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STUDIES IN THE BORAGINACEAE, XX REPRESENTATIVES OF THREE SUBFAMILIES IN EASTERN ASIA

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PRESENTED HERE is an account of the Cordioideae, Ehretioideae and Heliotropioideae known from China, northern Indo-China, Hainan, Formosa, Ryukyus, and Japan. The classification of the larger and much more complex Boraginoideae will be treated in subsequent papers. The groups here treated are the more primitive ones of the family and are chiefly trees and shrubs. They are well represented in the herbarium of the Arnold Arboretum. My study has been based primarily on that collection. Very valuable in clarifying many details, however, have been specimens made available to me at the Gray Herbarium and the New York Botanical Garden.

KEY TO THE SUBFAMILIES AND GENERA

Style twice forked, the four ultimate branches each bearing a stigma; cotyledons plicate; endosperm absent. CORDIOIDEAE.....1. *Cordia*.
Style simple or simply forked or divided; stigmas 1 or 2; cotyledons not plicate.

Style arising from the fruit and seated terminally in its pericarp, falling away with it; endosperm usually present though often scanty.

Stigmas usually 2, small, capitate or elongate or rarely subpeltate, not differentiated into receptive and sterile tissue; style usually lobed or parted. EHRETIOIDEAE.

Fruit dry, breaking up into bony nutlets; herbs..2. *Coldenia*.

Fruit drupaceous; shrubs or trees.

Style simple, terminated by a small obscurely bilobed subpeltate stigma; endocarp strongly lobed.....3. *Rotula*.

Style evidently lobed or even nearly divided; stigmas 2.

Style almost divided, forking well below middle; endocarp of mature fruit remaining entire, ovoid.....

.....4. *Carmona*.

Style forked above the middle; endocarp of mature fruit dividing into single-seeded or 2-seeded pyrenes.....5. *Ehretia*.

Stigma single, partially sterile, conic or frustrum-like or rarely pel-tate, stigmatic only in an obvious sharply delimited and usually tumid circumferential band at base, or rarely irregularly globose and broadly and somewhat indefinitely stigmatic laterally but sterile at the apex; sterile portion of stigma frequently somewhat bilobed; style simple or none. HELIOTROPIOIDEAE.

Fruit at maturity without a clearly differentiated, well-developed mesocarp, dry, the bony endocarp covered only by a thin layer of epicarp; herbs and suffrutescent plants.....6. *Heliotropium*.

Fruit at maturity with an evident well-developed mesocarp; mostly shrubs and trees.

Mesocarp very juicy, soft and watery, shrinking greatly or even disappearing in drying; chiefly scandent shrubs....7. *Tournefortia*.

Mesocarp vesicular, forming permanent firm corky tissue about the endocarp; herbs, shrubs, and trees:.....8. *Messerschmidia*.

Style not borne directly on the fruit, seated independently at the middle of the floral receptacle or on a central upward projection of the receptacle (gynobase) and arising between the lobes of the dry fruit (nutlets) and free from them; style simple; stigma simple or rarely 2-lobed; endosperm absent; mostly herbs. BORAGINOIDEAE.

1. CORDIA L.

Cordia L., Sp. Pl. 190 (1753) and Gen. Pl. 87 (1754).

Trees or shrubs; leaves small to large, usually evidently petiolate, margin entire, crenate, serrate or rarely even lobulate; cymes ebracteate, mostly corymbose; flowers homomorphous or heterostyled or functionally more or less unisexual (functionally male flowers with style and stigmas much reduced or completely undeveloped); corolla campanulate to funnelform, small to large, white, yellow, orange or red, usually 5-merous but occasionally 4-8-merous, lobes ascending to recurved, tube short to long, cylindric or expanding; stamens exserted or included, filaments often hairy towards the base, usually well developed; style terminal on ovary, dichotomous, a simple column at base, then dividing into two branches which in turn fork to produce the four ultimate branches each bearing a stigma; stigmas 4, clavate to spatulate or capitate; fruit a drupe with watery or glutinous mesocarp or rarely without fleshy mesocarp and hence a nut; endocarp bony, 1-4-seeded; seeds without endosperm; cotyledons plicate.

A large group of tropical trees and shrubs having the majority of its species and its center of greatest diversity in America. With the sole exception of *C. subcordata*, all the Old World species belong to the section *Myxa*. It is now clear that a large number of American species, those treated in my previous writings as belonging to the section *Pilicordia*, also belong in the section *Myxa*. The section, accordingly, is now recognized as the largest and most widely represented in the genus. With so many species and with representatives in so many floras involved it would

be unfortunate to have this large section disassociated from the genus *Cordia*. This is a possibility if the genus continues to be typified by *C. Sebestena*. The substitution of *C. Myxa* as genotype should be considered.

The generic name *Cordia* was historically first associated with *Cordia Sebestena*, and Linnaeus gave every evidence of building his generic concept around that species, cf. Johnston, Contr. Gray Herb. 92: 41 (1930) and Jour. Arnold Arb. 16: 4 (1935); and Hitchcock and Greene, Proposals Brit. Botanists, Intern. Bot. Cong. Cambridge p. 133 (1929). Logic may demand that *C. Sebestena* be accepted as genotype, but I have come to realize the possible effects, and now believe logic should yield to expediency. *Cordia Sebestena* is one of a small group of mainly West Indian species, certainly aberrant in *Cordia* as a whole, which has been and probably should be treated as generically distinct. I am not prepared to have the name *Cordia* restricted to the few relatives of *C. Sebestena*. It seems best to have *C. Myxa* declared the genotype of *Cordia* and so guarantee the continued wide application of the epithet. In justification of this it can be pointed out that among the three species of *Cordia* treated in the Species Plantarum of 1753, *Cordia Myxa* was the first treated and the only officinal plant, and it certainly was the best known to Linnaeus and his contemporaries.

KEY TO THE SPECIES

Flowers large, orange, over 3 cm. long; fruit with corky mesocarp, developing completely and tightly enclosed by the enlarged coriaceous calyx.

§ *Sebestena*.....1. *C. subcordata*.

Flowers small, white, 6–16 mm. long; fruit a drupe with watery or viscous mesocarp, supported at base by a small, weakly accrescent, usually explanate calyx. § *Myxa*.

Calyx strongly 10-ribbed; flowers heterostylic, style developed in all flowers; Formosa.....2. *C. Kanehirai*.

Calyx not strongly ribbed; flowers either hermaphroditic or male; no style developed in the male flowers.

Lateral inflorescences extra-axillary; corolla 7–9 mm. long; ultimate style-branches 2 mm. long.....3. *C. furcans*.

Lateral inflorescences terminal on short leafy axillary twigs.

Inflorescence loose; corolla 8–10 mm. long; ultimate style-branches 3–5 mm. long.....4. *C. dichotoma*.

Inflorescence narrow and congested; corolla 14–16 mm. long; ultimate style-branches 5.5–6 mm. long.....5. *C. cochinchinensis*.

1. *Cordia subcordata* Lam., Tab. Encyc. 1: 421 (1891); Poir., Encyc. 7: 41 (1806); Clarke, Fl. Brit. India 4: 140 (1883); Gagnep. & Cour., Fl. Indo-Chine 4: 204 (1914) — “ex insulis Praliniis,” *Commerçon*.

Cordia orientalis R. Br., Prodr. 498 (1810) — type from Australia.

Cordia campanulata Roxb., Hort. Bengal 17 (1814) and Fl. Indica, ed. Car. & Wall. 2: 332 and 336 (1824) — type from India.

Cordia Rumphii Blume, Bijdr. 14: 843 (1826); Merrill, Interp. Rumph. Herb. Amboin. 447 (1917) — "in insulis Moluccanis."

Cordia muluccana Roxb., Fl. Indica, ed. Car. & Wall. 2: 337 (1824); Hallier, Meded. R. Herb. Leiden 36: 3 (1918) — "native of the Moluccas."

Cordia hexandra R. & S., Syst. 4: 799 (1819) — type from India.

Tree 2–15 m. tall; leaves ovate to elliptic, firm, 8–20 cm. long, 5–15 cm. broad, with petiole 2–8 cm. long, margin entire (or toothed only on vigorous shoots), base obtuse to rounded or rarely subcordate, apex obtuse to rounded or rarely acute, short-acuminate, upper surface somewhat lustrous bearing minute inconspicuous very scattered short appressed hairs, in age frequently dotted with groups of mineralized epidermal cells, under surface more or less villulose or even tomentulose along the midrib and principal veins; inflorescence terminal, loose, cymose, 6–20-flowered, usually becoming oppositifolious and nodding at maturity, without the flowers 2–5 cm. long and 1–3 cm. broad, peduncle 0.5–2 cm. long; calyx at anthesis coriaceous, smooth, cylindric or slightly ampliate, 10–20 mm. long 4–8 mm. thick, glabrous or sparingly strigose, pedicel 0.2–1 cm. long; calyx after anthesis accrescent with the tube greatly distended by the enlarging fruit which it tightly and completely encloses, green or becoming somewhat yellowish at maturity; corolla large, conspicuous, funnelform, orange, 3.5–5 cm. long, with limb nearly as broad, lobes 5–7, broad, rounded, spreading; filaments attached above middle (about 17 mm. above base) of the flaring corolla-tube; style 23–30 mm. long; fruit dry, a nut (not a drupe), ovoid or obovoid or subglobular, 15–25 mm. thick, 20–30 mm. long, developing tightly and completely invested by the coriaceous calyx-tube, at extreme maturity by slight shrinkage of the corky mesocarp becoming loosened within the now hardened and somewhat woody calyx and only by chance destruction of the latter freed from it; endocarp bony, angular, much ridged and roughened, containing 4 ovuliferous cavities and a central sterile one, commonly maturing only 1–2 seeds; mesocarp firm, corky, permanently surrounding the rough endocarp and giving the fruit its rounded contours, dry at maturity.

Hainan; Indo-China to India and southward through the East Indies; also on the islands of the South Pacific, on the islands of the Indian Ocean, and along the east coast of Africa; a plant of tropical coasts having a fruit suitable for dissemination by ocean currents.

