

oblong; petals nearly entire. Drupe the size of a pea, slightly 2-4-lobed.

A small undershrub, common in pastures in the Doons and the sub-Himalayan tract, from the Jumna to Assam, ascending to 3000 ft., with a short, thick, woody stem underground, throwing up annually a number of herbaceous shoots, seldom more than a few ft. high. These, after bearing leaves, flowers, and fruit, are generally burnt down by the jungle-fires of the hot season. The fruit is small, but palatable.

10. *G. lævigata*, Vahl; W. & A. Prodr. 77.—Syn. *G. didyma*, Roxb. Fl. Ind. ii. 591. Vern. *Kat bhewal*, *bhimul*, N.W.P.; *Kakki*, Oudh.

Nearly glabrous, extremities and young leaves pubescent with scattered stellate hairs. Leaves bifarious, on short petioles, ovate-lanceolate, long-acuminate, serrate, base acute, 3-6 in. long, penniveined, the lowest pair of nerves from the base; transverse nerves not prominent. Stipules caducous. Peduncles axillary, 2-3 together, slender, nearly an inch long, each bearing 3 yellowish flowers on shorter bracteate pedicels. Buds oblong, ribbed. Sepals linear, $\frac{1}{2}$ inch long or more, pilose. Petals oblong, entire, obtuse, less than $\frac{1}{2}$ the length of sepals. Drupe glabrous, consisting of 2, rarely 3, distinct lobes, each lobe containing one or two 1-celled nuts. Specimens in leaf only may be distinguished by the nearly glabrous long-acuminate leaves with acute base; transverse veins not prominent.

Outer Himalaya, as far as the Jumna, ascending to 3000 ft. Plentiful in the Gonda and Baraith divisions of the Oudh forests. Bengal, Behar, and Central Provinces. Leaves are shed and renewed in April. Fl. June-Sept. A small tree, 20 ft. high, 2 ft. girth, with a short, erect trunk, and a smooth, greenish, cinereous bark. Wood white, even, close-grained, elastic; no distinct heartwood. Twigs and leaves lopped for cattle-fodder in the N.W. Provinces.

G. sepiaria, Roxb. l. c. 589, is nearly allied to this sp., but has solitary peduncles, employed to make hedges in Bengal.

11. *G. polygama*, Roxb. Fl. Ind. ii. 588.—Syn. *G. helicterifolia*, Wall.

Extremities grey-tomentose, branchlets pubescent. Leaves bifarious, on short petioles, lanceolate, 2-3 in. long, sharp-serrate, penniveined, the lowest pair of nerves from the base, glabrescent above, white or grey-velvety beneath. Stipules subulate, longer than petioles. Flowers polygamous, mostly unisexual. Peduncles slender, axillary, 1-5 together, much longer than petiole, $\frac{1}{2}$ -1 in. long, pedicels 2-4, shorter than peduncle. Petals half the length of sepals. Male flowers: stamens about 20, inserted on an elevated torus. Female flowers: anthers effete, on short filaments; stigma large, stellate. Drupe $\frac{1}{2}$ in. diam., indistinctly 4-lobed, shining, with a few scattered hairs. Stones 4, 1-seeded.

Outer Himalaya, from the Chenab to Assam, ascending to 4000 ft. Salt range, Panjab. Behar, the Konkan, Burma, Ceylon. North Australia. A shrub or small tree, with a short trunk, bifarious spreading branches, and a small rounded crown. Fl. July-Aug.; fruit ripe, Nov. Dec.

12. *G. salvifolia*, Heyne; W. & A. Prodr. 77.—Syn. *G. bicolor*, Juss. Vern. *Bather*, *nikki-bekkar*, *gargas*, Pb.

Extremities and under side of leaves covered with short white or grey hoary pubescence. Leaves lanceolate, 2-3 in. long, margin entire undulate or serrulate, 3 basal nerves, and 2 or 3 lateral nerves on either side of midrib; transverse veins indistinct; petioles $\frac{1}{4}$ in. long. Stipules linear, longer than petiole, with a distinct nerve. Peduncles axillary, 1, 2, or 3, longer than petiole, 2-3-flowered; pedicels as long as, or longer than peduncles. Flowers conspicuous, of a fine yellow; petals obovate, bifid, half the length of sepals. Drupes of 1-2 more or less distinct subglobose lobes.

Panjab, cis- and trans-Indus (ascends in the Salt range to 3000 ft.), Sindh, Central Provinces, and the Peninsula. A shrub or small tree 16-20 ft. high, with a short, straight stem, attaining a girth of 18-24 in. Bark light grey to reddish brown, or blackish, longitudinally rugose. Fl. Feb., March; fruit small, not succulent, subacid, eaten.

G. Rothii, DC.; W & A. Prodr. 78—syn. *G. salvifolia*, Roxb. l. c. 587—Coromandel and Bandelkhand, with broader, finely serrate leaves, and distinct transverse veins, is nearly allied to this, and perhaps not specifically different.

2. ELÆOCARPUS, Linn.

Flowers in axillary racemes, generally bisexual. Sepals 4 or 5. Petals as many as sepals, fringed or lobed, rarely entire, inserted round the base of the thick glandular torus; induplicate-valvate in bud. Stamens numerous, inserted on the torus between the glands; anthers linear, opening at the top in 2 confluent short slits. Ovary 2-5-celled; style one, subulate. Fruit a drupe with one kernel, 1- or 2-5-celled, one seed in each cell. Albumen fleshy; cotyledons flat, broad.

1. *E. Ganitrus*, Roxb. Fl. Ind. ii. 592; Wight Ic. t. 66.—Sans. *Rudrāksha*. Vern. *Rudrak*, *rudraksh*.

Leaves alternate, approximate near ends of branches, on petioles many times shorter than the leaf, ovate-lanceolate, indistinctly serrate, slightly silky when young, afterwards glabrous on both sides, about 6 in. long. Stipules minute, caducous. Racemes below the leaves, on two-year-old branchlets, unilateral, drooping; bracts deciduous; pedicels as long as flowers. Sepals 5, lanceolate, acute, silky. Petals 5, oblong, divided into numerous subulate segments. Filaments 25-40, short, inserted on the large convex disc. Ovary ovoid, villous, 5-lobed, 5-celled; style 5-grooved. Drupes globose, size of a large cherry, purple; nut globose, thick, very hard, 5-celled, surface elegantly tubercled, marked with 5 equidistant grooves, running from the apex to the base. Seed generally one in each cell. Cotyledons oblong, thin, 3-nerved.

Nepal, Assam, Western Ghats, and probably occurs in the southern forests of the Central Provinces. A large tree, flowers in the cold season, and ripens its fruit in autumn. The hard, tubercled nuts are polished, made into rosaries and bracelets, worn by Brahmins and Fakirs, and are frequently set in gold.

Another species, *E. serratus*, Roxb. l. c. 596, with bluntly serrate, ovate leaves, petioles $\frac{1}{2}$ or $\frac{1}{3}$ length of leaf, exterior anther-valve bearded, and a 3-

celled ovary, is said to have been found in Kamaon. The fruit (*Julpai*, Beng.), size and shape of an olive, is pickled; nut oblong, smooth, not tubercled.

Numerous species of this genus are in the forests of South India and Burma.

ORDER XV. MALPIGHIACEÆ.

Usually climbing shrubs with opposite simple leaves; exstipulate, or stipules inconspicuous. Flowers regular, bisexual, pentamerous, usually yellow, white, or red. Calyx deeply divided, usually with one or more sessile glands outside (eglandular in *Aspidopterys*). Petals free, clawed or sessile, toothed or entire. Stamens hypogynous, 10. Ovary free, 3-celled and 3-lobed; placentation axile; ovules solitary. Fruit-carpels 1-3, usually winged (samaroid). Seed exalbuminous.—Gen. Pl. i. 247; Royle III. 133; Wight III. i. 136.

Petals clawed, unequal; 1 stamen longer than the rest; style one; carpels winged at the end

1. HIPTAGE.

Petals sessile; all stamens equal; styles 3; carpels winged all round

2. ASPIDOPTERYS.

1. HIPTAGE, Gærtner.

Climbing shrubs, with opposite, coriaceous, entire leaves, without stipules. Calyx 5-parted, with a large oblong gland outside, adnate to pedicel and calyx. Petals 5, unequal, unguiculate, silky. Stamens 10, declinate, all antheriferous, one much longer than the rest. Ovary 3-lobed; style 1, filiform. Fruit of 1-3 samaras, connate at the base, and terminating in long wings.

1. *H. Madablota*, Gærtn.; W. & A. Prodr. 107.—Syn. *Gærtnera racemosa*, Roxb. Cor. pl. t. 18; Fl. Ind. ii. 368. Vern. *Kampti*, C.P.; *Mad multi*, *saita lagula*, N.W.P.; *Endra*, *chopar*, *benkar*, *khumb*, Pl. hills; *Chabuk chūri*, Pb. plains; *Holad-wail*, Mahratta.

A large climbing shrub. Leaves glabrous, elliptic or elliptic-oblong, acuminate, 4-6 in. long, on short, channelled petioles, penniveined, main lateral nerves arcuate, 4-6 on either side of midrib. Flowers showy, $\frac{3}{4}$ in. across, white and yellow, in large terminal panicles; pedicels articulate, with 2 subulate bracts in the middle. Carpels 3, wings oblanceolate, unequal, one about 2 in. long, the two others shorter.

Common in ravines and moist places in most parts of India. Often on Sāi trees. Sub-Himalayan tract to Indus, ascending to 3000 ft. Mt. Aboo, Burma. Ceylon. China. Fl. Jan.-March. Fr. May. Bark bitter.

2. ASPIDOPTERYS, A. Jussieu.

Climbing shrubs, with opposite, entire leaves, without stipules. Calyx 5-parted, without a gland. Petals 5, equal, not clawed. Stamens 10, equal, all antheriferous. Ovary 3-lobed; styles 3, short. Fruit of 3 samaras; the seed in the middle of a circular, oblong, or ovate membranous wing.

1. *A. lanuginosa*, A. Juss.—Syn. *Hiraa lanuginosa*, Wall. Pl. As. Rar. i. 13.

A large climber. Leaves cordate or ovate-cordate, long-acuminate, 4-6 in. long; petiole $\frac{3}{4}$ in. long. Under side of leaves, young shoots, and inflorescence clothed with soft, grey, silky tomentum. Flowers $\frac{1}{4}$ in. across. Ovaries tomentose, with long white hairs. Wings of fruit oval, $1\frac{1}{2}$ in. long.

Nepal, Kamaon (to 4000 ft.), Dehra Doon. Fl. June.

A. nutans, A. Juss.—Syn. *Hiraea nutans*, Roxb. Fl. Ind. ii. 447; W. & A. Prodr. 108, is similar, but has glabrous leaves and longer petioles. Bengal.

A. Roxburghiana, A. Juss.—syn. *Triopteris indica*, Roxb. Cor. pl. t. 160; *Hiraea indica*, Roxb. Fl. Ind. ii. 448, W. & A. Prodr. 108—has glabrous leaves, ovary with short hairs, and oblong fruit-wings. South India, Bengal, Nepal, Burma.

ORDER XVI. GERANIACEÆ.

Herbs or shrubs, rarely trees, with opposite or alternate leaves. Flowers bisexual. Sepals 5, rarely fewer, free or more or less connate. Petals as many as sepals or wanting, hypogynous or perigynous, imbricate or contorted. Stamens generally twice the number of petals; anthers versatile, 2-celled, without connective, the cells parallel, dehiscing longitudinally. Ovary of 3-5 carpels, 3-5-celled and -lobed, the carpels adnate to the axis below; ovules 1 or 2 in each cell, rarely numerous (as in *Averrhoa*). Fruit various; albumen scanty or none.—Gen. Pl. i. 269; Royle III. 152; Wight III. i. 160 (*Oxalidea*).

1. AVERRHOA, Linn.

Trees with alternate, imparipinnate leaves, without stipules. Flowers in cymose panicles, small, regular. Sepals 5, imbricate. Petals 5, hypogynous, contorted. Stamens 10, slightly connate at the base, 5 shorter, 5 longer. Ovary 5-lobed, 5-celled; styles distinct, with capitate stigmas; ovules numerous in each cell. Fruit oblong, fleshy, indehiscent. Seeds 2-5 in each cell, with or without arillus; embryo straight, with thin foliaceous cotyledons in a fleshy albumen.

Leaflets ovate, acuminate, 2-5 pair; fruit acutely angled; seeds arillate	1. <i>A. Carambola</i> .
Leaflets oblong, acuminate, 5-12 pair; fruit obtusely angled; seeds without arillus	2. <i>A. Bilimbi</i> .

1. *A. Carambola*, Linn.; Roxb. Fl. Ind. ii. 450; W. & A. Prodr. 141.—Sans. *Karmara*, *karma-ranga*. Vern. *Kamaranga*.

A tree, with close, thick-set, drooping branches; leaflets subopposite, pale beneath, glabrous or slightly pubescent, ovate, acuminate, 2-5 pair; petioles short, pubescent. Flowers small, variegated with white and purple, in panicles, generally axillary, sometimes from the old wood. Calyx glabrous. The 5 shorter stamens usually very minute, and wholly without anthers, or occasionally 1 or 2 of them longer, with small brown anthers. Fruit obovoid-oblong, 3 in. long, with acute angles, yellow. Funicle of seed dilated into a fleshy, bilabiate, irregularly-cut arillus.

Native country unknown, probably in the Indian Archipelago. Cultivated on account of its fruit for ages in tropical and subtropical India, as far north as

Lahore. Produces fruit at Hoshiarpur. Fl. H. and R.S. Fruit C.S. Two varieties cultivated in Bengal, one with acid, the other with sweet fruit. The leaves are sensitive.

2. *A. Bilimbi*, Linn.; Roxb. ii. 451; W. & A. 142; Bedd. Fl. Sylv. t. 117.—Vern. *Bilimbi*, *belambu*, *blimbu*, *anvalla*.

A small tree; leaflets subopposite, pubescent, oblong, acuminate, 3 in. long, 6-14 pair, on short pubescent petiolules. Flowers $\frac{1}{2}$ in. long, dark brownish purple, in panicles on the old wood of stem and branches. Calyx and branches of inflorescence with dense ferruginous pubescence. All stamens generally antheriferous. Fruit oblong, 2 in. long, with obtuse angles, yellow. Seeds without arillus.

Cultivated and run wild in tropical India. Native country unknown. Fl. H.S. Fr. R.S. Fruit acid, pickled or preserved with sugar.

ORDER XVII. RUTACEÆ.

Shrubs or trees, rarely herbs, generally aromatic, with alternate or more rarely opposite, compound or simple exstipulate leaves, dotted with translucent glands. Sepals 4-5, free or connate. Petals same number as sepals, hypogynous or perigynous. Stamens as many, or twice as many, as petals; anthers generally versatile, 2-celled. Disc annular, cylindrical or elongated, between stamens and ovary. Carpels 4-5, mostly connate. Seeds oblong or reniform, with or without albumen; embryo large; cotyledons fleshy or foliaceous.—Gen. Pl. i. 278; Royle III. 129, 157; Wight III. i. 104, 165 (*Aurantiaceæ*, *Zanthoxyloæ*).

Carpels more or less distinct; flowers unisexual 1. ZANTHOXYLUM.
Carpels connate; ovules 1-2 in each cell.

Petals imbricate; stamens 8-10.

Style deciduous; leaves imparipinnate.

Thorny shrubs; leaflets opposite; common petiole winged 2. LIMONIA.

Unarmed shrubs; leaflets alternate or subopposite; common petiole terete.

Stamens 10; filaments subulate; leaflets alternate 3. MURRAYA.

Stamens 8-10; filaments dilated; leaflets subopposite 4. CLAUSENA.

Style short, persistent; leaves 1-5 foliolate 5. GLYCOSMIA.

Petals valvate; stamens 4-5 6. SKIMMIA.

Carpels connate; ovules numerous.

Leaves simple; stamens 20-60 7. CITRUS.

Leaves imparipinnate; stamens 10-12 8. FERONIA.

Leaves trifoliate; stamens 30-60 9. ÆGLE.

Toddalia aculeata, Pers.; Wight III. t. 66; syn. *Scopolia aculeata*, Roxb. Fl. Ind. i. 616,—is a thorny scandent shrub, with 3-foliate leaves, and orange-coloured pungent berries, 5-grooved and 5-seeded. South India, Karnaon (*Kan*), found by Madden in Mairwara (*Dahan, lahan*).—As. Soc. Journ. xvii. pt. i. 404.

1. ZANTHOXYLUM, Linn.

Leaves alternate, imparipinnate. Flowers unisexual. Calyx 3-5-lobed, imbricate. Petals 3-5, or none. Male flowers: stamens 3-5, round a rudimentary ovary; anthers versatile. Female flowers: carpels 1-5, oblique, 1-celled, 2 ovules in each cell; styles lateral. Fruit-carpels distinct, 1-5, dry or drupaceous, 1-seeded, splitting in 2 valves. Seeds with a

filiform funicle, and black crustaceous testa, often covered by a thin fleshy epidermis; albumen fleshy, enclosing a straight or curved embryo, with round, flat, foliaceous cotyledons.

1. *Z. alatum*, Roxb. Fl. Ind. iii. 768.—Syn. *Z. hostile*, Wall. Vern. *Timbūr*, *timūr*, *simūr*, *timru*, *darmar*, *tirmal*, *tezmal*, *tezbāl*, *tiswal*.

Aculeate, with strong, smooth, nearly straight prickles on branches, petioles, and midrib of leaflets, the prickles on branches often surrounded at the base by a ring of cork; 2 prickles at the base of petiole in the place of stipules. Leaves alternate, imparipinnate; common petiole winged; leaflets opposite, mostly 2-4 pair, sessile, lanceolate, more or less indistinctly serrate, pellucid-punctate. Flowers small, yellow, on lateral panicles; peduncles and pedicels pubescent; bracts small. Calyx with 6-8 acute segments. Petals none. Filaments 6, 7, or 8, much longer than calyx. Fruit-carpels 1, 2, or 3, reniform or ovoid, on short stalks, reddish, of the size of a small pea when fresh.

Outer Himalaya, from the Indus to Bhutan, ascending to 6000 ft., Kasia hills. In the N.W. Himalaya chiefly in hot valleys. Fl. April-July; fruit ripens Aug.-October.

Usually a shrub, at times a small tree 20 ft. high, with a short, straight trunk 2 ft. girth, short, stiff, bushy branches, forming a small roundish thin head of dark-green foliage. Every part of the plant possesses a peculiar aromatic pungency. Bark of larger branches thin, dark brown, even, scabrous, with small white specks, that of the trunk cinereous and smooth. Wood whitish, close, even-grained, hard, heavy, strong, used for walking-sticks and clubs. Tooth-brushes are made of the branches. The aromatic pungent fruit is used as a remedy for toothache, and as a condiment; bruised, it is put into unwholesome water to make it good. The bark is used for intoxicating fish.

Z. oxyphyllum, Edgew. Trans. Linn. Soc. xx. 42, a straggling shrub, often climbing over tall forest-trees, has larger leaves; leaflets 6-8 pair, serrate; common petiole not winged; flowers in compact terminal panicles, shorter than leaf. Carpels red, $\frac{1}{2}$ in. diam., often 4 ripening. Garhwal. Kumaon. Nepal. Sikkim. Kasia. Shady forests, 6000-8000 ft.

Zanthoxylum Clava Herculis, Linn., the prickly yellow wood of Jamaica, is a large West Indian timber-tree with beautiful close-grained wood, used for furniture and inlaid-work.

2. LIMONIA, Linn.

Leaves alternate, imparipinnate or 3-foliolate; leaflets opposite. Flowers bisexual. Calyx 4- or 5-cleft. Petals 4 or 5, oblong, imbricate. Stamens 8 or 10, free; filaments subulate; anthers versatile. Ovary 4-5-celled, on an annular or elongated disc; style deciduous; ovules 1 or 2 in each cell. Fruit baccate, 1-4-celled; seeds 1-4, surrounded with mucilage; embryo straight; radicle short, conical; cotyledons fleshy, plano-convex; albumen none.

1. *L. acidissima*, Linn.; W. & A. Prodr. 92.—Syn. *L. crenulata*, Roxb. Cor. Pl. t. 81, Fl. Ind. ii. 381. Vern. *Beli*, North-West Prov.

Glabrous, armed with straight thorns $\frac{1}{2}$ inch to 1 inch long, mostly axillary. Leaves alternate, imparipinnate; common petiole broadly winged, foliaceous; leaflets commonly 5 to 9, sessile, ovate-lanceolate, like the wings of the petiole crenate and pellucid-punctate. Flowers white,

fragrant, in short axillary racemes, frequently bearing 1 or 2 leaves. Calyx 4-cleft. Petals 4, oblong, more than twice the length of calyx, pellucid-punctate. Stamens 8, nearly equal. Ovary oblong, obtuse, 4-celled; ovules 1 in each cell, pendulous; stigma capitate, obtuse. Berry globose, fleshy, black when ripe, less than $\frac{1}{2}$ inch diam.; seeds 1-4.

Outer Himalaya, from the Sutlej to Garhwal, ascending to 4000 ft. Assam, Bengal. South India. Hardy in England. Fl April, May.

A shrub 8 to 10 ft. high; in favourable conditions a small tree 16 to 18 ft., with a short trunk 18 in. girth, and a small, elegant oval head. Bark cinereous, rugose: wood yellow, very handsome, hard, close-grained, worthy of attention for the lathe; used for axles of oil-presses, rice-pounders; good fuel. Pulp of fruit flesh-coloured, exceedingly acid; an article of commerce in Malabar; considered protective against contagion, and an antidote to venomous poisons.

3. *MURRAYA*, Linn.

Unarmed shrubs or trees. Leaves alternate, imparipinnate, with alternate leaflets. Flowers bisexual. Calyx 5-cleft. Petals 5, free, imbricate. Stamens 10, free; alternate shorter, filaments subulate. Ovary on a more or less elongated disc, 2-5-celled, attenuated into the style, which is eventually deciduous; ovules 1 or 2 in each cell. Fruit a 1-2-seeded berry. Seeds without albumen; cotyledons plano-convex.

Nearly glabrous; leaflets usually 5-7 1. *M. exotica*.

Pubescent, leaflets usually 10-25 2. *M. Koenigii*.

1. *M. exotica*, L.; Roxb. Fl. Ind. ii. 374; W. & A. Prodr. 94; Wight Ic. t. 96.—Syn. *M. paniculata*, Jack; Dalz. & Gibs. Bombay Fl. 29. Vern. *Kamini*, Beng.; *Marchula*, *juti*, Kamaon.

A shrub or small tree, evergreen, with ash-coloured bark; glabrous, or young parts pubescent. Leaflets usually 5-7, shortly petiolulate, ovate or obovate, entire, frequently oblique at base, 1-2 in. long, thinly coriaceous and shining. Flowers white, fragrant, in short terminal and axillary corymbs. Petals linear or cuneate, many times longer than calyx. Ovary linear, 2-celled; style filiform; stigma capitate. Berries red, acuminate at both ends, 2-seeded. Varies with many-flowered corymbs, and with few, sometimes solitary flowers.

Outer Himalaya from the Jumna to Assam, ascending to 4500 ft., hilly parts of the Oudh forests, Behar, South India, and Burma. Wood close-grained, hard, white, has been used for wood-engraving. Cultivated in gardens throughout India. Fl. May-Sept. Fr. Oct.-Feb.

2. *M. Koenigii*, Sprengel.—Syn. *Bergera Koenigii*, Linn.; Roxb. Fl. Ind. ii. 375; Cor. Pl. t. 112; W. & A. Prodr. 94. Vern. *Gandila*, *gandela*, *gāndla*, *gāndī*, *gānt*, *gani*, *bowāla*, Pb., N.W.P.; *Harri*, *Kat-nām*, Oudh; *Barsanga*, Beng.

Pubescent. Leaflets 10-25, oblique at base, ovate-lanceolate, short-petiolulate, about 1 in. long. Flowers white, in terminal corymbose panicles. Calyx persistent; segments short, triangular. Petals oblong, dotted, 4-5 times longer than calyx. Anthers short, cordate. Ovary 2-celled; style short, cylindrical; stigma capitate, sulcate. Fruit ovoid, black when ripe, surface rugose; seeds embedded in mucilaginous fluid.

Outer Himalaya, from the Ravi to Assam, ascending to 4000, sometimes to 5000 ft.; Oudh, Gorakhpur, not common in the Central Provinces. Common in Bengal and South India. Leaves renewed in March and April; fl. from April onward; fruit ripens June-January. Fruit aromatic, astringent; pulp with a subacid white juice.

A small, elegant tree, 12-15 ft. high, with a short trunk to 18 in. girth, a round, close, shady crown, with bright green foliage. All parts of the plant have a peculiar, powerful, rather disagreeable, aromatic odour, whence most of the native names. Bark thin, purplish brown, smooth, partly reticulate, the old bark exfoliating in flat, nearly 4-sided, hard scales. Wood close-, even-grained, hard, durable, employed for agricultural implements. Cultivated for the sake of its leaves, which are used to flavour curries.

4. CLAUSENA, Burm.

Unarmed shrubs or trees, with alternate, imparipinnate leaves. Flowers bisexual. Calyx 4-5-toothed, or lobed. Petals 4-5, free, slightly imbricate. Stamens 8-10, free; filaments dilated. Ovary on a short raised torus, 2-5-celled; style at length deciduous; ovules 2 in each cell. Fruit a 1-5-celled and -seeded berry.

1. *C. pentaphylla*, DC.—Syn. *Amyris pentaphylla*, Roxb. Fl. Ind. ii. 247. Vern. *Rattanajote*, *surjumukha*, Khyrigarh; *Teyrür*, Gonda (Oudh).

A deciduous shrub, extremities silky tomentose; full-grown leaves pubescent. Leaflets 5-7, leaflets subopposite or alternate, ovate or ovate-lanceolate, acuminate, 4-6 in. long, short-petiolulate. Main lateral nerves prominent, numerous, anastomosing by conspicuous intramarginal veins. Flowers yellowish, in terminal, hairy cymose panicles. Berry ovoid, verrucose, pale orange, $\frac{1}{3}$ - $\frac{1}{2}$ in. long.

Sub-Himalayan tract, Kamaon, and Nepal. Säl forests of the Doons and of Oudh.—Fl. April, May. Fruit ripens Nov. The bruised leaves are highly aromatic.

5. GLYCOSMIS, Correa.

Unarmed shrubs or trees with imparipinnate or unifoliolate leaves. Flowers bisexual, small. Calyx 5-partite. Petals 5, free, imbricate. Stamens 10, free, alternately shorter. Ovary sessile, or on a very short stipe, with 5 (or fewer) cells; ovules solitary; style very short and thick, continuous with the ovary, persistent. Fruit 1- or few-seeded.

1. *G. pentaphylla*, DC.; W. & A. Prodr. 93.—Syn. *Limonia pentaphylla*, Roxb. Cor. Pl. t. 84; Fl. Ind. ii. 381. Vern. *Ban-nimbu* (wild lemon), *pilra potala*, N.W.P.; *Girgitti*, Oudh; *Kirmira*, Bomb.

A small, evergreen, erect shrub, wholly glabrous, exceedingly variable in its foliage. Leaves generally with 3-5 leaflets, often unifoliolate; lateral leaflets alternate or subopposite. Leaflets ovate-lanceolate, ovate or obovate, acuminate, 4-12 in. long, penninerved; main lateral nerves distinct, but not prominent, joined by inconspicuous intramarginal veins. Flowers white, fragrant, in erect terminal or lateral panicles. Berries subglobose, white, pink, or blue, somewhat compressed, $\frac{1}{2}$ in. across.

