

SAPINDACEAE

无患子科 wu huan zi ke

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Trees or shrubs (or woody vines with tendrils in *Cardiospermum* and allied genera), rarely herbaceous climbers. Indumentum usually of simple hairs, often glandular on young parts, buds, and inflorescences. Leaves alternate, usually estipulate; leaf blade pinnate or digitate, rarely simple; leaflets alternate to opposite, entire or dentate to serrate. Inflorescence a terminal or axillary thyrse; bracts and bracteoles small. Flowers unisexual, rarely polygamous or bisexual, actinomorphic or zygomorphic, usually small. Sepals 4 or 5 (or 6), equal or unequal, free or connate at base, imbricate or valvate. Petals 4 or 5 (or 6), sometimes absent, free, imbricate, usually clawed, often with scales or hair-tufted basal appendages. Disk conspicuous, fleshy, complete or interrupted, lobed or annular, rarely absent. Stamens 5–10 (–74), usually 8, rarely numerous, variously inserted but usually within disk, often exerted in male flowers; filaments free, rarely connate; anthers dorsifixed, longitudinally dehiscent, introrse; staminodes sometimes present in carpellate flowers, but filaments shorter and anthers with a thick wall, indehiscent. Ovary superior, (1–)3 (or 4)-loculed; ovules 1 or 2 (or several) per locule, placentation axile, rarely parietal, anatropous, campylotropous, or amphitropous; style usually apical (terminal), semigynobasic in *Allophylus* [gynobasic in *Deinbollia* Schumacher & Thonning]; stigma entire or 2 or 3 (or 4)-lobed, usually rudimentary in male flowers. Fruit a loculicidal capsule, berry, or drupe, or consisting of 2 or 3 samaras, often 1-seeded and 1-loculed by abortion. Seeds 1 (or 2 or more) per locule; testa black or brown, hard, often with a conspicuous fleshy aril or sarcotesta; embryo curved, plicate, or twisted, oily and starchy; endosperm usually absent. $2n = 20–36$.

One hundred thirty-five genera and ca. 1500 species: widely distributed in tropical and subtropical regions, especially well represented in tropical SE Asia; 21 genera (one endemic) and 52 species (16 endemic, one introduced) in China.

There is some variation in the circumscription of Sapindaceae in taxonomic treatments, particularly with regard to the inclusion of genera from the closely related, predominately temperate families Aceraceae and Hippocastanaceae. Several studies including Müller and Leenhouts (in Ferguson & Müller, *Evolutionary Significance Exine*: 407–445. 1976), and more recently those based on molecular data (Stevens, *Angiosperm Phylogeny Website*, 2001 onward; Harrington et al., *Syst. Bot.* 30: 366–382. 2005), supported the recognition of a broadly defined Sapindaceae incorporating Aceraceae and Hippocastanaceae. Harrington et al. (loc. cit.) proposed four subfamilies or clades, comprising Sapindoideae (including *Koelreuteria* and *Ungnadia* Endlicher), Dodonaeoideae, Hippocastanoideae (including taxa previously referred to Aceraceae and Hippocastanaceae, plus *Handeliidendron*), and a monotypic “Xanthoceroideae”. Within Hippocastanoideae, *Acer* Linnaeus and *Dipteronia* Oliver comprise a monophyletic group and are treated in this Flora as Aceraceae. Similarly, *Aesculus* Linnaeus, *Billia* Peyritsch, and the Chinese endemic *Handeliidendron* Rehder form a monophyletic group and are treated here as Hippocastanaceae. There is some support for “Xanthoceroideae” being the first lineage to diverge within the broadly defined Sapindaceae assemblage; consequently, *Xanthoceras* is treated separately from genera in Sapindoideae and Dodonaeoideae in the following account of Sapindaceae s.s. The sequence of genera reflects Müller and Leenhouts (loc. cit.) as modified by recent analyses based on molecular and morphological data, rather than following the order developed by Radlkofér (Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 105–379. 1890; and in Engler, *Pflanzenreich* 98a–h (IV. 165): 1–1539. 1931–1934), which was previously followed in FRPS.

The main economic uses of this family include (1) timber: *Amesiodendron chinense*, *Dimocarpus longan*, *D. confinis*, *Litchi chinensis*, *Paviasia kwangsiensis*, and *Pometia pinnata*; (2) fruit: *Dimocarpus longan*, *Litchi chinensis*, and *Nephelium lappaceum*; (3) medicine: *Dimocarpus longan* (arillode), *Litchi chinensis* (seeds), and *Sapindus saponaria* (roots); (4) oil: *Amesiodendron chinense*, *Delavaya toxocarpa*, and *Xanthoceras sorbifolium*. Saponins occur widely in the family, commonly used as a fish poison and for their detergent properties.

Lo Hsien-shui & Chen Te-chao. 1985. Sapindaceae (excluding *Handeliidendron*). In: Law Yuh-wu & Lo Hsien-shui, eds., *Fl. Reipubl. Popularis Sin.* 47(1): 1–72.

- 1a. Herbaceous climbers; inflorescences with basal tendrils 21. *Cardiospermum*
- 1b. Trees or shrubs; inflorescences without tendrils.
 - 2a. Fruit indehiscent, drupaceous or berrylike.
 - 3a. Leaves pinnate, sessile, first pair leaflets inserted at base of leaf axis like a pair of stipules; fruit without spines and tubercles.
 - 4a. Leaves imparipinnate, leaflets entire; fruit not lobed into schizocarps, 1–1.2 cm 10. *Lepisanthes*
 - 4b. Leaves paripinnate, leaflets serrate; fruit lobed into 2 schizocarps, usually only 1 developed, longer than 2 cm 13. *Pometia*
 - 3b. Leaves petiolate.
 - 5a. Exocarp fleshy; arillode absent; petals with scales.
 - 6a. Leaves digitate, leaflets 1–5; fruit shorter than 1 cm; sepals and petals 4; disk 4-sectioned 20. *Allophylus*
 - 6b. Leaves pinnate; fruit longer than 1 cm; sepals 5; disk complete or lobed.
 - 7a. Testa osseous, hilum linear; petals 4 or 5, rarely 6, with 2 earlike scales or 1 large scale; deciduous trees 9. *Sapindus*
 - 7b. Testa membranous or crustaceous, hilum orbicular; evergreen trees or shrubs 10. *Lepisanthes*
 - 5b. Exocarp leathery or crustaceous.