HAINAN: Yaichow, Yu-lum Harbor, seashore, *C. Wang* 34802 (A, NY).

A well-known and widely distributed strand-tree having fruit buoyed and protected by a tough corky mesocarp, well adapted for dissemination by ocean currents. It belongs to the section *Sebestena*, a very well marked group of species. Except for *C. subcordata*, all are confined to the West Indies, where several are local endemics in the Greater Antilles and only *C. Sebestena* has a wide occurrence as a wild tree. None of these American relatives are ocean-disseminated. *Cordia subcordata*, indeed, appears to be the only one so dispersed in the whole of *Cordia*.

The species is probably heterostylic. In some flowers the filaments are only 3 mm. long and support anthers 2–2.5 mm. long, while others have filaments two to three times as long, as well as anthers up to 3.5 mm. in length. The flowers with short stamens are associated with styles 27–30 mm. long, while those with longer stamens have styles 22–25 mm. in length. Heterostyly occurs in the American members of the section *Sebestena*. Field observations are needed to determine how general and how marked it may be in this Old World relative.

2. *Cordia Kanehirai* Hayata, Icon. Pl. Formosa 6: 31 (1916); Kanehira, Formosan Trees 634, f. 591 (1936) — type from Kuraru, Kôshun, Formosa, *Kanehira* 7.

Small tree; branches dichotomous, terete, with a short brownish appressed pubescence when young, later glabrescent; leaves lanceolate, broadest below middle, 8–14 cm. long, 2.5–5 cm. broad, with scattered minute appressed hairs especially when young, glabrescent in age, apex acute to slenderly acuminate, base broadly acute or rounded, with petiole 1.5–3 cm. long, margin entire or remotely and inconspicuously serrate, primary veins 5–6 on either side of the midrib, secondary and tertiary veins not conspicuous; inflorescence loosely cymose, 3–6 cm. broad, borne terminal between the diverging branches of the dichotomous stem or borne lateral and internodal; calyx densely brownish strigose, cylindric, 10-ribbed, 4–5 mm. long, with 5 small acute teeth; corolla white, lobes verrucose on upper surface, elongate, about as long as the tube; stamens attached above middle of tube, not much exerted; drupe probably white, erect, ellipsoidal, about 12 mm. long, supported by a cupulate calyx which becomes about 8 mm. in diameter; endocarp elongate, irregularly roughened by coarse ridges and tuberculations.

Known only from southern Formosa.

FORMOSA: Kôshun, Kuraru, Jan. 8, 1914, *Kanehira* 7 (ISOTYPE, A).

According to Kanehira, l.c., the plant is "known only from Kural, Kôsyun Peninsula" at the south end of Formosa, where it is "very scarce." It belongs to a closely interrelated group of species containing *C. aspera* Forst. of Polynesia, *C. micronesica* Kanehira & Hatusima of Palau, and *C. Cumingiana* Vidal of the Philippines. Judging only from the type collection, *C. Kanehirai* may be readily distinguished by its lanceolate glabrescent leaves and elongate endocarps. I have seen only very immature corollas. No doubt it, like its immediate relatives, has heterostylic flowers that function as either male or female. The style developed in the male flowers is only half the size of that in the female. As regards the size of stamens just the reverse condition is true. Functionally the trees are unisexual and the species dioecious. The strongest relations of the *C. aspera* group appear to be with species of Central America.

3. *Cordia furcans*, sp. nov.

Arbor 3–15 m. alta; foliis ovatis vel ellipticis 5–17(–25) cm. longis, 4–12(–20) cm. latis graciliter 3–8 cm. longeqe petiolatis, basi saepissime

obtusis vel rotundis, rare acutis vel subcordatis, apice obtusis non rariter plus minusve breviter lateque acuminatis, margine integris vel rariter obscure crenatis, supra saepe pilis minutis rigidulis adpressis plus minusve donatis (pilis e basi subbulbosa vel discoidea maturitate saepe pallida orientibus), subtus juventate pilis pallidis vel fulvescentibus mollibus non rariter abundantibus donatis tomentosis vel velutinis vel puberulentis, maturitate plus minusve glabratis sed non rariter velutinis, costa cum nerviis in facie inferiori folii prominentibus, in facie superiori leviter convexa; venis primariis majoribus utroque latere costae 3–5 fere rectis; inflorescentia terminali vel internodali laxa dichotomeque cymosa 2–20 cm. diametro 2–8 cm. longe pedunculata; floribus dimorphis 4–5-meris; calyce sessili vel subsessili in alabastro obovoideo saepissime haud apiculato juventate plus minusve fulvo-tomentoso vel subglabro, sub anthesi campanulato 4–6 mm. longo, lobis inaequalibus recurvatis 1–1.5 mm. longis; corolla alba 7–9 mm. longa, lobis 3.5–5 mm. longis oblongis recurvatis, tubo 3.5–4 mm. longo gradatim ampliato basi 1–1.5 mm. crasso apice 2–2.5 mm. crasso; filamentis sparse villosis apicem versus tubi affixis, eis floris masculini 3.5–5 mm. longis (antheris 2–2.5 mm. longis), eis floris hermaphroditi 1–1.5 mm. longis (antheris 0.5–0.8 mm. longis); ovario glabro globoso; stylo floris masculini nullo, floris hermaphroditi 4 mm. longo, columna basali 4 mm. longa, ramulis primariis 0.5 mm. longis, ramulis ultimis stigmatiferis 2 mm. longis valde compressis anguste oblanceolatis margine plus minusve lobulatis; drupa rubra vel rosea, erecta crasse ellipsoidea, calyce cupulata irregulariter lobata 5–8 mm. diametro glabro vel puberulento suffulto.

Southern China (so. Yunnan and Kwangsi), Hainan and south into Burma, Indo-China, and northern Siam.

YUNNAN: Ho-kou, alt. 1700 m., *H. T. Tsai* 52656 (A); Sheau-meng-yeang, Che-li Hsien, *C. W. Wang* 79199 (A); Meng-nün, Jenn-yeh Hsien, 950 m., *C. W. Wang* 79997 (A); Meng-him, Jenn-yeh Hsien, 800 m., *C. W. Wang* 80063 (A); Meng-la, Jenn-yeh Hsien, 900 m., *C. W. Wang* 80563 (A); Maan-tsang, Sheau-meng-yeang, Luh-shuen Hsien, 800 m., *C. W. Wang* 81085 (A); Mienning, Matai, 1160 m., *T. T. Yü* 18116 (A); Yuanchiang, 5000 ft., *Henry* 13251 (A, TYPE; NY, ISOTYPE); Szemao, Namban Ho, 5000 ft., *Henry* 13386 (A, NY).

KWANGSI: mountains near Pa Lau Village, near Sui-luk, southwest of Nanning, *W. T. Tsang* 21808 (A).

HAINAN: Pak Shik Ling, *C. I. Lei* 243 and 428 (A, NY); Ka Chik Shan, *S. K. Lau* 1519 (A, NY) and 2855 (A); Chim Fung Ling, *S. K. Lau* 3502 (A); I Kap Shan, *S. K. Lau* 1028 (A, NY); Yaichow, *N. K. Chun & C. L. Tso* 44708 (A, NY); without locality, *H. Y. Liang* 63556 (A, NY), *C. Wang* 36288 (A, NY) and 36351 (A, NY).

INDO-CHINA: Tonkin: betw. Dong Mo and Van Linh, prov. Langron, *Petelot* 2104 (A, NY) and 2110 (A); vicinity of Dong Mo, *Petelot* 6313 (A); Thank Moi, prov. Longron, *Petelot* 6617 (A).

INDIA: Mainimukli, Kassalong River, Chittagong Hill Tract, *Parkinson* 4254 (NY).

BURMA: Kabaing to Kegalpyin, Ruby Mines District, *Lace* 5995 (A);

Pang Mah Ki Hat, Keng Tung Terr., Southeastern Shan States, *Rock* 1956 (A).

SIAM: betw. Ban Tong Ha and Ta Kaw, *Rock* 1701 (A); Chumpawn, Siep Yuan, *Kerr* 16248 (A); Chieng Mai, *Kerr* 6409 and 6462 (A); Kanburi, *Kerr* 10222 and 10189 (A).

This species is related to *C. grandis* Roxb. and confused with that species by various recent authors, e.g. Fl. Indo-Chine 4: 202 (1914). That species, however, is a tree of Bengal, Assam, and adjacent Burma, and was based upon material from Chittagong. It differs from *C. furcans* in having only terminal, leafless inflorescences. These are very large and symmetrical and are borne at the ends of elongate leafy non-forking branches. In *C. furcans* the smaller asymmetric inflorescences are mostly lateral along the leafy branches, borne on short non-axillary branchlets. Leaves are frequently present on their lowermost branches. The inflorescence of *C. grandis*, accordingly, is not only larger but also projects out much more from the leafy mass of the plant. The leaves of that species are much less variable in outline than those of *C. furcans* and have a characteristic pointed and ovate contour. Its mature flower-buds are oblong-ovate and generally have a distinct, minute apical appendage. They are longer and proportionately more elongate than the plump, obovate, usually unappendaged buds of *C. furcans*. The drupes of *C. grandis* are described as "dirty yellowish." Those of *C. furcans* are stated by collectors to be red or pink.

The name *Cordia Clarkei* Brace ex Prain, Bengal Pl. 713-14 (1903), has also been applied to the present plant. Handel-Mazzetti, Symb. Sin. 7: 814 (1936) so reports a collection (*H.-M.* 5960) from between Mengtse and Hokow, southern Yunnan, said to be the same as collections of *Henry* (nos. 13251 and 13386) from the same region. A collection from Lungdschou, Kwangsi, *Morse* 414, is also listed. For all practical purposes, though unhappily not legally, *Cordia Clarkei* is a *nomen subnudum*. For nearly a half-century it still remains known in botanical literature chiefly from a few odd bits of ambiguous information contained in a brief superficial key to the Bengal species of *Cordia*. It was said to grow in East Bengal and Chittagong, but no type was designated nor any other representative collections listed. Brandis, Indian Trees 479 and 714 (1906), alludes to *C. Clarkei* and suggests it as possibly conspecific with our plant from Yunnan. *Henry* 414 was cited along with collections from Assam and Bengal. Whether or not Brandis had true *C. Clarkei* is uncertain, however. His few notes could apply to a very hairy form of *C. grandis*. Indeed, *C. Clarkei* may be such a plant.