Common in South India, Ceylon, Burma, Bengal. Oudh forests, forming thick undergrowth in parts. The ripe fruit is eaten. Fl. spring, autumn, and nearly throughout the year.

6. *SKIMMIA*, Thunberg.

1. *S. Laureola*, Zuccarini.—Syn. *Limonia Laureola*, Wall. Pl. As. rar. t. 245; *Anquetilia Laureola*, Jacquem. Voy. Bot. t. 161. Vern. *Ner, barru*, Pb. *Nehar, gurl pata*, Kamaon.

A small, wholly glabrous, shrub; leaves alternate, lanceolate or oblanceolate, coriaceous, entire, often approximate near the ends of branches, midrib prominent, without conspicuous secondary nerves. Flowers white, in erect, compact, terminal panicles. Drupes subglobose, $\frac{1}{2}$ in. across.

Himalaya, Indus to Bhutan, alt. 5000-11,000 ft. Afghanistan. Fl. April, May. Fruit Oct. The leaves have an orange-like smell when crushed.

7. *CITRUS*, Linn.

Evergreen shrubs or trees, armed with axillary thorns; wood close and even-grained. Leaves alternate, simple (unifoliate), glandular-dotted, coriaceous; petiole often winged. Flowers white, or tinged with red, sweet-scented. Calyx cup-shaped, 4-5 cleft. Petals 4-5, rarely more, thick, with glandular dots, imbricate in bud. Stamens 20-60; filaments flat, more or less connate in bundles; anthers oblong. Ovary many-celled, on a large annular or cup-shaped disc; style terete, deciduous, with a capitate, lobed stigma; ovules axile, biseriate, 4-8 in each cell. Fruit globose or oblong, succulent, indehiscent, divided into 9-15 cells by membranous dissepiments, the cells with numerous transverse vesicles, filled with sweet or more or less acid juice; the rind full of vesicles or glands, filled with aromatic essential oil. Seeds few in each cell; testa leathery; albumen none; embryo straight, with a short radicle, and thick, fleshy, oily cotyledons. Often 2 or 3 embryos in one seed.

Young shoots and leaves perfectly glabrous; transverse vesicles of pulp concrete.

Young shoots purple; petals generally tinged with red; flowers often unisexual; stamens 20-40; fruit globose, ovoid or oblong, often terminated by a knob

1. *C. medica*.

Young shoots whitish; petals white; flowers bisexual; stamens 20-30; fruit globose or flattened; pulp sweet, acid, or bitter

2. *C. Aurantium*.

Young shoots and under side of leaves pubescent; transverse vesicles of pulp distinct

3. *C. decumana*.

C. japonica, Thunberg, the *Kumquat*, with small globose fruit and lanceolate leaves, as well as the other Chinese and Japanese species and forms, cannot be noticed here.

To this genus belong the *Citron*, *Lesson*, the sweet and acid *Lime*, the sweet and bitter *Orange*, the *Bergamot*, and the *Shaddock*, most of which are cultivated in India, and some of which are found wild in the forests of the outer Himalayan valleys, in Sikkim, Kamaon, and Garhwal, in the Kasia hills, the Western Ghats, on the Pachmarhis in the Satpura range, and in Burma. The great multitude of forms of this widely cultivated genus has probably arisen from two or three distinct species, and the study of the wild forms of Oranges and Limes in India may throw some light upon the origin and history of the cultivated kinds. At present it seems most convenient to class the wild and cultivated forms under the three species defined above; but further researches

may eventually alter the number of species, and modify their limits and characters. These researches should, however, comprise not only the apparently indigenous forms, and those cultivated in Europe and India, but equally the large variety of Oranges cultivated in China, Japan, and Polynesia.

A few introductory remarks regarding the classification of this genus may not be out of place. Linnæus established two species, *C. medica*, with linear petioles, comprising the Lime, Lemon, and Citron; *C. Aurantium*, with winged petioles, comprising the sweet and bitter Orange and the Shaddock. From these Willdenow separated the Shaddock, *C. decumana*; and Roxburgh, Fl. Ind. iii. 390, added *C. acida*, under which name he described the acid Lemons and Limes, and the sweet Limes of India with winged petiole, which therefore could not be classed under *C. medica* of Linnæus. *C. inermis*, the small unarmed Orange of China, he added as a separate species. About the time that Roxburgh wrote his 'Flora Indica,' the history and classification of the cultivated Oranges was the subject of careful researches by two botanists in the south of Europe. Georges Galesio, Sous Préfet of Savona, published in 1811 a small octavo volume (Traité du Citrus) containing the results of most valuable studies and observations made by him in the district of Finale, between Nice and Genoa, on the Riviera di Ponente. Galesio establishes 4 species (*Citron*, *Lemon*, *sweet* and *bitter Orange*), to which he refers, either as varieties or as hybrids, all forms known to him. A few years later—in 1813—A. Risso, Professor of Natural Sciences at the Lyceum of Nice, published in the 20th volume of the 'Annales du Muséum d'Histoire Naturelle,' his "Mémoire sur l'histoire naturelle des Orangers, cultivés dans le Département des Alpes Maritimes." His classification agrees in the main with that of Galesio, but he adds the *sweet Lime* (*C. Limetta*) as a 5th species; and in a subsequent work which appeared in 1819, with magnificent illustrations (Risso et Poiteau Histoire Naturelle des Orangers), 8 types or races are described: 1. *C. Aurantium*, the sweet Orange; 2. *C. Bigaradia*, the bitter Orange; 3. *C. Bergamia*, the Bergamot; 4. *C. Limetta*, the sweet Lime (with white flowers); 5. *C. decumana*, the Shaddock; 6. *C. Lumia*, the sweet Lemon (flowers tinged with red); 7. *C. Limonum*, the Lemon; and 8. *C. medica*, the Citron. This classification has been adopted in many standard works. A. Dcéandolle, however, in his 'Géographie Botanique raisonnée' (1855), 871, expresses his opinion that the principal forms may be reduced to 3 species, *C. medica*, *C. Limonum*, and *C. Aurantium*, with the addition, as a doubtful species, of the Shaddock. This arrangement is carried out in Lowe, 'Flora of Madeira' (1868), 71; but he adds *C. nobilis*, Lour., comprising the sweet Oranges with loose skin (the Tangerine and Mandarin Orange), as a separate species. Grisebach, in his 'West Indian Flora' (1864), 122, reverts to the three original species, *C. medica*, *Aurantium*, and *decumana*; and this is the arrangement which I have here adopted, with some modification of the specific characters. I desire, however, to state at the outset, that the characters here set forth do not hold good in the case of all cultivated kinds classed under these three species. Some of the intermediate forms may be hybrids; and besides, it is more than probable that we have not yet arrived at the correct classification of this genus. The present arrangement, however, seems the most convenient to guide and facilitate further researches in India on this interesting subject.

1. *C. medica*, Linn. The *Citron*, *Lemon*, *sweet* and *acid Lime*. Comprises *C. medica*, *Limonum*, and *Lumia* of Risso and Poiteau.

Shrubs, sometimes trees, generally bearing flowers and fruit at all, or at most, seasons of the year. Young shoots glabrous, purple. Leaves glabrous, 3-6 in. long, oblong elliptic ovate or ovate-lanceolate; petioles naked or winged. Flowers white, generally tinged with red, small or middle-sized, often unisexual; stamens 20-40. Fruit ovoid, oblong or globose,

usually yellow when ripe, skin thick or thin, with or without a knob, surface even or rough.

Wild in Burma; Chittagong (Hooker), "Sitakund hill;" Kasia (Hooker and Thomson), "foot of hills, ascending to 4000 ft.;" Sikkim (Hooker and Thomson), "hot valleys, ascending to 4000 ft., fruit like a lemon, but narrow-peaked, 2 lb. weight." Common in the Doons between Sardah and Jumna; Pachmarhi hills, in deep ravines, and here and there on the Western Ghats. The specimens of the wild Limes and Citrons in India which I have had an opportunity of examining, have oblong oblong-elliptic or oblong-obovate leaves, 3-5 in. long, edge crenate or blunt-serrate; petioles short, thick, unwinged, or longer, and narrow-winged; flowers in racemes of 5-20, often unisexual; number of stamens varying, generally between 20 and 30, sometimes more than 30. Fruit often knobbed. Royle, Ill. 129, mentions two forms found by him, apparently wild, in the Doons of the N.W. Himalaya: one called *Bijouri*, with the characteristics of the Citron; the other called *Behari-Nimbu*, or *Pahari Kagūzi*, with those of the Lemon,—and which retain their difference under cultivation. Madden also, in his paper on the Terai and outer mountains of Kamaon, mentions "two species of Citrus, probably *Limonium* and *medica*, *Janūr* and *Bijaura*."—Journ. As. Soc. xvii., pt. i. 391. Certainly there are different forms among the specimens collected by Royle, by Dr Stewart, myself, and others, in the N.W. Himalaya; but they require further investigation on the spot: and for the present it seems more convenient to unite them all under *C. medica*.

Under this species may be classed the following cultivated kinds:—

a. THE CITRON. *Cédrotier*, French; *Cedro*, Ital.; *Vijapūra*, Sans.; *Utrej*, *otrej*, Arab.; *Bejaura*, Hind.; *Begpura*, Beng. (*Karanphal*, Kamaon.) Leaves oblong; petiole short, naked or marginate; fruit large, oblong or obovoid, generally terminating in a blunt-pointed beak, or irregularly shaped; surface warty, rarely even; rind thick, very aromatic, tender; pulp scanty, subacid. Cultivated in many parts of India—Assam, Calcutta, Chota Nagpore, North-West India, Bombay; also in Persia. The Chinese place the fragrant fruit on dishes to perfume the air. Madeira and the south of Europe export candied Citron, the thick fragrant rind preserved in sugar. Lowe (Flora of Madeira) retains the Citron as a distinct species, characterised by oblong leaves, short unwinged petioles, and numerous flowers in a cluster. Mr Lowe's classification is based on long-continued study of the plants cultivated in Madeira, and it is not impossible that it may eventually be found to be correct in this respect.

b. THE LEMON. *Limoniér*, more generally *Citronnier*, French; *Limone*, Ital.; *Citrone*, German; *Bara nimbu*, Hind.; *Korna Nebu*, Beng. Leaves ovate; petioles marginate or winged; fruit middle-sized, ovoid, yellow, knobbed; rind thin; pulp abundant, very acid. Cultivated abundantly in the south of Europe. Citric acid is made of it. In Madeira the Lemon grows into a tree 20-30 ft. high, and is in flower and fruit from Oct.-May.

c. THE ACID LIME OF INDIA. *C. acida*, Roxb. l. c. 390; Ic. Roxb. in Herb. Kew. *Jambira*, Sans.; *Limu*, *limoun*, Arab.; *Lebu*, *nebu*, *limbu*, *nimbu*, Beng., Hind. Leaves oval; petioles winged, many times shorter than leaf; wings linear or obovate. Flowers small, in short racemes; petals generally 4. Roxburgh describes seven varieties, of which the two small thin-skinned kinds, yellow when ripe, with an abundance of pale, sharp acid juice, are the most generally cultivated. (*Pāti Nebu*, the small round Lime; and *Kagūzi Nebu*, *Kagūzi Nimbu*, the small long Lime.) A third kind, the large acid Lime, is grown in Burma and in Bengal (*Kāmarāli-Nebu*).

d. THE SWEET LIME OF INDIA, *Mitha Nebu*. (*Amritphal*, Kamaon.) Commonly cultivated in most parts of India and Burma. Fruit globose, smooth, 3-5 in. diam., thin-skinned, with an abundance of sweet, not aromatic, juice. Ripens

at different seasons, but principally in summer. It is a matter for further inquiry whether all kinds of Indian sweet Limes should be referred to this species. The sweet Limes cultivated in France and Italy are referred by Risso and Poiteau partly to *C. Limetta*, with white flowers, partly to *C. Lumia*, with the flowers tinged with red. Voigt, Hort. Suburb. Calc. 142, refers the Indian sweet Lime to *C. Limetta*.

2. *C. Aurantium*, Linn. The bitter and sweet Orange, and the Bergamot. Comprises *C. Aurantium*, *Bigaradia*, *Bergamia*, and *Limetta* of Risso and Poiteau.

Trees, rarely shrubs, bearing flowers and fruit generally at one season of the year only. Young shoots glabrous, greenish white. Leaves glabrous, 3-6 in. long, elliptic or ovate, acuminate; petioles naked or winged, wings often obovate, as large as the leaf, or nearly so. Flowers pure white, middle-sized, bisexual; stamens 20-30. Fruit globose, often depressed, generally orange-coloured, ripe in India generally Dec.-March.

Orange-trees have been found wild or apparently wild in the Kasia hills (Hooker and Thomson), between 4000 and 3000 ft., with globose fruit, winged and unwinged petioles, and acute or obtuse leaves; in Sikkim (Hooker and Thomson), alt. 1000 ft., with unwinged petioles, and oblong-elliptic acuminate leaves; in Kamaon (Strachey), at Bagesar, 3000 ft., with unwinged petioles; in Garhwal (Thomson), at 2000 ft., with globose fruit, naked or marginate petioles, and oblong-lanceolate acuminate leaves.

Under this species may be classed the following cultivated kinds:—

a. THE BITTER OR SEVILLE ORANGE. *C. Bigaradia*, Risso et Poiteau. *Bigaradier*, French; *Arancio forte*, Italian; *Pomeranze*, German; *Naranj*, Arab. Petiole generally winged; flowers larger and more strongly scented than those of the sweet Orange; rind of fruit very aromatic; pulp not sweet, bitter or austere. Not extensively cultivated in India. Grown in large orchards on the island of Sardinia, in Spain, and elsewhere in the Mediterranean region, mainly on account of the flowers, from which the essential oil of Oranges is distilled. In the south of Europe the bitter Orange is more hardy than the sweet Orange, and this again is more hardy than the Lemon.

b. THE SWEET ORANGE. *C. Aurantium*, Risso et Poiteau. *Oranger*, French; *Arancio dolce*, *portogallo*, Italian; *Portogallo*, Greek; *Apfelsine*, German; *Nagaranga*, Sans.; *Naranj*, Arab.; *Narangi*, *naringi*, *sangtara*, *sunthara*, *kunda nebu*, Hindi and Bengali. Petiole naked or winged; pulp sweet, yellow, sometimes red, in a loose or adhering rind. The sweet Orange does not come to perfection in all parts of India. In Lower Bengal it does not fruit at all, or does not bear freely, and the fruit is dry and austere. Calcutta is supplied from the valleys of the Kasia hills north of Silhet. Delhi, Nagpore, Aurangabad, Santgur near Vellore, and the Northern Circars, are famous for their Oranges; but there are large tracts where none or inferior kinds only are produced. In India the fruit generally ripens between December and March, according to the climate of the locality. A variety which flowers twice a-year (Feb. and July), and yields two crops—the first from November to January, and the second crop in March and April—is grown at Nagpore (Firminger's Gardening, 2d ed., p. 223). The sweet Orange is grown in all parts of the Mediterranean region, and the fruit is largely exported from Sardinia, Sicily, the Balearic Islands, Spain, Portugal, and Madeira. On the Riviera, the cultivation, which was very extensive in the time of Gallezio, has declined; and in many cases the bitter Orange has been substituted, the flowers of this kind being more

profitable there at present than the fruit of the sweet Orange. In the south of Europe the Orange attains a much larger size than in India. A yield of 3000 to 5000 Oranges per tree annually is not rare. Near Milis, on the island of Sardinia, there are trees more than 6 ft. in girth, said to be 700 years old. The wood of the Orange is hard, close-, and even-grained, yellowish, weighs 49 lb. when seasoned, and 65-70 lb. when green (Skinner). In South Europe it is used for turning, engraving, inlaid and cabinet work, and excellent walking-sticks are made of shoots and branches.

In favour of considering the sweet and bitter Orange as distinct species, the fact has been urged that in some districts in the south of Europe the seed of the sweet Orange always reproduces its own kind without grafting. Regarding the fact there seems to be no doubt; Galesio affirms it as the result of his researches and of direct experiments, and his statements are confirmed by other information of a later date. Galesio states (l. c. p. 32), that during a series of years he had sown the seeds of the sweet Orange; that they never produced bitter Oranges; and that during a period of 60 years no instance was known to the practical gardeners of the Finalais of a bitter Orange having been produced from the seed of a sweet Orange-tree, or a sweet Orange having arisen from the seed of a Bigaradier. In the last chapter of his book he relates how, in the severe winter of 1709, all Orange-trees in Liguria were killed; and how, to replenish the gardens, nurseries were formed with the seed of the sweet Orange. The trees thus raised were grafted according to old custom, but severe frost recurred in subsequent years, and many of the grafts were killed. Some of the trees were regrafted; others were left alone, and these were found to produce excellent fruit. This discovery was followed up; and the result was, that the old custom of grafting was abandoned in many parts of the Riviera. At present the sweet Orange is often grafted on the bitter Orange stock, because the latter is more hardy, and because grafted trees come into bearing more quickly than seedlings (*arbres francs*); but as far as our knowledge goes, there seems no doubt that on the Riviera, at least, the seed of the sweet Orange reproduces its own kind. As far as I have been able to ascertain, the sweet Orange-trees in the vast orchards of the Kasia valleys are all raised from seed without grafting. On the other hand, there seems no doubt that in America the matter is often different. On the island of Guadalupe the seed of the sweet Orange produces bitter fruit; and in Caracas, *Naranzo agrio* is the term for an austere kind, often produced from the seed of sweet Oranges (Ernst, plants cultivated or naturalised in the valley of Caracas, Seemann Journ. Bot. v. 272). Macfadyen, in his 'Flora of Jamaica' (1837), p. 129, states that the seed of the sweet Orange frequently grows up into a tree bearing the bitter fruit. It is clear, then, that the question, whether the sweet and bitter Orange are specifically distinct, derives no support from these facts either way, and that it must be decided on other grounds. The case is similar to that of the Mango in India. In Burma, and I believe also in other parts of India, the seed of certain good varieties produces fruit of a similar kind without grafting; whereas, apparently, in a climate or under circumstances somewhat less favourable, ungrafted trees, as a rule, bear nothing but inferior fruit, more or less stringy and turpentiney. The matter is one well worthy of further research in India. As matters stand at present, there does not seem sufficient ground for considering the sweet and bitter Orange as distinct species.

c. THE BERGAMOT. *C. Bergamia*, Risso et Poiteau. Flowers small, very sweet-scented; fruit pear-shaped or globose; rind smooth, pale yellow; pulp acidulous, with a pleasant aroma. Not, as far as I know, cultivated in India. Bergamot oil is the volatile oil of the rind. Voigt, l. c. 142, refers to this the acid *Limes* of India, but they certainly have more the character of *C. medica*.

d. THE ACID LIME OF THE WEST INDIES (*C. Lima*, Macfadyen; *C. acidis-*

sima, Meyer) is referred by Grisebach, l. c., to *C. Aurantium*. It is described as a thorny shrub or small tree of shrubby growth; leaves oval; flowers white, pentamerous; stamens 25, rarely 30. Fruit nearly globose, small, yellow when ripe, with a thin skin, and an abundance of pure acid juice. In Jamaica it is quite naturalised, and forms strong fences; lime-juice and citric acid are made from the fruit. The fruit is much like the *small acid Lime* of India, and it is a matter for further inquiry whether it should be classified under *C. Aurantium*. Lowe classes the West Indian Lime grown in Madeira (*Limaõ de Gallinha*, Port.) under *C. Limonum*. Others have classed the West Indian Lime under *C. Limetta*, Risso.

3. *C. decumana*, Willd. *The Shaddock, Pumelo, Pomplemoes*.—Vern. *Batawi Nebu, maha nambu, chakotra*.

A tree, attaining 30-40 ft.; young shoots pubescent. Leaves large, 6-9 in. long, oval-oblong, pubescent beneath, frequently emarginate; petiole broad-winged. Flowers white, large; stamens 16-24. Fruit large, pale yellow, globose or pear-shaped; rind thick; pulp pale yellow pink or crimson, sweet or acrid; transverse vesicles distinct.

Introduced into India from Java. Seemann, *Flora Vitiensis*, p. 33, states that it apparently is indigenous in Polynesia. Cultivated in most tropical countries.

The history of the gradual spread of the species of this genus is remarkable. The Citron alone is described by classical writers. It was cultivated in Media and Persia long before the conquests of Alexander the Great. The Greek botanist Theophrastus, who wrote shortly after Alexander's death, gives a description of the tree and its fruit which cannot be mistaken. They were called Median and Persian apples, and valued highly on account of their strong aromatic scent, as antidotes against poison, and to make the breath sweet. In Greece and Italy the tree does not appear to have been cultivated much before the third century of our era, although the fruit was imported at a much earlier date. Plinius mentions its use in Rome, and in his books the name Citrus first occurs. In the fifth century it was cultivated in the island of Sardinia, and about Naples. On the coast of Mentone and Hyeres it was, according to Gallesio, introduced in the twelfth or thirteenth century.

Oranges and Lemons are not mentioned in the works of Greek and Roman authors. The first notice regarding them is found in Arab books of the tenth and eleventh century; and it seems certain that the Lemon and the bitter Orange were brought from India to Arabia, Syria, and Egypt in the ninth or tenth century, and that their introduction in South Europe was mainly due to the progress of Arab conquest, in some cases to the Crusaders, and to the trade connections between the Italian ports and the East. The bitter Orange was extensively cultivated in Sicily and in Spain in the twelfth century. In Italy and the south of France, Oranges and Lemons were not commonly grown before the fourteenth century.

The sweet Orange was introduced in Europe at a much later date; and it cannot yet be considered as finally decided whether it came by way of Syria—which, however, seems probable—or whether the Portuguese may claim the honour of having imported it by sea from India or China. So much is certain, that on landing in India the Portuguese found sweet Oranges in abundance; this fact is specially noted in the account of Vasco de Gama's voyage.

A comparison of the European, Sanskrit, and Arabic names of the Citron, Orange, and Lemon, confirms the result of historical research regarding the spread of their cultivation. The Sanskrit name of the Citron, *Vijapūra*, never went far West. At the time of Alexander the Great, the fruit was known under the

name of Persian and Median apples, and was afterwards called *Citrus*, the Latin term for *κείπων*, by which the *Cedar*, *Juniper*, and other aromatic and resinous coniferous woods, were designated, which, like the *Citron*, had the property, or were supposed to possess the property, of keeping away insects. On the other hand, the words *Limone*, *Lime*, *Lemon*, evidently derive their origin from the Arab *Limu*; and this name probably has a Sanskrit origin. The Sanskrit word *Nagaranga*, for Orange, is readily traced in the Arab *Naranj*, and the European terms *Aranzio*, *Pomaranze*, *Orange*. Again, the word *portogallo*, by which the sweet Orange is known in parts of the Mediterranean region—for instance, in Greece and Albania—is quoted in proof of the introduction of this fruit by the Portuguese, in the same way as the German (and Russian) term, *Apfelsine*, seems to point to its having been brought from China.

So far regarding the westward spread of these fruits. Whether the numerous varieties of Citrons and Oranges cultivated in China have originated in species indigenous in that country, or whether the mountains of India are their original home, and whether any fruit-trees of this genus are indigenous in the Indian Archipelago or in Polynesia—these are questions of great interest, which call for further botanical and historical studies. My object in bringing these questions forward prominently in this place is to induce others with more leisure and more opportunities of observation to study a subject of great historical interest, which may eventually serve to bring out important results regarding the spread and changes of arborescent species under cultivation.

8. FERONIA, Correa.

Leaves alternate, imparipinnate. Flowers frequently unisexual. Calyx small, 5-dentate, deciduous. Petals 5, rarely 4-6, oblong-lanceolate, imbricate. Stamens 10-12; filaments subulate from a broad, densely villous base; anthers linear-oblong. Ovary 5-celled, or 1-celled owing to the slight cohesion of the axile placenta, continued into a thick oblong or cylindrical style; ovules numerous, crowded in several series. Fruit globose, 1-celled, filled with pulp, with a hard rind. Seeds numerous, oblong, flat; cotyledons thick, fleshy.

1. **F. Elephantum**, Correa; Roxb. Cor. Pl. t. 141; Fl. Ind. ii. 411; Wight Ic. t. 15; W. & A. Prodr. 96. *Elephant- or Wood-Apple*.—Sansk. *Kapittha*. Vern. *Bilin*, *kait*, *kaitha*, *katbel*.

Glabrous, armed with strong, straight, axillary thorns. Leaflets 5-7, cuneate or obovate, crenate at the top. Flowers of a dull-reddish colour, in loose, lateral, or terminal leaf-bearing panicles; axis and branches pubescent, male and bisexual flowers frequently on the same panicle. Fruit globose, 2½ in. diam.; rind hard, woody, outside rough, grey-coloured; seeds embedded in a fleshy, edible pulp.

Wild in South India; in the Outer Himalaya and Siwalik tract, ascending to 1500 ft., and extending west as far as the Ravi. Cultivated, and occasionally wild, throughout India, but not in the plains of the Panjab. Fl. Feb.-May; the fruit ripens about Oct., and often remains long on the tree.

A moderate-sized tree, with a symmetrical trunk, 2-4 ft. in girth, bearing an elegant oval head; leaves with a slight smell of aniseed. Bark dark grey or nearly black, wrinkled, corrugated with longitudinal shallow furrows. Wood yellowish or light brown, with distinct medullary rays, close, even, fine-grained, strong, hard, 50 lb. per cub. ft., 62-65 lb. when green. Value of P. 587-660 (Cunningham); 645 (Skinner). Used for housebuilding, maves, oil-crushers, and agricultural implements. Too coarse for engraving, but well adapted for

ornamental carving. The sapwood often eaten by beetles. A white transparent gum exudes from the bark, which is collected, and forms part of the East Indian Gum-Arabie of commerce, together with the gum of the *Nim*, *Mango*, *Babul*, *Seriss*, *Khair*, *Bahera*, and several other trees. Pulp of the fruit acid; a jelly is made from it.

9. *ÆGLE*, Correa.

Leaves alternate, trifoliate; leaflets pellucid-punctate. Flowers bisexual. Calyx small, 4-5-dentate, deciduous. Petals 4-5, imbricate. Stamens numerous, with short subulate filaments, and long linear anthers. Ovary on cylindrical disc, with a thick fleshy axis, and 10-20 small cells near the circumference, with numerous ovules in each cell attached to the central angle. Stigma capitate, obtuse, deciduous. Fruit globose, with a hard woody rind, 8-16-celled, filled with an aromatic pulp. Seeds numerous, oblong, flat; testa woolly, covered with a viscid fluid.

1. *A. Marmelos*, Correa; Roxb. Cor. Pl. t. 143; Fl. Ind. ii. 579; Wight & A. Prodr. 96; Wight Ic. 16; Bedd. Fl. Sylv. t. 161. The *Bael* tree.—Sans. *Bilva*, *malaria*. Vern. *Bel*, *bil*, *bila*, *bili*. Local name, *Mahaka-marra*, Gonds., C.P.; *Ushitben*, Burm.

Glabrous, armed with axillary, straight, strong, sharp spines, 1 in. long or more. Leaflets 3, rarely 5, ovate-lanceolate, crenate, terminal long-petiolulate, lateral nearly sessile. Flowers greenish white, with a fine honey scent, on short lateral panicles; pedicels and calyx pubescent. Calyx flat, teeth indistinct. Petals oblong, coriaceous, thickly dotted. Filaments occasionally fascicled. Fruit globose, oblong, or pyriform, 2 to 5 in. diam., with a smooth, grey or yellow rind, and a thick, orange-coloured, sweet, aromatic pulp.