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- 8a. Seeds without arillode; fruit not lobed into schizocarps, densely tomentose 10. *Lepisanthes*
- 8b. Seeds with arillode; fruit parted into schizocarps, usually only 1 or 2 developed, abaxially usually with various tubercles or spines, glabrous or sparsely hairy.
- 9a. Arillode distinct from testa; fruit without spines, usually with tubercles or nearly smooth.
- 10a. Sepals imbricate; leaflets abaxially with naked glands in lateral vein axils, if without naked glands then inflorescences with stellate hairs 11. *Dimocarpus*
- 10b. Sepals valvate; leaflets abaxially without naked glands; inflorescences tomentose 12. *Litchi*
- 9b. Arillode adnate to testa.
- 11a. Petals and sepals 4 14. *Xerospermum*
- 11b. Petals absent; calyx 5- or 6-lobed; fruit with soft spines 15. *Nephelium*
- 2b. Fruit capsular, loculicidal.
- 12a. Leaves simple; petals absent; branches, leaves, and inflorescences with sticky juice; fruit winged 2. *Dodonaea*
- 12b. Leaves compound; branches, leaves, and inflorescences without sticky juice.
- 13a. Leaves digitate, leaflets 3; exocarp leathery or nearly woody; seeds without arillode; petals 5, with scales 5. *Delavaya*
- 13b. Leaves pinnate.
- 14a. Fruit inflated, exocarp membranous or papery, veined.
- 15a. Leaves imparipinnate; sepals valvate; filaments villous; fruit not winged 6. *Koelreuteria*
- 15b. Leaves paripinnate; sepals imbricate; filaments glabrous; fruit 3-winged 7. *Boniodendron*
- 14b. Fruit not inflated, exocarp leathery or woody.
- 16a. Seeds with arillode; leaves paripinnate.
- 17a. Fruit parted into schizocarps; leaflets abaxially with orbicular naked glands at lateral vein axils 16. *Arytera*
- 17b. Fruit not parted into schizocarps.
- 18a. Fruit pearlike or clavate; stamens 8; ovary 3-loculed; leaflets with naked glands in lateral vein axils 17. *Mischocarpus*
- 18b. Fruit transversely ellipsoid or subglobose; stamens 5; ovary 2-loculed; leaflets without naked glands in lateral vein axils 3. *Harpullia*
- 16b. Seeds without arillode.
- 19a. Leaves imparipinnate.
- 20a. Fruit with dense, short spines, 1-loculed, 1-seeded; petals ca. 1 mm, white, scaly; disk lobes without appendages; evergreen trees 8. *Paranephelium*
- 20b. Fruit without spines, 3-loculed, with several seeds per locule; petals ca. 1.7 cm, base red or yellow, without scales; disk lobes with appendages; deciduous shrubs or small trees 1. *Xanthoceras*
- 19b. Leaves paripinnate.
- 21a. Fruit 7–8 mm, exocarp leathery, densely tomentose, testa black, hilum small; petals without scales 4. *Eurycorymbus*
- 21b. Fruit longer than 1 cm, exocarp woody, glabrous, testa brown, hilum large; petals with scales.
- 22a. Fruit not parted into schizocarps; leaf axis trigonous 18. *Pavieasia*
- 22b. Fruit parted into schizocarps; leaf axis terete 19. *Amesiodendron*

1. XANTHOCERAS Bunge, Enum. Pl. China Bor. 11. 1833.

文冠果属 wen guan guo shu

Shrubs or trees. Leaves imparipinnate; leaflets serrate. Bracts ovate, large; flowers polygamous, male flowers and bisexual flowers on same plant but not in same inflorescence, actinomorphic. Sepals 5, oblong, imbricate. Petals 5, broadly obovate, shortly clawed, scale absent. Disk 5-lobed, lobes alternate to petals, apex with a hornlike appendage abaxially. Stamens 8, not exerted; anthers ellipsoid, apex of connectives and base of cells with 1 globose gland. Ovary ellipsoid, 3-loculed; ovules 7 or 8 per locule, in 2 lines; style terminal, erect; stigma papillate. Capsules subglobose or broadly ellipsoid, 3-ridged, loculicidal into 3 schizocarps, 3-loculed; pericarp thick, rigid, containing fiber bundles. Seeds several per locule, compressed-globose, pericarp thickly leathery, arillode absent; hilum semilunar, large; embryo arched, cotyledons one large and one small. $2n = 30$.

One species: N and NE China, Korea.

There is some support based primarily on DNA sequence data to place *Xanthoceras* as sister to all other members of Sapindaceae s.l. including Aceraceae and Hippocastanaceae (see Harrington et al., Syst. Bot. 30: 366. 2005).

Xanthoceras enkianthiflorum H. Léveillé (Repert. Spec. Nov. Regni Veg. 12: 534. 1913, “*enkianthiflora*”), described from Guizhou, is a synonym of *Staphylea holocarpa* Hemsley in the Staphyleaceae (see Fl. China 11).

1. *Xanthoceras sorbifolium* Bunge, Enum. Pl. China Bor. 11. 1833 [“*sorbifolia*”].

文冠果 wen guan guo

Shrubs or small trees, deciduous, 2–5 m tall. Branches brownish red, strong, stout, glabrous; terminal buds and lateral buds with imbricate scales. Leaves with petiole 15–30 cm; leaflets 4–8-jugate, abaxially green when fresh, adaxially deep green, lanceolate or subovate, bilaterally slightly asymmetrical, 2.5–6 × 1.2–2 cm, membranous or papery, abaxially tomentose and fascicled stellate when young, adaxially glabrous or sparsely hairy on midvein, lateral veins slender, slightly prominent on both sides, base cuneate, apex acuminate, margin

sharply serrate; terminal leaflet usually deeply 3-lobed. Inflorescences terminal, male ones axillary, erect, 12–20 cm; peduncle short, often with rudimentary scales at base. Pedicels 1.2–2 cm; bracts 0.5–1 cm. Sepals 6–7 mm, grayish tomentose. Petals white, purplish red or yellow at base, ca. 2 × 0.7–1 cm, with evident veins, claw ciliate on both sides; hornlike appendage on disk orange, 4–5 mm. Stamens ca. 1.5 cm; filaments glabrous. Ovary grayish tomentose. Capsules black, shiny, ca. 1.8 cm. Fl. spring, fr. early autumn. $2n = 30$.

Hills and slopes. Gansu, Hebei, Henan, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi [Korea].

The seeds are edible.

2. DODONAEA Miller, Gard. Dict. Abr., ed. 4. 1754.

车桑子属 che sang zi shu

Shrubs or small trees, evergreen, sometimes with a glandular resinous exudate on leaves and inflorescences. Leaves simple or pinnate, estipulate. Flowers bisexual or unisexual and plants dioecious, actinomorphic, solitary and axillary or arranged in terminal and axillary racemes, corymbs or panicles. Sepals (3–)5(–7), valvate or sometimes imbricate, deciduous when mature. Petals absent. Disk inconspicuous, absent in male flowers. Stamens (male flowers) 5–8; filaments short; anthers ellipsoid, obtusely 4-gonous, connectives prominent. Ovary (female flowers) ellipsoid, obcordiform, or transversely ellipsoid, 2- or 3(or 5 or 6)-gonous, 2- or 3(or 5 or 6)-loculed; ovules 2 per locule, one ascending, and one pendulous; style apical, much longer than ovary, often twisted, deciduous; stigma 2–6-lobed. Capsules samaralike, 2- or 3(–6)-loculed, septifragal, boatlike. Seeds 1 or 2 per locule, obovoid, lenslike, or subglobose; testa crustaceous, arillode present or absent; hilum thick; embryo revolute, cotyledons linear. $2n = 28, 30, 32$.

About 65 species: mainly in Australia and neighboring islands; one species in China.

1. *Dodonaea viscosa* Jacquin, Enum. Syst. Pl. 19. 1760.

车桑子 che sang zi

Ptelea viscosa Linnaeus, Sp. Pl. 1: 118. 1753.

