

6. *G. multiflora*, *Juss.* Syn. *G. sepiaria*, *Roxb.*; *Pansaura*, *H.*

A shrub or sometimes a tree with slender twigs, sparsely scabridly pubescent with forked hairs, broadly or narrowly lanceolate or oblanceolate pale green leaves, usually 1·5—4" long by ·5—1·3" broad, and white flowers ·5—·7" diam., succeeded by didymous fruits, each lobe ·2—·25" diam., again slightly 2-lobed, black when ripe. Peduncle slender. ·3—·9", solitary.

forms 3-nerved leaves are often on the same plant as slightly-lobed fruits and 4-nerved leaves with deeply-lobed fruits. Both breadth with its correlated number of basal nerves and depth of lobing of the fruit are very variable characters.

Northern tract, Northern Purneah common, as a shrub or a tree! Mals of Puri, as a shrub, sometimes sub-gregarious! Fls. June—Sept. Fr. Oct.—Jan. Evergreen, renews leaves April—May.

Attain 3 ft. girth. Hairs on twigs and peduncles somewhat scale-like. L. glabrous or somewhat stellate-hispid on the nerves, often with quite small ones (under 1") below the ordinary leaves, sometimes obovate acuminate, serrulate, base 3-nerved, secondary nerves 3—5, tertiaries sub-parallel. Petiole hispidly hairy, .2". Stipules filiform, .15—2". Pedicels 2—6, .2—4", thickened upwards. Buds obovoid, strigosely tomentose. Sepals .2—3". Petals 1" oblong, the blade about as long as the gland. Gonophore densely pubescent at top. Stigma peltate with several narrow lobes.

Roxburgh states that it forms good hedges.

7. *G. disperma*, Rottl. Syn. *G. lævigata*, Vahl.; Gara Bursu, K.; Marang jowar, S.; Patat, Th.

A small tree with shortly pubescent slender branchlets, narrow leaves, green and somewhat glaucous beneath, usually 3—6" by 1.25—2", and white flowers 1—1.5" diam., succeeded by didymous or 4-lobed green fruits, drupels .25—27" diam.

Widely distributed. Champaran! Chota Nagpur and Santal Parganas, common along streams and nalabs! Sambalpur, in similar places! Angul! Puri, common! Mayurbhanj, common to 3000 ft.!

Fls. June—Oct. Fr. Dec.—Feb. Evergreen.

Bark grey, smooth, with slight horizontal stipular ridges. Blaze soft, thick, white, with streaks of light brown.

L. narrow-elliptic or oblong-lanceolate, acuminate, serrulate, attaining in moist localities 9" by 3", slightly stellate beneath, base acute, 3-nerved. Secondary nerves 3—5, oblique, cross nervules distinct. Petioles .25—3". Peduncles .75—1". Pedicels .5—75". Buds .5" long or more. Sepals 3-nerved, .5—6". Petals less than one fourth as long, orbicular or quadrate, glandular, with very small blade.

The wood does not appear to be used.

8. *G. tiliaefolia*, Vahl. Syn. *G. asiatica*, var. *tiliaefolia*, Brandis; Jang Olat, S.; Dhaman, Ahsing, Gonyer, K.; Dhaman, H., Kharw.; Dhaman, Dhamuro, Bhangia, Or.; Kultho (*Muyurbhanj*); Aintu Baranda, Gond.

A tree, usually small, with very broadly ovate to obovate, *unequal* sided, obtuse or shortly cuspidate, usually crenate glabrescent leaves with the base usually auricled on one side, *slender* petioles up to 1" long, usually thickened at the top, mostly *falcate* stipules, and peduncles usually much shorter than the petioles. Gonophore long, short or 0. Fruit didymous (one lobe sometimes failing).

General throughout the province in forest areas, attaining its best development in valleys and lower slopes of the southern hills. Fls. April—June. Fr. Sept.—Oct. Deciduous April—May.

Bark nearly smooth, sometimes with faint rings. Blaze fibrous, pink or red, with fine alternating zones of crimson and white. Attains 4½ ft. girth in the Angul forests, usually smaller. It is rather variable.

a. tiliaefolia proper. Leaves large, 6" or more long and nearly glabrous at the time of flowering, mostly auricled on one side, crenate, 5—7-nerved and very distinct sub-parallel cross nervules. Petiole .5—1", very young only tomentose. Stipules semi-cordate at base. Peduncles .25—3", usually crowded and much shorter than the petioles. Buds shortly ellipsoid to oblong, somewhat tomentose, ribbed. Sepals under .25".

This is the common form. Champaran to Orissa!

β. L. only half-developed at the time of flowering, nearly glabrous, oblong to ovate, with sometimes sub-regular base, but very falcate or semi-cordate stipules. Fls. larger. Sepals over .25". Buds oblong, tomentose. Peduncles shorter, or in some plants as long as their .5—7" petioles.

Singbhum! Palamau! Ascends to Neterhat, 3000 ft.

May be a hybrid with *G. vestita*.

γ. L. only half-developed, not over 3.5" at time of flowering. Stipules only falcate while young. Buds globose and tomentose or sometimes ellipsoid just before expanding. Sepals over .25".

Palamau.

δ. L. very membranous, oblong to ovate with sub-regular or oblique base, half developed only at the time of flowering. Stipules linear or falcate. Peduncles few or many, slender and often as long as petiole, .2—5". Buds oblong. Linear bracteoles sub-persistent (they are caducous in other forms) or caducous.

Santal Parganas! Kalahandi!

G. tiliifolia is the "Dhaman" *par excellence*, though other species sometimes are called this. It is the best wood for *banghies* and other purposes where strength and elasticity are required.

9. *G. rotundifolia*, Juss. Syn. *G. orbiculata*, *F. B. I.*; *Mirga Chara* (Deer's Food), *Or.*; *Kala Dhaman*, *H.*

A small, usually crooked tree, with broadly ovate, broadly elliptic or orbicular denticulate or occasionally coarsely toothed leaves, easily recognised by the persistent tomentum or pubescence beneath, which gives the tree a grey-green colour. Flowers very numerous, tomentose, umbelled on slender peduncles which considerably exceed the young .2—3" petioles.

Local in open jungles. Frequent on the sandstones and conglomerates of the Durgapur forest, Angul! Fls. April—May with the new L. Old L. fall in March.

Bark of old trees cracked, dark grey. Blaze deep crimson with some lighter streaks. L. young, often subequal at base, old usually oblique. Principal nerves 5—7, secondary few, tertiaries numerous, close, strong scalariform. Petioles .3", often thickened upwards. Peduncles fascicled, usually twice as long. Fl. buds large, woolly, globose, or broadly ellipsoid. Fls. deep yellow, .5" diam. Sepals .25", linear. Petals .16". Gonophore very short. Drupe grey-tomentose, slightly 2-lobed.

10. *G. elastica*, Royle. Inc. *G. cinnamomea*, *Gamble*; Syn. *G. vestita*, *Wall.*; *G. asiatica*, *Brandis* (in part); *G. celtidifolia* (*List of trees of S.C., C.P., Drummond in Journal of Botany, 1911**); *Boror*, *Gonyer, K.*; *Nanha Olat*, *S.*; *Pharsa, Th.*; *Mirgi Chara, Or.*

A tree with very tomentose shoots, usually oblong but also ovate or elliptic, acuminate, serrate or serrulate, 5—7-nerved leaves, tomentose when young and often persistently white or tomentose beneath when old, with oblique but not cordate base. Petioles short (usually under .5" even in large leaves), stout, uniform or gradually thickened upwards. Stipules linear to setaceous, more rarely tapering. Peduncles few to many, usually stout, tomentose and divaricate, but sometimes slender in var. δ. Bracteoles narrowly linear or setaceous, more persistent

* I have now examined the Malayan material of *Grewia* in the Calcutta Herbarium and compared Jussieu's description of *G. celtidifolia* in *Ann. Mus. Nat.*, 1804, and do not think there is sufficient evidence of *Grewia elastica* being the same species.

than in last. Buds subglobose to oblong. Gonophore present or absent. Fruit globose, not didymous, under $\cdot 25''$ diam.

Throughout the province, more abundant at high elevations! Fls. April—May. Fr. Oct.—Jan. Deciduous, the new leaves appearing on the same shoots with the fls.

Attains 5 ft. girth, but is commonly only seen up to 3 ft. girth. Bark nearly smooth, grey, thick, very white in young trees. Blaze in red-brown laminations with white streaks. The layers are very close, but distinct and uniform, and the ends of the fibres and the pores in the bast in alternate layers very distinct with a lens. In young trees the blaze is soft and white. Twigs with usually red or reddish-brown bark.

Sub.-sp. 1. **elastica** proper. Royle's typical form with lobed ovate leaves, very tomentose, on some shoots attaining $11''$, is found chiefly in the North-West Himalayas.

Forma α (*G. elatostemodius* Bot. & Hemsley?). Bammasuri, Th. Branches often drooping. Shoots when young with shaggy white or (*forma cinnamomea*) rufous tomentum. L. $3-5''$, obliquely broadly ovate, acuminate or acute, persistently white beneath when old, serrulate. Stipules broadly linear or subulate. Petioles $\cdot 3''$. Peduncles $\cdot 3-75''$. Bracts linear or subulate. Buds large globose to cylindrical, very tomentose. Sepals tomentose without, about $3-6''$. Petals oblong, $\cdot 12-15''$. Ovary villous. Stigma capitate with much lobed or fimbriate margin, or deeply 2-fid with lamellate branches. Fr. $\cdot 25''$.

Ramnagar Hills, common! Chota Nagpur, especially on Parasnath and the higher hills! Also in the lower hills! Mayurbhanj! Angul (rare)!

Forma β . Less tomentose. L. becoming quite green beneath, but permanently stellately puberulous, attaining 6.5 by $3.5''$. Singbhum!

Sub.-sp. 2. **vestita**, Wall (sp.).

Forma γ . Wallich's type. Densely brown-villous on twigs and peduncles. Peduncles very short and pedicels equalling or exceeding them. Leaves oblong-acuminate, stellately villous beneath. Sepals $\cdot 22-29''$. Petals linear-oblong, $1''$. Found in Sikkim and Nepal, Himalayas, but scarcely enters our province, except perhaps on the Purneah border.

Forma δ . Less densely tomentose or villous than *elastica*. L. oblong or narrowly ovate, $3-6''$, scarcely or very finely tomentose, ultimately green or hoary beneath, finely acuminate. Stipules as long as petiole, linear to setaceous, but sometimes with sub-auricled base. Peduncle slender, $\cdot 3-75''$. Pedicels shorter than peduncles. Buds oblong or clavate before opening. Bracts setaceous. Sepals $\cdot 3-4''$. Petals linear or linear-oblong, $\cdot 12-2''$.

Gaya Ghats! Singbhum, frequent! Baud (called Baranga)!

The wood is much valued, but is not as good as that of *G. tiliifolia*.

11. **G. Hainesiana**, *Hole. Ind. For.*, xliii, 316. Syn. *G. asiatica*, *Roxb. non Linn.*; Phalsa, *H.*; Pat-dhaman, *Kharw.*; Olat, *S.*

A tree, usually small, but (in our area) not at all shrubby, with tomentose shoots, very broadly ovate or sub-orbicular, obtuse or shortly cuspidate leaves, $4-7''$ by $3-6''$, with regular or usually oblique, very rarely cordate 5-7-nerved base, sharply (often doubly) serrate leaves, tomentose when young, but green both sides when mature. Petioles stout, uniform or clavate, $\cdot 3-75''$. Peduncles several up to $\cdot 8''$, usually exceeding the petiole. Flowers large. Gonophore long. Fruit purple, globose, $\cdot 3-5''$ diam., pyrenes 1-2, 1-2-celled.

Often cultivated in our area for its fruit. Ranchi! Palamau! Manbhum! Purneah! Muzafferpur!

Fls. April—May. Fr. June—July.

B.O.—7

Bark smooth, thick. Blaze thin brown, often with chlorophyll, thin, pale yellow, or in older trees light pink streaked white, the harder and softer bast tissues distinctly zoned. L. sometimes slightly lobed, often somewhat pubescent beneath when mature, but green. Buds up to .25", ribbed. Sepals .3—4" long. Petals oblong, half as long, emarginate or 2-fid. Stigma 4-lobed.

The Fr. is eaten and a sherbert is prepared from it. Kanjilal states that the sweet-makers of Saharanpur use the mucilaginous bark to clarify sugar.

12. *G. asiatica*, L. (not of Roxb.). Phalsa, H.

A shrub with tomentose shoots, sub-orbicular, cuspidate, sharply and often coarsely doubly serrate leaves, 3—4" long, permanently white beneath with regular or oblique or cordate 5—7-nerved base. Petioles .25—5", often slender and clavate. Peduncles usually many, long and slender, far exceeding the petioles and often 3—4 times as long, sometimes over 1". Flowers large. Gonophore long. Fruit red (to purple?), globose, .25—3" diam., pyrenes 1—2, always 1-celled only.

Cultivated only, and very rare in our area in the gardens of Indians. Rairakholl

Stipules linear, subulate or lanceolate, variable as in the last. Fl. buds broadly cylindrical or clavate. Sepals .45" long, stellately pubescent or tomentose (as in last). Petals oblong, .25", jagged or entire, not bifid, gland with a wide fleshy margin, pubescent towards the edges. Stigma with 4 short, rounded lobes, style much thickened above.

The acid fruit is eaten.

13. *G. sapida*, Roxb. Syn. *G. Campbellii*, Watt (in descriptive catalogue); Barsa pakor, S.

An undershrub with more or less perennial shoots (if not burnt), from a woody rootstock, with broadly oblong to sub-orbicular and obovate rounded or obtuse serrate leaves, usually with cuneate 5-nerved base, very short petioles .1—25", lanceolate or subulate stipules, and very long slender peduncles .5—1.25". Fls. large, drupe globose, sometimes somewhat lobed, with 1—3, 1-seeded pyrenes.

On the hills and plateaux, especially on fire lines and other grassy places annually burnt, in all districts of Chota Nagpur! Northern area, in grass lands towards the northern boundary, Champaran! Purneah! Fls., Fr. April—June.

L. attain 4", usually harsh and hispidly stellate both sides or glabrous (var. *Campbellii*) and usually green, sometimes pale beneath, often irregular and somewhat lobed but with a rounded or truncate, very rarely acute apex. Peduncles hispid, 3-flowered. Pedicels .25—5". Buds large, clavate, .25" or more before opening. Sepals .3". Petals .17", usually 2-fid. Drupes .25", stellately hairy.

The Fr. is eaten.

14. *G. Rothii*, DC. Syn. *G. excelsa*, F. B. I. non Vahl; *G. salvifolia*, Roxb. non Heyne; Bursu, K.; Phulari, Miri Chara, Or.; Bansuli, Gondi.

A pretty shrub, rarely a small tree, with hoary branchlets, oblong- or ovate-lanceolate or lanceolate, acuminate, serrulate or crenulate, 3(—5)-nerved leaves always beautifully white beneath and short petioles rarely over .25". Stipules broadly linear to linear-subulate, equalling or exceeding the petiole. Peduncles 1—6, very slender, .5—1" long, with 3 very slender pedicels, clavate beneath the flower and linear bracts .17" long. Fruit about .25", sub-persistently hoary, rarely lobed, finally purple.

Not noted from the Northern area. Common in the forests throughout the Central area, especially in the hills! Also found in all districts of the Southern area! Fls. April—Sept. Fr. June—Oct. Evergreen.

Twigs often purple. L. usually 2—3", but attaining 4—5" by 1.5", acuminate, rarely only acute. Sepals .3", linear or linear oblong. Petals about .12", entire oblong.

Bursu is one of the woods used by the Kols in producing fire (from its dry sticks). The flowers are often borne in great profusion and it is well worth a place in the garden. The bark gives a fibre used for tying.

6. ELÆOCARPUS, L.

Trees with simple leaves and flowers in axillary racemes. Petals usually lacinate. Stamens usually indefinite, inserted on the inside of the swollen annular torus, usually in groups opposite to the petals and alternating with the glands of the torus; anthers linear, opening by a pore. Ovary 2—5-celled, cells 2—many-ovuled. Fruit drupaceous, which is 5—3 or 1-celled, with 1 pendulous seed in each cell, albumen fleshy, cotyledons flat.

A. L. 3—5".

Petiole .5—75". Fr. globose, 4—5-celled

Petiole .75—1.8". Fr. ellipsoid, 3-celled

1. *ganitrus*.

2. *serratus*.

B. L. 5—8".

Petiole 1—2.5", blade 7—12", glabrous, exc. nerves

Petiole .7—2", blade 5—8", pubescent

3. *robustus*.

4. *Wallichii*.

1. *E. ganitrus*, Roxb. Rudrak, H.

A moderate-sized tree, with elliptic-lanceolate or oblong, very shallowly serrate, nearly glabrous leaves, 3—6" long, secondary nerves 10—15. Petiole .5—75", not at all geniculate, pubescent. Flowers white, .5" diam, in rather dense racemes 2—3" long, mostly from old leaf axils, buds narrow, shortly beaked, sparsely silky, sepals .22—3" long, petals .3—4", fimbriate. Ovary 5—4-celled. Fruit globose, .75—1" diam., finally a fine deep blue or blue purple. Stone globose, with 4—5 vertical grooves and beautifully tubercled, 4—5-celled and -seeded.

Sometimes planted and possibly originally native in Purneah, as it occurs in Sikkim and Nepal! Fls. Aug.—Feb. Evergreen.

The stones are often seen strung into rosaries.

2. *E. serratus*, L. Var. *floribundus*. Syn. *E. floribundus*, Blume; Jalpai, Nep.

A moderate-sized tree with elliptic or elliptic-obovate, crenate-serrate, glabrous or nearly glabrous leaves, 3—5" long, with a petiole .75—1.8" long, slender, and with a thickening each end. Flowers white, in rather dense racemes, 2—4.5" long, mostly from old leaf axils, rhachis hairy, buds ellipsoid, silky, sepals .2"—.25", petals lacinate half way down, fimbriate. Stamens 20—30, bearded or not at apex. Ovary 3-celled. Fruit ellipsoid, green, smooth, stone 3-grooved, nearly smooth.

Planted in Purneah as well as native! Buchanan Hamilton recorded it as common there. Ranchi. Wood (no doubt planted).

Fls. June—July. Fr. Dec.—Jan. Evergreen.

Bark quite smooth, blaze blood red, then lighter red. The leaves (like many other species of this genus) turn red before falling.

3. *E. robustus*, Roxb. Syn. *E. lucidus*, Roxb.?; Nard Champa, Panasia, Patragundi, Or.

A moderate-sized or large tree, 6 ft. girth, with smooth pale bark, large oblong acuminate, shallowly crenate or crenate-serrate leaves, 7—12", and numerous lax lateral racemes, mostly from below the leaves, some axillary. Flowers white, 4—5" diam. Drupe ellipsoid, 1"—1.5", yellow, 3-celled.

Along streams in evergreen forest. Mals of Puri, common! Bonai, Cooper! Mayurbhanj, Meghasani, 3000 ft.

Fls. May—June. Fr. Sept.—Oct. Evergreen. Old leaves turn red before falling.

Blaze hard brown, then yellowish. Shoots tomentose. L. attain 4.5" in breadth, smaller ones sometimes ovate or lanceolate, base mostly obtuse or rounded with usually 1 or 2 secondary nerves close to base and 1—2 glands, glabrous except the nerves of young leaves. Secondary nerves 9—13 strong. Petiole 1—2.5", usually thickened both ends and sometimes with minute subulate glands at apex. Racemes 3—5", pubescent. Bracts small, linear, 2—5-gland-toothed, very caducous. Pedicels 2—3". Buds ovoid, 5-ribbed. Sepals lanceolate oblong, acute, .17", thinly tomentose. Petals .2", cuneate fimbriate, pubescent on margin. Stamens about 40—50. Anthers minutely 2-valved at the tip, minutely pubescent and usually bearded with 4—5 small bristles on one of the valves. Disc of 5 large tomentose lobes. Ovary tomentose. Drupe 1 (—3?)-seeded. Endocarp very hard, deeply rugose.

A common tree in the Duars and Chittagong. I doubt whether *E. lucidus*, Roxb., is distinct; both the characters on which the species is separated occur on some flowers and leaves and not on others of the same tree!

4. *E. Wallichii*, Kurz.

A large tree with tawny tomentosely-villose shoots, thick twigs and oblong or somewhat elliptical or obovate-oblong, rather distantly serrate leaves, 5—8" long, with the petiole .7—1.7" long, and slightly thickened both ends. Flowers and racemes very similar to those of *E. robustus*, but more tomentose.

Mayurbhanj, Meghasani, 3000 ft. Fls. April.

Distrib.: Burmah.

Bark nearly smooth. Blaze hard reddish brown, then yellowish. L. somewhat chartaceous, shortly acuminate, base rounded, serratures with deciduous points, beneath puberulous and densely pubescent on the nerves and young L., also tawny hairy on the nerves above; secondary nerves strong oblique, 10—12 each side. Stipules minute, caducous. Top of petiole with 2 or sometimes with 2 or more pairs of stipellæ-like glands. Racemes 4—7" at the scars of fallen leaves. Sepals oblong-lanceolate, tomentose, .15". Petals as long lacinate. Anthers minutely puberulous, mostly bearded with few short hairs. Fr. not seen.

Kurz says that the wood is red.

FAM. 29. EUPHORBIACEÆ.

Plants of very various habit, trees, shrubs or herbs, sometimes with thick fleshy branches, very rarely climbers, sap often milky, stellate hairs frequent, cystoliths rare, stinging hairs very rare. Leaves simple, alternate (see note), usually stipulate. Inflorescence very various. Flowers unisexual, monœcious or diœcious, regular, but sometimes reduced to single stamens or ovaries in composite, sometimes irregular, inflorescences resembling single flowers. Perianth often small or 0, usually calyciform, in some cases however, well developed and with differentiated calyx and corolla. Calyx inferior, valvate or imbricate, or open in bud or sepals in two series. Petals free, sometimes squamiform,

when larger, imbricate or sub-valvate. Perianth or petals sometimes different in the two sexes, or petals present in one sex and not in the other. Disc hypogynous, often annular, lobed, or of glands intrastaminal or alternating between the outer series of stamens in the male. Male flower with stamens isomerous with the sepals or petals or fewer or numerous, central in the flower or with a pistillode, anthers 2-locular, rarely 4-locular, variously affixed, longitudinally, obliquely or transversely dehiscent, or with an apical pore. Female flower with or usually without staminodes. Ovary mostly 3-celled, rarely 2—4-celled, very rarely 1— or 5—many-celled, style 0 or 1 with as many branches as the cells, and branches sometimes deeply 2—more fid, sometimes branched from the base, stigmas various. Ovules in each loculus, 1 or 2 collateral, anatropous pendulous from the inner angle, with ventral raphe and micropyle upwards and outwards, funicle or placenta very often dilated and pulvinate above the micropyle into an *obdurator* which sometimes covers a considerable part of the ovule. Fruit normally a 3-celled capsule becoming 3-coccos and falling away from a persistent columella (as in some Geraniales), sometimes, however, loculicidal or baccate or drupaceous, with as many cells or pyrenes or cocci as there are cells in the ovary or fewer. Seeds sometimes as many, sometimes fewer than the ovules, not rarely strophiolate (with a caruncle), albumen usually fleshy, copious, rarely thin or 0. Embryo central, straight or nearly so, with large, broad, flat foliaceous, often palmi-nerved cotyledons, very rarely fleshy or folded cotyledons, radicle superior, shortly exerted from, rarely included between, the bases of the cotyledons or elongate.

NOTE.—Compound or opposite L. are very rare, but, as in the Sterculiaceæ, palmately-nerved and palmate L. are common, and digitate L. therefore, as might be expected, sometimes occur (e.g. *Bischofia*, *Manihot*); true pinnate L. are never found, but the *pseudo-pinnate leaves* of many Phyllanthæ are very interesting, and may indicate a method by which one class of pinnate L. have been evolved. These are small, simple distichous leaves on branchlets of finite growth and which are deciduous as a whole; they strongly resemble the pinnate leaves of some of the Oxalidaceæ and are often stipulate, but some of them bear fls. In some of the cactus-like *Euphorbias* the L. are sometimes small and caducous; these may easily be distinguished from Cactaceæ by their milky juice, and the spines, if present, being paired (stipular). Opposite L. are found in *Euphorbia*, *Celonium*, and *Trewia*, but it is interesting to note that the seedlings of *Trewia* have alternate leaves!

The germination is epigeal in all cases examined by me, even where, as in *Jatropha*, the cotyledons are very thick and fleshy. The expanded cotyledons are usually broad and palmately-nerved, sometimes, as in *Bridelia*, retuse, and much resemble those of the Malvales.

KEY TO EUPHORBIACEÆ.

† Fls. distinct, i.e., not reduced to single stamens or a single ovary contained in an involucre. (Nos. 1—39.)

I. Cells of ovary 1-ovuled. Juice sometimes milky (2, 3, 19, 20). (Nos. 1—21.)

A. Petals present in one or both sexes, or if absent, calyx petalsloid.

1. Petals in both sexes, often showy. Stamens usually 10, central.

Fls. white, solitary and racemose

Fls. in 2—3-choromous cymes, green or red

1. *Dimorphocalyx*.

2. *Jatropha*.

2. Calyx petaloid, petals 0. Fls. large.
L. palmi-lobed, juice usually milky
3. Petals smaller than calyx, often 0 in female. Fls. racemed.
a. Anthers erect in bud.
Calyx valvate. Stellately pubescent herbs
Calyx imbricate or open. Glabrous shrubs
b. Anthers reversed in bud. Shrubs, often stellate
- B. Petals absent in both sexes. (Nos. 7—21.)
1. Calyx valvate in bud. (Nos. 7—15.)
a. Stamens many, or if few (some *Macaranga*) then L. peltate.
i. Stamens not branched. Trees with usually palmi-nerved leaves.
* Anther-cells oblong, 2-celled, cells oblong.
L. opposite. Styles long, linear. Fr. drupaceous
L. alternate. Styles fimbriate. Fr. 2—3-coccous
** Anthers mostly 4-celled, cells subglobose.
L. peltate. Styles simple. Fr. 1—3-coccous
L. not peltate, penninerved. Styles 2-fid
ii. Stamens central, connate, repeatedly branched.
* L. penninerved. Fls. spicate or female solitary.
L. sub-verticillate. Ovary scaly or tubercled
L. alternate, narrow. Ovary pubescent
** L. broad, palmi-lobed and-nerved. Fls. racemed
b. Stamens few (under 10). L. not peltate. Fls. in androgynous racemes. Anther-cells free above. Female fls. without large bracts, styles linear, simple
Female fls. in large bracts. Styles laciniate
2. Calyx imbricate.
a. Stamens 10 or more.
Small trees, L. punctulate. Fl.-clusters axillary
Shrubs, L.-base 2-glandular. Fl.-clusters racemed.
b. Stamens under 10.
Climbing herbs or undershrubs with pungent hairs
3. Male calyx open in bud. Stamens under 10. Fls. spiked or racemed.
a. Trees or shrubs with copious milky juice.
Calyx subentire or slightly toothed
Calyx 3—5-sepalous
b. Herbs. L. linear. Fr. muriccate
- II. Cells of ovary 2-ovuled. Juice very rarely milky. (Nos. 22—39.)
- A. Petals present, small. Calyx valvate. Filaments on a column.
Ovary 2-celled. Fr. baccate with 2 pyrenes
Ovary 3-celled. Fr. capsular
- B. Fls. apetalous. Calyx imbricate in bud. (Nos. 24—39.)
1. Fls. axillary, solitary, or mostly clustered. L. simple, entire, usually on short branchlets like the leaflets of a pinnate L. (*Phyllanthese* proper.)
a. Stamens 3—5. Styles distinct, usually 2-fid. Ovary cellis 3, rarely 4. Ovules collateral. Fls. with open mouth.
i. Dicciuous. Stamens 5, opposite the sepals, pistillode central.
Fr. baccate white, or small and of 3 2-valved cocci
3. *Manihot*.
4. *Chrozophora*.
Codiaeum (p. 108).
5. *Croton*.
7. *Trewia*.
8. *Mallotus*.
9. *Macaranga*.
10. *Cleidion*.
11. *Lasiococca*.
12. *Homonoia*.
13. *Ricinus*.
14. *Claoxylon*.
15. *Acalypha*.
16. *Gelontium*.
17. *Baliospermum*.
18. *Tragia*.
19. *Sapium*.
20. *Excoecaria*.
21. *Sebastiania*.
22. *Bridelia*.
23. *Cleistanthus*.
24. *Flueggea*.

- ii. Stamens 3—5, central. Fr. of 3 crustaceous, 2-valved cocci.
 * Fls. monoëcious. Herbs or undershrubs.
 Sepals 6. Stamens 3, connate. Styles very short. Fr. ovoid
 Sepals 5—6. Stamens 3. Capsule depressed, globose
 ** Trees. Fls. dicecious. Sepals 4. Stamens 4
 iii. Stamens 3—4, central, connate. Fr. a drupe, with 3—4-celled angled putamen. Trees.
 Leaflets narrow. Sepals 5—6. Stamens 3. Styles twice 2-fid
 Leaflets large. Sepals 4. Stamens 4. Styles 4
 b. Stamens 8—12, central. Styles 0, or combined into a column with minutely toothed tip. Ovary cells 5—15. Fls. with open mouth.
 Stamens 4—7, free or connate. Ovary 5—12-celled. Ovules superposed. Fr. baccate
 Stamens 3—12, connate. Ovary 3—15-celled. Ovules collateral. Fr. of 2-valved cocci sometimes with separable epicarp ..
 c. Stamens 3 in a central column. Male fls. turbinate or disciform, fleshy, with the mouth nearly closed. Styles flat, spreading, 2-lobed, or stigmas minute, sessile.
 Column terete, anthers contiguous
 Column 3-gonous, anthers discrete on the angles
 d. Stamens few or many, with large erect anthers. Styles with dilated stigmas. Fr. indehiscent.
 Stamens 2—4, central. Fr. a 1-celled drupe
 Stamens inserted round a vacant central area or pistillode. Fr. 2-celled, coriaceous
 2. Fls. in spikes or racemes, dicecious. L. simple. Stigmas short, broad, or subulate. Fr. not or tardily dehiscent.
 Fls. minute, bracts large. Stamens central. Fr. dry or fleshy
 Fls. minute, bracts small. Stamens round a pistillode. Fr. a compressed small drupe
 Fls. large. Stamens round a pistillode. Fr. dry, large
 3. Fls. panicled. L. 3-foliolate. Fr. baccate
25. *Agynceia*.
 26. *Phyllanthus*.
 27. *Prosorus*.
 28. *Embllica*.
 29. *Cicca*.
 30. *Kirganelia*.
 31. *Glochidion*.
 32. *Breynia*.
 33. *Sauropus*.
 34. *Putranjiva*.
 35. *Cyclostemon*.
 36. *Aporosa*.
 37. *Antidesma*.
 38. *Baccaurea*.
 39. *Bischofia*.

†† Fls. reduced to single-pedicelled stamens, enclosed in an involucre of more or less connate, sometimes coloured bracts, with or without a single female fl. without perianth, the whole resembling a single fl. Juice always milky. L. simple, alternate or opposite (Nos. 40—end.)

A. Involucres regular or subregular (with gland unilateral).

Glands on the involucre 1—5, discrete, inner bracts not connate

Glands on the involucre connate into a continuous ring. Inner bracts round group of male fls. more or less connate and forming a tube round the female

B. Involucre very obliquely zygomorphous, often coloured

40. *Euphorbia*.

41. *Synadenium*.

42. *Pedilanthus*.

1. DIMORPHOCALYX, *Thw.*

Glabrous trees with buds sometimes scaly, alternate, entire penninerved leaves and moderate-sized flowers in axillary, or terminal, few-flowered racemes or clusters or solitary, monœcious,* male and female different-looking. Male calyx cupular, or 5-partite or toothed, corolla well developed, campanulate (in our species), petals contorted in bud. Stamens 10—20, sometimes 2—3-seriate, the inner series with connate filaments, or all on a short columnar receptacle: anther-cells adnate to the thick connective, pistillode 0. Female flower rotate, sepals 5, enlarging in fruit, ovary 3-celled, styles erect 2-fid, ovules 1 in each cell. Capsule of 3 2-valved crustaceous cocci.

1. *D. glabellus*, *Thwaites*. (Perhaps not distinct from *D. Lawianus*, *Hook. f.*).

A small tree with dark green elliptic, ovate or (some) obovate shortly acuminate leaves, 2·5—5·5", pale beneath, and with about 8 slender, scarcely raised secondary nerves, little stronger than the intermediate and reticulations. Male flower solitary or clustered, on short, lateral scaly shoots from the old wood; female much larger, solitary on the new shoots. Males white, .35—4" long, with a spreading corolla, .5" diam., petals .5" long, oblong, nearly free, obtuse. Stamens 10—12, outer series free, or connate to column, with longer free filaments than the inner series on top of column. Female .7—8" diam., with 5 spreading, obovate, rounded or retuse sepals. Petals free, .4—5" by .2", broadly oblong. Disc annular. Capsule .5" diam., globose, 3-lobed and 6-grooved, thinly strigose-hairy, seated on the large spreading calyx.

Ravines in Angull! Fla., Fr. March—April. Evergreen.

Bark smooth or on some branches with large ridges of cork, twigs white or reddish, short, new shoots with several brown, shining, ovate scales, quite glabrous. Petiole .25—4", stipules small, triangular or ovate. Male fls. with very short pedicels, calyx cupular or urceolate only .1" long, 5-toothed, nearly glabrous. Female fls. with peduncle, .8—1·5", solitary, terminal, sometimes bracteate. Petals overlapping to right in bud. Ovary pubescent. Fruiting sepals very unequal. .25—5" long, strongly nerved.

A very interesting genus, the staminal column sometimes with two whorls of stamens and terminating in 1—2 stamens; petals contorted in bud and well developed remind one much of the Malvales.

2. JATROPHA, *L.*

Herbs, shrubs or trees, often glandular, with alternate palmately-nerved, entire or palmately-lobed or -partite leaves. Stipules often ciliate. Flowers green or coloured in terminal cymes, monœcious, the central one in the cyme or its forks usually female. Sepals 5, imbricate. Petals 5, contorted, free or connate. Disc entire or of 5 glands. Stamens usually 10, filaments, or the interior ones only, connate, anthers erect with vertical dehiscence. Pistillode in male 0. Ovary 2—4-celled, styles connate below, 2-fid, sometimes again 2-lobed. Ovule 1 in each cell. Fruit of 2—4 2-valved cocci, endocarp crustaceous or bony. Seeds ovoid or oblong.

* Perhaps dicecious in some species but wrongly termed so in *D. glabellus*, the male and female inflorescences being on separate branches but the same tree.

- A. Fls. greenish-yellow, petals more or less cohering
 B. Fls. red, petals free or nearly so.
- | | |
|---|--|
| 1. L. palmately-lobed or partite, with 3-several basal nerves.
L. multi-fid, stipules eglandular .
L. lobed, gland-serrate, stipules glandular .
L. lobed, eglandular. Stems with swollen base | 1. <i>curcas</i> .
2. <i>multifida</i> .
3. <i>gossypifolia</i> .
4. <i>podagrica</i> .
5. <i>panduræfolia</i> . |
| 2. L. panduriform, sub-penninerved | |

1. J. curcas, L. Kulajara, K.; Totkabindi, M.; Bhernda, S.; Bagh-randi, H.; Baghbarinda, Beng.; The Physic-nut.

A shrub or small tree, 10–20 ft., with glabrous (exc. when very young), 3–5-angled or -lobed leaves, 4–6" diam., and small yellowish flowers with a campanulate 5-lobed corolla, in terminal cymose panicles. Capsule subglobose or ellipsoid, 1" long.

Very common in village hedges throughout the area. Native of America.

Fls. May–Oct. Deciduous in the c.s., when it is frequently conspicuous from the persistent capsules.

Branches thick with large leaf scars. L. broad, cordate, usually 5-angled. Petioles 4–5". Stipules 0 or very early caducous (?). Male fls. on short articulate pedicels, corolla somewhat hairy, stamens 10 with 5 inner connate. Female fls. usually in the forks of the cymes, pedicelled. Stigmas 2-fid.

Easily grown from seed or cuttings. The seeds yield by expression about 30 per cent. of a pale yellow oil, which in doses of 12–15 drops acts as a purgative equal in action to one ounce of castor oil and is poisonous in larger quantities. The ill effects are partially corrected by lime-juice. Externally it is used for skin diseases (*Indian Plants and Drugs*).

2. J. multifida, L. Coral Plant; Purging-nut.

A handsome garden shrub, easily recognised by its orbicular, long-petioled leaves, 3–5" diam., palmately cut into narrow caudate segments, capillary multifid stipules, and flat-topped cymes of coral-red flowers. Disc of female urceolate. Capsules sub-fleshy, large yellow, 3-lobed.

Common in Indian gardens. Fls., Fr. chiefly r.s.

3. J. gossypifolia, L. Bhernda, verenda, K., S., H.; Lal-bherenda, Beng.

A shrub, 3–6 ft., with palmately 3–5-lobed leaves, easily recognised by the stipitate, yellow viscid glands, which cover the leaf margins, petioles and stipules, and by the small red flowers in glandular corymbose cymes. Stamens 10–12.

Very common in waste ground and by road-sides. A native of Brazil, now naturalised. Deciduous c.s. Fls., Fr. r.s.

4. J. podagrica, Hook. Bot. Mag. t. 4376. Gouty-stemmed Jatropha.

A shrub with smooth stems suddenly swollen at the base, long stalked, glabrous, cordate, 5-lobed leaves with lobes rounded, glandular fimbriate stipules, and cymes of scarlet flowers.

Common in gardens. Fls. chiefly r.s. Native of Panama.

5. J. panduræfolia, Andr. Bot. Rep. t. 267. Syn. J. hastata, Jacq. Enum. Pl. Carib.*

A pretty, rather slenderly branched shrub, with fiddle-shaped L. which are penninerved except for the two slender lateral nerves at the base.

* *J. hastata*, Jacq., has priority, but the description is so meagre that it is not possible to be sure of the plant intended.

Fls. in long-peduncled corymbose cymes, few female and many male, 1" diam., vivid crimson. Calyx small, 5-lobed. Petals large, obovate. Stamens central in a double whorl of 5 short and 5 larger stamens, the inner whorl with more or less connate filaments.

Frequent in gardens. Native of Cuba. Fls. most of the year.

Other species occur in gardens.

3. MANIHOT, *Adans.*

Shrubs or weak trees, often with tuberous roots and milky juice, alternate, petioled, palmately nerved, simple or lobed or palmipartite leaves. Flowers large, monoecious, in simple rarely compound racemes, males usually above and females below. Calyx often petaloid, campanulate or urceolate, 5-lobed or 5-fid, petals 0, stamens 10 in two whorls; filaments free, inserted between the lobes or glands of the disc; pistillode 0 or 3-lobed, disc in female hypogynous, ovary 3-celled, styles shortly connate at the base, spreading, dilated or lobed at the tips, cells 1-ovuled. Capsule of three 2-valved cocci.

L. peltate, mostly 3-partite. Small tree

1. *Glaziovii*.

L. not peltate, mostly 7-partite. Shrub

2. *utilissima*.

1. *M. Glaziovii*, *Müll.-Arg.* Ceara or Manicoba Rubber.

A small tree, about 30 ft. high, with a rounded head of greyish-green, long petioled, peltately attached leaves, varying from simple lanceolate to 3-7-palmipartite on the same tree, 6-10" broad. Flowers in branched racemes, solitary in the axils of small bracts. Capsules subglobose.

Occasionally planted. The tree is said to flourish in dry rocky soils at elevations of about 4000 ft. and might succeed at Neterhat. It grows from cuttings or from seed, which have a hard testa and take a year to germinate.

Para rubber is derived from *Hevea brasiliensis*, another Euphorbiaceous tree.

2. *M. utilissima*, *Pohl.* Roti alu, *Vern.*; Cassava; Tapioca Plant.

A sub-herbaceous shrub, with large tuberous roots, somewhat like those of a dahlia, very nodose stems, about 5 to 9 ft. high, and *Simul*-like leaves with 3-7 narrow segments. Flower not seen in our area.

Occasionally cultivated. The tubers sometimes attain very large size and have milky juice. They are eaten like yams. Their starch constitutes *Tapioca*, which is a granulated form imported chiefly from Brazil.

4. CHROZOPHORA, *Neck.*

Coarse herbs, less often undershrubs, clothed with stellate tomentum, very rarely nearly glabrous. Leaves usually undulately toothed, plicate, rugose or bullate or nearly flat, often with two glands at apex of petiole beneath. Flowers monoecious dichlamydeous, in short dense racemes in the upper axils, solitary in the bracts. Males above, sub-sessile. Females below, pedicelled, fewer. Calyx of male closed in bud, ultimately valvately 5-lobed, narrower in female. Petals 5, usually dirty yellow, externally lepidote, narrow or occasionally obsolete in female. Stamens 5-15, filaments connate, at least below central; anther-cells parallel. Disc of 5 short rather prominent glands alternating with petals in female. Pistillode 0. Ovary 3-celled, with peltate scales or stellate hairs. Styles 3, 2-fid, arms usually red. Ovule 1 in each cell. Capsule

3-lobed, pericarp clothed with stellate hairs, or with flat, sometimes pectinate scales, usually tinctorial. Seeds without caruncle. Albumen fleshy. Cotyledons broad, flat.

Prostrate. L. eglandular at base, stellate hairs stipitate
Erect. L. 2-glandular at base, stellate hairs sessile

1. *prostrata*.
2. *Rottleri*.

1. **C. prostrata**, Dalz. (vide *Kew Bull.* ii, 1918). Syn. *C. plicata*, β *genuina*, Muell.

A prostrate annual with branches 4—8" long. Leaves .5—1", usually ovate with rounded tip, covered with more or less stipitate stellate hairs, base eglandular; radical rosulate, sub-persistent. Petals yellowish, stigma orange. Capsule when mature grey-black, scarcely tinctorial.

Moist places. Behar, Patna, Ham.; Naoranga, near R. Son., Jacq. (*teste Prain, loc. cit.*). Fls. Jan.—May.

2. **C. Rottleri**, A. Juss. Syn. *C. plicata*, F. B. I.; *Croton plicatum*, Roxb.

An erect annual, or sometimes perennial. Leaves all cauline 1.25—3", rarely 4", sometimes broader than long, usually orbicular, with 3 rounded lobes; margin usually undulate-crenate, rarely ovate or acute or subacute, with subentire margins, hairs rough, sessile stellate. Petiole long. Racemes long for the genus, 1—2", equalling or exceeding the uppermost leaves. Petals yellow. Stigma red. Capsule .3" diam., densely stellate-tomentose, red-purple when mature and very tinctorial.

Waste places, fields and roadsides. Common! Behar, Jacquemont, to Maldah, Vicary (*vide Prain, loc. cit.*). Chota Nagpur, common! Santal Parganas! Fls. Fr. most of the year. Probably occurs in all districts.

Cloth moistened with the juice of the green capsules soon becomes blue after exposure to the open air. Roxb. (under *Croton plicatum*).

5. CROTON, L.

Trees or shrubs, rarely herbs, often scaly or with stellate hairs, alternate, rarely opposite, leaves, 2-glandular at the base. Flowers usually greenish in terminal racemes, often clustered in the axils of the small bracts, monœcious, rarely diœcious. Calyx 4—6-partite, sepals imbricate or sub-valvate. Petals as many, sometimes shorter than the sepals. Disc glands as many opposite the sepals. Stamens usually many on a hairy and sometimes scaly receptacle, filaments free, inflexed in bud, anthers adnate. Pistillode 0. Female flower sepals usually broader than in male, rarely accrescent, petals smaller or 0. Disc annular or of glands. Ovary 3— (2—4-celled), styles long, 2—4-cleft, ovules 1 in each cell. Capsule 3-valved, or of 3 deciduous 2-valved cocci. Seeds smooth, caruncle small.

I. Small trees.

L. penninerved. Ovary lepidote
L. palmately nerved. Ovary stellately hispid

1. *oblongifolius*.
2. *tiglium*.

II. Large scandent shrub.

L. palmately nerved. Ovary stellately woolly

3. *caudatus*.

III. Undershrub or sub-herbaceous.

L. with 3 basal nerves. Ovary stellate-hairy

4. *sparsiflorus*.

The handsome garden shrubs commonly known as "Crotons" belong to the genus *Codixum*, Rumph., and mostly to the species *C. variegatum*, L. *Codixum* differs from *Croton* in that the stamens are erect in the bud and the style undivided, subulate. *C. variegatum* has an extraordinary variety of leaf forms. In some of these the lamina is discontinuous and in some the base of the second portion or upper portion cup-shaped. It is a native of the Pacific Islands.

1. *C. oblongifolius*, Roxb. Mahson, Th.; Kuti, Kuti-konyer, K.; Gote, S.; Bhain swan, Kharw.; Putol, Mal P.; Poter, Ur.; Maisonda (Koderma); Masundi, Or.; Putri, Beng.

A small tree, with rather large coriaceous, more or less serrate, or coarsely, obtusely or acutely, toothed or repand, oblong or narrowly elliptic, or elliptic leaves, 4—12" (on same plant) long, the larger with over 12 fine spreading secondary nerves, mature glabrous. Flowers .3" diam., dioecious or monoecious, in long racemes, 5—12", with lepidote or nearly glabrous rachis, furnished with linear or minute subulate bracts. Capsule .4—5" long, covered with flat scales, splitting into 2-valved cocci.

Champan, sometimes gregarious as undergrowth in Ramnagar! Purneah! Santal Parganas, sometimes gregarious! Gaya, common on the ghats! Throughout Chota Nagpur! Bonai, Cooper! Mayurbhanj! Sambalpur! Fls. Jan.—Feb. Fr. April. More or less deciduous at the time of flowering and fruiting. L. turn red before falling.

Bark smooth, blaze streaked pink and white. L. with long or short petiole, acuminate or acute to rounded at apex, usually narrowed below, but rounded or subcordate at top of the petiole, young lepidote. Racemes numerous from the uppermost axils with many linear or sub-foliaceous oblanceolate bracts at their base, male pedicels .25—3" long, fls. densely villous within, outside lepidote, sepals ovate or triangular, petals rather longer, thinner, oblong, obtuse, stamens about 12. Female racemes and pedicels shorter. Ovary lepidote with 3 long branched styles. Seed smooth, brown.

The plant is described by Roxburgh as monoecious, "a few females mixed with the males," but it is sometimes, at least, dioecious.

The bark and root are given as a purgative and also as an alternative in dysentery, Campbell.

2. *C. tiglium*, L. Jamalgot, H.; Jaipal, Beng.

A small tree with elliptic or ovate acuminate, shallowly serrate leaves, with 3—5 basal nerves and somewhat stellately hairy beneath. Clusters of smallish green flowers in terminal sub-glabrous racemes.

"Chota Nagpur," Wood, but doubtless only cultivated. It is said to be "frequently cultivated," but I have not seen it in our area, though well acquainted with it in its wild state in the lower Bhotan Himalaya. Fls. June (in Bhotan). Fr. Sept.—Nov. Evergreen.

L. 4—7", usually caudate and with cuneate base, young, densely stellately pubescent beneath, secondary nerves few, strong, tertiary reticulate. There are 2 large glands on the base of the leaf or above the petiole. Racemes 5—6.5", sulcate, nearly glabrous or thinly stellately hairy. Petals narrower than sepals, woolly. Stamens many. Female fls. .25—3" diam., petals linear-oblong, shorter than the sepals. Ovary densely stellately strigose. Styles long, deeply 2-fid. Fr. stellately hairy, ultimately woody, sub-3-lobed, .75" long and broad. Seeds .5", black, slightly compressed, ellipsoid, with 8 raised lines.

The source of Croton oil.

3. *C. caudatus*, Geisel.

A scrambling or climbing shrub with trunk attaining 2 ft. girth, twigs stellately tomentose or stellately hairy. Leaves ovate or orbicular

cordate, 2.5—5" diam., toothed or crenate-dentate with a stalked deciduous gland at some of the sinuses beneath; base 3-nerved and often with 1—2 weaker nerves. Flowers whitish on 2—3-nate pedicels .25—.3" long, in racemes often elongating to 15", monoecious, the lower 2—6 flowers being usually female. Capsule globose, .6—.7" diam., stellately mealy.

Not common, though it often forms a dense undergrowth in Eastern Bengal.

Puri, Draper! Hooper! Fls., Fr. May—July.

L. stellately hairy beneath and on nerves above, stellate hairs between nerves above deciduous leaving copious small raised dots, 2 large stalked glands on either side of petiole beneath, secondary nerves on mid-rib 4—6, tertiaries sub-parallel and strong. Male Fls. villous, with stamens .25" long, clustered on the rhachis, oblong petals nearly as long as sepals, woolly. Styles cleft almost to base into two linear arms.

Somewhat resembles *Mallotus repandus*.

4. *C. sparsiflorus*, Morung.

A small shrub 2—3 ft. high, with tough branches ribbed with stellate hairs, somewhat resembling *Rivina humilis*. Leaves lanceolate, wavy and toothed, 1—1.7", sparsely stellately hairy beneath, base 3-nerved. Racemes 2—3", elongate. Male flowers fascicled, .1" diam. in axils of minute bracts. Stamens 12—13. Petals linear-oblong, rather exceeding sepals. Female solitary, with large gland, petals 0, disc of red glands. Ovary densely covered with stellate hairs. Seed carunculate.

Very common near the Mahanadi, Cuttack! Balasore! A native of America, now naturalised, and is very common along the Hughli, near Calcutta. Fls., Fr. May—Sept. and perhaps all the year round.

The plant is somewhat aromatic.

7. TREWIA, L.

Trees with opposite (alternate in the seedling) ovate or orbicular, cordate, entire palm-nerved leaves. Flowers dioecious, apetalous. Males in drooping catkin-like racemes, calyx globose, sepals 3—4, broad concave, stamens many, central, free, anthers dorsifixed, oblong. Female flower larger, solitary, on a long peduncle, or racemose; sepals 3—5, broad, imbricate caducous. Ovary 2—5-celled, styles 2—5, connate below, very long, entire, papillose, or almost fimbriate, ovules 1 in each cell. Fruit drupaceous, with a 2—4—5-celled crustaceous endocarp (or in one species loculicidal). Seeds ovoid, testa hard.

1. *T. nudiflora*, L. Bilur, Th.; Gambhar, H. (from confusion with *Gmelina*); Gara Loa, K.; Gada Loping, S.; Pitalu, Panigambhar, Beng., Or.

A large tree, superficially much resembling *Gmelina arborea*. Leaves narrow-ovate to broadly ovate, 3—8" long, on the same twig, with rounded or usually cordate base, green, tomentose or pubescent, or glabrescent beneath, sometimes villosely stellate, with long petioles 1.5—4" long. Male racemes drooping, 4—8" long, with flowers usually in threes, on slender, bracteolate, articulate pedicels; sepals finally reflexed. Female flower solitary or 2—3 terminal, closely invested by the urceolate, 5-toothed calyx, which splits longitudinally; peduncle short, very

stout bracteate, attaining 2—3.5" in fruit. Drupe 1.2—1.5" diam., globose or ellipsoid, and looking like a small potato when ripe.

Throughout the whole area, but rare in the south-western districts, common in Purneah! Usually along river beds and always so in the drier districts. Fls. Jan.—March. Fr. ripens Oct.—Dec. Leafless Dec. or Jan.—Feb., the fls. usually appearing while the tree is bare.

Bark light grey, old flaking in thin patches. Thin raised stipular lines are visible on the branches and young stems, although the stipules are minute and caducous. These lines may help to distinguish the tree from the pubescent-leaved form of *Gmelina arborea*, the likeness to which in leaf is really remarkable in some specimens. The venation of the leaf, viz. 5—7 basal nerves, 4—6 strong secondary nerves and strong cross-nervules, are much as in *Gmelina*, but the L. lack the small yellow glands beneath, and on the contrary have usually two large glandular areas on the blade above either side of the top of the petiole.

The wood is soft, white, and not durable, but according to *Gamble* is a good one for purpose for which a soft wood is required. It is stated that it is used for drums, but possibly through confusion with *Gmelina*, which is one of the best woods for drums. The weight is given as 28—29 lb. only.

8. MALLOTUS, *Lour.*

Trees or shrubs with opposite or alternate entire toothed or lobed, usually palmately-nerved leaves, often covered with minute round glands beneath and sometimes with glandular areas near the base above; petiole sometimes inserted above the base, stipules often prominent. Fls. small, usually dioecious, apetalous; males clustered, and females solitary, in the bracts of simple or paniced spikes or racemes. Male calyx valvately 3—5-partite, stamens numerous, central, free; anthers dorsifixed, 2-celled; cells globose or shortly oblong, parallel, adnate to and often widely separated by the thickened connective. Female calyx spathaceous or valvately 3—6-lobed or -partite. Ovary 2—4-celled, styles free or connate at base, entire, plumose or papillose, ovules 1 in each cell. Capsule of 2—3 2-valved cocci.

Small tree. L. peltately fixed, 7—9-nerved

Small tree. L. basally fixed, 3-nerved

Large sarmentose or scandent shrub

1. *Roxburghianus*.

2. *philippinensis*.

3. *repandus*.

1. *M. Roxburghianus*, *Muell.* Barui, S.; Dopsinga, *Mal. P.*

A small tree, softly pubescent, with simple and stellate hairs all over, long-petioled, orbicular or broadly ovate, peltately-attached, sinuate, dentate, or denticulate leaves 4—7" diam. and terminal racemes as long as the leaves. Capsule densely echinate and glandular.

Santal Parganas, in ravines, rare! Fl. May—June. Fr. Aug.—Sept.

L. stellately hairy and with yellow glands both sides, densely so beneath, above sparsely but also with simple hairs, secondary nerves 4—5, tertiaries scalariform. Petiole 1.5—4". Stipules linear, .5". Male sepals 2—5.

2. *M. philippinensis*, *Muell.* Gara Sinduri, K.; Rora, S.; Rori, *Kharw.*; Kamala, *H.*; Daosindra, *Mal. P.*

A tree, 20—30 ft., branched low, with ovate or rhomboid, acute or acuminate leaves, covered beneath when young, as are the shoots, with a greenish-yellow glandular pubescence, and permanently with small red glands. Male flowers clustered in racemes 6—10" long. Female racemes 2—3" long. Capsule smooth but densely covered with red glands.

Throughout the area, especially in moist ground! Fl. Oct.—Nov. Fr. Feb.—March. Evergreen.

Bark nearly smooth, grey, blaze red. L. 3—6", or some attaining 9" by 5", sometimes ovate and slightly toothed by the excurrent nerves, old L. often hoary beneath with fine stellate tomentum, glabrescent above, base 3-nerved, secondary nerves 3—4, with strong transverse tertiaries. Petiole 2—3.5", thickened both ends. Male racemes axillary and densely paniced at the end of the branchlets. Fls. whitish-yellow, .12" diam. Stamens 20—30, anther-cells longitudinally dehiscent, sometimes with a few red glands. Female fls. distant, rarely 2 together, perianth 4-fid, ovary tomentose and red-glandular, stigmas 3, spreading yellow. Capsule .3—5" diam. Seeds globose, smooth, black.

Wood not much used except as fuel. It coppices well and is frost-hardy. The red glands from the capsule are the source of the Kamela dye, and is met with in the bazaars as a purplish-red powder, used especially for silk. It is also used as a remedy for tape-worm.

3 *M. repandus*, Muell. Syn. *Rottlera tricocca*, Roxb.; Ghirguria, Or.

A large scandent or subscandent shrub with long thorns on the trunk. Branches tomentose. Leaves ovate with cordate straight or retuse base, rarely obtuse or rhomboid at base, acute, scarcely acuminate, entire or somewhat sinuate and some of the nerves excurrent as minute teeth, 2—4" long by 1.8—3.5" broad, softly stellate-pubescent and closely covered with small glands beneath, glabrescent above. Flowers in terminal paniced racemes in the male with 3—5 yellow, suborbicular or lanceolate concave tomentose sepals .12" long, glandular within; anthers with 2 oblong cells slightly produced beyond the connective. Female flowers green, in simple racemes, sepals linear, soon deciduous, ovary very tomentose, 2-lobed and -celled, stigmas plumose, sessile. Cocci globose glandular, .2" diam.