Wild in the Siwalik tract and Outer Himalaya, ascending to 4000 ft., from the Jhelam to Assam; also in Oudh, Behar, Bengal, Central and South India and Burma. Often gregarious when wild. Cultivated throughout India, except in the northern part of the Panjab; frequently planted near Hindoo temples. Leaves shed about March and April; the new foliage appears in April and May. Fl. about May; and fruit ripens in Oct., Nov., remains long on the tree.

When cultivated, a middle-sized tree to 35 ft. high, with a short, erect, often fluted, irregularly-compressed, and scooped-out trunk, attaining a girth of 7 ft.; branches few, extremities often drooping, forming a narrow oval head. Wild (in N.W. India) generally a small, scrubby tree. Bark of trunk and larger branches $\frac{1}{2}$ in. thick and more, outside soft, corky, light-cinereous or bluish grey, with large dark stains, and irregular, longitudinal, shallow furrows. Wood light-coloured, mottled with darker wavy lines and small light-coloured dots. Medullary rays indistinct. Even-, close-grained, 40-50 lb. per cub. ft. The tree being valued for its fruit, is not often felled; but the timber is esteemed for strength and toughness. Used in construction, for pestles of oil- and sugar-mills, naves and other parts of carts, and for agricultural implements. Twigs and leaves are lopped for cattle-fodder. The tenacious pulp of the fruit is used medicinally in diarrhoea and dysentery, as sherbet, and as a conserve (Pharm. Ind. 46). Dry, it keeps well as a hard, transparent substance. It is also considered an excellent addition to mortar, especially in building wells. Snuff-boxes are made of the shell of the fruit; the leaves, root, and bark are used in native medicine; from the flowers a scented water is distilled.

ORDER XVIII. SIMARUBEÆ.

Shrubs or trees, with bitter bark, pinnate leaves without stipules, and simple hairs. Flowers small, generally unisexual, regular. Calyx 3-5-cleft. Petals 3-5. Stamens hypogynous, inserted at the base of disc, as many as petals, or double the number; filaments free; anthers 2-celled, bursting longitudinally. Carpels more or less distinct, rarely connate throughout; ovary 1-5-celled, generally one ovule in each cell. Fruit-carpels 1-seeded.—Gen. Pl. i. 306; Royle Ill. 157 (*Zanthoxyleæ*); Wight Ill. i. 165, 169, 170.

Stamens twice as many as petals.

Fruit of 1-5 flat foliaceous samaræ; leaves pinnate

1. *AILANTHUS*.

Fruit a 1-seeded drupe; leaves 2-foliate

2. *BALANITES*.

Stamens as many as petals; leaves pinnate

3. *PICRAMMA*.

1. *AILANTHUS*, Desfontaines.

Large trees, with alternate pinnate leaves approximate near the ends of branches. Flowers polygamous, in large axillary panicles. Calyx small, 5-cleft; lobes imbricate. Petals 5, spreading, induplicate-valvate in bud. Male flowers: stamens 10, inserted at the base of disc. Female flowers: stamens none; carpels 2-5, distinct, laterally compressed, 1 ovule in each; styles as many as carpels. Bisexual flowers with 2-3 stamens. Fruit consisting of 4-5 flat, membranous, reticulate, linear-oblong samaras, each with one flattish seed in the middle. Seed with scanty albumen, flat, foliaceous, orbicular cotyledons, and a superior radicle.

1. *A. excelsa*, Roxb. Cor. Pl. t. 23; Fl. Ind. ii. 450; W. & A. Prodr. 150; Wight Ill. t. 67.—Sans. *Avalu*. Vern. *Arūa*, South Meywar; *Maruk*, Bomb.

A large tree, leaves abruptly pinnate, more or less tomentose, commonly 8-12 in., sometimes 2-3 feet long; leaflets nearly opposite, 8-14 pair, ovate from a very unequal base, often broadly falcate-lanceolate, deeply serrate, often lobed. Flowers yellowish, in axillary panicles, shorter than leaves. Petals glabrous, ovate. Filaments glabrous, shorter than anthers. Samaras lanceolate, pointed at both ends, with numerous prominent parallel nerves. (Roxburgh figures filaments longer than anthers.)

Indigenous in Central and South India, and extensively planted throughout India as far north as Saharanpur. Leafless during the early part of the cold season, the new leaves appear in March, April. Fl. April, May. Easily propagated by seed and cuttings. 60 to 80 ft. high, bark grey, wood soft, white, not much used, except to make floats for fishing, pith large.

A. glandulosa, Desf., which is at home in Japan (perhaps also in China), and cultivated in Europe, differs by filaments longer than anthers, hispid at the base, and petals woolly tomentose inside. The leaflets, which are often 4 in. long, have generally 1-3 pair of rounded glandular teeth near the base. Grows rapidly, throws up abundant root-suckers, and has on that account been employed in plantations made to clothe barren, stony hills in the south of France. Hardy in England. Bedd. Fl. Sylv. t. 122; Wight Ic. 1604.

A. malabarica, DC., a large tree of the Western Ghats, with thick rough bark, is characterized by glabrous leaves; leaflets lanceolate, entire; filaments

glabrous, longer than anthers, and a linear-oblong samara, rounded at both ends; yields a resin, *matti pāl*, used in medicine and as incense (Pharm. Ind. 50).

2. **BALANITES**, Delile.

Shrubs or small trees, usually armed with axillary or supra-axillary spines; leaves 2-foliolate; leaflets entire, coriaceous. Flowers bisexual; sepals and petals 5. Stamens 10, inserted at the base of disc; anthers dorsally affixed. Ovary globose, pilose, 5-celled, on the thick, fleshy, 10-furrowed disc; ovules 1 in each cell. Fruit a 1-seeded drupe, with a bony or crustaceous putamen. Seed without albumen; cotyledons thick, plano-convex, oblong.

1. **B. Roxburghii**, Planchon.—Syn. *B. ægyptiaca*, Wight Ic. t. 274; *Ximenia ægyptiaca*, Roxb. Fl. Ind. ii. 253. Vern. *Hingu*, *Inqua*, *Hingen*, *Hingot*, *Hingota*, *Iugol*.

Thorns axillary, strong, very sharp, often long, leaf- and flower-bearing; young parts pubescent, in dry localities hoary-tomentose. Leaflets lanceolate, oblong or obovate, nearly sessile, on a common petiole less than $\frac{1}{4}$ length of leaflets. Flowers small, white, or greenish white, fragrant, crowded in fascicles, axillary and along lateral branches. Sepals oval, downy, nearly as long as petals, both spreading, reflexed, and eventually deciduous. Style erect, short; stigma slightly 5-lobed. Drupe ovoid, 2 in. long, 5-grooved, covered with a light-grey dry rind, enclosing a bitter pulp with an offensive greasy smell; nut exceedingly hard, tubercled outside, 1-seeded.

Common in many parts of India, as far north as Delhi; in Rajputana, Bandelkhand, the Central Provinces, the Northern Circars, the Dekkan, and South India; grows chiefly in open dry places and on stiff clay soil. New leaves in March. Fl. in April and May. Usually a scraggy shrub, in favourable conditions a small tree, 30 ft. high, with an erect, short trunk, 2 ft. and more in girth. The roots spread far, and throw up suckers at a considerable distance from the trunk. Bark of trunk smooth, yellow or cinereous. Wood chiefly used for fuel. From the seed a fixed oil is pressed; the pulp is used to clean silk in Rajputana; the seeds, the bitter bark, and subacid leaves are employed in native medicine; the hard kernel of the fruit (filled with gunpowder) is used in fireworks.

The second species of this genus, *B. ægyptiaca*, Delile,—Boissier Fl. Orient. i. 944, Oliver Flora Trop. Afr. i. 315; Palestine, Egypt, Arabia, and tropical Africa,—has longer petioles, and the ovary lengthens out considerably after flowering. In the Indian plant the ovary swells, but remains ovoid and short. It is, however, a matter for further inquiry, whether all Indian forms belong to one species.

3. **PICRASMA**, Blume.

Trees, all parts very bitter, with alternate imparipinnate leaves. Flowers unisexual, in corymbose panicles. Calyx small, 4-5-dentate. Petals 4-5, ovate, valvate. Male flowers with 4-5 stamens, inserted under the disc. Carpels 3-5, distinct, on a thick disc; ovules solitary. Fruit consisting of 1-3, nearly dry, drupes; seeds with a straight embryo in a fleshy albumen.

1. **P. quassioides**, Bennett.—Syn. *Nima quassioides*, Hamilton. Vern.

Tūtāi, tithāi, tithu, hala, kulāshi, arkhar, Fb. (the two last names are also used for species of *Rhus*).

Young parts pubescent. Leaflets opposite in 4-6 pairs, nearly sessile, ovate-lanceolate, acuminate, serrate; common petiole 5-8 in. long. Corymbs axillary, shorter than leaf. Flowers small, greenish, generally pentamerous. Sepals and petals persistent; petals five to six times as long as sepals, ovate, acute. Filaments with a thick, pilose base; anthers cordate-ovate, versatile. Drupes globose, $\frac{1}{4}$ in. long, black when ripe.

Outer Himalaya, from the Chenab to Nepal, between 3000 and 5500 ft., ascending occasionally to 8000 ft. Also in China. Fl. from April-June; the bitter fruit ripens from July-Sept. A tall, scrambling shrub; bark smooth, brownish, with white specks, very bitter, and used in native medicine as a tonic and stomachic.

ORDER XIX. OCHNACEÆ.

Shrubs or trees, with alternate, simple, glabrous, stipulate leaves. Flowers yellow or orange, on jointed pedicels. Sepals 5, free, imbricate. Petals as many as sepals, or more. Stamens hypogynous, (10 or) indefinite; anthers linear, dehiscing longitudinally or by subterminal pores. Ovary deeply 3-10-lobed, 3-10-celled; cells uniovulate; style 1, central, slender. Fruit of 3-10 sessile drupes, inserted upon the enlarged torus. Seed exalbuminous.—Gen. Pl. i. 316; Royle Ill. 165; Wight Ill. i. 171.

1. *OCHNA*, Schreber.

Trees or shrubs, wholly glabrous. Leaves alternate, coriaceous, stipules axillary. Flowers yellow. Sepals 5. Petals 5-10. Stamens numerous, equal; anthers linear. Ovary 3-10-lobed.

A large shrub; flowers on short lateral racemes

1. *O. squarrosa*.

A small undershrub; flowers 3, on long axillary peduncles

2. *O. pumila*.

1. *O. squarrosa*, Roxb. Cor. Pl. t. 89 (1795); Fl. Ind. ii. 643; W. & A. Prodr. 152; Wight Ill. t. 69.—Syn. *O. lucida*, Lam. (1796).

A shrub or small tree; leaves elliptic-oblong, acute at both ends, 3-5 in. long, on short petioles, finely serrulate, with numerous fine, parallel, lateral nerves. Flowers in short lateral racemes on the previous year's wood, often on short generally leafless branchlets. Petals 7-12.

Bengal, Burma, South India. Will probably be found in the south-eastern part of the Centr. Prov. Fl. Feb., March. Fruit May, June. Grown in gardens.

2. *O. pumila*, Hamilton.—Syn. *O. humilis*, Hamilton; *O. collina*, Edgew. Trans. Linn. Soc. xx. 43. Vern. *Maidan-ka-kusum*, C.P.

An undershrub; leaves oblanceolate, 4-6 in. long, narrowed into a short petiole, serrulate with cuspidate teeth. Main lateral nerves distant, irregularly parallel. Flowers 3, on pedicels 1-2 in. long, peduncles axillary, nearly as long as leaf. Petals 5, longer than calyx.

Sub-Himalayan tract, principally in Sal forests. Satpura range. South Konkan. Underground stem perennial, throwing up annually, after the jungle-fires, a number of subherbaceous stems to 2 ft. high, bearing leaves and flowers. Fl. April, May.

ORDER XX. BURSERACEÆ.

Trees or shrubs, often resinous. Leaves generally alternate, 3-foliolate, or imparipinnate, in some cases 1-foliolate, without stipules. Flowers small, bisexual or polygamous. Calyx 3-5-cleft. Petals 3-5. Stamens as many as petals, or twice their number, inserted on the edge or outside base of disc; anthers 2-celled, longitudinally dehiscent. Ovary free, 2-5-celled; ovules generally 2 in each cell, axile. Fruit generally drupaceous. Seeds one or few, pendulous, without albumen; cotyledons generally twisted or crumpled, radicle pointing upwards.—Gen. Pl. i. 321; Royle III. 174; Wight III. i. 180. (Suborder of Terebinthaceæ).

Leaves imparipinnate, with numerous leaflets.

Fruit a 3-valved capsule, the valves separating from the axis; calyx small, open

Fruit a drupe; calyx campanulate

Leaves generally 3-foliolate

1. BOSWELLIA.

2. GARUGA.

3. BALSAMODENDRON.

Bursera serrata, Wall. (*Icica indica*, W. & A. Prodr. 177), a large tree, with close-grained timber, esteemed for furniture—Assam, Chittagong, the Rajmahal hills—belongs to this family, and may possibly be found further west. Leaves large, imparipinnate; leaflets lanceolate, acuminate, glabrous. Flowers small, in axillary panicles; calyx small, indistinctly dentate; petals 5, inserted below disc; stamens 10; stigma sessile; drupe generally 1-seeded.

1. BOSWELLIA, Roxb.

Trees abounding in resin, with alternate imparipinnate leaves, crowded at the ends of branches. Flowers bisexual, hypogynous. Calyx small, open, 5-7-cleft. Petals 5-7. Stamens mostly 10, inserted at the base of the annular disc. Ovary half immersed in the disc, 3-celled; 2 collateral ovules in each cell. Fruit a 3-valved capsule, opening septifragally, the dissepiments remaining attached to the axis, and bearing 3 seeds, pendulous from the top of the inner angle, enclosed in a hard, bony shell, with a broad membranous wing, which is not the testa of the seed, but the endocarp of the fruit, separated from the outer layer of the pericarp. Seed without albumen; cotyledons trifid, lobes lacinate; radicle superior.

1. *B. thurifera*, Colebrooke; Roxb. Fl. Ind. ii. 383; W. & A. Prodr. 174.—Syn. *B. glabra*, Roxb. Pl. Cor. t. 207; Fl. Ind.; W. & A. Prodr. l. c.; Bedd. Fl. Sylv. 124. *Boswellia serrata*, Stackhouse (probably). Vern. *Salhe*, *Sale*, *Salai*, *Salei*, *Saler*. Local names: *Gūggar*, Kamaon; *Bhor-salai*, Gonds., C.P.

Young parts and leaves mostly pubescent, with simple hairs. Leaves crowded near ends of branches, 8-15 in. long; leaflets 8-15 pairs, opposite, or nearly opposite, sessile, lanceolate or ovate-lanceolate, from an

oblique base more or less deeply crenate, apex generally rounded, obtuse. Flowers white, about $\frac{1}{4}$ inch across; a number of racemes, or racemose panicles, at the ends of branches, shorter than the leaves; bracts small, deciduous. Calyx cup-shaped, 5-7-toothed. Petals broad-ovate, shortly unguiculate. Anthers 10-12, hairy. Disc fleshy, red. Stigma 4-5-lobed. Bony endocarp heart-shaped, beaked, in the centre of an oblong, membranous wing.

Common throughout Behar, the Dekkan, to within 20 miles of the Western Ghats (Dalzell), the Central Provinces, Bandelkhand, and Rajputana, in the forest tracts at the foot of the Himalaya, westward as far as the Sutlej, also in South India. Grows chiefly on hot, arid hills, more or less gregariously, forming open forests, and often associated with *Sterculia urens*. Particularly abundant on the trap hills of the Dekkan and the Satpura range.

Deciduous, the old leaves fall about March and April, and are replaced in June by the fresh foliage. The flowers appear when the tree is leafless; sometimes before the old leaves fall, or after the young leaves have appeared. Rate of growth generally rapid; a tree in the Saharanpur gardens, 30 years old, measured 6 ft. girth. Throws up abundant coppice-shoots when felled, and grows readily from cuttings and stakes if planted during the rains.

A moderate-sized tree, generally not more than 30 ft. high, and 5-6 ft. girth, with a spreading, flat crown. Bark nearly $\frac{1}{2}$ in. thick, juicy when fresh, inner substance brown. Outside usually greenish ash-coloured, peeling off in smooth thin flakes. Wood light-coloured when fresh, darker when seasoned, soft, spongy, coarse- and open-grained, 30-35 lb. per cub. ft., not durable. Used chiefly as fuel. Charcoal is made of it, used for iron-smelting in Nimar. From wounds and cracks in the bark exudes an abundance of transparent, fragrant gum-resin, diffusing, when burnt, an agreeable smell. It is used medicinally and as incense in India, and sold in the bazaars under the name of *Labanu*, *Kundur*, or *Kundura*; but it is not the Olibanon or frankincense chiefly used in Europe, which is yielded by several other species of *Boswellia* growing in the Somali country, and on the Hadramaut hills in Arabia, and described by Dr Birdwood in Trans. Linn. Soc. xxvii. 111.

I only know one sp. of *Boswellia* in Central India, well represented by Roxburgh's and Beddome's figures of *B. glabra*. There is, however, a difficulty in Roxburgh's description of *B. glabra* in the text of the Coromandel plants. He says, "It is one of the largest trees, with a hard, heavy, and durable wood. The lower masts of coast-built vessels are generally made of it, though its weight renders it less fit than fir or teak." These remarks would not apply to *Salai*, and Roxburgh's description may possibly refer to another species.

2. *GARUGA*, Roxb.

Trees with alternate imparipinnate leaves, crowded at the ends of branches. Flowers polygamous. Calyx campanulate, 5-cleft, valvate, inside lined by a thin disc with a crenate margin. Petals 5, inserted in the calyx-tube above the middle. Stamens 10, perigynous, inserted below the petals. Ovary ovoid, 4-5-celled; stigma capitate, 4-5-lobed; 2 collateral ovules in each cell. Fruit a globose fleshy drupe, with 5 or fewer bony nuts. Seeds solitary in each nut; cotyledons thin, twisted.

1. *G. pinnata*, Roxb.—*Tab. XIII.*—Pl. Corom. t. 208; Fl. Ind. ii. 400; W. & A. Prodr. 175; Bedd. Fl. Sylv. t. 118.—Vern. *Kharpat* (grass-leaf), *Katmanna*, *kitmirria*, *kilmira*, *karolu*, *katula*, *karota*, Pb.,

N.W.P.; Ghogar, kaikar, Oudh; Kankar, kakar, kaikra, ghunja, ghurri, maharut, C.P.; Chinyuk, Burn.

Leaves approximate near the ends of branches, 6-12 in. long; leaflets 6-9 pairs, opposite or nearly so, nearly sessile, lanceolate or ovate-lanceolate, crenate, acuminate, glabrous or tomentose. Flowers yellow, in spreading panicles, several at the ends of branches; branches of inflorescence, pedicels, and calyx tomentose; bracts linear, deciduous. Calyx 10-ribbed. Filaments, ovary, and style hairy; stigma 5-lobed. Drupe fleshy, smooth, about the size of a nutmeg; nuts generally two, tuberculated outside.

Dry forests in the hilly regions of the greater part of Central and South India and Burma. At the foot of the Himalaya, and in the outer valleys (ascending to 3500 ft.) from the Jumna to Assam, often in Sāl forests; in North-West India frequently associated with *Odina Wodier*, which it resembles when leafless. Leafless during the greater part of the dry season. The fresh foliage generally appears in April or May, with the flowers or after them. The fruit ripens about June and July. Oval, smooth, brown galls on petioles not uncommon in November. Stakes of branches planted during the rains grow readily.

Under favourable circumstances a large tree, 50-60 ft. high, with an erect, straight trunk, 15-20 ft. long and 5-6 ft. in girth. Branchlets with conspicuous marks of lapsed petioles. Bark of trunk thick, light grey or brown, furrowed by shallow longitudinal wrinkles; outer layers getting black, and exfoliating in broad, irregularly angular flakes. Inner bark reddish brown. Sapwood large, whitish; heartwood dark reddish-brown, mottled, even but rather open-grained, 52 lb. per cub. ft. (*Chinyuk* from Burma.) I am inclined to think that the wood of *Garuga pinnata* is often light-coloured and of less weight. Seasons well, durability doubtful, readily attacked by insects. Not much used for construction, but employed for indoor work, and as fuel. Has been recommended for cabinet-work. Bark employed for tanning; a gum exudes from it. The fruit is eaten, raw and pickled. Shoots and leaves are lopped as fodder, whence the name *Kharpat*.

3. BALSAMODENDRON, Kunth.

Small trees or shrubs, yielding aromatic resin; branches often thorny. Leaves alternate or crowded at the end of short branches, imparipinnate or 1-3-foliate. Flowers polygamous. Calyx tubular, campanulate, or urceolate, 4-cleft, persistent. Petals 4, erect or with recurved tips, inserted at the bottom of calyx. Stamens 8, inserted on or outside the margin of a cup-shaped disc. Ovary sessile, 2-3-celled, narrowed into a short thick style; ovules geminate, collateral, pendulous. Fruit a drupe, the rind or epicarp frequently splitting more or less irregularly into 2-4 valves, leaving exposed the pulp or mesocarp, which encloses the nut. Nuts 1-3, with bony endocarp, either separate or more or less connate. Seed without albumen, one in each nut; testa membranous; embryo straight, the radicle pointing upwards; cotyledons thin, crumpled and plaited.

Most species of this genus inhabit Arabia and Eastern Africa, and several of these yield the Myrrh of commerce. Some of the Indian species also yield a fragrant gum-resin, which is an article of trade, under the name of *Gugal*, *gugul*, *guggur* (*mukul*, Arab.), which is believed to be the *Bellium* of classic writers, and which most likely furnishes part of the Myrrh which is exported from Bombay. They are not important as forest-trees, in the sense in which this word is generally accepted, but they merit attention as forming part of the

scanty arborescent vegetation of the arid hills of Sindh and Rajputana; and it is not impossible that a better knowledge of them, and increased attention paid to them, may eventually lead to increased production of a valuable article of commerce. Two species only are yet known from North-West India; a third, though indigenous in South India, is added to guard against misconception.

Leaves usually unifoliate	1. <i>B. Mukul</i> .
Leaves ternate or imparipinnate.	
Unarmed	2. <i>B. pubescens</i> .
Thorny	3. <i>B. Berryi</i> .

1. **B. Mukul**, Hook.; Stocks in Hooker's Journal of Botany, i. (1849) t. 8; Boissier Fl. Orient. ii. 3.—Vern. *Gūgal*, Sindh.

Branches frequently spiniform; leaves generally approximate at the end of thick, short, tuberculate or woody branchlets, smooth and shining, obovate, almost sessile, the tapering base entire, the upper part shallow-toothed. On luxuriant shoots, the leaves are alternate, cuneate-obovate, rhomboid or oval, acute, deeply serrate, with a petiole, from the summit of which spring one or two lateral leaflets, smaller than the terminal leaflet, sometimes minute; young leaves, while in the bud, covered with glandular hairs, which soon drop off. Flowers small, subsessile, 2 or 3 together at the end of branchlets, unisexual. Males with ovary short and barren; females with short stamens and imperfect anthers. Calyx cylindrical, supported by 3 minute bracts, covered with glandular hairs; tube splitting as the ovary swells, remaining withered at the base of the fruit. Petals 4-5, strap-shaped, brownish red, tips curled back. Disc 8-10-toothed, bearing 8-10 filaments, alternately longer, the short filaments inserted in the sinus between the teeth, opposite to the petals. Stigma obscurely 2-lobed. Drupe red when ripe, ovate, acuminate, separating into 2 fleshy valves, leaving the nut enveloped by a 4-cleft yellow pulp (mesocarp), the lobes of which meet at the apex. Nuts ovoid, acute, readily splitting into two, each 1-celled. Drupes rarely 4-valved, 4 nuts, and 8-cleft pulp.

Abundant on rocky ground in Sindh, Kattiawar, at Deesa, in Beluchistan, and probably in Arabia. In Sindh it flowers in March and April; the leaves and young shoots appear in May. A small tree, 4-6 ft. high or more, generally a stunted bush, with thick-spreading branches. Trunk and branches knotty and crooked, with the ash-coloured bark coming off in rough flakes, leaving exposed the under bark, which is bright and shining, and peels off in rolls like thin paper. Wood light-coloured, even-grained, but soft and light, takes a fine polish. Dr Stocks gives the following account of the collection of the gum, which is known as Indian Bdellium:—

"In Sindh the Gogul is collected in the cold season by making incisions with a knife in the tree, and letting the resin fall on the ground. It exudes in large tears, soft and opaque, hardens, and turns brownish black very slowly; a single tree is said to yield from half to a whole seer. It is brought to the bazaars of Hyderabad and Kurrachee, where it sells at the rate of 2 Rs. the maund of 80 lb. (1849)."

Nearly related to it, and probably the same species, is a shrub which I found on rocky hills in Rajputana in Dec. 1869 and Jan. 1870, with old leaves and unripe fruit, near Kishengurh, N.E. of Ajmir, and near Bednore, S.W. of that city, in both places under the name of *Gūgal*, yielding a fragrant gum-resin. The leaves are deep-dentate, and have peculiar, round, whitish

vesiculate blotches, as if the epidermis had separated from the cellular tissue below. Specimens exactly corresponding with those collected by me in Rajputana are in the Kew Herb. from the Peninsula, apparently from the Bellary district. Madgen, Journ. As. Soc. xvii. pt. i. 404, also mentions a *Balsamodendron* from Rajputana. In the Supplement to the 'Bombay Flora,' by Dalzell and Gibson, a similar shrub is described from Khandeish, under the name of *B. Roxburghii*, probably the same plant. It is said there, p. 20: "The whole plant is aromatic, abounding in a viscid balsamic juice, which is exported in considerable quantities from Omrawuttee." This species will probably be found to be indigenous on arid, rocky hills throughout Rajputana and a great part of the Dekkan. However, in order to avoid the possibility of a mistake, the preceding description of *B. mukul* has been based exclusively upon Dr Stocks's paper, and the specimens collected in Sindh.

2. *B. pubescens*, Stocks l. c. t. 9; Boiss. Fl. Or. ii. 2.—Vern. *Bayi*, *hai*, Beluchistan.

A small tree or stunted shrub. Unarmed, pubescent; leaves trifoliate, on slender petioles longer than leaflets, terminal leaflet stalked, generally fasciated on short tuberculate branchlets, but alternate on vigorous shoots, and then often imparipinnate; leaflets ovate or obovate, entire. Petals red or white. Stamens equal. Drupe red, valves 2, each cleft half-way up from below; mesocarp orange-coloured, 4-toothed, not reaching to the apex of the nut.

Beluchistan, and hills which separate that country from Sindh, as far south as Karachi. The young shoots and buds are remarkably fragrant when bruised. In the cold season it yields a small quantity of tasteless, inodorous, brittle gum, almost entirely soluble in water. Fl. in March and April; leaves and young shoots appear in April and May.

3. *B. Berryi*, Arnott; Ann. of Nat. Hist. iii. 86 (1839).—Syn. *Protium Gileadense*, W. & A. Prodr. 177.

Most lateral branches terminating in thorns at right angles to main branch; leaves alternate or fasciated on short tubercular branchlets, trifoliate, on slender petioles; leaflets sessile, obovate, the terminal one twice as large as the lateral ones, glabrous, generally entire. Flowers subsessile, fasciated; calyx 3-4-cleft; petals 3-4. Disc small, bearing 6-8 stamens alternately smaller, the larger ones opposite to petals; in the male flowers stamens longer than calyx. Drupe oblong, apiculate.

A small or middle-sized tree in the dry forests east of the Nilgiris, and cultivated as a hedge-plant all over South India. The whole tree has a grateful fragrance.

B. Gileadense, Kunth = *B. Opobalsamum*, Kunth.—Oliver Fl. Trop. Africa i. 326; Boiss. l. c. 2,—believed to be one of the Myrrh-yielding species, is a small unarmed tree, with 3-5 leaflets, in Nubia and Arabia.