From *C. Myxa* and its relatives *C. furcans* can be distinguished not only by the less prominent vein-reticulum on the lower leaf surface, but also by the extra-axillary rather than axillary origin of its lateral inflorescences. The origin of the lateral inflorescences in our species is the result of true stem-dichotomy. Among American species stem-dichotomies, or even trichotomies, are frequent and can be very regular and even delimit stem-sections associated with very marked heterophylly, cf.

Johnston, *Sargentia* 8: 256 and 258 (1949). Among Asiatic species regular symmetrical dichotomy is displayed only by *C. Kanehirai* of Formosa and *C. Cumingiana* of the Philippines. In *C. furcans* it is irregular, and the branches at each fork are unequal. At the fork one branch bears the lateral inflorescence and one to few leaves, while the other continues as part of the axis of the main shoot. The inflorescences, accordingly, appear to arise at any point in an internode along the main shoot. Only by chance do they arise near the leaf-axil or on the shoot opposite them. Indeed, when by chance they happen to be close to a leaf-axil, they tend to be somewhat lateral to it. Possibly there may be some vague tendency for heterophylly associated with this shoot system. In American species leaves of distinctive form may be repeated along the elongate shoot and always with a precise phyllotactic relation to the point on the stem where dichotomy occurs or is latent. Along sections of the dichotomizing stem of *C. furcans* the leaves show somewhat more than usual variation in size and proportional length of petiole, but if this has any phyllotactic relation it has eluded me. The matter is best investigated by one who has a supply of fresh vigorous shoots available. An analysis of this shoot system would be interesting.

4. *Cordia dichotoma* Forster f., Prodr. 18 (1786); Kanehira, Formosan Trees 633, f. 590 (1936); Chen Yung, Illus. Man. Chin. Trees 1038, fig. (1937); W. R. Brown, Useful Pl. Philippines 3: 268, f. 103 (1946) — type from New Caledonia.

Varronia sinensis Loureiro, Pl. Cochinch. 138 (1790); Merrill, Trans. Am. Philos. Soc. n.s. 24²: 329 (1935) — "Habitat in variis locis imperii Sinensis."

Cordia Loureiri R. & S., Syst. 4: 466 (1819) — based on *Varronia sinensis* Lour. non *Cordia sinensis* Lam.

?*Argyreia arborea* Loureiro, Fl. Cochinch. 135 (1790); Merrill, Trans. Am. Philos. Soc. n.s. 24²: 329 (1935) — "Habitat in sylvis, et colitur in hortis tam in Cochinchina, quam in China."

Cordia suaveolens Blume, Bijdr. 14: 843 (1826) — type from western Java.

Cordia indica Lam., Tab. Encyc. 1: 422 (1791); Poir., Encyc. 7: 49 (1806) — type from East Indies, *Sonnerat*.

Cordia Brownii DC., Prodr. 9: 499 (1845) — type from tropical Australia.

Cordia ixiocarpa F. v. M., Frag. 1: 59 (1858) — type from tropical Australia.

?*Cordia Lowriana* Brandis, Indian Trees 479 (1906) — type from India.

?*Cordia crenata* sensu Duthie, Fl. Upper Gangetic Pl. 2: 83 (1911).

Tree 3–10 m. tall; leaves elliptic to ovate or obovate, not very thick, usually 8–12 cm. long and 4–8 cm. broad, apex obtuse or frequently also with a short usually obtusish acumen, base rounded to acute, margin entire or rarely somewhat repand or sinuate above the middle, upper surface sparingly puberulent, glabrescent, at times dotted with minute clusters of mineralized epidermal cells or minutely punctate or both, lower surface paler, puberulent, usually glabrescent, petiole slender, 2–4 cm. long;

inflorescence cymose, dichotomous, bractless, loosely branched, 3–8 cm. broad, borne on peduncle 1–3 cm. long, terminal on twigs which are usually 1–8 cm. long; fertile twigs producing only a few (2–5) leaves, and springing from the axils along the defoliated elongate sterile shoots of the previous season; flowers of two sorts, male and hermaphrodite, produced apparently on separate trees; MALE FLOWERS shorter than the hermaphrodite, similar in form or at times with a somewhat expanded corolla-tube, filaments 3.5–4.7 mm. long, sparingly hairy below the middle, attached just below the corolla-sinus, anthers 2–2.8 mm. long, ovary abortive, globose, glabrous, bearing a minute terminal papilla representing the undeveloped style; HERMAPHRODITE FLOWERS with calyx 5–6 mm. long, obovate in bud, not striate, campanulate, 4–6 mm. in diameter at summit, base rounded, sessile, lobes recurved, unequal, somewhat triangular, becoming dry and friable; corolla 8–10 mm. long, lobes recurving 5–6 mm. long, 2–2.5 mm. wide, tube 3–5 mm. long, usually shorter than lobes, hairy only below the stamen-attachment; filaments 1–2 mm. long, usually borne just below the corolla-sinus, sparingly hairy below the middle; anthers 2 mm. long; ovary glabrous, 2.5–3.5 mm. long, narrowed above the middle; style with basal column 1–1.5 mm. long, the first branch about 1 mm. long, the ultimate stigmatiferous branches 3–5 mm. long, flattened, broadened and usually minutely lobulate above the middle; drupe with viscous mesocarp, globose, 10–15 mm. in diameter, yellow or somewhat orange or reddish, supported by an accrescent indurate saucer-shaped calyx 8–12 mm. in diameter.

Southern China, Formosa, Hainan, and Indo-China, also from northern India to New Caledonia and northeastern Australia.

FUKIEN: Amoy, temple grounds, *H. H. Chung* 4689 (A); Koo Long Ul, garden, *McClure* 19236 (NY); Amoy, *H. H. Chung* 4641, 4649, and 5973 (A); Fukien, *Dunn* 3356 (A).

HUPEH: Lokiashan, Wuchang, *S. C. Sun* 116 (NY).

KWANGSI: Hin Yen, *R. C. Ching* 6788 (NY).

KWANGTUNG: Canton, *Levine* 2081 (A); Ting Woo Shan, Kao-Yao District, riverbank, *S. K. Lau* 20267 (A, NY); Ho Yuen, *C. L. Tso* 21512 (NY); Lau Lung, Lungchun, *C. L. Tso* 21667 (NY).

YUNNAN: Chen Kang Hsien, *C. W. Wang* 72851 (A); Fo-Hai, *C. W. Wang* 74065, 74265, 74738, and 77093 (A); Hei-lung-tarn, Fo-hai Hsien, *C. W. Wang* 76292 (A).

FORMOSA: Hokuto, *Faurie* 1835 (A); Taihoku, *Tanaka* 99 (A); Taihoku, *S. Sasaki* 206 (A); Takow, *Henry s.n.* (A, NY); Sanzyuko, Taihoku, *Y. Simada* 5880 (A); without locality, *Oldham* 350 (G).

HAINAN: Ka La, *McClure* 9198 (A); Lin Fa Shan, *T. T. Tsang* 8, 332, and 468 (A); Sha Po Shan, *W. T. Tsang* 563 (A, NY); Yaichow, *H. Y. Liang* 62545 (A); Po-ting, Lingshin, *H. Y. Liang* 61583 (A, NY); Yaichow, *F. C. How* 70876 (A, NY); Manning, *F. C. How* 71349 (A); Hung Mo Shan Tsang, *Tang and Fung* 70 (A, NY); Fan Ya, *McClure* 9639 (NY); without locality, *Levine* 870 (A).

The plant I have described is that found in China, Formosa and Hainan. Very similar ones occur in Indo-China and Siam and eastward to tropical

Australia and New Caledonia and westward into northern India. Over much of the area mentioned the plant may be part of the indigenous flora even though it may appear as a weed tree or, because of reputed medicinal properties of its fruit, be sometimes cultivated. Enough small differences can be detected to suggest that perhaps it may display several minor geographically correlated tendencies possibly worthy of nomenclatorial recognition. At present, however, without field studies any attempt at segregation is premature. Observations in various places must be made as to what proportion of the material passing as *C. dichotoma* is probably indigenous and what proportion may be selected cultivated forms disseminated by man and possibly of foreign origin. Field observations are also needed as to the flowering habits of the plant. In our area they appear to produce exclusively male or exclusively hermaphrodite flowers and never both on the same tree. There is a possibility that trees in some regions may produce only the fertile hermaphrodite flowers and never any of the sterile male. This needs verification, as also the report that the male and hermaphrodite flowers may both be developed in a single mixed inflorescence, or that one or the other may appear abundantly and exclusively on a single tree but at different seasons of the year. Notes on the size, shape, and color of the mature fresh drupes are also needed. Available data on these details are contradictory and confusing.

Until Hutchinson, Kew Bull. 1918: 217-221, f. 1 (1918), published a note on *Cordia Myxa* L., the Asiatic and East Indian plants were commonly identified with that plant of Africa and the Near East. The African *Cordia Myxa*, sens. str., appears to be a recognizable form, but actually it is no more distinct than some other forms in the same circle of relationship. Certainly it is not set off so nicely as Hutchinson's key and discussion would suggest. Its relations are closest with the plant of peninsular India described as *C. obliqua* Willd. Since it is reported as always associated with Man it may be only a cultivated race, possibly even of Indian origin. *Cordia Myxa* and also *C. obliqua* and its allies in India differ from the plant here called *C. dichotoma* in their broad rounded thickish non-acuminate leaves, as well as in their coarser flowers and very much larger drupes. Typically their leaves are less than once and a half as long as broad. Frequently they are about as broad as long. The thinner, more elongate, frequently acuminate leaves of *C. dichotoma* are usually once and a half to twice as long as broad. They are never subcordate at the base, as is not infrequently the case with the leaves of *C. Myxa* and relatives. The Indian plants representing phases or close allies of *C. obliqua* are much more diverse than the Asiatic and East Indian plants assigned to *C. dichotoma*. The discussion by Roxburgh, Fl. Indica 2: 330-39 (1824), of *C. latifolia*, *C. Myxa*, and *C. tomentosa* is pertinent here. As economic plants *C. Myxa* and *C. obliqua* and allies seem to be more important than any of the forms of *C. dichotoma*. It is to be expected that some of the Indian plants, because of their very large drupes, may have been introduced further east into an area formerly

occupied only by *C. dichotoma*. The plant described as *C. obliqua* in the Flore Générale de l'Indo-Chine 4: 200 (1914) appears to be such.