In the damper regions only, Champaran! Purneah, common! Santal Parganas and Monghyr, towards the Ganges! Dalbhum, *Gamble*! Puri, very common in the damper parts! Angul! Fl. Jan.—Feb. Fr. March—April.

L. with 2—3 secondary nerves above the 3-nerved base, tertiaries sub-parallel, petiole 1—2" long, stipules minute, tomentose. Capsule densely fulvous tomentose, seeds subglobose.

9. MACARANGA, Thouars.

Trees or shrubs with most of the characters of *Mallotus*, from which genus they are somewhat artificially separated by the stamens. These are 1—many with flexuous filaments and are always supposed to have 3—4-locellate anthers with the cells more or less 2-valved. The anthers are, however, variable; in some species they open by 4 valves like the 4-valvate sepals of a flower; usually they have 3—4 2-valved terminal cells, but sometimes (*e.g. M. indica*) only 2 cells occur on the same plant as 4 celled anthers, and then these resemble a *Mallotus* except by the smaller connective and more apical slits. Female flowers one to few in a bract, calyx 2—4-lobed or -toothed. Ovary 1—6-celled (1—2-celled in our species), with as many cocci in fruit.

L. peltately attached above the base in all.

I. Floral bracts of male narrow, not concealing the fls. Female with narrow styles and stigmas.

Stamens 6—30. Ovary 2-celled, stigmas 2 terminal

Stamens 6—10. Ovary mostly 1-celled, stigma 1 lateral

1. *denticulata*.

2. *indica*.

II. Floral bracts very broad, concealing the male fls. Female with peltate lateral stigma

3. *peltata*.

1. *M. denticulata*, Muell. Mallota, *Nep.*

A small tree with a low crown of deltoid-ovate light green leaves 4—12" long, whitish and closely covered with minute glands beneath. Male panicles 3—4" long, pyramidal, with small, sub-orbicular, or broadly ovate bracts only .06—07" long, with broad sessile base. Female panicles densely branched, 1.5—2.5" long, with oblong deciduous bracts leaving a prominent scar; flowers usually paired in the lower bracts with stout pedicels, sepals 2—3" broadly-ovate, ovary 2-celled, closely covered with yellow glands; stylar column short and stout with 2-curved stout subulate stigmas. Capsule .25" diam., didymous.

North Purneah, on the borders of the Sikkim Tarai only! Fls. April. Fr. July. Evergreen.

Stem with quite smooth light-coloured bark. Shoots brown, tomentose. L. with 3 strong principal nerves and about 6 other basal ones, secondary nerves 9—12, strong, parallel, with the two lateral principal nerves running nearly to margin and then bifurcating, each short branch ending in a gland or (in the young L.) in a tooth, the margin sometimes permanently denticulate; tertiary nerves close scalariform, base of leaf usually rounded or somewhat retuse, apex sharply acuminate or obtuse. Stipules lanceolate, caducous.

The tree has been found useful in the Duars in reclaiming Savannah tracts.

2. *M. indica*, Wight.

A quick-growing tree up to 5 ft. girth and 50 ft. high with green or glaucous branchlets, large broadly ovate or sub-orbicular leaves 6—13" long, glaucous and glandular beneath. Male panicles 3—4" long with zig-zag branches bearing stipitate bracts, the lower foliaceous, the upper with blade modified into a large gland and cuspidate. Female panicles pyramidally branched, 3" long, hairy, flowers 1—3 at the nodes, on pedicels .2—4" long, sepals triangular, acute. Ovary shortly hairy and densely glandular, mostly 1-celled, with a lateral sessile, long subulate stigma. Capsule 1-coccos, globose, .25" diam.

Ravines in the hills of Singbhum, rare! Fl. Sept.—Oct. Fr. Oct.—Nov.

Juice very gummy. Branchlets robust, shoots tomentose. Nervation much as in *denticulata*, but the 7—10 secondary nerves more curved within the margin and giving off very short nervules, which run into the marginal teeth or glands; these glands glabrous; large elliptic glandular areas also frequently occur on the upper surface along some of the basal nerves. Stipules .5", ovate, ciliate, caducous.

There is some doubt about the occurrence of this tree, which I have described from Sikkim specimens collected at 4000 ft. elevation. My specimens collected in Singbhum were sent to Sir Dietrich Brandis, and were referred by him to *M. indica* (*Indian Trees*, p. 592), but other specimens from the same forest are *M. peltata* (*q.v.*)

3. *M. peltata*, Muell. Arg. Syn. *M. Roxburghii*, *F. B. I.*; *Osyris peltata*, *Roxb.*; *Piania*, Gondaguria, *Or*; *Tabhari* (Mayurbhanj).

A small or moderate-sized tree with green branches and glandular twigs, large, peltate, orbicular-ovate acuminate leaves mostly 4—9" long, densely tomentose when young and permanently more or less hairy on the nerves beneath, and with numerous minute glands between the nerves; somewhat rusty above. Male panicles 3—4" long, but rather strict, bearing large tomentose bracts, foliaceous at the base of the branches, transversely oblong or orbicular and denticulate, concealing the flower-clusters; bracts .15—3" broad according to position, shortly

stipitate. Female flowers in nearly simple racemes or these branched at the base, 1·2" long, also with large rusty tomentose deciduous bracts; flowers on long pedicels ·25—·6" long, sepals very minute, rounded. Ovary densely covered with glands glabrous or only slightly puberulous, bearing a lateral sessile, broadly-peltate papillose stigma. Capsule globose, ·3" diam., often grooved, with deciduous yellow glands. Seed 1, globose, black.

Singbhum, in deep valleys, very rare! Mayurbhanj! Puri, frequent! Angul, common! Fls. March. Fr. April. Evergreen.

Branches exuding large quantities of gummy sap when cut as in the last species. L. attain 12" in length, the nervation as in the last species, but the small nerves running into the margin ending usually in hirsute glands; upper surface dull, not shining. The Singbhum form is rather different in that the nervules below are much more raised and the marginal glands glabrous. Petiole usually 3—8", sometimes 15". Stipules ovate to oblong or ovate-lanceolate, or in the Singbhum form lanceolate and over ·5" long. Panicles mostly from the axils of fallen leaves. Anthers 4-valved.

A rapidly growing soft-wooded tree, soon overtopping the Teak in the Puri plantations.

10. CLEIDION, *Blume*.

Glabrous trees with alternate, toothed, penninerved leaves. Fls. monœcious or diœcious, males in long axillary racemes, females 1—2 on a long axillary peduncle. Male calyx globose, valvately 3—4-sepalous, stamens over 20, free, very close, central; anthers dorsifixed, 4-celled, or with 2 cells only transversely didymous on the margins of a broad connective. Female sepals 3—5, imbricate. Ovary 2—4-celled, styles connate below with 2—3 long filiform arms, cells 1-ovuled. Capsule of 1—3 2-valved cocci. Seeds subglobose.

1. *C. javanicum*, *Blume*.

A small tree with narrowly elliptic-lanceolate to obovate-oblong acuminate, coarsely sharply serrate leaves, 3—8" long, with a long petiole 1·3—3·5", thickened both ends. Male flowers in clusters of 2—5 on slender spikes or racemes 2—6" long, sepals 3, triangular. Females solitary, the peduncle often swollen above, styles 3—4, very long, ·75". Fruit mostly 3-coccos, ·8—1" diam. and ·4" long on a peduncle 2—4". Seeds ·3—·5 diam., globose, smooth.

Near streams, rare. Rannagar forests! Fls. Dec.—Jan. Fr. Feb.—March. Evergreen.

Bark grey, corky, blaze with chlorophyll. L. somewhat repand with the teeth often incurved, secondary nerves 5—7 strong but fine beneath, tertiaries numerous, close, reticulate between. Thickened ends of petiole and peduncle transversely rugose when dry. Raceme sometimes pubescent, bracts minute.

11. LASIOCOCCA, *Hook. f.*

Small trees with subverticillate, more rarely alternate or sub-opposite, shortly petioled oblanceolate or obovate leaves, entire with cordate base. Fls. monœcious or diœcious, males racemose, females solitary, peduncled, axillary or sub-corymbose at the apices of the new shoots. Male flower with globose calyx, valvately 3-parite, stamens numerous, connate into a much-branched column, the branches with

numerous anthers with 2 globose anther-cells, connective large. Female flower with 5—7 unequal sepals, persistent and somewhat accrescent. Ovary globose or slightly 3-lobed, scaly or tubercled; styles 3, filiform erect, stigmatose on the inner side. Ovules 1 in each cell. Capsule finally 3-coccos, deciduous from a 3-cornered columella covered with stout bristles, hard conical points or tubercles. Seeds subglobose, smooth, with thin crustaceous testa, raphe linear, albumen fleshy, cotyledons large orbicular, subcordate, thin.

1. L. Comberi, *Haines* (*Kew Bulletin*, 1920, No. 2.) Kukri-hari, Or.

A small tree, with bushy crown, white twigs and sub-verticillate obovate, cordate-based or panduriform leaves 3—7" long, with usually caudate tip, glabrous, margin rather wavy-cartilaginous, secondary nerves 10—13, rather strong, petiole tomentose, very short. Male racemes 1—2.25" long, axillary and from the axils of fallen leaves, pedicels very short, articulate, calyx pubescent only at the tip in bud, sepals elliptic-oblong, .12—.13". Female peduncles pubescent, .6—1" long, in the axils of the terminal leaves or sub-corymbose in the axils of bracts, sepals unequal; mostly broadly ovate acuminate, inner narrower or linear, glabrous except a few ciliolæ. Ovary tubercled, each tubercle with a simple seta. Capsule .5" diam., depressed, tubercled. Seed globose, brown.

Rocky ravines and nalas. Puri (*Dhuanali* forest, common)! Angul! Mountains of Mayurbhanj! Fl. June. Fr. Aug.—Sept. Evergreen.

Stem often buttressed, bark pale or white, blaze hard, brown and white. New shoots densely pubescent. Buds rusty tomentose, .1—.25" long. Tertiary nerves fine scalariform, and upper surface of L. microscopically pitted, pits sometimes visible as translucent dots. An inflorescence-like growth is sometimes produced by galls.

12. HOMONOIA, *Lour.*

Shrubs with alternate, entire, or toothed leaves, lepidote beneath. Flowers usually dicecious, bracteate and 2-bracteolate in axillary spikes rarely, sometimes reduced to single flowers. Male with globose calyx splitting into 3-valvate sepals, stamens united into a central column, which is divided into numerous branches and finally dense clusters of 2-celled anthers, with a very minute connective. Female sepals 5—8, narrower imbricate, inner sometimes smaller, deciduous. Ovary 3-celled with 3 spreading entire papillose or almost fimbriate styles. Capsule small, of 3 usually tomentose 2-valved cocci, not scaly or tubercled. Seeds ovoid with a thin fleshy coat.

- | | |
|--|------------------------|
| A. Female fls. in slender spikes as long as the male. | |
| L. linear to linear-oblong, entire or serrulate | 1. <i>riparia</i> . |
| B. Female fls. subsolitary or in short spikes. L. toothed. | |
| L. oblong to obovate, 1.5—3.5". Outer female sepals .14" | 2. <i>intermedia</i> . |
| L. cuneate-obovate, .7—1.5". Female sepals equal, .07" | 3. <i>retusa</i> . |

1. H. riparia, *Lour.* Syn. *Adelia nereifolia*, *Roth.* (and in *F.I.*); Gara-huru, *M.*; Sunukui, Gurjor, *S.*; Jamla, *Or.*

A large rigid shrub with numerous erect stems marked with prominent leaf-scars, tomentose above. Leaves linear, linear-lanceolate or

linear-oblong, willow-like, 3—10" long by '3—1" broad, entire, or with wavy margins, or sometimes toothed or serrulate towards the tip, closely pubescent on the nerves beneath. Male spikes 1·5—4" long with tomentose rhachis; bract '94—'05", ovate acuminate, bracteoles smaller, lanceolate. Female spikes 2—3", bracts as in the male, rhachis grey tomentose, sepals lanceolate, 5—6, '07" long, nearly equal, pubescent. Ovary tomentose. Capsule tomentose 2—'25" diam., seeds bright crimson.

Rocky river-beds, throughout the area but somewhat local! Fl. March—April with the young shoots. Fr. May—Sept. Usually described as evergreen, but it is often completely deciduous in cold weather.

Secondary nerves of leaf very numerous, sometimes over 30, but dependent on the size of l.; other nerves sometimes much raised, leaving deep areoles between them, in other forms not much raised. Petiole '25—'3". Stipules linear, '24", deciduous. Male sepals nearly glabrous, elliptic, '13".

2. *H. intermedia*, Haines.

A shrub with many erect branches and stout, usually red, minutely pubescent twigs. Leaves mostly 2—4·5", sometimes only 1" on abbreviated shoots, oblong with somewhat attenuated base, rarely obovate, with usually rounded, obtuse or acute tip, serrate or coarsely serrate, somewhat pubescent on the nerves beneath when young; secondary nerves 7—8, petiole '1—'15". Male spikes not seen. Female spikes '4—'7" with pink pubescent rhachis, bract and bracteoles subequal, acuminate, '11" long, sepals lanceolate, outer 3 larger, red, '14", styles more fimbriate, '07—'08".

Mahanadi river bed! Fl. March.

This plant, which for want of the male spikes I have not elsewhere described, is almost intermediate in leaf between *riparia* and *retusa*, and it might possibly be a hybrid. It has the female fls. almost twice the size of the other two species. Treated as a variety of either it would be very difficult to know to which to assign it.

3. *H. retusa*, Muell. Arg.

A smaller shrub than *riparia* with obovate L., 1—2", usually cuneate at base, rounded or retuse at tip and usually serrate-dentate, beneath glabrous, and with fewer scales than in *riparia* and only about 5—6 secondary nerves. Male spikes '5—1" long, stout. Female fls. subsolitary or in spikes '5" long, with pink pubescent rhachis closely resembling *intermedia*, but fls. only as large as in *riparia*. Sepals of male glabrous, of female minutely pubescent. Capsule '1—'15" diam.

This, which has been described from specimens from the Central Provinces for purposes of comparison with *intermedia*, has not been found in our area.

13. RICINUS, L. Castor-oil.

A tall stout herb, or perennial and sub-arborescent, with large, orbicular, palmately-lobed and serrate leaves. Flowers in terminal, subpanicked racemes, monoecious. Males crowded in the upper parts of the racemes, calyx splitting into 3—5 valvate segments, stamens very many, connate in several branched columns, anthers clustered on the final branches, cells distinct, subglobose on the rather large connective. Female fl.

large, in the lower part of the raceme, calyx spathaceous, caducous. Ovary 3-celled, styles spreading, entire, 2-fid or 2-partite, feathery or papillose, often very large and brightly coloured. Ovules 1 in each cell. Capsule of 3 2-valved cocci. Seeds oblong, with large caruncle and crustaceous testa.

1. **R. communis**, L. Arandi, H.; Bheranda, Beng.; Jara Bindi, K.

This is the well-known *Castor oil* plant, which is cultivated under two common forms: (1) A perennial with stems woody below with large fruits and large red seeds, said to yield about 40 per cent. of oil, used chiefly for lubricating and illumination (*Nadharni*), and (2) an annual grown as a crop with small grey and brown mottled seeds yielding rather less oil of better quality for medicinal purposes. The seeds contain a toxic, extremely poisonous substance, "ricin," which is, however, not contained in the oil. (3) var. *Gibsonii*, which large purple bronze leaves, is grown as an ornamental plant only. Müller distinguishes 17 varieties. De Candolle states that its cultivation is extremely ancient, and considers its home was originally in Abyssinia, Sennaar and Kordofan.

14. **CLAOXYLON**, A. Juss.

Herbs (in our area), or usually trees or shrubs, with long-petioled, entire or toothed, penninerved or sub-palmately-nerved leaves. Flowers small or minute, monœcious or diœcious, in sometimes very slender spikes or racemes. Calyx subglobose, of 3-4 valvate segments, petals 0, disc 0 or of 3 petal-like hypogynous scales alternate with the carpels. Stamens many, or few, on or around a central receptacle often intermixed with glands or linear scales, anther cells distinct, free above and erect. Ovary 3-celled, styles entire, spreading, fringed, ovules one in each cell. Capsule of 3 2-valved cocci or indehiscent. Seeds subglobose, testa crustaceous, sometimes arillate or verrucose, albumen fleshy, cotyledons broad, flat.

1. **C. mercurialis**, Thw. Syn. *Tragia mercurialis*, Willd.

An erect, weedy annual 12-24" high with pale sub-glabrous stems, long-petioled, ovate or rhomboid, acuminate-crenate or serrate leaves 1-3" long, and numerous capillary racemes 2-3" long, bearing distant clusters of minute subsessile or shortly-pedicelled males and slender-pedicelled larger females .07" diam. Sepals 3, distant lanceolate, scales 3, shorter, ligulate or sub-terete. Capsule .17", deeply 3-lobed, depressed, pilose. Seeds pitted or verrucose.

Monghyr, *Ham.* 1 Orissa, near the coast (Konarak) 1. Fl., Fr. Aug.-Sept.

L. glabrous with a matt surface, sometimes obtuse (*teste F. B. I.*), base cuneate, rarely with a slight cordation or obtuse on the 1-1.7"-long petiole; 3-5-nerved, but with lateral basal nerves slender; secondary nerves 3-4. Bract at the flower-clusters very small. Male fl. most minute, with only 2-3 stamens (often 5-10, *teste F. B. I.*); filaments very short, anther-cells short, erect, parallel.

15. **ACALYPHA**, L.

Herbs, shrubs or trees, with alternate, toothed or crenate, rarely entire leaves, and minute flowers, monœcious, rarely diœcious, apeta-

lous, in axillary or terminal racemes, with the females at the base of the rachis and bracteate, with the more minute males ebracteate, or females separate, 1—2 in a peduncled solitary bract or in separate bracteate spikes. Male with 4-valvate membranous sepals, disc 0, stamens 8—many on a convex receptacle, anther cells divaricate, often flexuose or twisted, pistillode 0. Female flowers with 3—4 imbricate sepals, ovary 3-celled, styles filiform, often very long and laciniate or fimbriate. Ovary 3-celled, ovules 1 in each cell. Capsule of 3 minute 2-valved cocci. Seed subglobose.

Herbs with males and females on the same spikes in our species.

Female bracts dentate or crenate

1. *indica*.

Female bracts almost pectinate, with long, hispid teeth

2. *ciliata*.

A large genus, widely spread in the tropics of both hemispheres, and of which several handsome shrubs with variegated and copper-coloured leaves are found in all Indian gardens.

1. *A. indica*, L.

A stiff erect herb, 18"—2.5 ft. high with puberulous stems, spreading, long-petioled, rhomboid-ovate, serrate leaves, and very numerous axillary spikes with foliaceous concave sub-orbicular-cuneiform many-nerved toothed bracts, bearing green female flowers in the lower part of the spike, the top of the spike being male and ebracteate. Capsule concealed by the bract, hispid, usually 1-seeded.

Northern Bengal (possibly Purneah), Kurz! Hazaribagh, near Chorparan, etc.! Puri, near Balugaon, Hooper! Fls., Fr. c.s.

L. 2—2.5", with a 5-nerved cuneate entire base, margin somewhat ciliate, apex obtuse toothed, surface minutely dotted, petiole longer than the blade, pubescent. Spikes 1.5—2.5", several in one axil or on short axillary branchlets; female bracts with a nerve to each tooth and bearing one to a succession of fls.; perianth of 3 minute hyaline scales with gland-tipped cilia. Ovary 3-lobed with curly pubescence, style arms with 3 slender branches. Male fls. very minute, clustered, with 4-lobed perianth, buds 4-angled, stamens with curved swollen hyaline filaments and 2 erect slender cells.

2. *A. ciliata*, Forsk.

An erect, rather stout, glabrous or pubescent herb 1—2 ft. high, with long-petioled ovate or ovate-lanceolate, acuminate serrate leaves 2—3" long, with rounded or cuneate base and petiole usually longer than the blade. Spikes rarely 1" long, with the female bracts almost tubular, crowded, with many nerves ending in long subulate, hispid teeth as long as the limb, each with 1—2 flowers. Male flowers few, very minute at the end of the spike. Ovary sparsely hispid. Capsule glabrous, cocci very thin white.

Behar, Kurz! Fls., Fr. July—Dec.

16. GELONIUM, Roxb.

Small glabrous trees or shrubs, the branches with stipular lines at the nodes. Leaves sometimes opposite, pellucid punctulate, entire or serrate, with connate, sheathing, caducous stipules. Flowers axillary, cymose or clustered, dicecious. Male sepals 5, orbicular, imbricate, stamens 10—60, free central, anthers oblong dorsifixed, cells parallel,

introrse. Female flowers sepals 5—6, usually narrower than in the male, disc cupular or annular, sometimes with staminodes. Ovary 2—4-celled, styles minute, stigmas reniform, semi-lunate or 2-fid, ovules 1 in each cell. Fruit 3—4-gonous or 2—4-lobed, fleshy, coriaceous or crustaceous, tardily dehiscent. Seeds subglobose, arillate.

Fls. in contracted cymes. Male .4—5" diam. Female sepals .15" in fl., .2—25" in fr. Fr. .7—9" 1. *multiflorum*.
 Fls. fewer fascicled. Male fl. .2" diam. Female 1—4 together only, sepals .1" in fl., scarcely accrescent. Fr. .4" 2. *lanceolatum*.

1. **G. multiflorum**, *A. Juss.* Khakra, Kukra, *Or.*; Ganari, *Gond*.

A small straight tree with green twigs prominently marked by the pale stipular scars and with very resinous buds. Leaves 3—6", elliptic-oblong or sometimes oblanceolate-obtuse, or few acute, some somewhat serrate, more or less cuneate on the .1—25"-long petiole. Flowers usually in contracted cymes, more rarely merely clustered. Males very sweet scented, yellow from the large, yellow, honeyed receptacle and anthers, .4—5" diam. including the many stamens; sepals 5, reflexed, .17—2", broadly oblong, obtuse, often concave and with somewhat minutely-ragged hyaline margins. Stamens 40—70. Female sepals pubescent, orbicular or broadly oblong, .15", soon enlarging to .2" or .25" in fruit; disc annular, rough, with rudimentary staminodes (?), stigmas flabellately lobed. Fruit .7—9", slightly 3-gonous and 3-grooved.

More or less evergreen forest round the eastern, damper side of the province. Purneah! Santal Parganas, rare! Puri, common! Angul, common! Nilghiri! Mayurbhanj! Fla. March—April. Fr. April—June.

Bark nearly smooth. L. with 5—10 oblique secondary nerves, reticulate between, fine, slightly raised above, translucent dots not clear and often diffused, sometimes slightly raised on the dry leaf. The fr. in some specimens is somewhat tubercled, but I have only seen smooth frs. in our area.

2. **G. lanceolatum**, *Willd.* Same vernacular names.

A small, straight, much-branched tree, closely resembling the last in habit and foliage, but leaves usually smaller, 1.5—4", rarely up to 6", nearly always more or less obovate or oblanceolate, sometimes elliptic-obovate to oblong, shining both sides and coriaceous (as in last). Petiole .1—2". Male flower in small fascicles, not cymose, only .2" diam. including the stamens, which are usually under 40, sepals orbicular, erect, .07—1", receptacle not swollen. Female flower solitary or 2—4 together, sepals broadly ovate, .1", and scarcely larger in fruit. Stigmas 2-fid with incurved subulate arms, which are somewhat toothed. Disc thinner, more cupular and less pulvinate than in *multiflorum* and without staminodes. Capsule .3—4" with the lobes keeled.

Mals of Puri! Fls. usually a few weeks later than *multiflorum*. Also a flowering specimen (*Lace*) in November.

Bark smoothish grey-brown, blaze rather hard flesh-coloured. The translucent dots sometimes barely visible. Hooker states that the fls. are sometimes in short racemes, of which the rhachis is covered with imbricating bracteoles, and that the capsules are rough. Seeds globose, .12—17" diam., testa with large shallow pits.

17. BALIOSPERMUM, *Blume.*

Shrubs or undershrubs with alternate, sinuate, dentate or lobed leaves, penninerved or palminerved; base 2-glandular. Flowers small, monœcious or diœcious, fascicled, racemed or paniced. Male sepals 4—6, orbicular, concave, imbricate, disc of 4—6 glands, stamens 10—30 on a small receptacle, filaments free or few connate, anther-cells parallel, adnate to a broad connective. Female sepals 5—6, lanceolate, sometimes accrescent in fruit, disc entire. Ovary 3-celled, styles rather long, stout, 2-fid or 2-partite, with smooth stigmatic surfaces, cells 1-ovuled. Capsule of 3 2-valved crustaceous cocci. Seeds ovoid.

1. *B. montanum*, *Muell.* Syn. *B. axillare*, *Bl.*; *Jatropha montana*, *Willd.*

A shrub or undershrub with numerous, erect, herbaceous shoots from the perennial rootstock, with variously lobed, lobulate, sinuate or serrate leaves, lowest sometimes palmately-lobed and broad, mostly elliptic-oblong, becoming lanceolate above, often attaining 6—10" long below. Fls. green, fascicled, axillary and in the axils of bracts on proliferous shoots or in contracted leafless panicles. Capsule 3-lobed, 3—4" long, pubescent. Seeds with a brown caruncle.

Usually in undergrowth in damp places. Purneah and Santal Parganas! Singbhum and Palamau! Parasnath, *Prain!* Angul, very common! Fls. chiefly Dec.—March.

Attains 6 ft. in Angul with weak stems, more or less strigose or twigs pubescent. L. with 3—5 nerves at or near the base. Fls. said to be monœcious in the type.

Var. *dioica*, *Haines* (*F. C. N. & Indian Trees*, p. 583).

Leaves with very strong tertiary nerves. Fls. diœcious, males fascicled in narrow panicles, and the females 1—3 axillary. The common form in our area.

18. TRAGIA, *L.*

Usually climbing herbs, hispid, with pungent or stinging hairs. Leaves alternate, simple or palmately 3-lobed, with often cordate base, palmately nerved. Flowers minute, monœcious, racemose, males several in the upper parts of the racemes, females solitary or few, in the lower parts. Male calyx valvately 3—5-sepalous, stamens 1—3, rarely more, filaments free or connate, anther-cells contiguous, parallel. Female sepals 6, much larger than in the male, imbricate, sometimes pinnatifid and accrescent. Styles 3-fid with spreading entire arms. Capsule of 3 2-valved cocci. Seeds globose.

Female sepals accrescent pectinate, hirsute .

1. *involutrata.*

Female sepals not accrescent, entire, puberulous

2. *Gagei.*

1. *T. involutrata*, *L.* Jipenda, *Ho*; Sengel-sing, *K., S.*; Barhanta, *H.*; Bichati, *Beng., Or.*

A stout herb, woody below, and with a perennial stock, with sub-erect or twining branches, puberulous and villous as well as with scattered pungent hairs. Leaves 1—4.5", oblong, ovate-oblong, elliptic or rhomboid acuminate, base usually rounded, sharply serrate, young almost tomentose beneath, old hairy and setose. Flowers usually in

leaf-opposed sub-spicate racemes, sometimes racemes terminal or on short axillary branches. Male sepals .05", broadly ovate. Stamens 3, sometimes 2-branched, each branch with an anther. Female sepals linear with long, glandular, hirsute teeth or lobes, hardened in fruit and spreading, 2-3" long, ovary villous. Capsule 3" diam., usually hirsute. Seed globose, purple black, strophiolate, slightly under 2", mottled with thin white scales.

Waste places and hedges, often among rocks. Chota Nagpur! Santal Parganas! Puril to Kalahandil Fls., Fr. Dec.—April.

Leaf 3-5-nerved and with 3-4 secondary nerves and fine cross tertiaries. Petiole .7-1". Stipules lanceolate, 1-2". Spikes or racemes 3-1", upper male portion with close oblanceolate stipitate bracts about .06" long.

2. *T. Gagei*, Haines, in *Journ. As. Soc. Beng.*, xv, p. 7.

A slender twining herb with brown, slightly pilose branches. Leaves oblong, 4-5" long, abruptly acuminate with cordate base, margin shallowly dentate-serrate, beneath almost glabrous even when young, above slightly setose, base 5-7-nerved, secondary nerves about 3, tertiaries reticulate. Male sepals 4, oblong acute. Stamens 2, anthers broader than long. Female sepals oblong-oblanceolate, acute, scarcely 1" long in fruit, entire puberulous outside, glabrous within. Capsule hispid, 3", seeds globose, 2", quite smooth, marbled brown and white, not at all strophiolate or tumid at the chalaza.

Mals of Puril Fls., Fr. March—May.

Scarcely stinging. Petiole 1.2-1.5" long, slightly thickened both ends, villous when young. Stipules triangular, .07". Bracts on the racemes, ovate, .05", or shorter below the male fls., almost glabrous except the margins.

19. SAPIUM, *P. Br.*

Trees or shrubs with milky juice, entire or toothed penninerved leaves, petiole often 2-glandular at the top. Flowers in terminal spikes or racemes, monoecious. Males several in each bract, calyx shortly 2-3-lobed or -toothed or valvately 3-sepalous, stamens 2-3, free, anther-cells parallel. Female flowers usually at the base of the spikes, solitary in each bract, or spikes unisexual, calyx 3-fid or -partite, ovary 2-3-celled, styles sometimes connate at base, spreading, simple, cells 1-ovuled. Fruit crustaceous, fleshy or rarely woody, tardily loculicidally 3-valved. Seeds globose, usually long-persistent on the columella.

Spikes androgynous. L. rhomboid

1. *sebiferum*.

Spikes unisexual. L. large, elliptic-lanceolate

2. *insigne*.

1. *S. sebiferum*, Roxb. Momchina. *Beng.*; Bilaiti-sissu, *Vern.*; Chinese Tallow Tree.

A small glabrous tree somewhat resembling *Sissu*, the leaves being of much the same shape as *Sissu* leaflets, broadly rhomboid, 1.5-3" long with a short or long acumen, sometimes broader than long, base 3-nerved, of which the lateral are sometimes marginal, two glands at the junction of blade and the 1.5-3" slender petiole. Racemes terminal, 2-5" long, with small rhomboid bracts and large gland either side of each bract; some racemes male with barren bracts below,

others with a few female flowers below and the rest male. Females with pedicels 2—4" long and long linear styles connate about half-way. Males several in a bract, more shortly unequally pedicelled, yellow, calyx cupular, toothed or truncate, anthers large, broader than long. Capsule coriaceous, 25", seeds with a coating of wax under the epidermis.

A native of China, very commonly planted, and more or less naturalised in Purneah. Fls. Aug.—Sept. The open capsules may remain on the tree until November. Deciduous Nov.—March in the dryer districts, turning red before falling.

Growth very fast and tree ornamental. The source of the vegetable tallow of China. Roxburgh considers that cocoa-nut oil is superior to it for burning.

2. *S. insigne*, Benth.

A small tree with thick, pale brown, succulent branchlets and rather fleshy large leaves crowded at their ends. Leaves elliptic-lanceolate, acuminate or finely caudate, 6—10", crenate, base narrowed into the 1—1.7" petiole, which is 2-glandular above. Stipules very small, finely acuminate with glandular base. Male flowers in round clusters on the stout fleshy rhachis of solitary terminal spikes, 3—6" long. Female flowers sessile (or shortly pedicelled, *f. F.B.I.*), in similar spikes but not clustered, rarely spikes 2-sexual. Ovary ovoid. Fruit ovoid or broader than long, 3—4".

Very rare. On rocky aspects on the highest mountains of Mayurbhanj, elevation above 2000 ft. Fls. Dec.—Feb. Fr. March. Deciduous, renews L. March—May.

Blaze pale with much milky juice. Crenations of leaf at first serrate with deciduous glandular tips. Secondary nerves about 12, rather strong, oblique.

This is one of the numerous cases of a Himalayan and Chittagong plant being found in Orissa. The tree has, however, also been collected from Southern India and Malabar, presumably from the mountains.

20. EXCÆCARIA, L.

Glabrous trees or shrubs with acrid milky juice and alternate or opposite leaves. Flowers in bracteate spikes or racemes, monœcious or diœcious, very small, rhachis with large glands. Male flowers 1—3 in each bract, sepals 3—5, stamens 3, free, with didymous anthers. Female flowers sometimes on the lower part of the male spikes, sometimes on distinct racemes or spikes, calyx 3-fid or -partite. Ovary with 3 stout, spreading, or recurved styles, cells 1-ovuled. Capsule of 3 cocci separating from a columella. Seeds subglobose, estrophiolate.

1. *E. agallocha*, L. Gowan, Or.; Gengwa, Beng.

A small tree or large shrub with much milky juice, numerous erect stems or branches, well clothed with coriaceous, long-petioled, entire or sinuate-crenate ovate lanceolate, ovate or orbicular leaves, 2—3" long, the old ones deep red (before falling). Male flowers in catkin-like spikes, 1.5—2.5" long, from the upper axils or from the axils of fallen leaves. Female spikes or racemes fewer, 5—1", on separate trees. Fruit deeply 3-lobed, depressed, 6" diam.

Muddy ditches near the sea, Balasore! Tidal forests, Cuttack! Fls. May—June with the new leaves. Fr. May—June. The old L. drop at the time of the new flowering.

L. with rounded base and short acuminate tip. Secondary nerves 5—8, rather obscure, spreading, petiole .5—1", 2-glandular at junction with blade. Male bracts rounded, 0.7" broad; fl. sessile or pedicelled, bracteolate; sepals very minute, lanceolate with incurved very acute tip and minutely toothed; anthers far exerted, with small connective and two large ellipsoid cells. Female bracts cuspidate, fls. sometimes subsessile, sepals larger than in male, ovate cuspidate, .05". Styles 3, revolute.

In a specimen collected by *Bourne* there is one twig with male racemes and immature leaves and another with capsules and mature L., which, he says, were "collected from the same tree." Hooker says the variations in the size of fr. and seeds is remarkable.

The juice causes blisters and bad sores. Gamble gives weight of wood as 24 lb. only.

21. SEBASTIANIA, Spreng.

Shrubs or (in our species) a herb with alternate penninerved leaves and minute monœcious flowers in slender racemes. Males 1—3 in each bract, calyx unequally 5-lobed or -partite, stamens 2—4, anther-cells distinct but contiguous. Females solitary or at the base of the male racemes, calyx 3-lobed or -partite, ovary 3-celled, styles revolute or spreading, sometimes connate at base. Capsule of 3 cocci separating from a columella. Seeds strophiolate.

1. *S. chamælea*, Muell.

A glabrous annual, with erect or ascending often angled stems, 18—30" high, and linear obtuse leaves, .7—3" long, minutely saw-edged, with petiole .1". Flowers most minute in short terminal or leaf-opposed spikes, .25—5" long, female at the base and male above, or female also solitary. Female perianth with ovate segments, persistent and enlarged in fruit, fimbriate and ciliate. Capsule .17" long, 3-lobed, lobes each with two lines of short spines.

Cultivated ground. Ranchi, *Clarke*, Wood! Hazaribagh! Singbhum! Manbhum, *Kurz*! Behar, *Kurz*! Fls., Fr. Oct.—Dec.

22. BRIDELIA, Willd.

Trees or shrubs, sometimes scandent, with entire, rarely somewhat crenate leaves with strong parallel secondary nerves frequently uniting in a marginal nerve, and small monœcious, rarely diœcious flowers in axillary clusters, or clusters in simple or paniced spikes. Calyx with 5 sometimes sub-perigynous, valvate, persistent sepals, and 5 usually small, white, persistent petals inserted under the margin of the prominent disc. Disc flat or somewhat concave, often with an annular rim in the male, in the female furnished with a corona (or inner disc of some writers) from the inner margin, which often closely invests the ovary and is toothed or lobed, or consists of sub-petaloid lobes. Stamens 5, on a distinct gonophore with a pistillode. Ovary 2-celled, with 2 free or partially connate styles, often 2-lobed. Fruit a drupe, with a 2-celled stone, ultimately splitting into 2 1-seeded, 2-valved (always ?) pyrenes.

- I. Erect trees or shrubs with secondary nerves unbranched up to the marginal nerve.
- A. L. mostly over 4" long, oblong or obovate.
 Secondary nerves 15—20. Fls. axillary and spicate
 glabrous. Fr. globose 1. *retusa*.
 Secondary nerve 8—16. Fls. all sessile axillary, pubescent at base. Fr. oblong 2. *verrucosa*.
- B. L. mostly under 4", lanceolate.
 Secondary nerves 7—13. Fls. glabrous. Fr. globose 3. *tomentosa*.
- II. Erect. Secondary nerves forked, looped or reticulate within margin (exc. 4 var. *Hamiltoniana*).
 Shrub with rhomboid obovate L. Sepals glabrous 4. *montana*.
 Tree with oblong acuminate L. Sepals pubescent 5. *pubescens*.
- III. Sarmentose or scandent, nervation as in I. Sepals pubescent 6. *stipularis*.
1. **B. retusa**, *Spreng.* Syn. *B. spinosa*, *Roxb.*; *Cluytia retusa*, *L.*; *Karaka*, *M.*; *Kaka*, *Ho.*; *Kadrupala*, *S.*; *Kaj*, *Kharw.*; *Khooj*, *Th.*; *Kasai*, *Kosai*, *Beng., Or.*; *Pani-kasi*, *Or.*

A small or moderate-sized tree, usually with long conical thorns on the trunk when young, stiff, elliptic-oblong, acute or obtuse, rarely rounded leaves, with rounded base and 15—20 strong secondary nerves which meet a marginal one. Flowers small, greenish, in axillary clusters and clusters also in long spikes, 3—6" long, males and females usually intermixed. Fruit greenish-yellow or flesh-coloured, globose, .25—.3" diam., pyrenes ridged.

Throughout the province, in the dryer districts usually near streams and nalas, or on the cool sides of the hills. Fls. Aug.—Oct. Fr. Nov.—Jan. Evergreen.

Attains 4—5 ft. girth with grey flaky bark, rather thick and a dark crimson blaze. L. 4—10" long, mostly about 6", usually pubescent, grey or glaucous beneath. Sometimes somewhat obovate, base sometimes subcordate, never acute, except on occasional branches, tertiary nerves closely scalariform. Petiole .25—.5", often swollen. Male fls. pedicelled, female sub-sessile, sepals lanceolate, petals of male broad, angular, or coarsely toothed, of female oblong, entire persistent. Disc of male thick, patelliform, scarcely lobed, of female annular with an inner sub-petaloid limb, entire or of 5 lobes, erect in the young fl., ultimately spreading.

The drupes are quoted as purplish-black by Brandis, and in the *F. B. I.* This is so when over-ripe or dry, but they are usually eaten before that stage by green-pigeon, hornbills and parrots, of which birds they are a favourite food.

The heart-wood is deep brown, veined black, and is very handsome. *Gamble* states that it is durable, and that the weight is about 52 lb. The poles are largely used in native houses and for agricultural implements. The leaves are much cut for buffalo fodder.

The seedling has broadly emarginate, faintly nerved cotyledons; the first leaves are strongly nerved.

2. **B. verrucosa**, *Haines.* Syn. *B. montana*, *Hook. f.* (in *F. B. I.*), non *Willd.*; vide *Journal of Botany*, 1921.

A small tree without much trunk, which is short and sometimes thick, but never thorny, closely branched, with upright verrucose branches. Leaves broadly elliptic or obovate, with rounded tip, 3—6" long on the flowering branches, often 8" on flowerless ones, with 10—16 strong secondary nerves, meeting a marginal one as in *retusa*, beneath pallid, glabrous or nearly so, base rounded. Flowers never spicate, in dense axillary clusters on small tubercles in the axils of standing or fallen leaves on previous year's branchlets, closely invested by the broad, scarious, thinly hairy bracts, which are as long as the male flowers,

monoecious, sessile, males with a small villous sheath at the base, females also villous on the tube. Fruit broadly ellipsoid.

Sameshwar Hills, near nalas! Common in rocky ravines in the Santal Parganas. Ravines in the higher hills of Chota Nagpur! Parasnath. *J. D. H., Clarke, Campbell!* Fls. Oct.—Dec. Fr. Feb.

Bark flaky in old trees, blaze red or crimson as in *B. retusa*.

Branchlets brown, glabrous, except on new shoots and buds, pustulate. Male fl. shorter than the female, with obovate, irregularly lobed or toothed petals inserted outside the patelliform, crenulate and rugose disc. The curious villous sheath is detachable from the fl. on boiling, and I am unable to state its morphological significance; it is perhaps the pedicel. Female fl. .06—.07" long, with lanceolate acuminate sepals and oblanceolate entire petals. Disc conical, with small mouth girding the base of the long styles and usually circumsciss at the base, becoming lifted up as a cap on the young fr., but variable.

3. *B. tomentosa*, *Bl.* Syn. *B. lanceæfolia*, *Roxb.*

A large bushy shrub or small tree with often drooping branches, slender, rusty tomentose or pubescent, or (in age) puberulous twigs, and small lanceolate, or linear-lanceolate, or sometimes oblanceolate, often acuminate leaves, 1—4" long, pale or glaucous and more or less pubescent or puberulous beneath, with 7—13 nearly straight secondary nerves running without branching or reticulating into a marginal nerve; tertiary nerves close scalariform. Flowers glabrous, monoecious or dioecious, very small, clustered, axillary, or rarely ends of the branchlets without leaves, white, .15—.17" diam. Fruit .17—.25" diam., blue-black.

Usually in the damper region. Purneah! Gya, *Ham., And.!* Eastern Manbhum! Santal Parganas! Dhalbhum, *Gamble!* Puri, frequent. Fls. Sept.—Oct. Fr. Nov.—Jan.

Attains tree dimensions in Purneah with smooth white bark and red blaze. L. sometimes attain 6" on the main branches, but are smaller upwards, and often only 1" on the flowering branches, dull above, base acute or obtuse, or rounded on the .1"-long pubescent petiole. Sepals ovate to lanceolate, petals half as long, obovate or rounded with broad claw, coarsely toothed in both sexes or entire in the female.

In old drupes the pericarp splits into 6 valves and each of the pyrenes into 2 valves. Seed black, somewhat cordate.

Cotyledons epigeal, broad and somewhat emerginate, seedling pubescent, first pair of leaves opposite or alternate, stipules setaceous.

4. *B. montana*, *Willd.* non *Hook. f.* (*F. B. I.*). Syn. *Cluytia montana*, *Roxb.*; *B. Hamiltoniana*, *Wall.*; vide *Journal of Botany*, 1921; *Marda, Or.*

A much-branched, large shrub, with usually numerous stems or long brown branches, glabrous or nearly so; leaves 2—4", mostly rhombic-obovate, varying to rhombic-ovate, sub-orbicular, or occasionally oblanceolate or lanceolate, with 6—7 (very rarely up to 10 and then only in a few leaves) secondary nerves, with the ends mostly forked, looped, or reticulate before reaching the margin, glabrous or sometimes puberulous beneath. Stipules persistent (for the genus), narrowly linear-lanceolate, .2" long, often curved. Flowers usually few in an axil with lanceolate, almost glabrous bracts, sessile, quite glabrous, .08—.1" long, monoecious. Male petal broad, strongly angled or toothed; female rhomboid or obovate, minutely toothed. Lobes of pistillode subulate. Fruit .25—.3 diam., ultimately much like that of *tomentosa*.

Usually in dry rocky places, or in the dryer parts of the province in rocky nalas, not common. Monghyr Hills, Ham.! Kurz! Behar, *J. D. H.*! Sambalpur, especially in the Boropahar range, frequent! Fls. Aug.—Sept. Fr. Oct.—Dec.

Bark thin, rather rough on old stems, blaze pink. Branchlets not pustulate. Petioles .1—2", glabrous or pubescent. L. margins sometimes repand or shallowly crenate. Inner disc in female fl. broadly cupular, scarcely covering half the subglobose ovary or longer, minutely toothed or 4—5-lobed in flower, 4—5-fid to base in fr.

Var. **Hamiltoniana**, *Wall.* (sp.)

Pubescent. L. with several of the secondary nerves running into the marginal nerve. Monghyr, *Ham.*! Kaimor Hills, *J. D. H.* (but glabrous)!

5. B. pubescens, *Kurz.*

A small tree with pubescent or tomentose twigs, narrowly elliptic leaves, acuminate at the apex and pilose or thinly hairy beneath, with rounded or acute base and 7—15 secondary nerves, mostly looping within the margin. Flowers white, .2—2.5" diam., densely pubescent outside in axillary dense clusters and sometimes short spikes. Drupe ellipsoid or oblong, .5" by .25".

Along streams. Saranda forests, Singhum, usually above 2000 ft.! Simlipahar forests, Mayurbhanj, above 3000 ft.! Fls. April. Fr. ripens the following c.s. Evergreen.

L. 4—10" long, rarely some of the lower on a twig broadly elliptic, base sometimes oblique and cuneate, texture thinner than in *retusa* and *montana*. Male fls. with short stout pedicels, female subsessile. Sepals lanceolate. Petals broadly flabellate or rhomboid in male and tip sometimes 3-toothed; oblong or obovate entire in female, outside pubescent. Male disc often granulate with smooth annular margin, female like the male but smoother and thinner, and with inner tubular conical limb nearly concealing the ovary obscurely lobed.

6. B. stipularis, *Bl.* Babu janga, *S.*; Kunji, *Th.*; Nota Kasi, *Or.*

A large woody climber with pendent branches, broadly elliptic-oblong, strongly-nerved leaves mostly about 4.5 by 3.5", but much reduced on the flowering branches, and those on the lower branches sometimes (as in the case of most *Bridelias*) exceptionally large and up to 8", hairy or sub-tomentose beneath. Flowers monœcious, numerous, axillary, or spiked, and in paniced spikes, green, densely hairy outside. Drupes oblong, red (till over-ripe), .5" long.

In the moister regions only. Northern tract, all along the northern boundary and throughout Purneah! Santal Parganas, along the banks of nalas and in ravines! Mayurbhanj, at higher elevations! Puri! Baud, Daspalla, and Nayagarh in Orissa, Cooper. Fls. May—Oct. Fr. Dec.—Feb. Evergreen.

Branches pubescent. L. obtuse or rounded, or suddenly acute at the tip and with rounded or sub-cordate base; secondary nerves 7—12, strong joining a marginal nerve with strong scalariform tertiaries and nervules. Fls. .15" long, fruiting calyx .3—4" diam. Petals obovate or orbicular, sometimes with a dorsal tuft of hair, alike in both sexes (teste *F. B. I.*) or (in my specimens) toothed in the male only. Female disc densely hirsute at base within.

The fr. is globose in a Purneah specimen, and the sepals densely shaggy with fulvous hairs outside.

23. CLEISTANTHUS, *Hook. f.*

Trees or shrubs, with bifarious entire leaves and small diœcious or monœcious flowers in axillary clusters, clusters sometimes also spicate.

Calyx 4—6-sepalous, valvate, petals, stamens and disc much as in *Bridelia*. Ovary 3-celled, usually with long hairs, styles 3, 2-fid, ovules 2 in each cell. Fruit capsular, 6-valved, or of three 2-valved cocci. Seeds without aril or caruncle. Cotyledons thin or fleshy, often folded.

L. broadly elliptic. Ovary glabrous

1. *collinus*.

L. ovate to lanceolate. Ovary pilose

2. *patulus*.

1. **C. collinus**, *Benth.* Syn. *Cluytia collina*, *Roxb.*; *Lebidieropsis orbicularis*, *Muell. Arg.*; *Parasu*, *M.*; *Paṣu*, *Ho.*; *Kargali*, *S., Kharw.*; *Karla*, *H.*; *Garari*, *Gond.*; *Korora*, *Karada*, *Or.*

A small, rarely moderate-sized tree, with orbicular, obovate or elliptic leaves, 1—4" long by .75—3" broad, glaucous beneath and small green flowers, .25—3" diam., appearing with the new leaves, the males clustered, the females often solitary sessile. Capsules somewhat 3-gonous, woody, chestnut-coloured when ripe, shining, .75—1" diam., sometimes dehiscing with a considerable report on hot evenings.

Central and Southern tracts: Shahabad! Gayal Chota Nagpur, very common on the hills, but local; a large form occurs along talas! Santal Parganas, south of the Brahmini! One of the commonest trees throughout Orissa and Sambalpur! Fls. April—May, occasionally also in Sept. Fr. ripens March—April of the following year. Deciduous March—April.

Bark nearly black, rough, with red blaze. Twigs slender, lenticillate. L. rounded or retuse, both ends with fine reticulate nerves, sometimes slightly silky beneath when young. Petiole .17—25". Stipules deciduous, hairy, shorter than petiole. The fls. are often dioecious, males in few-flowered clusters, females solitary, buds conical, 5-angular, softly pubescent, with minute villous bracts; sepals spreading, often twisted, sometimes .25" in female; petals minute, fleshy, sometimes 0. Disc of male, pulvinate, of female conical, with a thick margin and partly surrounding the glabrous ovoid ovary.

The wood is durable, and is prized for house posts, fences, etc., as it is not attacked by white ants. All parts of the tree are very astringent, and the roots and fr. are poisonous and used to poison fish. Campbell says that the bark is applied in cutaneous diseases. The tree coppices freely, and as it is not eaten by goats it sometimes forms the only vegetation on rocky hills exposed to browsing and is of the greatest assistance in re-afforestation. Makins states that a 5-year-old coppice in Singbhum showed growth of 10 ft. high and 5" girth.

2. **C. patulus**, *Muell.* *Sanahati*, *Sarpatria*, *Or.*

A small tree with close branches and slender glabrescent twigs. Leaves ovate to elliptic-lanceolate and acuminate with rounded base, 2.5—4", rarely 5.5" long, quite glabrous but pallid beneath, with 5—8 slender secondary nerves, looping or reticulate some distance from the marginal nerve, on flowering branches often reduced and nearly white. Petiole .2". Flowers green with white disc and anthers, monoecious or sub-dioecious, 2—3 in a fascicle only; fascicles spicate on new short leafless branches, or in the axils of white bractiform leaves; sepals 4—6, oblong, acute, glabrous, .15" long in female, shorter in male; petals obovate, clawed, crenulate in male, sub-entire in female, disc shortly cylindrical, thin, shallowly crenate, or minutely toothed in male, sometimes deeply lobed in the female, not as long as the globose densely villous, ovary; pistillode large and 3-lobed. Capsule .35" diam., deeply 3-lobed, somewhat silky in the furrows.

Southern tract only. Puri, rocky hill-sides 2000 ft. Mayurbhanj, 2000 ft. and above! Angul, in rocky ravines! Fls. Feb.—April, also found in fl. in July. Fr. April—May.

Bark smooth, exfoliating in thin plates, brown underneath, blaze pink or crimson, then yellowish.

Gamble says that the wood is reddish-brown, hard and close-grained. Weight about 50 lb.

24. FLUEGGEA, Willd.

Shrubs, sometimes thorny, with small distichous leaves, and minute, pedicelled, axillary dioecious flowers, clustered in the leaf axils, or females sub-solitary. Sepals 5, imbricate, sub-petaloid. Male flowers, stamens 5, free, alternating with 5 fleshy disc-lobes or glands, pistillode small, with 2—3 long styles. Female flowers with annular toothed disc, ovary 3-celled (1—3, *F. B. I.*), with long recurved styles connate at the base, entire or 2-lobed above; ovules 2 in each cell. Fruit globose, dry or with white fleshy epicarp, finally loculicidally dehiscent. Seeds not arilled, triquetrous, dorsally convex.

1. *F. obovata*, Baill. Syn. *F. microcarpa*, *Bl.* *Securinea obovata*, *Muell.*; *Xylophylla obovata*, *Willd.*; *F. virosa*, *Baill.*; *Sikat*, *Kharw.*; *Remre-horte*, *S.*; *Patri*, *Or.*; *Bari Pitondi*, *Vern.*

A glabrous, usually straggling shrub, with thin elliptic, obovate, or orbicular thin leaves, mostly 1—3" long, sometimes attaining 4·6 by 2", glaucous beneath. Flowers pedicelled, clustered in both sexes on filiform 17—5" long pedicels. Fruits pretty, white, 3" diam., rarely dry and only 12—17" diam.

Champan! Gayal! Santal Parganas! Singhum, in valley forests, frequent! Manbhum! Ranchi! Hazaribagh! Palamau! Puri, chiefly in the Mals! Sambalpur! Probably therefore in all districts. Fls. May—Aug. Fr. July—Sept. Evergreen, or nearly so, new leaves in May.

Bark thin, nearly smooth, blaze pink. Rarely somewhat climbing or thorny. Branchlets angled or compressed. L. with usually rounded apex, base cuneate, secondary nerves slender and scarcely raised at time of flowering, in mature L. raised and prominent, 5—8, tertiaries rather irregularly scalariform, finely reticulate between. Petiole 12—25" slender. Fls. about 08" diam. only, sepals thin, rounded.

25. AGYNEIA, Vent.

Herbs, or suffruticose with diffuse often angled or compressed stems and small entire leaves. Flowers minute, monœcious, pedicelled, axillary; males clustered; females larger, sub-solitary. Male sepals 6, gland-dotted with thin white margins, disc 6-lobed, stamens 3 with connate filaments, and sub-sessile anthers with longitudinal dehiscence. Female flowers with much larger sepals, sometimes not margined, disc 0, ovary turbinate, with expanded top and slightly depressed centre, with short, 2-fid, thick, spreading styles. Ovules 2 in each cell. Fruit not lobed, splitting into three 2-valved cocci. Seeds slender, curved, hilum long. Embryo curved, with broad flat cotyledons.

L. A. bacciformis, *A. Juss.*

Stems 6—18", spreading, laxly branched, angular, with somewhat woody base. Leaves elliptic to oblong-obovate, .25—5", rarely .75" (in our area), acute or obtuse, apiculate, rather thick, sub-sessile; secondary nerves not evident. Stipules lanceolate or deltoid and auricled, setaceous, bracts subulate setaceous. Male flowers under .05" diam., 2—1-nate, with slender pedicels from the lower axils. Female flowers 1—2 near the top of the branches, .15" diam., with ovate long-acuminate sepals. Capsule very distinct, drooping, oblong-ovoid with truncate tip, .22" long.

Chandpur, Balasore, near the sea! Fls. Fr. May.

26. PHYLLANTHUS, *L.*

Shrubs or herbs with slender branches, often supported by bracts, and bearing small, alternate, distichous leaves, which with the branchlet resemble pinnate leaves and are sometimes deciduous with it, stipulate. Flowers small or minute, monœcious, in axillary clusters or sub-solitary, apetalous; females with usually accrescent perianth and larger than the males. Sepals 5—6, imbricate in two series. Disc in male of minute glands; of female of glands or expanded and often lobed. Stamens 3, with filaments united into a short column, anthers oblong or didymous, sometimes connivent or spreading, but never connate, 2-celled, cells linear or oblong with vertical dehiscence or subglobose, and often confluent with vertical or transverse dehiscence, connective produced or not. Ovary 3-celled. Styles 3, free or connate at base, often flattened, 2-fid or 2-lobed. Fruit of three 2-valved cocci, rarely with a sub-succulent epicarp. Seeds 3-gonous, with rounded back, strophiolate.

NOTE.—*Phyllanthus* is here limited to the sections *Paraphyllanthus* and *Euphyllanthus* of Mueller (in *DC. Prodrromus*) and the *F. B. I.*

I. Anthers with vertical dehiscence, usually oblong.

A. Shrub. L. linear-oblong. Anthers apiculate

1. *Lawii*.

B. Herbs.

1. Anthers with connective apiculate or mucous.

L. cuneate-obovate. Capsule smooth

2. *maderaspatensis*.

L. oblong to linear-oblong. Capsule verrucose

3. *urinaria*.

L. oblong to linear-oblong. Capsule sub-succulent

var. *lævis*.

2. Anthers very short, connective, with crescentic crest

4. *simplex*.

II. Anthers with transverse dehiscence (exc. perhaps in 8).

A. Erect herbs, sometimes suffruticose below.

L. elliptic oblong. Female fl. .06" diam. in. fr.

5. *niruri*.

L. elliptic, .5—.75". Male and female fls. .1" diam.

6. *debilis*.

B. Small prostrate herbs with very small leaves.

L. .1—2". Fls. .1—2" diam.

7. *rotundifolius*.

L. .1—15". Fls. under .05" diam.

8. *nanus*.