ORDER XXI. MELIACEÆ.

Trees and shrubs, with alternate, generally pinnate, leaves, without stipules. Flowers regular, small, bisexual, a large proportion sterile, in large panicles, frequently with determinate inflorescence. Calyx small,

4-5-cleft. Petals generally 4-5, free, rarely connate. Stamens generally double the number of petals, rarely 5; the filaments in most genera united into a tube, rarely free, inserted on the disc, or outside at its base; anthers 2-celled, dehiscing longitudinally, introrse. Disc annular, cup-shaped or tubular. Ovary free, 3-5-celled; style 1; ovules either 2 in each cell or numerous; placentation axile. Fruit various; seeds with or without albumen.—Gen. Pl. i. 327; Royle Ill. 139; Wight Ill. i. 145, 148. (Cedrelaceæ.)

Stamens united in a tube; ovules 1-2 in each cell.

Staminal tube cylindrical, 10-toothed, bearing 10 anthers at the top; petals erect 1. MELIA.

Staminal tube globular or campanulate, bearing 5-10 anthers on the inside; petals concave, connivent at the top 2. AMOORA.

Staminal tube cleft into 8-10 divisions, each bearing an anther; petals erect 3. HEYNEA.

Stamens united in a tube; ovules numerous.

Staminal tube urceolate, 10-toothed; seeds winged at the upper end, with a thin fleshy albumen 4. SWIETENIA.

Staminal tube cup-shaped, 10-cleft, each division 2-toothed; seeds winged at both ends; no albumen 5. SOYMIDA.

Stamens free, inserted on the disc.

Stamens 4-6, ovary 5-celled, capsule opening septifragally 6. CEDRELA.

Stamens 10; ovary 3-celled; capsule opening loculicidally 7. CHLOROXYLON.

Besides the trees here described, this family contains the Chittagong wood, *Chickassia tabularis*, Juss.; Bedd. Fl. Sylv. t. 9. A large tree of the hills of Eastern Bengal, Burma, and South India, with light-reddish wood, abruptly pinnate tomentose leaves, terminal panicles; staminal tube cylindrical, with 10 anthers on its edge; a woody 3-celled capsule, with numerous winged seeds.

1. MELIA, Linn.

Trees with alternate pinnate, bipinnate, or tripinnate leaves. Flowers white or purple, in large, branched panicles. Calyx 5-6-cleft, imbricate. Petals 5-6, linear-spathulate, convolute in bud. Stamens 10-12, monadelphous, edge of tube with 10-30 teeth; anthers inserted on the edge of the tube between the teeth, or within the tube below its mouth. Ovary 3-6-celled, surrounded at the base by the annular disc, continued into a cylindrical or filiform style, bearing a 3-6-lobed, deciduous stigma; ovules 2 in each cell. Fruit a fleshy or dry drupe, the putamen 1-5-celled, each cell containing 1 pendulous seed, with a crustaceous testa; albumen scanty or none; cotyledons foliaceous.

Leaves pinnate; flowers white; fruit 1-celled; endocarp cartilaginous 1. *M. indica*.

Leaves bipinnate; fruit 5-celled; endocarp osseous.

Leaflets serrate, with large, often unequal, teeth; staminal tube glabrous, purple, edge with 20-30 teeth as long as anthers 2. *M. Azedarach*.

Leaflets entire or crenate; staminal tube hairy, white, edge with an indefinite number of short subulate teeth, shorter than anthers 3. *M. composita*.

1. *M. indica*.*—Syn. *M. Azadirachta*, Linn.; Roxb. Fl. Ind. ii. 394; Bedd. Fl. Sylv. t. 13. *Azadirachta indica*, Juss.; Wight Ic. t. 17; W. & A. Prodr. 118. The *Neem tree*. Sans. *Nimba*; Pers. *Azād-dirakht*. Vern. *Nim*. Local names: *Betain*, Kamaon; *Limbo*, C.P.; *Nimuri*, Sindh.

Leaves imparipinnate, 9-15 in. long; leaflets 9-13, nearly opposite, shortly petiolate, 1-3 in. long, unequal-sided, ovate-lanceolate, sometimes falcate, deep and sharply serrate, acuminate, glabrous. Flowers white, with a strong smell of honey, especially at night, pentamerous, on short slender pedicels, with short scattered hairs, in large axillary panicles, shorter than leaf; bracts small, caducous. Calyx small, flat, with 5 rounded, obtuse segments. Petals spathulate, obliquely imbricate in bud. Anthers 10, linear, inserted opposite and below the teeth of the staminal tube. Ovary 3-celled. Drupe ovoid-oblong, size of an olive, smooth, dark purple when ripe; putamen cartilaginous, 1-celled, 1-seeded, reticulate outside.

A common tree throughout the greater part of India, as far west as the Sutlej; planted or self-sown, but (in N.W. India) nowhere really wild in the original forest. West of the Sutlej it is comparatively rare, and much smaller in size. Beyond the Jhelam it disappears altogether. Ascends to 5000 ft. in Kamaon. Never leafless; the fresh leaves issue in March and April before the old leaves fall. Flowers March-May; fruit ripens in July and August. Grows readily from seed; seedlings require shelter from frost in N.W. India; when cut, throws up abundant and vigorous coppice-shoots; growth fairly quick, 3-4 rings per in. radius.

A large tree, 40-50 ft. and higher, with a straight trunk, not long, attaining a girth of 6-9 ft., and a broad, rounded crown of dark-green foliage. Bark of trunk $\frac{1}{2}$ in. thick, inner substance reddish brown or yellow, outside grey, with scattered small tubercles between numerous dark longitudinal and oblique wrinkled furrows.

Sapwood yellowish white; heartwood red or brown, especially the inner part, compact, closer than that of *M. Azedarach*. The weight of unseasoned wood is 55-60 lb. (Skinner), that of seasoned wood 45-52 lb. per cub. ft. Value of P. 539 (Puckle), 587 (Cunningham), and 720 (Skinner). Somewhat resembles mahogany, takes a beautiful polish; in South India much employed for furniture. Fairly durable, bitter, so that white ants or other insects will not touch it. Used for construction, cart-building, shipbuilding, and agricultural implements. Held sacred by Hindus, and used for making idols.

From incisions in the trunk near the base, made in spring, issues a quantity of sap, often flowing for weeks; used as a stomachic and cooling drink. A gum, used as a stimulant, exudes from the bark. From the fruit is extracted, by boiling or pressure, a fixed, acrid, bitter oil (*margosa*), deep yellow, with strong disagreeable flavour. It is used medicinally, in dyeing, as an antiseptic and anthelmintic, and is burnt in lamps. It is said to be expressed from the pulp, and not from the seed. It is exported from Madras, chiefly to Ceylon. The seeds are employed to kill insects, and for washing the hair. The leaves are bitter, and are used medicinally; the bark is very bitter, and is used as a substitute for Peruvian bark (Pharm. Ind. 53).

* There is no sufficient ground for maintaining *Melia* and *Azadirachta* as distinct genera, and I follow the authors of the Gen. Plant. in reuniting them. But the Linnean names, *M. Azadirachta* for the *Nim*, and *M. Azedarach* for the *Bakain*, cannot remain side by side, as they are merely different modes of spelling the same word. This compels me to take Jussieu's specific name *indica*.

2. *M. Azedarach*, Linn.; Roxb. Fl. Ind. ii. 395; W. & A. Prodr. 117; Bedd. Fl. Sylv. t. 14. Boissier Fl. Orient. i. 954. *Persian Lilac*, *Bastard Cedar*, *Common bead-tree*.—Vern. *Drek, dek, jek, bakain, bukain, betain, deikna*, Pb., N.W.P. *Maha limbo, malla nim, muhli*, C.P.

Young parts and inflorescence covered with minute stellate hairs. Leaves bipinnate, 9-18 in. long, pinnae opposite or nearly so, with 3, 5, or 7 leaflets; leaflets ovate-lanceolate, shortly petiolulate, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, acuminate, more or less deeply serrate, sometimes lobed. Flowers generally pentamerous, lilac, with a strong honey-scent, on slender pedicels, in axillary panicles, shorter than leaf. Calyx deeply cleft; lobes oblong. Petals linear-spathulate, patent or reflexed. Staminal tube purple, $\frac{1}{4}$ in. long or more, with 20-30 linear teeth, as long as the anthers. Ovary 5-celled; stigma capitate, 5-sulcate. Drupe ovoid or globose, yellow when ripe, $\frac{1}{2}$ - $\frac{3}{4}$ in. diam.; rind tough; putamen thick, hard, 5-celled, 5-seeded, or with fewer cells and seeds by abortion.

Commonly cultivated throughout India. In the Panjab it replaces the Nim, being rare in the east, and abundant in the centre and west of that province. Stocks found it wild in Beluchistan, and it is believed to be indigenous in the Lower Himalaya and the Siwalik tract. Generally it is found as a cultivated tree, ascending in the Himalaya to 5800 ft. It is commonly cultivated in Afghanistan, Western Asia, South Europe, the West Indies, South America, Australia, China, and the Indian Archipelago. Bare of leaves for 3-4 months in the cold season, in full leaf and bloom from March-May; very handsome at that time. The bunches of yellow fruit ripen in autumn, and remain on the tree while it is leafless, untouched by animals, except the Bulbul (Madden). In that state the tree presents a curious appearance. Grows readily from seed and cuttings; does not require much water. Young plants are not touched by rats. Throws up vigorous coppice-shoots when felled; the roots are shallow, spreading near the surface, and the tree is readily blown over. Rate of growth moderately rapid; the concentric rings correspond to the age of the tree. Specimens of 6 $\frac{1}{2}$ in., 4 $\frac{1}{2}$ in., and 4 $\frac{3}{4}$ in. radius, showed respectively 22, 15, and 14 concentric rings.

A moderate-sized tree, 40 ft. high, and generally less, with a short, erect trunk, attaining a girth of 6-7 ft., generally hollow when larger, branches spreading into a large, broad crown. Bark of trunk $\frac{1}{2}$ in. thick, inner substance hard, brownish red, outside light and dark grey, with small oblong and white specks across, slight cracks, between long, deep, longitudinal, brown fissures, and shorter shallow ones across. The outer 3-4 rings are generally sapwood of yellowish colour; the heartwood is brownish, white, or often reddish, coarse-fibred, warps and splits, weighs only 30 lb. per cub. ft. (38-42 lb. unseasoned). Value of P. 596 (Skinner). The wood of old trees often handsomely marked, and used for furniture in the Peninsula. Bark extremely bitter; leaves and pulp of the fruit used in native medicine. From the fruit a fixed oil is extracted. The hard nuts are frequently strung as beads.

Melia sempervirens, Swartz., the *West Indian bead-tree*, Bot. Reg. t. 643; Grisebach, West Ind. Fl. 128,—is indigenous in Jamaica and Central America; but is almost certainly the same species as *M. Azedarach*. Roxb., l. c. 395, states that it is also a native of Persia, and that it is "a small delicate evergreen, of short duration compared with *M. Azedarach*, which is a robust deciduous timber-tree." Wight & Arnott (Prodr., 117) find no difference between the two species. In North America the root-bark of the tree enjoys considerable repute as an anthelmintic (Pharm. Ind. 55).

3. *M. composita*, Willd. ; W. & A. Prodr. 117 ; Bedd. Fl. Sylv. t. 12. —Syn. *M. superba*, Roxb. Fl. Ind. ii. 396 ; *M. robusta*, Roxb. l. c. ii. 397. Vern. *Eisur*, *limbarra*, *nimbarra*, Bomb.

A large and handsome tree of rapid growth, with a smooth, dark brown bark, and large, bi- or tri-pinnate leaves ; pinnæ 3-7-foliolate ; leaflets entire or crenate. Flowers white, fragrant. Young leaves, inflorescence, calyx, and petals densely covered with a mealy stellate pubescence. Staminal tube less than $\frac{1}{4}$ in. long, villous with long white hairs ; anthers inserted below the edge of the staminal column, which is divided into numerous small subulate teeth, shorter than the anthers. Drupes ovoid, of the size of a large olive, with a thick hard long putamen, 5-celled, or by abortion with fewer cells. The figure in Beddome's 'Flora Sylvatica' shows the anthers alternating with an equal number of teeth of the staminal tube. This I am unable to verify.

Western coast and Western Ghats. Burma, Malay peninsula. Indian Archipelago. Cultivated in gardens. Fl. Feb., April ; fr. Dec., Jan. Benth., Fl. Austr. i. 380, refers an Australian tree (Queensland, North Australia, New South Wales) to this species, and thinks that it scarcely differs from *M. Azedarach*.

2. AMOORA, Roxb.

Trees with imparipinnate leaves, and polygamous flowers, in spikes racemes or panicles. Calyx cup-shaped, or sepals distinct, 3-5. Petals 3-5, thick, concave, imbricate in bud. Staminal tube globose or campanulate ; anthers 6-10, sessile on the inside of the tube. Disc 0. Ovary 3-5-celled, ovules 1 or 2 in each cell. Capsule 3-4-celled ; cells 1-seeded. Seeds exalbuminous, with a fleshy arillus.

1. *A. Rohituka*, W. & A. Prodr. 119 ; Bedd. Fl. Sylv. t. 132. —Syn. *Andersonia Rohituka*, Roxb. Fl. Ind. ii. 213. Sans. *Rohituka*. Vern. *Sohāga*, Oudh ; *Harin harra*, or *Harin khana*, Hind. ; *Tikta-raj*, Beng.

Leaves coriaceous, glabrous, varying to 2 ft. long ; leaflets opposite, in 2-8 pairs, shortly petiolulate, ovate-lanceolate from unequal base, acuminate, entire. Flowers in spikes, small, white, nearly sessile, subtended by minute bracts ; male spikes paniculate ; bisexual spikes solitary or twin, supra-axillary. Calyx coriaceous, deeply cleft into 5 round obtuse lobes. Petals 3. Staminal tube globular, fleshy, white ; anthers 6, attached half-way up the tube. Ovary 3-celled ; stigma sessile, 3-lobed. Capsule pale yellow, soft and fleshy, obovoid, globose, or pyriform, 1 in. long, 3-celled, opening longitudinally by 3 valves from apex. Seeds solitary, with a chestnut-coloured, smooth, shining testa, surrounded by a scarlet arillus.

Oudh (only in moist ravines of the central and eastern part of the Gonda forests), Assam, Eastern Bengal, South India, along and near the Western Ghats. Ceylon. Evergreen ; fl. in July, August ; fruit ripens in the cold season. A moderate-sized tree, 30 ft. high, with a short, erect, straight trunk to 4 ft. in girth, with a close, shady, rounded head, somewhat resembling *Cedrela toona* in general appearance. Bark thick, wood reddish brown, medullary rays very numerous, fine, pores large. In Bengal, oil is extracted from the seeds.

3. **HEYNEA**, Roxb.

Trees with imparipinnate leaves; leaflets opposite, petiolulate; common petiole articulate. Flowers bisexual, cymose, on axillary panicles; peduncles and pedicels articulate. Calyx small, 4-5-cleft. Petals 4-5, erect, imbricate. Staminal tube deeply 8-10-cleft, divisions linear, sharply 2-toothed at the top, and bearing an anther between the teeth. Ovary 2-3-celled, immersed in the fleshy disc; style short, clavate, with a fleshy ring at the top; ovules 2 in each cell, collateral. Capsule fleshy, 1-celled, 2-valved, 1-seeded. Seed without albumen, enclosed in an arillus, the radicle pointing upwards.

1. *H. trijuga*, Roxb. Cor. Pl. t. 260; Fl. Ind. ii. 390.—Vern. *Yakūshi*, Nepal. *Limbara*, Bomb.

Leaflets ovate-oblong, acuminate, glabrous, 2-4 pair, 4-8 in. long. Panicles corymbose, on long common peduncles. Bracts minute, caducous. Flowers numerous, small, white, pentamerous. Petals linear-oblong. Long hairs on both sides of staminal column; anthers 10, nearly sessile, between 2 subulate teeth nearly as long as anthers. Ovary 2-celled; style below stigma surrounded by a distinct fleshy ring. Capsule round, size of a small cherry, opening into 2 broad, oblong valves. Seed 1, round, invested in a complete, thin, white arillus; testa orange when fresh, chestnut-coloured afterwards; cotyledons hemispherical.

Oudh forests, Nepal, Bhutan, the Kasia hills, and west side of the peninsula. The old leaves are shed in March, and the fresh foliage appears soon afterwards. Fl. in Feb., March; fruit ripens Oct.-Feb. A moderate-sized tree, 30 ft. high, with an erect trunk, attaining a girth of 5 ft.; few spreading branches, forming a round crown. Bark of trunk dark ash-coloured. Bark and leaves are bitter, and contain an adstringent substance.

Closely allied to this species, and possibly not different from it, is *H. affinis*, Juss.; Bedd. Fl. Sylv. t. 134; from the western mountains of South India.

4. **SWIETENIA**, Linn.

1. *S. Mahagoni*, Linn.; Hook. Bot. Miscell. i. t. 16, 17. *Mahogany*.

A large tree, with abruptly pinnate, smooth, coriaceous leaves; leaflets opposite, on short petiolules, ovate, unequal-sided. Panicles axillary, pendulous, branches and pedicels slender. Flowers small, pale-greenish white, pentamerous. Petals patent, oblong. Staminal tube urceolate, 10-toothed; anthers alternating with the teeth. Disc annular, surrounding the base of the 5-celled ovary, with a short thick style and a flat discoid stigma. Capsule ovoid, 3-6 in. long, opening septically into 5 valves, leaving a large pentagonal axis in the centre. Seeds flat, attached to the top of the axis, with a long wing at the upper end; albumen thin, enclosing the flat foliaceous cotyledons.

A native of Central America and the West Indies; has been cultivated successfully near Calcutta and in Sikkim, and is grown as far north as Saharanpur. Fl. April. The excellent qualities of mahogany as a furniture-wood are well known; it is also used for shipbuilding. Heartwood large, reddish brown, very

durable. The weight of Spanish, West India, and Honduras mahogany (seasoned), varies from 35 to 55 lb., and the value of P. from 425 to 637. The quality of the wood of trees grown at the Botanical Garden, Calcutta, and blown down by the cyclones of 1864 and 1867, was found excellent. In Bengal the tree has rapid growth, and bears seed, though sparingly. About 40,000 tons annually are imported into Great Britain from Honduras, Jamaica, and St Domingo.

5. SOYMIDA, A. Juss.

Trees, with bitter bark and paripinnate leaves. Flowers bisexual, pentamerous. Petals contorted in bud. Staminal tube cup-shaped, short, 10-cleft, each division with 2 short, fleshy teeth, the anther between them on a short filament. Ovary 5-celled, narrowed into a short style, with a broad fleshy stigma; ovules numerous in each cell. Capsule woody, 5-celled, 5-valved, opening septifragally, the valves separating from the dissepiments, which remain attached to the axis. Seeds numerous in each cell, imbricated, with long wings above and below; cotyledons foliaceous, auriculate at base, the radicle pointing upwards.

1. *S. febrifuga*, Juss.; Bedd. Fl. Sylv. t. 8; W. & A. Prodr. 122.—Syn. *Swietenia febrifuga*, Willd.; Roxb. Fl. Ind. ii. 398; Cor. Pl. t. 17. *Bastard cedar*, *Indian red wood*.—Vern. *Rohan*, *rohun*, *rohin*, *rohni*, *rohini*, *soymida*.

Glabrous; leaves abruptly pinnate, 9-12 in. long; common petiole with a thickened base; leaflets opposite, 3-6 pair, on short petiolules, oblong from oblique base, obtuse, 2-4 in. long. Panicles terminal, the main branches (in reality panicles from the axils of abortive, uppermost leaves) starting at acute angles from axis, the secondary branches at right angles; pedicels short; flowers greenish white. Bracts triangular. Calyx deeply 5-cleft; segments broad, obtuse. Petals obovate, narrowed into a claw. Capsule smooth, black when ripe, 1-2 in. long.

Common in the forests of Central India. Its northernmost known points are the forests of the Banswara State, in Rajputana, near the Mhiye river, and the hills south of Mirzapur. As far as is known at present, the range of the tree does not extend beyond the 25th degree of N. lat. It is an important tree in the dry forests of the Central Provinces and many parts of the peninsula. Nearly evergreen. The young foliage issues in April and May, while part of the old leaves are still on the tree. Fl. in April and May; seed ripens, and is shed in July and August.

A large tree, 70-80 ft., with a tall, symmetrical, straight trunk, attaining a girth of 7-8 ft., with a large, rounded, dense head of numerous branches. Bark of trunk dusky, very rough, exfoliating in large plates or scales. Heart-wood distinct, bright red when fresh-cut, dark reddish brown when dry, close, straight-grained, and strong. Its weight, when seasoned, varies between 60 and 70 lb. per cub. ft., green 80-85 lb., P. 1024 (Skinner). Durable underground; not much attacked by white ants. Easily worked and planed, takes a fine polish, and being of a handsome grain and colour, seems well adapted for ornamental furniture. Held sacred by Hindus in parts of South India. Employed for construction, well-work; ploughshares are made of it, and pestles and pounders for oil-seeds. The bark is bitter, and has been used as a substitute

for Cinchona bark. Mr Broughton reports that the bitter substance has the properties of a resin (Pharm. Ind. 55).

6. CEDRELA, Linn.

Trees with pinnate leaves, and small, paniculate, bisexual flowers. Calyx small, 5-cleft. Petals 5, erect, with a prominent thick line inside at the base like a keel, imbricate contorted or valvate at the base. Disc thick, fleshy, 5-cleft, or cylindrical. Filaments 4-6, inserted on the edge of the disc, subulate; anthers oblong, versatile, occasionally with alternate sterile filaments. Ovary 5-celled, narrowed into a style, with a broad stigma; ovules 8-12 in each cell, biserial, pendulous. Capsule coriaceous or membranous, opening septifragally by 5 valves, the valves separating from the dissepiments, which remain attached to the axis, forming a pentagonal column of soft pith. Seeds numerous, pendulous, flat, imbricate, winged, with a scanty albumen, and straight embryo with foliaceous cotyledons, the radicle pointing upwards.

- | | |
|--|------------------------|
| Flower-panicles as long as leaves, or shorter; leaflets generally entire; no sterile filaments; seeds winged at both ends | 1. <i>C. Toona</i> . |
| Flower-panicles longer than leaves; leaflets serrate; sterile filaments alternating with stamens; seeds winged at the upper end only | 2. <i>C. serrata</i> . |

The West-Indian Cedar, *Cedrela odorata*, Linn., furnishes a beautiful wood for cabinet-work.

1. *C. Toona*, Roxb.—Tab. XIV.—Pl. Cor. t. 238; Fl. Ind. i. 635; W. & A. 124; Wight Ic. t. 161; Bedd. Fl. Sylv. t. 10. *The Toon-tree*. Sans. *Tunna*, *kuberaka*, *kachla*.—Vern. *Tūn*, *tūni*, *tūni*, *tūni*, *maha limbo*, *maha nīm*. Local names, *Māhlun*, Satpuras; *Drawi*, *chiti-sirin*, Pb.

Leaves abruptly pinnate, 12-18 in. long, glabrous; leaflets generally opposite, 10-20, petiolulate, lanceolate or ovate-lanceolate, acuminate, entire or slightly undulate (toothed in South India). Panicles terminal, pubescent, nearly as long as leaves, pendulous, the lower ramifications frequently in the axils of leaves. Flowers white, with a fragrance like honey. Calyx flat, 5-cleft, lobes ciliate, obtuse. Petals oblong, ciliate. Stamens 5, inserted on 5 fleshy, orange-coloured, hairy lobes of the disc; sterile filaments none. Stigma peltate, 5-lobed. Capsule oblong, $\frac{3}{4}$ -1 in. long, seeds with membranous wings at both ends.

Indigenous in the forests of South India, particularly on the west side, in Burma, Bengal, Oudh, and in the sub-Himalayan tract, nearly to the Indus, ascending to 3000 ft., and at times higher. Cultivated throughout India. Evergreen, or nearly so. The old leaves are shed gradually during the cold season, and the young foliage comes out in March and April with the flowers. The seed ripens June, July, the empty capsules remaining on the tree for months. Toon is a rapid grower. In 1863, I measured the following trees on the Eastern Jumna Canal above Saharanpur:—

Age 30 years,	girth 58 inches,	mean of 6 trees.
" 35 "	" 86 "	mean of 5 trees.

It requires, however, a rich soil and much moisture. In the Panjab plains

(Lahore and Amritsar) it requires shelter against frost while young, but grows freely afterwards.

Attains 60-70 ft. under favourable circumstances, with an erect, symmetrical but not tall trunk, 6-10 ft. girth (instances of 15-30 ft. girths are known). Branches numerous, forming a large, close, shady crown. Bark thin, $\frac{1}{4}$ in. thick, dark grey, exfoliating when old with irregular, woody scales.

The sapwood is whitish, the heartwood red, or reddish brown, light, even-textured, open-grained, not strong, seasons readily, is easily worked, and polishes well, somewhat fragrant when sawn or broken. Annual rings distinct, pores large, close together in the inner wood of each ring, scarce in the outer wood. A cub. ft. of seasoned Toon weighs between 29 and 36 lb., and the value of P. fluctuates between 420 and 560. Baker's experiments with wood from Chitlagong gives the weight between 34.6 and 45.9 lb., and the value of P. from 413 to 633; but this was probably not Toon, but *Chickrassia tabularis*, which is a somewhat heavier and stronger wood (weight 42 lb., P. = 614, Skinner). Highly valued as a furniture-wood, used for door-panels and carving. In Kangra was reckoned as a royal (padshahi) wood. In some parts of the hills the young shoots and leaves are lopped as cattle-fodder. The bark is a powerful astringent (Pharm. Ind. 55), and from the flowers a red or yellowish dye is made.

Benth. (Fl. Aust. ii. 387) identifies the Red Cedar of New South Wales and Queensland (*C. australis*, F. Mueller) with *C. Toona*.

2. *C. serrata*, Royle Ill. t. 25.—Vern. *Drab, drawi, dor, dūnri, deri, khishīng, dhal, dal, dala, dalli, daral, darlu*, N.W. Him.

Leaves usually imparipinnate, 15-20 in. long, glabrous; leaflets opposite, 15-25, on short petiolules, lanceolate or ovate-lanceolate, acuminate, serrate, teeth long and irregular, green above, glaucous beneath. Panicles terminal, large, longer than leaves, drooping; ramifications and pedicels covered with short rusty pubescence. Flowers occasionally hexamerous. Calyx cup-shaped; lobes ciliate or glabrous, obtuse. Petals oblong, not ciliate; disc glabrous. Sterile filaments alternating with stamens. Capsule ovoid, acute; seeds with a wing at the upper end only.

Valleys of the Himalaya, extending to the Indus, and ascending to 8000 ft., in moist, shady places. Often associated with *Sapindus*. Attains 70 ft., and 6 ft. girth, resembling *C. Toona* in appearance. The fresh foliage comes out in May, about the time that the old leaves are shed. The great clusters of flowers appear in May and June, and the seed ripens in August.

Sapwood whitish yellow, heartwood red, has on the Sutlej the smell of the pencil-cedar when fresh-cut, at times said to have a strong fetid smell. The wood is lighter-coloured, and more open in the grain, than that of the Toon, but much like it in appearance. The hoops of sieves are made of it; it is also used for bridges. Shoots and leaves are lopped for cattle-fodder.

7. *CHLOROXYLON*, DC.