5. *Cordia cochinchinensis* Gagnep., Not. Syst. 3: 35 (1914) and Fl. Indo-Chine 4: 203, f. 24 (1914) — type from Indo-China.

Small tree or clambering shrub 2–3 m. tall; leaves oblong to elliptic or narrowly ovate to obovate, nearly glabrous, entire, 6–12 (–“16”) cm. long, 2.5–5 (–“9”) cm. broad, base acute to rounded, apex acute to short or acuminate, upper surface minutely punctate, petiole 1.5–3 cm. long; inflorescence terminal on short leafy twigs, usually dense and longer than broad, flowers relatively few, crowded on few stout stiff divaricate branches; flowers hermaphrodite (no male flowers seen), calyx deeply cup-shaped, ca. 7 mm. long, with 4–5 irregular triangular lobes, outside glabrous; corolla 14–16 mm. long, glabrous, tube about as long as the corolla-lobes, filaments 3.5–4.5 mm. long, glabrous or with scattered short hairs, anthers 1.5 mm. long; style with basal column 3 mm. long, first branch 1 mm. long, ultimate branches 3.5–5 mm. long, slender; drupe subglobose, usually 1.5 cm. in diameter (becoming 3 cm. long and 2.2 mm. thick, fide Gagnepain), supported by the explanate indurate saucer-shaped calyx 1–1.5 cm. in diameter.

Hainan and Indo-China; reported from Siam.

HAINAN: Yaichow, shrub in thicket near sea, *F. C. How* 70895 (A, NY); Naam Shan Leng, erect, 5 m. tall, *S. K. Lau* 255 (A); Fung Leng, erect, 2 m. tall, *S. K. Lau* 485 (A); Kumyun, scandent, *S. K. Lau* 27741 and 27849 (A).

INDO-CHINA: Cambodge, 1929, *Bejeaud* 45 (A, NY).

The description given above is based upon the cited specimens. It agrees with the illustration of *C. cochinchinensis* published by the author of the species but differs from the original description in details and especially as to size of mature fruit. Fruiting specimens from Hainan have drupes, perhaps slightly larger but generally similar to those of *C. dichotoma*. The fruit described by Gagnepain is nearly twice as large and hence much resembles the fruit of *C. obliqua*. Some collections from southern Indo-China and Siam have the dense contracted inflorescence of *C. cochinchinensis* but have broad leaves that are suggestive of those of *C. obliqua*. Such plants, associated also with large fruit, leave the species distinguished only by the contracted inflorescence. Pending further study, I have restricted *C. cochinchinensis* to the form found on Hainan.

EXCLUDED OR UNPLACED SPECIES

Cordia venosa Hemsley, Jour. Linn. Soc. Bot. 26: 143 (1890).

Based upon collections from Ningpo Mts., Chekiang, *Faber* 183. Rehder, Jour. Arnold Arb. 12: 76 (1931), reports that it represents *Clerodendron cyrtophyllum* Turcz., of the Verbenaceae.

Cordia sinensis Lam., Tab. Encyc. 1: 423 (1791); Poir., Encyc. 7: 49 (1806); DC., Prodr. 9: 500 (1845).

Based on material said to have been collected by Sonnerat in China. Leaves oblong, entire, 2–3 inches long and about half an inch broad, with tufts of hairs in the axils of the veins beneath but otherwise glabrous; petiole about an inch long. Not recognized and probably not a member of the Boraginaceae. DeCandolle, Prodr. 9: 500 (1845), suggests that it may be a form of *C. subcordata*, but that is extremely doubtful.

Cordia spinescens L., Mant. 2: 206 (1771).

Originally stated to be a plant from "India orientali," but actually from tropical America. See Johnston, Jour. Arnold Arb. 30: 103 (1949).

2. *COLDENIA* L.

Coldenia L., Sp. Pl. 125 (1753) and Gen. Pl. 61 (1754) — type-species, *C. procumbens* L.

Herbaceous or suffruticose plants with slender, forking, usually prostrate or widely spreading stems; leaves small and numerous, subsessile or petiolate; flowers generally extra-axillary, along leafy twigs or at the forks of the branches, sometimes glomerate; corolla mostly small, with cylindric or ampliate tube and spreading lobes, throat naked or sometimes appendaged; style terminal on ovary, short to long, bilobed or biparted, stigmas 2, not conspicuously differentiated from the style-branch; fruit dry, pyramidal or hemispheric or more or less obviously 4-lobed, dividing into usually 4 single-seeded nutlets; nutlets more or less broadly united ventrally or joined to a central prolongation of the receptacle.

The genus consists of *C. procumbens*, the single species of the Old World and the type of the genus, and also twenty species native to arid regions of America. It is a very natural assemblage, is easily circumscribed, and has no close relations. Clearly a member of the Ehretioideae, it differs from all other genera of the subfamily not only in its dry fruit but also in its lowly habitat. One Mexican species forms a dense globose twiggy bush less than a meter tall, but other members of the genus are lowly plants with prostrate or trailing, more or less dorsiventral forking stems, and generally a mat-like habit of growth. All members of the genus have small thickish leaves, and many of them have the veins conspicuously impressed on the upper surface of the leaf. Not only do the *Coldenia* species differ from the other Ehretioids in microphyly, but also in inflorescence. Borne generally away from leaf-axils, their flowers occur between leaves on branchlets or may be crowded into almost bractless glomerules. The open, distinctly forking cymes or the scorpioid clusters developed by other Ehretioids are not produced by *Coldenia*. The organization of the fruit among the species of *Coldenia* is of great interest. Outside the Boraginoideae, that great herbaceous group and certainly the most highly evolved in the family, a fruit in the form of dry nutlets is produced only by *Heliotropium* and *Coldenia*. The range of fruit structure in *Heliotropium* is limited. In the genus *Coldenia*, however, are to be found illustrations of many of the evolutionary stages by which a dry fruit derived from a drupe of the type found in *Ehretia* can divide into nutlets; there is the

first stage, in which the fruit is deeply lobed and the nutlets (the lobes) are joined to one another by portions of their ventral surface; there is the more advanced stage, in which the nutlets are affixed independently by inner angle to a differentiated central axis; and finally there is the stage in which, by the shortening of the central axis, the nutlets shift from lateral to nearly basal in attachment and arise individually from the pyramidal or flattened floral receptacle. Not only in its fruit, but also in its lowly herbaceous or merely suffruticose habit, and even in the development of faucal appendages in the corolla of a few species, the genus shows many approaches to the more highly evolved Boraginoideae. No other genus in the Cordioideae, Heliotropioideae or Ehretioideae shows such close relationship with that subfamily.

Coldenia procumbens L., Sp. Pl. 125 (1753); Clarke, Fl. Brit. India 4: 144 (1883); Gagnep. & Cour., Fl. Indo-Chine 4: 213, f. 25 (1914).

Lobophyllum tetrandrum F. v. M., Hooker's Jour. Bot. & Kew Miscell. 9: 21 (1857) — Australia.

Prostrate annual herb, the stems dorsiventrally compressed, ascendingly branched, 1–5 dm. long, grayish hairy; leaves 5–30 mm. long, 3–15 mm. wide, coarsely crenate-dentate or lobulate, markedly asymmetric, somewhat oblong or obovate, on petioles 0–5 mm. long, upper surface coarsely strigose between the veins, the hairs (frequently with bulbous bases) converging concentrically in the vein-areole or directed towards the apex of the nearest tooth on the leaf-margin, lower surface with spreading hairs, veins impressed on upper leaf-surface and prominent on the lower, simple or weakly branched, terminating at leaf-margin at the base of the acute sinus between the teeth, 4–6 pairs on either side of midrib; flowers minute, subsessile, 4-merous, extra-axillary, borne between leaves or bracts and not subtended or opposed by them; calyx 1.5 mm. long, divided into 4 lanceolate or ovate-lanceolate lobes, persistent, at maturity somewhat accrescent and supporting the fruit; corolla white, glabrous, minute, 1.5–1.8 mm. long, tube 1–1.3 mm. long, cylindric, lobes 0.2–0.4 mm. long, ascending, rounded; filaments 4, attached about the middle of the corolla-tube, included, 0.2–0.4 mm. long, glabrous; anthers broad, 0.1–0.2 mm. long; ovary pyramidal, short-beaked, 0.6 mm. long, sulcate on four sides, glandular villulose; styles borne on beak of ovary, 2, united at base, ca. 0.1 mm. long, terete, stigmatiferous only at apex; fruit 3–4 mm. long, sparingly glandular-hairy, beaked, pyramidal in general form, 4-lobed, first dividing along the very broad dorsiventral commissure into biseminiferous halves, the halves later divided individually along a narrower but more tenacious commissure into single-seeded nutlets; nutlets beaked, frequently somewhat rugose and tuberculate or even bearing subulate processes, the back developing vesicular corky mesocarp and consequently high-convex and rounded, the ventrum sharply angulate, having one large and one small commissural face.

Formosa; Hainan; Indo-China to India and through the East Indies; usually on dessicating land subject to seasonal floodings and accordingly often a weed in dried-out rice paddies.

FORMOSA: Banayotyo, April 15, 1912, *T. Kawakani* (photo, A); Takow, *Henry* (NY).

HAINAN: vicinity of Ka Chik Shan, *S. K. Lau* 1701 (G, NY); Chim Fung Ling near Sam Mo Watt Village, *S. K. Lau* 3909 (G); Loktung, *S. K. Lau* 27054 (G); Yaichow, *H. Y. Liang* 61918 (G, NY).