1. P. Lawii, *Grah.* Tirsibirsi, *M.*; Jhawar-khandera, *S.*

A pretty shrub with numerous erect rigid stems, 3—4.5 ft. high, densely clothed with spreading leafy branchlets with very close often raised nodes and persistent stipules. Leaves distichous, crowded, sub-sessile, .1—3" long, linear-oblong, obtuse, glaucous, with sub-cordate

base and 3—4 faint secondary nerves. Flowers minute, pink, solitary or few in nearly all the axils. Fruit nearly dry .12—.17" diam., smooth.

Gregarious along the banks and in the beds of rocky rivers with a constant water supply. Throughout the area, but local! Fls., Fr. Jan.—March.

Branches terete, glabrous. Stipules narrowly subulate, 3—4 times the minute petiole. Pedicels .06—.12" long. Male fl. sepals .05—.1" long, outer oblong, inner rather smaller, oblong or obovate-oblong. Disc of 6 peltate glands. Anthers slightly apiculate, erect, linear-oblong; combined filaments at first very short, finally as long as the anthers. Female sepals .06—.1" long, oblong-obovate. Ovary 3-lobed and lobes again slightly channelled. Styles flattened, sub-erect, connate only at base, with two spreading lobes. Seeds smooth, microscopically pitted, reddish.

2. *P. maderaspatensis*, L.

Erect, herbaceous or suffruticose, 12—16" high, with ascending, glabrous, angled branches, and usually cuneate-obovate leaves, .25—.8", rarely 1", glabrous with rounded and apiculate apex. Stipules large, persistent, .08", lanceolate, acuminate, scarious, basifixed or peltate (F.B.I.). Flowers numerous on the under side of the branchlets, males usually fascicled with one much larger female .1—.15" diam. in fruit and with a pedicel about .06" long. Capsule smooth, depressed, globose, .1—.12" diam., shallowly 6-lobed.

Not common. Behar, Kurtz! Balugaon, Puri, Hooper! Fls., Fr., Feb., March, Aug. and Sept.

Sometimes decumbent below. L. sometimes truncate or retuse, usually rounded at apex; secondary nerves 4—6, oblique, not looping. Male fls. .05" diam. with rounded or obtusate sepals. Disc of glands in both sexes. Anthers free above with longitudinal dehiscence. Female sepals obovate, or inner oblong-obovate green with white margins, sometimes keeled within. Styles free, minutely 2-lobed. Seeds striated in lines of dots.

3. *P. urinaria*, L.

A suffruticose annual, with slender erect stems, 6—18" high, somewhat compressed or angular, with numerous spreading leafy branchlets resembling pinnate leaves, 1.5—3" long, with ovate setaceous-acuminate stipules at their base, .12"—.15" long. Leaves small, distichous, upper imbricate, .12—.4" long only on some plants, up to .6" on others. Flowers minute, reddish, axillary, but secund and appearing to be borne in a continuous row on the under surface of the branchlets; both sexes sessile or sub-sessile, the larger female under .1" diam. Capsule depressed, globose, usually minutely, densely verrucose, seeds with marked transverse furrows on the back and faces.

Very common and probably in all districts, in the rains. Fls., Fr. July—Dec. Annual.

Stems often reddish. L. oblong or linear-oblong, apiculate, base unequal, margin minutely cillolate, beneath glaucous, with 4—5 fine secondary nerves looping within the margin, one usually near base, subsessile, stipules subulate or filiform, .05—.07". Clusters of fls. functionally 1-sexual, the males first developing and deciduous, and subsequently the females, so that the lower ones appear all female. Male .04—.05" diam., sepals oblong, white, often with red centre, ciliate in the type; stamens 3; anthers erect, connivent, not connate, broader than long, but dehiscence longitudinal; filaments very short, connate (in our specimens, free, F. B. I.), disc glands 6, most minute, peltate. Female fls. .07" diam., sepals linear-oblong, spreading, with red centre, stigmas (styles?) broad spreading, connate at base, with 2 minute spreading lobes.

Var. *lævis*, *Haines*.

This appears to differ from the type in the basifixed stipules, the quite glabrous sepals, connate filaments (very short, and I doubt the type being free as described). The fr. is quite smooth and sub-succulent when fresh! Swampy places, Neterhat, 2500 ft.!

The leaves exhibit sleep movements like the leaflets of a true pinnate leaf.

4. *P. simplex*, *Retz.*

A herb with numerous slender branches from a somewhat woody stock; stems 1—2 ft. high, terete, with a keel on one or both sides decurrent from the leaf bases, or distinctly compressed, glabrous, with very long slender branches and more or less secund or distichous linear-oblong leaves, .3—1.3" long, subsessile, with secondary nerve scarcely visible beneath. Flowers minute from an axillary cluster of minute bracts, about 2, very shortly pedicelled, minute males, and usually one long-pedicelled female from each cluster. Female pedicel in fruit .2—·3" long, clavate above. Capsule depressed, globose, .12" diam., smooth and glabrous, or sometimes slightly pubescent or minutely warty.

Common, probably in all districts. Monghyr Hills. *Kurz!* Singbhum, very common in open places and low jungle in the rainy season! Manbhum, common! *Grissa, Hooper!* Fls., Fr. Aug.—Dec. It is not usually seen much after Dec. and is, I think, annual in our area.

L. narrowly elliptic-oblong in Monghyr specimens; often distichously imbricate when young, rather thick with prominent midrib, and about 5 slender looping secondary nerves visible above, beneath glaucous, base rounded or sub-cordate, apex acute or obtuse and mucronulate. Stipules very small, triangular, often with an auricled base on one side (described as peltate in *F. B. I.*, but rarely so). Male fl. about .03" diam., column subsessile, with connectives terminating in three curved ridges above the broadly oblong 2-celled anthers which dehisce longitudinally. Disc of broad lobes (glands?). Female fl. .06—·07" diam., sepals ovate-oblong, larger in fr., disc annular wavy, ovary minutely mammillate, styles spreading flat on the top of the ovary, grooved, with 2 recurved stigmas. Seeds with lines of most minute warts, or practically smooth.

5. *P. niruri*, *L.* Jar-amlā, *H.*; Bhuiamla, *Beng.*

An erect, very slender glabrous annual, about 1 ft. high, with very numerous spreading or erecto-patent slender branches, 4—6" long, looking like pinnate leaves. Leaves elliptic-oblong, more rarely somewhat obovate or linear-oblong, distichously spreading, .15—·75 long. Flowers minute, green or whitish, about 2—3 male and one female in an axil, males on pedicels .03—·04" long only, sepals .03". Female flowers much smaller than in *P. debilis*, with calyx about .06" diam. in fruit, with oblong sepals. Fruits small, globose, forming a row on the under side of the branchlet, glabrous, .08—·12" diam., on pedicels .2—·3" long. Seeds each a one-sixth segment of a sphere, brown with vertical lines (of minute dots) and transverse slender striæ.

A common weed, probably in all districts. Fls., Fr. r.s.

Branches angled, usually 2-edged. L. sensitive, base obtuse, apex obtuse or acute, secondary nerves 2—4, obscure. Petiole hardly any, stipules ovate, acuminate, or subulate. Male: sepals orbicular, anther-cells 3, on top of short column, most minute, with transverse dehiscence; disc glands 6, very minute. Disc of female patelliform lobed. Styles minute, free, 2-lobed. Capsule sometimes minutely granulate.

The plant is considered de-obstruent, diuretic, astringent and cooling, and is administered in jaundice, dropsy and genito-urinary affections. A bitter principle called Phyllanthin has been isolated from it. (*Nadkarni*.)

6. *P. debilis*, Ham.

An erect slender herb or undershrub, 1—3 ft. high, with straight single stem and many erect-patent or spreading branches, which are 2—4-edged and frequently microscopically toothed on the angles. Leaves distichous, elliptic or elliptic-obovate, .5—.75" long, obtuse or rounded at apex, glabrous. Stipules narrow-lanceolate, with setaceous tip, often twice the very short petiole. Flowers all shortly pedicelled in small bracteate axillary clusters, or sometimes on distinct peduncles, densely clothed with imbricating, linear-acuminate, white nerveless bracts, and often .1" long. Male campanulate, about .1" diam. (when opened out), sepals 6, subequal, oblong or outer larger elliptic-oblong; disc glands 6, filaments combined into a *distinct column* (*free, F. B. I.*), with very short, free portion above and broadly-oblong anthers, with transverse dehiscence. Female flower on a clavate pedicel longer than that of the male, and sometimes attaining .1" in fruit; sepals spreading, green with white margins, oblong-spathulate or obovate-oblong, .08—.1" long. Capsule smooth, slightly over .1" diam.; seeds pale, with numerous curved parallel lines of microscopic raised red dots.

Chiefly in shady places, common in the forests. Probably in all districts. Purneah! Monghyr, Kurz! Rajmahal Hills, Kurz! Gaya! Palamau, ascending to 3000 ft., common! and throughout Chota Nagpur, ascending to top of Parasnath! Often perennial with deciduous branchlets and leaves. Fls., Fr. May—Jan.

Stems often woody, terete with raised lines below. L. with rounded or cuneate base, lower surface pale, microscopically papillose, with 4—5 slender, very fine secondary nerves, margin thickened.

7. *P. rotundifolius*, Klein.

A pretty little plant with prostrate and ascending numerous stems 8—18" long, and small round leaves .1—.2" diam. only, pinnately arranged on numerous lateral branchlets 1—1.5" long. Petiole distinct, one-fifth as long as the leaf. Male flowers .1" diam. (when opened out), often on short bracteate peduncles as in *debilis*. Structure of the flowers exactly as in *debilis*, from which it is very easily distinguished by the leaves and habit as well as the short pedicels (under .1" in fruit).

Sea coast, on the sands, Puri! Fls., Fr. Sept. Perennial.

Rootstock rather woody. L. apiculate, glabrous or minutely pubescent beneath, margin thickened, secondary nerves obscure. Female fls. .2" diam., sepals ovate or ovate-oblong, white with green mid-rib, disc annular and gland-papillose as in *debilis*. Disc of male of minute green glands or glands larger and papillose. Capsule pale. Seeds pale brown, smooth, with fine curved raised lines.

8. *P. nanus*, Hook. f.

Resembles a very dwarf *P. niruri*, with spreading branches or stems, 3—6" long only, and very small oblong leaves .1—.15" long. Female flowers with oblong obtuse or suddenly acute sepals.

Hooker says "this resembles a minute, rigid, branched *Niruri* and has similar styles, but is smaller in all its parts with differently ribbed seeds." A drawing on the sheet shows, however, the short didymous anthers with vertical dehiscence.

The seeds are longitudinally striate with short transverse striæ.

The species is added to our Flora on a note by Col. Gage in *Herb. Kew* that "this (a Burman specimen of *P. nanus*) agrees with the specimen of *Phyllanthus sanphalia*, Ham., No. 2093, in *Herb. Ham.*, at Edinburgh, and collected at Monghyr.

27. PROSORUS, Dalz. (*Phyllanthus*, sec.)

Dioecious small trees with deciduous branchlets and leaves more or less pinnately arranged. Flowers small in clusters, mostly below the leaves, in the axils of caducous bracts on the new shoots, sepals in two unequal pairs. Disc of male large, flattened, faintly lobed, sometimes narrower in the female. Filaments 4, opposite the sepals from inside the disc, with oblong anthers and longitudinal dehiscence. Styles 3, stout spreading 2-fid. Fruit with thin dry epicarp, bursting irregularly, and enclosing 3 thin-walled 2-valved cocci. Seeds usually blue. The genus was included in the section *Cicca* of *Phyllanthus* by *Muell. Arg.*, but the 3-locular ovary and dry fruit is rather that of *Phyllanthus* proper.

1. *P. indicus*, Dalz. Syn. *Phyllanthus indicus*, *Muell.-Arg.*

A small straight tree, with white bark, glabrous, with broadly elliptic obovate, or elliptic-oblong obtuse, or sometimes shortly acuminate leaves, at the time of flowering very membranous and only 1—3" long, finally 2—6" long. Male flowers very small, green, on slender .2—·25"-long pedicels, in dense clusters, mostly below the leaves on the new shoots. Females in similar positions but fewer, .1—·15" diam. Fruit .4" diam., depressed globose.

Mals of Orissa, on the higher hills, not common! Fls. April—May on the new shoots. Deciduous Feb.—March.

Blaze white with chlorophyll (but I have only seen small trees in our area). Branches covered with white lenticels. L. glaucous when mature, with 5—7 fine secondary nerves, soon reticulate. Petiole .25". Stipules oblong-lanceolate, acute, .1", base sometimes sub-hastate. Sepals green, membranous, oblong or obovate-oblong, reflexed. Female pedicels often .5" long and stouter.

28. EMBLICA, Gäertn.

Trees with small leaves pinnately arranged on short lateral branchlets, which are supported by a small bract and two stipules, and are often deciduous. Juice somewhat milky. Stipules minute, scarious. Flowers minute, axillary, and from axils of scales below the leaves, secund towards the lower surface. Female flowers chiefly in the lower axils, but mixed with the males, and with shorter pedicels. Sepals 6 (—5). Filaments connate into a slender column, anthers 3, free, but broad connectives connivent back to back, cells with vertical dehiscence. Disc 0, or of distinct glands in male, cupular in female. Ovary 3-celled, styles more or less connate below, 2—3-fid or twice 2-fid above. Ovules 2, collateral in each cell. Fruit a drupe with woody, 3-celled, 6-grooved endocarp.

1. *E. officinalis*, Gäertn. Syn. *Phyllanthus emblica*, *L.*; *Cicca Emblica*, *Kurz*; *Amla*, *Aonla*, *Amlika*, *H.*, *Beng.*; *Aura*, *Or.*; *Miral*, *K.*; The Emblic Myrabolan.

A small or moderate-sized tree, with greenish-grey or red bark, peeling off in scales and long strips and with pretty feathery grey foliage. Branchlets hairy, 3—8" long, with close-set, distichous, linear, glabrous, margined leaves, 3—7.5" long, imbricate when young. Stipules fimbriate, or with a hair tip. Flowers densely fascicled, yellowish on the new shoots, males on slender pedicels, females sessile, few. Fruit globose, succulent, yellow or pink when ripe, .7—1" diam., with a 6-ridged putamen (not of cocci) which is tardily dehiscent at the ridges.

Common throughout the area and in all situations. Fls. Feb.—May. Fr. Oct.—April (often ripe in Oct.). Deciduous March—April.

Bark of young trees quite smooth, greyish-white, blaze pink, in old trees hard and dark crimson.

Wood fairly good and much used for native houses, also for agricultural implements. The fruit contains much gallic acid and is astringent but sialagogue, and hence is often taken by Indians in the forest when thirsty. *Mr. Fraymouth* says that as a tannin material he had nothing good to say of either fruit or leaves though they contain a high percentage of tannin, but that the twig-bark has proven of great value as a light tan-stuff, and might take the place of a third of the Tarwad now used (1917). The fr., fresh and dried, is largely used in Hindu medicine, different preparations being diuretic and laxative or useful in diarrhoea and dysentery and in dyspepsia. It is eaten as a cure for cough in Chota Nagpur, and the juice of the fresh fr. as well as an infusion of the seeds for inflammation of the eyes. *Campbell* says that, boiled till it becomes of an oily consistency, it is used for Khasra (a skin disease). The frs. boiled with sugar make an excellent preserve.

The growth of trees which were raised from seed at Chaibassa was 37 ft. in height and 26.5" girth in 16 years. It coppices easily, but requires to be cut low down or the shoots are produced above the ground.

29. CICC[A], *L.*

Characters of *Emblica*, but leaves larger and flowers usually 4-merous. Filaments free. Clusters of flowers usually racemed from the reduction of leaves on the branchlets, clusters with several males and 1—2 females. Ovary 3—4-celled and -lobed with 3—4 spreading 2-fid stigmas. Drupe usually 3—4-lobed with 3—4-angled putamen.

1. *C. disticha*, *L.* Hariphal, *Beng.*; Nurce, Nurphal, *H.*; Aura-kuli, Bungarada, *Or.* Star Gooseberry.

A small or moderate-sized tree with very thick branches closely marked with the scars of the deciduous branchlets, and often tuberculate, bearing a terminal cluster of what look like pinnate leaves, 6—15" long, with a number of small bracts at their base, and subtended by a bract and its two stipules. Leaves (the apparent leaflets) 1—2.5" long, at base of the rhachis shorter and roundish, the upper larger ovate-lanceolate acute, somewhat pale glaucous beneath. Stipules minute, subulate. Flowers mostly in slender racemes from the tubercles, rarely 2-sexual, males red, minute, sepals 4, imbricate in pairs, stamens 4. Females green, larger, sepals 4, two usually larger than the others, ovary shortly stipitate with 3—4 spreading 2-fid styles. Fruit much depressed, globose, and 6—8-grooved, about .7" diam.

Frequent in gardens. Fls. May. Fr. June—July.

The green leaves are eaten as a sag and the acid fruits are eaten cooked and as a preserve.

30. KIRGANELIA, *Baill.*

Slender shrubs, usually sarmentose, or sometimes climbing by means of hardened reflexed stipules and bract at the base of the shoots, branchlets often deciduous. Leaves small or moderate-sized, pinnately arranged on the slender branchlets, stipules lanceolate entire, basifixed. Male and female flowers mixed in axillary, few-flowered clusters, sometimes paired, clusters sometimes appearing racemose, from the reduction of the leaves on special branchlets. Male sepals 5, imbricate, 3 inner often larger and sub-petaloid, disc of 5 fleshy glands, stamens 4—7 or usually 5, free or inner 2—3 with connate filaments, anthers with cells obliquely adnate or parallel, dehiscence longitudinal. Female flower like the male in size, perianth and disc glands. Ovary 5—12-celled, with as many minute, sessile, fleshy stigmas, or half as many 2-lobed stigmas. Ovules 2, superposed in each cell. Fruit with fleshy exocarp and softly coriaceous 5—12-celled endocarp, seeds usually fewer than twice the number of cells.

1. **K. reticulata**, *Baill.* Syn. *Phyllanthus reticulatus*, *Poir.*; Panjoli, *H., Beng.*; Jandaki, *Or.*

A sarmentose shrub with slender, glabrous or pubescent branches, and elliptic or oblong leaves, .5—1.75" long. Flowers green or purple, campanulate, male and female sub-similar on slender pedicels, .15—.25" long, usually one male and one female in each axil, sometimes racemed, inner sepals .05—.06" long, elliptic, rather broader and often orbicular in fruit in the female, up to .075" in fruit. Berries black, .2" diam., usually 8—10-seeded.

Throughout the whole area, chiefly in hedges along naals. Fls., Fr. most of the year, chiefly Feb.—May, more or less leafless Jan.—Feb.

Leaves sometimes attain 3" in length, rounded both ends, pale beneath, dark green above, sec. n. 6—8, slender. Petiole .1—1.5". Stipules lanceolate, shorter than or equalling the petiole, occasionally hardening.

31. GLOCHIDION, *Forst.*

Trees or shrubs, usually evergreen, and with alternate bifarious, entire shortly petioled leaves. Flowers small in axillary clusters, usually monœcious. Male flowers usually yellowish, with 6, rarely 5, spreading sepals in two series, anthers connivent or connate in a sessile or subsessile column, with longitudinal dehiscence, connectives more or less produced with free tips or connate in a small head. Disc 0. Pistillodes usually 0. Female: calyx shortly tubular, 6-toothed or cleft, or sepals 2-seriate, nearly free. Ovary 3—15-celled, styles connate in a column, lobed or toothed at the tip, or minute sunk in the depressed crown of the ovary. Ovules two in each cell. Fruit of three or more 2-valved cocci with epicarp sometimes separately dehiscent, lobes of fruit often twice as many as the cells. Seeds usually laterally compressed, sometimes with a red aril-like coat.

1. Fr. much depressed, distinctly lobed, intruded both ends.

Glabrous shrub. St. 4—12, connectives very short

Small pubescent tree. St. 3, connectives long, white

1. *multiloculare*.

2. *velutinum*.

II. Fr. not much depressed nor intruded at the ends, not deeply lobed when fresh.

A. Glabrous small trees.

1. Stamens 3, connectives umbonate. Fr. .2" diam. 3. *assanicum*.
2. Stamens over 3. Fr. over .25" diam.
L. 3—6", base cuneate. Connectives long. Fr. .6—7" 4. *lanceolarium*.
- L. 4—9", base rounded (at least on one side). Connectives free, but very short. Fr. .3—4" diam. . . . 5. *zeylanicum*.

B. Tomentose or pubescent small trees, otherwise as in 5. Var. *Talboti*.

1. *G. multiloculæ*, *Muell.-Arg.* Nanha-bania-Kandhum, S.

A dwarf usually gregarious bush 3—4 ft. high, with the twigs sharply usually 2-angled and flexuous. Leaves 2—5" long, lanceolate, linear-oblong or narrowly obovate, glaucous, sometimes purplish beneath, secondary nerves oblique, 5—7, slender. Male flower small, shortly pedicelled, with 4—12 anthers, female flower large, stoutly pedicelled, calyx .37" diam. in fruit which is .75—1" diam., 10—15-lobed, intruded base and apex.

In the moister regions, and usually in grass lands. Champaran! to Purneah! Monghyr, *Ham.*! Manbhurn and Santal Parganas, near river beds! Fls., Fr. April—Oct. Evergreen.

Leaves acute or obtuse apiculate, tertiary nerves numerous, sub-parallel, raised beneath but fine. Petiole .1". Male fls. .12" diam., sepals oblong. The male inflorescence is often monstrous, of numerous short branchlets, clothed with imbricating bracts. Style a depressed cone or umbo with hollowed top, rayed. Capsule three times as broad as high, with thin separable epicarp and the cocci also falling away from the conical carpophore, leaving the red arilled seeds attached to the axis.

2. *G. velutinum*, *Wight*.

A small tree with nearly all parts pubescent or tomentose. Leaves 3—6" (sometimes smaller at base of shoots), elliptic to oblong or oblong-lanceolate, sometimes oblique, base usually cuneate, apex acuminate or with a short rounded tip, persistently pubescent on the nerves beneath, secondary nerves 4—7 strong, united by scalariform tertiaries. Monœcious or sometimes diœcious, males yellow, .17—19" diam., sepals and petals subequal, pale yellow, narrowly oblong-lanceolate, obtuse, outside pubescent, anthers 3, connectives produced into a broad subulate white point, about one-third as long as the cells. Female green, sepals 6, very pubescent, linear to oblong, styler column in the very young flower often as broad as the ovary, and longer than the small sepals, or somewhat narrower than the ovary, often far exserted, pubescent except at the tip, terete, or slightly dilated above, stigmas 4—6. Capsules .3—4" diam., flattened and depressed both ends, fruiting pedicels .1—3".

Champaran Hills! Singbhum, in valleys, not common! Usually on the higher hills, Ranchi and Palamau, elev. 2000 ft. and above! Hazaribagh, on Parasnath! Sambalpur, occasional! Fls. on the new shoots April—May. Fr. June—Aug.

Bark brown and rough, blaze crimson. Twigs often hirsute pubescent. Leaves sometimes ovate, base rounded or acute. In a high Ranchi form (Ichadagh) somewhat falcate, obtuse or obtusely acuminate, glabrous between the nerves when mature. Petiole .15—3". Stipules subulate. Male pedicels .25—4", fem. in flower, .1—2" long. Capsule usually 10-lobed, pericarp dehiscent on the tree, leaving the red seeds attached to the axis.

3. *G. assamicum*, Hook. f.

A small leafy tree, with angled or almost 2-winged green branchlets, sometimes slightly pendent. Leaves usually 3—5" at flowering time, afterwards 4—6", elliptic-oblong, acuminate or cuspidate, with rounded or oblique base, mature often very like those of *G. lanceolarium*, shining both sides with 3—5 secondary nerves. Male and female flowers from the same axils. Male glabrous, .12" diam., on slender capillary 3—5" long pedicels, anthers 3, connate, very short, with connectives terminating in an umbo. Females often very numerous, sepals 6, nearly free, erect, alternate larger, outside hispid. Ovary 4—5-lobed, sessile, pubescent, style conical, short, glabrous, 8-sulcate, and apex 8-toothed. Fruits .2" diam., usually crowded at the axils, with 4, rarely 5, sometimes only 3 loculi.

Bettiah, *Hieronymus*! Ramnagar! Fls. April—May. Fr. Oct.—March. Probably also Purneah.

4. *G. lanceolarium*, Dalz. Bania-Kandhum, S.; Kalchua, Chikni, Or.

A small glabrous tree, or often flowering as a shrub, with green rather flexuous and angular twigs, coriaceous dark green (grey-green when dry) shining leaves, usually narrowly-elliptic or elliptic acuminate, or oblanceolate, 3—6" long, with usually obliquely cuneate base and slender secondary nerves, curving up within the margin. Male flowers numerous, clustered, axillary, yellowish, .2—3" diam., on slender pedicels, .3—7" long, with 4—6 anthers. Female flower green, 1—3 or more together, .12" long, narrow-campanulate. Capsule orbicular, somewhat depressed, .65—7" diam., pale, not deeply lobed, sessile or pedicelled.

Champan, not very common! Gaya! Santal Parganas! Common throughout Chota Nagpur, especially along streams! Frequent throughout Orissa! Sambalpur! Fls. March—May. Fr. Sept.—Jan. New shoots in March. Evergreen.

Bark smooth grey, striate, with a delicate pink blaze, reddish on the wood. Leaves mostly 4.5—6.5", rarely attaining 7" by 3.5", those at base of twigs much smaller and relatively broader; sometimes oblong or broadly elliptic and cuspidate. Petiole .25". Stipules .12", acuminate, sometimes hardened. Perianth 2-seriate, outer spreading, inner often erect, male sepals narrowly oblong, connectives long, subulate, as long as the cells, free. Fem. outer sepals oblong lanceolate, 3—4, inner narrower. Ovary stalked, villous, styles united into a 6—8-toothed tube, pubescent without, swollen below. The red seeds often persist after dehiscence of the capsule.

"Bark given medicinally when the stomach revolts against food," *Camp*. The seeds give an oil used for burning.

The fruits are sometimes converted into large crimson 6—8-celled bodies, without seeds, due doubtless to a parasite.

5. *G. zeylanicum*, A. Juss. Syn. *G. tomentosum*, Dalz (in part).

A small tree, quite glabrous or densely pubescent, with shining ovate-lanceolate, or oblong, often curved or oblique leaves, attaining 9" by 3.75", with rounded or cordate base on one or both sides and acute or shortly acuminate apex, secondary nerves 6—9, petiole short, stout, .15—25". Flowers monœcious. Male .25" diam., yellowish-green or reddish on pedicels .25" long, stamens 5—7, not connate but connivent, filaments hardly any, connective shortly produced, with short free tips,

pistillode small. Female outer sepals erect, reddish, suborbicular, styler column with 5—6 minute lobes. Fruit '3—'4" diam., depressed globose, not lobed (when fresh; it is in the herbarium), apex not intruded, beaked by the styler column, pedicel scarcely '2" long.

Along streams. Athmallik! Sambalpur (Katabaga and Hathibari forests)! Fla. Feb.—May. Fr. may be found up to the following flowering season. Evergreen.

Attains 2.5 ft. girth. Bark dark. Leaves sometimes bullate, those at base of twig often only 3", tertiary nerves scalariform, stipules small, subulate hardened and sometimes recurved or deciduous. Male flowers several in same clusters with female in usually supra-axillary clusters, sepals imbricate in bud, '13" long, broadly elliptic-oblong recurved, inner narrowly obovate-oblong, adnate at base with the outer. Fem. outer sepals erect, suborbicular, inner larger, oblong, pedicels shorter and stouter than in male. Frt. sometimes slightly 5—6-gonous, epicarp thin, rupturing before the deeply lobed endocarp.

Var. **nitidum**, Dalz. & Gibs. Quite glabrous. The localities quoted above.

Var. **typica**, Pubescent. Mayurbhanj, Hooper! Angul!

Var. **Talbotii**, Syn. *G. tomentosum*, var. *Talbotii*, F. B. I.

Leaves grey tomentose or densely hairy on the nerves beneath, less so between, above thinly hairy. Lower stipules ovate, upper lanceolate acuminate, '15", often reflexed, petioles tomentose-hairy, '2". Male outer sepals broadly ovate, '12", inner '07", nearly glabrous, ovate-oblong.

Along streams. Athmallik!

Cooke says that the fls. are in supra-axillary umbels in *zeylanicum* and axillary in *G. tomentosum*. Specimens do not confirm this difference.

32. BREYNIA, Forst.

Shrubs or small trees, with leaves small, entire, and often resembling pinnate leaves. Flowers minute or very small, monoecious. Male turbinate, truncate, fleshy, with the small rounded sepals inserted towards the centre of the truncate top, which is often slightly lobulate at the margin, sepals 5—6, usually inflexed, and nearly closing the mouth. Stamens connate into a sub-sessile column, with the three 2-celled anthers closely connivent or connate, connective not or slightly produced, dehiscence longitudinal. Female flower with turbinate, campanulate, or with coriaceous rotate broadly 5—6-lobed calyx, sometimes very much larger than in the male, and accrescent in fruit, disc 0 in either sex. Ovary globose or truncate, or depressed at the top, 3-celled, with either 3 sessile or sub-sessile 2-lobed spreading or inflexed styles, or stigmas 3 minute, sessile, sunk in the fleshy top of the ovary. Ovules 2 in each cell. Fruit more or less fleshy and coloured, 6-valved, or with 3—6-cocci. Cotyledons broad, radicle long.

Not always easily separable from *Sauropus*. Pax (in *Nat. Pflanz. Fam.*) distinguishes it by the calyx at the base not being thickened by union with disc-glands or scales, whereas in *Sauropus* the calyx-lobes are strongly thickened in this way.*

M. fl. '08".	Fem. fl. campanulate, calyx in fruit small	1. <i>rhamnoides</i> .
M. fl. '1—'17".	Fem. fl. rotate, '2" diam. to '5" diam. in fruit. Styles short spreading 2-lobed	2. <i>patens</i> .
	Calyx of <i>patens</i> , but stigmas minute sessile as in 1	3. <i>cernua</i> .

* See note under *Sauropus*.

1. *B. rhamnoides*, *Muell.* Kadrupala, Karki, S.; Jajan, Or.

A pretty shrub when well grown, 4—10 ft. high, with the spreading branchlets resembling pinnate leaves. Leaves close-set, distichous, glabrous, 3—1" long, or sometimes attaining 2·2". Flowers minute, monœcious, or rarely diœcious, green, yellow or pinkish, solitary rarely in axillary few-flowered clusters, male and female often on separate twigs. Male turbinate, ·08", with the inflected lobes nearly closing the mouth. Female solitary, always green, campanulate, 6-lobed, with a large ovary soon exceeding the erect calyx, with a fleshy raised rim more or less 5—6-lobed, inside which are 3 inflected stigmas or rarely 5. Berries red, usually numerous, but only one from each axil, ·2" diam., globose-ovoid or globose with a hollowed umbo, seated on the enlarged spreading calyx, which, however, is not as broad as the diameter of the fruit.

Throughout the Province but not at all common, chiefly in moist open glades. Ramnagar forests! Muzafferpur (with sarmentose branches)! Santal Parganæ along streams, frequent in the North! Manbhūm! Athmalik State! Puri, frequent!

Fls. March—Dec. Fr. March—Jan., practically all the year. Evergreen.

Bark light-coloured. Shoots often 2-edged but without raised angles from the stipules. L. elliptic-ovate or elliptic, rounded or somewhat retuse, pale beneath, base obtuse or cuneate, rarely rounded, sec. n. 3—5, fine, tertiaries very fine, not much reticulate, often joining up the secondaries. Petiole ·1—·15". Stipules very short triangular or ovate-acuminate. M. fls. sometimes on minute shoots closely clothed with bracts, pedicels ·1". Fem. sepals from triangular-ovate to cordate (in same flower). Ovules linear or linear-oblong.

2. *B. patens*, *Benth.* Jajan, Or.

A pretty little shrub, 3—4 ft. high, somewhat resembling the last superficially, from which it may easily be distinguished by the young branchlets having a raised pair of lines from the stipules, as well as from the petioles, so that they are 4-angular, the male flowers are larger and more numerous, usually 2—3 from an axil, ·1—·17" long, with the anther columns often exerted, and with more slender pedicels. Female much larger, the calyx spreading from the first, ·2" diam., enlarging to ·5" diam. in fruit. Pistil very different, the style being central, with 3 spreading 2-fid short arms. Fruit flattened both ends, brilliant carmine when ripe, ·3" diam. on the crimson calyx.

Rare in our area. Puri, fairly frequent in open jungle! Possibly occurs in Northern Purneah. The Chota Nagpur locality in *Bengal Plants* and *F.C.N.*, seems to be an error, Campbell's specimen being *B. rhamnoides*! Fls. Fr. April—July.

L. mostly elliptic-oblong, ·5—8". Sec. n. 2—4, usually 1 from base. Stipules lanceolate. M. fl. often ·1" diam. at mouth, pedicels ·2—·25", filiform. Fem. sepals broadly obovate, pedicels shorter, stouter, in fruit ·2" and clavate upwards.

3. *B. cernua*, *Muell.-Arg.* Syn. *Phyllanthus cernuus*, *Poir.*; *P. nivosus* *W. G. Smith* (an excellent figure in *Floral Magazine*, 1874), the name usually given in horticultural gardens.

A pretty shrub, with leaves somewhat like those of *B. rhamnoides*, elliptic or broadly ovate, 1—2" long, with rounded tip, and obtuse to retuse base. It is conspicuous by the new shoots and their young leaves being pink or white.

Very commonly grown in gardens and verandahs. Fls. April. It is apparently a native of Polynesia (Timor).

Older branches with red-brown striate bark. Stipules linear-subulate. Fls. solitary monœcious. Male perianth turbinate truncate, lobes round the mouth erect rounded, staminal column shortly stipitate, connective slightly produced, truncate, 3-gonous. Fem. perianth 3" diam. even before fruiting, salver-shaped, with 5 shallow retuse lobes and the ovary turbinate slightly 3-lobed truncate, sessile in the tube, stigmas 3, fleshy, minute, inflexed very minutely 2-lobed.

33. SAUROPUS, Blume.

Shrubs or undershrubs with distichous entire leaves as in *Breynia*, but often moderate sized. Flowers axillary, monœcious, solitary or clustered. Male flower turbinate, disciform or urceolate, outer rim entire or deeply lobed, inner edge with 6 minute lobes or thickenings towards the centre which meet closely round the staminal column, often covering it in bud. Stamens 3, combined into a 3-gonous truncate column, with the discrete anthers sessile on the angles, cells linear or subglobose-oblong. Female flower often larger, perianth 6-cleft, persistent accrescent. Ovary ovoid or globose, with rounded or concave top, 3-celled, styles 3, usually on the broad margin of the ovary, sessile depressed, spreading with 3 recurved or incurved arms. Ovules 2 in each cell. Fruit globose or depressed, fleshy or coriaceous, 6-valved or rupturing irregularly, with 6 indehiscent 3-gonous cocci.

There appears to me to be no essential difference in the structure of the calyx in *Breynia* and *Sauropus*. The outer rim of the calyx is often slightly lobed in *Breynia*; it varies from sub-entire to very deeply lobed in *Sauropus*; the so-called superficial thickenings or scales in *Sauropus* are homologous with the so-called sepals or perianth lobes in *Breynia*. The best distinction of the genera unless they be reconstituted and arranged according to the condition of sessile stigmas or 2-lobed styles, appears to be the three-gonous column with discrete anthers and the discrete styles in *Sauropus*, the anthers in *Breynia* are sub-connivent round the terete column and more elongate, the stigmas or bases of the styles are central. The perianth of the female flower is also usually more deeply lobed in *Sauropus* than in *Breynia*.

Outer perianth lobes broadly oblong, retuse. L. pubescent
Outer perianth lobes linear-oblong. Leaves glabrous

1. *pubescens*.
2. *quadrangularis*.

1. *S. pubescens*, Hook. f.

An erect undershrub, 3—4 ft. high, often tomentose when young, branchlets compressed, often 2-ridged or subulate, permanently pubescent, leaves small, broadly ovate or elliptic, 5—1.25" long, pubescent beneath even when old, distichously arranged on the obliquely spreading short branchlets. Flowers minute, red, .08—1" diam., perianth lobes of male obovate retuse, with inflected rounded ligule or scale (or sepal? see above) on a level with the top of the staminal column, alternately over the grooves and opposite the anthers, the former larger, cells very shortly oblong. Female flower larger with rounded orbicular-obovate lobes, style arms very short incurved. Fruit sub-baccate, .25", ovoid with truncate top.

Ramnagar! Purneah (probably; it occurs close to the boundary!). Singbhum, in nalas! Mayurbhanj (Baripada, Hopper)! Fls. May—July. Fr. with the later flowers. Deciduous in February.

Leaves acute or sub-obtuse with rounded base, margins thickened or recurved, sec. n. about 3 fine looping. Petiole minute. Stipules and bracts minute, persistent. Usually one male and one female at each axil. Fem. fl. 15—2".

2. *S. quadrangularis*, Muell.

A glabrous undershrub, 1—2 ft., with habit of last. Leaves thin, elliptic or obovate, or orbicular-obovate rounded at tip, sometimes with a short obtuse tip, rarely acute. Male flowers minute, stellate, .07—.08" diam., with spreading linear-oblong lobes with small thickenings at their base and prominent 3-angled staminal column. Female flower .25", with large orbicular obovate lobes and 3 divergent 2-lobed styles. Fruit globose, .3" diam., depressed, narrower than the accrescent calyx.

Manbhūm (Tundi Hills), *Camp.*! Karakpur Hills (Monghyr), *Ham.* Fls. Aug.

34. PUTRANJIVA, Wall.

Trees with alternate, entire or serrulate penninerved leaves, with minute caducous stipules. Flowers inconspicuous, monoëcious, or (in all our specimens) diëcious, apetalous, males clustered, axillary, or at the axils of caducous bracts on the new shoots, females long-peduncled, usually solitary, axillary, disc 0. Calyx 3—6-lobed or -partite, lobes unequal imbricate, disc 0. Male with 2—4 central stamens, anthers large, erect. Female with 2—3-celled ovary, and as many styles, with large, fan-shaped, papillose stigmas. Ovules 2 in each cell. Fruit a globose or ovoid drupe with hard 1-celled and 1-seeded endocarp. Seed ovoid with crustaceous testa, albumen fleshy, cotyledons flat, somewhat curved in the middle, broad.

1. *P. Roxburghii*, Wall. Pitonj, S.; Piten (in Hazaribagh); Putranjiva, Jiaputa, Beng.; Poirundia, Poichandia, Or.

A large or moderate-sized handsome tree, frequently with somewhat drooping branches. Leaves bifarious, broadly lanceolate or oblong-lanceolate, 1—3.5", often with a wavy or serrulate margin, base obtuse or rounded, nerves very fine, petiole .2—.35". Male flowers in numerous, minute, yellow axillary heads or contracted racemes, often on leafless axillary shoots and on previous year's wood. Female flower green, solitary on current year's shoots or in few-flowered racemes on the previous year's. Ovary white tomentose. Drupe ellipsoid, hoary, .6—.7", crowned with the style bases, pedicels .5—1" long.

N. Champaran, in mixed forest, apparently wild! Purneah! Manbhūm and S. P. apparently planted only as it is in several other districts and may often be seen on railway platforms! Common wild in the Mals of Puri! Angul! Fla. March—April. Fr. Jan.—March (following year). Evergreen.

Shoots and petioles pubescent or tomentose. Leaves shining above, glabrous or puberulous both sides, obtuse to acuminate, sec. n. about 12, very fine, soon looping and reticulate. M. sepals lanceolate or linear-oblong, ciliate, filaments more or less connate below. Fem. sepals entire or wider upwards and toothed, .05—.07" long, pedicels pubescent, sometimes 2 on a short peduncle.

The stones of the fruits are strung into rosaries and worn as a charm. A tree sown by me measured 31 ft. high and 19.8" girth after 16 years. Leaves sometimes used for fodder. Wood not much used. Wt. 49 lbs. (*Gamble*).

35. CYCLOSTEMON, *Blume*.

Trees with alternate entire or crenulate penninerved leaves and minute caducous stipules. Flowers inconspicuous dioecious, axillary clustered or racemed in the male, or female solitary. Sepals 4—6 broad, the two outer in male covering the entire (globose) bud, petals 0. Male flower with few to many stamens on the outer margin of a slightly thickened disc, or among the scales of the disc or (teste *F. B. I.*) inserted round a flattened or depressed disc, anthers large with vertical dehiscence. Pistillode 0 or minute. Female flower disc annular or failing. Ovary 2—4-celled, stigmas 2—4, dilated, fleshy or connate and peltate, with or without styles. Ovules 2 in each cell. Fruit subglobose, or ovoid, or somewhat didymous, indehiscent, with coriaceous or hardened pericarp. Seeds solitary in the cells.

1. *C. assamicus*, *Hook. f.*

A small, much branched evergreen tree, with deep green glabrous shining elliptic-lanceolate, elliptic-oblong to ovate-lanceolate leaves, 3—6.5" by 1.5—3" and greenish flowers. Males clustered, .25" diam., with 7—10 stamens on the margins of a depressed glabrous disc. Female solitary, sessile, with rather thick, broadly shallowly lobed perianth, with pubescent margins and densely brown tomentose ovary. Fruit scarlet, ovoid-oblong, somewhat didymous, .5—75" long.

Along nalas and in ravines. Sameshwar Hills, Champaran! Tholakabad Forest, Singbhum! Southern Range, Puri! Fls. Nov.—Dec. Fr. ripens April.

Bark light-cold., blaze white, slightly yellow-streaked. Buds, shoots and petiole rusty pubescent. Leaves rarely attain 9.5", shortly acuminate, with rounded or acute, usually oblique base, sec. n. 7—10, very fine, obscure with reticulate nervules, petiole .25—.35". Mature male with 2 outer orbicular sepals appressed hairy and ciliate and 2—3 inner imbricate larger ones. Disc thin hirsute on the margin (according to a field note, but my specimens seem glabrous), fil. and connective pubescent (always?). Stigmas 2, large, fleshy, sessile, half-orbicular. Epicarp coriaceous, endocarp pulpy, seed with hard coriaceous testa.

36. APOROSA, *Blume*.

Trees with alternate, entire, rarely sinuate-toothed, penninerved leaves with caducous stipules and sometimes two hairy stipellæ-like glands at the base of the leaf. Flowers minute, dioecious, apetalous. Males in axillary solitary or clustered catkin-like spikes. Fem. sessile or shortly pedicelled in stouter abbreviated bracteate spikes. Sepals usually 4 (3—6) in both sexes, but female larger, imbricate. Stamens 1—5, central, with capillary filaments and didymous anthers. Ovary 2-, rarely 3-celled, stigmas small plumose, simple or 2—4-cleft. Ovules 2 in each cell. Fruit coriaceous or fleshy, sometimes partially 2—4-valved when dry, endocarp thin, often separable, cells sometimes hairy within. Seeds oblong or suborbicular, with sometimes fleshy testa.

1. *A. dioica*, *Muell.* Syn. *A. Roxburghii*, *Baill.*; *Alnus dioica*, *Roxb.*; *Mossu*, *Or.* (from confusion with *Saccopetalum*).

A small bushy tree, with entire shining oblong or elliptic-oblong, or oblong-lanceolate obtuse or acuminate leaves, very variable in size, often

only 3—4.5" in trees in the open, but 5—6", or even 7", in shady localities, coriaceous, ultimately glabrous; secondary nerves 6—9, oblique and looped, depressed above. Petiole 4—6", often thickened at the top. Male flowers very minute, in 1—3-nate spikes 7—1" long from the axils and scars of fallen leaves on the old branches, bracts orbicular, brown edged, slightly brown-hairy. Female sessile or subsessile, usually about 4—6 from the upper bracts of a short ovoid spike 3" long, bracts glabrous ciliate, ovary hairy, 2-celled with 4-cleft stigma. Fruit ovoid-oblong, thinly rusty-villous, 4" long, 2-celled with hairy septum, seeds with orange-coloured testa.

N. Purneah, common! Mayurbhanj, near streams, 2000 ft.! Mals of Puri, frequent in evergreen forest! Fls. Feb.—April. Fr. April—May. Evergreen.

Bark nearly smooth grey-brown or rough in old trees, blaze dark brown, then deep red, then yellowish or (in the Puri tree) hard light brown. Young leaves (Puri) rusty silky on the nerves and gland-toothed with deciduous tufts of hair at the glands, stipules 3—4.5", rusty-villous, unequal-sided, only 2" in the Purneah tree, ovate-oblong.

37. ANTIDESMA, L.

Small trees or shrubs with entire stipulate leaves and small or minute dioecious flowers in slender spikes or racemes produced on the new shoots and sometimes paniced. Calyx 3—5-, rarely 7-lobed or -partite. Stamens 2—5, rarely 6—7, inserted on or inside the often lobed or annular disc, bases sometimes combined in a short column below the pistillode, anther cells globose or globose-oblong, usually terminal on a broad connective. Ovary 1-, rarely more-celled, stigmas 2—4, 2-lobed sometimes on a short style. Ovules 2, pendulous. Fruit a small, more or less compressed drupe.

I. Leaves acute or acuminate one or both ends, glabrescent.

A. Racemes or spikes mostly solitary.

Shrub. Rhachis glabrous. Fls. pedicelled, calyx glabrous outside

1. *diandra*.

Tree. Rhachis hairy. M. fl. sessile, calyx hairy

2. *bunius*.

B. Racemes mostly paniced.

Tree. Rhachis pubescent. Fls. shortly pedicelled

3. *acuminatum*.

II. Leaves rounded both ends. Racemes paniced, tomentose

4. *ghæsembilla*.

1. **A. diandrum**, Roth. Mata-ara, Mata-sura, K.; Matha arak', S.; Amti, H., Kharw.; Archal, Th.; Matta, Beng.; Amtua sag, Mal Pah.; Marmuri, Kundui, Or.

A large shrub usually glabrous except the shoots, with obovate-lanceolate or somewhat rhomboidly-elliptic leaves, usually 1.5—3.5" long, nearly always tapering at the tip to an acute or obtuse apex, base cuneate, shining especially beneath. Flowers minute, green, in mostly solitary, rarely 2—3-nate, racemes 1—2" long; or female 3" in fruit, rhachis and sepals outside glabrous, disc and sepals inside usually pilose. Fruit sub-globose, 14—2" diam., red to black, with a slightly compressed and rugose keeled seed.

Common in all districts. Chiefly in the valleys in hilly areas and near streams. Fls. May—June. Fr. Nov.—Jan. Leaves turn red from Jan. to March and then fall.

Shoots pubescent, and a form occurs in Chota Nagpur with the leaves permanently sub-tomentose beneath. L. pale beneath and shining with 3—5 slender sec. n.

and others indistinct. Luxuriant specimens occasionally occur with leaves up to 7" long, but these have only 5 or rarely 6 sec. n. and are acuminate with cuneate base. Petiole 1—2". Stipules linear, much longer than petiole, caducous. Sepals usually 4. Stamens 2, rarely 3. Disc lobed glabrous, or usually pilose. Ovary glabrous.

The young leaves make an excellent spinach. The fruit is also eaten.

2. *A. bunius*, Spreng.

A small tree up to 30 ft. high and 3 ft. girth, with the twigs and buds somewhat fulvous hairy, especially near the leaf axils. Leaves 3—5" long at time of flowering, ultimately 3—8", elliptic-oblong or usually more or less obovate or oblanceolate and shortly acuminate, glabrescent and shining both sides, stipules very caducous 1—17", falling as the leaves expand. Male flowers spicate, female racemed, spikes or racemes 2—4" long, solitary or sometimes 2—3 together, usually terminating short branchlets, rarely lateral from leaf-scars. Male rhachis tomentose, flowers sessile, shallowly cupular sub-entire or shortly lobed, thinly hairy with thick lobed disc. Stamens 3—4, united at base into a short column beneath the clavate pistillode. Fruit elliptic compressed, .25", very juicy, red, turning black when ripe, seated on the cupular ciliate perianth with pedicels .15" long.

On the highest mountains only, in evergreen forest. Simlipahar, Mayurbhanj! Parasnath! Fls. April—May. Fr. Aug.

Bark smooth grey, blaze with chlorophyll, pinkish or pink, hard. Twigs and rhachis below the spike soon glabrous. L. shining both sides with 5—7 rather weak sec. n. not distinctly looping, tertiary not at all raised. Petiole 2—4". Bracts minute fleshy hairy, at some little distance below the pedicels. Fem. racemes thinly fulvous pubescent, calyx pulvinate cupular with minute thinly hairy limb, disc annular, ovary glabrous ovoid with 3—4, usually 4, rarely 5, sessile recurved obtuse stigmas.

3. *A. acuminatum*, Wall. Kath Jamrala, Or.

A small tree with tomentose buds and shoots. Leaves at time of flowering 3—5" long, ultimately 4—12", glabrous and shining, only the very young slightly silky, oblong or slightly ovate-oblong acuminate, base usually rounded, secondary nerves 6—8, distinct, looping with each other close to margin, silky when young, petiole .2", stipules sub-persistent, linear, silky, .25" long. Flowers in terminal paniced spikes or racemes 2—3" long at time of flowering, up to 4.5" in fruit, rhachis pubescent, bracts small but distinct, subulate-lanceolate, silky, immediately at base of pedicels. Perianth 3—4-fid. Stamens 3—4.

Along streams in the Saranda Forests, Singbhum! Bofai, Cooper! Mayurbhanj! Fls. May. Fr. Sept. Evergreen or nearly so, renewing leaves at time of flowering.

Attains about 3 ft. girth. Easily distinguished from *A. bunius* by the deeply lobed calyx in both sexes, the paniced racemes and large stipules which are also found on the panicles. Leaves very dark green, sometimes 12" long. Flowers unequally pedicelled, those of the male usually very short. Sepals glabrous in male, pubescent or ciliolate in female. Disc fleshy glabrous. Pistillode distinct in male and usually staminodes in female. Stigmas acute. Fruit elliptic acute .2" long on slender pedicels 1—12" long. The pedicels in the male are late in development and care should be taken with specimens in bud not to confuse them with species with sessile flowers.

4. **A. ghæsembilla**, *Gærtn.* Mata-sura, *K.*; Amtua, *Kharw*; Nuniari, *Or.*; Jamula, *Or.*; also Kath-marmuri (in Angul).

A shrub, rarely a small tree, with broadly elliptic or orbicular or elliptic-oblong leaves, always rounded both ends, sometimes also with a short blunt acumen, 2—4·5" long, grey-or hoary-tomentose when young, more or less pubescent or villous beneath when old with 3—6 strong secondary nerves. Flowers in densely tomentose paniced racemes, minutely pedicelled. Sepals woolly, stamens 4—7, disc and usually ovary pubescent or hairy. Fruit red to black, oblong, .25".

Common, in almost all districts! Champaran! Purneah! Gaya! Throughout Chota Nagpur! S.P.! Puri! Angul! Sambalpur! Mayurbhanj!

A plant of dryer localities than any of the other species, being often found on dry hill sides and in scrub jungles. Fls. May—June. Fr. Sept.—Oct. Deciduous before flowering.

Bark pale, smooth or slightly cracked, blaze pink. Leaves exceptionally 5·5—6" long, never quite glabrous in our area, sometimes permanently sub-tomentose. Petiole .17—5". Racemes .75—2·5" (the last in fruit). Perianth usually 5—7-partite, sometimes only 3-partite. Disc usually 5-partite.

The fruit is eaten.

38. BACCAUREA, *Lour.*

Trees with alternate, entire or crenate-serrate, penninerved leaves, stipules covering the buds, caducous. Flowers dioecious, rarely monoecious, in simple or compound spiciform racemes or racemiform panicles, apetalous. Male flower sepals 4—5, usually unequal, imbricate. Stamens 4—8, filaments short, anthers didymous. Pistillode usually orbicular, pubescent. Female sepals 4—6, much larger than in the male. Ovary 2—5-celled with 2—5 papillose, 2—3-lobed or -cleft stigmas, free and sessile or with a short style, rarely connate and peltate. Ovules 2 in each cell. Fruit coriaceous, crustaceous or woody, 2—4-celled, tardily loculicidally dehiscent. Seeds broad, testa with a thick aril-like coat, albumen hard or fleshy.

1. **B. sapida**, *Muell.*

A small tree with light smooth bark. Leaves obovate, elliptic-obovate or oblanceolate, or some elliptic, entire or repand, obtuse or acuminate, 4—8" long, with a long petiole thickened both ends, glabrous (exc. the quite young). Racemes hoary-tomentose or pubescent from bract- and leaf-scars, sometimes from the trunk and old branches, when they are several together. Male flowers sub-sessile, .15" diam., solitary or grouped on very small lateral branches of the raceme in the axils of deciduous lanceolate stipular bracts, .08—17" long, longer or shorter than the flower clusters; sepals 4, oblong or ovate, obtuse, pistillode large 3-lobed. Female flowers yellow, .5" diam., with oblong-oblanceolate, incurved, yellow, tomentose sepals, .3" long, articulate on .18" long pedicels in simple racemes 6—7" long, elongating in fruit. Ovary strigosely tomentose, 3-celled; stigma large, peltate, scarcely lobed, almost fimbriate with large papillæ. Fruit globose-oblong, 1—1·2", thinly hairy, terminated by three stigmatic scars, cells each with 1 large plano-convex seed, .7" long, with white aril and blood-red testa.

Probably in N. Purneah (it occurs close by)! Mayurbhanj, elev. 3000 ft.! Fls. April—May. Fr. following May. Evergreen.

Blaze flesh-cold. Buds and young twigs densely strigosely hairy. L. with about 8 rather prominent sec. n. The male flowers are contracted at the base and articulate, but can scarcely be said to be stalked.

39. BISCHOFIA, *Blume*.

One species only, easily recognised from its alternate 3-foliolate leaves and small flowers in lateral paniced racemes. Flowers dioecious. Sepals 5, orbicular, concave and hooded over the large anthers in bud, finally reflexed, caducous, ovate in the female. Disc 0. Stamens 5, one opposite each sepal, with very short filament, inserted under the peltate pistillode. Staminodes in female small or 0. Ovary 3—4-celled, with linear recurved styles. Ovules 2 in each cell. Fruit globose fleshy, with 3—4 cells lined with a parchment-like 2-valved endocarp. Seed oval.

1. *B. javanica*, *Blume*. Areng, *Th.*; Hajam, *M.*; Pader, *S.*

A moderate-sized tree with long-petioled 3-fol. leaves and crenate or serrate, rarely entire, elliptic-oblong to obovate leaflets, 3—6" long, suddenly acuminate or caudate, glabrous, rather strongly nerved and sometimes with glands in the nerve-axils. Male flowers scattered and clustered on the panicle branches, anthers yellow. Fruit 3" diam., brown or black.

Not common but occurs throughout the province along streams. Fls. March—April. Fr. Oct.—Dec. Evergreen, new shoots March—April.

Bark dark, flaking when old, blaze pink with crimson juice, then whitish. Petiole 2.5—6" long, terminal petiolules .75—1.5", lateral short. Panicles 3—4" from the scale axils of the new shoots.

It is an excellent wood for planking and the ceilings of some forest rest-houses have been made from it.

40. EUPHORBIA, *L.* Spurge; Milk-bush.

Trees or shrubs, often with thick fleshy branches and stipular spines, with alternate leaves; or herbs of various habit with opposite or alternate leaves, always with milky juice. Leaves entire or toothed, sometimes pseudo-whorled, often caducous or reduced in the fleshy species. Stipules present or not. Inflorescence composite. Male flowers of naked pedicelled stamens usually many together, frequently in 5 groups, in a calyx-like 4—5-lobed involucre, the lobes thin, sepaloid, entire or divided, alternating with large, rarely small, glandular processes forming an outer whorl, or in some cases glands solitary, and sometimes furnished with a petaloid expansion or limb or with horns. Involucres 1-sexual or usually 2-sexual, containing a solitary central female flower consisting of a pedicelled ovary, naked or sometimes with rudiments of a 3-merous calyx. Ovary 3-celled, more or less deeply 3-lobed, styles 3, free, or more or less connate, often 2-lobed or 2-fid, ovule 1 in each cell. Capsule of three 2-valved cocci, separating from a columella when ripe, fruiting pedicel elongate and usually decurved. Seed with or without a caruncle.