Shrubs or small trees, 1–3 m tall or higher. Branches flat, narrowly winged or ridged, with sticky juice. Leaves simple; petiole short or sessile; blades variable in shape and size, linear, linear-spoon-shaped, linear-lanceolate, or oblong, 5–12 × 0.5–4 cm, papery, both surfaces with sticky juice, glabrous, nitid when dry, lateral veins many, dense, very slender, margin entire or inconspicuously shallowly wavy, apex acute, obtuse, or rounded. Inflorescences terminal or axillary near apices, shorter than leaves, densely flowered, rachis and branches ridged. Pedicels 2–5 mm, sometimes to 1 cm, slender. Sepals 4,

lanceolate or narrowly elliptic, ca. 3 mm, apex obtuse. Stamens 7 or 8; filaments less than 1 mm; anthers incurved, ca. 2.5 mm, glandular. Ovary ellipsoid, abaxially with sticky juice, 2- or 3-loculed; style ca. 6 mm, apex 2- or 3-lobed. Capsules obcordiform or compressed-globose, 2- or 3-winged, 1.5–2.2 cm tall, with wing 1.8–2.5 cm wide; testa membranous or papery, veined. Seeds 1 or 2 per locule, black, lenslike. Fl. late autumn, fr. late autumn–early spring. $2n = 28$.

Forest margins, savannahs, coastal vegetation on or behind sandy beaches. Fujian, Guangdong, Guangxi, Hainan, Sichuan, Taiwan, Yunnan [widely distributed in tropical and subtropical regions].

Two forms of this species are often recognized, one coastal and the other at higher elevations.

3. HARPULLIA Roxburgh, Fl. Ind. 2: 441. 1824.

假山萝属 jia shan luo shu

Shrubs or trees, dioecious. Leaves paripinnate, estipulate; rachis and petiole sometimes winged; leaflets often entire. Thyrses compound racemose or sometimes racemose, terminal or axillary; bracts and bracteoles small. Flowers functionally unisexual, actinomorphic. Sepals 5, imbricate, persistent or deciduous. Petals 5, subcuneate, longer than calyx, slightly fleshy, scales absent, apex reflexed, or petals subpatulate, distinctly clawed, adaxially with 2 earlike, thin scales ca. 2 × as long as calyx. Disk small. Stamens (male flowers) 5–8, nearly as long as petals, conduplicate in flower buds; anthers ellipsoid. Ovary (female flowers) globose or ovoid, sessile or shortly stalked, bilaterally compressed, 2(–4)-loculed; ovules 1 or 2 per locule, pendulous; style short or long, twisted. Capsules usually compressed, 2(–4)-loculed, grooved between locules; pericarp papery or crustaceous. Seeds 1 or 2 per locule, ellipsoid or ovoid; testa shiny, thinly crustaceous, often with white or orange fleshy aril; embryo curved, cotyledons fleshy. $2n = 30$.

About 26 species: from Sri Lanka and India through SE China and Malesia to Australia; one species in China.

1. Harpullia cupanioides Roxburgh, Fl. Ind. 2: 442. 1824.

假山萝 jia shan luo

Trees, to 20 m tall. Bark black or dark gray; branches strong, stout, only young parts golden tomentose. Leaves with petiole 15–50 cm, axis grooved, subglabrous; leaflets 3–6-jugate, sometimes 7-jugate; petiolules 5–8 mm; blades adaxially shiny, obliquely lanceolate, asymmetrical, 6–12 × 2–4 cm, thinly leathery, glabrous; lateral veins ca. 10 pairs, slender, base cuneate, apex acuminate or shortly acuminate. Inflorescences sparse, axillary or terminal, shorter than leaves, slender; bracts lanceolate, deciduous. Flowers fragrant. Pedicels 6–8 mm. Se-

pals broadly ovate, ca. 5 mm or slightly longer, tomentose, persistent. Petals 8–10 mm, slightly fleshy, cuneate. Disk tomentose. Stamens 5, slightly shorter than petals. Ovary ovoid, tomentose. Capsules brown, subglobose or transversely ellipsoid, compressed, ca. 2 × 2–3 cm, glabrous when mature. Seeds black-brown, ovoid or ellipsoid, 1.3–1.5 cm, arillode covering all of seed. Fl. spring–summer, fr. late autumn.

Rain forests to open disturbed areas including roadsides; below 700 m. Guangdong, Hainan, S Yunnan [Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; N Australia].

4. EURYCORYMBUS Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 59: 104. 1922.

伞花木属 san hua mu shu

Trees, dioecious. Leaves paripinnate, alternate, estipulate; leaflets serrate. Thyrses terminal and axillary near apex; bracts and bracteoles very small. Flowers unisexual, actinomorphic. Sepals 5, thinly membranous, imbricate. Petals 5, spoon-shaped, shortly clawed, scale absent. Disk annular, margin crenately lobed. Stamens (male flowers) 8, sometimes 7, exserted; filaments slender, conduplicate in buds; anthers ovoid, small. Ovary (female flowers) obcordiform, 3(or 4)-lobed and 3(or 4)-loculed; ovules 2 per locule, in pairs; style inserted between ovary lobes, erect, filiform. Capsules deeply lobed into 3 schizocarps, usually only 1 or sometimes 2 developed, broadly ovoid or broadly ellipsoid, loculicidal when mature; pericarp leathery. Seeds only 1 per fertile schizocarp, subglobose; testa rigid, arillode absent; hilum small; embryo convolute.

- One species: China.

1. Eurycorymbus cavaleriei (H. Léveillé) Rehder & Handel-Mazzetti, J. Arnold Arbor. 15: 8. 1934.

伞花木 san hua mu

Rhus cavaleriei H. Léveillé, Repert. Spec. Nov. Regni Veg. 10: 474. 1912; *Eurycorymbus austrosinensis* Handel-Mazzetti.

Trees, deciduous, to 20 m tall. Bark gray; branches terete, tomentose. Leaves with petiole 14–45 cm, axis appressed pilose; leaflets 4–10-jugate, subopposite; petiolules ca. 1 cm or shorter; blades oblong-lanceolate or oblong-ovate, 7–11 × 2.5–3.5 cm, thinly papery, abaxially subglabrous or pilosulose on

midvein, adaxially only hairy on midvein, lateral veins dense, ca. 16 pairs, slender, netted at tips, base broadly cuneate, apex acuminate. Inflorescences hemispheroid, dense and many flowered, main rachis and corymbose arranged branches tomentose. Flowers fragrant. Pedicels 2–5 mm. Sepals ovate, 1–1.5 mm, abaxially tomentose. Petals ca. 2 mm, abaxially villous. Filaments ca. 4 mm, glabrous. Ovary tomentose. Fertile schizocarps ca. 8 × 7 mm, tomentose. Seeds black; hilum cinnabar. Fl. May–Jun, fr. Oct.

- Broad-leaved forests; 300–1400 m. Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan.

5. DELAVAYA Franchet, Bull. Soc. Bot. France 33: 462. 1886.

茶条木属 cha tiao mu shu

Shrubs or small trees, dioecious. Leaves alternate, 3-foliolate, estipulate. Thyrses terminal or axillary, solitary or 2- or 3-fascicled; bracts and bracteoles small. Flowers unisexual. Sepals 5, imbricate, outer 2 smaller, persistent. Petals 5, longer than calyx, base with one 2-lobed scale adaxially, clawed. Disk shortly terete in lower part, cupular in upper part, margin membranous, wavy. Stamens (male flowers) 8, slightly exserted; filaments filiform, conduplicate in flower buds; anthers ellipsoid. Ovary (female flowers) shortly stalked, subglobose, 2-loculed or sometimes 3-loculed; ovules 2 per locule, inserted on middle axis, in pairs; style terminal, erect, subulate. Capsules obcordiform, 2- or 3-lobed, lobes obovoid or subglobose; pericarp leathery or nearly woody. Seeds 1 per locule, obovoid or subglobose; testa black and shiny, arillode absent; hilum orbicular.

- One species: SW China, N Vietnam.