INDO-CHINA: Dalat, southern Annam, *R. W. Squires* 779 (G, NY); dry rice paddies, Cochinchina, *Thorel* 318 (G).

The nutlets of the American species have relatively thin endocarp and no evident development of mesocarp. Their surface is smooth, even polished, or variously papillate. In *C. procumbens*, however, the thicker endocarp is much roughened by strong ridges and protuberances, and the back of the nutlet supports a high rounded mass of vesicular mesocarp. Some of these peculiarities in the nutlet of *C. procumbens* may be associated with the habitat of the plant. The American species are inhabitants of dry sandy or rocky places in arid regions. Such are very different from the periodically inundated places frequented by the Old World species. Under the latter conditions the development of vesicular mesocarp would have a function. By increasing the buoyancy of the nutlet it would serve during periods of flooding as an aid in water dissemination. The unusually thick endocarp might also be useful, since it would provide stout protection for the seed, which must survive not only periods of immersion but also very dry conditions, including baking in the sun.

Coldenia procumbens can develop and flourish on the sunbaked soil of rice paddies subjected to drought, great heat, and intense light. As a remarkable xerophyte it is discussed in a semipopular article by J. Beumée, *De Tropiche Natur* 15: 82–86, f. 1–3 (May 1926). Not only the rigorous conditions which it withstands but also some of its morphologic adaptations are there described.

The veining of the leaves in our species is a morphologic anomaly. The veins, unlike those in other plants with lobed or toothed margins, do not run from the midrib to the tip of a lobe or tooth, but rather to the base of the sinus between the lobes or teeth. DeCandolle, *Prodr.* 9: 558 (1845), remarks that he knows of such behavior only in *Crataegus oxyacantha* and in the genus *Rhinanthus*. In these, however, only an occasional or secondary vein exhibits this behavior. In our *Coldenia* the primary veins all go to the sinus. Indeed there is no evident veining that reaches the lobe-tips. This behavior is altogether very unorthodox and perhaps unique.

3. ROTULA Loureiro

Rotula Loureiro, *Fl. Cochinch.* 121 (1790) — type-species, *R. aquatica* Lour.

Rhabdia Martius, *Nov. Gen.* 2: 136, t. 195 (1827) — type-species, *R. lycioides* Mart.

Zombiana Baillon, Hist. Pl. 9: 421 (1888) — type-species, *Z. africana* Baill.

Shrub with numerous slender elongate stems; leaves numerous, thickish, not large, petiole short or none; inflorescence a small few-flowered terminal cyme; corolla with 5 spreading rounded lobes and a short tube; stamens exerted; filaments elongate, glabrous; style arising from the apex of the ovary, slender, elongate, terminated by a small somewhat bilobed sub-peltate stigma; fruit a drupe, red; endocarp strongly 4-lobed and early breaking up into 4 single-seeded pyrenes.

A genus closely related to *Ehretia* but differing in the simple style and more strongly lobed endocarp, as well as in growth habit and in selection of habitat. It is composed of two very closely related species, *Rotula aquatica*, ranging from India to the Philippines and the East Indies, and *Rotula lycioides* (Mart.) comb. nov. occurring in tropical West Africa and in eastern Brazil. The latter differs from the Asiatic and Malaysian relative in having slightly larger flowers, a usually more ample, minutely glandular inflorescence, and a noticeably reddish tone in its dried foliage. It has synonyms in *Rhabdia lycioides* Mart. (1827), *Rhabdia crebrifolia* Miers (1868), *Zombiana africana* Baill. (1888), and *Rhabdia Pohlii* Kuhlm. (1934). The two species affect the same extreme habitat, both growing in forested tropical regions in rocky or gravelly open places along streams, where they are subjected to protracted periods of inundation during seasons of high water. For a very detailed discussion of the fruiting structure of the genus see Miers, Contr. Bot. 2: 219–224, t. 84 (1869).

Rotula aquatica Loureiro, Fl. Cochinch. 121 (1790); Bunting, Jour. Bot. 47: 270 (1909) — type from Indo-China.

Rhabdia aquatica (Lour.) Kuntze, Rev. Gen. 2: 439 (1891).

Ehretia viminea Wall., Cat. no. 906; DC., Prodr. 9: 509 (1845); Edgeworth, Jour. Linn. Soc. Bot. 9: 324 (1867) — type from Burma.

Carmona viminea (Wall.) Don, Gen. Syst. 4: 391 (1837).

Rhabdia viminea Wall. ex Dalzell, Hook. Icon. 5: t. 823 (1852).

Ehretia cuneata Wight, Icon. Pl. Ind. Or. 4: t. 1385 (1848) — type from India.

Rhabdia fluvialis Edgeworth, Jour. As. Soc. Bengal 21: 175 (1853) — type from India.

Rhabdia sericea Edgeworth, Jour. As. Soc. Bengal 21: 176 (1853), *nomen*.

Rhabdia lycioides sensu Clarke, Fl. Brit. India 4: 145 (1883); Duthie, Fl. Upper Gangetic Pl. 2: 88 (1911); Gagnep & Cour., Fl. Indo-Chine 4: 214 (1914).

Shrub with many ascending or trailing elongate terete virgate stems, bearing leaves on numerous short annual lateral branchlets 1–10 cm. long; leaves subcoriaceous, thickish, obscurely if at all veined, 0.6–2.5 cm. long, 0.2–0.9 cm. broad, oblanceolate to oblong, usually somewhat strigose or strigose-villose, rarely nearly glabrous, petiole 0.5–3 mm. long; inflorescence a small few-flowered cyme terminating the branchlets; calyx 4–5 mm. long, lobes lance-cuneate, unequal in width, 0.5–1.5 mm. broad; pedicels bracted; corolla pink to purplish, 5–7 mm. long, lobes rounded,

spreading, tube 1–2 mm. long; filaments attached above middle of corolla-tube; style 4–5 mm. long; ovary oblong, about 0.8 mm. long; drupe red, subglobose, 3–4 mm. in diameter.

Southern China, Indo-China, Siam, Burma, India, Ceylon, and Malaya; also in the Philippines, Borneo, and the Celebes.

KWEICHOW: Chengfeng, by stream, *Y. Tsiang* 7319 (NY).

INDO-CHINA: vicinity of Hue, Annam, *R. W. Squires* 207 (A, NY); 3 km. de Kep, Tonkin, *Petelot* 4366 (NY); Luang-prabang, Laos, *Spire* 1465 (A); Village de Poun Luong, Muong de Pae Hin Boun, prov. de Cammon, Laos, *Colám*, sub *Petelot* 4322 (NY).

Edgeworth, Jour. Linn. Soc. Bot. 9: 324 (1867), gives some interesting observations concerning the behavior of this plant. "This shrub is very peculiar in its habits, growing upon granitic rocks in the bed of the river often submerged for weeks, its long branches hanging down into the water when the rocks are left exposed. These branches are so flexible and tough that they may be tied into a knot without breaking." Brandis, Indian Trees, pg. xxii (1906), lists the species as one of several Indian plants especially characteristic of such unusual habitats. It is surprising that no detailed study of their habits and life history has yet been published.

4. CARMONA Cav.

Carmona Cav., Icones 5: 22, t. 438 (1799) — type-species, *C. heterophylla* Cav.

Shrubs or trees; leaves small, short-petiolate, usually coarsely toothed, mostly fasciculate; corolla white, with short tube and broad spreading lobes; filaments slender, elongate, anthers exserted; style terminal on ovary, branched near the base, the two arms slender and elongate; stigmas 2, minute, subcapitate; drupe red; endocarp bony, subglobose, short-rostrate at apex, 4-seeded, remaining entire, not breaking up into pyrenes.

A monotypic genus obviously related to *Ehretia* but differing markedly in the organization of the endocarp and in its very deeply cleft or almost divided style, as well as in the distinctive growth-habit and general appearance of the plant. It is surprising that it has so long gone without general recognition.

Unlike that in *Ehretia*, the mature endocarp in *Carmona* does not divide in half along the dorso-ventral axis. It remains a unit, a subglobular body, short-beaked at the summit and more or less rugose externally. At various levels from the base upwards cross-sections show changing arrangement of internal cavities. The four large seminiferous cavities are in pairs on either side of the dorso-ventral line and extend for nearly the length of the endocarp. In cross-sections near the base of the endocarp they are accompanied by five sterile cavities, two large lateral ones on the dorso-ventral line, a small central one, and a small lateral one to the left and right of both pairs of fertile cavities. At a higher level a section shows a set of three tiny cavities along both the left and the right side of the endocarp. The tiny central cavity is here replaced by two tiny sterile cavities, one interposed between the members of each pair of fertile cavities.

Accordingly there are eight sterile cavities at a level just below the middle of the fruit. In the upper half of the endocarp, first two and later three large sterile cavities appear along the dorso-ventral line. There are no tiny sterile cavities interposed in the pairs of fertile cavities, while the sets of tiny cavities to the left and right of the fertile cavities may be present, only to disappear at slightly higher levels. The number of sterile cavities within the endocarp of *Carmona* that are visible in any transverse section, accordingly, may vary from eight to three. Four seeds are commonly matured in each endocarp.

In *Ehretia* the sterile cavities present along the dorso-ventral axis of the endocarp are broad and well developed. They destroy the solidity of the endocarp. Indeed they are instrumental in forming the primary commissure along which it divides in half at maturity. Also unlike that of *Carmona* the endocarp of *Ehretia* regularly has a well-developed sterile cavity interposed between the members of each pair of seed-bearing cavities. This sterile cavity is commonly about as large as the fertile one on either side of it. It may have four stout bony walls or the wall next to the exterior of the endocarp may be very weak or partially absent. When the latter condition exists the endocarp is further weakened structurally and after dividing in half always divides again to form four single-seeded pyrenes. The second division of the endocarp is effected by breakage of the walls of the sterile cavity mentioned. The endocarp of *Ehretia* in its internal structure and function is accordingly very different from that of *Carmona*.

***Carmona microphylla* (Lam.) Don, Gen. Syst. 4: 391 (1837).**

Ehretia microphylla Lam., Tab. Encyc. 1: 425 (1791?); Poir., Encyc. Suppl. 2: 1 (1811); Kanehira, Formosan Trees 637, f. 594 (1936); W. H. Brown, Useful Pl. Philippines 3: 270, f. 104 (1946) — type from East Indies, *Sonnerat*.