- I. Fleshy trees or shrubs or (*fusiformis*) an undershrub with subterranean rootstock. Leaves alternate fleshy or 0. Inflor. not leafy (Sec. *Euphorbium*):—
- A. Armed with stipular spines. Involucres in 2—3-chotomous cymes:—
1. Branchlets not winged:—
 - Spines not on prominent tubercles. Anthers didymous, purple
 - Spines on prominent tubercles which are sub-confluent in 5 lines. L. obovate or spatulate 3—6". Anthers apiculate
 - Spines on distant tubercles. L. ovate to oblong-ovate. Anthers yellow, not apiculate, oblong or didymous
 2. Branchlets 3—rarely 4—5-winged:—
 - End 3—6 joints of branches under 8" long
 - Penultimate and preceding joints over 9" long
- B. Without spines:—
- Aërial stem 0. Leaves and cymes as in *nivulia*.
 - Tree or shrub. L. very small. Involucres clustered
- II. Shrubs or herbs, neither very fleshy nor umbellately branched. L. alternate or upper opposite. Involucres with a single large gland, often with brilliantly coloured bracts (Sec. *Poinsettia*):—
- Garden shrub. Inflor. with brilliant scarlet bracts
 - Garden herb or undershrub. Bracts of inflor. particoloured
 - Introduced herb. Bracts mostly green or pale at base
- III. Herbs umbellately branched above, upper leaves opp. or whorled. Involucres regular, glands not petaloid (Sec. *Tithymalus*):—
- A. Final ramifications of inflorescence forming a sympodium on which the solitary involucres are axillary
 - B. Inflorescence umbellate or dichasial throughout:—
 - Perennial. Invol. glabrous, lobes triangular, fimbriate
 - Annual. Invol. hairy within, lobes ovate ciliate
- IV. Herbs, rarely umbellately branched, leaves all opposite with oblique base. Glands of invol. often with a petaloid limb or appendage.
- A. Involucres sub-solitary in the axils of the uppermost leaves which imbricate and conceal them:—
 - Erect. Limb of glands entire
 - Ascending. Limb of glands laciniate
 - B. Involucres cymose, cymes axillary and terminal. Leaves 3—1.5":—
 - Glabrous or thinly pubescent. Cymes not capitate
 - Hispidly pubescent. Cymes capitate
 - Prostrate. Cymes few-involucered, sessile, pink
 - C. Prostrate herbs with leaves under 3". Involucres solitary or clustered axillary:—
 1. Involucres pubescent:—
 - L. .15—3" crenulate
 - L. .1—1.4" entire, villous
 2. Involucres glabrous:—
 - L. .17—25" coriaceous, sometimes toothed at apex

1. *E. nivulia*, Ham. Syn. *E. nereifolia* in *F.I. and Bombay Flora*.^{*} *Sij, Beng.*; Etke, K., S.

A tree 10—30 ft. high, with straight trunk and terete, jointed, spreading, often whorled branches, with straight geminate stipular spines (or

some unarmed). Pairs of spines inserted on flat brown or black corky areas, not on swellings of the branchlets. Leaves (usually only present in the r.s.) up to 9" by 2.5", fleshy, linear-oblongate or spatulate, obtuse, apiculate, base narrowly cuneate, nerves only visible by transmitted light. Petiole 0. Cyme about twice forked, borne at the leaf-scars towards the ends of the branchlets, 1.5" long. Involucres yellow, anthers purple with yellow pollen. Stigmatic lobes flattened and slightly expanded. Capsule sharply 3-lobed, lobes compressed.

The common indigenous species, frequent on barren rocks and in rocky places from Shahabad! and the Gaya and Curruckpur hills! southwards. Santal P. on trap! Sambalpur, occasional even on the shales near Nalas! Common on the quartz rocks of the Jhargati hills! Found in association with Sal in the Maniband forest, Puri! Fls. Feb.—April. Fr. April. Leafless Feb.—June or longer according to situation.

Bark thick rugose and corky on large trees. Stipular spines .12—3" long, usually black. Cyme normally consists of a peduncle, .3" long, two sec. peduncles .5", each with two tertiary ped. .3—5" long, bracts inconspicuous, upper oblong truncate keeled and toothed. First involucre usually disciform, male only, others sub-campanulate with a single female finally with recurved pedicel. Lobes and numerous bracteoles of the involucre fimbriate. Glands 5, fleshy, transversely oblong.

The milky juice is taken internally by the Kols as a violent purgative in cases of fever.

2. *E. neriifolia*, L. Syn. *E. ligularia*, Roxb.; *E. nivulia*, Cooke in *Bombay Flora*.* Etke, K., S.; Mansa-sij, Beng.

A large branched shrub or small tree, 6—15 ft. high, with the pairs of stipular spines on tubercles or swellings of the branchlets, these tubercles more or less confluent in five vertical or slightly spiral lines, so that the branch is more or less obtusely 5-gonous in section. Leaves obovate, very similar to those of the last species. Involucres yellowish, 3—7 in a cyme, usually 3, with a very short fleshy peduncle about .15" long. Oldest involucre, male, 2-bracteate, bearing in the bract axils a 2-sexual involucre, the opposite bracts of which may in their turn bear each a peduncle and are 3-lobed with central lobe toothed. Lobes of involucres broadly cuneate and fimbriate, much as in last species. Anthers sagittate, apiculate (*teste Roxburgh*), colour not noted. Fruit as in last. Style 3-fid, stigmas slightly dilated and minutely toothed. Fruit much as in last species.

Common in village hedges. Nowhere seen wild unless the next is its wild form. Fls., Fr. Feb.—April.

3. *E. caducifolia*, Haines.

A dense shrub with several stems from the root or densely branched close to the ground. Branchlets with small rather distant tubercles, not confluent, with a very black areole bearing two black stipular spines as in last. Leaves broadly-ovate with crisped margin, becoming more oblong-obovate and cuspidate with age, but not exceeding 2—3" and

* Cooke follows Roxburgh in the nomenclature of these two species, but the Linnean description of *neriifolia* and his quotation of Commelin's figure, which exactly agrees, leaves no doubt that he was not referring to Hamilton's subsequently named *nivulia*, but to the common village form with tubercles in 5 rows.

then falling. Involucres solitary or 2—3 nate on very short fleshy peduncles, usually bearing a central male involucre and two pedicelled 2-sexual involucres, with very stout pedicels .25" long or .4" in fruit. Involucre .17" diam., lobes broadly oblong obtuse-toothed, scarcely fimbriate. Anthers yellow, oblong with oblong or linear-oblong lobes and longitudinal dehiscence (or sometimes with the lobes erecto-patent or globose, possibly from a different species in the same locality). The male flowers are in 5 distinct groups (more visible when old) opposite the lobes. Styles connate for half their length then spreading with minutely 2-lobed stigmas.

Wild on rocks on the Puri coast! Fls., Fr., Jan.—April.

If the variation in the shape of the anthers indicated above is correct, this may be the wild form of *E. nerifolia*, but more observations *in situ* and more specimens are required; especially the colour of the anther in *nerifolia* should be noted. The pollen-grains are yellow, 3-grooved and in section 3-lobed. Ovary sharply 3-gonous, microscopically thinly papillose. Capsule .2" long, .4—5" diam., with compressed cocci much as in last two species. Seed smooth, globose. The bracts of the 2-sexual involucres corresponding to the lobed bracts in *nerifolia* are concave and minutely toothed, not lobed. There is sometimes a rudiment of a 3-lobed calyx under the fruit.

4. *E. antiquorum*, L. Etke, S.; Tidhara-send, H.; Baj-varan, Beng.; Dokana-sij, Or.

A much branched small tree, 12—25 ft. high, with jointed branches and usually 3—, more rarely 4—5-winged branchlets, the wings repand-sinate with short stipulary spines. Leaves fugacious and small, fleshy, obovate-oblong or spatulate, .5" long. Cymes usually short and 3-involucered only, longer in fruit, but once-forked and 7-involucered in vigorous specimens. Styles free, 2-lobed. Cocci compressed.

Not indigenous, except, perhaps, on the laterite in Khurda. Frequently seen in village hedges, especially in the south. Fls., Fr. Dec.—Jan. Leaves Aug.—Sept.

The joints in this species are short, especially towards the ends of the branches, where they are usually as broad as long.

5. *E. trigona*, Haw. Vern. names of last.

A tree, 10—20 ft. high, with ascending branches and 3-winged branchlets much as in the last species, but the wings less broad in proportion to the length of the joints, which bear more numerous small tubercles and geminate spines; the penultimate and older joints are nearly always over 9" long, while the 3—6 last joints of *E. antiquorum* are under 8" long. Leaves obtuse, 1—2" long, pale beneath.

Introduced only and now frequently planted on railway platforms (as is the last), in gardens, etc. Fls., Fr. Feb.—April.

Cymes mostly short and 3-involucered. Central one usually male only as in other species (in *E. antiquorum* the central one is described in *F. B. I.* as female; this is not in accordance with my observations). Anthers didymous. Styles shortly connate, stigmas emarginate.

6. *E. fusiformis*, Ham. Syn. *E. acaulis*, Roxb.

A dwarf species reduced to an underground rootstock, .75—1.5" diam., producing annually from its apex a crop of sessile or sub-sessile oblan-ceolate or broadly obovate-spathulate leaves, 6—8" long by 1.3—3.8" broad, the margin often crenulate-crested. Involucres .25" diam., 3—7

in a short- or long-peduncled cyme which may be up to 6" in length, lobes spatulate, fimbriate. Styles combined half-way. Capsule 3" diam.

Very common on white sandy soil in the forests of N. Champani! Purneah, Roxb. Fls. April. Fl., Fr. March—May. The leaves appear in the rains and remain till December or January.

Except for its habit the plant reminds one altogether of the *nivulia-neriifolia* group.

7. E. tirucalli, L. Lanka-sij, Beng. (*tirucalli* is the Tamil name).

A small tree easily recognised from the erect branches and smooth, terete, polished, whorled or fascicled branchlets, not much thicker than a quill, which bear in the rainy season small linear-oblong leaves, .25—.5" long. Involucres clustered in the forks of the branchlets, shortly pedicelled, mostly female, campanulate, glands 5—3, transversely oval peltate, lobes short, hairy, bracteoles numerous, laccrate. Female woolly, styles short, recurved, 2-lobed. Capsule 2", cocci compressed, velvety. Seeds ovoid, smooth.

Naturalised in parts of Puri and frequent in village hedges, chiefly in the south. Fls., Fr. r.s.

8. E. pulcherrima, Willd. The Poinsettia.

A lax shrub, 10—15 ft. high, with leafy fistular branchlets. Leaves alternate, elliptic or oblong, 4—6" long, repand-dentate. Involucres in corymbose cymes surrounded by brilliant scarlet foliaceous bracts (or, in variety *albida*, bracts white), involucres with a large, unilateral, ellipsoid, compressed, yellow gland.

Cultivated in all Indian gardens and one of the most ornamental shrubs when in flower. Fls. c. s. Native of Central America.

It is usually rigorously cut back after flowering or becomes very straggling and is easily propagated (like all the preceding species) from cuttings. Whether it ripens seed or not I do not know.

9. E. heterophylla, L.

A herb, 1—4 ft. high, like a dwarf *Poinsettia* but far less handsome. The leaves are almost lobed and the floral bracts are green, with the scarlet colouring never extending more than half-way up, often less. Here, also, the coloration may be white. The gland is single as in *E. pulcherrima*.

Common in gardens. Fls., Fr. all the year.

It is a native of America, where it is widely distributed. It seeds itself very readily in this province, becoming quite a weed in some gardens.

10. E. geniculata, Orteg. Syn. *E. prunifolia, Jacq.*

A herb, 2—3 ft. high, with long-petioled, oblong-obovate, sub-entire, shallowly denticulate leaves, 3—4" long, the lower alternate, the upper opposite with stipular glands, secondary nerves 12—18, fine but distinct. Involucres very small, .1" long at flowering time, campanulate in dense corymbose cymes only .7—1" diam., with the subtending leaves whitish or pale near the base. Gland one, large-stalked, with expanded disciform hollow top.

Cultivated fields and sometimes in gardens! Fls., Fr. Aug.—Oct. Annual.

Internodes below the inflorescence usually very long. Lobes of involucre very broadly oblong lacerate, with often gland-tipped fimbriae. Male fls. numerous without bracteoles, anthers broadly oblong with longitudinal dehiscence. Ovary glabrous, styles shortly connate, 2-fid, erect with subulate stigmas. Capsule smooth, seeds dark grey, truncate at the lower end.

11. *E. perbracteata*, Gage.

A rather coarse annual, 18—30" high, with pale stems, 2—3-chotomously paniculately branched above, lower leaves alternate, sessile, narrow, oblong, 2" long, deciduous, upper opposite, broader, those on the panicle ovate to orbicular, united at their base, about 7" broad and rounded at tip, with many nerves from the base, a pair at each fork and sub-imbricate on the final branches of the inflorescence. Stipules 0. Involucres solitary in the upper forks and cymosely subspicate (in scorpioid biparous cymes), one in each pair of bracts alternately each side of the rhachis (sympodium), very shortly pedicelled, tubular-campanulate, 1" long in flower, lobes membranous, small, 2-toothed, glands 4, truncate, broadly oblong, with a reflexed horn each side, petaloid limb 0.

Behar, Kurz! I have collected it in cultivated fields only as though introduced. Fls., Fr. Feb.—April.

Stamens few without hairs or bracteoles, the filament stouter than its slender pedicel, anther cells globose transversely, laterally dehiscent. Ovary glabrous, styles connate at base, 2-lobed, stigma slightly expanded. Cocci 17", smooth. Seed dark grey or brown marbled, 1—12", caruncle deciduous.

12. *E. prolifera*, Ham.

Erect, herbaceous, from a woody rootstock with several stems 1—2 ft. high, with close linear leaves or scattered linear-oblong or oblong, or towards and on the inflorescence, ovate leaves. Inflorescence of several (usually 4—5) umbellately spreading branches, with a pseudo-whorl of leaves at its base and a terminal involucre; branches with a pair of leaves also terminating in an involucre. From the side of the involucre other lateral branches may either continue the inflorescence or are purely vegetative, so that after flowering and fruiting the plants are much paniculately branched above with leafy shoots (proliferous).

Higher plateaux of Chota Nagpur. Neterhat, elev. 3000 ft., frequent! Fls., Fr. April—June.

The new shoots after fires may have orbicular ovate leaves, 5" long, and a subverticil of sessile, broadly ovate leaves 6—7" long supporting the young inflorescence. All involucre 2-sexual with one female, central involucre shortly stipitate, 15" diam. Glands 5—7, shortly stipitate, transversely oval and toothed or semi-lunate and 2-horned. Anther lobes oval, erecto-patent dehiscing across the top. Capsule 3-lobed, 25" long, with a pedicel 2—3" long, styles 3, short recurved with 2-lobed stigmas.

13. *E. dracunculoides*, Lamk. Parwa, S.; Jychi, Chagulpuputi, Beng.

A glabrous annual, 4—8", rarely 12—18" high, with opposite or repeatedly dichotomous branches, often umbellate above. Leaves sessile, linear, linear-lanceolate or linear-oblong, 7—2" long, the lower alternate, secondary nerves not visible. Involucres solitary at the forks, turbinate or campanulate, sub-sessile, glabrous without, hairy within, 06"

long. Capsule .15" with pedicel about as long, cocci reticulato-venose with a median dorsal nerve, but scarcely keeled.

In fields. Bettiah! Behar, abundant, *J. D. H.*! Chota Nagpur, occasional! Fls., Fr. Nov.—March.

Leaves usually narrowed towards the base, floral usually shorter and broader. Glands transversely oblong 2-cornute, horns often slender, lobes ovate, denticulate, ciliate. Anther-cells globose. Styles as long as young ovary, 2-fid. Seeds tubercled, caruncle depressed.

14. *E. pycnostegia*, Boiss. Syn. *E. zornioides* (in *Bengal Plants*).

A slender erect annual, about 12—18" high, with opposite oblong or linear-oblong leaves 1—1.5" long, rounded at the apex, very minutely serrulate, glabrous, base oblique semi-cordate, secondary nerves very obscure. Involucres mostly solitary in the axils of the uppermost leaves, which are mostly distichously imbricate and sometimes pale between greener reticulations. Lobes of involucre toothed, glands with a large obovate petaloid limb. Seeds granulate.

Behar, *Kurz!* Fls., Fr. Sept. (in *C. P.*).

Youngest leaves slightly silky beneath in some specimens. Petiole hardly any. Stipules minute or indistinct.

15. *E. cristata*, Heyne.

A prostrate or ascending annual with slender stems, 6—10" long, clothed with long flexuose hairs, often dichotomously branched above. Leaves opposite, covered with long flexuose hairs, ovate-cordate obtuse serrulate. Involucres sub-sessile, hairy, sub-solitary, in the axils of the uppermost leaves which are distichously imbricate, lobes linear-lanceolate, glands with a pectinate and fimbriate petaloid limb. Cocci globose.

Very rare. Behar, *Kurz!*

16. *E. hypericifolia*, L.

A herb of various habit with stems 6" to 2 ft. long (or high), with oblong or somewhat obovate obtuse or rounded serrulate leaves under 1.7" long, with oblique rounded or cordate base. Involucres campanulate minute, .07" long, in numerous small cymes, axillary or terminating short axillary branchlets, about .5" diam., with erect, narrow lanceolate bracts at all the nodes. Lobes of the involucre narrowly lanceolate, acuminate, longer than the shortly stipitate glands, which are 4—5, disciform, usually with a minute white or pink petaloid limb. Ovary and capsule glabrous, appressed hairy or hispid. Seeds smooth "or with shallow transverse pits" (*F. B. L.*).

A common weed in open situations, probably in all districts. Fls., Fr. Dec.—May, perhaps all the year round.

The following two varieties at first look distinct:

Var. *α*. A large form with sub-woody, sub-erect or ascending stems, puberulous branches, swollen nodes and lower leaves 1.5" long crenulate above. Stipules subulate or setaceous. Involucre and ovary nearly glabrous. Petaloid limb minute, white, or apparently (in dried specimens) obsolete, the gland often pink. Chota Nagpur!

Var. *β*. Stems spreading, procumbent more pubescent, leaves .5—.75", appressed hairy beneath. Involucres pubescent, the lobes ciliate, glands with a distinct, but

small, pink petaloid limb. Chota Nagpur! A similar form in Purneah! but more erect.

Seeds of the last oblong, keeled opposite to the fine raphe, and with two depressed or flattened faces, grey (microscopically punctulate).

17. *E. hirta*, L. Syn. *E. pilulifera* (F.B.I.); Pusi-toa, K., S.; Barakerui, Beng.

An erect or decumbent roughly hairy herb, 8" to 2 ft. high, with opposite unequal-sided serrulate elliptic-oblong obovate or oblong-lanceolate leaves, .75—1.5" long, with acute or cuneate tip. Involucres minute, .04—.05" long, crowded in capitate finally peduncled axillary cymes, hairy, campanulate, with 4 shortly stipitate red-tipped glands without a limb or with a minute fleshy rounded green or white limb.

A common weed everywhere. Fls., Fr. all the year round, annual.

Pubescence often curly. Leaves sometimes sub-rhomboid, the upper extremity nearly always acute; one variety prostrate with leaves under 1" long and with a black patch in the centre of each; lower surface pale and hispidly hairy on the 3—4 rather strong sub-flabellate nerves, hairs sometimes red or brown, those on the stem usually coarse and finer silky ones beneath. Petiole .12—2" long. Stipules of glands or fimbriæ, minute. Cymes always congested, at first sessile but peduncle elongate and finally sometimes forked and sometimes 1" long, from nearly all the alternate axils. Involucre minute, only .04" long, strigose, lobes subulate ciliolate exceeding the minute stipitate glands or as long, glands scarcely dilated above, tip concave, sometimes with a distinct minute fleshy limb (without a perceptible limb, F.B.I.). Styles 2-fid to base. Capsule hairy, .05" long, seed oblong, reddish, 3-keeled and faintly transversely rugose.

The root is given to allay vomiting by the Santals, and the plant to nursing mothers as a galactagogue.

18. *E. rosea*, Retz. Syn. *E. auricularia*, Boiss.

A little herb with woody rootstock, many slender prostrate flexuous stems up to 12" long from a perennial rootstock and opposite, coriaceous, obliquely obovate, oblanceolate-oblong, or linear-spathulate leaves .3—.6" long with rounded crenulate tip. Involucres solitary or few in small sessile cymes conspicuous from the general pink or purple colour of all its parts. Involucre .12", sub-campanulate, glabrous, lobes triangular-ovate, acute, 3—5-fid, glands with a conspicuous rosy limb. Styles deeply 2-fid, stigma spathulate. Capsule minutely tuberculate or smooth (in our plant). Seed keeled.

Sands of the Orissa coast between Puri and Konarak, common! Chilka Lake, Alcock!

This little plant is conspicuous in the rains when in flower from the rosy cymes. It has been named *E. auricularia*, Boiss. in the *Calcutta Herb.*, on account of the involucre and capsules being perfectly smooth, but Colonel Gage considers it scarcely distinct from *E. rosea* with which it is united in the F.B.I.

19. *E. thymifolia*, L. Nanha pusi-tuar, S.

A small herb with numerous horizontally spreading branches which are pubescent above and glabrous below, small, opposite, distichous, obliquely oblong, rounded, minutely crenulate leaves, .15—.3" long, and small axillary green or pinkish clusters of involucres without a common peduncle. Capsules erect, pubescent, .03".

Chiefly in the moister districts. Purneah! Singbhum! Manbhum, Campbell, Kurz! Ranchi, Wood! Perhaps in all the districts. Fls., Fr. r.s.

Stems often pink with short branches successively to the right and left from each alternate pair of leaves. Petiole minute. Stipules subulate, hairy. Involucres .03" turbinate pubescent, glands minute, stipitate, with or without a minute petaloid limb. Capsule erect, pubescent. Seeds with shallow transverse furrows.

20. E. granulata, Forsk. Kantha arak', S.

A small procumbent herb with many villously hairy stems, 2—8" long, from a stout rootstock, villosely-hairy all over. Leaves minute, .1—.15", rarely .2", opp., broadly oblong with oblique base of somewhat obovate, apex obscurely denticulate, stipules scarious. Invol. minute, .04" long with oblong lobes, glands often without a limb. Capsule hairy, cocci with rounded backs. Seeds acutely oblong tetragonous, faintly pitted or rugulose-lacunose, sericeous.

Dry plains. Gangetic Plain! but no satisfactory specimens seen by me from our area. Chota Nagpur, Prain. Fls. Oct.—April.

21. E. microphylla, Heyne. Syn. *E. serpens*, var. *indica*, Boiss.

Very similar to *E. granulata*, but with slender root, glabrous or only sparingly villous, leaves usually larger, .12—.24", entire or toothed. Petiole distinct. Stipules subulate. Involucre minute, .02", lobes ovate very acute or mucronate, glands distinctly pedicelled. Styles spreading. Cocci distinctly keeled, glabrous or sparingly villous. Seeds ovate, acutely tetragonous, nearly smooth (undulately rugulose), whitish-blue.

Banks of stream, Behar, J.D.H.! Bettiah, Hieronymus! Fls., Fr. Sept.—March.

The Bettiah plant is villous and scarcely separable from *granulata*, except in the keeled cocci; glands narrow-elliptic, limb a mere rim, lobes minute lanceolate with small villi or bristles, styles very short, seeds transversely furrowed.

41. SYNADENIUM, Boiss.

Shrubs with unarmed terete fleshy branches and well-developed alternate entire somewhat fleshy leaves. Flowers reduced to single stamens in the male and a single ovary with or without a rudimentary perianth in the female, the males or males with a single female collected into capitula as in *Euphorbia*, but with the glands of the involucre completely fused with one another into a continuous fleshy ring; lobes (outer) of the involucre as in *Euphorbia*, but inner bracts surrounding groups of male flowers connate by their inner margins, thus forming an inner involucre round the female flower where present. Capsule 3-lobed. An African genus.

1. S. Grantii, Hook. f. Syn. *S. umbellatum*, Pax. African Milk Bush.

An erect bush, 6—7 ft. high, with green terete branches, the ultimate ones about .3" diam., and numerous oblanceolate or obovate scarcely fleshy leaves 3—6" long, dark green and often clouded above with the very oblique secondary nerves much more evident than in the fleshy *Euphorbias*. Involucres in somewhat supra-axillary cymes, 2—6" long at the uppermost axils, repeatedly forked or branches umbellately 3—5-nate, hairy above. Involucres .3" diam., saucer-shaped, red-purple, the pulvinate annulus (connate glands) entire or wavy, somewhat pubescent at base, densely covered with close papillæ on the inner side, lobes 5, erect, sub-quadrate, shortly fimbriate or toothed. Usually 2-sexual. Ovary tomentose. Perianth annular, sub-entire.

Common in hedges about ~~Cuttack~~, and occasionally elsewhere in gardens! Fla., Fr. Jan.—Feb.

The distinctions described between *S. Grantii* and *S. umbellatum* disappear if a number of Indian specimens are examined growing freely. The leaf margins are ciliate, or the pubescence extends for some distance from the margin, which is often incurved at the lower part and tapers into a short petiole. Involucres supported by scarious oblong truncate bracts, .1—'.15" long. Involucel more or less villous.

42. PEDILANTHUS, Neck.

Somewhat fleshy shrubs with milky juice, leaves alternate below, floral opposite. Flowers as in *Euphorbia*, but involucre zygomorphic, slipper-shaped (in our species), with the florets exerted from the toe, and the heel composed of the saccate base of an outermost superior shorter lobe or "appendage," containing inside at its base 2—6 large tumid glands, rarely glandless. Involucral lobes very unequal, two anterior largest, three dorsal smaller (the appendage is considered as not homologous with a lobe and is exterior to the involucre proper, its morphology seems doubtful), innermost ligulate. Style stout, beak-like, with 3 short 2-toothed lobes.

1. *P. tithymaloides*, Poit. Bilaiti-sij, Vern.; Adjutant's Hedge; Jew's Slipper.

A fleshy shrub or undershrub with many erect stems, usually about 3 ft. high, but sometimes much larger, bearing numerous more or less elliptic leaves and red or orange slipper-shaped involucres in dichotomous cymes with caducous bracts.

Very common in gardens and hedges. There is a variegated form with white on the leaves. Native of tropical America.

FAM. 30. CALLITRICHACEÆ.

Small weak terrestrial, amphibious or aquatic herbs, with opposite or sub-verticillate (when floating), narrow entire 3-nerved leaves. Hairs sometimes stellate. Flowers monœcious, reduced to a single stamen in the male and a single naked ovary in the female, usually solitary, axillary, supported by two bracteoles at right angles to the leaf, sometimes a single male sub-tended by the bracteoles and an outer female in the same axil, *but without bracteoles*. Filament slender, anther 2-celled, with lateral dehiscence. Ovary of two carpels, each divided by a partition to form a 4-celled compressed 4-lobed ovary, with 2 simple, subulate, stigmatose styles. Ovules 1 in each cell, pendulous, anatropous, with ventral raphe and only one integument. Fruit 4-lobed, splitting into 4 cocci or drupels. Seeds with thin testa and fleshy albumen. Embryo central terete.

Only one genus.

1. CALLITRICHE, L.

1. *C. stagnalis*, Scop.

A small water-weed with the upper leaves forming a floating rosette, obovate-spathulate, .5—'.75" long. The minute yellow anthers can often

be detected with the naked eye from the axils of the rosette of leaves, the female flowers are usually submerged, at least in fruit. Fruit sub-orbicular with acute keeled but scarcely winged lobes.

Sirguja plateau, 2000 ft., in still water near a stream, *Wood*.

FAM. 31. LINACEÆ.

Herbs or shrubs with alternate simple usually entire leaves. Stipules sometimes intrapetiolar or 0. Flowers 2-sexual. Sepals 4—5, free or connate below. Petals contorted or rarely imbricate. Stamens diplostemonous, the alternate ones sometimes reduced to minute staminodes, filaments united at the base into a hypogynous or somewhat perigynous ring, anthers versatile. Glands 5 or 0, usually adnate to the staminal ring, sometimes 2-lobed. Ovary 3—5-celled, not lobed; styles 3—5, sometimes connate below. Ovules 1—2 axile, anatropous. Fruit 3—5-coccos, or drupaceous. Albumen fleshy or 0. Embryo nearly as long as the seed, straight, rarely incurved, cotyledons broad, radicle superior.

Herbs. Perfect stamens 5. Styles 5	1. <i>Linum</i> .
Undershrubs. Perfect stamens 5. Styles 3—4	2. <i>Reinwardtia</i> .
Shrubs. Perfect stamens 10. Styles 5	3. <i>Hugonia</i> .
Cultivated shrub. Perfect stamens 10—12. Styles 3—4	4. <i>Erythroxyton</i> .

1. LINUM, L. Flax.

Herbs with narrow entire leaves. Stipules 0 or glandular. Stamens 5, perfect, staminodes minute. Disc of 5 glands. Ovary 5-celled, the cells sometimes divided into 2. Styles free. Cocci 5, 1- or partially 2-celled, 2-seeded.

1. *L. usitatissimum*, L. Unchi, K.; Tisi, alsî, H.; Tisi, Mosina, Beng.; Pesu, Or.; The Flax or Linseed.

An annual 1—2 ft. high with stem simple below, linear or lanceolate leaves, 3-nerved at base and blue flowers, 7—1" diam. Capsule about as long as the acuminate sepals.

Extensively cultivated and forming fields of a beautiful blue when in full flower. In all the districts. Fls., Fr. c.s.

It is grown for its seed only, the flax not being manufactured. A pint of raw linseed oil with an ounce each of laudanum and spirits of turpentine is one of the best remedies for colic in ponies.

2. REINWARDTIA, Dumost.

Undershrubs with entire or crenate leaves and minute subulate caducous stipules. Flowers yellow in cymose fascicles. Stamens 5 perfect, hypogynous, connate below, with intermediate subulate staminodes. Glands 2—3. Ovary 3—4-celled, cells 2-locellate, styles 3.

1. *R. trigyna*, Planch (inc. *R. tetragyna*, Planch) Langora, Vern.

A very pretty small shrub, 2—4 ft. high, with green herbaceous branches, ovate-oblong to elliptic-lanceolate, entire or crenate-serrate

leaves, and bright yellow or chrome-yellow flowers, 1—1.5" diam., on numerous small axillary branchlets, rarely solitary or in terminal cymes.

On shady banks and ravines. N. Champaran! Gaya! Chota Nagpur! Angul! Probably therefore in all districts. Fls. Oct.—Feb. Fr. Feb.—March. Perennial, evergreen.

Branches sometimes woody, erect or prostrate and rooting, glabrous. L. up to 3—4" rarely sometimes with minute teeth, mucronate, narrowed into the slender .5—1" petiole. Sepals erect. Petals obovate. Styles 3 (*R. trigyna*) or 4—5 (*R. tetragyna*). Capsule .3" diam., depressed globose, with alternate green and orange bands in some states.

Is well worth a place in the garden.

3. HUGONIA, L.

Leaves stipulate. Flowers yellow, the lower peduncles converted into spiral hooks. Stamens 10, hypogynous, with glandular swellings on the ring between the filaments. Ovary 5-celled, styles 5, filiform. Ovules 2, collateral in each cell. Drupe globose. Seeds compressed, albuminous. Cotyledons flat.

1. *H. mystax*, L. Chulijinka, Or.

A sarmentose or climbing shrub, of which the short branchlets bear opposite circinate tendrils (modified peduncles) below the clusters of obovate-elliptic, entire leaves which are 1.5—3" long, or less on the flowering branchlets. Flowers 1—1.5" diam., yellow. Drupe yellow, orange or red, .5"—6" diam.

Scrub jungles of Puri Dist. frequent. Fls. May—Aug. Fr. Sept.—Nov.

Young parts yellow tomentose. L. usually rounded at apex (obtuse or subacute, *F. B. I.*), young with a few yellow hairs on mid-rib. Sec. n. fine spreading, very reticulate between. Peti. very short. Stipules subulate, .2". Sep. ovate-lanceolate, tomentose, .25". St. 5 long and 5 shorter, exserted.

4. ERYTHROXYLON, L.

E. coca, Lamk., has been grown on the Ranchi plateau for the drug cocaine derived from its leaves, but without much success commercially. It is a native of the Andes and Peru.

E. monogynum, Roxb., might possibly be found in Kalahandi. It is a bright-green shrub with cuneate-obovate leaves and red edible drupes.

FAM. 32. MALPIGHIACEÆ.

(In the Indian Genera.) Climbing or sub-erect shrubs with opposite entire leaves. Stipules small or 0. Flowers moderate-sized or rather small, regular or irregular, with articulate pedicels, racemed or paniced, 2-sexual. Sepals 5, more or less connate below, one or more sometimes furnished with a large gland. Petals 5, imbricate. Disc obscure. Stamens 10, hypogynous or sub-perigynous, one or more sometimes larger than the others, filaments sometimes connate below. Ovary 3-celled, sometimes angled, with 1—3 straight or coiled styles. Ovule 1 in each cell, axile, pendulous, with ventral raphe and superior micropyle. Fruit of 1—3 winged samaras. Seed exalbuminous, embryo straight or curved.

It is a large American family and several pretty exotic erect shrubs (*Malpighia*, *Galphimia*, etc.) are grown in Indian gardens. These have often small and toothed leaves and the fruit without wings.

Sub-erect or scandent. Fls. m.s., irregular
Scandent. Fls. rather small, regular

1. *Hiptage*.
2. *Aspidopterys*.

1. HIPTAGE, Gaertn.

Stout climbing or sub-erect shrubs with coriaceous leaves and sometimes intramarginal glands. Stipules 0. Flowers in simple or branched racemes, irregular. Calyx with large glands adnate to the pedicel. Petals unequal and one differently coloured, clawed. Stamens declinate, unequal, filaments connate at base. Ovary 3-lobed. Styles 1—2 coiled and 2—1 rudimentary. Fruit of 1—3 samaras. Seed subglobose. Cotyledons thick, unequal.

1. *H. madablota*, Gaertn. Sang Karla, S.; Madubluta, Beng.; Boromali, Nata Nageswar (fide Grieve), Or.

A large woody shrub, sometimes climbing to a considerable height, with pale branches, elliptic or ovate-oblong or oblong-lanceolate, shortly acuminate leaves, 4—7" by 2.5", and showy white flowers .75—1" across, with one yellow petal. Each carpel with one large, central, erect, oblanceolate wing, 1.5—2" long, and two smaller lateral wings.

Chiefly along nalas and ravines. Singbhum and Porahat! Hazaribagh and Gaya Ghats! Santal P.! Mayurbhanj! Narsinghpur! Angul, frequent! Kalandi, Grieve.

Fls. Feb.—March. Fr. April—May. Evergreen.

Young branches and leaves tomentose but soon glabrescent and mature leaves shining, penninerved, with 4—6 arched sec. n. and numerous very faint intermediate ones, base of leaf obtuse. Petiole .25". Racemes pubescent, sometimes in leafy panicles. Petals fimbriate.

2. ASPIDOPTERYS, A. Juss.

Tall climbing, often slender shrubs with opposite entire leaves, stipules small or 0. Flowers small, in axillary or terminal panicles, pedicels articulate, often minutely 2-bractcolate. Calyx short, eglandular. Petals sessile, entire. Stamens 10. Ovary 3-locular, loculi flattened at the back and laterally winged, these wings largely developing in fruit which consists of 3 (—1) samaras, nucleus sometimes with an additional small dorsal wing. Styles 3.

L. sometimes glabrescent. Samara narrow oblong
L. densely silky beneath. Samara broadly elliptic

1. *indica*.
2. *Hutchinsoni*.

1. *A. indica*, Hochreut. Syn. *A. Roxburghiana*, A. Juss.

Climber, with broadly ovate or elliptic shortly acuminate ovate shining leaves, glabrous or silky beneath, mostly 4—5", with acute to rounded but not cordate base. Flowers small, white, on slender articulate pedicels, in large axillary and terminal effuse panicles, and samaroid fruit with elliptic-oblong or linear-oblong wings 1.5—2.3" long.

Orissa, frequent, Puri and Angul! Fls. Sept.—Oct. Fr. Jan.—Feb.

Stems attain 4" diam. Branches with deciduous rusty hairs. L. (in some Angul specimens) attain 8" by 5.5" with usually rounded often oblique base and short

curved acumen, larger sec. n. only 3—4, of which 2 are usually near the base and very oblique, intermediate sec. n. fine spreading, marginal nerve strong. Petiole .6—1" or sometimes 1.4". Lower branches of panicle (from leaf axils) up to 8" long, rusty pubescent, secondary branches usually sub-verticillate with the flowers racemed and subcorymbose. Pedicels capillary .3—4". Petals reflexed .12" long. St. exserted. There are two varieties.

Var. *a*. Leaves thinly fulvous silky beneath even in fruit. Samara linear-oblong, attaining 2" by .5". Pedicels above the articulation and calyx conspicuously pubescent. Mals of Puri.

Var. *β*. Leaves glabrescent. Samara much broader in the middle (ell. oblong) attaining 2.3" by .8". Pedicels above the articulation, glabrous. Calyx minutely puberulous and ciliate. Puri and Angul.

NOTE.—Var *a* is evidently *A. indica*, Hochreut. (*Kew Bulletin*, No. 3, 1917, Revision of *Aspidopterys*), but var. *β* appears to connect the species with *A. floribunda*, Hutchinson, except that the calyx is not quite glabrous.

The shape of the samara in a long suite of specimens appears rather variable.

2. *A. Hutchinsoni*, Haines. *Kew Bulletin*, No. 2, 1920.

A stout climber with sub-woody branches rough with the bases of fallen hairs. Twigs tomentosely hairy. Leaves rather coriaceous, orbicular-obovate or orbicular, suddenly cuspidate, 3—4" long, base straight or rounded, densely silkily hairy beneath. Panicles short, lateral. Samaras broadly elliptic, 1" by nearly 1", nucleus also with a median wing .5" long.

Mayurbhanj, elev. 3000 ft.! Fls. Dec.—Feb. Fr. May—June.

L. sometimes broader than long, mostly 4 by 3.5", densely yellow tomentose both sides when young, glabrescent above, sec. n. about 5, of which one is usually from the base, tertiary raised beneath. Petiole .75", pubescent. Panicles brown hairy. Pedicels short articulate near the base and glabrous (in fruit) above the articulation. Sep. dorsally hairy. Pet. oblong, .18" long. Samaras membranous, retuse at the apex. Dorsal wing semi-ovate or semi-lanceolate .15" broad. Carpophore 3 mm. long, puberulous.

FAM. 33. ZYGOPHYLLACEÆ.

Shrubs, undershrubs or herbs, rarely small trees, usually with opposite, pari-pinnate leaves, rarely alternate (*Peganum*) or simple or odd pinnate; stipulate. Flowers solitary or in scorpioid cymes or contracted racemes, often appearing axillary or extra-axillary (in *Guaicum* appearing umbellate), regular. Sepals 5, rarely 4, free or united at base, imbricate, rarely valvate. Petals, as in the sepals, rarely 0. Stamens diplostemonous, rarely 3 times as many as petals, filaments usually appendaged at base with a scale, anthers versatile. Ovary 4—5-, seldom 2—12-celled, usually angled or winged, with 1—several axile pendulous ovules. Style angled or furrowed, stigma simple, rarely 5. Fruit usually capsular, or of cocci more rarely baccate or drupaceous. Albumen present or 0. Embryo as long as the seed, straight, rarely curved; cotyledons thick or flat; radicle straight, superior.

Prostrate herbs with pari-pinnate leaves	1. <i>Tribulus</i> .
Erect herb with deeply irregularly cut leaves	2. <i>Peganum</i> .
Small grey green tree or shrub with 2-foliolate leaves. Fruit drupaceous	3. <i>Balanites</i> .
Small cultivated tree with blue flowers	<i>Guaicum</i> , p. 159

1. TRIBULUS, L.

Prostrate herbs with opposite pari-pinnate leaves and white or yellow small flowers appearing axillary or pseudo-axillary (the branching is really cymose). Petals 5, fugacious. Disc annular, 10-lobed. Epipetalous stamens longer, alternate shorter with a small gland at base. Ovary hirsute, 5—12-celled and -lobed, Fruit of 5—12 winged or spinous or tuberculate indehiscent cocci.

1. *T. terrestris*, L. Gokhru, Goksura, Beng., H.; Caltrops, Eng.

Densely hairy, with prostrate branches, 1—2 ft. long. Leaves 2—3" long, often unequal in a pair, leaflets 4—7 pairs, oblong with oblique base, mucronate, 3—8". Flowers pale yellowish, 3—6" diam., on peduncles 4—5". Fruit usually hairy, cocci each with 2 very sharp rigid spines and 2 shorter ones.

Common roadsides and pastures, especially in sandy soil, throughout the area. Fls., Fr. h.s. and r.s., perhaps all the year round.

Some specimens outside our area show flowers over 1" diam. A form collected by me near Chandpur on the sands near the sea (Balasore Dist.) had snow-white tomentose leaves, leaflets only 1—2" and small flowers. The species, if really one, has a wonderful range extending from the plains to the Tibetan tableland, 11,000 ft., and to Australia and Africa!

Bicycle tyres are certain to be punctured if wheeled over grass where this weed occurs. The entire plant and especially the dried fruits are used in Hindu medicine. Water is rendered mucilaginous by it and is drunk especially in diseases of the genito-urinary system.

2. PEGANUM, L.

Perennial herbs, with alternate entire or multifid leaves with setaceous stipules. Flowers leaf-opposed, white. Sepals often foliaceous and pinnatifid, persistent. Stamens 12—15, in two whorls, the outer with twice as many as the inner, filaments dilated below. Ovary deeply 2—3-lobed. Fruit 3—4-celled, 3-valved or indehiscent.

1. *P. harmala*, L. Harmal, H.; Isband, Beng.; Syrian Rue.

Rather a pretty bush, 1—3 ft. high, densely dichotomously corymbosely branched and with the leaves cut into linear segments about 1" long. Flowers white, 5" long, on leaf-opposed peduncles. Sepals linear, exceeding the petals. Stamens 12—15. Capsule globose, 4" diam.

Fairly frequent in the U.P. and Punjab and occasionally entering the province from the north-west.

Fls., Fr. April.

The seeds yield a red dye and are used in medicine. They contain alkaloids.

Guaicum officinale, L., is a small tree with dark glossy pinnate leaves and the branchlets terminated by pseudo-whorls (through the abbreviation of the axes of the cyme) of blue flowers. It is one of the most beautiful and ornamental trees in flower and deserves to be far more widely cultivated than it is.

3. BALANITES, Delile.

Thorny small tree or shrub, with alternate leaves consisting of one pair of coriaceous leaflets. Flowers yellowish green, in contracted cymes or pseudo-umbels. Sepals 5, concave. Petals 5, imbricate. Stamens 10,

inserted on the somewhat elongate torus at the base of the prominent disc which is 10-lobed below, filaments subulate. Ovary 5-celled, or by suppression 1-celled, slightly sunk in the disc with 1 pendulous ovule in each cell. Fruit drupaceous with a very hard 5-angled, 1-celled and 1-seeded stone.

1. B. Roxburghii, Planch. Hingua, H.; Ingun, Kharw.

A small grey-green tree or low bush, copiously armed with axillary or extra-axillary thorns, hoary-tomentose all over with 2-foliolate leaves and green and yellow flowers 3" diam. Drupe oval, 1.5—2" long, slightly 5-grooved both ends.

Common in Palamau on the east bank of the Son and frequent near Kechki! Hazaribagh, waste lands and low scrub jungle! Gaya, frequent! Fls. Nov., also Feb.—May. Fr. Nov.—Dec.

Thorns stout, often elongate and bearing leaves. Lfts. entire elliptic, obovate or oblanceolate, .75—1.25", petiole hardly any. Petals strap-shaped or oblanceolate villous above, yellow, loosely imbricate in bud. Style subulate, stout 5-grooved. Drupe yellow, full of oil and with a very offensive smell.

FAM. 34. GERANIACEÆ.

Herbs, undershrubs or rarely trees, with opposite or alternate, simple or compound, stipulate, often palm-nerved, leaves. Flowers umbelled, cymose or racemose, small or showy, regular or nearly so. Sepals 5, free, imbricate, or connate below. Petals 5, usually alternating with 5 glands. Stamens as many or 2—3-times as many as the petals, connate into a ring at their base or free, the outermost opposite the petals. Ovary 3—5-lobed or -celled, with 1-2 or 2—many ovules in each cell usually pendulous with micropyle upwards. Fruit capsular or splitting into beaked cocci which separate from the central axis or (in *Averrhoa*) baccate. Embryo often green, straight or curved in albumen.

- | | |
|--|-----------------------|
| 1. Herbs. Fruit capsular or of cocci. | |
| Leaves simple, often lobed. Petals alternating with glands | 1. <i>Geranium</i> . |
| Leaves pinnate. Glands 0 | 2. <i>Biophytum</i> . |
| Leaves 3-foliolate. Glands 0 | 3. <i>Oxalis</i> . |
| 2. Trees. Leaves pinnate. Fruit baccate | 4. <i>Averrhoa</i> . |

The common garden "geranium" belongs to the genus *Pelargonium*. The flowers are more or less irregular and a peculiar tube-like spur will be found under the uppermost sepal adnate to the pedicel; there are no disc glands and only 2—7 of the stamens bear anthers.

The garden "nasturtium" belongs to the genus *Tropæolum*, often put into a separate family (*Tropæolaceæ*), distinguished by the long hollow free spur on the posterior sepal, 8 stamens and 3-celled ovary splitting into 3 cocci in fruit. The genus *Nasturtium* belongs to the family *Cruciferae*.

1. GERANIUM, L.

Leaves palmately-lobed, rarely entire. Flowers on 1—2-flowered peduncles. Stamens 10, all with anthers. Fruit beaked, breaking up into 5 cocci with elastically coiling ends which remain for a time suspended to the tip of the central axis of the fruit.

1. *G. ocellatum*, Camb. Purple-eyed Geranium.

A small herb with a short rather woody stem, often clothed with the persistent leaf stipules, tufted long-petioled orbicular palmately 4—7-lobed leaves, 1—1.5" (rarely 2") diam., and numerous axillary few-flowered peduncles of rose-coloured flowers, .5—75" diam., with a purple eye.

Parasnath 4000 ft. Neterhat (Palamau) 3300 ft. Fls. Oct.—Dec. and sometimes up to March. Fr. Dec.—April.

Compact and tufted with very short peduncles among the crowded radical leaves or with long, slender, few-leaved flowering stems which attain 10" long. L. cut about three-fourths of the way down into obovate or cuneate lobes, lobes 3—5-lobulate and lobules with few teeth, both sides hairy. Petioles 2—4", hairy. Peduncles among the radical leaves usually very short and 1—2-fld with short pedicels, those on the stems either short and sub-umbellate, or sometimes very slender and up to 3" long, with pedicels up to 1.5" long! Bracts lanceolate, hairy, .1—2". Buds ovoid. Sep. .17", hairy and glandular lanceolate or ovate-acuminate strongly 3-nerved with the central nerve produced into a long mucro, base rounded. Fruiting pedicels deflexed and fruiting calyx .2" long. Ripe carpels transversely corrugate.

2. BIOPHYTUM, DC.

Herbs often small and sometimes like miniature trees, with a single stem and crown of leaves. Leaves pari-pinnate, leaflets opposite, petiole swollen at base. Flowers small, yellow umbelled on terminal peduncles. Stamens 10, free, 5 outer smaller. Styles 5. Fruit a loculicidal capsule.

Flowers dimorphous as regards relative length of style and stamens. The leaflets are sensitive and close at nights.

Stem often short. Sepals longer than pedicels and fruit.

Lfts. 8—14 prs., pedicels distinct

Lfts. 5—7 prs., fls. sessile or nearly so

Stem usually long and graceful. Sepals shorter than the pedicels

1. *sensitivum*.

2. *apodiscias*.

3. *Reinwardtii*.

1. *B. sensitivum*, DC. Lak chana, H.

A pretty little herb with leaves and peduncles rising direct from a stout stock or crowning a hairy sometimes branched stem 3—4" high. Leaves 1.5—5" long, with terminal leaflets .3—5" long, decreasing in size downwards, sessile, oblong or oblong-obovate, rhachis usually hairy. Peduncles often exceeding the leaves, densely hairy with numerous, chaffy, nerved bracts and small yellow flowers on short pedicels. Sepals lanceolate, .2" long, like the bracts and exceeding the pedicels. Capsule ellipsoid, 5-grooved.

Common Chota Nagpur! Pur! Probably throughout the area. Fls., Fr. r.s. It is given to children to induce sleep by the Kols and Santals. A case of the Law of Signatures!

2. *B. apodiscias*, Turcz.

A very small delicate species, 1—3" high, leaves .5—1" long only, with only 5—7 pairs of strongly nerved leaflets and inflorescence nearly sessile. The seeds are said to have scattered tubercles; while those of *B. sensitivum* have transverse tubercled ridges.

Monghyr, Hamilton.

Stems rarely 3" sometimes 0, hairy above. Peduncles 0 or very short. Pedicels .1—15", sepals .2", about as long as the rather acute capsule. It is not the pedicels, as sometimes stated, but the peduncles that are so short in this species.

3. *B. Reinwardtii*, Walp.

A graceful little herb with its crown of pinnate leaves always terminating a slender stem 2.5—10" high. Leaves 2—3" with usually 8—12 pairs of leaflets, which decrease in size very rapidly towards the base, so that the uppermost are .4—5" and the lowest are often only .1" long, rachis usually hairy, often pink. Peduncles shorter or longer than the leaves, pubescent; crown of chaffy bracts shorter than the pedicels, which again are longer than the .1" long sepals. Sepals equal or somewhat longer than the capsule.

Rocky jungles and damp banks. Hills of Chota Nagpur, common. Fls., Fr. r.s. and c.s.

3. OXALIS, L. Wood Sorrel.

Herbs with often bulbous or tuberous roots and acid juice. Leaves digitately 3-foliolate. Flowers variously coloured, on axillary 1—more flowered peduncles. Disc without glands. Stamens 10, all antheriferous, free or slightly connate at base. Fruit a loculicidal capsule with 5 persistent valves.

The leaflets are articulate on the petiole and close at night.

1. *O. corniculata*, L. Amboti, Chalmori, H.; Amrul, Beng.; Tandichatom arak', S.; Yellow Sorrel.

Stems diffuse with procumbent branches, leaflets obcordate, stipules oblong, united to the base of the petioles, peduncles about 2-flowered, shorter than the leaves, pedicels reflexed in fruit. Flowers yellow, .4—5" diam. Capsules narrowly oblong.

A common weed in gardens, etc., in all districts. It extends into England. Fls., Fr. all the year.

The leaves are used as a pot-herb.

4. AVERRHOA, L.

Trees with alternate exstipulate imparipinnate leaves and opposite or alternate leaflets. Flowers regular in paniced cymes, often from the old wood. Sepals 5, imbricate. Petals 5, twisted or occasionally imbricate. Glands 0. Stamens 10, all perfect, or 5 staminodes, united at the base. Ovary 5-lobed and -celled, each lobe with a short style and capitate stigma. Ovules many. Fruit baccate, 5-ridged or-lobed. Seeds sometimes arilled, albumen scanty. Embryo straight.

1. *A. carambola*, L. Kamaranga, H., Or.; Karmal, Kamarak, Beng.

A small tree with somewhat smooth bark and dense dark crown. Leaflets 7—11, broadly-oblong, ovate, elliptic or elliptic-lanceolate, obtuse to acuminate, basal often only .7", upper often 4" by 2". Flowers campanulate, .2—2.5" long and broad, pretty, pink with deeper pink

throat, in panicles from the branches or axillary or terminal. Fruit 3" long, yellowish, sharply 5-angled.

Planted to a small extent in most stations! Fls. June—Sept. Fr. Sept.—Oct. Evergreen.

Attains 3 ft. girth. Leaflets puberulous beneath, base usually very oblique. Seeds with a 2-lobed lacerate aril. Leaves said to be irritable to touch. Fruit eaten, usually stewed with sugar.

2. *A. bilimbi*, L. Bilimbi, Vern.

Easily distinguished by the more numerous narrow-oblong or linear-lanceolate acuminate leaflets more pubescent beneath. Fruit with rounded lobes and exarillate seeds. A graceful little tree, occasionally planted. The acid fruits are, like the last, supposed to promote digestion. The juice is made into a cooling drink and also used to remove stains from clothes.

FAM. 35. BALSAMINACEÆ.

Herbs with opposite alternate or whorled, simple exstipulate penninerved leaves, and axillary, rarely pseudo-terminal, solitary or racemed, usually brilliantly coloured flowers. Flowers ebracteate, zygomorphic. Sepals 3, rarely 5, imbricate, the large posterior (standard) variously shaped, differing from the others, petaloid and always spurred. Petals 5, or, through fusion of two pairs, 3, variously shaped. Stamens with short broad filaments and connate anthers which are hooded over the stigma. Ovary 5-celled with 3—more pendulous axile ovules in each cell, raphe dorsal. Fruit a succulent capsule elastically opening upwards by 5 valves (or in *Hydrocera* baccate). Albumen 0.

1. IMPATIENS, L.

Characters as above.

1. *I. balsamina*, L. Gul-mendi, H.; Dupati, Beng.; Hatagaura, Or.; Common Balsam.

An annual with alternate rather distant leaves, narrow-lanceolate acuminate, deeply serrate, with glandular petiole. Flowers purple or rose coloured, solitary or fascicled, lateral sepals broad, ovate, minute, standard orbicular retuse, wing petals very broad, lip small, spur short or long, incurved. Capsule tomentose.

Common in waste ground in the rains, but usually near villages. Fls., Fr. r.s. The origin of the common garden balsam.

FAM. 36. RUTACEÆ.

Trees or shrubs, rarely herbs, abounding in pellucid glands filled with essential oil, with opposite or alternate, simple or compound exstipulate leaves. Flowers regular in cymes or panicles, often polygamous. Calyx of 4—5 sepals usually connate below. Petals 4—5, rarely fewer (or more in some *Aurantieæ*), valvate or imbricate. Stamens hypogynous, diplostemonous or numerous, filaments free or somewhat connate, inserted

around a crenate or lobed, sometimes elongate disc. Anthers introrse. Ovary entire or lobed, 4—5-celled (1-celled in *Feronia*) or more-celled (many *Aurantia*). Styles as many as carpels or united with terminal stigma. Ovules usually 2, sometimes numerous in each cell. Fruit baccate, drupaceous or capsular, sometimes splitting into cocci. Seeds often solitary in the cells. Albumen fleshy or 0. Embryo straight or curved, radicle superior.

Chloroxylon is sometimes included in this family on account of its gland-dotted leaves, but its numerous ovules and its fruit are more those of *Meliaceæ*, tribe *Cadrea*, which connects the two families.

Tribe *Aurantia* (genera 5—15) is best characterised by its exalbuminous seeds—an awkward field character not here used.

The thorns are often found laterally to a leaf or fascicle of leaves. In the axil there arises 1—3 buds. Frequently one of these develops into a thorn; sometimes the two lateral develop as thorns, in other cases one lateral bud develops as a thorn and the other as a branch bearing one or a fascicle of leaves. When the original subtending leaf falls the thorn thus becomes lateral to a leaf or fascicle.

I. Ovules 2—1 in each cell.

A. L. pinnate. Ovary 2—5-lobed. Fruit a capsule.

Leaves opposite. Unarmed

Leaves alternate. Usually prickly

B. L. digitately 3-foliolate. Branches prickly

C. L. 1-foliolate. Fruit dry or baccate:—

a. Unarmed. Flowers in long peduncled corymbs

b. Usually with axillary thorns. Fls. axillary.

Fls. small fascicled or shortly racemose

Fls. large, 1" long

D. L. pinnately 3-foliolate. Ovary entire. Fruit baccate.

Leaves sessile

Leaves with winged petioles

E. L. pinnate (rarely also 3—1-foliolate mixed in *Glycosmis*).

Ovary entire. Fruit baccate.

a. Thorny. Petioles winged

b. Unarmed. Petioles not winged.

1. Style short persistent. Fls. small in narrow panicles

2. Style articulate, deciduous.

Petals valvate. Fls. in large terminal corymbs

Petals imbricate. Filaments linear-subulate

Petals imbricate. Filaments dilated below

II. Ovules many in each cell.

L. 1-foliolate

L. 3-foliolate

L. pinnate. Ovary 1-celled

1. *Evodia*.

2. *Zanthoxylum*.