1. Delavaya toxocarpa Franchet, Bull. Soc. Bot. France 33: 462. 1886.

茶条木 cha tiao mu

Delavaya yunnanensis Franchet.

Shrubs or small trees, 3–8 m tall. Bark brownish red;

branches slightly grooved, glabrous. Petiole 3–4.5 cm; leaflets thinly leathery; middle one elliptic or ovate-elliptic, sometimes lanceolate-ovate, 8–15 × 1.5–4.5 cm, base cuneate, with stalk ca. 1 cm, apex long acuminate; lateral ones smaller, ovate or lanceolate-ovate, sessile, margin somewhat thickly serrate, rarely entire, glabrous; lateral veins slender, slightly prominent on both sides. Inflorescences narrow, slender, sparsely flow-

ered. Pedicels 5–10 mm. Sepals suborbicular, concave, larger ones 4–5 mm, glabrous. Petals white or pink, narrowly elliptic or obovate, ca. 8 mm; scale broadly obovate, cuneate or square, upper part fimbriate. Filaments glabrous. Ovary glabrous or

sparsely glandular hairy. Capsules royal purple, lobes 1.5–2.5 cm or slightly longer. Seeds 1–1.5 cm in diam. Fl. Apr, fr. Aug.

Dense forests; 500–2000 m. Guangxi, Yunnan [N Vietnam].

6. KOELREUTERIA Laxmann, Novi Comment. Acad. Sci. Imp. Petrop. 16: 562. 1772.

栲树属 luan shu shu

Trees or shrubs, deciduous, polygamo-monoecious or polygamo-dioecious. Leaves imparipinnate or bipinnate, estipulate; leaflets alternate or opposite, usually serrate or parted, rarely entire. Thyrses terminal, rarely axillary, large; branches many, spreading. Flowers zygomorphic. Sepals (4 or)5, valvate, outer 2 smaller. Petals 4 or sometimes 5, slightly unequal in length, adaxially with 2-lobed scales at base, clawed. Disk thick, apex often crenate. Stamens often 8, sometimes fewer, inserted on disk; filaments distinct, often villous. Ovary 3-loculed; ovules 2 per locule, on upper half of middle axis; style short or slightly longer; stigma 3-lobed or entire. Capsules swollen, ovoid, ellipsoid, or subglobose, trigonous, loculicidal into 3 schizocarps; carpels membranous, reticulate. Seeds 1 per locule, globose, arillodes absent; testa black, crustaceous; embryo revolute, radicles slightly longer. $2n = 22, 30, 32$.

Three species: S China (including Taiwan), Japan, and perhaps Fiji; three species (two endemic) in China.

- 1a. Leaves pinnate or imperfectly bipinnate; leaflet margin irregularly obtusely serrate, teeth usually sparse and fissured; capsules conical, apex acuminate 1. *K. paniculata*
 1b. Leaves bipinnate; leaflet margin serrulate; capsules ellipsoid, broadly ovoid, or subglobose, apex rounded or obtuse.
 2a. Leaflets basally slightly oblique, apex acute to shortly acuminate; petals 4, rarely 5 2. *K. bipinnata*
 2b. Leaflets basally extremely oblique, apex long acuminate to caudate; petals 5 3. *K. elegans*

1. Koelreuteria paniculata Laxmann, Novi Comment. Acad. Sci. Imp. Petrop. 16: 561. 1772.

栲树 luan shu

Koelreuteria apiculata Rehder & E. H. Wilson; *K. bipinnata* Franchet var. *apiculata* F. C. How & C. N. Ho; *K. chinensis* (Murray) Hoffmannsegg; *K. paniculata* var. *apiculata* (Rehder & E. H. Wilson) Rehder; *K. paniculata* var. *lixianensis* H. L. Tsiang; *Sapindus chinensis* Murray.

Trees or shrubs, deciduous. Bark grayish brown to black, stout, fissured when dry; lenticels gray to dark brown, small; branches tuberculate, appressed pubescent or glabrous with axes and petioles. Leaves fascicled on young branches, spreading, pinnate, imperfectly bipinnate, or sometimes bipinnate, to 50 cm; leaflets (7–)11–18 (terminal one sometimes connate with uppermost pair below middle), sessile or very shortly petiolate, opposite or alternate, ovate or broadly ovate to ovate-lanceolate, (3–)5–10 × 3–6 cm, papery, abaxially barbulate on vein axils, sometimes tomentose, or densely pale yellow pubescent, adaxially scattered appressed pubescent on midvein, base obtuse to subtruncate, apex acute or shortly acuminate, margin irregularly obtusely serrate, teeth mucronate at tips, sometimes teeth near base sparse and fissured, or pinnately lobed. Thyrses 25–40 cm, densely pilosulose, branches spreading and long, cymes on last branches 3–6-flowered, densely arranged and capitate; bracts narrowly lanceolate, scabrous-hairy. Flowers pale yellow, slightly fragrant. Pedicels 2.5–5 mm. Sepals ovate, margin glandular ciliate, erose. Petals 4, reflexed when flowering, linear-oblong, 5–9 mm, claw 1–2.5 mm, villous; scale yellow at first, orange when flowering, irregularly fissured, tuberculate, appressed hairy. Stamens 8, 7–9 mm in male flowers, 4–5 mm in female ones; filaments densely spreading white villous at lower half. Disk oblique, with obtuse lobes. Ovary trigonous, glabrous except on ridges; rudimentary ovary densely hispidulous. Capsules conical, 4–6 cm, 3-ridged, apex acuminate; carpels ovoid, abaxially reticulate veined, adaxially

smooth and slightly shiny. Seeds subglobose, 6–8 mm in diam. Fl. Jun–Aug, fr. Sep–Oct.

• Anhui, Gansu, Hebei, Henan, Liaoning, Shaanxi, Shandong, Sichuan, Yunnan [widely cultivated elsewhere].

This species is used as an ornamental and for timber.

2. Koelreuteria bipinnata Franchet, Bull. Soc. Bot. France 33: 453. 1886.

复羽叶栲树 fu yu ye luan shu

Koelreuteria bipinnata var. *puberula* Chun; *K. bipinnata* var. *integrifoliola* (Merrill) T. C. Chen; *K. integrifoliola* Merrill.

Trees, to 20 m tall. Branches tuberculate, lenticels orbicular to elliptic. Leaves spreading, bipinnate, 45–70 cm; axis and adaxial surface of petiole often with one line appressed pubescent; leaflets 9–17, alternate, rarely opposite; petiolules ca. 3 mm or leaflets subsessile; blades obliquely ovate, 3.5–7 × 2–3.5 cm, papery or subleathery, abaxially densely pubescent or sometimes mixed with appressed hairs, adaxially glabrous or pilosulose on midvein, base broadly cuneate or rounded, slightly oblique, margin incurved serrate or sometimes entire. Thyrses spreading, large, 35–70 cm, pubescent with pedicels. Calyx 5-lobed to middle; sepals broadly triangular or elliptic, hispidulous and fimbriate glandular, margin erose. Petals 4, oblong-lanceolate, 6–9 × 1.5–3 mm, apex obtuse or acute, claw 1.5–3 mm, villous; scales deeply 2-lobed. Stamens 8, 4–7 mm; filaments spreading white villous; anthers short and sparsely hairy. Ovary trigonous-ellipsoid, pilose. Capsules pale purplish red, brown when mature, ellipsoid or subglobose, 3-ridged, 4–7 × 3.5–5 cm, apex obtuse or rounded, mucronate; carpels ellipsoid to subcordiform, abaxially reticulate veined, adaxially shiny. Seeds subglobose, 5–6 mm in diam. Fl. Jun–Sep, fr. Aug–Oct.