A tree with abruptly pinnate leaves, and small paniculate, bisexual flowers. Calyx small, 5-cleft. Petals 5, spreading, clawed, imbricate. Disc thick, fleshy, 10-lobed. Stamens 10, inserted outside the base of the disc; anthers cordate, apiculate, versatile. Ovary immersed in the disc, 3-celled; style short; ovules 8 in each cell, axile. Capsule oblong, coriaceous, 3-celled, loculicidally 3-valved, the dissepiments remaining attached

to the middle of the valves. Seeds attached to edge of dissepiments, imbricate, oblong, winged; no albumen; cotyledons plano-convex.

1. *C. Swietenia*, DC.; Bedd. Fl. Sylv. t. 11; W. & A. Prodr. 123.—Syn. *Swietenia chloroxylon*, Roxb. Cor. t. 64; Fl. Ind. ii. 400. *Satin-wood*. Vern. *Bhirra*, *bihra*, *giryra*, C.P.; *Billu*, *hulda*, Bomb. :

Young parts, petioles, and inflorescence covered with short grey pubescence. Leaflets 20-40, shortly petiolulate, unequal-sided, obliquely-oblong or semicordate, almost falcate, obtuse, about 1 in. long, glabrous, pale and dotted beneath. Panicles terminal and axillary; pedicels longer than flowers; bracts small, deciduous. Petals on short claws, obovate, obtuse, entire. Stamens nearly as long as petals, 5 generally shorter. Ovary covered with short white tomentum. Capsule 1 in. long, glabrous, dark brown when ripe. Seeds brown, angular, with broad wing at one end.

A common tree in the Satpura range, the Dekkan, the Konkan, and the drier parts of the peninsula and Ceylon. The fresh foliage appears in May, about the time that old leaves fall. Fl. March, April; the seed ripens in June, and remains on the tree for several months.

A small tree in Central India, in South India attaining 30-40 ft.; trunk straight, symmetrical. Bark yellow, soft, corky, $\frac{1}{2}$ in. thick or more. Heart-wood, with a beautiful satin lustre, fragrant, when seasoned greenish white, with a yellow tinge, or yellow, mottled, and feathered, close-grained. Heavy, the cub. ft. weighs 51-66 lb. when seasoned, and 70-75 lb. when green. The value of P. has been found to fluctuate between 600 and 1059, and the average may be taken at 800. Has been compared to box, not found suited for engraving, but is excellent for turning. Employed for agricultural implements, cart-building, makes beautiful furniture, and picture-frames. Imported into England, used for cabinet-work and the backs of brushes.

ORDER XXII. OLACINÆÆ.

Trees or shrubs, with alternate simple exstipulate leaves. Flowers 4-5-merous, uni- or bi-sexual, usually rather small. Calyx small, entire, or toothed, occasionally obsolete, unchanged or enlarged after flowering. Petals free or more or less connate, usually valvate. Stamens as many, or twice as many, as petals, free and hypogynous, or united below to the petals. Ovary free or partially immersed in the torus; 1-celled or incompletely 3-5-celled; ovules solitary or in pairs, pendulous. Fruit 1-celled, 1-seeded, indehiscent. Seed usually with copious albumen and a minute embryo.—Gen. Pl. i. 342; Royle Ill. 128; Wight Ill. i. 100.

Stamens and staminodes more numerous than petals; calyx enlarging.

Stamens all antheriferous, as many as petals; calyx minute, unchanged.

1. OLAX.

2. CANSJERA.

1. OLAX, Linn.

Shrubs or small trees, with alternate leaves, and small flowers. Calyx cup-shaped, enlarging after flowering (in the following species). Petals 5-6, free or slightly connected by alternating filaments. Stamens 8-12, of which only 3-5 are antheriferous, the anantherous ones opposite to the

petals. Ovary free, 1-celled or with 3 imperfect cells, each with 1 ovule. Fruit drupaceous. Seed albuminous.

1. *O. scandens*, Roxb. Corom. Pl. t. 102; Fl. Ind. i. 163; W. & A. Prodr. 89.

A powerful climber, a few stout thorns on the older branches; branchlets, petioles, and midrib pubescent. Leaves distichous, alternate, ovate-oblong, shortly petiolate, 2-3 in. long. Flowers white, scentless, in short axillary racemes. Drupe globose, 1-seeded, $\frac{1}{8}$ in. diam., yellow, fleshy, more than half enclosed in the enlarged calyx.

South India, Ceylon, Burma, Behar, Satpura range, sub-Himalayan tract of Kamaon. On wet ground near rivers and ravines. Most destructive to trees, which it covers with its dense-spreading, dark-green foliage. Bark ash-grey. Fl. cold season.

O. nana, Wall., is a small undershrub with subsessile lanceolate leaves and solitary axillary flowers on slender peduncles. N.W. India, ascending to 5000 ft.

2. CANSJERA, Juss.

Climbing shrubs, with entire, alternate leaves, and small bisexual flowers in axillary spikes. Calyx minute. Corolla gamopetalous, 4-lobed. Stamens 4, opposite to the petals, and somewhat adnate to them; 4 hypogynous scales, alternate with the stamens. Ovary fleshy, 1-celled, with 1 ovule. Fruit a drupe, with a crustaceous endocarp. Seed ovoid; embryo minute in the axis of a fleshy albumen.

1. *C. Rheedii*, Gmelin.; Wight Ic. t. 1861.—Syn. *C. scandens*, Roxb. Cor. Pl. t. 103; Fl. Ind. i. 441.

A large evergreen climbing shrub, armed with a few stout scattered spines; young branches, inflorescence, and petioles minutely pubescent. Leaves ovate-lanceolate, $1\frac{1}{2}$ -3 in. long, short-petioled, glabrous, thick and somewhat fleshy, rugose when dry; main lateral nerves 3-5 pair, obliquely arching, the middle pair nearly meeting at the apex of leaf. Flowers sessile, yellow, in short axillary spikes. Corolla campanulate. Fruit orange-red, ovoid, about $\frac{1}{2}$ in. long.

South India, western coast, Oudh forests (common in damp, well-wooded places). Fl. Sept.-March; fr. April.

ORDER XXIII. ILICINÆÆ.

Trees or shrubs, generally evergreen, with alternate, simple, petiolate, glabrous leaves, exstipulate, or with minute, caducous stipules, and with small white flowers. Calyx imbricate in bud, 3-6-cleft, persistent. Petals 4-5, free or connate at the base, deciduous, imbricate in bud. Stamens as many as petals, alternating with them, hypogynous, free or adhering to petals, filaments subulate; anthers 2-celled, introrse, dehiscing longitudinally. Disc 0. Ovary free, 3-5- (rarely more) -celled, with a short style or sessile stigma. Ovules pendulous, 1 or 2 in each cell. Fruit a drupe, with 3 or more 1-seeded, free or connate stones. Seed with a membranous testa, fleshy albumen, and a minute straight embryo.—Gen. Pl. i. 355; Royle Ill. 166 (under Celastrinæ); Wight Ill. ii. 147.

1. ILEX, Linn.

Flowers generally bisexual. Calyx small, 4-5-parted. Corolla rotate, 4, rarely 5-6-parted, divisions obtuse. Stamens adhering to base of corolla; anthers oblong. Ovary sessile, 4-6-celled. Drupe globose, with 4-8 stones, more or less distinct.

Leaves coriaceous, generally serrate, with strong spinescent teeth;

flowers bisexual, tetramerous; drupe generally with 2 stones

1. *I. dippyrena*.

Leaves membranous, entire; flowers bisexual, pentamerous; drupe with 5 stones

2. *I. exsulca*.

Leaves coriaceous, crenulate; flowers unisexual, tetramerous; drupe with 4 stones

3. *I. odorata*.

To this genus belong the common English Holly, *Ilex Aquifolium*, L., a slow-growing shrub or small tree in the forests of western and southern Europe, from Norway to Turkey, on the Caucasus, and in Western Asia; stands deep shade, and produces a hard homogeneous wood. Also *Ilex paraguayensis*, the leaves of which yield the *Mati*, or Paraguay tea.

1. *I. dippyrena*, Wall.—Tab. XV.—Roxb. Fl. Ind., ed. Carey, i. 473; Wall. Pl. As. rar. t. 292. *Himalayan Holly*.—Vern. *Shangala*, *kandla*, *kandlar*, *kalūcho*, *krucho*, *diusa*, *dodru*, *drūnda*, Pb.; *Kaula*, Nepal.

Extremities and pedicels pilose, leaves glabrous. Leaves coriaceous, shining, ovate or ovate-lanceolate, on short channelled petioles, some quite entire, but generally bordered with large, strong prickly teeth. Flowers tetramerous, bisexual, on short pedicels, with 2 small bracts, clustered in axillary rounded fascicles. Petals broadly ovate, obtuse. Stamens as long as petals. Ovary small, stigma sessile, obscurely 2-lobed. Drupe crowned with persistent base of style, red when ripe, dark brown when dry, globose, $\frac{1}{8}$ inch across. Stones 2, sometimes 3-4, irregularly furrowed and rugose outside.

Himalaya, from the Indus to Bhutan, between 5000 and 9500 ft. Not quite hardy in England. Fl. Apr.-June; fr. Aug.-Oct. A moderate-sized evergreen tree, 30-40 ft. high, with a straight symmetrical trunk, attaining a large girth. Madden records one of 16-17 ft. near Naini-Tal. Numerous branches, forming a dense oval crown. Bark of stem and larger branches greenish grey, smooth, slightly marked, with long shallow longitudinal, and short small transverse wrinkles. Foliage shining, dark green. Wood light-coloured, heavy, close and hard, with distinct medullary rays.

2. *I. exsulca*, Wall.—Syn. *Ehretia umbellulata*, Wall., and *Cassine excelsa*, Wall. in Roxb. Fl. Ind., ed. Carey, i. 344 and 376. Sometimes called *Ilex excelsa*. Vern. *Tūmari*, N.W.P.

Leaves membranous, ovate, acuminate, entire, glabrous, on petioles $\frac{1}{2}$ in. to 1 in. long, with minute, caducous stipules. Flowers bisexual, generally pentamerous, small, greenish white, fragrant, in axillary umbellate cymes, on a common pilose peduncle, varying in length, with small bracts at the base of pedicels. Petals spreading, then recurved. Stamens longer than petals. Stigma sessile, 4-5-lobed. Drupe globose, $\frac{1}{8}$ in. across, with five 3-sided stones.

Siwalik tract, and outer ranges of Himalaya, ascending to 6000 ft., from the Junna to Assam, Kasia hills, and Malayan peninsula. Evergreen; blooms

March-August; fruit ripens October. In Kamaon a large-sized shrub. In Nepal, Wallich states that it grows to be a stately tree, with numerous spreading branches, forming a large crown. Bark of stem pale cinereous, dark grey, or brownish, with callous dots.

3. *I. odorata*, Hamilton; Don Prodr. Fl. Nepalensis, p. 189.

Glabrous; leaves coriaceous, on short sulcate petioles, oblong or oblong-lanceolate, acuminate, 4-8 in. long, crenulate; stipules minute, caducous. Flowers tetramerous, unisexual, crowded on short axillary cymose panicles, often 2 or 3 together; bracts small, at the base of pedicels. Stamens as long as, or longer than, petals. Stigma sessile, 4-lobed. Drupe ovoid, $\frac{1}{4}$ in. long, black, with 4 stones.

An evergreen tree in the outer ranges of the Himalaya, ascending to 6000 ft., from the Sutlej to Sikkim. Fl. in April; the fruit ripens in June.

ORDER XXIV. CELASTRINEÆ.

Trees or shrubs, with simple, alternate or opposite, generally coriaceous leaves; stipules none minute or early deciduous. Flowers small, inflorescence generally cymose. Calyx small, 4-5-cleft, imbricate. Petals 4-5, spreading, not clawed, inserted on the disc, imbricate. Stamens 3-5, inserted on the disc, alternate with the petals; filaments short, subulate; anthers short, 2-celled, dehiscing longitudinally. Disc large, surrounding the base of the 3-5-celled ovary. Ovules generally 2 in each cell; style short. Fruit various; embryo straight; radicle nearly always inferior.—Gen. Pl. i. 357; Royle Ill. 166; Wight Ill. i. 174.

Capsule 2-5-celled, dehiscing loculicidally; stamens 4-5; seeds albuminous.

- | | |
|---|-----------------|
| Capsule 3-5-valved; leaves opposite | 1. EUONYMUS. |
| Capsule 2-3-valved; leaves alternate | 2. CELASTRUS. |
| Fruit indehiscent; leaves opposite; seeds albuminous | 3. ELÆODENDRON. |
| Capsule 1-celled, 2-valved, laterally compressed; leaves opposite; stamens 3; seeds without albumen | 4. HIPPOCRATEA. |

1. EUONYMUS, Linn.

Trees or shrubs, with opposite leaves and deciduous stipules. Flowers bisexual, in axillary cymes. Calyx flat, 4-6-cleft. Petals 4-6, stamens as many, both inserted on a broad, fleshy, 4-6-lobed disc. Ovary immersed in disc, 3-5-celled; style short. Capsule 3-5-lobed and-celled, angled or winged, dehiscence loculicidal; cells 1-2-seeded. Seeds more or less enclosed in a fleshy arillus,* with a straight embryo enclosed in oily albumen.

Capsules smooth or rough, without prickles.

Leaves membranous; cymes with small, numerous flowers.

- | | |
|--|------------------------------|
| Capsules 4-lobed, not winged | 1. <i>E. Hamiltonianus</i> . |
| Capsules with 4 long tapering wings | 2. <i>E. lacerus</i> . |
| Leaves coriaceous; flowers more than $\frac{1}{2}$ in. across. | |
| Capsules more or less winged; seeds enclosed in arillus | 3. <i>E. pendulus</i> . |
| Capsules not winged, arillus cup-shaped | 4. <i>E. tingens</i> . |
| Capsules covered with numerous subulate prickles | 5. <i>E. echinatus</i> . |

* The arillus of *Euonymus* is sometimes called arillode, not being an enlargement of the funicle, but an excrescence of the outer coat of the ovule near the foramen.

Closely allied to *E. Hamiltonianus* is *E. europæus*, L., the *Spindle-tree*, a common European shrub, also found in North Africa and West Siberia, with 4-angled green twigs, greenish-white flowers, and 4-lobed crimson capsules. Wood used for turning, and to make charcoal for the finer sorts of gunpowder.

1. *E. Hamiltonianus*, Wall.—Tab. XVI.—Wall. in Roxb. Fl. Ind., ed. Carey, ii. 403.—Syn. *E. atropurpureus*, Roxb. Fl. Ind. i. 627. Vern. *Singi, siki, chual, watal, papar, rithu, ranāi, brahmāni, banchor, karūn, shioch, sidhera*, Pb.; *Agniūn, agnu*, Kamaon.

Branches and branchlets round, glabrous, green. Leaves 2-5 in. long, glabrous, membranous, oblong-lanceolate, finely serrulate, acuminate, on petioles about $\frac{1}{3}$ or $\frac{1}{2}$ in. long. Cymes regularly dichotomous, axillary and intra-axillary, opposite, occasionally clustered on undeveloped branchlets, with 15-30 greenish-white flowers; bracts minute, deciduous. Petals oblong, obtuse. Stamens shorter than, or as long as, petals. Capsule yellow, deeply 4-lobed, not winged; seeds entirely enveloped by a scarlet arillus.

Common in the Outer Himalayan ranges from the Indus to Bhutan, between 3800 and 8500 ft. Kasia hills. Generally in mixed forests, where there is some shade. Fl. from March-June; the fruit ripens from Aug. onwards. Hardy in England. A large shrub, under favourable circumstances a moderate-sized tree, 30-35 ft. high, with a short straight trunk, 4-5 ft. girth; bark of stem smooth, yellowish cinereous, or reddish brown. Wood beautifully white, compact and close, not very hard, used for making spoons. Young shoots and leaves lopped for fodder.

2. *E. lacerus*, Ham.—Syn. *E. fimbriatus*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 408. Vern. *Siki, battali, pattali, bancher, dudhapar, papar, hanchu, pash, mara, chikan, rang chul, kioch*, Pb.

Young shoots of the current year compressed alternately in either direction; branches round, glabrous, grey or reddish-brown. Leaves 2-4 in. long, glabrous, membranous, elliptic or broadly ovate, shortly acuminate, serrate, serratures frequently serrulate, decurrent into petioles about $\frac{1}{3}$ in. long; stipules minute, linear, deciduous. Cymes umbelliform, on long slender peduncles; main branches 3-7, slender, each bearing a simple or compound umbellate fascicle of small flowers. Bracts linear, deciduous. Cymes inserted near the base of this year's branchlets, most below the first leaf, a few in the axils of the lower leaves. Flowers small, tetramerous. Petals white. Anthers on short filaments. Capsule with 2-5, generally 4, vertical, long tapering wings, the valves when ripe spreading out flat when opening. Seeds ovoid, enclosed in a bright red arillus.

In many parts of the Himalaya, but not common. At higher elevations than the preceding species, generally between 6000 and 11,000 ft. from near the Indus to Sikkim. Open places in forests. Fl. from March-June; fruit ripens from July-Oct. A small, handsome tree, 25 ft. high, with a short straight trunk to 3 ft. girth; bark of stem grey, or brownish grey, smooth, and with slight longitudinal wrinkles. Foliage dark green, red in autumn before falling. The wood is white, close-grained, and tough; it is carved into spoons. Young shoots and leaves are lopped to feed goats. In Bussahir the seeds with their bright red arils are strung up and used as ornaments.

3. *E. pendulus*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 406. Sometimes called *E. japonicus*.—Vern. *Chopra*, *pincho*, *garur*, *kūnku*, N.W.P.

Young twigs angular or compressed; leaves 2-4 in. long, oblong-lanceolate, coriaceous, glabrous, pale, often cinereous beneath, sharply serrate; petioles sulcate, less than $\frac{1}{2}$ in. long; stipules minute, with a few long hairs. Cymes axillary, opposite, with 3-20 flowers, on peduncles 2 in. long, often flat, sulcate, regularly dichotomous, or bearing 3 or more branches. Bracts ovate, lacerate. Flowers tetramerous, rarely pentamerous, $\frac{1}{2}$ in. across. Calyx-lobes obtuse, fimbriate. Petals whitish, oblong, fimbriate. Stamens nearly as long as petals; anthers ovate, short. Style short, filiform. Capsule 3- or 4-lobed, the angles sharp, more or less winged; seeds enclosed in a thin arillus.

Locally (nowhere common) in the Himalaya between 2500 and 7500 ft., rarely ascending to 8500 ft., from the Jhelam to Nepal and further east. Fl. in April and May; the fruit ripens in June and July. A small, elegant tree, to 40 ft. high, with a short straight trunk, $2\frac{1}{2}$ ft. girth; numerous branches ascending and spreading; the ultimate branchlets drooping, forming an oval crown. Bark of trunk dark grey, brownish, or yellow, scabrous and longitudinally rugose. Young foliage brown and shining; old, dull grey.

4. *E. tingens*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 406.—Vern. *Kungku*, N.W.P.; *Newar*, *Kasūri*, Nepal.

Branchlets indistinctly 4-sided; scales of buds lanceolate, fimbriate. Leaves 1-2 in. long, glabrous, coriaceous, ovate or ovate-lanceolate, obtusely serrate or crenate, acute or shortly acuminate, on short petioles, with brown subulate, fimbriate stipules. Cymes axillary, approximate, in pairs at the base of this year's branchlets; peduncles varying in length, the longest 2 in., with regular dichotomous cymes of 3-7 large flowers $\frac{1}{2}$ in. across, pentamerous or tetramerous, with linear-lanceolate, fimbriate bracts. Divisions of calyx broadly ovate, irregularly dentate or fimbriate. Petals orbicular, shortly unguiculate, white or yellowish, beautifully marked with dark purple veins. Stamens a little shorter than petals; anther-cells diverging, attached to a horseshoe-shaped connective. Style subulate, as long as stamens. Capsule 3-4- or 5-cornered, not winged; seeds oblong, with a cup-shaped arillus.

Himalaya, from 6500-10,000 ft., from the Sutlej to Nepal. Fl. from April-June, the fruit ripening in August and Sept. A small tree, to 20 ft. high, with a short, erect, symmetrical trunk, $2\frac{1}{2}$ -3 ft. girth; few branches, forming a small, rounded crown. Bark dark cinereous, or yellowish brown, with numerous yellow tubercles, and whitish longitudinal cracks and wrinkles, inner substance brown, with fine white fibres. Wood light brown, fine-grained, compact and hard, not porous, with fine indistinct medullary rays. Wallich states that the Nepalese employ the bark for the purpose of marking the forehead.

E. grandiflorus, Wall. Pl. As. rar. t. 254, may possibly be synonymous with this species; but the figure represents the capsule as ovoid, and does not show the dark veins of petals, and the figure is supported by the description of *E. grandiflorus* in Fl. Ind., ed. Carey, 404.

5. *E. echinatus*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 410.

Branchlets tetragonal, with 4 thick lines, decurrent from either side of the petioles; scales of buds brown, fimbriate, often persistent at the base of the current year's shoots. Leaves 2-3 in. long, decurrent into short petioles, coriaceous, oblong-lanceolate, crenate or obtusely serrate, with minute stipules. Cymes axillary, shorter than leaves, with 3-10 tetramerous, peagreen, scentless flowers; bracts small, triangular, fimbriate. Capsules globose, $\frac{1}{3}$ in. across, beset with numerous subulate prickles, 4-valved, with 4 ovoid seeds, entirely enveloped in a thin, scarlet arillus.

In many parts of the Himalaya range, between 7000 and 12,000 ft., from the Jhelam to Sikkim. Fl. in March and April; fruit ripens about August, and often remains several months hanging on the branches. Most frequently a large shrub, stem and branches often climbing and trailing like ivy to a considerable distance over trees and damp shaded rocks, attaching itself by dense tufts of capillary rootlets to 2 in. long. Occasionally a small handsome tree, 15-20 ft. high, with a short straight trunk, 12-16 in. girth. Branches opposite, smooth, ash-coloured, bark of stem light grey, with parallel longitudinal furrows; inner substance soft, spongy, yellow.

2. *CELASTRUS*, Linn.

Leaves alternate; stipules minute, deciduous. Flowers small, frequently unisexual. Calyx 5-cleft. Disc flat or cup-shaped. Petals 5, usually spreading. Stamens 5, inserted upon or under the margin of the disc; anthers 2-celled, dehiscing longitudinally. Ovary 2-3 rarely 4-celled; style short; stigma generally lobed. Capsule globose or oblong, 3-2- or 1-celled, with 1 or 2 seeds to each cell, dehiscing loculicidally. Seeds often arillate, with a fleshy albumen; cotyledons foliaceous; radicle inferior.

Armed with axillary spines; cymes lateral; capsule generally 3-celled, 3-valved.

Peduncles capillary, 1-1½ in. long; leaves lanceolate . . . 1. *C. rufus*.

Cymes subsessile; leaves ovate or obovate . . . 2. *C. spinosus*.

Armed with axillary spines; cymes axillary, with divaricate branches; capsule generally 2-valved, 1- or 2-celled . . . 3. *C. senegalensis*.

Unarmed, climbing; cymes in a terminal compound raceme . . . 4. *C. paniculatus*.

1. *C. rufus*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 397.

A tree, sparingly armed with axillary short spines; wholly glabrous. Leaves subcoriaceous, lanceolate, serrulate, 3-5 in. long. Peduncles numerous, lateral, fascicled, capillary, reddish, 1-1½ in. long, bearing a dichotomous cyme of a few small white flowers, supported on capillary pedicels. Bracts lanceolate. Capsule obovate, 3-valved, 3-celled, 3-seeded.

Himalaya from Kamaon to Bhutan, ascending to 6000 ft. Kasia hills. Fl. March, April; fruit ripe June.

2. *C. spinosus*, Royle; Boissier Fl. Orient. ii. 11.—Syn. *Gymnosporia spinosa*. Vern. Dzara, trans-Indus; Kandu, kandiāri, pātāki, lei, phū-pāri, badlo, kadewar, Pb.; Kūra, bāgrivāla dārim, gwāla dārim (darim is Pomegranate), N.W.P.

Glabrous, armed with numerous straight axillary spines, generally about $\frac{1}{2}$ in. long. Leaves on short petioles, broadly ovate or obovate, crenate, coriaceous, cinereous. Cymes axillary, subsessile or shortly pedunculate, often fascicled on short dichotomous branchlets; flowers numerous, up to 30; bracts small, triangular, ciliate. Calyx-lobes obtuse, ciliate. Petals oblong, reddish, with white margins. Filaments subulate, inserted under edge of disc; anthers oval, versatile. Disc 5-lobed, fleshy, surrounding base of 3-celled ovary. Style short cylindrical; stigma 3- or 5-lobed. Capsule turbinate or obovoid, 3-celled, 3-cornered, $\frac{1}{2}$ in. long; seeds half covered with an aril.

Common in Afghanistan and North-West India, extending as far as Kamaon in the Outer Himalaya and Siwalik tract; also reported from Bandelkhand. Generally on dry, hot, rocky, rugged slopes, often on *kankar* soil. In flower and fruit from March-Nov. A stiff, densely-branching shrub, 8-12 ft. high, usually with strong, stiff, sharp spines, rarely unarmed. Bark dark grey, or with a reddish tinge, scurfy, but not much marked; foliage dull greyish green. The seeds have a bitter taste.

3. *C. senegalensis*, Lam.; Boissier Fl. Orient. ii. 11; Bedd. Fl. Sylv. anal. t. x. 2.—Syn. *C. montana*, Roxb. Fl. Ind. i. 620; W. & A. Prodr. 159; Wight Ic. t. 382. Vern. *Sherawane*, trans-Indus; *Talkar*, *dajkar*, *mareila*, *kingaro*, *kharai*, Pb.; *Baikar*, *gajachinni*, C.P.; *Māl kangoni*, Bomb.

Glabrous, glaucous or pale green, usually armed with numerous straight axillary spines, generally 1-2 in. long, and often bearing leaves and flowers. Leaves variable in form and size, coriaceous, entire or crenate, narrowed into petiole, obovate oblanceolate or linear-spathulate. Cymes axillary, often 2 or more together on short tubercular branchlets, regularly dichotomous; branches divaricate; bracts triangular, fimbriate. Flowers small, pale greenish white, a large proportion sterile. Lobes of calyx obtuse or acute, fimbriate. Petals oblong, with entire or fimbriate edges. Disc broad, flat, 10-lobed. Filaments subulate; anthers round, versatile. Style short; stigma 3-lobed. Capsule globose or ovoid, about the size of a small pea, generally 2-valved, often 1-celled, with 1, 2, rarely 3 seeds; occasionally 3-valved. (The seeds of this species should be examined; some of the specimens before me have an arillus, others are naked.)

This plant has a wide distribution, from the Mediterranean region over a great part of tropical Africa to India. It is common in many parts of the Panjab trans-Indus, in Sindh, the Salt range, about Delhi, in the Siwalik tract, and the outer Himalaya (ascending to 4000 ft.), in Guzerat, the Dekkan, and many parts of the Peninsula. The specimens from Sindh, Afghanistan, and Delhi have narrow, those from South India have broadly obovate leaves. Mostly in stony, rocky, dry, barren localities. Fl. at various times throughout the year, the seed ripening in summer and autumn.

A tall shrub, under favourable circumstances a small tree 15-20 ft. high, with a short crooked trunk, 2-4 ft. in girth, stiff branches forming a loose oval crown. Bark of stem $\frac{1}{2}$ in. thick, yellowish, reddish, or purplish grey. Wood white, close-grained, hard, and durable; the leaves are thrashed out and used as fodder, the branches employed as dunnage for the roofs of houses.