3. *Toddalia*.

4. *Acronychia*.

5. *Atalantia*.

6. *Paramignya*.

7. *Triphasia*.

8. *Limonia*.

8. *Limonia*.

9. *Glycosmis*.

10. *Micromelum*.

11. *Murraya*.

12. *Clausena*.

13. *Citrus*.

14. *Ægle*.

15. *Feronia*.

1. EVODIA, Forst.

Trees or shrubs with opposite simple 3-foliolate or imparipinnate leaves with entire leaflets. Flowers small in paniced cymes, 4—5-merous. Petals, without claws, valvate or slightly imbricate. Stamens inserted at base of the disc, filaments subulate, anthers oblong. Ovary deeply, usually 4-rarely 5-lobed and -celled. Style from between the lobes. Ovules 2 in each cell, collateral or superposed. Fruit of 4 (or 5) coriaceous, 1-seeded dehiscent carpels with separable horny endocarp. Seeds with hard shining testa, sometimes extruded from the carpel, hilum linear. Embryo straight with ovate or oval cotyledons.

1. *E. meliæfolia*, Benth. Ankhijhora, Or.

A large tree with grey bark, marked on the branches with very large prominent lenticels. Leaves imparipinnate with 9 to 17 lanceolate or oblong-lanceolate acuminate leaflets, 3.5–6" long, opposite or subopposite. Flowers in terminal panicles as broad as long. Fruit deeply 4–5-lobed, 3–4" diam., each carpel with a shining black oval-oblong seed .12", extruded on the persistent placenta.

Bonai, Cooper! Fls. May–July? Fr. Sept.–Oct.

Distrib.—Eastern Himalayas (ascending to 6000 ft. in Sikkim and Bhutan) Assam and Upper Burma.

Bark rough (Cooper). L. rhachis 8–14", pubescent. Lfts. mostly opposite, lower sometimes alt. and smaller, more or less permanently pubescent on the midrib. Sec. n. spreading 15–20 fine, glands very minute and indistinct or scarcely visible. Petiolule .1". Panicles terminal (sometimes also axillary), 4–6" diam., brachiate pubescent. Fls. white. Pet. oblong .17". St. exserted. Placentas from the inner basal angle of the carpel broad, membranous and extruded in fruit. Ovules collateral. Carpels usually 4, very aromatic with large glands in the epicarp. Testa very thick. Albumen scanty fleshy. Cotyledons fleshy, veinless, broadly oval with short blunt radicle.

2. ZANTHOXYLUM, L.

Trees or shrubs usually armed with stout prickles. Leaves alternate, 3-foliolate or imparipinnate with opposite or alternate entire or crenate, often very oblique leaflets. Flowers small, in axillary or terminal peduncled cymes. Calyx 3–8-fid or 0. Petals 3–5 rarely 0, imbricate or induplicate-valvate. Disc small or obscure. Stamens 3–5, hypogynous or reduced to scales in female flowers. Ovary of 1–5 oblique 1-celled carpels. Styles sub-lateral. Ovules 2 in each cell, usually collateral. Fruit of 1–5 globose, coriaceous, or fleshy 1-seeded carpels dehiscing ventrally, endocarp horny, separating or not. Seed oblong and compressed or globose, often extruded from the carpel, hilum broad, testa bony or crustaceous, blue or black shining, albumen fleshy; embryo axile, straight or curved, cotyledons flat, radicle very short.

Petiole not winged, flowers polypetalous.

Lfts. crenate, with a large gland in each crenature

1. *budrunga*.

Lfts. entire, very unequal-sided

Var. *rhetsa*.

1. *Z. budrunga*, Wall. Syn. *Z. Rhetsa*, DC.; *Fagara Budrunga*, Roxb.; Morai, Or.

A small or moderate-sized tree with pale corky bark, covered with conical prickles on stems and branches and sometimes a few small ones on the leaf rhachis. Leaves clustered towards the ends of the stout branchlets, 18"–2 ft. long (with the petiole). Leaflets 19–25 or fewer, somewhat like those of a Toon, 3–6" long, oblong or lanceolate, caudate, entire or crenate, when crenate with a large gland in the sinus. Flowers .17" diam., yellow, 4-merous, in large terminal panicles with opposite branches.

Ranchi Ghats (Bishanpur, along nalas)! Puri, common! Fls. March–June. Fr. r.s. Deciduous. New leaves appear June.

Bark corky. Pith large septate. Young prickles upcurved. Lfts. very oblique at base, rounded on the upper side, with the lamina shorter, narrower and acute on

the petiole on the lower side; some Puri specimens, however, have leaflets with a more regular lamina. Rhachis in Puri specimens unarmed and leaflets less crenate, often entire. Panicles sometimes 18". Pet. valvate. Ripe carpels solitary, .25" diam., tubercled. Seed blue-black, tasting of black-pepper.

I think it is impossible to separate *Z. budrunga* and *Z. rhetsa*. The former is usually the north India form, the latter usually the Peninsular form, and, as might be expected, the Bihar and Orissa plant unites the two, that from Bishanpur being more nearly *Z. budrunga* and that from Puri more nearly *Z. rhetsa*, but even in the latter some leaflets are crenate. Again, some Sikkim and Chittagong specimens occur with entire leaves and several have been doubtfully named in the *Calcutta Herbarium*. Moreover, the characters used by *Roxburgh* to discriminate the two species are *not* the leaf crenatures, and both his descriptions and figures show the leaves of both species quite entire! He evidently knew his "Fagara Rhetsa" well, but seems to have had a specimen of *F. budrunga* with very few leaflets.

3. TODDALIA, *Juss.*

1. *T. aculeata*, *Pers.* Syn. *T. asiatica*, *Lamk*; Tundpora, Tundpara, *Or.*

A rambling or scandent very prickly shrub with alternate 3-foliolate leaves with sessile leaflets. Flowers small, 1-sexual, in axillary cymes, white or yellowish. Fruit globose, .25" diam., 3-5-grooved and -celled, orange. Seeds 1 in each cell, angled, testa coriaceous. Embryo curved, terete.

In the south of the Province especially near the coast, Balasore! Puri, common, esp. in the scrub jungles! Mayurbhanj, in the hills, common!

Fl. Fr. Aug.—Dec.

Lfts. 1-3", ell., obovate oblong or lanceolate, crenulate, tip obtuse retuse or acute or obtusely acuminate. Fls. .2" diam.

Fresh root bark and whole plant pungent and aromatic. The former is used in Hindu medicine and is used in fevers, and is both diaphoretic and antiperiodic. It contains the bitter alkaloid "berberine." Unripe berries pickled and eaten. Vide *I.P. & D.* for other uses.

4. ACRONYCHIA, *Forst.*

Trees or large shrubs with opp. or alt. 1-foliolate entire leaves. Fls. yellow in peduncled corymbs, polygamous. Calyx 4-lobed, imbricate. Pet. 4, spreading and revolute, valvate. St. 8, inserted under a thick 8-angled tomentose disc, fil. subulate, alternate longer. Ovary sunk in the disc, tomentose 3-5-celled; style terminal, stigma 4-grooved; ovules 2 superposed. Fr. a 3-5-celled drupe. Seeds often extruded from the carpels, testa black, albumen copious, embryo straight, cotyledons oblong, flat.

1. *A. laurifolia*, *Blume.*

A small tree with opp. and alt. leaves. Lft. 3-7", ell.-oblong obtuse or mostly obtusely acuminate, glabrous, with rather irregular and finely reticulate nervation. Corymbs axillary, 3-5.5", including the long peduncles. Petals .2", linear, bearded at the base within.

Damp jungles. Mals of Puri! Bonai, rather rare, *Cooper*! Fls. June—Aug. Fr. Nov.—Dec. Evergreen.

Bark grey, smooth. Lft. with about 8 sec. n. fine raised beneath, some uniting in loops and with intermediate nearly as strong, tertiaries very reticulate, marginal strong. Petiole (rhachis) .5-1" long, thickened both ends. Fls. fragrant, yellowish-

white. Pedicels slender pubescent. Sep. very small rounded persistent, as also is the disc. Fruit 4" diam., somewhat obovoid with depressed or apiculate top, 4-sided or grooved, pubescent, very aromatic.

"Wood greyish white, little used. Wt. about 47 lbs." *Gamble*.

5. ATALANTIA, *Correa*.

Thorny or unarmed shrubs or trees with alt. 1-foliolate coriaceous persistent entire or crenulate leaves. Stipule-like scales (undeveloped leaf buds) often present at base of the petioles and spines. Fls. fascicled or in short axillary racemes, corymbs or panicles. Calyx 3—5-lobed or -partite, sometimes irregularly lobed and split. Pet. 3—5, free or adnate to the stamens and united with them into a tube, imbricate. St. 6—8, rarely more, sometimes united into a tube inserted round an annular or cupular disc, subequal or alternate shorter. Anths. short, ovate-oblong or base cordate. Ovary 2- or 4-, rarely 3- or 5-celled. Style deciduous. Ovules 1 or 2 collateral. Berry sub-globose, 1—5-celled and -seeded. Seeds oblong, cotyledons fleshy.

1. *A. monophylla*, *Correa*. Narguni, Or.

A large thorny shrub or small tree with quite smooth bark, ovate-ell., ell. or lanceolate entire leaves, 1—3" by 5—1.25", with emarginate tip and rounded base. Fls. white, in very short axillary or sub-terminal corymbs. Calyx sometimes irregularly split. Fruit 5" diam. (1" *F.B.I.*).

In the south of the province, chiefly on the east coast. Common in Puri! Banki! Sambalpur, as a shrub only, and rare! Fls. Oct.—Dec. Fr. April—May.

Attains 15" girth. Trunk often with branched thorns. Twigs pubescent, often with short axillary thorns. L. very finely nerved, with about 1—8 sec. n. with fine intermediate and reticulate tertiaries. Petiole 2—3", pubescent. Corymbs sessile, pubescent, rhachis shorter than the 3—5" long pedicels. Calyx subequally or irregularly shallowly 3—5-lobed. Pet. .25", adnate at base to the staminal tube. Ovary usually 4-celled narrowly ovoid, the tip only as wide as base of the .12" long style. Berry 1—4-seeded.

"Wood yellow, hard close grained." *Gamble*. Recommended by *Kurz* and *Gamble* as a substitute for boxwood.

6. PARAMIGNYA, *Wight*.

Shrubs, often climbing and with axillary thorns. L. 1-foliolate, entire persistent. Fls. rather large, axillary, solitary or fascicled. Calyx cupular or small and 4—8-lobed. Pet. 4—5, free, imbricate or rarely induplicate-valvate. St. 8—12, inserted round a columnar disc, filaments free, anthers linear-oblong. Ovary 3—5-celled. Style elongate, deciduous. Ovules 1 or 2, obliquely superposed. Berry ovoid or sub-globose, 1—5-seeded. Seeds large, oblong, compressed, testa membranous, cotyledons fleshy.

1. *P. Griffithii*, *Hook. f.*

A woody climber with thorny bosses on the stem and stout reflexed or recurved axillary thorns. L. oblong-lanceolate or oblong. 3—5.5", acuminate with rounded base and petiole 5" long. Flowers 1—2, axillary, 7" diam., white. Berry subglobose, broader than long, circular

or elliptic in transverse section, .8—1.25" diam., hairy, juice viscous with strong unpleasant smell, the pericarp full of large glands.

Evergreen forest, Mals of Orissa! Fls. Dec.? Fr. April.

Stems attain 6" girth, bark white, rather corky, blaze brownish. Twigs pubescent. L. softly hairy beneath or at least on midrib; sec. n. 9—12 inconspicuous. Peduncle .25". Calyx .15" diam., acutely 6—8-toothed. Pet. (not seen in our specimens) linear-oblong, .3" long. Ovary hairy, cells 2-ovuled. Berry suddenly contracted at the base into a short stalk about the persistent calyx. Seeds large, oblong, .5—7" long.

2. P. monophylla, *Wight*, occurs (*f. Gamble*) in Ganjam and therefore might be found in Orissa. The leaves are nearly always glabrous, obtuse or with short blunt acumen. Calyx .25—27" diam., obtusely-lobed. Pet. 1" long. Fruit ovoid or obovoid, longer than broad.

7. TRIPHASIA, *Lour.*

1. T. aurantiola, *Lour.* Syn. *T. trifoliata*, *F. B. I.*; Chini narangi; *Vern.*

A handsome glabrous shrub with straight usually paired axillary thorns, 3-foliolate leaves scarcely petioled and ovate or elliptic coriaceous rounded or retuse crenulate leaflets .5—1.3" long. Fls. solitary axillary, .4" long, white, fragrant, peduncles hardly any. Calyx small pubescent. Petals linear-oblong. Berry .5", fleshy.

In gardens only. Fls., Fr. h.s.

8. LIMONIA, *L.*

Shrubs or small trees, usually thorny* with pinnately 3—more-foliolate leaves with winged petioles. Flowers paniced, racemed or fascicled. Stamens 8—10. Ovary oblong, 4—5-celled, with short stout deciduous style. Fruit baccate, 1—4-celled and -seeded, seeds imbedded in mucilage, cotyledons fleshy.

1. L. acidissima, *L.* *Beli*, *H.*; *Belsain*, *Kharw.*; *Bhenta*, *Or.*

A small straight tree, attaining 30 ft., with 1—2 axillary thorns,* 5—7 leaflets with winged rhachis, and small white or pale yellowish-white flowers, in very short close racemes. Fruits small, globose, black when ripe and intensely bitter (*not acid*).

In the drier jungles south of the Gangetic plain. Frequent in Palamau (Betlah Forest, etc.)! Santal Parg., in the south! Mayurbhanj! Puri, very common, esp. on the laterite! Athmallik! Angul, Durgapur range! Kalahandi, *Cooper*.

Fls. May—June. Fr. ripens Nov.—Dec. Sub-deciduous at the time of flowering.

Shoots pubescent. Lfts. opposite ell. or elliptic-ovate crenate, 1—2" long, with cuneate base and usually obtuse notched apex. Wings narrowly obovate. Racemes .5—1", mostly from leafless axils. Fls. .25" to (in Mayurbhanj) .5" diam., long-pedicelled, 4-merous. Ovary cells 1-ovuled. Fruits .5" diam., green till ripe.

It is largely used for cart axles.

9. GLYCOSMIS, *Correa*.

Shrubs or trees. Leaves 1-foliolate or imparipinnate, with alt. or opp. leaflets. Flowers small in axillary, rarely terminal panicles. Calyx 4—5-partite. Sepals small, broad, imbricate. Pet. 4—5 imbricate often

* See the note on thorns in Aurantiacæ at the beginning.

glandular. St. 8—10 free, inserted round the disc, filaments linear or subulate, anthers with a dorsal or apical gland. Ovary 2—5-celled, with very short persistent style and simple stigma. Ovules solitary and pendulous. Berry 1—3-seeded. Seeds oblong, testa membranous.

The two following species are connected by intermediates and are united in the *F.B.I.* under *G. pentaphylla*, *Corr.*, and under *G. cochinchinensis*, *Pierre*, in the *Flora of Madras*. They are easily distinguished in our area.

Large bush or small tree, lfts. 1—4", panicle .5—2", axillary, pet. lanceolate or oblanceolate, .22", filaments terete, gradually attenuate, .12" 1. *arborea*.
 Shrub 2—4 ft., lfts. 2—5", panicles 1.5"—3", often terminal, pet. obovate, .18", filaments flattened with suddenly acute tip, .08" 2. *pentaphylla*.

1. *G. arborea*, *DC.* Syn. *G. cochinchinense*, *Pierre*; *G. pentaphylla*, *F. B. I.*; *Chowal Dua*, *Or.*

A dark green small tree or large bush, 8—20 ft. high. L. with 3—5 (rarely only 1) elliptic or ovate leaflets 1—4" long. Fls. small, white, sweet-scented, subsessile, in short, axillary, furfuraceously rusty-tomentose panicles, .5—1.5" long, with suberect or spreading lanceolate or oblanceolate petals .2—28" long. Berry .5", yellow.

Puri Division, in all ranges, especially on the Khandgiri sandstones. Fls. Oct.—Dec. Fr. Nov.—Jan. Evergreen.

Bark on twigs pale grey. Buds rusty tomentose. L. rachis 1—3", lfts, alt. or opp. articulate glabrous shining, mostly with a blunt acumen, nervation obscure above, sec. n. about 6—8 reticulate. Petiolule .15". Fls. .3" diam. in very short peduncled cymes which are racemosely arranged in short panicles. Sep. minute, orbicular, rusty. Stamens not or very slightly dilated. Ovary base constricted above the disc, not or slightly mammillate, gradually passing into the thick style which slightly narrows upwards.

2. *G. pentaphylla*, *Correa*. Syn. *G. cochinchinense*, *Pierre*; *Howmonicho*, *Or.* (*f. Haslett*).

A shrub 2—4 ft. high, often gregarious, with pinnately 1—5 foliolate usually ell. or ell-oblong entire or obscurely-toothed leaflets 2—5" by 1—2.5". Fls. small white in pubescent or puberulous axillary and terminal panicles 1.5—3" long, with erect obovate petals usually under .2". Berry .3—5" depressed globose, often pinkish, glassy, 1-seeded.

Throughout the damper parts of the province. Common in village shrubberies in the Northern Tract! Santal Parganas! Parasnath, *Anders*; Puri! Fls. most of the year, especially Sept.—Feb.

Stamens distinctly dilated, suddenly pointed at top. Ovary base scarcely distinct from the disc, very mammillate with large glands, the short thick style dilated upwards.

10. MICROMELUM, *Blume*.

Small trees without thorns. Leaves imparipinnate, with alternate leaflets, oblique at the base. Flowers in large terminal panicles. Calyx cupular, 3—5-toothed or lobed. Stamens 10, inserted round a short or long disc, alternate shorter. Style constricted at the base and deciduous. Ovules 2, superposed in each cell. Septa of small berry twisted. Cotyledons leafy, crumpled.

1. *M. pubescens*, Blume. Soitani, K.

A small tree, attaining 25 ft., leaves 8—18", with 5—11 very large leaflets and large corymbs of white flowers .5", which are succeeded by foetid, ovoid, yellow or scarlet berries .5" long.

Damp, esp. evergreen, forests. Singbhum, frequent! Hazaribagh! Puri, common in the southern Range: Bonai, *Cooper!* Fls. Jan.—Mar. Fr. May—July. Evergreen.

Lfts. ovate to lanceolate or ell.-oblong attaining 8" by 3.5", lowest sometimes only 1.5", pubescent beneath, acuminate, base rounded oblique, rarely acute, sometimes cordate. Corymbs pubescent or tomentose, often 1 ft. across; fls. with a strong sweet smell, sometimes only .3", petals narrow oblong, valvate. Very pretty when in flower or fruit.

11. MURRAYA, L.

Unarmed small trees or shrubs, with imparipinnate leaves and small alternate leaflets with oblique base. Fls. in axillary or terminal corymbose, cymes rarely sub-solitary. Petals 5. Stamens 10, inserted round an elongate disc, filaments linear-subulate, alternate shorter. Ovary 2—5-celled, narrowed into a long deciduous style. Ovules 1—2. Berry 1—2-seeded.

1. *M. exotica*, L. Otili, K.; Athel, S.; Kamini, H. Beng.; Pitondi, Gond.; Ban Mallika, Harkankali, Or.; The Chinese Myrtle; Chinese Box.

A handsome small tree or shrub, with leaves 4—5" long, small, shining, dark green leaflets, .75"—2" long, and white fragrant flowers in corymbs or few-flowered loose cymes.

Throughout the hills of the province in rocky ravines, not uncommon. Sameshwar Hills! Singbhum! Hazaribagh (on Parasnath)! Sant. Parg.! Ranchi, on the ghats! Palamanu (Neterhat)! Bonai, *Cooper!* Angul, frequent! Sambalpur! Puri, Southern range! Fls. April—July. Fr. Dec.—Jan. Evergreen.

Lfts. 3—8 rigid glabrous entire. Petals .5" oblong-lanceolate. Ovary 2-celled. Berry red or yellow, .5—.75", ellipsoid apiculate 1—2-seeded, seated on the persistent calyx.

Var. *sumatrana*, *Roxb.*, is distinguished by its few-fl. cymes or subsolitary flowers, larger leaflets often 4" by 1.75" and subulate sepals, cymes 3—4-fl.

This is the more common wild form. In above localities, also Gaya ghats, Ranchi ghats and Neterhat. One Santal Parganahs form has obtuse sepals, and petals .9" long.

2. *M. Koenigii*, Spreng. Bakler, Th.; Barsanga, H.; Barsan, Or.

A shrub or small tree with pinnate leaves 5—16" long, very oblique, strongly scented, lanceolate or ovate leaflets 1—3" long, and terminal short-peduncled pubescent corymbs of odorous white flowers, .5—6" diam.

Northern tract, wild along the Nepal boundary! Possibly wild in the jungles of the Mahanadi Delta but only seen by me near False Point! Not wild elsewhere but often seen in gardens.

Twigs pubescent. Leaflets entire or crenulate, usually acuminate, lowest much smaller, 6—15 prs., opposite or alternate. Petals linear oblong .3" long. Fruit succulent, ovoid or ellipsoid, .3—5" long, pink, finally black. Seed large.

The leaves are used in curries and as a stomachic.

12. CLAUSENA, *Burm.*

Unarmed shrubs or trees with imparipinnate leaves and small flowers in cymes, panicles or racemes. Stamens 8—10 inserted round an elongated disc, alternate shorter, filaments usually dilated or arched and concave below the subulate tip. Ovary stipitate, style usually distinct, deciduous, ovules 2 collateral or superposed in each cell. Berry small, ovoid or globose. Seeds oblong, cotyledons plano-convex.

- | | |
|----------------------------------|-------------------------|
| 1. Shrubs, leaves pubescent. | |
| Leaflets 9—15, 1.5—3.5" long | 1. <i>excavata</i> . |
| Leaflets 5—7, 3—7" long | 2. <i>pentaphylla</i> . |
| 2. Small trees, leaves glabrous. | |
| Leaflets 5—9, 3—6" long | 3. <i>Wampi</i> . |

1. *C. excavata*, *Burm.* Ote-armu, Duki potum, *K.*; Agnijhal, *Or.*

An undershrub (in our area) of which the shoots attain 1.5—2 ft. only and die down annually, with alternate 9—many-foliolate leaves and terminal panicles of green flowers with 8 yellow stamens.

Chota Nagpur, common in the Sal forests in Singhum! Western Bonai, *Cooper!*
Fls. May—June. Fr. July—Aug.

Strongly scented. Branches tomentose from a perennial rootstock. Leaf-rhachis tomentose, 6—12" long. Lfts. 1.5—3.5", ovate to oblong or lanceolate with very oblique base, acuminate, hairy especially beneath when young and with large marginal pubescent glands. Branches of panicle cymose. Fls. .25" diam. hairy. Sep. 4 minute. Petals 4, 3-nerved. Ovary villous. Fr. .75", ellipsoid.

Used for indigestion and as a diuretic. The dried and powdered rootstock is also used by the kols for decayed teeth.

In British Bhotan it becomes a small tree.

2. *C. pentaphylla*, *DC.* Rowana, *Th.*; Ratanjot, *H.*

A very aromatic shrub 3—4 ft. high with all parts pubescent or tomentose. L. alt. ascending 5—7-foliolate, Lfts. ell. or rhomboid acuminate alt. or sub-opp., 3—6", conspicuously gland-punctate. Fls. 4-merous yellowish in terminal panicles. Berry verrucose, 3"—4" long, broadly oblong, pale orange.

Common in the Sal jungles of northern Champaran. Fls. May—June. Fr. r.s.
Branchlets tomentose. Lfts. with oblique cuneate base, sometimes faintly toothed, pubescent esp. on the nerves. sec. n. 10—15 rather irregular. Petiolule .05—1". Panicle 4—10" long. Fls. .25" diam. Sep. triangular acute. Pet. oblong, concave, obtuse.

A much-valued Indian veterinary medicine. The bark is powdered and applied with sweet oil to flesh wounds. For sprains of tendons and ligaments, bruises and abrasions, the powder is first boiled in sweet oil for 15 minutes and applied as a poultice. Also used for ossification (see *Polo in India* by Lieut.-Col. H. de Lisle, p. 185).

3. *C. wampi*, *Blanco.* Wampi (from the Chinese).

A small tree occasionally cultivated for its edible berries which are greenish and about .5" diam. The leaves are 5—9-foliolate, 8—13" long, glabrous. Lfts. 3—5.5", obliquely ovate. Rind of fruit full of glands.

Fls. May. Fr. July.

13. CITRUS, L. Orange, Lemon and Citron.

Small trees or shrubs, usually with axillary thorns. Leaves 1-foliolate with often winged petiole. Flowers axillary, solitary fascicled or in small cymes, rather large, not greenish or yellow, sweet scented. Petals variable in number, imbricate. Stamens numerous often in bundles with more or less connate filaments and oblong anthers. Ovary many-celled. Ovules 4-5 in each cell. Berry many-celled, succulent, with coriaceous or fleshy rind. Seeds sometimes 2-more-embryous with plano-convex often unequal cotyledons.

A. New shoots and leaves glabrous.

Twigs pale, petals white. Fls. 2-sexual

1. *aurantium*.

Twigs purple. Some or all the flowers tinged with pink.

Fls. often polygamous

2. *medica*.

B. New shoots and underside of leaves pubescent

3. *decumana*.

The above is *Brandis's* classification from his interesting account in *The Forest Flora of the N.W. and Central India*, but *Bonavia* has shown that among the cultivated races such definite lines cannot now be drawn between the species. For a full account see *Bonavia (Cult. Oranges and Lemons, etc., of India & Ceylon, 1890)*.

1. *C. aurantium*, L. The Wild Orange. Narengi, H.

A small tree much-branched from near the ground, with green angular twigs and nearly entire scented leaves 2.5-5" by 1-2" with petiole .25-.5" long, narrowly winged or not. Fruit small globose or oblate not mammillate, 2-2.5" diam., juicy and resembling a sweet lime in flavour, rind green, not thick.

Rocky secluded valleys in Singbhum and Bonai. Flowers not seen. Fruit ripens April-June.

Branchlets mostly armed with straight axillary thorns .25-.75" long. L. ell. acute or somewhat acuminate and narrowed at the base, entire or faintly crenate-serrate.

The flowers of this interesting plant should be looked for. In form and leaf it is very close to a wild *Citrus* in the Pachmari hills, but the ordinary wild *Citrus medica* is very different both in its larger leaves and thick-skinned elliptic mammillate fruit.

The orange is commonly cultivated in Chota Nagpur and Sambalpur.

2. *C. medica*, L. Jamira, K.; Jambir, S.; Nimbu, H.

Usually a very thorny bush, young shoots purplish. L. 3-6". Fls. often 1-sexual and pink. Fruit mamillate at the apex.

Wild in the Mayurbhanj hills, near ravines! Sometimes apparently wild in waste places especially on the Hazaribagh plateau, but not truly so. It is frequently wild in the moister valleys of the sub-Himalayas and in the Duars.

The cultivated varieties include the Citron, Lemon and Limes, but some of the last are without either the thick skin or mammillate fruit and pass into *C. aurantium*. The wild plant has a large ellipsoid very thick-skinned fruit.

3. *C. decumana*, L. Pamalo; Shaddock; Grape Fruit.

A small tree with leaves 6-9" long and fruit often 6" diam. with very large cells. Commonly cultivated.

14. *ÆGLE*, *Correa*.

Trees with 1 or more axillary thorns and alternate 3-foliolate leaves, with sub-crenulate crenate or nearly entire leaflets. Fls. rather large white or greenish white in axillary panicles. Petals 4—5, spreading imbricate. Stamens numerous, inserted round an inconspicuous disc with short subulate filaments and long anthers. Ovary ovoid with a stout axis and 8—20 cells, short style and deciduous stigma. Ovules many 2-seriate. Fruit large, several-celled and many-seeded, rind woody. Testa mucilaginous and woolly, albumen 0, cotyledons thick, fleshy.

1. *A. marmelos*, *Correa*. Lohagasi, K.; Sinjo, S.; Bel, H.; The Bael tree.

A small tree or sometimes m.s. with 1—2 strong thorns from the leaf axils. Lfts. elliptic or ovate-lanceolate, 2—4" long, sessile with rhachis .5—1" long and petiole 1—2.5' long. Fls. 1" diam., greenish-white in very numerous lateral and sub-terminal simple panicles, 1.5—3" long, appearing with the new leaves. Fruit 2—3" diam. (larger in cultivated forms), globose or oval. Seeds embedded in a clear mucilage and yellow sweetly aromatic pulp.

Sometimes apparently wild in the Champaran hills! On high and stiff soil in Purneah, *Ham.* Wild in the hills of the Central and Southern tracts and also common in the scrub jungles of Puri, where it is sometimes the only tree left standing!

Fls., Fr. May—June. Fruit ripens May—June. Deciduous or sub-deciduous April.

A most valuable tree of which the properties in cases of bowel complaints, especially diarrhœa and dysentery, are well known. The fresh juice is also said (*Nadkarni*) to be a highly prized remedy in catarrh and feverishness, for which also a decoction of the root bark is used. The juice is used by Indian builders in mortar and cement, especially for bringing a glaze to the surface.

The leaves are sacred to Siva.

Var.? In ravines in the Santal Parganas I have found a mod.-sized thornless tree with broadly ovate leaflets, sometimes faintly crenate, 2—4" by 1.3—2.3", shortly obtusely acuminate and puberulous both sides, lateral petiolules .25". It was neither in flower nor fruit.

The bael is frost-hardy. Very slow-growing.

15. *FERONIA*, *Correa*.

Only one species known. Generically it is distinguished from *Ægle* and *Citrus* by the placentæ not altogether reaching the axis of the ovary so that they are parietal. Ovules many. Stamens 10—12. Leaves imparipinnate.

1. *F. elephantum*, *Correa*. Kat-bel, Kochbel, S., *Beng.*; Kaith, Or, H.; The Elephant Apple or Wood-apple.

A small or rather large thorny tree with dark green odd-pinnate leaves, opposite small sub-sessile entire leaflets and green or dull red flowers, 3" diam. in short racemes or racemes paniced on short lateral

branches with or without reduced simple or 3-foliolate leaves. Fruit 2.5—3" diam., many-seeded, with a rough woody rind.

Common and perhaps indigenous on the cotton soil of Angul, Khandpara, Banki and Puril. Planted throughout the province but chiefly in the drier parts and not common elsewhere. Fls. Feb.—April. Fr. Nov.—Jan. Evergreen. New leaves with the flowers in Feb. and March.

Bark dark grey or black, rough. L. fascicled, about 3" long, with 5—7 elliptic or obovate leaflets about .5—1" long, with large marginal glands and often notched at apex, rhachis narrowly winged. Pedicels glabrous, articulate on the pubescent peduncle. Sepals minute open in bud, soon withering. Petals green or reddish, imbricate, oblong, .12". St. usually 10, bases adnate to the large woolly disc. Anthers red.

The wood is sometimes used for agricultural implements. The pulp of the fruit is edible and aromatic and has much the same properties as the bacl. It is also used for affections of the gums and throat. The gum is also given in diarrhœa and dysentery.

FAM. 37. SIMARUBACEÆ.

Trees or shrubs with bitter bark. Leaves alternate, usually large and pinnate, stipules 0 or deciduous. Flowers small, in terminal or axillary panicles or cymes, regular, 3—5-merous. Petals rarely 0, hypogynous. Disc annular or elongate, simple or lobed. Stamens isostemonous or diplostemonous, inserted at base of the disc, filaments free, often with a scale at the base. Ovary free, deeply 2—5-celled and lobed with as many free or connate styles and capitate stigmas; ovules 1 in each cell, raphe ventral. Fruit samaroid or of several drupels or baccate, the carpels more or less distinct. Embryo straight or curved.

1. AILANTHUS, Desf.

Large trees. Fls. small, polygamous, bracteolate, paniced, 5-merous. Petals valvate. Stamens 10 in the male, 2—3 in the hermaphrodite flower, without scales. Ovary 2—5-partite, styles connate. Fruit of 1—5 samaras.

1. *A. excelsa*, Roxb. Pir nim, Choranim, H.; Chorkaranj, Kharw.

A large tree with light-coloured bark, stout hoary tomentose branchlets, large pinnate leaves with 10—13 pairs of very coarsely toothed leaflets and large panicles of yellowish flowers.

Hazaribagh, frequent! Palamau! Gangpur! Orissa, frequent! Often near villages and roadsides. Fls. Jan.—March. Fr. May. Sub-deciduous in May and renews leaves in April to June.

Smell foetid. Twigs .3—1" diam. with large leaf scars. L. 2—3 ft. long, with hoary tomentose rhachis. Lfts. 3.5—6" by 2—3", densely pubescent beneath, and pubescent above when young, acute or acuminate with a very oblique base, sec. nerves 12—20. Petiolule 1—2", with two hairy glands near the base, and sometimes in place of the lowest leaflets also. Samaras often solitary, 1.75—2" by .5", strongly nerved with a twisted base.

The ground bark is used in Indian veterinary practice.

FAM. 38. OCHNACEÆ.

Glabrous trees or shrubs with alternate simple stipulate leaves. Flowers usually large, paniced or umbellate, bracteate. Sepals 4—7, free imbricate, persistent and sometimes coloured in fruit. Petals 5—10, hypogynous deciduous. Disc enlarged after flowering. Stamens various, sometimes numerous, inserted on the disc; anthers basifixed, dehiscing by terminal pores or longitudinally. Ovary 2—10-celled with axile or parietal placentæ, sometimes deeply lobed, styles connate or distinct at the apex. Ovules 1—2 in each cell or indefinite, ascending or rarely pendulous, raphe ventral. Fruit of several drupels or pyrenes each 1—4-seeded, or capsular.

1. OCHNA, L.

L. serrate. Fls. large yellow, in racemes or umbels. Disc large. Stamens many, filaments persistent, anthers deciduous. Ovary deeply 5—10-lobed, lobes 1-ovuled, distinct in fruit on the enlarged torus. Drupels each with 1 erect albuminous seed.

1. *O. squarrosa*, Roxb. Champa baha, S.; Pata champa, Koniari, Buin champa, Or.

A small tree or large shrub with ell., ell.-lanceolate to obovate acute or somewhat acuminate leaves, 3—7" long, with very numerous fine oblique sec. n. Flowers handsome bright-yellow, fragrant, 1.5" diam. in short lateral sub-corymbose rarely paniced racemes from the leaf scars. Sep. 6—7.5", erect after flowering, but again spreading and deep purple in fruit.

In rocky ravines and cool rocky slopes. Rajmahal Hills, from Barbait northwards! Mayurbhanj, 2000 ft. Angul! Puri forests, common! Athmallik, along valleys! Fls. April—May. Fr. r.s. Sub-deciduous Feb.—March, the new leaves often a beautiful crimson.

Attains 2 ft. girth, bark smooth pale grey, blaze dark pink, red on the wood. Buds perulate. L. often clustered, finely spinulose-serrate, but points deciduous and then crenulate or serrulate, base acute. Petiole .17—2.5". Pedicels 1—1.25", articulate.

2. *O. pumila*, Ham. Champa baha, S.

A very pretty undershrub with a long stout rootstock from which it sends up annually shoots 8—18", rarely 2 ft. high, bearing umbels of showy yellow flowers, 1.5—2" diam. Conspicuous in fruit from the spreading deep red sepals.

In open especially grassy forests and waste land. Champaran, on the bhavar! Gaya ghats! Ranchi: Horhap, Neterhat, etc.! Singbhum! Hazaribagh! Palamau! Manbhum!

Fls. Feb.—June. Fr. March—July.

The new shoots usually appear immediately after the jungle fires. L. broadly oblanceolate, 3—6" by 1—2", narrowed into the short petiole, finely sub-spinulose serrate when young, rarely coarsely toothed, sometimes sub-entire when old. Fls. on pedicels 1—2" long, peduncle axillary 1—3". Petals .5—7.5". Drupels greenish, usually 4—6.

Campbell states that the root is used by the Santals as an antidote to snake bite and for certain menstrual complaints, consumption and asthma.

FAM. 39. BURSERACEÆ.

Trees or shrubs secreting oleo-resins in the cortex. L. alternate, imparipinnate, usually with opposite leaflets stipulate or (in all the following) exstipulate. Fls. regular, small, often polygamous in axillary or terminal racemes or panicles. Calyx often minute, lobes 3—6 imbricate or valvate. Petals 3—6 imbricate or valvate. Disc free or adnate to the base of the calyx. St. twice as many as the petals inserted on the margin of or underneath the disc. Anthers 2-celled dehiscing longitudinally. Ovary free, 3—5-celled. Ovules 2 in each cell, axile pendulous anatropous. Fruit a drupe with 1—5 free or united pyrenes or dry and dehiscent, each pyrene 1-seeded. Albumen 0. Cotyledons generally twisted plicate or crumpled.

A. Flowers with a campanulate hypanthium lined by the disc.

Fruit a globose drupe.

Tree flowering before the leaves. Lfts. crenate pubescent

1. *Garuga*.

B. Flowers with a small cupular or saucer-shaped calyx.

1. Disc annular crenate.

Tree flowering with the leaves. Panicles axillary, diffuse

2. *Bursera*.

Panicles pseudo-terminal racemiform. Fruit trigonous

3. *Boswellia*.

2. Disc at base of small cupular calyx.

Panicles cymose dichotomous exceeding the leaves

4. *Commiphora*.

1. GARUGA, Roxb.

Trees with pubescent branchlets and exstipulate leaves clustered at the ends of the twigs with opposite subsessile crenate leaflets. Flowers polygamous in much-branched panicles. Calyx campanulate, 5-fid, valvate. Disc conspicuous, lining the calyx-tube. Petals and stamens inserted on its margin. Ovary sessile or shortly stipitate 4—5-celled, stigma capitate 4—5-lobed. Fruit a drupe with 1—5, 1-seeded pyrenes.

1. *G. pinnata*, Roxb. Jiga, Kekar, *H., Th.*; Armu, *K.*; Kandwer, *S.*; Karur, *Bhumij*; Kosromba, *Mal P.*

A large or m.s. tree, handsome in full foliage, with odd-pinnate leaves 12—18" long, 8—16 prs. ovate-lanceolate Lfts. attaining 4.5" by 1.5", crenate caudate, pubescent both sides, lowest pair usually very short and reflexed. The yellow campanulate flowers, 25" long, are borne when the tree is leafless in numerous panicles 4—6" long from the leaf scars at the tips of the branchlets.

Throughout the area. Chiefly in the valleys, ghats or cool sides of the hills in the hotter districts. Fls. March—April. Fr. June—Aug. Leafless March—May. Old leaves turn red before falling.

Bark pale grey, smooth or flaky. Blaze in young trees thin, pink, in old trees thick with outer brown dead bark, then pink or deep crimson streaked with white. If the bark is recently shed a chlorophyll layer occurs in place of the brown outer layer. Lfts. hairy with 12—16 sec. n.; petiolules .08—12". Calyx-tube very hairy, sepals half as long as the erect linear-oblong petals. Filaments hairy. Fruit globose, yellowish-green, .75" diam., with 2—4, rarely 5 pyrenes.

The leaves are very frequently attacked by red galls which are very conspicuous in the autumn. It is a good tree for the reclamation of grass lands in damp districts, being among the fire hardy species. It grows readily from cuttings and coppices easily. It is not much used. *Hamilton* says that "Jiga" is used for canoes and coarse furniture, and remarks on the green plicate cotyledons.

2. BURSERA, L.

Trees with exstipulate leaves. Fls. small polygamous or 2-sexual in axillary panicles, 4—6-merous, with annular crenate disc free from the calyx-tube and 8—12 stamens inserted at its base or alternately on and between the crenatures. Ovary free, 3—5-celled. Drupe with 3—5 pyrenes.

1. *B. serrata*, *Colebr.* Syn. *Protium serratum*, *Engl.*; Kāndior, Kariar, K.; Armu, S.; Karonda, *Kharw.*; Sari, *Mal. P.*; Garur, Nimburu, Limbru, *Or.*; Mohi, *Gond.*

A m.s. tree with leaves 6—12" long, lfts. 3—4 prs., oblong, 3—5.5", caudate, entire or more or less serrate, pubescent on the 6—12 sec. n. beneath. The very small green flowers .12" diam. are borne when the tree is in full leaf in lax panicles from the leaf axils and from the axils of fallen leaves.

Throughout the area but not at all gregarious. Chiefly among rocks and on the cool sides of hills and streams in the central area! Champaran! Angul and Puri, common! Sambalpur, rare! Athmallik, along rivers! Common in the higher hills in both the Central and Southern area! Fls. April. Fr. May. Evergreen or nearly so, renews leaves in April.

Bark grey, slightly cracked, blaze deep brown (in old trees), then thick deep pink.

Twigs pubescent. Petiolules .25—5". Calyx tube very shallow with small lobes. Petals spreading above. Style very short. Fruit globose red when ripe, about .5—75" diam. with 1—3 stones.

It is a tall and valuable timber tree in Burmah but not much used except as building posts in our area. It coppices from the cambian ring.

Var. *serratissima*. Lfts. 4.5—7.5" long, very deeply and coarsely serrate. Sambalpur! Kalahandi, *Cooper!* Along streams.

3. BOSWELLIA, *Roxb.*

Trees, often with a papery bark. L. exstipulate with opposite sessile usually serrate leaflets. Flowers rather small racemed or paniced. Calyx small 5-toothed, persistent. Petals 5 imbricate. Disc annular crenate. Stamens inserted at the base of the disc 5 long and 5 shorter. Ovary sessile 3-celled, stigma 3-lobed, ovules 2 in each cell, pendulous. Drupe trigonous, containing 3 pyrenes.

1. *B. serrata*, *Roxb.* Salga, Salai, Sali, *H.*; Salga, *S., K.*

A pretty tree with green, grey or reddish bark peeling off in thin flakes. Leaves 12—18" long with 9—16 prs. opposite coarsely crenate-serrate leaflets 1.5—3" long, and numerous racemes of smallish white flowers at the tips of the branches, usually appearing when the tree is bare of leaves.

Very common on dry hills in the Central and parts of the Southern area, but not common in S.P., Angul or Puri! Fls. Jan.—March. Frt. May—June. Deciduous Jan.—May or June.

Bark very thin grey flaky, with chlorophyll layer beneath the thin outer layer. Blaze flushed with lighter and darker pink; from it exudes small drops of resin.

L. at the ends of the branchlets. Lfts. lanceolate or ovate-lanceolate, glaucous beneath, pubescent on the nerves above, sometimes sub-lobed. Racemes 4—8", pubescent, sometimes with short branches, crowded near the apex but not really terminal, as the branch grows through them and they are below the leaves in fruit. Calyx cupular, 5—6-lobed, villous. Petals .25", oblong-ovate with thickened

base. Disc scarlet, fleshy, papillose. Anthers sagittate introrse. Fruit 5", 3-gonous, with three valves and 3 winged hard pyrenes.

The wood is used for charcoal. The tree yields the Indian Olibanum, a golden-yellow gum-resin (Inban, loban, S.), very fragrant and transparent. The leaves hung up in cattle-sheds drive away flies. Can be grown from large cuttings.

4. COMMIPHORA, Jacq.

Trees or shrubs, often spinescent. L. alt. 3-foliolate or imparipinnate; stipules 0. Fls. small polygamous fascicled or in dichasial panicles. Calyx cupular or tubular, 4-, rarely 5—6-lobed, valvate, persistent. *Pet. 4, rarely 5—6, inserted on or under the margin of the cup-shaped disc. St. 8—10 inserted with the petals, alternate longer. Ovary ovoid, sessile, 2—4-celled, stigma 3—4-lobed; ovules 2 in each cell, collateral. Fruit drupaceous with 2—6 pyrenes.

1. *C. caudata*, Engl., syn. *Protium caudatum*, W. & A., is a deciduous small tree or shrub with greenish papery bark peeling off in thin flakes. L. 3-foliolate (in our specimens, but sometimes 5—7-foliolate), leaflets orbicular or ovate suddenly acuminate 1.25—3" long, nervation very fine reticulate. Fls. yellowish in long-peduncled slender dichasial panicles 3—many-flowered, 2—6" long. Drupe ovoid, .4" long.

Planted on the Orissa coast as near Konarak, probably from cuttings, and hence it appears at present shrubby. The sap is abundant and fragrant. Fls. May. Deciduous.

FAM. 40. MELIACEÆ.

Trees or shrubs without (exc. *Chloroxylon*) translucent glands in the leaves. Leaves alternate pinnate, rarely 2—3-pinnate, exstipulate. Flowers regular, usually in axillary panicles. Calyx 3—6-toothed, -partite, or sub-entire. Petals 3—6, sometimes cohering at the base. Stamens 4—12, usually twice as many as the petals, more or less completely united into a tube except in the tribe *Cedrelexæ*, outside the disc. Tube usually toothed. Disc frequently tubular and sheathing the ovary, sometimes pulvinate, rarely absent, sometimes adnate to the staminal tube. Ovary usually free, 2—5-, rarely 6-celled. Style 1 with disciform or capitate stigma. Ovules 2 or more in each cell, rarely solitary. Seeds sometimes arilled or winged. Albumen thin or absent.

A. Ovules several or many in each cell. Seeds winged.

I. Stamens not united into tube. Capsule under 1.5".

Perfect stamens 10. Leaves gland-dotted .

Perfect stamens 4—6. Leaves not gland-dotted .

II. Stamens united into a tube. Capsule over 1.5":

a. Exotic.

Anthers between the teeth of st. tube

b. Indigenous.

Anthers between the two teeth of nearly free lobes of the tube.

Anthers on margin of almost entire st.-tube.

B. Ovules 1—2 in each cell. Seeds not winged. St. united into a tube.

I. Lfts. mostly toothed. Petals usually spreading.

a. Fruit drupaceous. St. tube oblong.

Leaves pinnate

1. *Chloroxylon*.

2. *Cedrela*.

3. *Swietenia*.

4. *Soyimida*.

5. *Chickrassia*.

6. *Azadirachta*.

- Leaves 2-3-pinnate
 b. Fruit nearly dry 5-gonous. St. tube very short
- II. Leaflets entire. Petals erect or sub-erect (exc. 9).
- a. Terrestrial trees.
 Petals ovate-oblong. Leaflets 3
 Petals shortly oblong. Leaflets 5-11
 Petals concave 3. Leaflets many
 Petals concave 5. Leaflets 3-7
- b. Littoral trees. Lfts. 2-4. Fruit very large
7. *Melia*.
 8. *Cipadessa*.
 9. *Walsura*.
 10. *Heyneá*.
 11. *Amoora*.
 12. *Aglaia*.
 13. *Carapa*.

1. CHLOROXYLON, DC.

L. paripinnate. Flowers 5-merous in terminal and axillary panicles, petals spreading clawed. Stamens in the depressions of the 10-lobed disc, not connate into a tube, alternate shorter. Ovary sunk in the prominent disc, 3-lobed and -celled. Ovules about 8 in each cell. Capsule coriaceous, loculicidally 3-valved. Seeds compressed exalbuminous, winged above.

1. *C. swietenia*, DC. Sengel-sali K.; Bhañhul, *Kharw.*; Bhira, H.; Indian Satinwood.

A small or m.s. tree, larger in the south, with thick corky bark, pretty, greyish- or glaucous-green foliage, leaflets 10-20 pairs, about 1" long, gland-dotted. Fls. white, .25" diam., on the cymose branchlets of pubescent 3-5"-long panicles, which are clustered towards the ends of the branches from the leaf scars. Capsule 3-gonous, oblong-ovoid, 1-1.75", 3-celled.

Not recorded from the Northern area. Common in the Central area but local, chiefly on northern slopes! Southern area: chiefly in the drier forests, not common in Puri, chiefly Durgapur range in Angul! Orissa States, in open forest, chiefly on lime soils and generally small, *Cooper*.

Attains 4.5 ft. girth. Lfts. rhomboid-oblong with rounded apex, petiolule .08-1", rhachis with petiole together 8-12" long.

The poles are largely sought after for building and implements, hence the scarcity of large trees. It is a very good coppicer. It thrives with heavy grazing owing to the very acrid juice, which blisters the skin, making it unpalatable even for goats. (Hence the Kol name sengel-sali, sengel = fire.)

2. CEDRELA, L.

Trees with pinnate leaves. Fls. short-oblong, white in terminal and sub-terminal panicles, 4-6- usually 5-merous. St. sometimes with alternating staminodes, inserted on the fleshy disc which is more or less adnate to the base of the ovary. Ovary 5-celled. Cells with several 2-seriate pendulous ovules. Capsule septifrugally 5-valved, globose when young, then ellipsoid or oblong. Seeds many imbricate, winged at one or both ends.

1. *C. toona*, *Roxb.* Katangai, Roronga, *Ho.*; Katangari, *M.*; Tun, *H.*; The Toon Tree.

A m.s. or large tree with large spreading leaves 1-2.5 ft. long, with 5-12 prs. of alt. or opp. lanceolate or oblong-lanc. caudate or finely acuminate glabrous or pubescent entire or faintly undulate leaflets 3-7" long (on same leaf), with long petiolules 4-5" and oblique acute bases

rounded on the acroscopic side and 13—18 sec. n. Terminal odd leaflet usually present. Fls. 1.6—2" long in drooping or sub-erect panicles on the new shoots. Seeds winged both ends.

Wild in the Northern tract in the Ramnagar Hills and Purneah! Wild generally in the Central and Southern tract in valleys among the hills! Largely planted everywhere. Fls. March—April. Fr. June—July, but the capsules often remain a whole year on the tree. Deciduous Dec.—Feb.

The following varieties occur which I have endeavoured to name as far as possible in accordance with *C. de Candolle's* monograph.* -

A. Branchlets puberulous when young only. L. glabrous when mature except the nerve axils beneath.

α. **typica**, Panicles glabrous or nearly so, long and drooping. Flowers without staminodes. Anths. minutely apiculate. Capsules .75—9", smooth, sparsely lenticellate.

Southern range, Puril Narsingpur! Chiefly cultivated elsewhere.

β. **Hainesii**, *C.D.C.* (sp.) As in *typica* but staminodes 5, filiform and panicle only 8—9", erect. Singbhum! also apparently (but flowers not seen). Angul!

γ. **Hasletti**, *Haines* (Fl. Ch. Nag.) Lfts., opp. 6—10 prs. only, under 4". Panicles erect, 6", glabrous. Fls. 1.6". Anthers with a tail $\frac{1}{2}$ — $\frac{3}{4}$ as long as themselves. Capsule under .65". Santal Parganas, Khatikhund, *Haslett!*

B. Branchlets and leaves more or less permanently pubescent or puberulous. Panicles shorter than the leaves.

δ. **multijuga**, L. often 2 ft. in length. Singbhum! Bonail! It scarcely appears to merit the rank of a variety. Filaments glabrous, therefore not var. *pubescens*.

2. *C. brevipetiolum*, n. sp.

A small tree with permanently pubescent twigs, petioles, rachis and midrib above remarkable for the very short petiolules of the leaflets, which do not exceed .1". Lfts. about 10—15-jugate, much as in *C. toona*.

Mals of Orissal

The flower and fruit has not been seen and the species therefore has not been described. It is the same tree apparently as Barber's No. 5774 from the Anamalais, which was not taken up in the *Madras Flora* owing to the same lack of inflorescence.

3. SWIETENIA, L. Mahogany.

Large trees with pari-pinnate leaves and opposite or sub-opp. leaflets. Fls. 2-sexual small greenish paniced. Calyx 5-fid. Petals spreading. Anther tube urceolate or ovoid-cylindric with the anthers between the 10 small teeth. Disc annular. Ovary 5-celled with many ovules. Fruit a large woody septifrugally dehiscent capsule with numerous pendulous 2-seriate winged seeds in each loculus.

1. *S. macrophylla*, King, Large-leaved Mahogany.

A large tree, leaflets generally 4 pairs somewhat like those of a *Cedrela* with very oblique base, larger about 6" long. Flowers greenish, .3—4" diam., sweet smelling, in narrow supra-axillary panicles about 3.5—5" long. Capsules like large inverted clubs, erect, 5—6" long, very woody.

* Vide *Rec. Bot. Surv. India*, III, 4, on the Indian species of *Cedrela*.

Now somewhat largely planted. Purneah! Dumka! Ranchi, etc.! Flowers in April when in full leaf. Fruit ripens nearly a year later. Nearly evergreen but leaves fall end of Feb.—March.

Bark of twigs brown. Leaf rhachis 6—8". Lfts. sub-falcate lanceolate acuminate with 8—12 pale sec. n. Petals greenish, oblong, .15". St. tube cream-coloured, anthers included, inserted below the sinus. Disc red.

2. *S. mahogani*, L. Small-leaved Mahogany.

A large tree with rather rugose grey-black bark, pinnate leaves with 2—4 prs. of leaflets of 1.2—2" long only and panicles of greenish flowers .3" diam. with yellow staminal tube.

Often planted in Muzaffarpur, Dumka, etc. and thrives well towards Orissa, but is stunted in Chota Nagpur. Fls. April—May. Renews leaves April and is practically evergreen. It flowers rather later than *S. macrophylla*.

Leaflets very oblique, often sub-falcate, with a short slender apex. Panicles quite glabrous, 1.5—2", shorter than the leaves. Petals obovate-oblong, st. tube .12" long with 10 sharp teeth.

It does not set seed so freely as the last.

4. SOYMIDA, A. Juss.

A tree with paripinnate leaves. Fls. in axillary and terminal panicles. Pet. 5 imbricate, obovate, clawed, spreading. St. tube cupular 10-cleft or sometimes stamens nearly free and spreading, lobes fleshy, apex minutely 2-lobed with the anther in the sinus. Disc flat. Ovary 5-celled, cells with about 12 pendulous 2-seriate ovules. Style short. Stigma large capitate, slightly lobed. Capsule 5-valved woody, valves separating from a large 5-rayed central axis. Seeds numerous, large winged both ends, albuminous, cotyledons foliaceous.

1. *S. febrifuga*, A. Juss. Rohini, K.; Ruhen, S.; Rohana, H., Kharw.; Suam, Or.

A large or m.s. tree with thick wrinkled branchlets and leaves 9—18" long with 3—6 prs. of opposite or sometimes alt. leaflets 2—4" long, sprinkled when young with small peltate glands. Fls. .3—4" diam., white, with sometimes green on the petals, in large terminal panicles. Conspicuous in fruit from the large ellipsoid or obovoid pendant woody septifragal capsules 3" by 2".

Central and Southern tract. Singbhum, rare (Chirubera)! Gangpur, common! Manbhum! Hazaribagh! Palamau! Puri, not very common! Angul, chiefly in the dryer forests! Narsingpur, ditto! Mayurbhanj, ditto! Sambalpur, frequent! Common in the other states of Orissa, Cooper, Grievé. It is very usual on poor lime soils and also grows on cotton soil.

Fls. with the old falling leaves Feb.—March or with the new leaves April—May. Fr. May—June. Deciduous.

Bark dark brown, splitting into oblong flakes on old trees. L. usually red when young and often with permanent red rhachis and midrib. Lfts. sessile or nearly so, broadly oblong or elliptic, obtuse with very oblique base, glabrous. Sep. 5, short imbricate. Staminal tube usually erect.

"The wood is extremely hard and very dark red-brown, very durable and makes a beautiful furniture, if well seasoned. It is somewhat cross-grained," Gamble. It is used for building, for oil mills and other purposes, but is usually taken as poles. It coppices well. The bark is bitter and astringent and is employed in

dysentery and diarrhoea. "A decoction is given for rheumatic swellings," *Campbell*. "It is said to be as good as Sunari (*Cassia fistula*) for tanning purposes," *Cooper*. "Wt. about 75 lbs. P=1024 according to *Skinner* but only 626 according to *Fowke*," *Gamble*.

5. CHUKRASIA (sometimes spelt *Chickrassia*), *A. Juss.*

1. *C. tabularis*, *A. Juss.*

In a pamphlet entitled "On the Flora of Behar and the mountain Parasnath," by Thomas Anderson, formerly Superintendent of the Royal Botanic Gardens, Calcutta, it is stated that *Chickrassia tabularis* occurs on Parasnath from base to summit. This is the only record, and I suspect an error as I have failed to find it on Parasnath or anywhere else in Bihar and Orissa.

C. tabularis has 5—12 prs. of leaflets. White flowers .5" long, with erect oblong petals and a woody capsule about 1.5—1.75" long.