• Sparse forests, slopes; 400–2500 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan, Sichuan, Yunnan.

3. *Koelreuteria elegans* (Seemann) A. C. Smith subsp. **formosana** (Hayata) F. G. Meyer, *J. Arnold Arbor.* 57: 162. 1976.

台湾栾树 tai wan luan shu

Koelreuteria formosana Hayata, *Icon. Pl. Formosan.* 3: 64. 1913; *K. henryi* Dummer.

Trees, 15–17 m tall or higher. Branches ridged, pubescent. Leaves bipinnate, with petiole ca. 50 cm; leaflets 5–13; petiolules 2–2.5 cm; blades oblong-ovate, 6–8 × 2.5–3 cm, varied in shape and size, subleathery, abaxially glabrous or only barbate at vein axils, base extremely oblique, margin slightly incurved

serrate or nearly entire below middle, apex long acuminate to caudate. Thyrses terminal, large, ca. 25 cm; branches and pedicels pubescent. Flowers yellow, ca. 5 mm in diam. Sepals 5, oval or ovate-triangular, ciliate. Petals 5, lanceolate or oblong, with 2-lobed, tuberculate toothed scale, claw hairy. Stamens 7 or 8; filaments hairy. Capsules inflated, ellipsoid, 3-ridged, ca. 4 cm; carpels subcordiform, abaxially reticulate veined, adaxially shiny. Seeds black, globose, ca. 5 mm in diam.

• Taiwan.

Koelreuteria elegans subsp. *elegans* is distributed in Fiji.

7. BONIODENDRON Gagnepain, *Notul. Syst. (Paris)* 12: 246. 1946.

黄梨木属 huang li mu shu

Sinoradlkofera F. G. Meyer.

Trees, small, evergreen. Leaves alternate, paripinnate, stipulate; leaflets alternate or subopposite, base asymmetric, margin obtusely serrate. Thyrses terminal and axillary, large, multibranching, each inflorescence with many male flowers and few female flowers. Flowers unisexual; buds globose. Pedicels jointed. Sepals 5, imbricate, outer 1 smaller. Petals 5, longer than sepals, obovate or oblong, clawed, each side with 1 inflexed earlike scale at base. Disk annular, 5-lobed. Stamens (male flowers) 8; filaments long exerted above petals, glabrous; anthers small, ovoid. Ovary (female flowers) hairy, 3-loculed, each locule with 2 or 3 ovules; stigma shallowly 2- or 3-lobed. Capsules ovoid or globose, 3-winged; schizocarps 3, membranous, abaxially veined, adaxially shiny. Seeds 1 per locule; testa 2-layered; outer layer black, shiny, crustaceous; inner layer thinner; embryo spirally curved, radicle short.

Two species: one in China, one in N Vietnam.

1. *Boniodendron minus* (Hemsley) T. C. Chen, *Acta Phytotax. Sin.* 17(2): 38. 1979 [“*minus*”].

黄梨木 huang li mu

Koelreuteria minor Hemsley, *Hooker's Icon. Pl.* 27: t. 2642. 1900; *Sinoradlkofera minor* (Hemsley) F. G. Meyer.

Trees small, 2–15 m tall. Bark dark brown, fissured; branches pubescent. Leaves fascicled at branch apices, paripinnate, 9–12 cm; petiole 1–2 cm, slender, pubescent with axis; leaflets 10–20; petiolules ca. 1 mm; blades lanceolate or elliptic, 2–3(–4) × 1–1.5 cm, papery, glabrous except pubescent on midvein, base oblique, one side cuneate, other side rounded or obtuse, margin obtusely serrate, apex obtuse. Thyrses terminal,

rarely axillary, nearly as long as leaves, pubescent; branches spreading. Flowers pale yellow to nearly white; buds globose, ca. 1.5 mm in diam. Pedicels 2–3 mm, pubescent. Sepals 5; upper 4 oblong, ca. 2.2 mm; lower 1 suborbicular, ca. 1.6 mm, white pubescent, margin ciliate. Petals oblong, ca. 2.4 mm, pinnately veined, abaxially white pilose, adaxially glabrous. Stamens 8; filaments ca. 4 mm. Ovary 3-furrowed and ridged, hairy. Capsules subglobose in outline, 3-winged, 1.8–2.3 cm (including wings) in diam., apex concave and with persistent style. Seeds ca. 4 mm in diam. Fl. May–Jun, fr. Jul–Aug.

• Limestone mountains. Guangdong, Guangxi, Guizhou, Hunan, Yunnan.

This species is used for its timber.

8. PARANEPHELIUM Miquel, *Fl. Ned. Ind., Eerste Bijv.* 509. 1861 [“1860”].

假韶子属 jia shao zi shu

Shrubs or trees, monoecious or dioecious. Leaves imparipinnate or (pari)pinnate, petiolate; leaflets 1–5-jugate, leathery, margin entire or sparsely dentate. Thyrses axillary or terminal; bracts and bracteoles small. Flowers actinomorphic, unisexual. Calyx cupular, 5-lobed; sepals triangular, valvate. Petals 5, small, slightly longer than calyx, slender, with 1 large scale adaxially; scale connate with margin of petals funnellform. Disk annular, 5-lobed. Stamens (male flowers) 6–10, exerted; filaments glabrous or hairy. Ovary (female flowers) obovoid, tuberculous; ovules 1 per locule; style terminal; stigma 3-lobed, lobes excurved. Capsules subglobose, usually rudimentary 1-loculed, loculicidal into 3 schizocarps; pericarp leathery or fibrous-woody, tuberculous or woody-spiny. Seeds compressed-globose or transversely ellipsoid; testa leathery; hilum transversely elliptic, large; embryo arched.

About eight species: tropical Asia; two species (one endemic) in China.

- 1a. Leaflet margin sparsely serrate; inflorescences terminal or nearly axillary 1. *P. hainanense*
 1b. Leaflet margin entire; inflorescences cauliflorous 2. *P. hystrix*

1. *Paranephelium hainanense* H. S. Lo, *Fl. Hainan.* 3: 575. 1974.

海南假韶子 hai nan jia shao zi

Trees, 3–9 m tall, evergreen. Branches reddish brown, with dense elliptic lenticels, only pubescent when young; axis striate, slender. Leaflets 3–7; petiolules inflated, ca. 8 mm; blades slightly shiny, oblong or oblong-elliptic, sometimes

slightly asymmetric, 8–20 × 3–7 cm, leathery, glabrous, lateral veins 12–15 pairs, slender, sometimes concave adaxially, base cuneate, margin sparsely serrate, apex acute or acuminate. Inflorescences terminal or nearly axillary near apex, often large, multiflowered, ferruginous pubescent. Flowers small, shortly pedicellate. Sepals triangular, ca. 1 mm, both surfaces tomentose. Petals 5, ovate, ca. 1 mm; scale 2-lobed; lobes divaricate, villous. Disk 5-lobed. Stamens often 8; filaments ca. 2.5 mm, subglabrous. Ovary strigose. Capsules subglobose, 2.5–3 cm in diam. including spines; spines strong, ca. 5 mm, woody. Seeds 1, obliquely compressed, ca. 2 cm; hilum elliptic, large. Fl. Apr–May.

- Forests. Hainan.

2. *Paranephelium hystrix* W. W. Smith, Rec. Bot. Surv. India 4: 275. 1911.