4. *C. paniculatus*, Willd.; Roxb. Fl. Ind. i. 621; Wight Ill. t. 72; Ic. Pl. t. 158; W. & A. Prodr. 158.—Syn. *C. nutans*, Roxb. l. c. 623. Vern. *Māl kākai*, Oudh, N.W.P.; *Kākundan*, *rangul*, *wāhrangur*, C.P.; *Kanguni*, Bomb.

Unarmed; climbing or scrambling. Leaves glabrous, broadly-ovate or obovate, acuminate, crenate. Flowers unisexual; cymes arranged in terminal, compound, elongated panicles; peduncles and pedicels pubescent; bracts fimbriate. Calyx-lobes rounded, toothed; disc mostly connate with the cup of the calyx. Stamens inserted on its free margin; anthers attached near the base. Capsule globose, generally 3-valved, 3-celled, 3-6-seeded. Seeds enclosed in a complete red arillus.

A large scrambling or climbing shrub, probably diœcious, common in many parts of India. Outer Himalaya, ascending to 4000 ft., from the Jhelam to Assam, Eastern Bengal, Behar, and South India. Leaves and seeds are used in native medicine; an oil is extracted from the seeds, which is used medicinally.

3. *ELÆODENDRON*, Jacq. fil.

Shrubs or trees with alternate or opposite leaves, and small caducous stipules; flowers small, occasionally unisexual, in axillary cymes. Calyx 4-5-cleft. Petals 4-5-spreading. Disc thick, fleshy, angled. Stamens 4-5, inserted under the edge of the disc; anthers nearly globose. Base of ovary confluent with disc, 3-celled, rarely 2- or 5-celled; style short; ovules erect, 2 in each cell. Fruit a dry or fleshy indehiscent drupe, the putamen 1-3-celled, 1, rarely 2, seeds in each cell. Seeds erect, without an arillus; albumen scanty or copious, enclosing a straight embryo, with flat cotyledons.

1. *E. Roxburghii*, W. & A. Prodr. 157; Wight Ill. t. 71; Bedd. Fl. Sylv. t. 148.—Syn. *Neerija dichotoma*, Roxb. Fl. Ind. i. 646. Vern. *Mirandu*, *patriūn*, *bakra*, *jamou*, Pb.; *Bakra*, *shauria*, *chauli*, *daberi*, *māmri*, N.W.P.; *Chauri*, *metkūr*, Oudh; *Jamrassi*, *jumrassi*, *kala muka*, *rohi*, C.P.; *Dhakka marrah*, Gondi; *Tamruj*, Bomb.

Leaves glabrous, generally opposite, on petioles $\frac{1}{2}$ in. to 1 in. long, elliptic ovate or oblong, acuminate, crenate, coriaceous; stipules small, triangular, deciduous. Cymes axillary, dichotomous, spreading, as long as or shorter than leaves; peduncle longer than petiole; branches divaricate; bracts small, caducous. Calyx-segments broad, round, obtuse. Petals oblong with membranous edges, yellowish brown and white. Stamens shorter than petals; filaments recurved; anther-cells attached to a broad semicircular connective, diverging at base. Drupe ovoid or obovoid, $\frac{1}{2}$ in. long, yellowish green when ripe, thin, fleshy; putamen 1-celled, 1-seeded, crustaceous.

Common in the Siwalik tract and outer Himalaya, ascending to 6000 ft., from the Ravi to Sikkim. Behar, Bandelkhand, Oudh forests, the Central Provinces, and the Peninsula. The old leaves shed in February and March, the

young foliage issues in May; the full-grown foliage is dark green and shining. Fl. Feb.-June, the fruit ripening in April and May of the following year.

A moderate-sized tree, at times a shrub only, attains 30-50 ft. in the Oudh forests, with an erect, symmetrical trunk, attaining from 3-8 ft. in girth, numerous branches forming a close oval crown. Bark of trunk thin, cinereous, or ferruginous, smooth, with irregular longitudinal wrinkles, or dark and scurfy. The wood is whitish or light reddish-brown, even, close, compact; a cub. ft. weighs 40-50 lb. when seasoned, and 60-65 lb. when green. Value of P. 511 (Fowke), 513 (Skinner). Seasons well, works easily, and is durable. Is often beautifully curled and flaked, and takes a fine polish; is used for cabinet-work, and recommended for picture-frames. The root is believed to be a specific against snake-bites, and the bark is used in native medicine, said to be a virulent poison. The young tree is often attacked by an aphid, and in consequence a saccharine matter is excreted on the leaves.

4. HIPPOCRATEA, Linn.

Climbing shrubs or trees, with opposite, entire or serrate, coriaceous leaves. Flowers bisexual. Sepals 5. Petals 5, longer than sepals. Stamens 3. Ovary 3-celled. Fruit-carpels 3, distinct, each 1-celled, laterally compressed, 2-valved, the valves navicular. Seeds 1-3, compressed, erect, attached to the base of the capsule, the funicle dilated into a broad wing. Albumen none; cotyledons flat, oval; radicle short, inferior.

Leaves 5-6 in. long; capsule 3 in. long	1. <i>H. arborea</i> .
Leaves 2-3 in. long; capsule 1-1½ in. long	2. <i>H. indica</i> .

1. *H. arborea*, Roxb. Cor. Pl. t. 205; Fl. Ind. i. 167.

A large climber, with long flexuose branches, wholly glabrous. Leaves ovate, or ovate-oblong, shortly acuminate, serrulate, 5-6 in. long; petiole ½ in. long; main lateral nerves 6-8 pair, arcuate. Flowers yellow, in axillary, pedunculate cymes. Capsules 1-3, at the end of terminal peduncles, obovate-oblong, acute at both ends, 3 in. long and 1½ in. broad, thickly coriaceous, with numerous prominent longitudinal nerves. Seeds 2. Wing of seed tawny, ovate, 1½ in. long, smooth, corky. Seed ¾ in. long. Cotyledons greenish yellow, fleshy.

Abundant in the mixed forests of Baraich and Gonda in Oudh (R. Thompson). Ascends the largest forest-trees, often enveloping them with its thick, heavy foliage. Leaves renewed April, May. Fl. in July, and the fruit ripens in April.

2. *H. indica*, Willd.; Roxb. Cor. Pl. t. 130; Fl. Ind. i. 165; W. & A. Prodr. 104.—Vern. *Kazurati*, Bomb.

A climbing shrub, wholly glabrous. Leaves ovate, acuminate, crenate, 2-3 in. long; petiole ½ in. long. Flowers rusty yellow, in axillary, pedunculate cymes. Capsules oblong, striated, 1-1½ in. long, ½ in. broad. Seeds 2, reddish brown; wings membranous.

South India, Bengal, Behar, and probably Central India, Burma, Ceylon, Indian Archipelago; also in tropical Africa. Fl. Jan-April.

ORDER XXV. RHAMNEÆ.

Trees or shrubs, often armed with spinescent branches or stipular spines. Leaves simple, alternate or opposite. Flowers small, often unisexual, green or yellow. Inflorescence generally cymose. Calyx 4-5-cleft; lobes triangular, valvate in bud. Petals generally present, inserted on the calyx-tube near the edge, and alternate with its segments. Stamens opposite the petals, and often enclosed by them, inserted with the petals or on the edge of the disc; anthers 2-celled, bursting longitudinally. Disc annular cupular or coating the calyx-tube. Ovary free, or more or less adhering to the calyx-tube, 2- or 3-celled, rarely 4-celled, with one erect ovule in each cell. Fruit various, with 1-3 seeds, with or without albumen, and a large embryo.—Gen. Pl. i. 371; Royle III. 168; Wight III. i. 179.

Fruit a fleshy, rarely dry drupe or berry, 1-3-seeded.

Armed with stipular spines; leaves 3-5-nerved

Unarmed; stipules foliaceous; leaves with numerous prominent parallel lateral nerves

Armed with spinescent branches, or unarmed; calyx-lobes deciduous

Unarmed; branches of cymes swell into a fleshy mass

Armed with spinescent branches, or unarmed; calyx-lobes persistent

Fruit a dry 1-seeded nut, terminating in a long narrow wing

1. ZIZYPHUS.

2. BERCHEMIA.

3. RHAMNUS.

4. HOVENIA.

5. SAGERETIA.

6. VESTILAGO.

1. ZIZYPHUS, Juss.

Shrubs or trees, generally armed with stipular spines. Leaves alternate, more or less distichous, petiolate, with 3-5 main nerves from the base. Flowers small, mostly bisexual, generally in axillary cymes. Calyx-tube cup-shaped, or broad-obconical; limb 5-cleft, the divisions keeled inside. Petals sometimes wanting, generally 5; lamina more or less concave or hood-shaped. Disc coating the calyx-tube, edge free, pentagonous or 5-10-lobed. Ovary immersed in disc, more or less confluent with it, 2-celled, rarely 3- or 4-celled; styles 2-3, free or partly connate. Drupe fleshy, kernel generally woody or osseous, 1-3-celled, 1 seed in each cell. Seeds with a smooth, brittle testa; albumen thin, enclosing the embryo; cotyledons thick, flat, or convex; radicle short.

Drupe fleshy; kernel 1-2-celled.

Cymes axillary, nearly sessile; petals 5.

Glabrous; young parts only pubescent.

Branchlets often fasciculate; drupe large; kernel 2-celled, with thick, hard, osseous shell.

Branchlets single; drupe small; kernel 2-celled, with thin crustaceous shell

More or less tomentose.

A straggling or climbing shrub; drupes small, $\frac{1}{4}$ in. long

A tree; drupes globose oblong or ovoid, $\frac{1}{4}$ - $\frac{3}{4}$ in. long, or longer

A low thorny shrub; drupes globose, $\frac{1}{4}$ - $\frac{1}{2}$ in. diam.

1. *Z. vulgaris*.

2. *Z. ocephylla*.

3. *Z. Enoplia*.

4. *Z. Jujuba*.

5. *Z. nummularia*.

Cymes axillary and terminal, long-pedunculate, forming a large thyrsus; petals none; kernel 1-celled, 1-seeded, shell thinly crustaceous.

6. *Z. rugosa*.

Drupe nearly dry; kernel 3-celled, shell thick, hard, osseous; cymes axillary, short-pedunculate.

7. *Z. xylopyra*.

1. *Z. vulgaris*, Lam.; Roxb. Fl. Ind. i. 609; Boiss. Fl. Orient. ii. 12.—Syn. *Z. flexuosa*, Wall. French, *Jujubier*. Vern. *Sinjli*, *Simli*, *bān*, *barj*, *phitni*, *relnu*, *ber*, *kāndika*, *kandiāri*, *birāri*, Pb.

A small tree, glabrous: branches brown and shining, frequently covered with a dull grey cuticle, flexuose or zigzag, with 2 strong stipular thorns, and one or more branchlets at each bend. Thorns grey or brown, shining, unequal, one straight, up to 1 in. long, or longer, the other much shorter, uncinate (straight while young). Branchlets often fasciculate, slender, nearly straight, with 10-30 alternate, bifarious leaves on short petioles, having frequently the appearance of imparipinnate leaves. Leaves obliquely ovate-lanceolate, obtuse, bluntly serrate, with 3 main basal nerves and finely reticulated veins between, without any prominent secondary nerves. Flowers yellowish, 2-12 on short pedicels, with small fimbriate subulate bracts, fasciculate on short axillary cymes; styles 2, rarely 3, distinct from base. Drupes solitary, pendulous, on short slender pedicels, ovoid or oblong, obtuse at both ends, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, dark red or black, glabrous, shining, fleshy; kernel 2-celled, rugose; shell thick, hard, osseous. *Z. nitida*, from China, Roxb. l. c. 609, is stated to have a pale yellow fruit when ripe, but is otherwise very similar to *Z. vulgaris*.

Wild and cultivated in the N.W. Himalaya from the Ravi to the Indus, ascending to 6500 ft. Also cultivated in the Panjab plains, in Beluchistan, and Bengal. Beyond India it is found, indigenous or cultivated, in Japan and China, in Western Asia, Greece, Macedonia, and North Africa. Cultivated and runs wild in the south of France, Corsica, and Italy. Not quite hardy in the south of England. Fl. from March-June, and the fruit ripens from September through the cold season. Leafless in winter.

In the Panjab often a shrub, in clusters or dense clumps, under favourable conditions a small tree, 25-30 ft., with a short, somewhat crooked trunk, to 5 or 6 ft. girth, few rigid spreading boughs, and stiff branches, often unarmed, the prickles having fallen off. Bark of stem dark grey, rough with longitudinal furrows. The full-grown foliage is of a beautiful bright glossy green. The leaves getting yellow before falling, impart a peculiar hue to tracts where the tree is common—e.g., near the great lake of Kashmir. The leaves are subject to the attacks of a small insect. About one-third of the radius of the stem is white sapwood, the heartwood being dark brown. In France the wood is used for cabinet-work, under the name of *Acajou d'Afrique*, sp. grav. 1.09.—Matthieu Fl. Forestière, 50. The fruit (in India) is acid, but well flavoured; that of the Mediterranean tree is sweet. Formerly officinal under the name of *bacca jujube*. The tree was known to classical writers; in Plinius and Columella it is called Zizyphus. Though it reproduces itself spontaneously in Greece and the south of France, it is not originally indigenous in those countries, but was introduced from Syria during the reign of Cæsar Augustus.

2. *Z. oxyphylla*, Edgew. in Trans. Linn. Soc. xx. 43.—Vern. *Kārkan ber*, Afg.; *Pitni*, *kokan ber*, *amlāi*, *amnia*, *beri*, *shamor*, Pb.; *Giggār*, N.W.P.

A small tree, glabrous, with a few scattered hairs on young parts; 2-year-old branches purple, or covered with a dull grey epidermis; branches and branchlets slightly flexuose, smooth, armed with pairs of slender purple stipular spines, one shorter, straight or curved, the other straight to $\frac{1}{2}$ in. long. Leaves on petioles $\frac{1}{3}$ in. long, ovate-lanceolate, base oblique, long-acuminate, mucronate with a hard brown point, finely serrate, the serratures mucronate with brown points, main basal nerves 3, the middle nerve with 2 or 4 prominent lateral nerves, joined by reticulate veins. Flowers 3-20, on slender pedicels $\frac{1}{4}$ in. long, fasciculate on short thick peduncles; bracts small, brown, subulate; calyx-lobes carinate to middle; petals clawed, expanding into a hood-shaped lamina; disc thin, membranous, pentagonous; styles 2, united to near the apex. Drupes ovoid, $\frac{1}{3}$ in. long, 2-celled, 2-seeded, pendulous, red or black when ripe, putamen flattened, shell thin crustaceous, seeds with a brown shining testa.

Found occasionally on the eastern flanks of the Suliman range trans-Indus, and in the outer Himalaya as far as the Ganges, at elevations from 2000 to 6000 ft. A small tree, 25-30 ft. high, and 5-6 ft. girth, resembling *Z. vulgaris* in general habit. Fruit eaten, but very acid.

3. *Z. Ctenoplia*, Mill; W. & A. Prodr. 163; probably *Z. Napeca*, Roxb. l. c. 613.—Vern. *Shya-kul*, Beng; *Töziben*, Burm.

A straggling or climbing shrub; branchlets strigose, or oftener covered with dense ferruginous tomentum, slightly flexuose, armed with short, straight or hooked and recurved stipular prickles, which are brown, shining, tomentose at base, and generally solitary. Leaves distichous, on short petioles, strigose or rusty tomentose beneath, with long adpressed simple hairs, ovate or rhomboid, base oblique, shortly acuminate, entire or minutely denticulate, generally with 4 main basal nerves, 2 in the larger, and 1 in the smaller half of the leaf, all with numerous prominent parallel lateral nerves. Cymes short, axillary, dichotomous, with 20-30 flowers; peduncles, pedicels, bracts, and calyx densely tomentose. Divisions of calyx keeled to the middle; petals generally shorter than calyx. Drupes 1-3 together, on slender pedicels, generally longer than peduncles, globose or obovate, black, $\frac{1}{4}$ in. long, 1- or 2-celled; shell woody or osseous.

Kamaon, Rohilkhand, Lower Bengal, Behar, Assam, Silhet, Chittagong, Burma, the Peninsula, Java, Ceylon, and Mauritius. Abundant in the Baraich forests of Oudh. Leaves renewed March, April. Fl. in the hot, ripens its fruit in the rainy season and autumn. The fruit is eaten. A common hedge-plant in South India.

The two last species require further attention. There appear to be intermediate forms, and there are forms of *Jujuba*, which, as far as herbarium specimens go, only differ from *Ctenoplia* by the size of the fruit.

4. *Z. Jujuba*, Lam.—Tab. XVII.—W. & A. Prodr. 162; Roxb. Fl. Ind. i. 608; Wight Ic. t. 99; Bedd. Fl. Sylv. t. 149; Boiss. l. c. 13.—Sans. *Badara*, *karkandhu*, *koli*. Vern. *Bēr*, *bēra*, *bēri*. (*Ziben*, Burm.)

A moderate-sized tree, ends of branches decurved or drooping, in some

varieties erect or spreading, tomentose, rarely glabrous. Two-year-old branches slightly flexuose, either dull brown, or covered with grey epidermis. Branches and branchlets armed with short stipular spines, generally twin, one straight, the other bent, or both equal, or one wanting, or entirely unarmed. Leaves sessile, short-petiolate, or on petioles $\frac{1}{2}$ the length of leaf, oblong-ovate, or nearly orbicular, obtuse or acute, 1-3 in. long, entire or serrulate, often mucronate, occasionally with a few large irregular teeth near the apex, with 3 main basal nerves, and more or less prominent lateral nerves. Leaves generally bright tawny- or nearly white-tomentose beneath, dark green and glabrous above, or more or less glabrous on both sides. Flowers greenish yellow, somewhat fetid, on short axillary subsessile, or short-pedunculate cymes; pedicels longer than peduncles. Calyx-lobes keeled to the middle; petals unguiculate, with an oblong concave or hood-shaped lamina; anther-cells parallel; disc fleshy, 10-lobed, 10-sulcate; styles 2, thick, conical, connate to middle. Drupe varying in size, generally about $\frac{1}{2}$ or $\frac{3}{4}$ in. long, on a stalk about half its length, globose, oblong, or ovoid, dark brown, orange or red when ripe; kernel irregularly furrowed, mostly 2-celled, with a hard, thick, bony shell.

This sp. varies exceedingly, in the shape and size of the fruit, the shape and tomentum of the leaves, and general habit. A remarkable variety, commonly cultivated in the Panjab, from Peshawar to Multan, has been described by Edgeworth (Journ. Linn. Society, vi. 201) as *Z. Jujuba*, var. *Hysudrica*. It is characterised by obtuse, oblong or ovate, sometimes orbicular leaves, on long petioles $\frac{1}{2}$ length of leaf, glabrous or slightly tomentose beneath, the branchlets not drooping, but erect or spreading. Dr Stewart refers this variety to *Z. Lotus*, Lam., but is of opinion that the Zizyphi of North India want more investigation on the spot. *Z. Lotus*, however, is a shrub nearly allied to *Z. nummularia*. *Z. Spina Christi*, Willd.—Boissier Fl. Orient. ii. 13—which Edgeworth states in the same place, is found in gardens in the Panjab, is a large tree of Western Asia, northern and tropical Africa, with white branches, ovate, almost glabrous leaves, petioles $\frac{1}{2}$ - $\frac{1}{3}$ length of blade; cymes large, compact, sessile, with numerous flowers, and a ring of white hairs (not in all specimens) round the base of the style; fruit-stalks often nearly 1 in. long. I do not venture to refer any of the specimens which I have examined from the Panjab either to *Z. Lotus* or to *Z. Spina Christi*, and I think it preferable at present to class all *Bēr* trees of North and Central India under *Z. Jujuba*. There is no difference in the inflorescence and structure of the flower; and as regards shape and tomentum of the leaves, there are intermediate forms.

Z. Jujuba is wild in some places of the Siwalik forests east of the Ganges (J. L. Stewart), and in South India (Beddome). Cultivated and self-sown, it is common in Afghanistan, Sindh, the Panjab, ascending in the outer Himalaya to 3000, and at times to 4500 ft., and throughout the rest of India and Burma. Further researches are required to define the localities where the tree is actually wild, forming part of the original forest. It is common in forests of Central and South India; but wherever I have seen it, it has been on sites of deserted

villages or temporary settlements. The young foliage appears in March, April, while the old leaves are shedding; there is often a second flush in July and August. Fl. usually April-June, also at other seasons; the fruit generally ripens from December-March.

A moderate-sized tree, 30-50 ft. high, stem short, erect, not very straight, girth 6-8, occasionally 10 ft., branches numerous, spreading in all directions, forming a broad, rounded crown, giving dense shade. Bark $\frac{1}{2}$ -1 in. thick, dark grey, almost black, cut up into obliquely oblong plates by deep irregular longitudinal furrows and short shallow cross-cracks. Inner substance reddish brown, showing in cracks and furrows. Wood light-coloured when fresh-cut, turns reddish brown on exposure to the air. Sapwood $\frac{1}{2}$ of the radius, of lighter colour. According to Skinner, a cub. ft. of seasoned wood weighs 58 lb., and the coefficient of transverse strength (P) is 672. Cunningham gives the following figures for sap and heartwood: sap—Weight 51.08, P. 330-385; heart—Weight 57.41, P. 477-513. The wood is hard, close, and even-grained, fibrous, tough and durable, a favourite material for saddle-trees (for horses' and camels' saddles), also used for building, agricultural implements, Persian wheels, oil-seed-crushers, well-curbs, legs of bedsteads, sandals, tent-pegs, and other purposes. Yields good charcoal, and is valuable as fuel.

Lakh is produced on this tree in Sindh, the Panjab, and Central India. The bark is used as dye-stuff; the root is a febrifuge in native pharmacy. A gum exudes from the trunk; and in Kangra a wild silk worm lives on the tree, the silk of which was much employed formerly to tie the barrel to the stock of the matchlock. But the tree is mainly cultivated for its fruit, which is more or less globose on the wild and commoner sorts, and ovoid or oblong on the cultivated and improved kinds. The pulp is mealy, sweetish, with a pleasant taste, and some of the cultivated kinds are very good indeed. The dried fruit of this species, and possibly also of *Z. vulgaris*, is sold in the bazaars of the Panjab under the name of *unāb*; the best kind is imported from Kandahar. In South India oil is extracted from the kernel. The leaves are much valued as cattle-fodder. The tree is readily raised from seed; young plants do not suffer much from frost, except that they lose their leaves; they stand a good deal of drought, but their roots are often eaten by rats. It thrives best on sandy loam, and on ploughed land; but it can be grown also on soils too saline for *Toon*, *Mulberry*, and *Sissoo*. Its growth is less rapid than of *Sissoo* or *Kikar*, but it copes with great vigour, and will on that account probably prove a most valuable tree in the Panjab plantations.

5. *Z. nummularia*, W. & A. Prodr. 162; Boissier Fl. Orient. ii. 13.—Syn. *Z. microphylla*, Roxb. Fl. Ind. i. 613. Sometimes called *Camelthorn*, but erroneously (see *Alhagi Maurorum*). Vern. Karkannā, Afg.; Malla, ber, berra, birār, jhāri, jharberi, jand, kānta, N.W. India; Gangr, jangra, Sindh.

A thorny, bushy shrub, tomentose; branches brown, or covered with white epidermis; branchlets bifarious, flexuose, armed with twin stipular prickles, pilose while young, one straight, slender, very sharp, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, the other much shorter, hooked, bent downwards. Leaves on short petioles, ovate, obtuse, denticulate; main nerves 3, with few prominent lateral nerves. Flowers 10-20, in axillary, short, compact cymes; pedicels $\frac{1}{2}$ in. long, longer than peduncles. Calyx-lobes keeled nearly to the base; petals spathulate, expanding into a broad-obovate, concave or flat lamina; disc slightly 10-lobed, 10-furrowed; styles 2, nearly distinct. Drupe

globose, $\frac{1}{2}$ in. diam., red, glabrous, shining when ripe; kernel rugose, 2-celled, with a hard osseous shell.

Common throughout North-West India and the drier parts of South India above the Ghats; not known from Bengal and Burma. Gregarious, covers extensive tracts in the Panjab, Sindh, Rajputana, and the Dekkan. Ascends to 3000 ft. on the eastern flanks of the Suliman range and in the outer Himalaya. Flourishes best in a heavy clay or loam; is abundant in the black soil of the Dekkan. South-West Persia.

Z. nummularia is always a bush, usually 6-8 ft. high, rarely attaining 15 ft., forming irregular rounded masses of thorns, with numerous clustered stems, and suckers thrown up from the roots. The bark of stems and main branches is grey, rugose; the foliage has a dull greyish-green colour. It is never leafless—the old leaves generally shed early in the hot weather, and the new leaves appear immediately afterwards. Fl. March-June, and the fruit ripens from November-January. The principal use of this species is to make fences round fields and gardens; the leaves are thrashed out and used as fodder for sheep and goats; the fruit is eaten, is sweet and acidulous, and has a pleasant flavour. During the famine of 1869, which drove large numbers of the inhabitants of Marwar and other parts of western Rajputana from their homes, the fruit of this bush served as food to thousands. In the winter '69-'70, the crop of these berries had been plentiful; and when I marched through Rajputana, from Agra to Guzerat, in Dec. 1869 and Jan. 1870, I found the shrubs completely stripped of their fruit wherever the flocks of hungry emigrants from Marwar had passed through; and it was only further south, on approaching Neemuch and Guzerat, where the Marwar emigrants had been less numerous, that I found the shrubs laden with fruit.

Of the *Zizyphi* outside India, *Z. Lotus*, Lam.; Boiss. l. c. 12; a small shrub from Northern Africa, comes nearest to this. Like *nummularia*, *Z. Lotus* has an eatable fruit, which is an important article of food in Tunis and Barbary. It throws up abundant suckers from the root, and the description given in Mathieu's *Flore Forestière de la France*, p. 50—"Parfois l'abord de cet arbrisseau (in Algeria) est rendu presque impossible par l'entourage serré des drageons épineux qu'il a produits"—would apply well to *Z. nummularia*. But the African shrub is almost quite glabrous, and the two styles are united nearly to the top. There is much variation in the species of *Zizyphus* as to pubescence, and the degree to which the styles are united; but, on the other hand, there does not yet seem sufficient ground for uniting *Z. nummularia* and *Z. Lotus*. It should be added that there are forms of *Z. nummularia* which are exceedingly similar to frutescent specimens of *Z. Jujuba*.

6. *Z. rugosa*, Lam.; W. & A. Prodr. 162; Wight Ic. t. 339.—Syn. *Z. latifolia*, Roxb. Fl. Ind. i. 607. Vern. *Dhaura*, *dhauri*, Baraich and Gonda in Oudh; *Suran*, *Churna*, C.P.; *Tūran*, Bomb.

A straggling shrub or small tree; young branches, inflorescence, prickles, and under side of leaves generally covered with a dense ferruginous tomentum, rarely glabrous. Branches armed with broad, laterally compressed, strong, hooked prickles, mostly solitary. Leaves on petioles $\frac{1}{2}$ in. long, with 3 or 4, rarely 5, nerves from base, and prominent lateral nerves, ovate or elliptic from an oblique, often cordate base; 2-5 in. long. Cymes large, on long peduncles, axillary and terminal, forming a large compound, generally drooping thyrsus. Lobes of calyx outside tomentose, inside with

a prominent pilose line, but not keeled; petals none; anthers broad-ovate; disc pentagonous. Drupe globose or pyriform, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, with a 1-celled, 1-seeded kernel, and a thin crustaceous shell.

Burma, hills of Eastern Bengal, Behar and Sikkim, sub-Himalayan tract as far as the Ganges, Oudh forests, Central Provinces, western side of the Peninsula, and Ceylon. A straggling evergreen shrub, often climbing, occasionally a small tree with a trunk 2 or 3 ft. in girth. Fl. Nov.-March; the fruit ripens in April and May. Bark exfoliating with flat quadrangular scales of dark brown or blackish colour. The fruit is eaten, has a peculiar mawkish flavour; the wood is used as fuel, often attacked by insects.