6. AZADIRACHTA, *A. Juss.*

Tree. Leaves pinnate, leaflets toothed, petals spreading, disc annular. St. tube 10-toothed, anthers opposite the teeth. Ovary 3—5-celled, ovules 2 in each cell superposed. Drupe 1-celled and 1-seeded. Cotyledons oblong-obovate, fleshy, sessile, epigeal with a long stout hypocotyl on germination.

1. *A. indica*, *A. Juss.* Syn. *Melia Azadirachta*, *L.*; *Nim*, *H.*; The *Neem Tree*; *Margosa*.

A handsome tree, leaves with 5—9 prs. of coarsely-serrate unequal-sided leaflets and axillary panicles of white scented flowers. Drupe .5—.75" ellipsoid, yellow when ripe.

Believed not to be indigenous in the province but occurs as if wild on some of the hills in Puri district and in jungles in Hazaribagh. It is frequently self-sown near gardens and villages and very commonly planted. Fls. March—May. Fr. June—July, and the seed germinates in July and Aug. of the same season. Evergreen.

L. 8—15", lfts. 1—3", sometimes lobulate near the base. Fls. .3" diam. St. tube .2" long. Cotyledons .3—4" long.

The wood is good and used for various purposes. The bark is bitter, and nearly every part is used medicinally in intermittent fever and as a tonic. The ripe fruits are largely collected for the oil, which is especially useful in parasitic skin-diseases and for dressing foul ulcers. Internally it is anthelmintic. The twigs are used for tooth-brushes. It is a good avenue tree.

The first leaves after germination are pinnatifid at base.

7. MELIA, *L.*

Trees with 2—3 pinnate leaves and 2-sexual flowers in large axillary panicles. Calyx 5-lobed or sep. 5 imbricate. Pet. 5, free. Disc annular. St. tube cylindrical dilated and lacinate at the mouth; anthers 10 included on or near the margin of the tube, apiculate. Ovary 5—8-celled, style cylindrical, stigma capitate; ovules 2 superposed. Fruit a drupe, cells 1 or more, 1-seeded. Seeds pendulous elliptic, testa crustaceous, albumen fleshy, thin, cotyledons foliaceous, radicle terete superior.

L. 2-pinnate. Fls. white. Drupes over 1" long 1. *composita*.
L. mostly 3-pinnate. Fls. lilac. Drupes under 1" long 2. *azedarach*.

1. *M. composita*, Willd. Syn. *M. dubia*, Cav.; Ghora-nim, Mahanim, H.; Batra, Or.

A very large tree with spreading crown and 2-pinnate leaves up to 2.5 ft. long clustered towards the ends of the branches. Fls. white, .5" diam., with spreading and reflexed greenish petals in numerous axillary stellately tomentose scurfy panicles 5—8" long. Drupes 1—1.25" long with very hard endocarp.

Forests of Angul and Puri, rather frequent in Angul! Fls. Feb.—March. Fr. Dec.—Jan. New leaves with the flowers. Deciduous.

Bark reddish, smooth and flaking. Blaze thin, crimson, then white. Twigs stout, brown. Shoots stellately scurfy. Pinnæ up to 8" long 3-foliolate or with up to 3—6 prs. of leaflets. Lfts. mostly ovate-lanceolate and acuminate, 1.5—2.5", glabrescent, crenate or crenulate. Petiolules .15—3" minutely pubescent when old. Fls. .25" long. Sep. small lanceolate. Pet. .3", spathulately-linear pubescent. St. tube narrowly tubular with over 20 short linear teeth, inside silky. Drupe with 1 chestnut-coloured seed with large embryo.

"Wood soft. Growth rapid, 2—3 rings per inch of radius in Madras to 7 rings in some Bengal specimens. Wt. 26—33 lb. The wood will probably be found useful for tea-boxes and similar purposes and the tree should be cultivated on account of its rapid growth." *Gamble*.

2. *M. azedarach*, L. Bakain, H.; Bokom baha, S.; The Persian Lilac.

A m.s. tree, but flowering when small, with mostly 3-pinnate leaves up to about 2 ft. long chiefly towards the ends of the branches. Fls. lilac with deeper purple staminal tube, in axillary panicles. Drupe .5—75", yellowish with very hard endocarp.

Cultivated in all stations! A native of Upper Burmah!

Fls. May—June. Fr. ripens Nov.—Dec., but often remains on the tree through out the cold weather. Leafless Dec.—April. Bark thick and deeply fluted in old trees, smooth in young. Shoots somewhat rusty with stellate hairs. Pinnæ up to 12" long. Sec. pinnæ 1—3-foliolate. Lfts. mostly lanceolate acuminate, .5—2.5", glabrescent serrate or gashed. Fls. .25—3" long, sweet-scented. Drupe often 5—6-celled, several cells usually with a long narrow seed with brown testa and fleshy linear-oblong cotyledons.

"Wood useful and pretty, handsomely marked. Wt. averages about 38 lb. Growth quick, often very quick, 3—4 rings per inch," *Gamble*. I have grown trees some 30 ft. high in 3 years from seed so that it is useful when quick growing trees are required. The inner bark contains a resinous alkaloidal substance and is used as an anthelmintic. The fruits are poisonous and are used in leprosy and scrofula (*I. P. & D.*).

8. CIPADESSA, *Blume*.

Shrubs or small trees with odd-pinnate leaves, opp. or sub-opp. leaflets, axillary or extra-axillary peduncled panicles and sub-globose fls. Petals 5 oblong spreading valvate. Staminal tube deeply 10-lobed, lobes linear, loosely cohering forked, anthers short in the forks. Disc shortly cupular, adnate to base of the staminal tube. Ovary 5-celled, ovules 2, collateral. Fruit scarcely fleshy 5-gonous.

1. *C. fruticosa*, *Blume*. Nalbali, Or.

Small tree or large shrub with long weak sub-sarmentose branches, leaves 5—12" long with 7—11 opposite variously-toothed lfts. and small cymose panicles of small white flowers.

Valley forests in Singbhum, frequent in Saranda and Porahat! Parasnath! Puri and Angul, very common! Narsingpur! Probably all the Orissa States, Cooper. Fls. March—June. Fr. May—Nov. Deciduous in March.

Whole plant usually more or less pubescent. Lfts. from .75" (at base of leaf) to 5" by 2.25", terminal oblong acuminate, petiolules .12—5". Panicles narrow, 3—4" long, including the long peduncle. Fruit under .25" diam.

9. WALSURA, Roxb.

Trees with 1—5-foliolate leaves and opp. lfts. Fls. in axillary and terminal panicles. Calyx short, 5-fid or -partite. St. 8 or 10 free or connate, lobes notched or 2-cornute. Disc annular. Ovary short?—3-celled sunk in the disc. Fruit baccate 1- rarely 2-celled and -seeded. Seed enclosed in a fleshy aril, exalbuminous.

1. *W. piscidia*, Roxb. (inc. *W. ternata*, Roxb.). Mundika, Or.; Siloi (Gaya); Bakom, Kuruwan (Samb.).

A bushy tree or scarcely more than a shrub with pinnately 3-foliolate leaves, oblong or somewhat ovate-oblong leaflets 3—5" by 1-2.25", pale glaucous beneath and very shining above, and white or yellowish small flowers with erect very slightly imbricate petals in axillary and terminal panicles 3—5" wide composed of several long-peduncled partial panicles. Panicles from the upper leaf axils and brown hairy leaf scales of the new shoots. Frt. 3" closely tomentose.

Along the Hazaribagh-Gaya Ghats in rocky ravines! Under the shade of immense gneiss rocks at the top of Koderma hill (Pal.)! Not found elsewhere in the Central tract. Common in the Puri division, chiefly in the southern range! Angul, chiefly in ravines! Sambalpur, chiefly on the shales near rivers! Fls. Feb.—June. In the Central tract it is partially deciduous at the time of flowering.

Bark grey, slightly cracked. Blaze rather hard, thick, pink then yellowish. Innovations brown tomentose. Lfts. usually rounded both ends or somewhat acuminate (var. *ternata*), sec. n. slender, about 10, very finely reticulate between; petiolules .15—3", terminal .75—1". Peduncles 1—3", usually thickened upward. Fls. .1—1.2" long. Sep. one-fourth to one-third as long as corolla. St. tube half length of petals 10-cleft for one-third to two-thirds of its length, 2-cornute segments, alt. slightly shorter, with yellow apiculate anthers inserted between the two very small horns. Disc short annular.

The bark is used to kill fish. An oil is said to be obtained from the wood by heating the chips. It is used for itch.

The following are sometimes considered as distinct species:—

Var α . *typica*. (*W. piscidia*, Roxb., *F.B.I.*, p. 564). Lfts. rounded at apex. Peduncles 1.5—3" thickened upwards. Sep. scarcely one-fourth as long as petals. Pet. 4 mm. long, erect oblong or lanceolate-oblong, yellowish. Central tract and Puri!

Var β . *ternata* (*W. ternata*, Roxb., *F.B.I.*, p. 563). Lfts. often somewhat acuminate. Peduncles usually under 1" long, uniform. Sep. one-third as long as petals. Pet. 3.5 mm., erecto-patent ell. or ell.-oblong, white, shorter segments of st. tube sometimes not horned. Sambalpur!

The depth of the lobing of the staminal tube used in the *F.B.I.* as a sectional character is very variable. Fig. 65 of *Brandis' Indian Trees* unites the two vars., having the long inflorescence of *typica* and the pointed leaves of *ternata*!

10. HEYNEA, Roxb.

Trees or shrubs with 5—11-foliolate leaves and opp. quite entire lfts. Panicles terminal and axillary, corymbose. Calyx short 4—5-fid. Petals

4—5 oblong sub-erect. St. tube cleft into 8 or 10 linear 2-toothed segments. Disc annular. Ovary immersed in the annular fleshy disc, 2—3-celled, narrowed into the short style. Fruit dehiscent, 1-celled, 2-valved, 1-seeded. Seed arillate, cotyledons large thick fleshy. Raphe large.

1. *H. trijuga*, Roxb.

A small ornamental tree with odd-pinnate leaves 12—18" long, 2—4 pairs of ovate acuminate leaflets 3—5" long, and small white flowers in lax corymbose panicles on long slender peduncles 7—12" long. Fls. shortly ablong .15—2". St. tube cleft about half way into 8—10 segments which are forked with apiculate anthers in the forks. Ovary 2-celled, cells 2-ovuled. Fruit reddish, .5", ellipsoid, with 2 thin coriaceous valves, and with 1 (rarely 2) pendulous seed (from an ascending funicle) with a thin white fleshy aril.

Sameswar Hills, Champaran! Valleys in Singbhum! Ranchi (Kolomda, 2000 ft.), Gamble! Bonai, Cooper! Mayurbhanj, in the mountains 2000 ft.—3000 ft. Often planted in Ranchi, etc. Fls. March—May. Fr. Aug.—Nov. Evergreen.

Attains about 3—4 ft. girth. Bark cracked or fluted, brown (or grey with red in the cracks), blaze red to crimson. Lfts. pale and somewhat pubescent beneath or glabrous, end one attains 6.5" by 3", base of lateral straight, rounded or obtuse with petiolules .25—75". Panicles (without peduncle) 2—4" only. Sep. broad pubescent.

The wood does not seem to be used. Gamble says that the seeds give an oil used for burning by the Nepalese.

The first several leaves of the seedlings are large, simple and ovate, the next 3-foliolate.

11. AMOORA, Roxb.

Trees sometimes with milky juice, with odd-pinnate leaves and entire leaflets. Fls. dicecious (or hermaphrodite in form), paniced, or females spicate or racemose. Calyx 3—5-partite. Petals 3-concave imbricate. St. tube subglobose or campanulate, 6—10-crenate or -toothed with the 6—10 anthers at the crenatures. Disc 0. Ovary 3(—5)-celled. Fruit usually coriaceous, ultimately loculicidally 3—4 (rarely 5)-valved. Seeds 1—4 with a fleshy aril.

Male flowers in paniced spikes or racemes, fem. in long simple spikes

1. *rohituka*.

Male flowers in paniced cymules, females in a short sub-racemose panicle

2. *spectabilis*.

1. *A. rohituka*, W. & A. Sikru, Ho.; Sikaroro, M.; Pitraj, Tiktaraj, Beng.; Mangai, Khanda, Or. (also Gilakusum or Panikusum in Puri).

A handsome small or m.s. tree with low spreading crown of large dark green glabrous pinnate leaves 1—3 ft. long with 4—7 pairs of leaflets 3—9" by 1.5—4", decreasing in size towards the base of the leaf and small white flowers in lax simple (female) or branched (male) spikes. Capsule 3-valved, yellowish or flesh-coloured, 1—1.5" diam., glabrescent.

Throughout the province but outside Orissa only wild along watercourses in evergreen or semi-evergreen forest. Champaran, frequent! Purneah! Singbhum! Porahat! S.P.! Puri, common! Often planted in other districts.

Fls. Aug.—Sept. Fr. May—June. Ev.

Bark smooth. Blaze thick crimson with bold white streaks. Branchlets stout, shoots brown-pubescent but glabrescent. L. rhachis grey with few scattered brown microscopic scales. Lfts. sometimes falcate, slightly puberulous beneath when very young but some glabrous and not at all scaly, green beneath, shortly sharply acuminate and base very oblique, always acute on one side; sec. n. 8—16. Petiolule .25—4". Diccious. Panicles (m.) or spikes (f.) axillary or extra-axillary and shorter than the leaves, sometimes 2-nate. Calyx 5-partite, lobes obtuse. Pet. 3. Anths. 6. Ovary 3-celled. Seeds with scarlet arillus, subglobose or oblong polished chestnut coloured with a white linear raphe, apiculate or ridged one or both ends, .5—7" without the aril.

The seeds are frequently 2-embryous, both embryos germinating. First leaves simple or with one additional lft. The name *Rohituka* is Sanskrit. Seeds yield a medicinal oil.

2. *A. spectabilis*, Miq. (*vide Kew Bulletin*, No. 7, 1920). Syn. *A. Wallichii*, King; *Sphærosacme rohituka*, Wall. *Herb.* (in part); *Karandali*, Or.

A tall handsome tree with considerable trunk and a high crown. Sap of young parts milky. L. crowded at the ends of the twigs 15" to 3 ft. long with a stout rhachis. Lfts. opp. or sub-opposite 9—19 (or sometimes close to the panicle only 3—7), terminal usually elliptic, lateral oblong, or basal ones ovate and reflexed. Fls. diccious (or according to King, polygamous). Males in panicles 9—22" long from the upper axils. St. tube subglobose crenate with 8—9, rarely 10 half-exserted anthers. Fem. panicles sub-racemose, 2.5—4", stout, with flowers on stout pedicels 3—4-merous. Capsule subglobose, 2" diam., 3—4-celled with milky juice when unripe, tomentose. Seeds with scarlet aril and chestnut-coloured testa.

Mountain valleys of Singbhum! Mayurbhanj! and Orissa!

Fls. July—Nov. Fr. May—June. Evergreen.

Bark smooth pale. Blaze rather soft, streaked with brown and cream and exuding drop of milky juice. Twigs and leaf rhachis grey or rusty with microscopic fimbriate scales or stellate hairs, young brown tomentose. Lfts. decreasing in size towards the base of the leaf, 6—14" long or basal only 3—4", acute or acuminate with regular or somewhat oblique rounded or obtuse base and 13—20 strong spreading sec. n. Petiolules .7" or of terminal leaflet 1—1.5". Ovary depressed yellow tomentose 3-gonous, stigma very large 3-lobed.

The tree yields a useful timber which is used for planking. It is red in colour. It should be preserved and propagated in evergreen forests.

12. AGLAIA, Lour.

Trees or shrubs often lepidote with 3-foliolate or odd-pinnate leaves and entire leaflets. Flowers polygamous. Calyx, corolla and androecium all 5-merous, rarely anthers 10, staminal tube subglobose entire or 5-toothed at apex. Disc very small. Ovary 1—3-celled. Fruit indehiscent, 1—2-celled and -seeded. Seeds with fleshy integument.

Leaflets 6—9" long. Panicles 2—4". Anthers 10
Leaflets 3—5.5" long. Panicles 5". Anthers 5

1. *Haslettiana*.
2. *Roxburghiana*.

1. A. Haslettiana, *Haines (Journ. As. Soc., xv, 7)*.

An evergreen tree up to 4 ft. girth with brown scaly shoots, rather distant impari- or pari-pinnate leaves with 5—7 large oblong shortly abruptly acuminate leaflets 6—9" long and axillary panicles of small globose very fragrant flowers .15" diam. Calyx broadly campanulate, scaly. St. tube as long as petals, globose, with scarcely toothed mouth. Anths. 10, 1-seriate equal sessile, included, on ridges formed by the equal adnate filaments.

Evergreen forest near nalas. Mals of Puri! Angul!

Fls. April—May. Fr. not seen.

Shoots, petioles and rachis lepidote. L. rachis 8—10" long. Lfts. sub-opp. or mostly alternate, larger 1.8—3" wide, base tapering and oblique, young densely lepidote beneath, glabrescent except for a few scales on the midrib, sec. n. strong, 10—15, incurved within the margin, tertiaries very obscure. Petiolule .2—4". Panicles 2—4" closely lepidote shortly peduncled. Pedicels .05—1". Calyx shallowly toothed. Pet. 5 ell.-oblong, tip rounded. Mouth of the staminal tube crenulate. Anths. oblong. Disc 0. Ovary short, somewhat 3 angled. Stigma sessile 3-lobed.

This species unites *Aglaiia Amooria*. The fruit is required.

2. A. Roxburghiana, *Miq.*

A tree or shrub with leaves 3—10" long, leaflets 5, rarely 6—7, 1.5—5.5" long, narrowly elliptic or ell.-lanceolate, obtuse or acute, glabrescent. Flowers under .1" diam., yellow, in elongate supra-axillary pyramidal tomentose and slightly scaly panicles as long as the leaves. Fruit sub-globose, .75" diam., rusty lepidote and velvety.

Very rare. Hill east of Pitorea (Ranchi), *Wood!* Baruni Hill (Puri), *Gamble!* Fls. Nov.—Dec. Fr. June.

Lfts. in the Ranchi specimen oblanceolate and only up to 4" long. Sec. n. 10—13, not reaching margin nor curved within it. Fls. sessile or pedicelled, calyx often stellately scaly, petals oblong.

The seeds have a white edible aril.

13. CARAPA, *Aubl.*

Littoral trees with paripinnate leaves and 1—3-jugate leaflets. Fls. in lax axillary panicles, 2-sexual, 4-merous. St. tube globosely urceolate, 8-toothed with 2-partite teeth. Anthers 8 included, sessile alternating with the teeth. Disc cupular adnate to base of ovary. Ovary 4-grooved, 4-celled, with 2—8 ovules in each cell. Style short, stigma discoid. Fruit very large subglobose with fleshy or coriaceous pericarp, 6—12-seeded, finally 1-celled by complete or partial absorption of the septa, loculicidally 4-valved. Seeds large, thick, irregularly angular and compressed. Aril?.* Hilum large. Alb. O.

1. C. obovata, *Bl.* Dhundul, *Beng.;* Susambar, *Or.*

A small tree. L. with 1—2 prs. of glabrous rather coriaceous, oblong or ell.-oblong leaflets 2.5—4.5" long. Fls. small yellowish, in panicles 1—2.5" long. Conspicuous in fruit by the large globose or oval fruit 3—4" long.

* The aril is described as absent in all works of reference consulted, but my notes state that an aril is present. It possibly disappears when the fruit is quite ripe.

Tidal Swamps of Mahanadi delta! Fls. r.s. Fr. April—May.

Bark smooth, that of twigs pale. Blaze pink. Lfts. rounded at tip, somewhat tapering at base into a brown petiole; sec. n. very fine, 8—10, soon finely reticulate. Fls. .17—2" long. Seeds .8—1.3", yellowish, with a thick orange coloured aril.*

The fruit is largely collected. It is said to be a cure for swellings of the breast and elephantiasis. *Brandis* says it attains 7—10 inches.

FAM. 41. ICACINACEÆ.

Trees or shrubs, often climbing, with alternate very rarely opposite, usually entire, sometimes lobed or toothed, exstipulate leaves. Flowers 4—5-merous, regular, usually small and in cymose panicles, or in axillary clusters, spikes or racemes, 1—2-sexual with perianth single or double. Calyx small, not enlarged in fruit. Petals 5, rarely 4, usually free valvate or narrowly imbricate, the apex usually bent inwards, then erect and finally deciduous. Stamens *isomerous and alternate*, to the petals, reduced to staminodes in the female, sometimes bearded below the anther, which is 4-celled with introrse or lateral dehiscence. Disc absent or cupular or lobed. Carpels usually 3, sometimes 2 or 5, united into an ovary which is usually 1-celled above, rarely completely 3- or 5-celled. Ovules 2 to each cell, collateral, pendulous from the top of the partition, anatropous, micropyle superior and interior. Stigma 2—5 lobed or capitate. Fruit usually drupaceous. Seed pendulous with thin coriaceous testa, usually albuminous. Embryo straight or bent with superior radicle and variously sized cotyledons.

1. NATSIATUM, *Ham.*

Climber with alt. palmi-nerved leaves and dioecious flowers in axillary racemes. M. fl. sepals 5 connate below, open in bud. Per. 5. St. 5 (4—6), anthers with large pointed connective and adnate cells, inserted inside the disc. Disc small yellow fleshy 10-lobed, and with 10 linear erect glands from the inner surface of the lobes. F. fl. as in M. but stamens reduced to staminodes. Ovary villous, style short, 2—3-lobed. Ovules 2, raphe dorsal. Drupe obliquely ovoid, compressed. Seed 1, alb. fleshy, cotyledons orbicular 3—5-nerved.

1. *N. herpeticum*, *Ham.*

A strong twiner with pallid almost white stems attaining 1" diam., alt. cordate-ovate dark green palmately 7—9-nerved dentate or denticulate long-petioled leaves, larger 6—7" by 4—5", and small drooping greenish-yellow villose urceolate flowers in long slender pendulous axillary or supra-axillary simple or compound racemes 4—9" long. Fruit an obliquely ovoid 1-celled compressed drupe .25" long.

In the moister forests, chiefly near nalas, rather rare. Puri Mals (Rajim)! Angul (Bolong and Raigoda forests)! Common in Purneah! Fls. Jan.—March. Fr. March—April. New leaves March.

Wood with groups of large pores and inconspicuous medullary rays. Branches strigose, youngest shoots densely yellow hirsute. L. glabrescent above but slightly scabrous, beneath permanently hirtellous, tip acuminate sometimes with the central nerve excurrent, margin repand or sinuate with mucronate teeth; sec. and

* The aril is described as absent in all works of reference consulted, but my notes state that an aril is present. It possibly disappears when the fruit is quite ripe.

tertiary nerves very irregular. Peti. 2—5" often coiled. Fls. 2" diam. Buds ovoid acute densely strigose. Calyx deeply (4—) 5-lobed, lobes spreading scabrid. Pet. 5 lanceolate or oblanceolate longer than the sepals, free or nearly so, flat recurved valvate. M. fl. fil. very short, anthers yellow incurved, pistil rudimentary. F. fl. style very short with 2 linear diverging lobes.

FAM. 42. OLACACEÆ.

Shrubs or trees, more rarely undershrubs with alternate simple entire exstipulate leaves and small regular usually 2-sexual flowers in spikes, racemes or cymes, usually axillary. "Calyx" small, toothed or reduced to a rim which may enlarge in fruit and envelop it. Tepals 4—6, free or connate, valvate, rarely imbricate. Stamens rarely isomerous, usually two to three times as many and opposite to the petals, some sometimes reduced to staminodes, anthers ovate or linear longitudinally dehiscent. Ovary free or more or less sunk in the torus, 2—5-celled at the base only rarely also above, usually with a free central placenta from which 1 (very rarely 2) slender anatropous ovules hang in each cell, micropyle superior and interior, occasionally ovary 1-celled with 1 pendulous or erect ovule. Style with small stigma. Fruit usually drupaceous and 1-seeded, the placenta usually sunk in a cleft of the seed which has a thin testa and copious albumen. Embryo small apical.

The family is allied to the *Santalaceæ* and *Loranthaceæ*, and is only introduced here in order to adhere as closely as possible to the order of the families in the *Genera Plantarum* and *F.B.I.*, vide Introduction. The morphology of the "calyx" is doubtful.

- | | |
|--|----------------------|
| A. Stamens two or three times as many as the petals. Ovary with 2 or more ovules | 1. <i>Olax</i> . |
| B. Stamens as many as petals or corolla lobes. Ovary 1-ovuled. | |
| Fls. pedicelled. Petals free | 2. <i>Opilia</i> . |
| Fls. sessile. Corolla 4-lobed | 3. <i>Cansjera</i> . |

1. OLAX, L.

Shrubs or undershrubs, sometimes scandent and spiny with alt. leaves. Fls. in axillary racemes or panicles with inconspicuous bracts. Perianth of a minute outer calyciform rim accrescent in fruit and 3—6 free or more or less connate tepals. St. 9—12, occasionally fewer, usually only 3 fertile, fertile stamens usually opposite to and attached to the edges and staminodes opposite the centres of the tepals. Anthers oblong 2-celled and filaments free. Ovary superior, usually 3-celled below and 1-celled above, style simple, stigma 3-lobed. Ovules 3 pendulous from the axis, two soon abortive. Fruit drupaceous surrounded by the accrescent outer perianth. Embryo minute apical in fleshy albumen.

The fertile ovule pushes the central placenta to one side, so that the latter appears as an ascending basal funicle in fruit.

1. *O. scandens*, Roxb. Rimil, Rimilbiri, K.; Hund, S.; Koko aru, Beng.; Bader, Badalia, Badurli, Bhadbhadia, Or.

A large usually scandent shrub with trunk attaining 1 ft. diam., pubescent branchlets and white flowers 25—3" long in short axillary

racemes. Fruit yellow fleshy sub-globose, .3" diam., more than half enclosed in the accrescent outer perianth.

Common from Bettiah to Puri and Kalahandi, *i.e.* throughout the whole province! Fls. April—June. Fr. Oct.—Dec. Evergreen.

Rarely spinose. L. patent, attaining 3 by 1.5", rarely 4.5 by 1.75", often less than 1" on the same branch, orbicular elliptic oblong or ovate with rounded base, apex obtuse or rounded, pubescent beneath. Sec. n. slender 4—7, scarcely distinguishable from shorter intermediate, not raised. Petiole .3—5", pubescent. Fls. often distichous, sometimes panicled from leaf suppression, pedicels short. "Calyx" ciliate. Tepals narrow, .2—3". St. 7—10, 3—5 fertile, staminodes 2-fid. Disc thin, cupular.

The fruit is eaten. It is insipid and somewhat viscous. A sherbet is made from it in Hazaribagh.

2. *O. nana*, Wall.

A suffruticose perennial with a woody rootstock, sending up annually erect strict herbaceous shoots 1—2 ft. high with sub-sessile oblong-lanceolate or linear-oblong leaves and solitary axillary small white flowers.

Usually in grass lands. Northern tract, near the Nepal frontier! Central tract, Neterhat plateau! Manbhum, *Campbell*. Fls., Fr. April—June.

Shoots striate. L. glabrous, reaching 3" by .5—75", obtuse. Peduncles .5" long. Fls. .3", white when expanded, buds oblong. "Calyx" rudimentary in flower, accrescent and enclosing the fruit with a fleshy scarlet coat. Petals 3, linear-oblong. Fertile stamens 3, staminodes 3, white 2-fid. Fruit (with coat) .5" diam., oblong or obovoid.

2. OPILIA, Roxb.

Shrubs, usually scandent with alt. penninerved leaves sometimes showing translucent dots. Fls. small fascicled on the rhachis of axillary racemes with large deciduous bracts concealing the flowers in bud. "Calyx" nearly obsolete annular. Tepals 5. Filaments 5 opp., the tepals very slender alternating with 5 fleshy disc glands or staminodes. Ovary superior 1-celled. Style short, stigma minute. Ovule solitary pendulous. Fruit drupaceous. Albumen fleshy. Embryo apical or axial.

1. *O. amentacea*, Roxb. Kara Badalia, Duraikuli, Or.

Usually scandent with fulvous-tomentose branchlets and sub-coriaceous lanceolate or lanc.-ovate mostly acuminate leaves 1.5—4" long with usually 5—8 distinct (or indistinct when fresh) fine and irregular sec. nerves. Fls. very small, greenish, slender-pedicelled, in threes concealed in bud by orbicular rhomboid ciliate bracts which are arranged in catkin-like axillary and extra-axillary spikes .75—1.5" long.

Sambalpur! Angul, very common on the gneiss and sandstones of the Durgapur range! Singbhum, rare! Santal Parganas, *Gamble*. Fls. April—May. Fr. July. Evergreen.

L. with small raised dots when dry, tertiary nerves usually distinct. Petiole .1—1.5". Racemes solitary or clustered, rhachis tomentose. Pedicels .15". Tepals yellowish or green. Anths. versatile. Drupe .3", pedicelled.

A root parasite, *Barber*.

3. CANSJERA, *Juss.*

Sarmentose or climbing sometimes spiny shrubs with alt. shortly-petioled penninerved leaves sometimes showing translucent markings. Fls. small, 2- or functionally 1-sexual in axillary spikes with inconspicuous bracts. Perianth campanulate, tepals 4—5 valvate. St. isomonous hypogynous inserted on the broad torus opposite the tepals outside of and alternate with large disc glands or staminodes. Anthers small oblong 2-celled sometimes adherent by the connective to the perianth, dehiscence longitudinal, filaments free or slightly adnate to base of perianth. Ovary superior 1-celled, stigma capitate lobed, lobes alternate with stamens. Ovule solitary pendulous. Frt. drupaceous surrounded by the marcescent perianth. Embryo in the upper part of the fleshy albumen, cotyledons 2 deeply bifid (or 4?) or 3 (according to Griffiths).*

1. *C. Rheedii*, *Gmel.* Jhantika, *Or.* Also Badalia, etc., from confusion with *Olox scandens*.

A large suberect or usually scandent shrub with generally spiny stems and green spinous or unarmed branches with a minute curly pubescence on the younger twigs. L. 1.5—3" patent ovate to lanceolate acuminate shining both sides but with a somewhat wrinkled appearance. Fls. sessile, .1", green or yellowish pubescent with 4 rarely 5 very short recurved broadly triangular lobes. Drupe .3—5" scarlet ellipsoid with thin hard endocarp.

Widely distributed but not usually common, mostly along ravines and near water. Champaran (Sameshwar Hills)! Central tract: Gaya ghats! Monghyr! and Santal Parganas! Southern tract: Singbhum! Puri, more frequent! Fls. Nov.—Dec. Fr. March—May.

Old trunks with large blunt spines and mottled with white lenticels, spines on the young stems and branches often slender .5—1.2" long. Twigs sometimes ferruginous-pubescent. L. occasionally 4.5" long, nearly opaque but with faint translucent nerves and dashes, young puberulous; sec. n. 3—4, rarely 5 or 6, 1—2 quite close to the often oblique usually rounded base, tertiaries very indistinct. Peti. .05—15", articulate at base. Spikes .4—1" long, 1—2-nate, sub-tomentose. Bracts minute subulate persistent. Ovary or pistillode narrow-oblong. Stigma slightly exserted.

NOTE.—A root parasite (vide *C. A. Barber in Memoirs of the Department of Agriculture in India*, Bot. Series, vol. ii, part 5). The ovaries often contain no ovule and a single fruit at the end of the peduncle is common. The broad torus sometimes extends beyond the perianth into a minute annulus which may be homologous with the "calyculus" of *Olox*. Embryo 2 mm. long with a very broad fleshy hypocotyl and 4 flat oblong cotyledons.

FAM. 43. ILICACEÆ.

Trees or shrubs with alternate usually coriaceous and evergreen or nearly evergreen leaves, stipules 0 or minute. Flowers regular, usually dioecious, small in axillary cymes, fascicles or umbels. Calyx 3—6-partite or lobed imbricate persistent. Petals 4—5, rarely 6—8, connate

* I thought in one case that I had confirmed Griffiths' observation, but found the third cotyledon easily separable into 2, or perhaps 2 segments.

at the base or free in the female, imbricate in bud. Stamens isomerous, adhering to base of petals or free hypogynous, filaments subulate anthers shortly oblong dorsifixed. Disc 0. Ovary free or imperfect in male, 3—16-celled; style short or 0, stigmas free or united capitate or discoid; ovules 1 or 2 collateral, pendulous with dorsal raphe and superior micropyle, funicle often cupular. Fruit a drupe with two or more 1-seeded pyrenes. Albumen fleshy, embryo minute.

1. ILEX, L.

Fls. 4—5-merous. Corolla rotate. Stigmas free or confluent.

1. *I. umbellulata*, Loes. Syn. *I. Godajam*, Colebr. Marcha, Th.

A small tree with pubescent twigs and simple elliptic or ovate-oblong rather coriaceous glossy leaves 3—5" long, when in flower young and often membranous. Fls. small, .18" diam., white or yellowish, crowded together in small umbels .3—4" diam. on slender peduncles which arise from the lower axils or from the axils of deciduous bud scales below the leaves.

Forests of Northern Champani. Fls. March—May with new leaves. Fr. May—June.

Distrib. along the foot of the Himalaya eastwards to Chittagong and Burma.

Attains 3—4 ft. girth. Bark nearly smooth. Blaze with chlorophyll in outer layer, then red. L. glabrous when old except on nerves beneath, shortly bluntly acuminate, base often cuneate and somewhat decurrent on the .5—7" long pubescent petiole, sec. n. about 6—7, fine spreading, rather irregular looping some distance from margin, which is slightly thickened. Stipules 0. Fls. polygamous. Peduncles .5—8" long. Pedicels .15" with triangular bracts at their base. Sepals orbicular. Petals usually 5 ovate-oblong rounded, connate below. Fr. ovoid-oblong, .15", with 5 (4—6) pyrenes, tipped with the short style and stigma, sulcate when dry.

NOTE.—A small tree with drooping branches and oblong leaves, 4—9.5", membranous, very glossy above, base narrowed to a stout usually curved and rusty petiole .5—6" long, sec. n. 7—8, found in the Ramnagar forests, was also probably this species.

FAM. 44. CELASTRACEÆ.

Usually glabrous, often thorny trees or shrubs, sometimes climbing, with simple opp. or alternate coriaceous leaves usually with small stipules. Fls. usually white or greenish, small, rarely terminal, in axillary cymes more rarely clustered or racemose and paniced, regular, 2—1-sexual. Calyx small with 4—5 sepals sometimes connate at base. Petals 4—5 usually imbricate in bud. Disc well-developed, thin and spreading or pulvinate, entire or lobed. Stamens 4—5 alternating with the petals, inserted on or under the margin of the disc; filaments short subulate with oval or ovate anthers attached dorsally. Ovary sessile free on the disc or immersed in it, superior very rarely half-inferior, 2—5-celled or (in the anomalous genus *Siphonodon*) with very numerous irregular cells. Style short, stigma capitate or lobed, sometimes very small. Ovules usually 2 in each cell, rarely 1 or more than 2, erect from the axis, rarely pendulous (if 1 only). Fruit loculicidal or

drupaceous or baccate. Seeds usually enclosed in a bright-coloured aril, sometimes winged, usually albuminous. Embryo axile with large usually green cotyledons and short radicle.

- | | |
|---|-------------------------|
| I. Ovary cells 3—5. Ovules 2 in each cell. | |
| a. L. opposite. Fr. capsular | 1. <i>Euonymus</i> . |
| b. L. alternate. Fr. capsular. | |
| Fls. cymose. Ovary sunk in the disc | 2. <i>Gymnosporia</i> . |
| Fls. racemose or paniced. Ovary free | 3. <i>Celastrus</i> . |
| c. L. opp. or sub-opp. Fr. drupaceous | 4. <i>Elæodendron</i> . |
| II. Ovary cells divided up into many cellules each containing | |
| 1 ovule. | |
| L. alt., fls. cymose. Fr. sub-baccate | 5. <i>Siphonodon</i> . |

1. EUONYMUS, L.

Trees or shrubs with glabrous opposite leaves and caducous stipules. Fls. mostly in 2—3-chotomous cymes. Disc large fleshy 4—5-lobed. Ovary more or less sunk in the disc 3—5-celled. Stigma 3—5-lobed. Ovules 2 in each cell, one ascending sub-basal, the other on the axis, rarely more than 2. Capsule 3—5-celled and -lobed, angled or winged, coriaceous.

1. *E. glaber*, Roxb.

A small dark-foliaged tree with coriaceous shining ell., ell.-oblong or oblong-oblanccolate shortly acuminate entire or serrate leaves 2—4" long and greenish-white 5-merous flowers 3"—4" diam. in dichotomous long-peduncled more or less twelve-flowered opposite cymes usually on abbreviated shoots from the axils of the leaves or from the axils of leaf scars on the older branches.

Mayurbhanj; Simlipahar Mountains, chiefly along streams, above 2000 ft. Fls. May. Fr. not seen. Evergreen.

Attains 3—4 ft. girth. Bark light, nearly smooth. Blaze white then deep crimson. L. sometimes obovate and attaining 4.5" by 2.5" in exceptional cases, shining both sides, quite glabrous, usually serrate in the upper half and with acute entire base; sec. n. very fine oblique and arched, about 5, with shorter intermediate, others inconspicuous. Petiole .25—3". Stipules small glabrous with brown hairy or fimbriate tips. Cymes sometimes apparently terminal in which case single and a new shoot springs from its side, usually from the axils of leaf scales on new shoots or special abbreviated branchlets, rarely only 5—7-fld., sometimes 2" broad and 15-fld. with slender divaricate branches. Peduncles 1—1.5". Pedicels articulate .2—5". Bracts minute lanceolate ciliate. Calyx sub-petaloid, sep. orbicular. Pet. twice as long, sub-orbicular .12", short-clawed, minutely denticulate. St. at the edge of the large conical 5-angled disc. Anths. very short. Ovary 5-celled right to its conical top, not deeply sunk in the disc. Ovules 2 in each cell, one sub-basal one axile. Capsule,?

2. GYMNOSPORA, W. & A.

Shrubs or small trees usually thorny with alternate exstipulate leaves and axillary often clustered dichotomous cymes of small flowers; cymes often much contracted so that the flowers appear clustered. Disc broad sinuate or lobed. Ovary more or less sunk in the disc, 2—3-celled with short style and 2—3 stigmas. Ovules 2 in each cell. Capsule usually obovoid. Aril partially or entirely covering the seed or 0.

- a. L. coriaceous orbicular or obovate.
 L. entire. Cymes contracted with long pedicels 1. *emarginata*.
 L. crenulate. Cymes divaricate, not contracted 2. *montana*.
 b. L. lanceolate acuminate or ovately-elliptic 3. *rufa*.

1. *G. emarginata*, Roth. Bali bhains, Boincha, Or. (from confusion with *Flacourtia*).

A rigid dense shrub unarmed or usually with long straight sharp thorns attaining 2—3 inches and leaves somewhat like that of a *Berberis*, entire very coriaceous or fleshy mostly obovate 1—2" long. Greenish-white flowers about .2" diam. with long slender pedicels densely clustered in very short cymes mostly on short branchlets in the axil of a thorn.

Puri, from the Khandgiri sandstones in the north to the shores of the Chilka Lake (among rocks) in the south!

Fls. Nov.—Dec. Fr. Jan.—March.

Sometimes only 3—4 ft. Branches sometimes zigzag. Bark pale grey. L. attain 2—3", rarely broadly elliptic or ovate, usually with rounded tip and cuneate base, tip occasionally retuse, pale beneath; sec. n. about 3, green, scarcely raised, very reticulate between and at margins. Petiole .1". Lower cymes often borne on the thorns, opposite, only 3-fld. or once or twice 2—3-choromously branched, sessile with minute brown fimbriate bracts, uppermost axillary often only 2—3-fld. and subsolitary. Pedicels .3—5". Fls. polygamous. Sep. minutely ciliate. Pet. 2—3 times as long, .1" oblong. St. from beneath the pulvinate disc, longer in the male than in herm. fl. Ovary in the m. small and sunk in the disc with 3 sessile stigmas; in fem. and herm. fls. exserted with conspicuous style and 3 oblong stigmas. Capsule coriaceous .3", 3-gonous, pyriform, split about four-fifths to base when ripe into 3 valves. Young seeds with a rudimentary lobed collar-like aril, 1—2 in each cell, ripe shining brown or reddish, .07—1" diam., aril spreading and finally deciduous.

(The flowers in both *F. B. I.* and *Bengal Plants* are referred to as "fascicled" in contra-distinction to those of *G. montana*, which are spoken of as "cymose," but this distinction does not hold if it implies that the fls. of this species are not cymose).

2. *G. montana*, Benth.

A large shrub with the branchlets mostly ending in thorns which often bear leaves and flowers. L. coriaceous grey-green especially when dry, 1.5—2.5" obovate oblanceolate elliptic or orbicular but always with cuneate base tapering into the .25—4" long petiole, and rounded or retuse at the apex, minutely crenulate. Fls. white .2" diam. in numerous lateral 2—3-choromous cymes .4—1" long. Fruit coriaceous sub-globose .2" diam, usually purple when ripe.

Behar, Kurz! not common; Parasnath, Anders., but the specimen has no inflorescence and leaves not at all typical; it is somewhat doubtful. Fls., Fr. Oct.—Dec. Evergreen.

L. with 6—10 sec. n., very fine, but more visible than in *emarginata*. Capsule mostly 2-valved. Seeds 1 or 2, rarely 3, with a thin aril or aril absent.

3. *G. rufa*, Wall. Var. *lanifolia*, Haines.

A large shrub or small tree with sharp (axillary) thorns on many of the branches, glabrous elliptic or ovately elliptic crenulate leaves 3—4.5" long, obtuse or bluntly acuminate and mostly with acute base. Fls. in axillary sessile, dichotomous or paniced cymes, often several from a bracteate tubercle. Capsules 3-gonous, .25" diam.

Ravines in the Sameshwar Hills! Fl. March—April* (f. Wallich). Fr. Nov.—Dec.

Shoots papillosely pubescent. Thorns .3" only or 1.5—2" on the same plant. L. sometimes 2.25" wide with about 7—10 fine sec. n. and other intermediate nerves, very finely but inconspicuously reticulate between, crenatures sometimes obscure, when young apiculate and then serrulate rather than crenate. Petiole .2—2.5", often pink, minutely pubescent, base of leaf decurrent on the sides as ridges. Stipules deciduous exceeding the petiole lanceolate, ending in a long villous tip. Cymes about 1" or when paniced up to 2.5", minutely pubescent, bracts at the forks minute lanceolate acuminate. Sep. 5, very small, broadly triangular persistent. Pet.* .08", suborbicular-ovate with very broad base, venose. St. 5 at edge of disc. Ovules 2 in each cell from near the base. Capsule .3" long, coriaceous, valves splitting about three-fourths of the way down. Young seeds with a collar-like aril (it probably grows up in older seeds).

NOTE.—Most of the specimens of *G. rufa* in Herbaria and Wallich's types have linear-lanceolate leaves or narrowly ell.-lanceolate and very capillary peduncles to the cymes, when in flower attaining 2" long, though often much shorter and invariably glabrous. Wallich says leaves lanceolate, acuminate serrulate. Corymbs axillary capillary on capillary reddish coloured peduncles. Young branches of a more or less deep red colour, glaucous.

3. CELASTRUS, L.

Scandent shrubs with alternate usually serrate leaves. Fls. polygamous, in terminal or axillary paniced cymes, or racemes, 5-merous (exc. the pistil). Disc broad concave 5-lobed. Ovary not immersed in the disc, 2—4 mostly 3-celled, stigma 3-lobed or 3-fid. Ovules 2 erect in each cell. Capsule usually coriaceous. Seeds enclosed in a fleshy aril; albumen fleshy. Embryo erect.

1. *C. paniculata*, Willd. Kujri, K., S.; Konjri Kharw.; Malkamni, Malkangni, H.; Maltangun, Th.; Peng, Korsana, Or.; Chiron, Mal. Pah.

A scrambling or climbing shrub with long lenticellate branches, obovate serrulate leaves 1.5—5" long by 1—2.5" broad, green flowers .12" diam. in terminal paniced cymes and yellow 3-lobed capsules .3" long with red-arilled seeds.

Very common in hedges, in all districts! Fls. April—June with the new leaves. Fr. Oct.—Jan.

L. sometimes ell. or oblong, always with a short sudden acumination, young (and young branchlets) pubescent and bright green, base acute, sec. n. slender 4—7, petiole .25—5", stipules minute deciduous. Panicles 2—6", lanceolar, with minute bracts. Sepals orbicular, erose. Petals ovate-oblong obtuse. Capsule globose or obovoid 3-valved, 3—6-seeded.

From the seeds are obtained two valuable oils by expression and by distillation respectively. The fixed oil is used for burning as well as for external use in rheumatism, but is not considered so valuable as that obtained by distillation, the so-called *Oleum nigrum*, which is used medicinally.

The fruit is sometimes eaten before it is ripe.

4. ELÆODENDRON, Jacq. f.

Small trees or shrubs with opp., sub-opp., or, on some shoots, alternate entire or crenate leaves and white green or brown flowers in axillary dichotomous cymes, often polygamous, 4—5-merous. Stamens inserted

* Fls. described from dried remains which could not have been older than September.

on and near the margin of the large often lobed disc, anthers subglobose. Ovary conical, base confluent with the disc, 2—4 (usually 2 in our species) rarely 5-celled, ovules 2 linear in each cell. Fruit a drupe with one exarillate seed.

1. *E. glaucum*, Pers. Miri, K.; Niuri, S.; Raj jehul, Beng.; Ratan gurur, Ghatw.; Geti, Mutowar, Th.

A small tree with crenate or serrulate rarely (Ramnagar) coarsely crenate-serrate leaves usually about 5" by 2·5" and lateral corymbose cymes of small greenish-white or brownish flowers succeeded by nearly dry oblong or obovoid drupes ·5" long.

Throughout the whole area from the Ramnagar Hills to Puri, commonest in the central tract. Fls. Sept.—Dec., but also (*teste Brandis & Cooke*) Feb.—Aug. The fruits may be found at most times of the year and appear to ripen about Feb. Evergreen, or nearly leafless March—April.

Bark grey, nearly smooth, thin. Blaze rather hard with dark red outer layer or (in old trees) thick red-brown outer layer, then whitish and reddish on the wood. The cut is followed almost immediately by a flow of water from the lower edge. L. deep green glabrous, 2—6" by 1—3", ovate to obovate, acute or acuminate nerves slender. Peti. ·5—1", cymes 2—4", peduncles long. Sep. unequal orbicular. Pet. ·15", oblong (from lower part of margin being recurved), dorsally pubescent. St. on the lobes of the disc, straight ascending, finally spreading and recurved (probably proterandrous).

A preparation of the bark is given in cholera (*Camp.*).

5. SIPHONODON, Griff.*

Tree with alternate leaves. Fls. in 3—several-flid. divaricate cymes axillary and from the old wood, 5-merous. Calyx with rounded sepals. Petals on the disc broad-oblong. Disc filling the calyx tube with a lobed margin. Filaments broad, inserted between the disc lobes, flattened, arching over the pistil, anthers with very broad connective bearing the oblique laterally dehiscing cells on the margin. Ovary at first inferior, subsequently half-superior consisting of a whorl of some 20—30 cells radially disposed, finally irregularly 2—3-seriate, each cell with one ovule horizontal or inclined upwards or downwards, with lateral raphe. Style annular with five minute stigmatic appendages opposite to the petals (there are also five smaller points alternating with these, not noticed in the article quoted on p. 189). From the centre of the annulus rises what looks like a stout style and capitate stigma; its use is unknown (its tissue is non-conducting). Fruit with coriaceous pericarp, firm fleshy mesocarp and numerous irregularly arranged radially compressed woody pyrenes. Testa very thin. Cotyledons large, thick; caulicle directed towards the axis.

The ovary may be looked upon as morphologically 5-celled, each cell separated between the ovules by secondary partitions and becoming irregularly displaced by growth.

1. *S. celastrineus*, Griff.

A small erect glabrous tree with coriaceous somewhat distichous ell-oblong more or less crenate leaves somewhat resembling those of *Croton*

* For an account of the remarkable structure of the pistil in this genus, *vide* Hooker, *Trans. Linn. Soc.* xxii, p. 133.

oblongifolius, white flowers .5—6" diam. in 3-fld. or up to 7-fld. cymes mostly from the old wood branches or trunk. Fruit broadly pyriform, 1.25—2" long by 1—1.5".

Ravines in the Rajmahal Hills, not common! Fls. April—June. Fr. ripens Feb. Evergreen.

• It occurs in Sikkim and no doubt was found in Purneah before the disforestation of that district.

Bark grey, slightly rough. Blaze thin grey, then yellow, white on the wood. L. 4—8" by 1.5—3.5", very shining above, acute or acuminate with rounded rarely acute base, sec. n. slender about 8, depressed above.

FAM. 45. HIPPOCRATEACEÆ.

Usually glabrous and usually climbing* shrubs with simple opposite, rarely alt., often coriaceous leaves without or with small caducous stipules. Fls. usually small, sometimes very small, white, green or yellow, axillary clustered (often on tubercles) or in dichotomous or dichasial cymes, regular. Calyx 5-merous, sepals more or less connate at base. Petals 5 free, larger than the sepals, inserted below the disc. Disc fleshy, sometimes very large and concealing the ovary. St. 3 (rarely 2 or 4) inserted on the inner side of the disc with flattened filaments, usually ultimately recurved. Ovary on or sunk in the disc, 3-celled with 3-lobed stigma. Ovules 2—10 in each cell, sometimes 2-seriate, anatropous. Fruit either of three often vertically compressed almost free dry carpels (samaras) or a berry, rarely a 3-lobed capsule. Seeds winged or not. Albumen 0. Cotyledons large, often nearly fused into one mass.

Erect or scandent. Fr. baccate .
Scandent. Fruiting carpels samaroid

1. *Salacia*.
2. *Hippocratea*.

1. SALACIA, L.

Small trees or (in our area) erect or scandent or sarmentose shrubs with opp. (rarely alternate) entire or toothed leaves, usually exstipulate. Fls. clustered axillary, often on small bracteate tubercles, rarely in cymes. Ovary conical, sunk in the disc, style very short, ovules 2—8 in each cell, 1—2-seriate. Fruit baccate, sometimes sub-woody. Seeds large angular.

1. *S. prinoides*, DC.

An erect shrub about 3 ft. high resembling a "*Euonymus*," or scandent, with twigs ridged from the decurrent bases of the deciduous stipules, oblong or elliptic coriaceous faintly crenate-serrate leaves mostly 2—3" long and clusters of 2—6 yellowish flowers axillary and from leafless axils. Fruit a scarlet globose berry .5" with white viscous flesh.

Puri, chiefly in the South! Erect and bushy on the rocky shores of the Chilka Lake but scandent in the forest! Behar, *Prair.* Fls. Dec.—Jan. Fr. April. Evergreen.

* By means of spirally growing twigs.

Branches pale but small twigs sometimes purple. L. sometimes 3·5", subacute or shortly tapering to an obtuse tip or rounded, base usually cuneate; sec. n. 6—10 very fine, scarcely visible above. Petiole ·25". Stipules deciduous. Pedicels ·1—15", arising from clusters of minute rounded bracts on very small tubercles. Fls. ·26" diam. Calyx spreading, ·08" diam., gamosepalous with deltoid lobes, glabrous. Pet. ·1" ell.-oblong or appearing obovate and clawed from the inferior margin being reflexed and hyaline, inserted between the disc and calyx. Disc very large pulvinate, ·05" high and nearly as broad as the calyx, dented at the base opp. the petals. St. 3 inserted on the inner edge at the top of the disc opp. the grooves of the ovary. Fil. flat, finally recurved, anther terminal transverse with 2 oblique cells confluent across the top. Ovary conical, slightly 3-grooved, base only immersed in the disc. Ovules 2 collateral in each cell, axile, horizontal with raphe superior. Style 0. Stigmas minute. Berry usually 1-seeded, sometimes ·7" diam. and then 2-seeded, on pedicels ·25—3" long. Seed light brown subglobose ·3".

Forma β . Fls. only 1—2 axillary. Pet. ovate and some crenate with cordate base and distinct claw. Scandent shrub, leaves sub-entire.

Malsl Fls. Dec. The shape of the petals corresponds with that described by Lawson (*S. prinoides*, DC.) in *F. B. I.*

2. HIPPOCRATEA, L.

Unarmed small trees or climbing shrubs with opposite, often coiled branches sometimes resembling pinnate leaves with opposite spreading often toothed leaves and small three-cornered caducous stipules. Flowers often very small in axillary forked cymes or sometimes terminal and paniced and in scorpioid cymes. Petals coriaceous or thick and fleshy. Ovary seated on the disc or sunk in it, sometimes concealed by the filaments, narrowed into a very short style, ovules 2—10 in each cell, often 2-seriate. Fruit with three winged lobes which are usually dehiscent through their centre and with few vertically compressed winged seeds.

Leaves 1·5—3" long. Samaras 1—1·5"
Leaves 3—5·5" long. Samaras 2—3"

1. *indica*.
2. *arborea*.

1. *H. indica*, Willd.

A rambling or scandent shrub climbing by means of its coiled branchlets, with quite glabrous elliptic or somewhat obovate shallowly crenate-serrate leaves 1·5—3·5", and minute yellow fragrant 5-merous flowers crowded on the branches of axillary and terminal dichasial or 3-chotomous decomposed cymes which are ·75—2" broad. Fruit 1—3 oblong samaras.

Puri, rather common in open jungles (Baghmari; Jaimangal, Kuhuri Hill, etc.) Behar, Prain; Fls. April, Dec.

Twigs either grey or brown, glabrous. L. rarely lanceolate shortly, often bluntly, acuminate with cuneate base, sometimes nearly entire; sec. n. 4—5 very fine curved, reticulate venules impressed, marginal nerve distinct following the serratures. Petiole slender ·2—3". Stipules most minute, of 1—3 subulæ, caducous. Cymes broader than long (excluding the 3—8" long peduncles) with subsidiary branches in the axils of the main forks. Bracts linear-lanceolate 1—1·5 mm., decurrent as minute ridges on the branches. Fls. 2·5 mm. diam. Sep. ell. ovate or oblong ovate ·7 mm., papillose ciliate esp. at base. Pet. 1·5 mm. linear-oblong, margins inflexed when dry. Disc cup-shaped, thin, with a minute free spreading border. Ovary with 3 prominent lobes above the level of the disc with conical tip about as long as the flattened stamens. Samaras oblong 1—1·5".

2. *H. arborea*, Roxb. Damanahar, Th.

A very robust rambling shrub with branches at wide intervals, climbing like the last, smaller branches distichous and looking like pinnate leaves bearing usually only 3—4 pairs of leaves 3—5.5" long, which are oblong smooth shallowly crenate-serrate with short abrupt acumination and rounded or sub-acute base. Minute greenish-yellow 5—6-merous flowers in decompound cymes 1.5—3.5" broad. Cymes (in my specimen) with numerous bracts on the pedicels. Bracts with black glandular minute deciduous tip and teeth (as in the leaves).

Forests of Ramnagar! Fls. Nov.—Dec. (and possible later). Fr. June—Sept.?
(old dropped fruits found in Nov.). "Fls. July. Fr. March," Roxb.

Stems attains 2.5 ft. in girth. Wood structure normal. Bark grey, somewhat flaking in squares in old trunks. Blaze pink. L. attain 7", shining, glabrous, crenatures with deciduous black points; sec. n. 6—8. Petiole 3—7". Cymes as in last but stouter and comparatively fewer-flowered. Bracts lanceolate. Fls. smaller than in last with sub-erect petals 1.2 mm. long. Sep. microscopically crenulate and sometimes with black deciduous tip and teeth, back puberulous. Branches of panicle woody in fruit. Ovary more sunk in the disc than in *H. indica*, very slightly lobed and ovules below level of top of disc, 2 in each cell, axile from near the base (as in *H. indica*). Samaras oblong, 2.25—3" long and .7—8" wide with cuncate base, brown, with 1—2 ovate seeds at the end.

FAM. 46. RHAMNACEÆ.