云南假韶子 yun nan jia shao zi

Trees, ca. 6 m tall to much taller. Branches gray, slightly ridged and furrowed, subglabrous, lenticels inconspicuous. Leaves imparipinnate; petiole ca. 40 cm or more; leaflets 7–11; petiolules inflated, less than 1 cm; blades slightly shiny, oblong to lanceolate, 15–45 × 5–12 cm, thinly leathery, glabrous, lateral veins 15–18 pairs, evidently prominent abaxially, minutely concave adaxially, base cuneate, margin entire, apex shortly acuminate, slightly mucronate. Inflorescences cauliflorous, several fascicled, pilose. Pedicels 1–2 mm. Calyx ca. 3 mm in diam., tomentose, 5-lobed, lobes ovate. Petals 5, smaller than calyx, tomentose; scale scutelliform. Disk crateriform, entire. Stamens 6–8, exserted; filaments glabrous. Ovary red, tomentose. Capsules yellow, usually ellipsoid, to 3 cm in diam., woody, with dense conical spines. Fr. autumn.

Wet forests; ca. 300 m. Yunnan (Yinjiang) [Myanmar].

9. *SAPINDUS* Linnaeus, Sp. Pl. 1: 367. 1753, nom. cons.

无患子属 wu huan zi shu

Dittelasma J. D. Hooker.

Trees, rarely shrubs, monoecious. Leaves paripinnate, rarely simple, alternate, estipulate; leaflets entire, opposite or alternate. Thyrses large, many branched, terminal or fascicled at branchlet apices; bracts and bracteoles subulate, small. Flowers unisexual, actinomorphic or zygomorphic. Sepals 5 or sometimes 4, imbricate, outer 2 smaller. Petals 5, clawed, with 2 earlike scales at base or margin thickened adaxially, or 4 (*S. sect. Dittelasma*), without claw, with 1 large scale at base adaxially. Disk acetabuliform or semilunar, fleshy, sometimes lobed. Stamens (male flowers) 8, rarely more or fewer, exserted; filaments hairy below middle or at base. Ovary (female flowers) obovoid or turbinate, usually 3-lobed, 3-loculed; ovules 1 per locule, ascending; style terminal. Fruit parted into 3 schizocarps, usually 1 or 2 developed, developed schizocarps subglobose or obovoid, abaxially slightly flat, adaxially with 1 or 2 semilunar sterile schizocarps; schizocarps free when mature, broadly ellipsoid or subglobose; pericarp fleshy, containing abundant saponin, long sericeous at place bearing seed adaxially. Seeds black or pale brown, ellipsoid or subglobose; testa osseous, pseudotesta absent; hilum linear; embryo arched, cotyledons thick. $2n = 22, 30$.

About 13 species: warm regions of Asia, Australia, and North and South America; four species (one endemic) in China.

- 1a. Flowers actinomorphic; petals 5, basally long clawed, with 2 earlike scales at base adaxially 1. *S. saponaria*
 1b. Flowers zygomorphic; petals 4, not clawed, with 1 large scale at base adaxially.
 2a. Sepals and petals abaxially densely sericeous; flower buds broadly ovoid; leaflets 7–12 pairs, oblong-lanceolate 2. *S. rarak*
 2b. Sepals and petals abaxially pilose; flower buds globose; leaflets ovate or ovate-oblong.
 3a. Leaflets 4–7 pairs, abaxially villous or subglabrous 3. *S. delavayi*
 3b. Leaflets 3 or 4 pairs, abaxially tomentose 4. *S. tomentosus*

1. *Sapindus saponaria* Linnaeus, Sp. Pl. 1: 367. 1753.

无患子 wu huan zi

Sapindus abruptus Loureiro; *S. mukorossi* Gaertner.

Trees, deciduous, to 20 m tall. Bark grayish brown or blackish brown; young branches green, glabrous. Leaves with petiole 25–45 cm or longer, axis slightly flat, grooved adaxially, glabrous or pilosulose; leaflets 5–8 pairs, usually subopposite; petiolule ca. 5 mm; blades adaxially shiny, narrowly elliptic-lanceolate or slightly falcate, 7–15 × 2–5 cm, thinly papery, abaxially glabrous or pilosulose, lateral veins 15–17 pairs, nearly parallel, dense, slender, base cuneate, slightly asymmetrical, apex acute or shortly acuminate. Inflorescences terminal, conical. Flowers actinomorphic, small. Pedicels very short. Sepals ovate or oblong-ovate, larger ones ca. 2 mm, abaxially pilose at base. Petals 5, lanceolate, ca. 2.5 mm,

abaxially villous at base or subglabrous, long clawed; scales 2, earlike, at base adaxially. Disk acetabuliform, glabrous. Stamens 8, exserted; filaments ca. 3.5 mm, densely villous below middle. Ovary glabrous. Fertile schizocarps orange, black when dry, subglobose, 2–2.5 cm in diam. Fl. spring, fr. summer–autumn.

Usually cultivated by temples, in gardens, and alongside villages. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan, Korea, Myanmar, New Guinea, Thailand, N Vietnam].

This species is used medicinally.

2. *Sapindus rarak* Candolle, Prodr. 1: 608. 1824.

毛瓣无患子 mao ban wu huan zi

Trees, deciduous, ca. 20 m tall. Branches strong, stout, grooved, grayish yellow pubescent when young. Leaves with

petiole 25–40 cm or longer, axis terete, often red when dry; leaflets 7–12 pairs, subopposite; petiolules 5–8 mm; blades adaxially slightly shiny, oblong or ovate-lanceolate, sometimes falcate, 7–13 × 1.5–4 cm, usually thinly papery, glabrous or densely appressed villous, lateral veins very dense, slender, slightly prominent on both surfaces, base obtuse, apex acute or sometimes nearly acuminate. Inflorescences terminal, erect, tower-shaped, main rachis deeply grooved, shortly golden tomentose. Flowers zygomorphic, slightly large; buds broadly ovoid. Pedicels ca. 1.5 mm. Sepals 5, oblong or broadly ovate, larger ones ca. 3 mm, subleathery, abaxially golden sericeous-tomentose. Petals 4, oblanceolate, ca. 3.8 mm, tomentose; scales large, nearly as long as 2/3 of petals, margin densely villous. Disk semilunar, thick. Filaments densely shortly hispid. Fertile schizocarps dark red or orange-red, globose, ca. 2.5 cm in diam. Fl. summer, fr. early autumn.

Sparse forests; 500–2100 m. Taiwan, Yunnan [Bhutan, Cambodia, India, Indonesia, Laos, W Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

This species is used medicinally and for timber.

- 1a. Leaf axis and abaxial surface of leaflets
glabrous 2a. var. *rarak*
1b. Leaf axis and abaxial surface of leaflets
densely appressed villous 2b. var. *velutinus*

2a. *Sapindus rarak* var. *rarak*

毛瓣无患子(原变种) mao ban wu huan zi (yuan bian zhong)

Dittelasma rarak (Candolle) Hiern.

Leaf axis and abaxial surface of leaflets glabrous.

Sparse forests; 500–1700 m. Taiwan, Yunnan [Bhutan, Cambodia, India, Indonesia, Laos, W Malaysia, Myanmar, Sri Lanka, Thailand, Vietnam].

2b. *Sapindus rarak* var. *velutinus* C. Y. Wu & T. L. Ming, Fl. Yunnan. 1: 261. 1977 [*“velutina”*].

石屏无患子 shi ping wu huan zi

Leaf axis and abaxial surface of leaflets densely appressed villous.

• Sparse forests; 1600–2100 m. Yunnan (Shiping).