Ehretia buxifolia var. *microphylla* (Lam.) DC., Prodr. 9: 509 (1845).

Cordia retusa Vahl, Symb. 2: 42 (1791) — type from East Indies.

Carmona retusa (Vahl) Masamune, Trans. Nat. Hist. Soc. Formosa 30: 61 (1940).

Ehretia buxifolia Roxb., Pl. Coromandel. 1: 42, t. 57 (1795) and Fl. Indica, ed. Car. & Wall. 2: 343 (1824); Clarke, Fl. Brit. India 4: 144 (1883) — India.

Carmona heterophylla Cav., Icones 5: 23, t. 238 (1799). — "Habitat prope Manbulac in insulae Luzon, et in Huamantae altera ex Marianis. Nees."

Ehretia heterophylla (Cav.) Spreng., Syst. 1: 848 (1825).

Ehretia buxifolia var. *heterophylla* (Spreng.) Gagnep. & Cour., Fl. Indo-Chine 4: 207 (1914).

Ehretia dentata Courchet, Not. Syst. 3: 35 (1914) and Fl. Indo-Chine 4: 206, f. 24 (1914) — Indo-China.

Ehretia buxifolia var. *latisepala* Gagnep., Fl. Indo-Chine 4: 207 (1914) — type from Cochinchina, *Thorel*.

Shrub, much branched, 1–4 m. tall, or rarely a tree to 10 m. tall; branches slender, 1–3 mm. thick, with internodes usually 1–2 cm. long, when young usually minutely hispid and frequently also puberulent; leaf-

axils at first with small brownish tomentose buds, later with pulvinate brownish tomentose short-shoots which may continue to produce inflorescences and leaf clusters for several years; leaves variable in size, form, and dentation, very numerous, borne singly along vigorous new shoots or clustered on the short-shoots along older branches, usually broadest well above the middle and commonly somewhat toothed or crenate towards the apex, 0.8–6(–10) cm. long, 0.5–2.5(–4) cm. broad, from above the middle gradually contracted downwards into a petiole 1–5(–10) mm. long, apex rounded to obtuse or rarely acute, margin usually somewhat recurved, upper surface lustrous, with impressed veins and costa, usually bearing short rigid somewhat appressed hairs arising from dot-like clusters of pallid mineralized epidermal cells, usually scabrous, lower surface dull, paler, commonly hispidulous; inflorescence completely bractless, peduncle very slender, 0.2–2.5 (–4) cm. long, arising from the leaf-axils or from the pulvinate short-shoots; flowers usually 2–6 in a loose glomerule 5–12 mm. in diameter or occasionally in a scantily branched open cyme 2–5 cm. broad; calyx 3–6 mm. long, borne on pedicels 0–7 mm. long, lobes linear or linear-spathulate, usually narrowed below the middle, 0.4–0.8 mm. broad, sparsely hispidulous, tube 0.3–1 mm. long, usually densely hairy on the inner surface; corolla white, 4.5–6.5 mm. long, limb 6–9 mm. in diameter, lobes spreading broad 2.5–4.5 mm. long, tube 1.7–2 mm. long, base 1.5 mm. broad, 2.5–4 mm. broad at summit; filaments 2.5–3.5 mm. long, attached 0.3–0.5 mm. above base of corolla-tube; anthers oblong, 1.8–2 mm. long; ovary glabrous; style 4.5–6.5 mm. long, deeply lobed or nearly divided, lobes 3–5 mm. long; drupe 5–6 mm. in diameter, red or yellow; endocarp 3–4 mm. in diameter, globular, short-rostrate, rugose, remaining entire, not breaking up into pyrenes, containing 4 seeds, and at various levels between base and summit with 3–8 sterile cavities.

Kwangtung, Ryukyu to Hainan, southern Asia, and eastward to New Guinea and the Solomon Islands.

KWANGTUNG: Pak-sha, Luichow Peninsula, *Hance* 9368 (A).

RYUKYU ISLANDS: without locality, *Wright* 206 (G), *S. Sakaguchi* 3017 (A); Miyako-zima, *Kanehira* 3208 (NY); Naha, Okinawa, *without collector* 142 (NY).

FORMOSA: Taihoku, cultivated, *U. Moro* (A); Tekow, *Henry* (A, NY).

HAINAN: Hoihow, *McClure* 7575 (A); Liamui (Leng Mun), *Gressitt* 1184 (A); Ta Hau, *Gressitt* 958 (A); Ta Hian, *Gressitt* 738 (A); Chim Fung Ling, *S. K. Lau* 3382 (A); Ue Lung Shan, *S. K. Lau* 3200 (A); Ka Chik Shan, *S. K. Lau* 1578 (A, NY); I Kap Shan, *S. K. Lau* 1145 (A, NY); Yeung Ling Shan, *S. K. Lau* 137 (A); near Po-ting, Lingshin, *H. Y. Liang* 61584 (A); Lam Ko District, *C. I. Lei* 1306 (A); Manning, *F. C. How* 71472 (A); west side of Po-ting, Lingshin, *P. S. Lo* 62409 (A); Po T'eng Shi (BoDeng), *H. Fung* 20027 (A); Hung Mo Shan, *Tsang, Tang & Fung* 77 (A); Nodoa, *Wai-Tak Tsang* 15513 (A, NY); Ngau Ma Woh, *Wai-Tak Tsang* 415 (A); without locality, *Henry* 7952 (A), *Native Collector*, *Hongkong Herb.* 1994 and 2184 (A).

INDO-CHINA: Tourane, *Clemens* 3212 (A); Phuoc-than, *Thorel* 1191 (A).

The species varies greatly in leaf-size and in the nature of the leaf-margin, but much of this variation is no doubt ecological in origin. It is usually a shrub 1–3 m. tall. However, some otherwise indistinguishable plants from New Guinea are described by their collectors as forming trees as much as 10 m. tall. As a cultivated plant I have seen collections of the species from Florida, Cuba, and Honduras.

5. EHRETIA L.

Ehretia L., Syst. ed. 10, 936 (1759) — type-species, *E. tinifolia* L.

Traxilum Raf., Sylva Tellur. 42 (1838) — type-species, *E. aspera* Roxb.

Trees and shrubs; leaves small to large, usually distinctly petiolate, margins entire or serrate; corolla white or yellowish, tube campanulate or elongate, lobes spreading or recurved; filaments elongate, the anthers usually exserted; style terminal on ovary, cleft above the middle; stigmas 2, small, capitate or elongate; drupe subglobose, mostly yellow, orange, or reddish, glabrous; endocarp at maturity breaking apart into either 2-seeded or single-seeded pyrenes.

The genus *Ehretia* has numerous species in Africa, in southern Asia, and in the East Indies. Only three species are known from America, but one of them, *E. tinifolia* L., is the type of the genus. The genus is well marked and homogeneous and has its closest relations in *Rotula* and *Carmona*. Its species can be grouped into two sections according to the nature of their endocarp. In the section *Euehretia* the endocarp promptly, or in some species only tardily, breaks in half to form two-seeded pyrenes. The section *Bourrerioides* contains species having endocarps that eventually divide into four single-seeded pyrenes. Most members of *Ehretia* have entire leaves, the chief exception being a group of species ranging in Asia, Malaysia, and America. These latter have regularly and sharply serrate leaf-margins, belong to *Euehretia*, and appear to be a natural assemblage.

KEY TO THE SPECIES

Leaves serrate; endocarp dividing into 2-seeded plano-convex halves.

Corolla-lobes longer than the tube; fruit small; toothing on leaf-margin antrorse, with thickened, strict or incurved tips.....1. *E. acuminata*.

Corolla-lobes shorter than the tube; fruit larger; toothing on leaf-margin spreading, not thickened at tip.

Fruit moderate, endocarp 6–8 mm. in diameter; leaves usually somewhat cordate at base.....2. *E. corylifolia*.

Fruit large, endocarp 9–12 mm. in diameter; leaves usually acute to somewhat rounded at base.....3. *E. Dicksoni*.

Leaves entire (or rarely coarsely toothed in no. 10); endocarp breaking up into single-seeded quarter-sections.

Corolla-lobes shorter than the tube or at most equalling it.

Tube of corolla cylindric; calyx-lobes linear, 4–6 mm. long; Formosa.....4. *E. resinosa*.

Tube of corolla evidently expanding from the base upwards, very much broader at top than at bottom; calyx-lobes 0.5–2 mm. long.

Corolla-tube short and wide, very broadly expanding, funnel-form, 2.5–3.5 mm. long, 1.5 mm. wide at base, 5–6 mm. wide at top, bearing filaments 1.5 mm. above its base; inflorescence terminal on new leafy twigs; Yunnan.....5. *E. confinis*.

Corolla-tube elongate, narrowly expanding, 4–10 mm. long, 1.5–2 mm. broad at base, 3–5 mm. broad at summit, bearing filaments 3–6 mm. above the base; inflorescence borne terminal or axillary on old shoots just previous to or during the time of leaf renewal.

Lobes of corolla equalling or only slightly shorter than the tube; leaves with evident secondary and tertiary veining; inflorescence very scantily glandular; Kwangsi and Yunnan.....6. *E. Tsangii*.

Lobes of the corolla evidently much shorter than the tube.

Leaves with evident secondary and tertiary veins; young twigs, inflorescences and calyx densely and minutely glandular; corolla less than 10 mm. long; Kweichow and Yunnan.....7. *E. Dunniana*.

Leaves with only primary veins evident, the secondary very obscure if at all discernible; plant not glandular; corolla 10–13 mm. long.....8. *E. longiflora*.

Corolla-lobes longer than the tube.

Inflorescence terminating leafy twigs, bearing small persistent linear bracts scattered on its branches; flowers mostly with slender very evident pedicels; leaves entire or with very coarse irregular teeth.....9. *E. asperula*.

Inflorescences not only terminal but also springing directly from leaf-axils, bractless or bracteate only on the primary axis; leaves always entire.