7. *Z. xylopyra*, Willd.; Roxb. Fl. Ind. i. 611; W. & A. Prodr. 162.—Syn. *elliptica* and *Caracutta*, Roxb. l. c. 610, 612. Vern. *Kalbēr*, *khat-bōr*, *bēri*, *gūti*, *ghotiā*, *goti*, *gotti*, *glūter*, *gotāha*, *kakoa*, *kukor*, *ghatūl*, *chettu*, *chittāniā*, *ghwet*, *sitaber*.

A large straggling shrub or small tree; young branchlets, under side of leaves, and inflorescence generally short and softly tomentose. Stipular prickles generally twin, one straight, the other hooked, recurved, strong, and very sharp. Leaves on short petioles, oval or rhomboid, finely serrulate, from an unequal-sided, often cordate base, with 3 or 4 main basal nerves, and prominent lateral nerves, pale, softly tomentose beneath. Cyfies axillary, compact, on short peduncles, with numerous (occasionally tetramerous) flowers; pedicels shorter than main branches of cyme. Lobes of calyx keeled near apex; petals on long claws, hood-shaped. Ovary 3-celled; styles 3, short, distinct. Drupe usually globose, occasionally oblong, with the remains of calyx marked as a prominent ring at base; $\frac{1}{2}$ –1 in. long, covered with a short, soft, grey tomentum, glabrous when old; dry, almost without fleshy pericarp; putamen furrowed, 3-celled, 3-seeded, with a thick, hard, osseous or ligneous shell.

Common all over South India, in Rajputana, the Central Provinces, Bandelkhand, and Behar; also in the Oudh forests, and the sub-Himalayan tract as far as the Ganges, ascending to 2000 ft. The old leaves are shed about Feb. or March; the new foliage issues in April and May; the flowers appear about the same time; and the fruit ripens from Sept.-Feb.

A large straggling shrub, and under favourable conditions a small tree to 15 ft. high. Often gregarious, covering considerable tracts with an impenetrable thorny scrub. Bark of trunk and larger branches light or dark cinereous or brownish black, surface smooth or cracked with thick, oblong, exfoliating scales. Heart- and sap-wood not distinct, clean, whitish red when fresh-cut, when dry yellowish white, orange or brownish, hard and tough, 60 lb. per cub. ft., P = 800 (Skinner). Easily worked and durable, used for cart-building and other purposes. Bark employed for tanning; the young shoots, leaves, and the fruit serve as fodder for cattle and goats. The fruit is not eatable for man, but it is largely collected and sold to be used (after being charred) in making a black dye for leather. The kernels are eaten. The wood makes excellent torches.

2. *BERCHEMIA*, Neck.

Shrubs or woody climbers, unarmed, with foliaceous, often intra-axillary

stipules. Leaves alternate, penniveined, elegantly marked underneath with parallel nerves diverging from the midrib, and small transverse veinlets. Flowers pentamerous. Calyx-segments linear or triangular, deciduous. Style simple; stigma capitate, more or less 2- or 4-lobed. Fruit a small, ovoid or oblong, 2-celled berry or drupe, on the persistent, but not enlarged, base of the calyx.

Flowers in small, axillary or terminal clusters	1. <i>B. lineata</i> .
Flowers in large, terminal panicles	2. <i>B. floribunda</i> .

1. *B. lineata*, DC.; Benth. Fl. Hong Kong, 67.

Leaves small, to $\frac{1}{2}$ in. long. Flowers 2-4 together, either in the axils of the leaves, or a few clusters together at the ends of branches above the leaves. Calyx-lobes long-triangular; petals as long as calyx, linear, sheathing and surrounding the stamens. Berry blue, cylindrical, $\frac{1}{2}$ in. long.

A small shrub, with grey bark, in Waziristan trans-Indus at 7000 ft., and from the Indus south-eastward at 4000-5000 ft., in Sikkim at 8000-10,000 ft. Common in China. Fl. from May-July, the berries ripening in Sept.

1. *B. floribunda*, Brongn.—Syn. *Zizyphus floribunda*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 368. Vern. *Kala lag*, Kamaon.

A large shrub or small tree, erect or climbing, with leaves 2-3 in. long, stipules intra-axillary bifid; flowers 3-10, in cymose clusters, arranged in racemes 2-3 in. long, which again form large, terminal panicles. Berries cylindrical, $\frac{1}{2}$ - $\frac{1}{2}$ in. long.

N.W. Himalaya from the Jhelam to Sikkim, Kasia hills. Fl. June-July. Near to, if not identical with, *B. racemosa*, Sieb., from China and Japan.

3. *RHAMNUS*, Linn.

Shrubs and trees, with alternate, petiolate leaves, penniveined, or with 3 nerves proceeding from base, and small deciduous stipules. Flowers often unisexual. Calyx 4-5-cleft, the segments triangular or ovate, deciduous, keeled inside, or with a prominent line. Petals 4-5, or none. Stamens 4-5, with short filaments. Disc clothing the calyx-tube; petals and stamens inserted on its edge. Ovary free, 3-4-celled, narrowed into a 3-4-cleft style; stigmata papillose, obtuse. Fruit an oblong or globose drupe on the persistent, but not enlarged, base of the calyx, with 2-4 1-seeded kernels. Seeds with a fleshy albumen; cotyledons flat or with recurved margins, often green; radicle short.

Unarmed; leaves and branches alternate.	
Pubescent; flowers in axillary sessile cymes	1. <i>R. purpureus</i> .
Tomentose; sessile cymes forming interrupted racemes	2. <i>R. triquetrus</i> .
Generally spinescent.	
Leaves and branches generally opposite	3. <i>R. virgatus</i> .
Leaves and branches always alternate	4. <i>R. persicus</i> .

1. *R. purpureus*, Edgeworth.—Tab. XVIII.—Trans. Linn. Soc. xx.

44.—Vern. *Bat sīnjāl, tūnāni zanāni (tūnāni madāni (male) is Viburnum foetens), tadru, tūndhi, mīmarāri, kunji, chaterni, Pb.*

Unarmed, the previous year's branchlets purple, young parts pubescent. Leaves and branchlets always alternate. Leaves membranous, ovate or ovate-lanceolate, acuminate, 3-4 in. long, serrate, with 6-10 prominent, parallel, nearly straight lateral nerves on either side of midrib, on petioles $\frac{1}{2}$ in. long; stipules linear, early deciduous, and leaving broad scars at the base of petiole. Flowers 1-5, mostly pentamerous and bisexual, in axillary sessile cymes; flower-buds ovoid. Calyx flat, cup-shaped; segments triangular; petals none. Style short, 3-cleft nearly to the base. Drupe pear-shaped, $\frac{1}{4}$ in. long; seeds 2-4.

A moderate-sized tree on the outer Himalaya ranges, from the Indus to the Sarda river, between 4500 and 10,000 ft., usually in the more open parts of the forests. Fl. in May and June. The fruit ripens from July-October. The small bitter fruit is used as a purgative in some parts of the hills.

2. *R. triquetrus*, Wall.—Syn. *Ceanothus triquetra*, Wall.; Fl. Ind., ed. Carey, ii. 376; *C. flavescens*, Royle. Vern. *Gūldē(i) or gūldē(i), fagora, gardhan, phulla, Pb.; Gogsa, ghant, ghont, N.W.P.*

Unarmed; leaves and branchlets covered with short tomentum, always alternate. Leaves generally yellow, ovate-oblong, acuminate, 3-5 in. long, serrate, on petioles $\frac{3}{4}$ in. long, with 6-10 prominent parallel, nearly straight lateral nerves on either side of midrib; stipules subulate, deciduous. Flowers generally pentamerous, in sessile, 5-20-flowered cymes, forming interrupted racemes, frequently leaf-bearing and branched. Flower-buds ovoid. Calyx turbinate, segments triangular. Petals short-clawed, emarginate, sheathing the stamens. Style 3-4-cleft, the branches cohering nearly to the apex. Drupe 3-lobed, nearly dry. Seeds on the back (the side of the raphe), with a long, broad, open groove.

Not uncommon in the Salt range and in the North-West Himalaya, between 3000 and 6000 ft., from the Jhelam to the Sarda river. A small tree, with grey, brown, or blackish purple bark, scabrous with elevated specks. Fl. in May and June.

3. *R. virgatus*, Roxb. Fl. Ind. i. 604.—Syn. *R. hirsutus*, W. & A. Prodr. 165; Wight Ic. t. 978. Vern. *Phipni, dādūr, tadru, seta pajja, kānji, mamrāl, shomfol, refen, gogsa, sindrol, mūtū, nior, chatr, romūsk, Pb.; Tsāpo, māil, Tibet, Spiti; Chato, chedwala, chadua, N.W.P.*

Branchlets generally spinescent, young parts pubescent. Leaves and branchlets generally opposite. Leaves frequently fascicled on short undeveloped branchlets; lanceolate, ovate-lanceolate, ovate or obovate, acuminate, 1-4 in. long, narrowed into petiole $\frac{1}{4}$ in. long, serrate or crenate, with 3-6 arcuate and converging lateral nerves on either side of midrib, the lower pair from near the base of leaf. Flowers greenish on slender pedicels, 4-5-merous, crowded in the axils of fascicled leaves, or

at the base of branchlets. Flower-buds ovate-lanceolate; calyx-tube campanulate or turbinate; petals minute linear or spathulate; style filiform, 2-4-cleft, the branches recurved. Drupes 2-3-celled; seeds grooved, groove narrow, nearly closed.

Trans-Indus territory, chiefly on and near the base of the hills. Himalaya, from 2400-7000, at times to 9500 ft., from the Indus to Bhutan, Nilgiris, and other hills near the Western Ghats, also in China. The leaves fall early, the fresh foliage appearing in May and June, often after the flowers. Fl. more or less at all seasons, but usually April-June, the fruit ripening from October during the cold season.

A large shrub, or a small tree, 15-20 ft. high, with much-ramified branches, long and straight branchlets, forming a dense rounded crown. Bark finely variegated, smooth with slight longitudinal wrinkles, the shining epidermis often peeling off. Heartwood distinct, of a bright red-brown or chocolate colour, strong, hard, and heavy. The fruit is bitter, emetic and purgative, given (*trans-Indus*) in affections of the spleen.

This species is closely allied to *R. catharticus*, L., the common *Buckthorn* of England, which is found nearly all over Europe, and occurs in North Africa and Siberia. The only points of difference seem to be that the leaves of *R. catharticus* frequently have a cordate base, and that the drupe is frequently 4-seeded.

4. *R. persicus*, Boissier Fl. Orient. ii. 17.—Vern. *Sherawane*, *wurak*, Afg.; *Kūkei*, *nār*, *nikki kander* (small thorn), *jaldar*, *kūchni*, Pb.

Spinescent or unarmed; leaves and branches alternate. Leaves coriaceous, ovate obovate or oblong, short-petiolate, entire or serrate, pubescent or short-tomentose, lateral nerves 2-5, not prominent. Flowers axillary, tetramerous, dioecious, on short pedicels; petals small, linear; style 2-4-cleft at the top. Drupe supported by the flat circular base of calyx; seeds with a shining testa, grooved on the back with a wide open groove, the edges of it thickened and bent inward at the top.

Persia. Beluchistan. Eastern flank of the Suliman range, the Salt range, and outer Himalaya, from the Indus to the Chenab, at an elevation from 2000-5000 ft. (A variety—or distinct species—is a small depressed spinescent shrub, in the arid Tibetan tract of the Himalaya between 9000 and 14,000 ft. Nubra, Ladak, Upper Chenab and Surtiej basin, and Upper Kamaon.) Nearly leafless for some months; the fresh foliage issues about April and May. Flowers at all seasons, frequently before the leaves come out. The fruit ripens about November, is sweet and edible, but emetic. *Trans-Indus* it is boiled for two days, and administered in affections of the spleen.

In the plains and lower hills, in arid rocky places, grows to a small tree 20 ft. high, with a short, erect trunk, and a rounded crown of stiff divergent branches. Bark yellowish or dark cinereous, smooth, at times with a whitish, shining, thin, exfoliating epidermis.

This species is closely allied to *R. oleoides*, L., a small spinescent shrub common in South Europe and North Africa. The main difference is that *oleoides* is always glabrous, and that the leaves are 1-nerved, with reticulate veins. There is also some affinity to *R. spathulifolius*, Fisch. et Mey., from the Caucasian provinces.

Another species, *R. procumbens*, Edgew. Trans. Linn. Soc. xx. 43, a small prostrate shrub, with coriaceous elliptic-lanceolate, sharp-serrate leaves, and

persistent stipules, axillary, solitary, pentamerous flowers without petals, on slender pedicels, is found between 7000 and 8000 ft. about Simla, on the Deoban range, and in Kamaon.

4. HOVENIA, Thunb.

A tree, unarmed; leaves alternate, without stipules. Flowers in axillary pedunculate cymes, pentamerous, bisexual. Calyx broad-obconical; segments ovate, thick, with an elevated median line inside, deciduous after flowering. Petals shortly unguiculate, obovate-spathulate. Stamens opposite to petals on the edge of disc; anthers attached at the back, 2-celled, bursting longitudinally. Disc fleshy, coating the calyx-tube, surrounding the ovary, densely woolly. Ovary 3-celled, with an erect ovule in each cell, narrowed into 3 erect styles, more or less coherent. Drupe nearly dry, 3-celled, 3-seeded; endocarp thin, crustaceous, brittle. Seeds with a hard, shining, dark olive green, thick testa, a fleshy albumen, a straight embryo, with flat foliaceous, orbicular cotyledons.

1. *H. dulcis*, Thunb.; Siebold et Zuccarini, *Flora Japonica*, t. 73, 74; Roxb. *Fl. Ind.* i. 630.—Vern. *Chamlūn*, Ravi. Pb.

Pubescent; leaves alternate, deciduous, petiolate, ovate, long-acuminate, serrate, with 3-5 lateral, often alternate nerves on either side of midrib, the lowest pair proceeding from the base. Flowers white. The ramifications of cymes and fruit-stalks swell into an irregularly and unevenly oblong fleshy mass, much and variously bent, sweet-aromatic, the pedicels remaining dry and slender.

Commonly cultivated in Nepal, Sikkim, Bhutan, Assam, China, and Japan, also here and there in Kamaon, and (rarely) in the Panjab Himalaya (a few miles north of Chamba, at 4000 ft., and, according to Falconer, but not found since, in Hazara). Wallich considered the tree indigenous in Nepal, and Royle states that it certainly is wild at 6500 ft. in forests near Mussoori; but Buchanan (in 1802) wrote from Katmandu that the tree was originally brought from China, or some country subject to China. Grows to be a moderate-sized tree, 30 ft. high, with an erect, straight stem, attaining a large girth, and a large broad, rounded crown. Fl. April-May; the fruit ripens in July. The wood is light-coloured, coarse and open-grained. The tree is cultivated on account of its fruit, which has a pleasant flavour, like that of a Bergamot pear.

5. SAGERETIA, Brongniart.

Unarmed or spinescent shrubs, with leaves and angular branches generally opposite, or the upper alternate, penniveined leaves and small deciduous stipules. Flowers small, pentamerous, bisexual, in small sessile clusters, supported by bracts, in terminal or axillary panicles. Calyx flat; segments keeled inside, persistent. Disc lining the calyx, upper part free, thick, fleshy, annular or cup-shaped. Petals and stamens inserted on the calyx. Petals short-clawed. Ovary 3-celled, narrowed into 3 short coherent styles. Fruit a drupe with 3 coriaceous, indehiscent kernels. Seeds completely filling the kernels, with a straight embryo, cotyledons foliaceous, enclosed by a thin fleshy albumen.

- Leaves acuminate ; lateral nerves 4-8 pair . . . 1. *S. oppositifolia*.
 Leaves acute or obtuse ; lateral nerves 2-4 pair.
 Under side of leaves covered with a dense white
 woolly tomentum . . . 2. *S. Brandrethiana*.
 Under side of full-grown leaves glabrous . . . 3. *S. theesans*.

1. ***S. oppositifolia***, Brongn. — Syn. *Zizyphus oppositifolia*, Wall. in Roxb. Fl. Ind., ed. Carey, ii. 370. Vern. Kanak, *gīdardāk* (jackal's vine), *drānge*, *girthan*, Pb.; *Aglaiā*, Kamaon.

Armed with short spinescent branchlets. Leaves short-petiolate, silky-tomentose when young, glabrous afterwards, coriaceous, ovate-oblong, acuminate, serrate, 2-4 in. long, with 4-8 pairs of lateral, arcuate nerves. Flowers in terminal panicles and lateral racemes, ramifications covered with short pubescence. Bracts 3-10 under each cluster, ovate, brown, ciliate. Calyx-lobes brown, persistent. Drupe turbinate, not lobed, $\frac{1}{4}$ in. long, black when ripe.

Common in the North-West Himalaya, alt. 2000-6000 ft.; from the Indus to Bhutan, also in the Konkan and on the Nilgiris. Fl. at various seasons, chiefly in autumn; the fruit, which is sweetish and edible, ripens in spring and summer. A large shrub or small tree, branches often climbing, angular, pubescent. Bark of stem and larger branches cinereous, often white speckled and fairly smooth.

2. ***S. Brandrethiana***, Aitchison; Linn. Journ. viii. 62; Boissier Fl. Orient. ii. 22. — Vern. *Māmāna*, *māimūna*, *nāmāni*, Afg.; *Ganger*, *Kanger*, *goher*, *koher*, Pb.

Armed with numerous spinescent branchlets; under side of leaves, young branches, and ramifications of inflorescence covered with a dense white woolly tomentum. Leaves on short petioles, elliptical, 1 in. long, entire or slightly dentate, glabrous above, lateral nerves 2-4 pair. Flower-panicles terminal and axillary. Bracts small, brown, ovate. Drupe ovoid, obtuse, trisulcate, size of a small pea or black currant, succulent, with raised longitudinal nerves, black when ripe.

Abundant on the east side of the Suliman range, in the Salt range, and at places in the outer N.W. Himalaya, between the Indus and Jhelam; also in Afghanistan, Beluchistan, and Muscat. Fl. usually from January-April, the fruit ripening about May. A shrub, at most 10-12 ft. high, branches stiff, divergent; the younger decussate, and often spinescent. Bark of larger branches glabrate, with a thin, white, shining epidermis, exfoliating while young. The foliage easily distinguished by the dark green upper- and white tomentose under side of the leaves. The fruit is sweetish, and is a great favourite with the Afghans; it is sold in bazaars of the frontier districts, and in some places a condiment is made of it.

3. ***S. theesans***, Brongn.; Benth. Fl. Hong Kong, 68. — Vern. *Drangu*, *ankol*, *kauli*, *karūr*, *phomphli*, *kānda*, *brankol*, *charuśh*, *katrāin*, *thūm*, *kūm*, Pb.

Branchlets often spinescent, glabrous, or young parts pubescent. Leaves short-petioled, elliptic or ovate, more or less distinctly serrate, 1-1½ in. long, with 3 or 4 pairs of distant lateral nerves, glabrous, shining on both sides, pale beneath. Flowers in terminal and lateral panicles. Bracts brown, ovate. Fruit globular, the size of a small pea, irregularly rugose, dark brown when ripe.

Common in places on the eastern flank of the Suliman range, at between 2000 and 8000 ft.; in the Salt range, and in the North-West Himalaya, between 3000 and 8000 ft., from the Jhelam to the Sarda; also in China and Japan. Fl. August-November. A small shrub 6-8 ft. high; the bark of older branches grey or brown, with small white lenticels and shallow longitudinal furrows. The fruit is eaten in parts of the Himalaya, and in China. The leaves are used as tea by the poorer classes in China.

6. *VENTILAGO*, Gaertn.

Climbing, unarmed shrubs, with alternate, simple, petiolate leaves. Flowers small, pentamerous, bisexual, in terminal or axillary panicles. Calyx-segments keeled inside. Petals hooded, deflexed. Stamens adnate to the base of the petals. Disc pentagonal, margin free. Ovary immersed in the disc, 2-celled; style very short. Fruit a subglobose nut, prolonged into an apical, linear, coriaceous wing, 1-celled, 1-seeded. Seed subglobose, exalbuminous, with a membranous testa; cotyledons thick, fleshy; radicle inferior, very short.

Lower half of fruit enclosed in the cup-shaped calyx . . . 1. *V. calyculata*.
Remains of calyx forming a flat disc at the base of fruit 2. *V. maderaspatana*.

1. *V. calyculata*, Tulasne.—Syn. *V. maderaspatana*; Roxb. Cor. Pl. t. 76; Fl. Ind. i. 629. Vern. *Papri*, C.P.; *Rakal-pita*, *kala lag*, Kamaon.

A large climbing shrub, with woody tendrils; branchlets, petioles, the younger leaves, and inflorescence pubescent. Leaves glabrate, subcoriaceous, elliptic-oblong from an oblique base, acuminate, irregularly dentate or entire; main lateral nerves 6-8 on either side of midrib, arcuate, anastomosing by numerous fine parallel and distinct intramarginal veins; blade 3-4 in.; petiole less than ½ in. long. Flowers numerous, small, greenish, with a strong and offensive smell, in long, terminal, leafless panicles. Nut subglobose, ¼ in. diam., girt about the middle by the rim of the adnate calyx; wing linear, 2½ in. long, pubescent, terminated by the remains of the bifid style.

Bengal, Central India, Western Ghats, Oudh forests, Rohilkhand, and sub-Himalayan tract to the Jumna—climbing to the top of the tallest trees. Fl. March. Seed ripens May.

V. Bombaiensis, Dalzell Bomb. Fl. 48, probably belongs to this species.

2. *V. maderaspatana*, Gaertner; Wight Ic. t. 163; W. & A. Prodr. 164.—Vern. *Lokandi*, *kanwail*, Bomb.

A large climbing shrub; leaves ovate, acuminate, coriaceous, shining, pubescent while young. Nut globose, ½ in. diam., the remains of calyx

forming a flat disc at the base; wing linear, 1-2 in. long, glabrous, shining.

South India, Ceylon, Burma, Ind. Archipelago. Fl. C.S. Cordage made of the bark. The root of this or the preceding species is collected and used as a red dye in Mysore, Salem, and Bellary (vern. *Popli-chukay*, Mysore), Buchanan i. 168.

ORDER XXVI. AMPELIDÆ.

Shrubs, erect or climbing; leaves alternate, petiolate, simple or compound. Flowers regular, small, in cymose panicles, racemes or spikes, terminal or leaf-opposed. Calyx small, entire, 4-5-dentate or lobed. Petals 4 or 5, hypogynous, small, valvate in the bud, distinct or cohering at the base or at the top. Stamens as many as and opposite to the petals, hypogynous, free and distinct or monadelphous. Ovary 2-6-celled, with 2 erect collateral ovules, or a single ovule in each cell. Style simple, often very short, or stigma sessile. Fruit a berry, with 1 or few bony seeds. Embryo very small, in the base of a copious albumen.—Gen. Pl. i. 386; Royle Ill. 144; Wight Ill. i. 149.

Woody or herbaceous climbers; filaments free; ovary 2-celled . . . 1. *VITIS*.
Erect shrubs or large herbs; filaments united in a tube; ovary 3-6 celled . . . 2. *LEEA*.

1. *VITIS*, Linn.

Vines, branchlets tumid at the nodes. Tendrils and peduncles generally leaf-opposed, tendrils rarely wanting. Leaves alternate, or the lowest opposite, entire palmately lobed or compound; leaflets pedate, ternate, or quinate. Stipules membranous, deciduous. Flowers numerous, cymose. Inside of calyx filled with a fleshy torus, which expands around the base of the ovary into a 4-5-lobed hypogynous disc. Petals 5 or 4, inserted under the edge of the disc, their summits frequently induplicate and slightly cohering, when the whole corolla, lifted up by the stamens, separates from the base, and falls away together; sometimes expanding in the ordinary way, early deciduous. Stamens free, inserted with the petals; filaments distinct; anthers cordate-ovate, fixed near the middle, 2-celled, the cells opening longitudinally. Ovary sessile, 2-celled, its base surrounded by the fleshy disc. Fruit a 2-celled (or by abortion 1-celled) globular berry, the cells 2-seeded, or by abortion 1-seeded. Seeds obovoid, the membranous testa covering a thick, bony, inner integument. Albumen cartilaginous-fleshy.

Numerous climbers in the Indian forest belong to this genus. It must here suffice to enumerate a few of the larger ones in North and Central India. Few Indian genera demand more study on the spot, and the following arrangement is by no means satisfactory:—

Leaves simple; fl. pentamerous, in thyrsoid panicles.

Branches glabrous or with deciduous tomentum; leaves suborbicular.

Panicles leaf-opposed, occasionally cirriferous; fl. green; petals cohering . . . 1. *V. vinifera*.

Panicles on leaf-opposed tendrils; fl. deep reddish brown; petals distinct . . . 2. *V. latifolia*.

Branches glabrous; leaves ovate, longer than broad . . . 3. *V. parvifolia*.

Branches densely tomentose.

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| Flowers in large compound panicles; petals connate | 4. <i>V. lanata</i> . |
| Flowers in compact cylindrical racemes; petals distinct | 5. <i>V. indica</i> . |
| Leaves simple; fl. tetramerous, in dichotomous cymes | 6. <i>V. adnata</i> . |
| Leaves simple; stems fleshy, quadrangular; fl. tetramerous | 7. <i>V. quadrangularis</i> . |
| Leaves trifoliate. | |
| Flowers pentamerous | 8. <i>V. himalayana</i> . |
| Flowers tetramerous, in leaf-opposed cymes; leaves rough | 9. <i>V. carnosa</i> . |
| Flowers tetramerous, in axillary cymes; leaves glabrous | 10. <i>V. lanceolaria</i> . |

1. *V. vinifera*, Linn.; W. & A. Prodr. 130. The grape vine.—Sans. *Drāksha*; Arab. *Ainab*; Pers. *Angūr*. Vern. *Dākḥ*, *dakki*, *drāksha*, *angūr*. Local, *Lānang* (fruit, *dakhang*), Kunawar.

A large woody climber, with long, bifid tendrils. Leaves glabrous above, clothed beneath with grey, floccose, deciduous tomentum, suborbicular with cordate base, more or less deeply 5-lobed, edge cut into large, unequal, acute teeth; basal nerves 5, the midrib with 4-5 pair of prominent main lateral nerves. Petiole generally shorter than leaf, but longer than half its length. Flowers green, fragrant, pentamerous, on slender pedicels longer than flower, in umbelliform cymes, which form large pyramidal compound panicles, one of the lower branches of the inflorescence sometimes terminating in a short tendril. Bracts oblong, early deciduous. Petals oblong, cohering at the top, separating from the base, and raised by the development of the stamens.

Indigenous in Armenia, the Caucasus, other parts of Western Asia, and probably also in Bulgaria, Thracia, and Greece, where the vine is found as a large woody climber on *Ostrya*, *Fraxinus*, *Platanus*, and other trees, in shady forests and moist valleys. In the N.W. Himalaya, also, the vine is often found apparently wild, but it is not always easy to distinguish it from some of the other species (Thoms. West. Him. 348). The native country of the vine cannot precisely be defined, for whenever cultivated under favourable climatic conditions, it spreads readily. So much, however, is certain, that its cultivation, both in Syria and Greece, is as old as the oldest historical records which we possess of those countries; that Greek colonists and traders imported it into Italy at an early age (*olivos, vinum*); that from Western Asia and South-Eastern Europe its cultivation has gradually spread over the rest of Europe; and that from Europe it has been introduced to the Cape, temperate Australia, and North America.