3. *Sapindus delavayi* (Franchet) Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 233. 1890.

川滇无患子 chuan dian wu huan zi

Pancovia delavayi Franchet, Bull. Soc. Bot. France 33: 461. 1886.

Trees, deciduous, ca. 10 m tall. Bark black-brown; branches pubescent. Leaves with petiole 25–35 cm or longer, axis pilose; leaflets 4–6(or 7) pairs, opposite or sometimes nearly alternate; petiolules usually less than 1 cm; blades ovate or ovate-oblong, bilaterally often asymmetrical, 6–14 × 2.5–5 cm, papery, slightly nitid, only villous on midvein and lateral veins, abaxially sparsely villous or subglabrous, rarely glabrous, lateral veins to 18 pairs, slender, base obtuse, apex acute. Inflorescences terminal, erect, often 3 × branched, main rachis and branches stronger, villous. Flowers zygomorphic; buds globose. Pedicels ca. 2 mm. Sepals 5, smaller ones broadly ovate, 2–2.5 mm, larger ones oblong, ca. 3.5 mm, base of abaxial surface and margin villous. Petals 4(5 or 6), narrowly lanceolate, ca. 5.5 mm; scales large, nearly as long as 2/3 of petals, margin densely tomentose. Disk semilunar, thick. Stamens 8, slightly exerted. Fertile schizocarps yellow, subglobose, ca. 2.2 cm in diam. Fl. early summer, fr. late autumn.

• Forests; 1200–2600 m. Guizhou, Hubei, Shaanxi, Sichuan, Yunnan.

This species is used medicinally and for timber.

4. *Sapindus tomentosus* Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 44: 204. 1875.

绒毛无患子 rong mao wu huan zi

Pancovia tomentosa (Kurz) Kurz.

?Trees. Branches terete, grooved, pale yellow pubescent, with scattered, glaucous lenticels. Leaves with petiole ca. 45 cm, axis pale yellow tomentose; leaflets 3 or 4 pairs, opposite or alternate; petiolules 8–10 mm, stout, tomentose; blades obliquely ovate-oblong, 10–16 × 5–6.5 cm, papery, abaxially densely shortly tomentose, adaxially hairy only on veins, lateral veins ascending, slightly prominent on both surfaces, reticulate veins visible, base rounded or sometimes those at lower part of axis subcordate, apex acuminate or acute, sometimes slightly obtuse. Inflorescences ca. 20 cm or longer, shortly tomentose. Flowers zygomorphic; buds globose. Sepals 5, oblong-lanceolate, abaxially pilose, apex acute. Petals 4, narrowly cuneate, with 2-lobed, densely villous scales at base adaxially. Disk semilunar. Filaments villous. Fertile schizocarps subglobose, slightly flat abaxially, ca. 2.5 cm wide, ca. 1.8 cm thick.

S and W Yunnan [Myanmar].

10. LEPISANTHES Blume, Bijdr. 237. 1825.

鳞花木属 lin hua mu shu

Aphania Blume; *Erioglossum* Blume; *Howethoa* Rauschert; *Otophora* Blume; *Sapindopsis* F. C. How & C. N. Ho (1955), not Fontaine (1889) [fossil].

Trees or shrubs, monoecious. Leaves usually paripinnate, alternate, stipulate, usually petiolate; leaflets 2 to several pairs, opposite or alternate, usually entire. Thyrses axillary, above axils or on old branches, solitary or several in fascicles. Flowers unisexual, actinomorphic or zygomorphic. Sepals 5, leathery, concave, imbricate, outer 2 smaller, orbicular, inner ones usually broadly ovate or elliptic. Petals 4 or 5, often spoon-shaped, longer than sepals, base clawed, apex with adaxial scale. Disk acetabuliform or semilunar, entire or lobed. Stamens (male flowers) 8, rarely more or fewer, with disk, longer than petals; filaments flat, usually hairy; anthers ellipsoid. Ovary (female flowers) 2- or 3-loculed, usually with grooves between locules; ovules 1 per locule; style short, apex

inflated, entire or 2- or 3-lobed. Fruit ellipsoid or subglobose, 2- or 3-loculed; pericarp leathery or slightly fleshy, both sides or only abaxially hairy, rarely glabrous on both sides. Seeds ellipsoid, bilaterally slightly flat, without pseudotesta; testa brown, thinly leathery or crustaceous, often glabrous; embryo small, arched, cotyledons thick, radicles small, papillate.

Leenhouts (Blumea 18: 429–430. 1969; and in Adema et al., Fl. Males., ser. 1, 11(3): 627–653. 1994) revised the genus, combining several genera previously recognized in FRPS (including *Aphania*, *Erioglossum*, and *Otophora*) into *Lepisanthes*.

About 24 species: tropical Africa, S and SE Asia, NW Australia, Madagascar; eight species (four endemic) in China.

- 1a. First pair leaflets stipulelike, much smaller than other leaflets 8. *L. unilocularis*
 1b. First pair leaflets not stipulelike, as large as other leaflets.
 2a. Leaflet blades cordate at base.
 3a. Leaves with petiole to 75 cm or longer, leaflets usually 5 or 6 pairs 6. *L. basicardia*
 3b. Leaves with petiole 25–40 cm, leaflets usually 4 pairs 7. *L. cauliflora*
 2b. Leaflet blades not cordate at base.
 4a. Leaflet blades abaxially densely tomentose, adaxially hairy only on midvein and lateral veins, base broadly cuneate to rounded 1. *L. rubiginosa*
 4b. Leaflet blades glabrous.
 5a. Petals linear to linear-spoon-shaped, scales without cristate appendage; disk acetabuliform 4. *L. browniana*
 5b. Petals broadly spoon-shaped or suborbicular above claw, scales with cristate appendage; disk semilunar, 3-lobed 5. *L. hainanensis*
 6a. Petals purplish red; fertile schizocarp ellipsoid, ca. 1.6 × 0.8 cm; leaflets 3–6 pairs 2. *L. senegalensis*
 6b. Petals greenish white; fertile schizocarp subglobose or broadly obovoid, 1.2–1.4 × 1–1.2 cm; leaflets 1 or 2 pairs 3. *L. oligophylla*

1. *Lepisanthes rubiginosa* (Roxburgh) Leenhouts, Blumea 17: 82. 1969.

赤才 chi cai

Sapindus rubiginosus Roxburgh, Pl. Coromandel 1: 44. 1795 [“*rubiginosa*”]; *Erioglossum rubiginosum* (Roxburgh) Blume.

Shrubs or small trees, evergreen, usually 2–3 m tall, sometimes to 7 m tall. Bark dark brown, irregularly longitudinally fissured; young branches, inflorescences, and leaf axis densely ferruginous tomentose. Leaves with petiole 15–50 cm; leaflets 2–8 pairs; petiolules short, less than 5 mm, stout; blades abaxially becoming brown when dry, adaxially deep green, slightly shiny, first pair (near base) ovate, evidently smaller, gradually larger toward leaf apex, elliptic-ovate to narrowly elliptic, 3–20 cm, leathery, abaxially densely tomentose, adaxially hairy only on midvein and lateral veins, lateral veins ca. 10 pairs, tips not reaching margin, base broadly cuneate to rounded, margin entire, apex obtuse or rounded, rarely acute. Inflorescences compound racemose, only branched once, densely flowered on upper part of branches; bracts subulate. Flowers fragrant, ca. 5 mm in diam. Sepals suborbicular, 2–2.5 mm. Petals 4, obovate, ca. 5 mm. Filaments villous. Fertile schizocarps red, 1.2–1.4 cm × 5–7 mm. Fl. spring, fr. summer.