Trees or shrubs, often scrambling or climbing, furnished with tendrils in *Gouania* and *Helinus* (and rarely with coiled twigs in *Ventilago*), frequently spinous or prickly. L. simple, alternate, rarely opposite (*Scutia*), frequently basal-nerved. Stipules small, deciduous or changed into prickles. Fls. small, green or yellowish, in axillary cymes or running out into cymose panicles. Calyx 4—5-merous, lobes triangular, valvate, often keeled within. Petals 4—5, rarely 0, inserted on the margin of the disc or on the throat of the calyx-tube (hypanthium), which is usually filled or lined with the disc, usually very small and often hooded over the small stamens, which are always inserted opposite to the petals under or on the margin of the disc, and are hence frequently perigynous. Anthers 2-celled. Ovary free or sunk in the disc, usually superior in fruit, but inferior in tribe *Gouanieæ*, 3-, rarely 2—4-celled. Style short simple, rarely cleft. Ovule 1 in each cell, erect anatropous. Fruit capsular or drupaceous, sometimes winged, 3-, rarely 1—4-celled; albumen fleshy, rarely 0. Embryo large erect.

- | | |
|--|-----------------------|
| A. Fruiting calyx hypogynous or perigynous. Tendrils absent. | |
| 1. Fruit samaroid. Unarmed climbers | 1. <i>Ventilago</i> . |
| 2. Fruit a drupe with a 1—3-celled stone.
Erect or climbing, armed with stipular prickles | 2. <i>Zizyphus</i> . |
| 3. Fruit baccate or drupaceous with 2—4 pyrenes.
Leaves alternate. Disc usually thin | 3. <i>Rhamnus</i> . |
| Leaves opp. or sub-opposite. Disc usually thick | 4. <i>Scutia</i> . |
| B. Fruiting calyx epigynous. Climbing shrubs with tendrils. | |
| Fls. in paniculate racemes. Fr. 3-winged | 5. <i>Gouania</i> . |
| Fls. in peduncled cymes. Fr. drupaceous | 6. <i>Helinus</i> . |

1. VENTILAGO, *Gærtn.*

Scrambling or climbing shrubs occasionally with some of the branchlets coiled into woody tendrils or hooks. L. penninerved entire or toothed, sub-bifarious stipules caducous. Fls. small greenish, 5-merous, 2-sexual, in terminal and axillary panicles. Petals cucullate or connate over the stamens. Anthers short, sometimes shortly horned. Disc filling the calyx-tube below and lining it above, with a short free margin. Ovary sunk in the disc, 2-celled with a short thick 2-fid style which develops in fruit into a large linear or oblong wing above the globose nut.

1. *V. maderaspatana*, *Gærtn.* Bonga-sarjom, *K., S.*; Keonti, *Kharw., Or.*; Petchuri, Pitchule, *Or.*; Pitti, Rai-dhani, *H.*; Rakto-kai (Blood-eater, from the red cracks in the bark), Rairui, Raktapita, *Beng.*

Widely scandent with long sarmentose branches, bifarious elliptic or oblong usually acuminate leaves about 5" long, yellow somewhat pubescent, and tomentose or pubescent fascicles of small yellow-green flowers .12" diam. arranged in interrupted panicles. The winged fruit is seated on the disc-like calyx.

Throughout the Central and Southern area, chiefly on the edges of forest glades and along streams. Chota Nagpur and Santal Par., frequent! Sambalpur! Mayurbhanj! Orissa! Fls. Sept.—March. Fr. March. Evergreen.

Bark dark grey, furrowed, with red in the furrows. Stems often 2 ft. girth, branchlets puberulous or glabrescent, often pale. L. 3—5.5" by 1.5—2.5", sometimes ovate or ovate-lanceolate esp. at base of the twigs, often crenate or crenate-serrate, with 6—8 very slender but distinct sec. nerves and very fine numerous parallel tertiaries. Peti. .25". Panicles pubescent. Calyx-lobes shorter than the tube. Petals obovate-spathulate, .003" long with produced mid-rib. Disc. nearly glabrous or villous. Wing of fruit linear-oblong, 1—2" long, coriaceous, glabrous.

Bark yields good cordage fibre. The seeds are said to be eaten when cooked and the oil expressed from them is used in cooking. *Campbell* says that the circinate woody tendrils are worn as charms by the Santals.

2. *V. calyculata*, *Tul.* Same vernacular names as the last.

Closely allied to the last and often treated as a variety of that species. The branchlets are more pubescent and the leaves often yellow tomentose, usually much more ovate and obtuse, rarely acuminate, often rounded and fewer secondary nerves (4—5). Panicles densely pubescent. Fls. said by *Gamble* to be larger than in the last and disc villous. Nut girt to the middle by the calyx-tube and yellow pubescent, wing often .5" broad thus becoming oblong, pubescent.

Throughout the area. Bettiah (but the leaves are glabrous and it appears intermediate). Monghyr! Chota Nagpur and Santal Parg., frequent! Angul! and other parts of Orissa, frequent!

Fls. Sept.—Nov. Fr. Feb.—April. Same uses as the last, the Indians not distinguishing the two varieties.

2. ZIZYPHUS, *Juss.*

Small trees or shrubs, sometimes scandent, usually with stipulary solitary or paired prickles; when paired one usually straight and the other hooked. L. sub-bifarious entire or toothed, basal-nerved. Fls.

in axillary fascicles or cymes or cymes forming terminal panicles. Calyx 5- rarely 4- or 6-fid, lobes spreading triangular keeled within. Petals very small, ultimately with the stamens reflexed, sometimes 0. Disc more or less filling the calyx-tube and often raised as a cushion above it or with a thin free margin under which the stamens are inserted. Ovary immersed in the disc 2-4-celled. Styles 2-4, free or partially united. Fruit a drupe, sometimes nearly dry, with a 2-3- rarely 1- or 4-celled stone. Albumen scanty or 0.

A. Cymes or fascicles axillary. Petals present.

1. Erect trees or shrubs.

a. Peduncles of cymes 0 or shorter than the pedicels.

Styles mostly 2 only. Fr. yellow or red.

Trec. L. densely tomentose beneath. Fr. 6-1" 1. *jujuba*.

Shrub. L. mostly elliptic, tomentose beneath, 5-1.5".
Fr. .3" var. *fruticosa*.

Shrub with slender zigzag branches. L. mostly orbicular, grey-tomentose beneath .3-7". Prickles very slender 2. *nummularia*.

b. Peduncles mostly longer than the pedicels. Styles 2-4, mostly 3. Fr. green. Tree 3. *xylopyra*.

2. Scramblers or climbers. Styles mostly 2.

L. silky beneath. Ped. hardly any. Fr. small black 4. *cenoplia*.

L. glabrous. Cymes peduncled, forked 5. *funiculosa*.

B. Cymes panicled. Petals 0. Usually climbing. Fr. white 6. *rugosa*.

1. **Z. jujuba**, Lamk. Janumjan, K.; Dodari, M.; Dedaori-janum, Jom-janum, S.; Dhani, Kharw.; Baer, H.; Ber, Bar, Beng.; Boyer, Baro-koli, Or.; Jujube, "Plum" of Anglo-Indians.

A small tree often with drooping branches and oblong or ovate dark green leaves 1.5-3" long densely tomentose beneath, small green flowers in dense axillary tomentose cymes or fascicles, and yellow or red fleshy drupes .5-.75" diam.

Appears indigenous on the Ranchi-Lohardaga ghats! Largely cultivated and self-sown over the rest of the area! Fls. March-Oct. Fr. Jan.-March. Renews leaves March-April.

Attains 2-3 ft. girth with grey or nearly black rough bark. Blaze thin brown then thick dark pink. Twigs tomentose with geminate prickles or often unarmed in old trees. L. with a white or red tomentum beneath glabrous shining above, usually minute serrulate or apex distinctly toothed obtuse rarely acute with an oblique 3-nerved base. Cymes .5-.75" long, sometimes with a short peduncle under .25" long. Fls. .2-.25" diam. on pedicels longer than the peduncle. Pet. spatulate white concave. Ovary cells 2 and style 2-fid. Fruit globose or in garden varieties ellipsoid, always ellipsoid when very young, stone 2-celled.

The fruit is eaten, it is believed to purify the blood. The bark contains much tannin and is a remedy in diarrhoea and when powdered is used for dressing unhealthy wounds.

Var. **fruticosa**, Haines. Janumjan, Ho.; Bakura, Bakula, M.; Kurit-rama (Vulture's talons), S.

A densely branched thorny shrub 3-4 ft. high. L. often symmetrical mostly elliptic .75-1.5" long sometimes ovate or suborbicular, minutely serrulate or with 3-more coarse teeth near the apex. Stipular

prickles geminate, straight one slender, .3—.5" long, the other much shorter, .15", stouter, curved. Fr. petioles .1—.12". Cymes sessile. Fls. .18—.25" diam., rarely 4-merous. Pet. oblong-spathulate concave. Fr. globose yellow or red shining .3—.5" diam.

Common and often gregarious in waste places, railway embankments, etc. From N. Champaran to Puri and Sambalpur! Fls. Aug.—Sept. Fr. Nov.—Feb.

It is largely used for fencing. The fruit is eaten but after being dried and pounded is chiefly used for a sherbert in the hot weather.

2. *Z. nummularia*, W. & A. Syn. *Z. rotundifolia*, Lamk.; Boyer, Or.

A somewhat smaller shrub than the last with more constantly zigzag and more slender branches, leaves mostly orbicular and often retuse only .5—.75", mostly white or grey tomentose beneath, sometimes also grey pubescent above, stipular prickles very slender especially the straight one often .6" (though sometimes the prickles of *fruticosa* are as slender). Fls. .14" diam. Petals very broadly spathulate, lateral margins very slightly inflexed. Fr. .3" diam. This is also said to differ from the last by the 10-lobed disc being pitted opposite each lobe whereas that of *Z. jujuba* is grooved. (I have not been able to confirm this character.)

On cotton soil, western Angul and Athmallik! Fls. Oct.—Dec. Fr. Nov.—Feb.

3. *Z. xylopyra*, Willd. Karkat, karkata, K., S.; Kankor, Kharw.; Ghatali, Khond; Kat-ber, H.; Ghont, Mal P.; Ghot, Ghonto, Or.; Goit, Bhumij.

A small usually straggling and thorny tree or old trees nearly thornless, with broadly elliptic or ovate leaves 1.5—3" long more or less pubescent or hairy beneath, sometimes woolly when young. Fls. .18—.2" diam., green, in axillary peduncled cymes .5—.2" long in the axils of the bright green leaves of the new shoots rarely (from leaf-suppression) in flexuous panicles up to 4" long, tomentose. Fr. globose 1—1.5" diam. deep-green when ripe, sometimes tomentose, 2—4- usually 3-celled with very hard stone.

Not common in the Northern area. Central and Southern areas very common, especially in inferior forest on the hills with a clay soil. Chota Nagpur! S.P.I Gaya! Puri! Angul! Sambalpur! Orissa States, common, Cooper. Fls. April—June. The fruit ripens in January or up to a year after flowering. Deciduous and renews its leaves April—May.

Bark grey or brown with thick oblong scales when old, blaze thin crimson streaked with white. Shoots tomentose and often unarmed. L. glabrescent above or somewhat permanently pubescent on the nerves, rounded or obtuse, serrulate, rounded or subcordate at the somewhat oblique 3-nerved base. Fls. sometimes 4-merous. Pet. spathulate hooded. Disc flat persistent. Style shortly 2—4-fid, very minute at first, ovary quickly rising up above the disc on fertilisation and style elongating. Roxburgh says that the valves of the nut separate when this has been exposed for some time to the weather.

The fruit and bark have for a long time been employed for tanning by the Indian tanners and it has recently come again into prominence at the Esociet Tannin Research Factory. Mr. Fraymouth stated (1917) that taken at the right time the fruit may yield as much as 20 per cent. and believed that it constituted the cheapest tanning in India. The kernel of the fruit is eaten. The wood is said to be hard and durable, reddish brown, but Gamble says not quite as good as that of *Z. jujuba*. It is one of the woods used by the Kols to obtain fire by friction.

4. *Z. canoplia*, Mill. Dathora, Kharw.; Makai, H.; Siakul, Beng.; Burukoli, Kontaikoli, Or.

A straggling thorny shrub becoming a large climber festooning the highest trees, the trunk armed with large conical spine-tipped woody bosses. L. obliquely ovate, ovate-lanceolate or oblong-ovate 1—2.5" with copious brown silky appressed hairs beneath. Cymes axillary under .5" long brown tomentose. Fr. small black succulent .25" diam. Stone rugose compressed, 1-rarely 2-seeded.

Throughout the province; commonest on sandy soils; Bettiah! Purneah! Singbhum, not common! Frequent in Gangpur, also in Manbhum, Hazaribagh, Ranchi, Palamau, S.P.! Common throughout the Southern area! Fls. June—Sept. Fr. Nov.—Dec. Evergreen, new leaves Feb.—April.

Twigs brown-tomentose. Prickles usually solitary small and hooked or with one nearly straight. L. acute or sub-acuminate entire or faintly crenate with very oblique 3—5-nerved base and very slender oblique silky sec. n. Petioles slender, .12—3". Petals cucullate. Ovary 2-celled.

The branches are used for fencing. The fruit is eaten. A morbid condition is common bearing dense fascicles of small branches and tiny leaves, believed by Mr. Hole to be analogous to the condition of "spike" in Sandal.

5. *Z. funiculosa*, Ham.

A scrambler or climber with glabrous oblong to elliptic-lanceolate sometimes ovate conspicuously acuminate leaves 2.5—3.5" long, with 3 prominent and usually 2 finer basal nerves, intermediate venation very fine and close giving the leaf a characteristic transversely striate appearance. Cymes peduncled, .7—2" long, dichotomous brown pubescent, sometimes paniced. Fruit obovoid densely tomentose when young or globose, older glabrous, .5" diam. Fls. Jan.—April. Fr. May.

Puri? (I have a single specimen marked Puri, 1915, but as I collected the same species in Burmah in 1914 the label may be an error and I have no field notes in connection with the Puri plant.)

6. *Z. rugosa*, Lamk. Sirka, Tsirka, K.; Sekra, S.; Pituar, Karail, Kharw.; Hohnoi, Mal P.; Kontai koli, Tinkoli, Or.

A large shrub or small tree with long pendent or, in favourable localities, widely scandent branches, large elliptic 3—5-nerved serrulate usually cordate-based leaves attaining 6" by 4.5" or more, and large tomentose panicles of greenish-yellow flowers arranged in peduncled cymes or the lower cymes axillary. Fr. .3—5" diam. white fleshy with a thin-walled 1-celled and 1-seeded stone.

Throughout the whole area from Bettiah! and Purneah! to Sambalpur! Angul! and Puri! Ascends to the tops of the mountains but usually occurs near ravines, nowhere very abundant. Fls. Feb.—March. Fr. May—July. Sometimes nearly deciduous, renewing its leaves in May, or evergreen with new shoots in Jan.—Feb.

Young parts all tomentose. L. sometimes glabrescent or permanently brown pubescent beneath, apex rounded. One stipule usually a short prickle the other triangular and caducous. Fls. .2—2.5", petals 0.

The fruit is eaten and is palatable. "The powdered bark mixed with ghee is applied to the swollen cheek in toothache and for ulcers in the mouth," Camp.

3. RHAMNUS, L. Buckthorn.

Shrubs or small trees. L. penninerved but often with 2 secondary nerves from near the base. Fls. fascicled in the axils of leaves or bud scales, or racemose, monœcious or diœcious. Calyx-tube (hypanthium)

urceolate or turbinate, lobes 4—5, keeled within. Petals 4—5 minute or 0. Disc lining the tube with thin margin, not swollen. Ovary free 3—4-celled. Fruit 2—4-celled, with 2—4 pyrenes, girt at base by the calyx tube, sometimes lobed.

Erect rigid. L. mostly under 3" long lanceolate
Sarmentose or erect. L. mostly 4—6" oblong

1. *dahuricus*.
2. *nepalensis*.

1. *R. dahuricus*, *Pall.*

A small bushy rigid tree or large shrub with smooth bark like that of a cherry, branches clothed with abbreviated closely scarred branchlets and sometimes ending in a sharp thorn, leaves small, often fascicled, .7—3" long, young pubescent. Fls. minute solitary or fascicled in the axils of bud scales of filiform pedicels .2" long.

Rocky places on the Neterhat plateau. Fls. March—April. Fr. May—June.

Distrib.: Himalayas and Ghats of Western Peninsula.

Branchlets often 4-farious. L. usually 1—2" lanceolate, acuminate, finely serrate, pubescent on the nerves beneath; sec. n. 3—6, tertiaries very reticulate impressed. Peti. slender, .1—3". Stipules filiform, pubescent. Fls. 1-sexual (sometimes polygamous?). Calyx tube .05", lobes 4, .07", caudate, 3-nerved. Pet. spatulate about half as long. Fil. shorter than petals. Fruit obovoid, somewhat compressed and faintly 2-lobed, .15" long seated on the hemispherical or patelliform calyx-tube. Pedicels and tube minutely pubescent.

2. *R. nepalensis*, *Lawson*.

A large suberect or rambling shrub with long brown sarmentose branches, sub-bifarious oblong acuminate serrulate shining leaves 3—6" rarely 8" long often interspersed with much smaller ones, petioles slender. Fls. small green pubescent fascicled in simple or compound racemes often with large foliaceous bracts. Capsule .25—3" at first rather succulent, broadly obovate, 3-lobed when dry.

High mountains of Orissa, Meghasani 3500 ft. Fl. June—July. Fr. July—Nov.

Distrib.: Himalayas to Duars and Assam.

Branches dotted with prominent brown lenticels, young parts pubescent. L. glabrous with tufts of hair in the axils of several of the sec. n. beneath, base rounded obtuse or subacute, often rather unequal. Sec. n. about 6 of which 1 or 2 close to base, conspicuous but slender slightly curved, very oblique tertiaries very fine. Petiole .3—7", pubescent or glabrous. Stipules subulate, caducous above and leaving a rounded base. Racemes pubescent. Fls. shortly pedicelled. Calyx lobes 5 lanceolate acute. Pet. 5 oblong concave over the stamens, caducous. Seeds brown shining oblong 2-sided within (*vide Wallich*).

4. *SCUTIA*, *Commers.*

Shrubs, usually armed with sharp hooked axillary, not stipulary, thorns and opposite or sub-opp. coriaceous penninerved leaves. It is usually said to differ from *Rhamnus* by the disc filling, not only lining, the calyx-tube but the character does not hold good as the disc is often quite as thin as, and closely resembles, some species of *Rhamnus*. Ovary nearly free, 2 (—3)-celled, base slightly sunk in the receptacle and the solitary ovule in each cell erect from the base. Fruit dry or very fleshy with 2—4 crustaceous pyrenes. Seed compressed with thin or no albumen and plano-convex fleshy cotyledons.

1. *S. myrtina*, Kurz. Syn. *S. indica*, Brogn.

A considerable shrub formidably armed with very sharp recurved axillary thorns, small shining opposite, sub-opp. or alternate one-nerved leaves mostly about 1" long, small white flowers .15—2" diam. fascicled on very short peduncles and green berries .3—4" diam. which *ultimately become dark blue*.

Scrub jungle near the Chilka Lake! Fls., Fr. April—May (probably also at other times).

Twigs glabrous, or grey with quite microscopical hairs, younger marked with longitudinal stipular raised lines. Thorns often .5" long, but those on flowering branches may be undeveloped. L. .8—2" long, elliptic or ell.-obovate obtuse or rounded both ends, mucronate. Mid-rib strong, sec. n. 3—6, very fine green, impressed beneath (not when dry), soon reticulate. Petiole .1—3" slender. Stipules flattened subulate .1". Fls. 1—6 axillary, appearing fascicled, but umbellately cymose on very short peduncles .02—1" long, which slightly elongate (up to .1—25") in fruit. Pedicels .05" bracteate and 2-bracteolate at base. Bracts brown nearly as long as pedicels, ovate mucronate, bracteoles smaller. Calyx .18" (4 mm.) long including tube, lobes as long as tube, 5 lanceolate keeled within below the solid triangular tip. Pet. minute, broader than long, deeply emarginate and minutely apiculate in the sinus, sides incurved round the short flattened triangular filaments and base of anther which exceeds the petal. Disc thin lining the tube. Ovary base slightly sunk in receptacle and constricted above it, globose above constriction with stout conical style and 2 (—3) apical stigmatic surfaces. Ovarian cells in base of ovary mostly below the globose portion. Fruit 1—3-celled and -seeded, seated on the patelliform calyx-tube.

5. GOUANIA, L.

Unarmed climbing shrubs with the ends of the branchlets often modified into tendrils. L. alternate, stipulate. Fls. small polygamous, fascicled on the rhachis of spikes or racemes which are sometimes paniced. Fls. 5-merous (exc. the ovary). Disc more or less filling the calyx-tube with 5 processes alternating with the stamens. Ovary sunk in the disc, 3-celled, style 3-cleft. Fr. inferior 3-winged or sharply angled, coriaceous, splitting into three cocci through the wings and leaving a slender axis. Seeds with hard shining testa and fleshy albumen.

1. *G. leptostachya*, DC. Bitkil-chand, S.; Ramduri (teste *Gamble*); Rakta Pitchali, Or.

A tendril climber with green branchlets, broadly ovate cordate coarsely crenate leaves and green flowers fascicled on the rhachis of simple or paniced terminal racemes, and 3-winged capsular fruits.

Chiefly along nalas and ravines in Central and Southern areas. Purneah! Chota Nagpur, not very common! S.P.! Mayurbhanj! Angul, frequent! Puril! Fls. Aug.—Sept. Fr. Nov.—Dec. Usually deciduous in the dryer localities and renews leaves March—April, practically evergreen in Angul. The old dry open fruits may sometimes be found up to March.

L. 2.5—5" by 1.5—4.5" shining above, nearly glabrous except on the 6—7 strong sec. n. of which the lowest are basal, crenatures glandular. Petiole 1—2.5". Racemes 6—8", pubescent. Fr. .3—5", broader than long, top emarginate crowned by the calyx. Seed black, compressed, broadly ovate-oblong .17".

The bark is used (ground up) for bruises in Mayurbhanj.

6. HELINUS, *E. Meyer.*

Unarmed-climbing shrubs with some of the branchlets modified into tendrils. L. alternate entire with small deciduous stipules. Fls. small in peduncled cymose umbels, 5-merous (exc. ovary). Disc filling the calyx-tube, epigynous and ovary inferior, 3-celled with short 3-cleft style and small recurved stigmas. Fr. drupaceous with a thin mesocarp, the putamen finally separating into 3 crustaceous pyrenes or cocci leaving the remains of the three septa, cocci ultimately dehiscent. Seeds with fleshy albumen and large flat cotyledons.

1. *H. lanceolatus*, *Brand.*

A bright green slender climbing shrub with ovate or lanceolate acute leaves about 2.5 by 1.25" and very numerous small yellowish flowers in slender peduncled cymes which are axillary or paniculate by reduction of the leaves. Fr. .25—5" diam.

Grassy valleys and sides of rocky ravines, Singbhum, not common! Ranchi, Neterhat! Santal P.! Fls. Jan.—April. Fr. April—May.

Branches finely ridged puberulous. L. glaucous beneath, those on the inflorescence much reduced, 3-nerved with 1—2 sec. n. and reticulate nervules. Stipules .05". Fls. .12—2" diam., shallow. Petals oblong whitish folded round the stamens which are inserted on the free margin of the disc with exerted anthers. Fruiting peduncle broadened above.

FAM. 47. AMPELIDACEÆ.

Erect or climbing herbs or soft-wooded shrubs, rarely small trees. Branchlets often transformed into tendrils in the Vines (*Vitis*). L. alternate, simple or compound, stipulate with petiole often sheathing at the base. Fl. small in compound inflorescences, regular, often polygamous, sometimes dioecious. Calyx small 4—5-lobed or truncate. Petals 4—5, hypogynous or perigynous, valvate, sometimes falling off as a cap without expanding (calyptrate). Stamens isomerous and opposite to the petals, sometimes perigynous, on or outside the disc, anthers 2-celled, introrse. Disc large or small, sometimes tubular and lobed. Ovary free or the base sunk in or surrounded by the disc, 2—6-celled, with 1—2 ascending anatropous ovules in each cell with the raphe towards the axis. Stigma simple or lobed. Fruit a berry. Seeds with copious hard albumen. Embryo short basal, cotyledons ovate.

NOTE.—Both the tendrils and the inflorescence in *Vitis* are morphologically main axes which get thrust aside with the growth of the stronger axillary shoots and thus often appear leaf-opposed.

Climbers. Stamens free on a hypogynous disc. Ovary 2-celled	1. <i>Vitis</i> .
Erect. Petals and stamens perigynous and outside a lobed tubular disc. Ovary 3—6-celled	2. <i>Leea</i> .

1. VITIS, *L.* Vine.

Herbs or shrubs climbing by means of a modification of the stem or branches into tendrils, which sometimes bear the inflorescence. L. simple and palmately nerved or digitate or pedate. Fls. 4—5-merous.

Petals often calyptrate. Disc of glands or lobed or annular. Stamens free. Ovary 2-celled, very rarely 4-celled, surrounded at the base or half way up by the disc. Ovules 2 in each cell. Berry 1—4-seeded.*

I. L. simple, often angled or lobed.

A. Fls. 4-merous (or ovary 2-merous). Fls. 2-sexual.

Inflorescence not bearing tendrils (*Cissus*)*

1. Branches jointed, very thick and fleshy, angled

1. *quadrangularis*.

2. Branches normal.

a. L. glabrous. Somewhat fleshy herbs.

Stems very glaucous, glabrous

2. *repens*.

Not glaucous, stems more or less hairy

3. *assamica*.

b. L. pubescent or tomentose.

L. 2—4", as broad as long, with short pubescence

4. *vitiginea*.

L. 2—6", ovate, tomentose. Cymes leaf-opposed

5. *adnata*.

L. 5—8"; broadly ovate or orbicular, young tomentose hairy. Cymes often paniced on leafless branches in flower

6. *repanda*.

B. Fls. mostly 5-merous, polygamous. Infl. tendrillate.

1. Petals calyptrate (*Vitis proper*)*

L. scarcely lobed, woolly beneath when young

7. *lanata*.

2. Petals expanding (*Ampelocissus*)*

Leaves angled or lobed, glabrous

8. *latifolia*.

Leaves deeply lobed, tomentose

9. *tomentosa*.

II. L. 3-foliolate. Inflorescence tendril-bearing.

Fls. 5-merous. Petals expanding (*Ampelocissus*)

10. *divaricata*.

III. L. 3- or 5—7-foliolate. Inflorescence not bearing tendrils.

Fls. 4-merous.

A. Fls. polygamous or dioecious. Petals or their tips spreading. Stigma large 4-lobed. Seeds furrowed, without deep pits (*Tetrastigma*).

1. L. all 3-foliolate. Stigmatic lobes not papillose.

a. Fls. very small, pet. with a dorsal apical spur.

Disc large but thin, ovary glabrous

11. *bracteolata*.

b. Petals not spurred, sometimes mucronulate.

Cymes very short. Disc rather thick. Ovary pubescent

Cymes divaricate. Disc 0. Ovary glabrous

12. *angustifolia*.

13. *alcicorne*.

2. L. mostly pedately 5-foliolate. Stigma papillose

14. *lanceolaria*.

B. Fls. 2-sexual. Pet. connivent or spreading. Stigma minute. Seed with 1—2 pits covered by a membrane (*Cayratia*).

1. L. all 3-foliolate.

Herbaceous, rather fleshy. Lfts. hairy

15. *trifolia*.

2. L. mostly digitately 5-foliolate

16. *auriculata*.

3. L. mostly pedately 5—7-foliolate, hairy

17. *pedata*.

* NOTE.—Planchon in his monograph divided *Vitis* up into a number of genera and this arrangement has been adopted at Kew and in the *Madras Flora*. These genera are shown in brackets above, but the genus shown in one Key for the convenience of Foresters in the field.

1. *V. quadrangularis*, Wall. Syn. *Cissus quadrangularis*, L.; Harjora, Beng.; Harbhanga, Or.

A fleshy cactus-like jointed climber with 4-winged internodes and a tendril at some of the nodes, bearing in the rains and cold season short-petioled cordate leaves 1—2.5" long and broad. Fls. greenish-

white in short peduncled small glabrous umbellate cymes. Berries .25" diam., red, 1-seeded.

Not very common. Puri, both in the north and common on rocks near the Chilka Lake! Angul, near villages! Fls. r.s. Fr. c.s. Deciduous.

Stems often 1" diam. sometimes festooning trees. L. very broadly ovate or reniform, rarely lobed, crenate-serrate, glabrous, leaf-opposed. Stipules foliaceous, ovate. Tendrils simple. Cymes with 3-4 umbellules. Seed fissured (Roxb.).

The young shoots are eaten.

2. *V. repens*, W. & A. Syn. *V. glauca*, Wallich's No. 5990A; *Cissus repens*, Lamk.

A weak glabrous succulent trailer with very glaucous white (less so when old) stems and sagittate or ovate cordate and acuminate quite glabrous leaves 2-5" long with rather distant small teeth, stipules large membranous amplexicaul broadly-ovate or -oblong, crumpled or broken off when old. Cymes leaf-opposed irregularly umbellate, 1-2" long, glabrous or minutely hairy. Fls. small 2-sexual. Calyx prominent campanulate or saucer-shaped, subentire, much as in *V. assamica*. Petals 4 white, suberect, lanceolate, .08-1"; tip hooded, acute. Berries black, juicy, .2-.25" diam. Seed 1, .2" long, globose pyriform, somewhat faceted or with raised reticulations, not scaly.

Mals of Orissa, rather rare! Fls. July-Sept. Fr. Nov.-Dec. New shoots appear in April and May. Distrib.: E. Bengal, Sikkim, Chittagong to Burma, also Madras.

Stems somewhat compressed waxy 5-nerved at base. L. gradually acuminate (in our area), sec. n. above basal 2-4 only. Petiole 1-2", rarely up to 4". Peduncles variable, usually short. Pedicels .5", swollen at apex. Ovary 2-celled. Stigma simple.

3. *V. assamica*, Laws. (Wall., No. 6001, *Cal. Herb.* Syn. *Cissus adnata*, Roxb. teste Planchon, but this seems to me an error).

A sub-succulent climber, stems somewhat hairy at the nodes with appressed brown hairs and sometimes on the internodes, leaves ovate cordate, shortly caudate bristle-serrate when young, rather membranous, stipules oblong rounded, .2", spreading, leaving a persistent base on falling. Cymes umbellate leaf-opposed, 1-2" long, hairy when young, sometimes paniced in fruit by fall of leaves. Fls. small, 2-sexual. Calyx prominent campanulate, .07-.08" diam., entire or crenulate. Petals 4 suberect, oblong, .075" long, tip hooded. Berry black, .2-.25" diam. Seed 1, pyriform with close grey flabellate scales,* otherwise smooth, raphe conspicuous.

Fairly common in the Mals of Orissa! Fls. July-Sept. Fr. Dec.

Stems somewhat obtusely angled. L. 4-6", but attaining 7" by 5", shining both sides with a narrowly recurved margin, distinctly serrate when old, glabrous or often with a few long yellow hairs on the nerves, base 3-5-nerved, sec. n. above basal 4-6, strong gently curved excurrent. Petiole 2-4". Tendrils simple or some forked at the extremity. Cymes with long rufous hairs when young, peduncles .7-1" (or in some Sikkim plants up to 2.7"), divaricate or ascending, fruiting pedicels .2-.25", sometimes verrucose. Ovary 2-celled, stigma simple.

The berries are not dry as stated in *F.B.I.* but are succulent and edible.

* Not seen in Herbarium specimens as they get removed with the adhering flesh.

4. *V. vitiginea*, *nov. comb.* (non *V. vitiginea*, *Kuntze* = *V. repanda*).
Syn. *V. Linnæi*, *Wall.*; *Cissus vitiginea*, *L.*; Jangli angur, *H.*

A weak hoary pubescent climber with corky bark, membranous simple cordate lobed and coarsely dentate leaves mostly about 3" diam., and umbellate compound cymes of small white 4-merous flowers. Fruit pale purple pruinose, 1-seeded on deflexed pedicels.

Puri, near the coast (Konarak)! Fls. July—Sept. with the fully developed leaves. Fr. Oct.—Nov. Dies down at end of cold season.

Stem and leaves beneath and inflorescence clothed with a short curly pubescence. L. also puberulous above, 2—4", basal sinus wide, 3-nerved, sec. n. ending in the obtuse teeth. Petiole 7—1.5". Stipules under .1", rounded, deciduous. Tendrils simple. Cymes 1—1.5" diam. with about 3 rays only, pedicels 3-many.

5. *V. adnata*, *Wall. Wall.*, No. 5998 (not 6001). Syn. *Cissus adnata*, *Roxb.*

A climber sometimes attaining large size, leaves ovate acuminate with cordate base, bristle-serrate when young, usually 2—6" long and never as broad as long, floccose hairy or tomentose beneath. Cymes umbellate, leaf-opposed and about as long as the leaves opposed to them. Fls. .12" diam., 4-merous with broadly oblong-ovate greenish spreading petals. Berries purple-brown, globose pyriform, .3" long. Seed somewhat obliquely pyriform, sharp pointed at base, .2" long, brown, smooth (faceted in *herbaria*, but this is not evident in the ripe fresh seed).

Purneah, common in the north! Fls., Fr. Sept.—Jan.

Not nearly so large a climber as *V. repanda*. Stems much harder, less succulent, and not corky, often flattened on two sides and grooved on the flat sides as in some other species. Leaves much smaller, but rarely they attain 8" length. Cymes arising in succession on the firm striate leafy branches, not in leafless panicles, compact, umbelliform, 1.5—2", rarely 3" long, including the peduncle. Pedicels much recurved in fruit.

The red tomentum is sometimes given as a distinguishing character, but the red is often entirely absent,* while the tomentum of *V. repanda* is sometimes red. I have never seen the shoots clothed with imbricating stipules as occurs in rapidly growing specimens of *V. repanda*.

6. *V. repanda*, *W. & A.* Syn. *Cissus repanda*, *Vahl*; Bambar, *K.*; Bod-lar-nari, *S.*; Gonvehli, *Gond.*; Harjarwa, *Kharw.*; Panlati, *Th.*; Takwale, *Or.*

A large-climber with soft very porous wood and corky bark, large simple deeply cordate usually repandly toothed leaves 5—8" diam., and long-peduncled tomentose irregularly-branched cymes, finally umbellate, which often appear copiously paniced before the advent of the leaves. Fruit .35—4", pyriform. Seed pyriform, nearly smooth, .3" long.

Throughout the whole area (in favourable localities) from Champaran to Southern Puri, Angul and Sambalpur! Chiefly in valleys and the damper jungles and is therefore rare in the Central and Northern tract. Ascends to 3000 ft. at Neterhat and Parasnath (4000 ft.)! Fls. April—June on the new shoots before and after expansion of the new leaves. Fr. June—July. Deciduous Feb.—May, the leaves turning yellow in December.

* This red appearance is also to a great extent a herbarium character. I find that my specimens collected without a trace of red gradually change to red after drying.

New shoots tomentose and hairy, tomentum often ferruginous. L. sub-orbicular to broadly ovate with deep basal sinus 5—7-nerved, the strong sec. n. running out into small teeth, under surface villosely tomentose when young and less so above, finally glabrous both sides. Petioles 6—12" long. Stipules oblong, 2—3", rounded, imbricate on young flowerless shoots on the terminal bud, sometimes falcate. Tendrils forked or dichotomous. Cymes terminating the new shoots, and from the old nodes, each becoming in turn leaf-opposed, 3—5-rayed and rays again rayed or with umbelled pedicels 1—3" long. Peduncles 2—5". Fl. buds often red ovoid and sub-umbonate pilose. Calyx .07" diam., truncate. Petals ovate calyptrate or expanding widely and reflexed, boat-shaped at the apex. Disc 4-lobed. St. from between the lobes. Young fruits ellipsoid apiculate on somewhat recurved elongated pedicels.

The stems yield a quantity of drinkable water. "The root, powdered and heated, is applied to cuts and fractures. The bark and stalk yield a good cordage fibre." *Campbell*.

To obtain the water cut obliquely through the soft stem with one clean blow, then cut through it again higher up when the water in the piece will at once run out from the lower end.

7. *V. lanata*, *Roxb.* Kolo nari, S.

A climber which in form of leaf sometimes resembles *V. adnata*, but it may be at once distinguished by the polygamous dioecious flowers being arranged in thyrsoid panicles 3—6" long, opposite to the leaves and usually tendril-bearing, by the 5-merous slender pedicelled flowers with calyptrate corolla and the very slender filaments of the male.

Manbhūm, *teste Campbell & Watt*; but I have seen no specimens from our area and it may be an error in identification. It is a plant of the lower Himalayas, Eastern Bengal and the Eastern Ghats. Fls. Feb.—May.

The leaves are ovate cordate, sometimes slightly 3-lobed, 2.5—8" long, densely lanate when young, but in one variety glabrescent. Seeds pyriform, somewhat 2-furrowed on the inner face and 1-furrowed on the outer.

8. *V. latifolia*, *Roxb.* Syn. *Ampelocissus latifolia*, *Planch.*; Oteron, K.; Icewar, S.; Khopri, *Kharw.*; Goveia, *Beng.*; Pani-kacho, *Or.*; Paniloha (Bonai, *f. Cooper*).

An extensive but scarcely woody climber, glabrous or nearly so, except the rhachis of the inflorescence, with simple palmately rarely deeply-lobed leaves 4—8" long and broad, deep brown-red flowers and black succulent berries .3" diam., which are sweet and juicy.

Throughout the area. Very common, especially in low scrub jungles in Chota Nagpur, Rajmahal Hills and Orissa! Fls. June—July. Fr. Aug.—Oct. The stems die down annually to the perennial rootstock, which sends out long bare shoots in May and June sometimes to a height of 10 ft. before the leaves expand, and it flowers before the leaves are fully developed.

New stems glaucous or quite blue, hollow, and often producing the inflorescence before the leaves. L. 3—7-angled or-lobed, lower sometimes 3-lobed half-way down while the upper are shallowly 3—7-angled, mealy when very young, cordate or retuse at the base, crenate-serrulate or dentate. Fls. rarely 4-merous, in pyramidal paniced cymes borne on a very stout peduncle together with a forked tendril. Petals .06", oblong, red, expanding, saccate at the apex. Disc prominent lobed becoming adnate and often showing as a ring on the fruit. Seeds 2—4, .22" long, roughly plano-convex with convex side rugose, sides rugose and a strong ridge on the plane face.

The fruit is eaten.

9. *V. tomentosa*, *Heyne*. Syn. *Ampelocissus tomentosa*, *Planch.*; Oteron, K.; Ghora-lidi, S.

An extensive but scarcely woody climber, densely often ferruginous tomentose with large orbicular very deeply cordate leaves often attaining 10" both ways and 3—5-lobed. Fls. sessile, red, in divaricate cymes on a peduncle under 1" long which again is borne together with a tendril on a common woody branchlet 3—6" long. Berry black, .3" diam.

Central and Southern areas, common. Gayal Hazaribagh! Ranchil Palamau, ascending to the top of Neterhat! Santal Parg.! Angul! etc. Fls. July—Sept. Fr. Sept.—Nov. Often dies back in the hot season.

Shoots covered with a dense cottony tomentum. L. with a dense brown tomentum beneath, basal lobes rounded, margin serrate or serrulate. Petiole 3—6". Petals spreading, usually 5. Seeds obcordate, furrowed and keeled on the inner face, pitted on the outer with rayed fissures from the pit.

10. *V. divaricata*, Wall. Syn. *Ampelocissus divaricata*, *Planch.*

A somewhat extensive climber with cottony tomentose but glabrescent branches, 3-foliolate membranous leaves with rather large ovate-oblong or oblong-lanceolate acuminate terminal leaflets and ovate-lanceolate semi-cordate lateral leaflets, crenate-dentate with the teeth sub-spinulose. Fls. reddish in rather dense 2—3-chotomous cymes 1.5—2" diam., borne laterally on the tendril-branches.

Sameshwar Hills, common! Fls. Oct.—Nov. Fr. Dec. (ripe?).

L. cottony-tomentose beneath or old ones only pubescent on the nerves. Petiole 2—4". Terminal lfts. 4—8.5" and up to 3.3" broad, lateral nearly as long and often broader, sometimes with a large side lobe near the middle, sec. n. 6—7, of which one or two from the base, or primary nerves 3—5. Tendrils once or twice forked with a bract at each fork. Cyme branches divaricate with linear bracts at the forks, peduncle .75—1.5" long, stouter than the common peduncle of cyme and tendril which is 3—5.5" long. Calyx spreading, thin, scarcely lobed. Disc large, cupular, about 10-pleated and -lobed. Stigma sessile. Ovary 2-celled. Fruit (not seen by me) said to be black and 3—4-seeded with seeds .3", almost round, flat and emarginate.

11. *V. bracteolata*, Wall. Syn. *Tetrastigma bracteolatum*, *Planch.*

A medium-sized vine nearly glabrous except the inflorescence with 3-foliolate leaves, thin leaflets 3.5—5.5" long, ell. or ovate acuminate serrate or crenate-serrate acuminate, sometimes puberulous or pubescent on the nerves beneath. Fls. very small, dioecious, greenish, 4-merous in axillary puberulous or pubescent 3-chotomous cymes, shorter or longer than the petiole (2—4" long and broad), petals oblong ovate, .04—0.05", with the inflexed acute tip furnished with a small dorsal spur or tail. Disc large but thin, girding the ovary half-way up in the female. Fruit black, succulent, .3—4" diam., usually marked equatorially by a white line (the remains of the disc margin).

Purneah! Fls. Sept.—Dec. Fr. Dec.—Feb. Common in the Bengal jungles east of Purneah.

Stems flattened sub-woody .3—4" diam. Lateral leaflets with base oblique and usually rounded, sec. n. 7—10, curving within the margin and each giving off a branch to a tooth. Petiole 2—3.5" and petiolules .3—5", puberulous. Cyme bracts oblong deciduous, leaving prominent scars, peduncle .7—2". Calyx saucer-shaped distinctly 4-toothed. Spur on petals making the buds 4-corniculate. Stigma sessile on the glabrous ovary with 4 acute lobes. Seeds 1—2 rounded or plano-convex, somewhat depressed on the plane inner side and with prominent linear raphe, 1—2-furrowed (with sometimes 1—2 shorter furrows) on the convex side and faintly transversely rugose on the rounded edges.

12. *V. angustifolia*, Laws. Syn. *Cissus angustifolia*, Roxb. (?); *Tetrastigma Thomsonianum*, Planch.

A rather slender climber, pubescent or puberulous all over except the leaves, which are 3-foliolate somewhat resembling those of *V. bracteolata*, but narrower lanceolate and lateral with lower half of leaf much more equal and base usually cuneate, larger leaflets 5.5 by 2", thicker or more succulent than those of *V. bracteolata* (membranous in the herbarium) and with sec. n. only 5—7. Cymes dense and densely pubescent not exceeding 1.5". Fls. small greenish-yellow, dioecious. Ovary papillose-pubescent. Stigma peltate, scarcely lobed. Berries spherical, pink, white or yellow, or ripe bright red, foetid when bruised.

N. Purneah in river-side jungles. Fls. Feb.—March. Fr. Oct.—Jan.

Stems flattened. Base of petiole, petiolules and inflorescence often pink. L. acuminate puberulous on the mid-rib and also on the nerves beneath or glabrous. Petiole 1.5" thickened below. Petiolules nearly equal or terminal longer .5—6". Stipules large oblong or somewhat triangular, .25", breaking off above the permanent base. Cymes with orbicular or oblong bracts on the .2—1" long peduncle. Petals not or rarely corniculate at tip. Disc rather thick round base of ovary. Seeds furrowed on each face and transversely rugose on the sides.*

Planchon throws doubt on this being Roxburgh's *Cissus angustifolia* because the latter came from Sumatra, but the figure and description are wonderfully suitable, and until the Sumatran plant is shown to be different I am inclined to keep Roxburgh's name.

13. *V. alcicorne*, Haines. Syn. *Tetrastigma alcicorne*, Haines in *Kew Bulletin*, 2, 1920.

A climber, glabrous except the inflorescence, with 3-foliolate leaves, leaflets shining both sides, 3.5—4" long, lateral elliptic terminal obovate, suddenly shortly caudate, remotely crenate in the upper half with sharp short teeth in the sinuses. Fls. small dioecious greenish-white, 4-merous in axillary puberulous dichotomous cymes, 1—2.5" long, shorter or longer than the petiole, with oblong or lanceolate-oblong puberulous flexuous petals .05" long with the tip usually obtuse and mucronulate, not appendaged. Bracts on the cyme sub-persistent ovate .05—06" long.

Sameshwar Hills, Champaran! Fls. Nov.—Dec.

Stems somewhat flattened. Tendrils leaf-opposed long simple. Lfts. with 4—6 sec. n. only. Petiole 2—2.5". Rhachis with terminal petiolule .8—1.25" long. Cyme branches usually flattened and wider above upwards. Calyx small saucer-shaped. Disc very small annular. Petals convex below, concave in the middle and again with a spreading and inflexed tip. Fruit not seen.

14. *V. lanceolaria*, Laws. Syn. *Cissus lanceolaria*, Roxb.†; *Tetrastigma lanceolaria*, Planch. *Wight's Icones*, tab. 28.

A large climber nearly glabrous exc. the inflorescence and stipules, with pedately 5 (-3)-foliolate somewhat fleshy leaves, lanceolate elliptic or oblanceolate distantly crenate-serrate leaflets 3—6.5" long. Cymes axillary or sub-axillary very shortly peduncled, dense, papillose, corymbose, rarely on the new shoots terminating long leaf-opposed peduncles which take the place of tendrils. Fls. yellowish, .1" long, polygamo-

* The seed described for this plant in the *F. B. I.* evidently belongs to a species of *Cayratia* and it could not have belonged to this species.

† The female was not known to Roxburgh.

dioecious, the buds oblong truncate, each petal sometimes with a spreading cusp. Berry 4", seed 3" long, rounded oblong with a broad groove on back and rounded end and a V-shaped groove and ridge on the inner face.

Not common. Damper regions along foot of Nepal Hills from Champaran! to Santal Parganahs (near Sahebganj)! Parasnath, Camp.! Fls. Jan.—March. Fr. June—July.

Larger stems woody, flattened and grooved. Tendrils simple, leaf-opposed. Petioles 2—6". Stipules oblong-lanceolate deciduous 5". Lfts. shortly sharply acuminate, with one fine and rather indistinct sec. n. to each tooth, tertiary nerves obscure, mid-rib broad. Petiolules stout, often shortly pubescent. Calyx inconspicuous. Petals ovate-oblong papillose-pubescent. Stamens long in the male, in female reduced to staminodes, disc at base of the grooved conic ovary, stigma shortly 4-lobed with papillose-fimbriate lobes.

15. *V. trifolia*, L. Syn. *V. carnosa*, Wall.; *Cayratia carnosa*, Gagnep. Amar-lati, H.

An herbaceous climber with succulent compressed stems springing from a stout perennial rootstock, with 3-foliolate leaves and crenate or dentate leaflets usually 2—3" long, pubescent both sides. Fls. small with green petals and conspicuous white cupular 4-lobed and crenate disc, in lax divaricate long-peduncled cymes 2—3.5" diam. Berries black, depressed globose, 5—7" diam., 2—4-seeded.

Throughout the whole area, sometimes adhering to rocks and trees by the expanded tips of the tendrils. Champaran! Purneah! S.P.! Gaya! Throughout Chota Nagpur, though nowhere very abundant, ascending to 3000 ft. at Ichadagh and Neterhat! Puri, very common! Fls. April—Sept. Fr. Sept.—Dec. It often dies back in Jan. and Feb.

Stems thin or attaining 1" diam. with a corky bark, branches brittle, young striate pubescent or villous. Lfts. sometimes attain 5" by 3", usually coarsely crenate with a fine point from the sinus but sometimes coarsely serrate or irregularly dentate, the latter from somewhat hispid on the nerves only, terminal elliptic or obovate, lateral usually broadly ovate and somewhat cordate at the base. Petiole fleshy, 2—4". Tendrils slender branched. Cymes thinly hairy. Calyx cupular. Petals rarely white, .08—09", saccate at the tip. Style prominent, subulate, often pink with simple stigma.

16. *V. auriculata*, Laws. Syn. *Cissus auriculata*, Roxb.; *Cayratia auriculata*, Gamble; Baiang, K.; Amar-lata, Kharw.; Kanjkanjia, Or.

A large sub-succulent climber with digitate rarely pedate 5(—3)-foliolate leaves, long petioluled crenate or crenate-serrate leaflets 3—5" (or small lateral ones only 2") shining above, pubescent beneath and large divaricating cymes on long succulent peduncles. Fruit cherry-like, 7" diam. and red or pink when ripe.

Widely distributed in the damper jungles, usually near water courses. Sameshwar Hills! Chota Nagpur, all districts, occasional near streams! Puri! Mayurbhanj! Angul, occasional! Fls. July—Sept. Fr. Oct.—Dec. Deciduous.

Stems up to 1.5" diam., corky when old. New shoots and leaves densely pubescent with short white hairs, clothed with large scimitar-shaped or half-orbicular stipules .7—1.5" long. Digitate and pedate leaves may occur on the same plant, usually digitate. Petiole 3—7". Lfts. only 3 in some leaves broadly elliptic to obovate, shortly acuminate, sec. n. about 7 and tertiary prominent. Petiolules

from 5" in lateral to 2" in terminal leaflets. Tendrils 2—3-fid. Fls. greenish-white. Seed 1.

The fruit is said to be eaten. I have not found it edible.

17. V. pedata, Vahl. Syn. Cayratia pedata, Juss.

A large weak climber with young branches and pedately 7-foliolate leaves softly hairy, leaflets 4—8", strongly veined between the sec. n. beneath. Fls. 4-merous, small, green or white in large sub-corymbose cymes as long as the petiole. Fruit sub-globose 2—4-seeded, rather dry.

In the more humid districts only. Bhagalpur and S.P. towards the Ganges! Narsingpur! Khandpara! Nilgiri! Balasore! Mayurbhanj! Puri, common! Fls. Aug.—Sept. Fr. Oct.—Jan.

Lfts. 4—8" or lateral only 2" oblong lanceolate, lateral unequal-sided and often elliptic, sharply acuminate, base often cordate. Petiole 3—6". Tendrils forked at the ends. Fruit 2" diam. depressed. Seeds convex and concave, the concave side closed by a membrane.

2. LEEA, L.

Stout herbs, shrubs or small trees, erect and without tendrils, usually with herbaceous branches. Leaves large with sheathing petiole, simple or usually pinnately decomposed. Peduncles leaf-opposed. Fls. in corymbose cymes. Petals and stamens perigynous inserted on a hypanthium which is prolonged into a tubular lobed disc. Ovary-cells 3—8, 1-ovuled. Berry 3—6-seeded, or seeds fewer.

I. Petals and inflorescence red.

L. 1-pinnate, lfts. sessile .

L. 2-pinnate, lfts. petioluled

1. *alata*.

2. *acuminata*.

II. Petals green or white. Inflorescence not red.

A. Herbaceous, with lower leaves very few large simple cordate, rarely one or two upper pinnate

3. *macrophylla*.

B. Suffruticose, L. 1—2- or few 3-pinnate, Sec. n. close parallel, one to each tooth or bifurcate with a branch to each tooth.

1. One sec. n. to each tooth. Corymbs sub-sessile. Stems with usually crisped wings

4. *crispa*.

2. Nerves less than one to each tooth. Corymbs peduncled. Lfts. usually setose and with cordate base

5. *aspera*.

Lfts. not or only slightly setose, base not cordate, usually rhomboid

[*herbacea*].

C. Shrubs or small trees, lfts. with usually 3 or more teeth to each sec. n.

1. Lfts. without scales beneath.

Lfts. glabrous

6. *sambucina*.

Lfts. pubescent beneath, at least on nerves

7. *robusta*.

2. Lfts. with many small peltate scales beneath

8. *æquata*.

1. L. alata, Edgew.

A shrub 2—5 ft. high, with simply pinnate leaves and oblong or oblong-oblancoate serrate sessile or sub-sessile leaflets 6—12" long. Fls. red as is also the whole inflorescence and fruit.

Not at all common in our area Manbhūm, Camp. Occasionally found in first-class Sal forests in Chota Nagpur, Gamble and Manson. It probably also occurs in Purneah. Fls. June—Aug. Fr. ripens Sept. It dies down annually.

L. 3—7-foliolate, petioles winged below, reddish. Lfts. with several serratures to each sec. n., tertiary nerves numerous, close and parallel. Peduncles usually long and slender.

2. *L. acuminata*, Wall.

A handsome shrub 4—8 ft. high, with 2-pinnate leaves often red, leaflets ovate to lanceolate acuminate, almost silvery beneath when young and shining above, crenate-serrate or serrate, 2.5—5" long, with slender petiolules 2—35". Fls. scarlet in puberulous scarlet corymbs 2—4".

Mountains of Mayurbhanj, 2000—3000 ft.! Fls. May.—Sept. Fr. Aug.—Sept. L. many-foliolate, glabrous. Petioles with large connate auriculate stipules which are deciduous. Leaflets with 7—11 sec. n., each sec. n. supplying 2—4 teeth. Corymbs branched, sessile or peduncled. Lobes of staminal tube sub-quadrate emarginate. Berries 25—3" with 4—6 carpels.

Both this and the preceding are common in the Eastern Sub-Himalayan region.

3. *L. macrophylla*, Horn. Hatkan, S.; Dholsamudra, Beng.; Garurain, Th.

A robust herb 1—3 ft. high, with annual shoots from a perennial stock, large ovate-cordate leaves 1—2 ft., very large stipules and white flowers in sessile corymbs. Fr. black, succulent, 3" diam.

Champaran, frequent! Purneah! Santa! Parganas and Chota Nagpur, but not common! Fls. June. Leaves turn yellow in January and plant dies back in February.

I have sometimes observed one or two pinnate leaves at the top of the stem in robust specimens.

The root is applied externally to allay pain, *Camp.*

4. *L. crispa*, L. Ban-chalita, Beng.; Gorar, Th.

An erect sub-herbaceous plant with annual stems from a perennial stock. Stems, petioles and peduncles ridged or with very crisped wings. L. pinnate or some 2-pinnate, lfts. with very parallel sides or some ell.-oblong, coarsely serrate, with strong parallel sec. n. each carried into a serrature. Corymbs sub-sessile, stout. Berry blue-black.

Grass lands of N. Champaran, frequent! Purneah, very common! Palamanu, grass lands, ascending to the tops of the pars! Singbhum (near Gamaria), rare! Mayurbhanj, about 2000 ft., common! The Singbhum form is not winged. Fls. June—Aug. Fr. Sept.—Oct. Leaves turn red before dying in December.

Ridges or wings about 8. Lfts. often with as many as 18 sec. n. 17" apart, quite glabrous above, puberulous beneath; not caudate.

5. *L. aspera*, Edgew. Syn. *L. herbacea*, Ham.; Hom, Ho.; Horom, M.; Gorar, Th.

A shrub scarcely woody, spreading or in some situations with many erect or curved stems from the root attaining 12—20 ft. high and 2" diam., soft-wooded with very large pith, never winged. L. 1—3-pinnate, but usually only 2-pinnate with mostly elliptic or ovate caudate leaflets with rounded or cordate base, strongly often coarsely serrate, with most of the strong sec. n. supplying more than one tooth, always pellucid punctate and more or less asperous or hirtellous above and puberulous or pubescent on the nerves beneath. Cymes small, rarely exceeding 4" in breadth, with ascending more or less 2-winged compressed

branches. Berries depressed glaucous or of a slatey-green colour and finally black, 5-seeded.

Very common throughout the Province and ascending to the tops of the hills in shady places. Fls. June—Sept. Fr. Nov.—Dec. The leaves turn red after fruiting and the stems break off at a node close to the ground.

Stems often longitudinally banded and with a minute microscopic tomentum. Base of lfts. 5—7-nerved. Cymes bifurcate at the base or with a peduncle up to 3" long, bracts linear-setaceous caducous, sometimes white. Lobes of disc-tube narrow oblong or lanceolate, usually 2-toothed. Petals lanceolate.

NOTE.—*L. herbacea* is usually separated from *L. aspera* by the characters given in the key but I find these quite unworkable in the forest. The long-stemmed form may differ from the shorter one but I think this depends on locality.