The present northern limit of vineyards on a large scale is at 47° 30' N. lat. in the Bretagne, and thence runs eastward, slightly tending towards the north, crossing the Rhine at lat. 50° 45', and attaining its northernmost point in Silesia at lat. 51° 55'.—(Grisebach, *Vegetation der Erde*, i. 126.) The comparison of this line with the lines of equal temperature during the different seasons, shows that it is the want of sufficient summer-heat which prevents its profitable cultivation further north in Western Europe. In the middle ages, however, there were vineyards in the south of England, and not far from the Baltic. In India, extensive vineyards were formerly in Kunawar, from Jami to Sangnam (between 5500 and 9000 ft.), and in some of the other inner and drier valleys of the N.W. Himalaya. But the vine disease broke out in these secluded valleys (between 1855 and 1860), and since then the cultivation has greatly diminished. Excellent grapes are grown in Kashmir, the plains of North-West India, the Dekkan, and in other parts of India, but not in the moist tropical climate of the western coast below Ghat, and of the Burma coast. Nor does the grape vine bear well in Lower Bengal. In the Himalaya the grape

ripens in September, in the plains of the North-West in June, and in the Dekkan in March. In the Mauritius the vine flowers twice, in Apr. and Sept. (Bojer, Hort. Maur. 60). The wood of the vine is remarkable by its numerous large medullary rays and exceedingly numerous pores, giving it the appearance of a sieve. In spring it yields an abundance of clear watery sap, which rises with great force, and several Indian species do the same.

2. *V. latifolia*, Roxb. Fl. Ind. i. 661; W. & A. Prodr. 130.—Syn. *Cissus latifolia*, Vahl; Dalzell & Gibson, Bomb. Fl. 39.

A large herbaceous climber, from a perennial root-stock. Tendrils long, bifid, often flower-bearing. Leaves tomentose beneath, suborbicular, with cordate base, angled or slightly 5-lobed, lobes dentate; basal nerves 5; the midrib with 2-5 pair of prominent main lateral nerves. Petioles shorter than leaf. Flowers pentamerous, deep reddish brown, on short thick pedicels; in compound pyramidal panicles 1-4 in. long, issuing from the middle of the tendril before it divides; petals distinct. Ovary 10-furrowed at the apex. Berry black.

Plains of North-West India, Sub-Himalayan tract (Sewaliks and Bhabar), as far as the Sutlej. Satpura range. The Konkan. Also in Bengal and South India. Fl. May-July. Madden, Journ. As. Soc. xvii. pt. i. 379, notices *V. latifolia* as "an immense climber, with cable-like stems, sometimes 2 ft. in diam." Vern. *Pan lagula*, *Bhains-amli*, Kamaon. Is this another species? (perhaps *adnata*.)

3. *V. parvifolia*, Roxb. Fl. Ind. i. 662. Vern. *Berain*, Kamaon.

A slender vine, stem and old branches ligneous, branchlets glabrous. Tendrils bifid. Leaves glabrous, 2-3 in. long, 1-2 in. broad, ovate, acuminate, dentate or serrate, often more or less deeply 3-lobed; basal nerves 5, midrib with 2-3 pair of main lateral nerves. Flowers minute, green, pentamerous, on long slender pedicels, umbellate, the umbels arranged in a panicle, 1-2 in. long, leaf-opposed, or inserted on a tendril. Petals cohering at the apex.

Sub-Himalayan tract, and outer ranges from Kashmir to Bengal, ascending to 6000 ft. Fl. April, May.

4. *V. lanata*, Roxb. Fl. Ind. i. 660; W. & A. Prodr. 131. Vern. *Purain*, Kamaon.

Woody, climbing over high trees; branches, petioles, and peduncles woolly. Leaves ovate, from a flat or cordate base, acuminate, about 4 in. long, 3 in. broad, dentate, angled or indistinctly 3-lobed, densely clothed beneath with rusty or reddish soft tomentum. Flowers small, greenish, pentamerous, umbellate, on slender pedicels, in large compound leaf-opposed panicles, one of the lower branches often terminating in a tendril. Petals pale yellow, cohering at the apex. Fruit globose, the size of a pea, 1-seeded.

South India, Bengal, Sub-Himalayan tract, as far north as Hazara, ascending to 5000 ft. Fl. April, May. The stem yields an abundance of sap in Spring. (Madden.)

V. rugosa, Wall. Roxb. Fl. Ind. ed. Carey, ii. 480.—Vern. *Asoja pahar-phuta* (the mountain-splitter), creeps over crags and rocks in Kamaon at from

5000 to 6500 ft. (Madden Journ. As. Soc. vol. xvii. pt. i. 417), and resembles *V. lanata*, but differs by larger leaves 6-12 in. long, deep red flowers, the petals distinct, not cohering. Fl. July. Grapes edible, ripen Sept.-Oct. (whence the first vern. name). In W. & A. Prodr., this sp. is united with *V. lanata*.

5. *V. indica*, Linn. ; Roxb. Fl. Ind. i. 660 ; W. & A. Prodr. 131.

A large climber ; branches petioles and peduncles villose ; leaves hard, firm, broad-ovate, 3-6 in. long, and of equal breadth, with a deep-cordate base, not lobed or angled, but large- and shallow-crenate, the nerves terminating in hard glandular teeth ; under side rusty-tomentose, upper floccose, at length glabrous. Flowers minute, pentamerous, yellowish green or greenish purple, on slender pedicels, umbels sessile along the rachis of a short compact cylindrical raceme, inserted about the middle of a long bifid tendril. Petals distinct ; fruit globose, 1-2-seeded.

South and probably Central India. Bengal. Fl. March, April.

6. *V. adnata*, Wall. ; W. & A. Prodr. 126.—Syn. *Cissus adnata*, Roxb. Fl. Ind. i. 405 ; Wight Ic. t. 144.

A large woody climber, young parts densely pubescent. Leaves broad-ovate from cordate base, acuminate, angled, and sharp-dentate. Flowers tetramerous, greenish yellow, in rounded leaf-opposed cymes ; petals distinct. Berry black when ripe.

Sub-Himalayan tract. Oudh forests, Satpura range. Bengal, South India. Fl. April-June. *C. rosea*, Royle Ill. t. 26, is nearly allied to this, but has pink flowers and larger leaves. Sewalik and Bhabar, Jumna to Sarda.

7. *V. quadrangularis*, Wall. ; W. & A. Prodr. 125 ; Wight Ic. t. 51.—Syn. *Cissus quadrangularis*, Roxb. Fl. Ind. i. 407. Vern. *Harjora*, Beng.

A perennial climber ; stems and branches dichotomous, succulent, quadrangular, constricted at the nodes, the angles winged. Leaves fleshy, varying from ovate and entire to cordate and deeply 3-lobed. Tendrils long, generally simple, leaf-opposed. Flowers tetramerous, pink and white, in umbelliform cymes, on short, leaf-opposed peduncles. Petals distinct. Berry globose, size of a small pea, red, 1-seeded.

Common throughout tropical and subtropical India. Fl. R.S., fr. C.S. Berries very acid, leaves and tender shoots eaten. Datzell, Bombay Fl. 40, calls this *Cissus edulis*, and a nearly allied species without wings in Guzerat (vern. *Harsanker*), he calls *Cissus quadrangularis*, Linn.

8. *V. himalayana*.—Syn. *Ampelopsis himalayana*, Royle Ill. 149. Vern. *Chappar tang*, Kamaon.

A large soft-wooded climber or scrambling shrub ; glabrous, or youngest shoots slightly pubescent. Leaves trifoliate, smooth, shining ; leaflets equally stalked, acuminate, sharp-serrate or dentate with cuspidate teeth, the terminal leaflet ovate or obovate ; main lateral nerves 6-10 pair, the two lateral leaflets very unequal-sided, falcate, or semicordate, all reticulate beneath with prominent veins. Stipules oblong, early deciduous. Flowers yellowish green, pentamerous, in compound, trichotomous, leaf-opposed, spreading cymes. Peduncles as long as, or shorter than, petiole of the opposite leaf.

Himalaya, 3000-9000 ft. (in Sikkim, to 11,000 ft.), from Kashmir to Assam Kasia hills, Pulney hills, Burma. Fl. April, May. Hardy in England.

9. *V. carnosa*, Wall. ; W. & A. Prodr. 127.—Syn. *Cissus carnosa*, Roxb. Fl. Ind. 409.

A large climber, with herbaceous compressed stem, from a perennial root-stock. Young parts clothed with short pubescence. Leaves trifoliolate, rough ; leaflets ovate or elliptic, the two lateral short-stalked, nearly sessile, often oblique, crenate-serrate, main lateral nerves 4-6 pair ; stipules oblong. Flowers tetramerous, greenish white, in trichotomous, compound, leaf-opposed cymes ; peduncles generally longer than common petiole of the opposite leaf. Petals distinct. Berries black, 2-4-seeded.

Common in hedges and forests in most parts of India and Burma, as far north as the Salt-range and the Indus in the Panjab. Fl. July, Aug.

10. *V. lanceolaria*, Wall. ; W. & A. Prodr. 128.—Syn. *Cissus lanceolaria*, Roxb. Fl. Ind. i. 412.

A large, evergreen, climbing shrub, glabrous, only inflorescence pubescent. Stems woody, with rough often muricated bark ; tendrils leaf-opposed. Leaves trifoliolate, coriaceous ; leaflets ovate or lanceolate, petiolulate, penniveined, 3-5 in. long, distantly serrate, acuminate. Flowers unisexual, pale yellow, tetramerous, in axillary, subsessile, dichotomous, compound cymes. Petals distinct. Fruit ovoid, $\frac{1}{2}$ in. long.

South India, Oudh forests. Fl. March, April.

A trifoliolate vine is described by Madden, l. c. 379, 418, as *V. tomentosa* (Vern. *Chappertang*, *chappertain*, *cheprain*, *amila*), with red flowers, similar to those of *V. rugosa*. "Very common, reaching to 6000 ft. in Kamaon." *V. capreolata*, Royle Ill. i. 149 (*Cissus capreolata*, Don ; Royle Ill. t. 26) ; Vern. *Pang pata*, Kamaon ; is a slender climber, with pedate, 5-foliolate, glabrous leaves, common in the N.W. Himalaya, 4000-7000 ft. "Clinging to the trunks of trees as closely as the ivy" (Royle).

2. LEEA, Linn.

Herbs or shrubs, branches generally furrowed. Leaves alternate, rarely opposite, simple pinnate bipinnate or tripinnate ; petioles with broad sheathing base. Flowers in compound cymes ; peduncles leaf-opposed ; no tendrils. Calyx 5-dentate. Petals 5, more or less cohering at the base, and adhering to the staminal tube. Stamens 5 ; anthers on short filaments, inserted on the outside of an entire or 5-cleft staminal tube. Ovary inserted on the disc, 3-6-celled ; style short ; one ovule in each cell. Fruit a 3-6-celled berry. Seeds erect ; embryo small in a cartilaginous albumen.

Several species of this genus are large perennial herbs or herbaceous shrubs, characteristic of certain descriptions of forests in India. The following are found in the sub-Himalayan tract of N.W. India :—

Leaves pinnate, or the lower only bipinnate.	.	.	1. <i>L. aspera</i> .
Peduncle as long as cyme, or shorter.	.	.	2. <i>L. alata</i> .
Peduncle several times longer than cyme.	.	.	3. <i>L. sambucina</i> .
All leaves bipinnate.	.	.	4. <i>L. macrophylla</i> .
Leaves simple.	.	.	

1. *L. aspera*, Wall.; Roxb. Fl. Ind., ed. Carey, ii. 468; Edgeworth Trans. Linn. Soc. xx. 36.—Vern. *Kumali*, *kurmali*, Kamaon.

A tall herbaceous perennial, 2-4 ft. high, pubescent. Leaves imparipinnate, the lower leaves often bipinnate; common petiole not winged; leaflets (pinnae) 2-3 pair, ovate or ovate-oblong, acuminate, base cordate or rounded, 4-8 in. long, pale beneath, obtusely dentate, main lateral nerves 12-16 pair, joined by distinct intramarginal and numerous fine closely-parallel veins. Cymes sessile or short-pedunculate, with subulate, deciduous bracts. Anthers not adhering to each other; filaments inserted near the base of the staminal tube, alternating with its oblong, obtuse emarginate lobes. Berry black.

Forests of the Outer Himalayan valleys, ascending to 6000 ft. Bias to Nepal, Oudh forests, Satpura range. Fl. June, July.

2. *L. alata*, Edgew. l. c. 36.—Syn. *L. rubra*, Royle Ill. p. 145.

A large herbaceous perennial, glabrous, but rough with elevated dots. Leaves imparipinnate; common petiole furrowed, winged with narrow membranous wings; leaflets 3 pair, 6-10 in. long, oblong, acute, base acute or rounded, the upper 2 pair sessile, the lowest pair short-petiolate; petioles winged; main lateral nerves 8-12, joined by parallel, transverse, and intramarginal veins. Cymes compact, compound, on long peduncles more than twice the length of cyme; peduncles and ramifications of cymes red, furrowed, winged, and rough with elevated glandular dots. Anthers adhering to each other sideways; filaments inserted below the edge of staminal tube, alternating with its obovate lobes.

Siwalik and sub-Himalayan tract, from the Jumna to Sikkim, ascending to 3000 ft. Fl. R.S.

3. *L. sambucina*, Willd.—Syn. *L. Staphylea*, Roxb. Fl. Ind. i. 658, W. & A. Prodr. 132; Wight Ill. i. t. 58.

A shrub, with stout soft-wooded stems; glabrous. Leaves twice or thrice pinnate; pinnae 2-3 pair; leaflets on short petioles, firm, hard, pale beneath, oblong ovate- or lanceolate-oblong, coarsely serrate, with 8-12 main lateral nerves; transverse veins not prominent. Stipules large, adnate to the base of petiole, coloured. Flowers greenish white, in large, trichotomous, divaricate cymes, on short peduncles. Berry black or dark-blue, size of a small cherry, depressed, 4-6-furrowed, 4-6-seeded.

Widely spread in the forests of tropical and subtropical India, probably in the forests of Oudh, Kamaon, and the Central Provinces. Tropical Asia, Upper Guinea, Queensland, and North Australia. Fl. R.S.

4. *L. macrophylla*, Roxb. Fl. Ind. i. 653; Wight Ic. t. 1154.

A large herbaceous perennial. Leaves broad-cordate, 12-20 in. long, deeply and unequally dentate, pale beneath, 8-12 pair main lateral nerves. Flowers small, white, in large terminal, compound cymes.

Forests of tropical and subtropical India, sub-Himalayan tract to the Ganges. Fl. R.S.

ORDER XXVII. SAPINDACEÆ.

Trees or shrubs, with alternate or opposite leaves, with or without stipules, and small flowers which are generally polygamous. Sepals mostly 4-5, imbricate, rarely valvate, more or less connate. Petals mostly 3-5 or none, imbricate, often hairy below. Disc complete or 1-sided. Stamens hypogynous, 5-10, generally 8, the filaments often hairy. Ovary 1-4-celled, generally 3-celled; ovules 1-2 in each cell, on axile placentas. Fruit various; seeds generally without albumen.—Gen. Pl. i. 388; Royle Ill. 136; Wight Ill. i. 139.

Fruit coriaceous, 1-3-celled; leaves without stipules.

Leaves opposite, palmately compound

1. *ÆSCULUS*.

Leaves alternate, pinnate

2. *SCHLEICHERA*.

Fruit of 1-3 nearly distinct indehiscent carpels; leaves usually without stipules.

Carpels not winged; leaves alternate, abruptly pinnate or unifoliate

3. *SAPINDUS*.

Carpels 2, with long wings at the back; leaves opposite, simple, entire or palmatifid

4. *ACER*.

Fruit a membranous, deliscent, 2-5-celled capsule; leaves with or without stipules.

Sepals 5, valvate; petals none; stamens 8; leaves simple, alternate, without stipules

5. *DODONÆA*.

Sepals 5, imbricate; petals 5; stamens 5; leaves opposite, trifoliate or pinnate, stipulate

6. *STAPHYLEA*.

1. *ÆSCULUS*, Linn.

Trees with large scaly buds, and opposite, digitate, deciduous leaves, without stipules. Flowers showy, in an ample terminal thyrsus, polygamous, the fertile flowers generally near the base of the branches of the thyrsus, the others sterile by abortion of the ovary, otherwise similar; the pedicels articulate; bracts deciduous. Calyx campanulate or tubular, 5-lobed, deciduous, the lobes more or less unequal, imbricate in bud. Petals 5, alternate with the lobes of the calyx, often only 4 from the abortion of the fifth, hypogynous, unequal, imbricate in bud, deciduous. Disc hypogynous, lobed. Stamens 6-8, commonly 7, outer circle 5, alternate with petals, inner circle 1-3; filaments subulate or filiform; anthers versatile, introrse, with glandular tips at both ends, 2-celled, opening longitudinally. Ovary 3-celled; style slender, undivided; ovules 2 in each cell. Fruit a large leathery capsule, 1-3-celled, the cells 1-seeded, loculicidally 2-3-valved. Seeds large, with a smooth, shining, coriaceous testa, and a broad opaque hilum. Albumen none; cotyledons thick, fleshy, more or less corrugate, and coherent by their contiguous faces, unequal, incumbent on the short conical radicle, plumule conspicuous, 2-leaved. The cotyledons remain in the coriaceous testa whilst the seed germinates.

1. *A. indica*, Colebrooke.—Tab. XIX.—Syn. *Paria indica*, Wall.; Jacquemont Voy. Bot. t. 35. *The Indian Horse-chestnut*.—Vern. *Seutoalla*, Kafiristan; *Torjaga*, Trans-Indus; *Hāne*, *hanūdūn*, Kashmir; *Ban-khor* (forest-walnut), *gūgu*, *kanor*, Pb.; *Pānkar*, N.W.P.

Leaflets 5-9, generally unequal, the centre leaflets longer, 6-9 in. long, glabrous, oblong, acuminate, sharp-serrate, petiolule $\frac{1}{2}$ -1 in. long. 15-20 alternate, arcuate, lateral nerves on either side of midrib. Thyrsus 12-15 in. long, composed of numerous scorpioid cymes on short peduncles; pedicels and calyx covered with grey, mealy pubescence. Calyx tubular, frequently splitting as the flower opens, with 5 short, obtuse, unequal teeth, one obcordate, larger than the others. Petals 4, white and yellow, clawed, lamina obcordate; 2 petals narrower than the rest. Stamens 7; filaments filiform, longer than petals. Disc unilateral. Capsule ovoid or obovoid, 1-2 in. long, brown when ripe, reddish brown when young, somewhat rough outside, but not echinate. Seeds dark brown or black.

Wild in Kaffiristan at 7000-8000 ft., in the forests on the Trans-Indus hills north-west of Peshawar, and common in many parts of the North-West Himalaya at 3400-9000 ft., from the Indus to Nepal. Never entirely bare of leaves. Flowers appear about April and May, when the tree, loaded with the large upright panicles of variegated blossoms, presents a very striking appearance. The fruit ripens between July and Oct.

The North Indian horse-chestnut is not a gregarious tree, but is often found in large numbers, particularly in moist and shady valleys. The trunk is short, attaining large girth (12-15 ft., occasionally 25 ft.) Numerous large boughs, spreading into a broad, depressed, close, umbrageous crown 40-50 ft. high, much resembling in habit the common horse-chestnut. The bark of trunk and large boughs is thick ($\frac{3}{4}$ -1 in.), the inner half light-yellowish brown, soft and brittle, the outer darker brown and more fibrous. Outer surface grey or dark brown, divided by numerous long shallow furrows into long quadrangular plates, often winding spirally round the trunk. When old, the outer layers partly peel off upwards in long strips, leaving exposed a smooth grey surface. The wood is light brown, soft, open-grained, not much valued, but used in the hills for building, for water-troughs, platters, packing-cases. Has been found to answer well for tea-boxes. The Tibetan drinking-cups are sometimes made of this wood.

The twigs and leaves are largely lopped for winter fodder in the Himalaya and Kaffiristan. Cattle and goats feed on the fruit. The seeds contain an abundance of starch combined with a bitter principle. In times of scarcity they are used as food, ground and mixed with flour, after having been steeped in water for some time.

Closely allied to this species is *A. punduana*, Wall., *A. assamica*, Griff., the horse-chestnut of Sikkim, Assam, and the Kasia hills; also found by me in the Thongyeen forests of Tenasserim, with larger, more coriaceous, obovate-oblong leaves, nearly sessile, and the thyrsus composed of long-pedunculate scorpioid cymes.

Esculus Hippocastanum, Linn., the common horse-chestnut, which has been cultivated in Europe ever since the sixteenth century (1576 in Vienna), has echinate capsules, 4 or 5 broad petals, larger leaflets, woolly when young, with double serratures, and prominent lateral nerves. The common horse-chestnut is supposed to be indigenous in India (Boissier Fl. Orient. i. 947). Of this, however, there is as yet no proof, and its original home is unknown. It is found in Persia and the Caucasian region, but not really wild.

2. SCHLEICHERA, Willd.

Trees with alternate pinnate leaves, without stipules. Flowers fasciculate, polygamous. Calyx small, 4-6-cleft. Petals none. Stamens 6-8, longer

than calyx, inserted near the centre of a flat, undulate, indistinctly lobed disc; anthers 2-celled, dehiscing longitudinally. Ovary ovoid, 3-4-celled, narrowed into a rigid style; stigma capitate, 3-4-cleft, divisions recurved; one erect ovule in each cell. Fruit dry, coriaceous, indehiscent, 1-3-celled. Seeds enclosed in a fleshy arillus; embryo conduplicate, the cotyledons unequal and closely coherent.

¶ 1. *S. trijuga*, Willd.—Tab. XX.—Bedd. Fl. Sylv. t. 119; Roxb. Fl. Ind. ii. 277; W. & A. Prodr. 114.—Vern. *Kosum*, *kossum*, *kussumb*, *gausam*, *kūsam*, North-West and Central India; *kassuma*, *Koham*, *kooham*, Panch Mehals; *Sagdi marra*, Can.; *Gyoben*, Burm.

Young parts downy. Leaves abruptly pinnate, coriaceous when old; leaflets 2-4 pair, opposite, sessile, oblong, entire, obtuse-acute or short acuminate, with 10-18 main lateral nerves on either side of the midrib, and intermediate shorter nerves; the leaflets of the lowest pair 1-3 in., of the terminal pair 6-9 in. long. Flowers yellow, on short pedicels, fascicled on interrupted, often branched, racemes. Racemes axillary, or below the leaves, often several on short branchlets. Male and bisexual flowers generally on different trees. Fruit the size of a nutmeg, pointed, often echinate. Seeds 1 or 2, with a smooth brown testa, enclosed by a pulpy arillus, which has a pleasant acid taste. The cotyledons full of fat oil.

Common in the dry forests of Southern, Central, and Eastern India, at elevations below 3000 ft. In North-West India it is found in the Oudh forests and the Siwalik tract, where it ascends to 3000 ft., its western limit being the Sutlej river. It is grown in gardens near Lahore, and in Sindh. The *Kosum* is not a gregarious tree; it grows singly, or a few together, mixed with the other trees of the dry forest. The old leaves are shed in Feb., the young foliage comes out in March, affording a grateful shade when the other trees of the dry forest are still leafless. The young leaves are purple at first, then light green, the old foliage has a deep green colour. The fl. come out with the young leaves.

A large tree, attaining 60-70 ft. in South India and Burma, smaller in Central and North India. Trunk scooped out longitudinally, with deep and irregular furrows, 5-6 feet in girth (to 12 ft. in Burma and South India), often hollow when large, with a few large ascending boughs, forming a broad rounded crown. Bark $\frac{1}{2}$ in. thick, ash-grey or greyish brown, marked by shallow hollows, left by oblong, exfoliating scales.

Heartwood distinct, red or reddish brown, very heavy, close-grained, hard, tough, and strong. Pores scanty, small, uniformly distributed. Medullary rays very numerous, very fine. Seasons well, takes polish, and is very durable. Weighs between 66 and 70 lb. per cub. ft. Valued where strength, hardness, and durability are required. Oil, rice, and sugar crushers, pestles and mortars, rollers, screws, and the teeth of harrows are made of it; it is also used in building, and for various parts of carts and ploughs.

In many parts of India, Lakh is produced on the young branches: at Mirzapūr the Lakh of this tree is stated to be the best, and to keep good for 10 years; while the Lakh of other trees is said to last 2 years only. In Oudh this tree is lopped, and the twigs and leaves are used as cattle-fodder during the dry season. Oil is extracted from the seeds in South India and Ceylon.

3. **SAPINDUS**, Linn.

Trees or shrubs, with alternate, abruptly pinnate, or unifoliolate leaves, without stipules. Flowers polygamous, in terminal or axillary panicles. Calyx of 5 somewhat unequal sepals, connate at base, imbricate in bud, deciduous. Petals 4 or 5, nearly equal, alternate with the sepals, claw thickened, and often with one or two scales on the inside. Disc fleshy, cup-shaped or flat, circular, hypogynous. Stamens generally 8-10, inserted in the centre of the disc round the ovary, or in the male flowers round the rudiment of the ovary; filaments hairy; anthers versatile. Ovary generally 2-4-lobed, usually 3-celled; ovule solitary in each cell, erect from the base, or ascending from the inner angle above the base. Fruit fleshy or coriaceous, consisting of 1-3 distinct indehiscent carpels. Seed globose; hilum inferior, without arillus; the embryo incurved or straight; cotyledons fleshy; radicle short.

Several species of this genus are cultivated in North and Central India on account of the fleshy pulp of the fruit, which contains a peculiar substance, saponine, with properties in many respects similar to soap. The pulp makes a lather with water, and is used extensively for washing, either by itself, or mixed with soap. For flannel and Kashmir shawls it is greatly preferred to soap, and some varieties are specially esteemed for washing silk. In Bengal, Central and Northern India, the tree is generally known under the name of *Ritha*, and the Sanskrit name is *Arishta*. The species and varieties of this genus will repay further study. Three species are here enumerated, in accordance with Roxburgh's *Flora Indica*, but it is probable that the two first should be united into one species.

Leaflets 4-6, generally opposite; main lateral nerves 6-12; disc and ovary hirsute; anthers oblong, apiculate.

Leaflets ovate or oblong, acuminate

1. *S. laurifolius*.

Leaflets ovate, obovate or oblong, obtuse or emarginate

2. *S. emarginatus*.

Leaflets 8-14, generally alternate; main lateral nerves 20 or more;

disc and ovary glabrous; anthers ovate, not apiculate

3. *S. detergens*.

1. ***S. laurifolius***, Vahl; Roxb. *Fl. Ind.* ii. 278; W. & A. *Prodr.* 111.

Leaflets ovate or oblong, acuminate, 2-3 pair, those of the terminal pair longest, 3-7 in. long, glabrous above, soft pubescent beneath; main lateral nerves 8-12 on either side of the midrib, with a few shorter intermediate ones. Ramifications of inflorescence and calyx clothed with rusty pubescence. Cymes generally 3-flowered, supported by 3 short bracts, lateral flowers often abortive. Male flowers numerous, bisexual flowers few, often on distinct branches. Sepals 5, obtuse, imbricate, 2 outside, 2 inside, 1 intermediate, the left edge overlapping. Petals 4 or 5, oblong or lanceolate, outside with adpressed tawny hairs, inside glabrous, but with long white hairs along the edge, with a membranous scale fringed with a dense mass of long white hairs, more or less attached to the claw and inner surface of the petal, probably free when quite young, sometimes attached along the middle line only, and free at the sides, in which case it happens that the two edges of the scale separate from the middle part, and appear as lateral appendices. In the descriptions quoted (*Fl. Ind.* and *Prodr.*), the petals are said to be without scales. Beddome