Calyx and inflorescence abundantly tawny-tomentulose; leaves broad, usually $1\frac{1}{2}$ –2 times longer than wide, apex obtuse or rounded; flowers sessile, at or before anthesis borne crowded in two evident ranks unilaterally along the ultimate branches of the inflorescence and hence somewhat scorpioid in arrangement; Hainan.....10. *E. laevis*.

Calyx and inflorescence glabrous or minutely and inconspicuously pubescent; leaves elongate, 2–4 times longer than wide, with an acuminate apex.

Petioles 1.5–3 cm. long; plant not darkening in drying; inflorescence sparingly branched, the branches becoming elongate, bearing the flowers unilaterally in two loose ranks, moderately scorpioid; Hainan.....11. *E. hainanensis*.

Petioles 0.7–1 cm. long; plant darkening in drying; inflorescence with very slender axis and branches, a repeatedly forking cyme, occasionally contracted but usually loose, its flowers not at all scorpioid in arrangement; Indo-China.....12. *E. dichotoma*.

1. *Ehretia acuminata* R. Br. var. *obovata* (Lindl.), comb. nov.

Ehretia serrata var. *obovata* Lindl., Bot. Reg. 13: sub t. 1097 (1827) — type from China.

Ehretia ovalifolia Hasskarl, Cat. Hort. Bogor. 137 (1844) — a Japanese plant cultivated at Buitenzorg, Java.

Cordia thyrsiflora Sieb. & Zucc., Abh. Akad. Muench. 4³: 150 (1846) — type from Japan.

Ehretia thyrsiflora (S. & Z.) Nakai, Trees and Shrubs Japan 1: 327, f. 179 (1922); Nakai, Fl. Sylv. Korea 14: 20, t. 4 (1923); Nakai, Jour. Arnold Arb. 5: 38 (1924); Hu & Chun, Ic. Pl. Sinicarum t. 99 (1929).

Ehretia acuminata var. *grandifolia* Pampanini, Nouv. Giorn. Bot. Ital. ser. 2, 17: 699 (1929) — based on material from northwestern Hupeh, China, *Silvestri* 1920, 1921, and 1922.

Ehretia thyrsiflora var. *latifolia* Nakai, Trees and Shrubs Japan 1: 329 (1922) and Jour. Arnold Arb. 5: 38 (1924) — type from Japan.

Ehretia taiwaniana Nakai, Jour. Arnold Arb. 5: 38 (1924); Kanehira, Formosan Trees 639, f. 596 (1936) — type from Formosa.

Ehretia Argyi Lévl., Fedde Repert. 11: 67 (1912); Rehder, Jour. Arnold Arb. 18: 243 (1937) — type from Kiangsi, *d'Argy*.

Ehretia kantonensis Masamune, Trans. Nat. Hist. Soc. Formosa 30: 60 (1940) — type from Tungshan, Kwangtung, *Tsing Ying* 1787.

Ehretia serrata sensu Shirasawa, Ic. Essent. Forest Trees Japan 2: 69 (1908).

Ehretia acuminata sensu auct. pl.; Wilson, Pl. Wilson. 3: 362 (1916); Gagnep. & Cour., Fl. Indo-Chine 4: 209 (1914).

Tree 3–15 m. tall, glabrous or inconspicuously short-strigose especially on the inflorescence and upper surface of young leaves; twigs usually brownish; axillary buds on leafy shoots usually elliptic, very depressed, elongate and usually low-convex, generally single; leaves elliptic to obovate or narrowly obovate, broadest at or above the middle, 15–20 cm. long, 4–10 cm. broad (most commonly 8–15 cm. \times 4–6 cm.), apex rounded or angled and frequently somewhat acuminate, base acute to rounded, margin finely and regularly serrate, the teeth ascending, usually with slender prolonged thickened strict or incurved tips, upper leaf-surface usually with scattered appressed inconspicuous hairs, lower surface glabrous or nearly so; inflorescence paniculate, 10–20 cm. long, 5–13 cm. broad, terminal on a leafy shoot, its lower branches usually subtended by well-developed leaves and either truly axillary or springing from the uppermost of two potential axillary buds and accordingly arising 1–3 mm. above the leaf attachment; flowers small, very numerous, fragrant; calyx sessile, 1.5–2 mm. long, lobes 0.8 mm. long, rounded and with ciliolate somewhat scarious margins; corolla white, 3–4 mm. long, lobes 2–3 mm. long, about 1.5 mm. wide, spreading, tube about 1 mm. long; filaments 2–3 mm. long, attached about 0.5 mm. above base of tube; anthers 1 mm. long; style 1.5–2 mm. long, its lobes 0.2–0.8 mm. long; fruit more or less orange or yellow (or rarely even red), 3–4 mm. in diameter; endocarp with outer surface rugose or scrobiculate, at maturity dividing into biseminiferous halves.

Ranging from Hupeh, Kiangsu, and Shantung, and from southern Japan south to northern Indo-China and Hainan.

SHANTUNG: Yen Miao, *J. Hers* 1924 (A).

HONAN: Yü Tai Shan, Teng Feng Hsien, *J. Hers* 282 (A).

KIANGSU: Kiangyin, *Allison* 186 (G); Huang Tsang Yü, Siao Hsien, *J. Hers* 1001 (A); Spirit Valley, Nanking, *A. N. Steward* 2159 (A); Nanking, *K. Ling* 7936 (A); Ih-shing, *R. C. Ching* 4881 (A); I-shing, *Ching & Teo* 711 (A); without locality, *d'Argy* (photo of type of *E. Argyi*, A).

ANHWEI: Wu Yuen, *K. Sing* 7873 (A); without locality, *R. C. Ching* 3099 (A).

HUPEH: Ma-pan-scian, *Silvestri* 1919 (A); Nan-to, *Henry* 1941 (G); Changyang, *Wilson* 818 and 1103 (A); Ichang, *Wilson* 74 (A); Siao-Ya-Tsze, *W. Y. Chun* 3633 (A); Hsing-shan Hsien, *Wilson* 74A (A); without locality, *Henry* 4556 (G) and 6358 (A).

CHEKIANG: Tien-moo-shan, *R. C. Ching* 5089 (A), 5135 (A), and 5101 (A); without locality, *R. C. Ching* 1804 (A) and 1758 (A).

HUNAN: betw. Tsing Chow and Wukang, *Handel-Mazzetti* 340 (A).

KIANGSI: Ta Yu Hsien, *H. H. Hu* 964 (A); Hwang Yen Sze, Lu Shan, *Steward & Cheo* 286 (A); Lam Uk Village, Lunguan district, *S. K. Lau* 4650 (A).

FUKIEN: Kuliang, *H. H. Chung* 6635 (A); without locality, *R. C. Ching* 2516 (A).

KWANGTUNG: Canton, *C. O. Levine* 446 (A); Pak-wan Cheung, Wai-yeung District, *T. M. Tsui* 173 (A); Wan Tong Shan, Ying Tak District, *T. M. Tsui* 410 (A); Kochow District, Paiyunshan, *Tsiang Ying* 2191 (A); Ying-tak District, *Y. K. Wang* 2833 (A); Hong Kong, *Wright* 415 (G).

KWANGSI: Ling Yün Hsien, Na Hung, *Steward & Cheo* 355 (A); Lung-mu-an, Kwei-lin District, *W. T. Tsang* 27779 (A); Hang-On-Yuen, *Z. S. Chung* 81798 (A); Hang-an, *McClure* 20558 (A); north of Luchen, *R. C. Ching* 5603 (NY).

YUNNAN: Shweli-Salween divide, lat. 25°45', *Forrest* 24303 (G); Shweli-Salween divide, lat. 25°30', *Forrest* 15821 (A) and 24276 (G); Mingkwang Valley, lat. 25°15', *Forrest* 7733 (G); near Pe-Yen Tsin, *Ten* 310 (A); Szemao, *Henry* 10454 (A); Fo-Hai, *C. W. Wang* 73630, 73726, 73857, 74379, 74434, and 76110 (A); Nan-Chiao, *C. W. Wang* 75106 (A); Che-li Hsien, *C. W. Wang* 75477 (A); Keng-Ma, *C. W. Wang* 72826 (A); Dah-meng-lung, Che-li Hsien, *C. W. Wang* 77927 (A).

JAPAN: KYUSHU: Hokozaiki, Fukuoka, *K. Ichekawa* 43 (A); Mt. Sobo, Bungo, *K. Sakurai* (A); Kirishima, *R. Yatabe* (A); Nagasaki, *Oldham* 581 (G); Nagasaki, 1863, *Maximowicz* (G).

RYUKYU ISLANDS: Okinawa, Naja, *Wilson* 8018 (A); without locality, *Wright* 205 (G).

FORMOSA: South Cape, *Henry* 922 and 952 (A); Bankinsing, *Henry* 433 (A) and 506 (A); Takow, *Henry* 1778 (A), 1778A (A), 1874 (A), and 1135 (A); Korisho, *Faurie* 392 (A); Taihoku, *Faurie* 1852 (A); Maruyama, *Faurie* 303 (A); Paehiran, *Faurie* 302 (A); Sinpo, Sintikusun, *K. Odashima* 17853 (A); Kuraru, *Gressitt* 42 (A); Pinan, *Wilson* 11133 (A); Tamsuy, *Oldham* 348 (G); without locality, *Faurie* 8270 (A) and 8271 (A), *Oldham* 349 (G).

HAINAN: Bak Sa, *S. K. Lau* 26174 (A); To-ting, *F. C. How* 71648 (A); Lokwui, *F. C. How* 72294 (A); Base of Dom, *W. Y. Chun* 6493 (A); Manyun, *S. P. Ko* 52133 (A); Sin Woh, *W. T. Tsang* 17105 (A, NY); Tai Wong Ling, *C. I. Lei* 492 (A); Pak Shik Ling, *C. I. Lei* 698 (A); without locality, *Henry* 8274 (G).

INDO-CHINA: Tonkin: Muong Thon, road from Hanoi to Hoa Binh, *Petelot* 4829 (A); betw. Dong Mo and Van Linh, *Petelot* 6382.