6. *L. sambucina*, Willd. Giringa, Khond.

A large woody shrub or sub- or quite arborescent (*L. umbraculifera*, Clarke), with 2—3-pinnate glabrous leaves, large oblong or lanceolate acuminate or caudate coarsely doubly serrate somewhat chartaceous leaflets with sec. n. much curved or looped within the margin and 3—5 times as many teeth as sec. nerves. Corymbs large paniced, 2—3-chotomous, 4—10" diam.

In the more humid forests. Santal Par., ravines in the Rajmahal Hills! Angul! Puri (common in the Mals)!

Fls. June—Sept. Fr. Oct.—March (usually Oct.—Dec.).

Stems up to 9" girth. Lfts. attain 12" by 3—5", occasionally ovate at the base of the pinnæ and only 3—4", base usually rounded, sec. n. 7—15 much raised beneath united by fine parallel tertiaries. Petiolules 2—1". Panicle branches compressed. Fls. green with yellowish staminal-tube, or white. Berries succulent turning from green to black pruinose, 3—35", depressed 3—6-seeded.

7. *L. robusta*, Roxb. Horn, Horom, K.; Haramda, Hatkan, S.

A large sub-woody shrub 4—6 ft. high, with more or less tomentose branchlets, large 2—3-pinnate leaves with the leaflets either pubescent beneath, or pubescent or somewhat hispid on the nerves only beneath, oblong to oblong-lanceolate or ovate-lanceolate acuminate, attaining 12" by 3—5", with several serratures to one sec. nerve. Fls. green with white staminal tube in large branched usually geminate corymbs 7—15" across. The plant somewhat reminds one of an Elder bush.

In ravines or along naals or on cool aspects, fairly frequent in Chota Nagpur! Santal Pr.! Puri! Angul! Probably throughout the area in favourable positions. Fls. Aug. Fr. Nov.—Dec. Apparently dies down annually in some districts.

Leaves 2—3 ft. Lfts. pale beneath with about 11—13 prs. sec. n. above the 5—7-nerved base which is sub-cordate, tertiary nerves numerous strong parallel. Cymes 2—3-chotomously branched, brachiate, pubescent. Berry purple black, 3—35" diam. depressed. Bracts not persistent.

8. *L. æquata*, L.

A large shrub with smooth erect stems or sub-arborescent easily distinguished by the hirsute twigs, petioles and inflorescence and the numerous small peltate raised glands on the leaves beneath. Corymbs small, 2—4" diam., sessile or shortly peduncled. Berries first red, finally black.

Mals of Orissa, frequent! Fls. r.s. Fr. Nov.—Jan. Old fruits remain till April. Perennial. New shoots May—June.

Sometimes almost arboreous. Leaves 1—2-pinnate, usually the lowest pinnae of a leaf again pinnate with about 3—5 leaflets. Lfts. somewhat resembling those of *L. sambucina*, larger 7—9" long, narrow-oblong or oblong-lanceolate, or lanceolate or terminal rhomboidly-lanceolate, caudate, base rounded, above with scattered hispid hairs, beneath hispid on the nerves, margin sharply serrate, usually 2—3 teeth to each strong sec. n., tertiaries strong parallel. Lateral petiolules 2—5". Peduncle of cymes 0—1", many of the hairs glandular on the branches. Berry 3—35", depressed 3—6-seeded (lobed when dry as in other species).

FAM. 48. STAPHYLEACEÆ.

Trees or shrubs with alternate or (in our species) opposite imparipinnate stipulate leaves. Fls. regular 2-sexual paniced. Sepals 5, free or nearly so, hypogynous. Petals 5, imbricate. Disc annular lobed. Stamens 5, inserted outside the disc opposite the sepals, anthers 2-celled introrse. Ovary of three carpels, free or combined; styles 3 short, stigmas capitate; ovules 2 or more in each cell. Fruit baccate or of three dehiscent carpels. Seeds 1—many in each cell, albuminous, sometimes arilled, with flat or plano-convex cotyledons.

1. TURPINIA, Vent.

L. opposite imparipinnate with opposite serrate stipellate leaflets. Fls. small in terminal and axillary panicles with opposite branches. Ovary 3-lobed, 3-celled. Fruit a 3-celled fleshy berry. Seeds angled, exarillate, with hard shining testa, large hilum and fleshy albumen.

1. *T. pomifera*, DC. Syn. *Dalrymplea pomifera*, Roxb. (1824); *Turpinia nepalensis*, W. & A. (1834).*

A small tree with opposite pinnate 5—7-foliolate glabrous leaves, elliptic serrate finely acuminate minutely stipellate leaflets 3—6" long, and small regular yellowish flowers in axillary panicles as long as the leaf rhachis. Frt. subglobose indehiscent 3-celled, 3-lobed.

My specimens were with withered flowers and in young fruit and I was therefore unable to satisfactorily determine either the colour of the flowers or the size of the ripe fruit.

Mayurbhanj, evergreen forest 3000 ft.! Fls. April—May. Fr. ripens(?). Evergreen.

Bark rugose, grey, blaze white with a chlorophyll layer then dirty yellow darkening on exposure to brown. Terminal bud thinly pubescent. L. rhachis 4—6". Stipules deciduous. Lfts. elliptic, lanceolate or ell.-oblong with cuneate base, terminal somewhat obovate. Petiolule .15—3", of terminal leaflets 0 (the position of the stipellæ shows that the so-called terminal petiolule is part of the rhachis). Stipellæ minute subulate, persistent. Panicles minutely puberulous above, lax. Fls. .25" diam., sep. 5 rather unequal, ciliate, nerved. Pet. 5, oblong. St. 5, with flattened subulate glabrous filaments inserted outside the lobed disc. Ovary 3-lobed and 3-celled, each lobe with a distinct style widely separated in fruit but slightly cohering in flower. Ovules 5—6 in each cell, axile pendulous. Frt. (young) 3-lobed, each lobe grooved.

Gamble give the weight of the wood as about 30 lb. It is apparently not used.

* *Turpinia nepalensis* is a small-fruited tree and may differ from *T. pomifera*, DC., which has large fruits.

FAM. 49. SAPINDACEÆ.

Trees or shrubs or (*Cardiospermum*) climbing herbs with alternate pinnate or rarely 1—3-foliolate exstipulate leaves. Fls. small or mod-sized, usually polygamous and more or less irregular, more rarely quite regular. Calyx 4—8-lobed or -sepalous, valvate or imbricate. Petals as many as or fewer than the sepals or 0, often bearded or squamate at the base. Stamens 4—10, usually 8, free, inserted inside, rarely outside an annular disc or disc unilateral, often lobed, sometimes 0 in male flowers. Ovary entire or lobed, sometimes excentric, usually 3-celled; cells 1-, rarely 2-ovuled. Fruit capsular or indehiscent and baccate, sometimes bladdery, entire lobed or winged. Seeds often arillate, albumen 0, embryo normally with curved or convolute cotyledons.

- A. Climbing herbs with tendrils and ternately divided leaves.
Disc unilateral 1. *Cardiospermum*.
- B. Erect trees or shrubs. Stamens inside the disc or unilateral.
1. Fls. zygomorphic, disc often unilateral or lobed.
 - a. Shrubs with 1—3-foliolate leaves 2. *Allophylus*.
 - b. Trees with 5—more-foliolate leaves.
 - Leaves odd-pinnate. Carpels nearly distinct in fruit 3. *Erioglossum*.
 - Leaves paripinnate. Fruit not deeply lobed 4. *Lepisanthes*.
 2. Fls. regular or stamens somewhat unilateral, disc annular or 0 (*Harpullia*).
 - a. Petals 0. Ovule 1 in each cell. Frt. entire 5. *Schleichera*.
 - b. Petals small (or 0 in *Nephelium litchi*). Ovule 1 in each cell. Fruit lobed or 1-coccous (only one lobe developing).
 - i. Trees. L. paripinnate. Cocci or lobes rounded. Calyx 4—8-lobed, sub-valvate. Coccus 1, crustaceous usually rough. 6. *Nephelium*.
 - Sepals 4—5 imbricate. Cocci globose fleshy 7. *Sapindus*.
 - ii. Trees or shrubs. L. paripinnate or 1-foliolate. Sepals 4—5 imbricate. Cocci or drupels oblong 8. *Aphania*.
 - c. Petals m.s. Ovules 2 in each cell. Frt. an inflated capsule 9. *Harpullia*.
- C. Shrub. Stamens outside the disc, or disc absent. Petals 0.
Leaves simple 10. *Dodonea*.

1. CARDIOSPERMUM, L.

Slender climbers with biternate leaves, coarsely dentate leaflets and small flowers in axillary racemes, the lowest pair of pedicels being developed as spiral tendrils. Fls. polygamo-dioecious. Sepals 4, two outer smaller. Petals 4, in unequal pairs, with scales above the base. Disc unilateral, almost reduced to two glands opposite the lower petals. St. 8 excentric, sometimes connate at base, 4 shorter. Capsule 3-celled, inflated, loculicidal, with 3 membranous valves. Seeds globose, usually arillate at base, cotyledons large, transversely conduplicate.

1. *C. halicacabum*, L. Galphul, *Kharw.*; Lataphatkari, Sibjhul, *Beng.*

An annual wiry herb, thinly pubescent or nearly glabrous with much acuminate leaflets. Fls. white, .12" diam. Capsules depressed pyriform, winged at the angles.

Common, probably in all districts. Fls., Fr. May—Nov.

The root is said to be emetic, laxative and stomachic, and is used in combination with other drugs in rheumatism, nervous diseases, etc.

2. ALLOPHYLUS, L.

Small trees or shrubs with 1—3-foliolate leaves and small polygamous irregular flowers in simple or branched racemes. Sepals 4 in unequal opposite pairs, imbricate, hooded. Petals 4 small or almost obsolete, generally declinate, often with a shaggy scale inside. Disc unilateral with usually 4 glands opposite the petals. Stamens 8. Ovary usually 2-lobed and 2-celled. Ovules ascending, 1 in each cell. Fruit indehiscent 1—2-lobed, dry or fleshy. Seeds usually with a short aril. Embryo curved.

1. *A. serratus*, Radlkofer (*Ueber die Gattung Allophylus*, etc., 1909). Syn. A. Cobbe, *Blume* (in part), Kandakola, Kontakura, Or.

A shrub erect 3—4 ft. high or much larger and with a straggling habit among other bushes, with 3-foliolate leaves, elliptic or obovate shortly acuminate dentate-serrate or crenate-denticulate leaflets 3—4" long by 2—2.5" and irregular small yellowish or white flowers clustered on simple axillary racemes 3—5" long. Drupels globose, .25" diam., orange-red.

Balasure to Puri, common! Fls. June—July. Fr. Sept.

Twigs white or grey, very lenticellate. Lfts. thinly hairy both sides with 6—10 prominent, often opposite sec. n., each nerve ending in a tooth. Petiole 2.5". Lateral petiolules very short. Racemes very pubescent. Petals somewhat declinate, cuneate, woolly in the centre.

A very variable plant, the Orissa plant belongs apparently to the forms *racemosus* and *serratus* of A. Cobbe of the *F. B. I.* distinguished as follows:

"Racemes simple and solitary, petals somewhat declinate, lfts. oval or ovate, glabrescent or somewhat hairy.

"Lfts. crenate-dentate. Bracts short *racemosus*.
"Lfts. serrate-denticulate. Bracts subulate *serratus*."

Roxburgh says that the ripe berries are eaten and the root is astringent.

3. ERIOGLOSSUM, Blume.

Trees with odd pinnate leaves and irregular flowers in terminal panicles. Sepals 5 orbicular, concave. Petals 4, each with a 2-fid scale. Disc fleshy unilateral. St. 8—9. Ovary stipitate 3-lobed. Fruit of 1—3 fleshy oblong diverging cocci. There are only two species of which one is Indian.

1. *E. rubiginosum*, Bl. Syn. *E. edule*, Bl.; *Sapindus rubiginosa*, *Roxb.*; Sona Mahanga, Nunga, Or.

A small tree with golden or rusty tomentose pubescence on the twigs and rhachis, pinnate leaves with about 6 pairs opp. or sub-opp. leaflets and occasionally an odd terminal leaflet and small irregular white or pinkish flowers .25" long clustered on the racemiform branches of a

terminal panicle 8—12" long. Anterior petal absent. Fruit of 1—3 black fleshy oblong carpels .7" long.

Cuttack, evergreen forests of the delta! Mayurbhanj, Simlipahar forests! Mals of Orissa! Fls. April—May. Fr. May. Evergreen.

Bark usually discoloured, blaze thin dark red. L. rhachis 5—11". Lfts. sometimes alternate, 9—13, small 1—3" and ovate at base of rhachis increasing in size upwards, largest 4—7" (3—15" *F.B.I.*) oblong or ell.-oblong, acuminate, base of lateral lfts. usually very unequal, both sides fulvous hairy, especially on the nerves, more or less glabrescent above; sec. n. 8—11, not quite uniting with the marginal nerve, very reticulate between. Branches of panicle 2"–5". Fls. tomentose. Bracts slender villosely tomentose. Calyx sub-globose 5-partite. Sep. unequal rounded hairy .15" concave and very imbricate in bud. Pet. 4, .2", ell.-oblong, long-clawed, each with a large fleshy 2-lobed scale bearded* on the inner face of its expanded top. St. 8 (or 9, 1 being forked), three posterior inside the fleshy one-sided lobed disc. Fil. sparsely hairy. Ovary and young fruit villous deeply 3-lobed. Style declinate. Ripe carpels only connate at base, red then black.

The fruit is eaten. *Roxburgh* says the wood is very useful, strong and durable and chocolate-coloured towards the centre. He describes it as a large tree in the Circars. *Gamble* gives the weight as 34 lb. only.

4. LEPISANTHES, Bl.

Trees or shrubs with paripinnate leaves and entire opposite leaflets. Flowers irregular (in our species), polygamous, in racemes or panicles. Sepals 5—4 imbricate, outer smaller. Petals 4—6, 1—2 sometimes small, clawed, with a two-lobed often crested ligule near the base. Disc regular or irregular and lobed. Stamens usually 8. Ovary excentric or not, 3-gonous. Ovule one erect in each cell. Fruit 3-celled and 3-gonous coriaceous and tomentose, hirsute within. Seeds oblong, exarillate (always ?), hilum linear, testa thick; cotyledons fleshy, obliquely superposed.

1. *L. tetraphylla*, *Radlk.* Syn. *Sapindus tetraphyllus*, *Vahl* (1794); *Molinæa canescens*, *Roxb.*; *Hemigyrosa canescens*, *Thwaites*; *Panikusum*, *Or.*

A small usually crooked tree up to about 3 fr. girth with thick gnarled twigs, glabrous leaves with only 2 pairs of leaflets (1—4 pairs *F. B. I.*), 4—8" long and copious spiciform panicles, both axillary and from the old leaf axils, of smallish white irregular flowers with erect petals.

Mals of Orissa, rather local! Fls. April. Fr. April—May. Evergreen.

Bark light coloured, blaze rather soft, thick, pale brown. Young twigs pale pubescent. Petiole and rhachis together 3—6" or more rarely 8" long, slender, nearly white. Lfts. coriaceous, very variable, either narrowly oblong, 3—7" by 1—2" or even smaller with cuneate base, or elliptic-oblong 4—8" by 2.5—3.4" with sub-cordate base, acute or rounded, glabrous, mid-rib prominent. Sec. n. 6—12 oblique and inarched at the margin ultimately confluent with a marginal nerve, shorter intermediate soon reticulate with the tertiaries. Petiolules .15—4" glabrous or pubescent, young yellow tomentose. Racemiform panicles 1—2.5" or elongating to 4—5" often fasciated, mostly from the old wood, dense-flowered nearly to base, rhachis tomentose. Fls. .25—3" sometimes .4" long, fasciated. Sep. 5, orbicular or orbic.-oblong connate at base, 2 posterior largest .18" with membranous margins, 2 anterior smallest .1". Pet. usually 4 but up to 6 oblong,

villous below and with a villous ligule half as long, ligule 2-lobed with a further linear forked appendage on its back exceeding the ligule, both petal and ligule sometimes toothed. Disc anterior. St. 8 hypogynous, within the disc, the posterior at base of calyx, fil. short base thicker, villous. Ovary villously tomentose, obscurely 3-gonous not eccentric, tomentose style and stigma somewhat declinate with 3 stigmatic confluent surfaces not lobed. One erect ovule in each cell with rudimentary aril. Fruit .8" (ripe?) coriaceous yellow tomentose obtusely 3-angled, cells hairy inside.

5. SCHLEICHERA, Willd.

^oTrees with paripinnate leaves and few pairs of opposite or sub-opposite leaflets. Fls. small, regular, polygamo-dioecious, fascicled on the rachis of simple or branched racemes, pedicels slender. Calyx small cupular, 4-6-lobed. Petals 0. Disc annular glabrous wavy. St. 4-8 with slender filaments. Ovary ovoid glabrous (or a villous pistillode in male) 3-celled narrowed to the rigid style, stigma lobed. Fruit usually 1-celled, toughly coriaceous, indehiscent. Seed erect with a fleshy aril. Seeds smooth, the large embryo curved round a septum in the seed and the radicle in a fold of the testa, albumen thin or 0 in the ripe seed, cotyledons oblong fleshy, unequal, plumule hairy. Germination epigeal.

1. *S. trijuga*, Willd. Kasma, Kusum, H., Kharw.; Swad Kusum, Or.; Baru, K., S.

A handsome dense-foliaged large tree with leaves 8-16" long, 2-4 pairs of opposite entire leaflets 3-10" long, the basal ones smallest, and inconspicuous greenish-yellow flowers in numerous lateral racemes, which are often paniced in the male and appear with the new foliage which is coloured a fresh green or deep red. Fruit 1-1.5" with a sharp point and often somewhat muricate.

In the Northern Tract it occurs in Bettiah but I have no note of its being wild in either the Ramnagar Hills nor in Purneah. It is often planted in the Gangetic plain but its real home is rather in the hilly parts of the Central and Southern tracts where it is frequent in the forests. Fls. Feb.-Mar. Fr. July-Aug. Nearly or quite evergreen.

Attains 7-8 ft. girth but not a great height. Bark rather thin, blaze pink, slightly mottled yellow darkening to brown. Leaves dark green with rachis 3-6" long, leaflets sessile ell. or oblong glabrous, very rarely repand or sub-lobed, with 10-16 slender distinct pale sec. n. and intermediate shorter ones finely reticulate between. Inflorescence tomentose. Racemes 2-6", axillary or below the leaves and often on special abbreviated branchlets. Filaments glabrous or slightly hairy, finally .15" long. Seed compressed, brown, .6" long. Cotyledons in the seedling oblong 1-1.5" long; first leaves opposite and 3-foliolate.

The timber is good but the tree is rarely cut, being left for the cultivation of lac. The large branches are cut off in the Santal Parganas for axles. Sugar presses and oil mills are made from it. *Gamble* gives the weight of the wood as about 68 lb. and P = 980, and he states that it seasons well and takes a good polish. The lac grown on it obtains twice the price of that grown on any other tree. Mr. Cooper states that the Kalahandi State alone obtains some Rs. 50,000 for monopoly fees for the right to cultivate. I have suggested that the tree should be extensively grown as a shade tree along fire lines as it is in leaf in the hot weather and lac cultivation could be easily watched. It is readily raised from seed sown as soon as ripe. The young plants should be put out in one year from

the time of sowing. The average of 13 trees sown by me in Singbhum was after 16 years 23.5 ft. high and 14.5" girth,* the largest 23" girth.

Both the aril and the kernel of the seed are eaten and a good oil for cooking is expressed from the seed. *Campbell* says that the oil is used for the treatment of certain skin diseases. It is also reputed to be the original Macassar Hair Oil.

6. NEPHELIUM, L.

Trees or shrubs with paripinnate leaves and entire sub-opposite leaflets. Fls. small regular polygamous racemed or paniced. Calyx cupular 4-6-lobed, open or closed in bud. Petals 4-6 or 0, small rarely squamate. Disc annular. Stamens 6-8, filaments slender. Ovary pubescent, often verrucose, 2-3-lobed and -celled. Fruit of 3-1 indehiscent globose often tubercled thinly crustaceous cocci. Seeds with a succulent aril.

1. *N. litchi*, *Camb.* Vern. Litchi (Chinese).

A demi-foliaged tree, often flowering in a dwarf state, with paripinnate leaves, two to six pairs of glabrous shining oblong lanceolate or ovate acuminate leaflets 2-6" long and small greenish-white or yellow flowers in pyramidal panicles, polygamous. Ovary 2-lobed compressed silky, only one lobe usually developing in fruit. Ripe fruit (coccus) with dry brittle tubercled pericarp. Seed one with large fleshy aril.

Everywhere cultivated! Fls. Feb.-March. Fr. May-June. Evergreen.

Lfts. coriaceous, sec. nervation obscure. Calyx cupular shallowly toothed. Cor. 0. St. incurved in bud, straight erect far exserted. Style in fertile fls. with 2 recurved lobes but most of the fls. are male with undivided style.

Requires a lot of water to grow well.

2. *N. longana*, *Roxb.* Ashphal, *Beng.* Longan (Chinese).

A large or small tree with a more distinct trunk than in the preceding and large bushy crown. Lfts. 2-5 prs. opp. or alt. ell. ovate oblong or lanceolate subacute or obtuse 2-8" long, shining above, rather glaucous and often slightly pubescent beneath. Fls. yellowish, tomentose, in panicles 10-15" long with long branches. Calyx closed in bud with imbricate ovate sepals. Petals 5-6 clawed and filaments hairy. Fruit of 1-2 cocci. Pericarp brown, rather rough but not acutely tubercled. Aril less thick and succulent than in the *Litchi*.

Frequently cultivated, but less common in European gardens than the *Litchi*. It is said to be indigenous in India but is not so in this province. Fls. March-April.

7. SAPINDUS, L.

Trees or shrubs with pari-pinnate leaves and entire opp. or sub-opp. leaflets. Fls. small regular paniced. Sepals 5 imbricate, in two series, unequal. Petals 4-5, sometimes squamate. Disc annular lobed. Stamens normally 8, filaments free, usually hairy. Ovary entire or 2-4-lobed, 2-4-celled or reduced to a villous pistillode in the male with usually 3 styles. Fruit of 1-3 fleshy or coriaceous drupaceous cocci, pericarp saponaceous. Seeds usually globose with two integu-

* Measurements kindly taken by Mr. A. N. Grieve in 1917.

ments, the outer very hard, the inner membranous. Cotyledons spirally convolute linear oblong unequal. Germination epigeal.

Lfts. broadly oblong or elliptic, obtuse or emarginate
Lfts. obliquely ovate-lanceolate acuminate, glabrous

1. *emarginatus*.
2. *trifoliatus*.

1. **S. emarginatus**, *Vahl* Syn. *S. trifoliatus*, *Hiern* (*F. B. I.*) in part; *Bor-ritha*, *Beng.*; *Muktamanji*, *Or.*; *Renthā*, *Or.* (? *Cooper*).

A dense dark-foliaged tree with pari-pinnate leaves and 2—3 prs. of broadly-oblong or elliptic, sometimes somewhat obovate, obtuse or emarginate, not shining leaflets 2.5—6" long, pubescent beneath with strong sec. n. and reticulations, and white flowers .15—2" long in rather dense terminal panicles shorter than the leaves. Pct. 5 long-clawed, lanceolate, .15" long, densely yellow-hairy outside and white fringed, glabrous within or sometimes *distinctly hairy* near the middle and with two inflected woolly tufts on the margin (representing the scale?). Ovary densely ferruginous-tomentose. Fruit of 2—3 drupels, yellow-brown, .7", glabrescent, wrinkled when ripe.

Not wild north of the Orissa Mals, where it is doubtfully so! Frequently cultivated in the south of the province! Occasionally cultivated in Chota Nagpur, Gaya, etc.! *Band*, *Palahara* cult. *Cooper*.

Fls. Nov.—Jan. Fr. March—May. Evergreen.

Young parts tomentose. L. rachis with petiole 2—5.5" tomentose or pubescent. Lfts. with rounded base, often shining above (*Gamble* says dull above), lowest pair smallest, sec. n. 7—10 running close to margin and reticulating with the marginal nerve, tertiaries very reticulate and raised both sides. Petiolules .1—2.5". Panicles 3—4". Sep. 5 oblong or ovate, tomentose. Petals 5, long-clawed, lanceolate. Stamens woolly. Unripe fruit undivided tomentose. Seed in each drupel round smooth.

The tree is easily grown from seed sown in June (with the pericarp). The expanded cotyledons are .75" long, oblong-linear, fleshy, petioled. Hypocotyl rather stout, 2" long, young stem and petiole of first leaves pubescent, first leaves 3-foliolate, lfts. elliptic but lanceolate both ends and *very acute*, rather coriaceous hairy beneath, reticulate, about .2" long, lateral shorter. Petiole .3". The pericarp is very saponaceous and is used for soap.

2. **S. trifoliatus**, *L.* Syn. *S. trifoliatus*, *Hiern* (in part); *S. laurifolius*, *Vahl* (*vide Kew Bull.*, No. 7, 1920, p. 250). Vern. names of last.

A tree somewhat resembling the last and considered by some to be merely a variety of the same species. The leaflets are, however, obliquely ovate-lanceolate or lanceolate or elliptic-oblong and *acuminate*, rarely only acute or obtuse, more shining above and glabrous or nearly glabrous beneath, sec. n. 8—10, not very distinct from the intermediate. Petals lanceolate equally woolly *all over the inside* except on the claw, scale 0 or minute. The fruit is velvety ferruginous and not glabrescent and is divided less than half-way down into upright drupels (I am not sure however that these are perfectly ripe).

Only occasionally planted in our area.

8. APHANIA, *Blume*.

Trees or shrubs with simple, 1-foliolate or pari-pinnate leaves and regular polygamous small flowers in terminal and axillary panicles. Sepals 4—5 widely imbricate. Petals 4—5, sometimes squamate, scale

2-fid. Stamens 6—8 neither unilateral nor declinate. Ovary entire or 2—3-lobed, 2—3-celled. Fruit of 1—3 oblong or ellipsoid drupels only united at the base. Seed with crustaceous or membranous testa, sometimes arillate, embryo with thick cotyledons.

1. **A. danura**, Radlk. Syn. *Scytalia Danura*, Roxb.; *Sapindus Danura*, F. B. I.; *Danura*, Beng.

A shrub in the form usually of a miniature tree about 10 ft. high or less with a crown of large oblanceolate or broadly lanceolate sub-sessile simple leaves with a broad sub-cordate or cordate base and terminal panicles 4—6" long of numerous small pedicelled pale pink flowers. Drupels 1—3, usually only 1 maturing ellipsoid .45—.5" with soft endocarp and one large seed.

Mals of Orissa, usually in glades in the forest! Fls. March. Fr. April. Stems slender. L. 6—13" by 1.75—4", long-acuminate glabrous tapering to the broad base, sec. n. 12—16 with shorter intermediate, tertiaries much reticulate, margin thickened. Petiole stout 4—5". Panicle with short spreading branches. Fls. not clustered. Sep. 5 unequal orbicular. Pet. 5 each with a short bifid woolly scale near the base. St. 6—8. Disc crenulate glabrous. Ovary 2—3-lobed. The fruit turns from orange through bright scarlet to black when quite ripe.

9. **HARPULLIA**, Roxb.

Trees with odd- or even-pinnate leaves and alternate leaflets. Fls. large (for the family), regular or sub-regular, polygamous or poly-diceous, in racemes and panicles. Sepals 4—5 imbricate in two series. Petals 4—5, oblanceolate or obovate, without scales. Stamens 5—8 hypogynous. Disc hardly any but torus raised under the ovary which is reduced to a villous pistillode in the male. Ovary tomentose 2 (rarely 3)-celled and -angled. Ovules 2 in each cell axile. Fruit a coriaceous inflated 2 (-3)-lobed and -celled loculicidal capsule. Seeds 1—2 in each cell horizontal ellipsoid or subglobose, more or less arillate. Albumen 0, embryo very large of 2 semi-spherical unequal cotyledons with radicle incumbent and directed towards the hilum in a fold of the testa. Germination hypogeal.

NOTE.—There appears to be no safe character in the twisting of the stigma. Mr. Hole in examining my specimen kindly pointed out that *Beddome* referring to *H. imbricata* says that the style is short or elongated and stigma sometimes not at all twisted, though both *Thwaites* and *Cooke* emphasise the importance of the style being 3—4 times as long as the ovary and the stigma oblong and spirally twisted. *Hiern* is perhaps correct in reducing *H. imbricata* to (a variety of) *H. cupanoides*, Roxb., but as I do not know the latter tree in the field I keep it distinct.

1. **H. imbricata**, *Thwaites*. Syn. *H. cupanoides*, F. B. I. (in part); *Phutika*, Or.

A tree up to about 4 ft. girth and of considerable height with long clear bole, stout closely lenticellate pubescent twigs and imparipinnate leaves but terminal lft. often rudimentary. Lfts. 8—13 mostly alternate ell. or ell-oblong acuminate with oblique base. Fls. large pale yellow in lax racemiform panicles 2.5—5" long extra-axillary and below the leaves on the old or new shoots. Fruit loculicidally dehiscent coriaceous scarlet inflated 1.7—2.5" diam. 2 (-3)-lobed and -celled.

Seeds ell.-oblong or ellipsoid with short thick funicle and a rudimentary aril.

Mals of Orissa, near streams, rare! Fls. April—May. Fr. July—Aug. Nearly evergreen, the new leaves appearing at the time of flowering while some of the old leaves are still on the tree.

Bark very light coloured. Blaze with chlorophyll, moderately hard, pale brown, white within. Hairs both simple and stellate. Shoots fulvous pubescent or tomentose. L. rhachis 8—16" pubescent, lfts. 5—8" with smaller ones at base, pubescent on the nerves, sec. n. 8—11 looped and united within the margin. Petiolule 3—4". Fls. .75" diam. Sep. 5, free, .4" long, oblong or obovate with rounded tip, tomentose. Pet. 5 clawed, .8", oblanceolate with involute crisped margins, sparsely stellate-hairy. St. 5—6, hypogynous, .6", anthers oblong basifixed. Disc practically *nil*, but torus densely villous pubescent raised under the ovary. M. fls. with villous pistillode and rudimentary style. Ovary minute flattened 2 (-3) -celled villous, style minutely 2-fid with flattened lobes. Ovules 2 in each cell axile. Capsule 1.2—1.5" long, transversely oblong, with very shortly stipitate base, permanently tomentose at the base. Seed 1, rarely 2, in each cell, horizontal .6—8" (never sub-globose as described in *F.B.I.*), hilum basal. Testa smooth black shining. First leaf solitary 4-foliate.

A very ornamental tree in fruit, from the scarlet capsules.

10. DODONÆA, L.

Shrubs or small trees with alternate simple leaves and small polygamous or poly-dicæious flowers in lateral and terminal cymes. Sepals 2—5 imbricate or valvate. Petals 0. Disc 0 in male, small in herm. fls. Stamens 5—10 inserted on the outer side of the disc where present. Ovary 2—6-angled and -celled. Ovules 2, rarely 1 in each cell. Fruit membranous or coriaceous, septicidally 2—6-valved, valves winged. Seeds without arillus, subglobose or lenticular. Embryo normal.

1. *D. viscosa*, L. Mehndi, *Vern.*; Mohara, *Or.*

A light green resinous shrub attaining 10 ft. high with simple alt. oblanceolate glabrous sub-sessile leaves 1—3.5" long and short axillary and terminal cymes of green flowers. Fruit membranous 2—4-winged, septicidally 2—4-valved.

Cuttack and Puri, near the sea, possibly wild! Plentiful in the Bajaragarh reserve, Kalahandi, *Cooper*. Often cultivated.

Fls. Nov.—Feb. Fr. Oct.—Nov.

Sub-gregarious where wild. L. coriaceous shining as though varnished, tapering into a short petiole. Sec. n. many. Fls. regular, polygamous long-pedicelled. Sep. 4—5 spreading .1—12". Pet. 0. St. 8. Disc inconspicuous. Ovary 3—4-celled. Ovules 2 in each cell. Fruit .5" long. Seeds sub-globose, nearly black with a thickened funicle. Embryo spiral.

FAM. 50. SABIACEÆ.

Trees or shrubs, sometimes scandent, with alternate simple or pinnate exstipulate leaves. Fls. small, sometimes polygamous, with 5—3 sepals and petals or apparently only 3 petals with two others reduced to scales. Stamens as many as the petals and opposite to them but frequently only two fertile and the others variously modified, inserted on or at the base of the disc. Ovary superior free, usually surrounded at

the base by the usually small toothed or lobed disc, 2- rarely 3-celled, sometimes 2-lobed. Ovules 2 (rarely 1) in each cell, axile, horizontal or pendulous, superposed, epitropous. Style short or 0. Fruit drupaceous and 1-seeded or of 2-3 drupels. Albumen 0, cotyledons conduplicate with long often spiral hypocotyl.

Shrubs, often climbing, with 4-5 perfect stamens
Trees, with 3 stamens reduced to staminodes

1. *Sabia*.
2. *Meliosma*.

1. SABIA, Colebr.

Climbing or sarmentose shrubs; branches with the bud-scales persistent at their bases. L. simple entire, sec. n. short, soon branched, and venation very reticulate. Fls. small axillary solitary or paniced 2-bracteate. Bracts, sepals and stamens all opposite. Calyx 4-5-partite. Petals 4-5. Disc. annular, 4-5-lobed. St. inserted at the base of the disc. Carpels 2 (-3) slightly cohering, gibbous and usually drupaceous in fruit with sub-basal style. Styles as many as carpels slightly cohering. Ovules 2 in each carpel, collateral or superposed. Seed reniform, testa coriaceous, dotted. Embryo curved.

1. *S. paniculata*, Edgew.

Sarmentose shrub. Branchlets glabrous or young somewhat hairy. L. glabrous coriaceous 6-8" by 2-3" elliptic or ell.-oblong shining above. Panicles long hairy. Fls. yellowish. Petals oblong or ovate-oblong, .05-.07" (.08-12" f. *F. B. I.*) Drupels .3".

Ravines in the Sameshwar Hills (N. Champaran). Elev. 2000 ft. Fls. Jan.-Feb. Fr. Feb.-March. Evergreen.

Stems up to 1" diam. L. with rounded base, apex slightly tapering or not. Sec. n. about 4-5, soon branched and with shorter intermediate, venation slightly raised above when dry. Petiole rather stout, .6-1", often with transversely elongated lenticels at the base.

2. MELIOSMA, Blume.

Trees or shrubs with simple or odd-pinnate leaves or sometimes even-pinnate, sometimes serrate or only serrate when young. Fls. 2-sexual paniced with small bracteoles which pass into the sepals and are persistent with them. Petals 5, with the two innermost more or less ligulate, often 2-fid and scale-like, the outer very concave and imbricate. Stamens with the three opposite to the outer petals reduced to staminodes, inner two more or less adnate at base to the inner petals. Fruit a small obliquely globose drupe, 1-seeded.

1. *M. simplicifolia*, Walp. Syn. *Millingtonia simplicifolia*, Roxb.; Churri, Nep.

A small tree with large simple oblanceolate entire shining leaves 6-12" by 1.75-4.5" and rusty pubescent panicles as long as the leaves of small yellowish-white flowers. Drupe small keeled, .17"-2" diam.

Bettiah and Sameshwar Hills, along watercourses! Deep ravines with a perennial water supply in the Saranda forests of Singbhum, especially above 1000 ft. elev. Fls. Dec.-March. Fr. March-June. Evergreen.

Twigs with prominent lenticels, puberulous. L. glabrescent and shining both sides, sometimes obovate, acuminate, base tapering into a slender pubescent petiole 1—1.5" long which is thickened at the base. Sec. n. 12—16 prominent oblique curving up inside the margin. Fls. minute sessile. Sep. 3—4 larger and 2 (bracteoles?) smaller, ciliate. Pet. 3, outer large orbicular concave, the two inner bifid scale-like.

Gamble says that the wood is reddish and moderately hard with a pretty silver grain but warps. Wt. about 33 lb.

FAM. 51. ANACARDIACEÆ.

Trees or shrubs with resin canals in the twigs and pericarp and usually with acrid resinous sometimes milky juice. Leaves alternate, rarely opposite, simple to odd-pinnate, often of hard texture, exstipulate, venation normally of rather numerous and strong sec. n. meeting by loops or reticulations in the margin. Fls. small regular (or sub-irregular in andrœcium and gynœceum) 2-sexual or dioecious or polygamous, often paniced. Calyx sometimes sub-perigynous, 3—5-sepalous usually from a shallow hypanthium lined with a disc free at its margins. Corolla 3—5-petalous, imbricate or sub-valvate. Stamens diplostemonous or reduced in number, rarely only one fertile, inserted under the margin of the disc or on it. Ovary superior or half-inferior of 1 or 3—6 free or more or less connate carpels forming a 1- or 3—5-celled ovary. Ovule 1 only or 1 in each carpel, pendulous, anatropous, pendulous from an ascending basal funicle or lateral or sub-apical, rarely axile, raphe dorsal (turned to the outside of the carpel). Fruit a 1—5-celled, usually a 1-celled and 1-seeded drupe which is often oblique. Endocarp sometimes ultimately dehiscent, albumen 0 or scanty. Embryo large and fleshy, often curved. Germination usually hypogeal, sometimes epigeal.

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|---|------------------------|
| A. Carpel one. St. 10—5, only 1—4 fertile. Leaves simple. | |
| Large trees. Fruit a succulent drupe (Mango) | 1. <i>Mangifera</i> . |
| Small tree. Fruit dry on a succulent hypocarp | 2. <i>Anacardium</i> . |
| B. Carpels 4—6 but only 1 fertile, all free. | |
| Trees. Leaves simple. Frt. 2 small drupe | 3. <i>Buchanania</i> . |
| C. Carpels 3 united into a 1-celled 1-ovuled ovary. | |
| 1. L. simple. Ovule pendulous from near top of ovary. | |
| Fls. 4-merous. Fruit not sunk in a fleshy cup | 4. <i>Nothopegia</i> . |
| Fls. 5-merous. Fruit sunk in a fleshy cup | 5. <i>Semecarpus</i> . |
| 2. L. usually 3-more foliolate. Ovule on a basal funicle | 6. <i>Rhus</i> . |
| D. Carpels 4—5 united into a 1—5-celled ovary. Styles 4—5. | |
| Ovules from top of cell. Leaves pinnate. | |
| Only 1 cell and seed developing. Fls. in simple or branched racemes. Drupe small compressed | 7. <i>Odina</i> . |
| Several cells with their seed developing. Fls. in erect panicles. Drupe large, ellipsoid | 8. <i>Spondias</i> . |

1. MANGIFERA, L. Mango.

Trees with small polygamous flowers on articulate pedicels in terminal panicles. Sepals and petals small spreading. Stamens only 1—2 usually perfect, inserted on the inner side of the tumid lobed disc, staminodes often minute. Ovary sessile 1-celled oblique with infra-terminal style and one ovule pendulous from a sub-basal funicle. Drupe large with fleshy and fibrous mesocarp. Germination hypogeal.

1. **M. indica**, L. Uli, K.; Ul, S. (the fruit, amsi); Am, H.; Ambo, Or.

This, the common mango, is very similar to the cultivated one but is a fine large tree attaining 70 ft. and up to 8 ft. girth or more. The fruit is 3—4" long with a very large stone, thin epicarp and very abundant pleasant juice but little flesh in the mesocarp.

There is no doubt that it is indigenous over a great part of the province as well as cultivated everywhere except by some of the aboriginal races. It still occurs wild in the ravines of the Sameshwar Hills and along rocky valleys and banks of streams in the deepest jungles of Chota Nagpur and Orissa, also apparently in the Santal Parganas and on the higher mountains.

Fls. Jan.—March. Fr. May—June. Evergreen, new leaves mostly in June.

The wood is chiefly employed for the manufacture of indigo and opium chests, and for packing cases. The wild mango is an important article of food to the aboriginal tribes, especially in times of famine. Large baskets of it are collected, it is boiled and the liquid drunk and the kernels after being steamed are also eaten. These however contain some 10 per cent. of tannic acid and they are indeed sometimes used on this account in cases of diarrhoea, so that they must be very unwholesome!

The tree is easily grown from seed, best sown *in situ* as soon as ripe. On germination the endocarp splits into two valves. It does not thrive in very dry localities, and is sometimes partly deciduous in such places where not protected by neighbouring trees.

2. **ANACARDIUM**, Rottb.

1. **A. occidentale**, L. Hijali-badam, Beng.; Kaju, H.; Lanka-Ambo, Bajan, Or.; Balia (Sambalpur). The Cashew-nut.

A small crooked tree often branched along the ground with simple alternate coriaceous obovate leaves 3—7" long and terminal and upper-axillary pubescent panicles much longer than the leaves, of pink somewhat irregular flowers 3—4" long. After flowering the top of the pedicel and torus enlarge into a clavate and ultimately pyriform fleshy body 2—3" long on which is seated the kidney-shaped nut 8—1" long.

Very commonly planted in Orissa near the coast, and running wild in some parts of the Mahanadi delta! Introduced from America. Fls. March—April. Fr. April—May.

Bark rough. L. with rounded or emarginate apex. Panicles and its branches long-peduncled with numerous lanceolate or ovate bracts .25" long. Fls. polygamous. Pedicels very short. Sep. 5 nearly free ovate or lanceolate .17". Pet. 5 linear subequal (2 posterior rather shorter) .32—4" recurved. St. 1, far exsert, 7—8 others included, inserted on the short disk. Ovary obovoid nearly regular, style as long as the long stamen somewhat curved, stout with small capitate stigma, ovule 1 pendulous from a lateral funicle near the top of the ovary, anatropous, upcurved.

I can find no justification for stating that the large "hypocarp" is formed of either the accrescent "disc" (*F.B.I.*, etc.) or the enlarged calyx-base (*Brandis*) in addition to the torus. Indeed it is open to question whether there is a disc, the stamen being merely connate into a short tube at the base easily detachable from the torus and slightly adnate to the base of the petals.

The tree grows well in pure sand and is being used in the Casuarina plantations at Puri. The hypocarp and the seed are eaten. The former is very astringent unless perfectly ripe, when it is very pleasant. The seeds are usually roasted. The pericarp of the fruit is full of oil glands which contain the same active principles as are found in *Semecarpus anacardium* (*q. v.*). The kernels when pressed yield a light yellow bland oil which is nutritious and emollient. Gamble

says that the growth shows about 8—11 rings per inch of radius; the wood is reddish-brown, moderately hard, and can be used for packing-cases and for charcoal. Wt. 30—38 lb. In the Andamans the oil from the pericarp is used to colour and preserve fishing-lines.

3. BUCHANANIA, Roxb.

Trees with alternate petioled simple entire leaves and small white 2-sexual flowers in dense axillary and terminal panicles. Calyx 3—5-toothed or -lobed, imbricate, persistent. Petals 4—5. Disc swollen 5-lobed. Stamens 8 or 10 inserted at the base of the disc. Carpels 5—6 of which only one is perfect, style short, stigma truncate. Ovule 1 pendulous from a basal funicle. Fruit a drupe with crustaceous or bony 2-valved endocarp. Seed gibbous, acute at one end with thick cotyledons.

1. **B. latifolia**, Roxb. Tarub, K.; Tarop, S.; Piar, Piar, Kharw., H.; Char, Achar, Khond.

A small straight tree with rough bark, stiff entire strongly nerved oblong or ovate-oblong leaves 6—10" long and dense pyramidal panicles of white flowers 2—2.5" diam. Drupes globose black .5" diam.

Northern area rather scarce. Champaran! Bhagalpur! Central and Southern areas very common, especially in the hilly tracts and towards the west.

Fls. Jan.—March. Fr. April—May. Nearly evergreen but sometimes leafless in April or May in dry years. New leaves in June.

Bark dark grey or black with oblong lumps. Innovations pubescent or villous. L. pubescent beneath rounded at the tip, nervation very similar to that of *Semecarpus* but without the grey or white felt between the nervules. Petiole .25—3", stout pubescent. Panicles densely pubescent. Sepals 5 nearly free. Petals triangular or oblong. Stamens erect as long as the spreading petals. Carpels hairy.

The wood is not much used but the fruit is largely eaten. The flesh is very palatable and the kernels, somewhat like Pistachio nuts, are used in sweetmeats. "They fetch Re. 1/- per seer in the Calcutta market from some of the Orissa States" (Cooper).

4. NOTHOPEGIA, Blume.

Small trees with alternate or opposite petioled entire leaves and small bracteate white or greenish polygamous flowers in short axillary racemes. Calyx 4—5-lobed persistent. Petals 4—5 spreading imbricate. Stamens 4—5 alternate with petals inserted on or under the margin of an annular 4—5-lobed disc, filaments free hairy. Ovary free sessile ovoid 1-celled with very short curved style and capitellate stigma. Ovule 1 pendulous, from a thick funicle from near the top of the ovary on the side to which the style is inclined. Drupe sub-baccate, somewhat oblique, pericarp often with large glands. Cotyledons thick, albumen fleshy.

1. **N. Heyneana**, Gamble. Syn. *N. Colebrookiana*, Blume, var. *Heyneana*, J. D. H.

A small tree with rusty hairy twigs and densely ferruginous buds, alternate narrowly oblong acuminate leaves 3—6.5", whitish beneath, with 15—20 raised sec. n. meeting the marginal one, minutely reticulate between. Fls. 4-merous small greenish in very short rusty racemes

or sub-solitary. Fr. 1-seeded, 2" diam., globosely obovoid, red, somewhat oblique, vertically striate when dry. Seed transversely oblong.

Mals of Puri, rare! Top of Mailgiri, 4000 ft., *Cooper!* Fls. March—April. Fr. April—May. Evergreen, new shoots April—May.

Bark smooth, blaze deep red. L. with lanceolate base, margins sometimes wavy. Petiole slender 3—5". Racemes 2" or less, pedicels swollen, longer than the subulate bracts. Calyx lobes 4 nearly free, ovate, spreading, rusty pubescent. Petals free small, erect, lanceolate-ovate or oblong, 15" long with recurved obtuse tip somewhat hairy. Stamens 4, filaments very short and shortly hairy. Pericarp with large glands. Seed laterally attached by a short thick funicle.

The fruit is baccate in my specimens but possibly becomes drupaceous and blue when quite ripe. The racemes are shorter and the leaves far longer than as described by *Gamble*.

5. SEMECARPUS, *L. f.*

Trees with alternate simple entire coriaceous leaves and small polygamous or dioecious flowers in terminal rarely axillary panicles. Calyx with deciduous sepals on a cupular or shallow hypanthium. Petals 5—6 imbricate. Disc broad annular. Stamens 5—6 inserted at the base of the annular disc. Ovary 1-celled with 3 styles. Ovule pendulous from a sub-apical lateral funicle. Drupe firm or fleshy, oblong or sub-globose, oblique, seated on the fleshy accrescent cupular hypanthium, pericarp full of acrid resin-glands. Seed pendulous with coriaceous testa and somewhat fleshy inner coat. Embryo with thick plano-convex cotyledons, radicle superior.

1. *S. anacardium*, *L.* Soso, *K.*, *S.*; Bhelwa, *H.*, *Kharw.*; Bhela, *Beng.*; Balia, *Or.* The Marking-nut tree.

A small tree with large simple oblong or usually obovate strongly-nerved leaves 8—18" long clustered at the ends of the branches, and smallish sub-sessile fasciculate dull greenish-yellow flowers 25" diam. on the branches of a stout pubescent panicle as long as or exceeding the leaves. Fruit an oblong or obliquely ovoid drupe 1" long, finally black, seated in the orange cup.

Throughout the whole area, chiefly in the hilly districts, from the Sameswar hills southwards. Fls. June—Sept. Fr.: I have notes of it ripe and dropping Nov.—Dec. but also notes of it up to March (perhaps a different flowering). The tree is deciduous March—May.

Branchlets stout, young pubescent or tomentose. L. hairy on the nerves beneath and grey between them with a close-felted layer of microscopic papillæ, apex rounded, sec. n. 16—25, reticulate within the thickened margin. Petiole 1—2". Petals oblong exceeding the small sepals. Ovary tomentose.

The wood is not used as the black caustic juice which exudes from the bark when felled causes blisters to the axe-men. Indeed "it is said to affect one even to walk under the tree, giving swollen eyes" (*Cooper*).

The pericarp abounds in black oily acrid juice which is used for marking cotton fabrics and, with lime as a mordant, is indelible. It contains anacardic acid and cardol and is strongly escharotic and vesicant. The *Sanskrit Materia Medica* and *Indian Plants and Drugs* give various prescriptions but it is not always clear whether the pericarp or seed is intended; thus "the ripe fruits are used internally and are considered digestive, nervine and useful in dyspepsia, piles, skin-diseases and nervous debility." The pericarp also gives one of the active principles in the preparation used by mahouts in "chobing" elephants' feet.

The orange cup is eaten when quite ripe but is a little astringent to the taste. The tree coppices readily from the side of the stool which is soon coloured black.

6. RHUS, L.

Trees or shrubs with alternate simple 3-foliolate or pinnate leaves with entire or serrate leaflets. Flowers small polygamous. Calyx, 4—6-partite with imbricate sepals. Petals 4—6 spreading. Disc cupular lobed. Stamens 10 or reduced in number, inserted at base of disc with subulate filaments. Ovary sessile usually ovoid or spherical with 3 styles and capitellate stigma. Ovule 1 pendulous from a basal funicle. Fruit a small drupe, sometimes compressed, with mesocarp full of resin cells and crustaceous or bony endocarp. Seed sometimes kidney-shaped with flat cotyledons and lateral up-curved radicle.

A large genus poorly represented in our area, often abounding in very acrid juice.

1. *R. semialata*, Murray. Bakiamela, Nep.

A small pretty tree with impari-pinnate pubescent leaves and 4—6 pairs of opposite sessile oblong or elliptic-oblong crenate or dentate strongly nerved lateral leaflets 2.5—6" long, smaller at the base of the often winged rhachis, and small white or yellow-green flowers .08" diam. in large terminal panicles nearly as long as the leaves. Drupe orbicular compressed, red and shining when ripe, .3" diam.

On the top of the Sameshwar Hills 2500 ft.! Fls. April—Sept. Fr. Dec. Deciduous, the leaves turn red before falling. It is a common tree in Nepal and Sikkim but usually above 3000 ft.

Bark rough. Blaze red exuding small drops of milky juice. Twigs, petioles and rhachis closely shortly pubescent. L. rhachis 9—18" narrowly margined or winged at least towards the end, leaflets shortly acuminate pubescent beneath and slightly so above, midrib tomentose, sec. n. 16—20, many bifurcate towards the tip, each nerve or bifurcation entering a tooth, base of terminal leaflet decurrent on the rhachis. Panicle with subsidiary smaller ones from the upper axils. Sep. ovate, obtuse, pubescent. Pet. larger oblong ciliate and with a ciliate ridge above. Disc cupular, 10-lobed.

The small acid drupes are eaten. Wood not used.

7. ODINA, Roxb. Syn. *Calesium*, Adans.

Trees, usually with thick twigs full of starch and 3—many-foliolate odd-pinnate leaves. Fls. small greenish dioecious or polygamo-dioecious clustered on the rhachis of simple or branched spikes or racemes (spici-form panicles), 4—more rarely also 5-merous. Sepals united into a short tube below. Petals longer, inserted with the diplostemonous stamens just under the margin of the 8—10-crenate or -lobed saucer-shaped disc. Male with deeply 4-lobed pistillode, female ovary 4—6-celled or -lobed or usually 1-celled, each lobe ending in a short stout style and simple papillose or capitellate stigma. Drupe often oblique. Ovule pendulous from near the top of each cell only one developing, or one only in 1-celled ovaries. Drupe often curved and oblique 1-celled (with *f. Engler*, sometimes 2—3 sterile cells, but I do not find this in our species).

1. *O. wodier*, Roxb. Nanam, K.; Doka, S.; Dhauuk, doka, Tanti; Jhingan, H.; Genjan, Kharw.; Jial, Kasmala, Beng.; Jhingna, Jian,

Th.; Mai, Mowai, *Khond* (or *Gond*?); Raji-mohi (Angul) and Mode (in the Orissa States, *f. Cooper*).

A small or large tree with pinnately 5—9-foliolate leaves clustered at the ends of the thick twigs, lfts. 2.5—5.5" paired, ovate acuminate with oblique base, lower smaller shortly petiolate, upper pairs sometimes sessile, terminal petiolate 1—2". Flowers small yellowish-green dioecious fasciated on the rachides of numerous racemes towards the ends of the bare twigs, males usually drooping longer and compound, females at first erect, fls. succeeded by curved oblong compressed drupes .5" long.

One of the commonest trees. Throughout the whole area from the Sameswar Hills and Purneah to the shores of the Chilka Lake and Kalahandi! Fls. March—April. Fr. April—June. One of the first trees to lose and one of the last to regain its leaves, being leafless Nov.—May but seedlings keep their leaves longer. It has chlorophyll under the outer bark.

Bark light-coloured and smooth in young trees, rough and dark in old ones with blaze bright crimson, streaked or flushed pale pink or white. Innovations with scattered stellate hairs or sometimes almost tomentose. Racemes never truly terminal and fruiting below the leaves, males 3—8", female 3—6" elongating in fruit. Sepals ovate ciliate. Petals .12" oblong acute, or longer and obtuse in female which has eight staminodes and a 4—6-lobed ovary. Drupe with a thin fleshy red epicarp and a large stone seated on the somewhat enlarged calyx .1" diam.

The timber of big trees although said to be strong and useful is hardly, if ever, used in the province but *Campbell* says that in Manbhūm it is suitable for bobbins. The pith and other tissues contain an abundance of starch which makes it good for elephant fodder and renders it easily grown from cuttings. It yields a gum in considerable quantity which is used in cloth-printing by weavers (*Brandis*) and in medicine. The bark is astringent and gives a coarse fibre. The fruit is largely eaten by birds. It coppices easily.

8. SPONDIAS, L.

Trees with alternate odd-pinnate leaves usually crowded at the ends of the branchlets and small or m. s. polygamous flowers in large terminal pyramidal panicles. Calyx and corolla 4—6-merous, sepals slightly imbricate, petals spreading sub-valvate. Stamens 8—10 inserted beneath the broad pulvinate lobulate disc. Ovary sessile 4—6-celled and -lobed above with 4—6 free or connivent styles. Ovule 1 pendulous in each cell. Fruit a large drupe with a 1—6-celled stone. Embryo with elongate cotyledons and superior radicle.

In germination the radicle grows out at the end of the stone which becomes spongy, the hypocotyl, which is very stout, pulls out the long linear cotyledons which become foliaceous. The first leaves are 3-foliolate with the leaflets (in our species) *denticulate*.

1. *S. mangifera*, Willd. Amar, *Ta.*; Ambo, *Ho.*; Amburu, *Mund.*; Amra, *S., H.*; Amara, *Kharw.*; Ambra, *Beng.*; Katambolam, *Mal. P.*; Ambada, *Or.* Hog Plum.

A large or m. s. tree with stout branchlets and sweet mango-smelling leaves with 4—6 prs. of strong-nerved leaflets 2—9" long by 1—4" broad. Fls. white .25—.35" diam. sessile in small cymes on the branches of a large panicle 1—2 ft. long when the tree is leafless. These are succeeded by large yellowish plum-like drupes 1.5" long, ellipsoid.

Throughout the whole area, especially near rivers, wild, and often planted near villages. Fls. Feb.—March. Fr. ripens in the following January when the tree is again bare of leaves, which it renews May—June.

Easily recognised by its mango like smell. Bark smooth white very thick and soft, blaze pink or light-red with narrow zones of lighter pink. Lfts. oblong acuminate with 10—30 horizontal sec. n. joined by a strong intramarginal one, petiolules short. Calyx salver-shaped with 5—6 ovate acute lobes. Petals ovate-oblong. Filaments short subulate. Carpels 4—6 free above united below into a 4—6-celled ovary, each lobe with a very short style. Drupe with a hard somewhat fibrous and slightly grooved 2—6-celled stone, usually 1—3-seeded, the other cells abortive.

It is not much used but the fruit is generally eaten as a condiment and made into chutney. Raw it is very astringent but occasionally palatable just as it ripens; it is greedily eaten by deer and other animals. "The pulp is useful in bilious dyspepsia and the leaves and bark in dysentery. The gum is demulcent" (*Nadkarni*).