This tree of China, Japan, Formosa and Hainan is most closely related to the tropical form of the species, *E. acuminata* var. *pyrifolia* (Don), comb. nov. This latter, based on *E. pyrifolia* D. Don, Prodr. Fl. Nepal. 102 (1825), ranges from eastern India and southern Indo-China to Java and eastward to New Guinea and the Cape York Peninsula of extreme northeastern Australia, and differs from our plant in having thinner, usually smaller leaves, broadest at or below the middle, and commonly much darkened in drying. Some of these differences are to be expected between plants inhabiting tropical as opposed to subtropical and temperate regions. However, our plants show morphologic tendencies never developed by the more southern tropical form. The result is differences in aspect when a series of specimens from the two areas are compared. It accordingly seems useful to separate the plants as weak geographical varieties.

Plants of the Chinese mainland commonly have large abundantly flowered inflorescences and leaves obovate-oblong in outline and hence noticeably broadest above the middle. Those from Japan usually have a much more slender, sparsely-flowered inflorescence and elliptic leaves broadest near the middle. The differences, apparent when many specimens are compared, are, however, simply very strong tendencies. In Formosa and Hainan trees with dense or sparse flower-clusters and either elliptic or obovate leaves are about equally common. Some Chinese specimens are indistinguishable from the most distinctive forms of Japan, and *vice versa*.

Our plant in southwestern China approaches the range of the Himalayan *E. acuminata* var. *serrata* (Roxb.), comb. nov. This was originally published as *E. serrata* Roxb. Hort. Bengal 17 (1814), *nomen*, and Fl. Ind., ed. Carey and Wall. 2: 340 (1824). Illustrations of it are given by Lindley, Bot. Reg. 13: t. 1097 (1827) and by Wight, Ill. Ind. Bot. 2: t. 170 (1850). It grows across northern India from Assam to Kashmir and is characterized by its sharply serrate, usually slenderly acuminate, lanceolate leaves. Its drupes are reported to be red rather than orange, as is generally the case in the var. *obovata* of China. Plants of Yunnan, all of which I consider referable to the var. *obovata*, may have somewhat lanceolate leaves and be more sharply serrate than is usual among Chinese plants. This may be evidence of intergradation between the Chinese and Indian varieties, which certainly can be expected in this transitional area.

Typical *E. acuminata* R. Br., with which our plant has been identified in the past, is separable from it, at least varietally. Typical *E. acuminata* is confined to the middle section of coastal eastern Australia; the type came from the vicinity of present-day Sydney. It has elongate leaves

which, like those of var. *obovata* but unlike those of its other varieties, are usually broadest above their middle. Its inflorescence is distinctive. The branches of the flower-cluster are elongate, scantily branched, and sufficiently slender to be commonly somewhat disarranged in the preparation of specimens. The flowers they bear are in globose glomerules. In other than the typical variety of *E. acuminata*, the flowers on the stiffer divaricately branched inflorescence are borne in much looser, usually subracemose glomerules. The var. *typica* is the most distinct of the geographical varieties within the widely dispersed *E. acuminata* sensu lat. It is confined to middle eastern Australia. The var. *pyrifolia* ranging through the East Indian Islands reaches northeastern Australia but is separated from the var. *typica* by a geographic hiatus, and furthermore, because of habit difference, can be distinguished from the latter at a glance. This is also true of *E. acuminata* var. *pilosula* (F. v. M.), comb. nov., based on *E. pilosula* F. v. M. (1865), which is known only from localities at the base of the Cape York Peninsula, just south of those from which the var. *pyrifolia* is known in Australia. The var. *pyrifolia*, indeed, is very close to the var. *pilosula*, differing from the latter only in having the lower leaf-surfaces glabrous or nearly so, rather than abundantly short-hairy. Another very close relative of the var. *pyrifolia* is the endemic Philippine *E. acuminata* var. *polyantha* (DC), comb. nov. — *E. polyantha* DC. (1845). It represents a geographic race tending to have a much larger pubescent inflorescence and smaller flowers.

Characteristic var. *obovata* is cultivated in the Arnold Arboretum. I have also seen specimens from trees grown at Atlanta, Georgia, at Gotha, Florida, and at Paris, France. The Himalayan var. *serrata* is represented by specimens cultivated in Australia (Brisbane Bot. Garden, *White* 2368; Palace Grounds, Sydney, *Camfield*), Egypt (Cairo, *Bornmüller* 10665), Florida (Gotha, 1920, *Rehder*) and Brazil (Sao Paulo, *Hoehne* 30662). Typical Australian *E. acuminata* I know in cultivation only from California (Santa Barbara, Franceschi Park, 1947, *Reed Moran* 2328).

2. *Ehretia corylifolia* C. H. Wright, Kew Bull. 1896: 25 (1896) — type from Mengtse, Yunnan, *Hancock* 153.

Shrub or tree, 2–15 m. tall; leaves ovate to elliptic, 9–15(–18) cm. long, 4–8(–11) cm. broad, margin usually evidently serrate, apex acute, base usually somewhat cordate or rounded, rarely obtuse; upper leaf-face green, usually strigose and somewhat scabrous; lower leaf-face paler, the indument of softer, usually curved hairs, commonly thinly tomentose or somewhat velvety, though at times sparse or nearly absent; inflorescence terminal, paniculate, 4–15 cm. broad, borne on a peduncle 2–5 cm. long, the major branches commonly subtended by linear deciduous bracts about 5 mm. long; flowers white or yellowish, fragrant; calyx 3–3.5 mm. long, lobes slender, 2–3 mm. long, linear or cuneate; corolla 10–12 mm. long, lobes to 3 mm. long, somewhat recurved outer face minutely strigulose, corolla-tube 7 mm. long, gradually expanding, 2 mm. thick at the base, 3–5 mm. thick at the summit; filaments 3.5–5 mm. long, attached

5 mm. above base of tube; anthers 2 mm. long, oblong; style 7–8 mm. long, usually with some appressed hairs, lobes about 1 mm. long; drupe yellow, reddish yellow or orange, endocarp 6–8 mm. long, ellipsoidal to subglobose, 5.5–6 mm. thick, its surface rather smooth, dividing into 2-seeded halves at maturity.

Known from Yunnan, southwestern Szechuan and southern Sikang.

YUNNAN: Salwin Valley northwest of Champutong, *T. T. Yü* 19159 (A); Meng-hua, Paitupo, *T. T. Yü* 15824 (A); Chenkang, Snow Range, Sangeorshan, *T. T. Yü* 17109 (A); Shunning, Wenkuankuai, *T. T. Yü* 16276 (A); Heluntan near Likiang, *R. C. Ching* 20753 (A); Ngerya, border of Chungtien, *K. M. Feng* 2775 (A); Hokin, near Sung-kwei, *K. M. Feng* 783 (A); Wei-si Hsien, Yeh-Chili, *C. W. Wang* 67898 (A); Lantsang Hsien, *C. W. Wang* 73374 (A); Der-la, Cham-pu-tung, *C. W. Wang* 66824 (A); Kun-Ming, *C. W. Wang* 62831 (A); Lan Ping Hsien, *H. T. Tsai* 56006 (A); Lu-feng Hsien, *H. T. Tsai* 53644 (A); Chin-lien-hsiang, Cheng-kiang, *H. Wang* 41409 (G); near Feng-tai-szu, Cheng-kiang, *Y. Tsiang & H. Wang* 16350 (G); without data, *H. T. Tsai* 57071, 57091, and 57244 (A); without data, *T. T. Yü* 7658, 8396, 10334, and 13510 (A); descent to Yangtze from eastern boundary of Likiang Valley, *Forrest* 10748 (G); Shweli-Salwin divide, lat. 25°45', *Forrest* 24326 (A); east flank of Tali Range, *Forrest* 4769 (A); without locality, *Forrest* 9876 and 9981 (A); Mt. Lauchunshan, southwest of Yangtze bend at Shiku, *Rock* 8409 (A); mountains south of Likiang, near Hochin and Chiuho, *Rock* 4044 (A); western slopes of Likiang Snow Range, *Rock* 4245 (A); watershed of Black River, between Mohei and Maokai, *Rock* 2950 (A) and 3064 (A); between Likiang and Taku, *Schneider* 3197 (A); near Yangtze between Likiang and Chungtien, *Schneider* 2168 (A); near Yungpeh, *Schneider* 1698 (A); Yunnan-fu, *Schoch* 73 (A); northwestern Yunnan, *Mombeg* 195 (A); Pe Yen Tsin, northwestern Yunnan, *Ten* 62 (A); Mengtse, *Henry* 10548 (A, NY), 10548A (A) and 10548B (A, NY); Tohe-hay, *Maire* 372 (A); Che-kia-po, *Maire* 106 (A); Tong-tchouan, *Maire* 483 (A) and 4012 (NY); Ge-choui-tang, *Maire* 171 (A) and 426 (A); Suen-oui, *Maire* 454 (A).

SZCHUAN: Opien Hsien, *T. T. Yü* 890 (A); He-chang Hsien, *T. T. Yü* 1134 (A).

SIKANG: Ningyüanfu, *Schneider* 842 (A); Te chang, *Schneider* 723 (A); between Muli and Kulu, *Rock* 24132 (A, NY); Muli Gompa, Muli Litang River valley, *Rock* 16123 (A); Mt. Mitzuga, Muli Kingdom, *Rock* 18263 (A, NY); Muli Kingdom, *Rock* 6478 (A).

As far as can be determined from the literature, *E. corylifolia* is most closely related to *E. macrophylla* Wall. of the eastern Himalayas. It differs from the latter only in its smaller leaves commonly cordate at the base. Wallich's original description, *Fl. Ind. ed. Carey & Wall.* 2: 343 (1824), and comments by Clarke, *Fl. Brit. Ind.* 4: 141 (1883), give many details regarding *E. macrophylla*. It was collected near Chundaghi, Nepal. Its leaves, described by Wallich as ovate, 13–26 cm. long, acute at both ends or sometimes rounded at the base, are described by Clarke as 19 cm. long, 10 cm. broad, broadly elliptic, and rhomboid or rounded at the base. The fruit is said to be 6 mm. long and hence very



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