Sparse forests, thickets, very common. Guangdong, Guangxi, Hainan; cultivated in Yunnan (Xishuangbanna) [India, Indochinese peninsula, Indonesia, Malaysia, New Guinea, Philippines; NW Australia].

This species is used medicinally and for timber.

2. *Lepisanthes senegalensis* (Poiret) Leenhouts, Blumea 17: 85. 1969.

滇赤才 dian chi cai

Sapindus senegalensis Poiret in Lamarck, Encycl. 6: 666. 1804; *Aphania rubra* (Roxburgh) Radlkofer; *S. ruber* (Roxburgh) Kurz; *Scytalia rubra* Roxburgh [“*rubia*”].

Trees or shrubs, evergreen, 4–6 m tall or more. Branches terete, glabrous. Leaves with petiole to 60 cm, axis strong, stout, grooved; leaflets 3–6 pairs; petiolule ca. 1 cm, stout; blades olive-green when dry, ovate or ovate-lanceolate, 15–40 × 4–14 cm, subleathery, glabrous, base rounded or sometimes nearly cuneate, margin entire, apex acuminate or shortly acuminate. Inflorescences axillary, usually shorter than leaves. Pedicels 1–2 mm. Smaller sepals broadly ovate, 1.2–2 mm; larger ones suborbicular, 2.5–3 mm in diam. Petals 5 or sometimes 4, purplish red, broadly ovate, 4–5 × 3–3.5 mm, apex rounded or subtruncate; scales ciliate. Stamens 8 or sometimes 7; filaments ca. 1.5 mm, middle part slightly inflated, villous; anthers oblong, connectives slightly prominent. Ovary obcordiform, usually 2-lobed, 2-loculed; style short, stout; stigma shallowly 2-lobed. Fruit purplish red; fertile schizocarp ellipsoid, ca. 1.6 × 0.8 cm. Fl. Feb–Mar, fr. May.

Wet valleys. Guangxi, S Yunnan [Bangladesh, Bhutan, India, Indochinese peninsula, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Sri Lanka; Africa, Madagascar].

3. *Lepisanthes oligophylla* (Merrill & Chun) N. H. Xia & Gadek, **comb. nov.**

赛木患 sai mu huan

Basionym: *Sapindus oligophyllus* Merrill & Chun, Sunyatsenia 2: 271. 1935; *Aphania oligophylla* (Merrill & Chun) H. S. Lo; *Howethoa oligophylla* (Merrill & Chun) Rauschert; *Sapindopsis oligophylla* (Merrill & Chun) F. C. How & C. N. Ho.

Shrubs or small trees, evergreen, 4–10 m tall. Branches grayish yellow, grooved, subglabrous. Leaves with slightly flat petioles 8–18 cm; leaflets 1 or 2 pairs, sometimes terminal pair only one developed; petiolules 5–8 mm; blades adaxially shiny, oblong-elliptic or narrowly elliptic, 6–14 × 2–4.5 cm, thinly leathery or papery, both surfaces glabrous, lateral veins 12–15 pairs, tips reticulate, base cuneate, margin entire, apex shortly acuminate. Inflorescences terminal or axillary near tips, usually

shorter than or ca. as long as leaves, main rachis slightly stout and strong, upper part ferruginous pubescent, branches usually short and slender. Pedicels ca. 2 mm, slender. Sepals suborbicular, larger ones ca. 2 mm in diam., ciliate. Petals greenish white, broadly ovate, nearly as long as sepals, abaxial surface and margin pilose. Disk inconspicuously lobed. Stamens 8; filaments ca. 3 mm. Ovary obovoid, 2-lobed, 2-loculed, sometimes 3-lobed and 3-loculed. Fertile schizocarps subglobose or broadly ovoid, 1.2–1.4 × 1–1.2 cm. Fl. spring, fr. summer.

- Forests. S Hainan.

4. *Lepisanthes browniana* Hiern in J. D. Hooker, Fl. Brit. India 1: 680. 1875.

大叶鳞花木 da ye lin hua mu

Trees, small, ca. 6 m tall. Branches and petioles red when dry, nearly terete, strong, stout, striate or grooved, pilosulose or subglabrous. Leaves with petiole to 70 cm; leaflets 3–5 pairs; petiolules 0.8–15 mm, inflated; blades usually grayish green, lanceolate-oblong or sometimes linear-obovate, 20–40 × 6–14 cm, papery, glabrous, lateral veins 18–20 pairs, prominent on both sides, reticulate veinlets conspicuous, base narrowly cuneate, margin entire, apex acuminate. Thyrses narrow, racemose or with 2–4 racemose branches near base, 5–18 cm, shortly tomentose, usually solitary on stems (or above axils). Pedicels 5–10 mm. Sepals nearly broadly ovate, 3.5–4.3 mm, abaxially ferruginous tomentose. Petals 5, linear to linear-spoon-shaped, ca. 6.2 mm, often erose or nearly entire, abaxial surface of claw and margin of adaxial surface villous; scales connate to claw margin, villous, apex 2-lobed, reflexed. Disk nearly acetabuliform, glabrous. Stamens 8; filaments villous. Ovary ferruginous villous, 3-lobed, 3-loculed; style nearly as long as ovary; stigma capitate. Fl. late autumn.

Wet forests; ca. 200 m. Yunnan (Yingjiang) [Myanmar].

5. *Lepisanthes hainanensis* H. S. Lo, Acta Phytotax. Sin. 17(2): 31. 1979.

鳞花木 lin hua mu

Trees, to 12 m tall. Branches grayish yellow, slightly zigzag, strong, stout, internodes often very short, subglabrous. Leaves paripinnate, slightly dense, axis strong, nearly concolorous with branches, terete, 15–34 cm, striate, glabrous; leaflets 4–6 pairs; petiolules ca. 1 cm, strong, stout, adaxially deeply furrowed; blades abaxially pale brown when dry, adaxially slightly shiny, olive-green, oblong-lanceolate to elliptic-ovate, 6–20 × 2–6 cm, first pair (near base) evidently smaller, leathery, glabrous, midvein, lateral, and reticulate veins prominent on both sides, lateral veins slightly denser, 15–22 pairs, arched and ascending near margin, inconspicuously netted, base broadly cuneate to obtuse, margin entire, apex shortly acuminate or cuspidate. Inflorescences axillary or on leafless old branches, to 30 cm, densely pilose, rachis slightly stout, ridged, branches spreading. Flower buds subglobose, ca. 5 mm. Sepals 5, suborbicular or broadly obovate, concave, margin thin, abaxially tomentose. Petals 5 or sometimes 4, upper part cuneate-orbicular, lower part gradually narrowed, 7–8 × 4–5 mm, abaxially only long white hairy at base, clawed, margin erose; scales connate with petals at margin, apex 2-lobed, white ciliate, with cristate appendage. Disk oblique, usually 3-lobed, abaxially to-

mentose, adaxially glabrous. Stamens 8 or sometimes 7, slightly exerted; filaments densely hairy. Ovary 3-loculed, tomentose; style stout; stigma capitate. Fruit (not thoroughly mature) with a short, stout stalk, subglobose, to 2 cm in diam., usually 3-loculed; pericarp leathery, abaxially shortly grayish tomentose, adaxially glabrous. Seeds 1 per locule. Fr. Jun–Jul.

- S Hainan.

6. *Lepisanthes basicardia* Radlkofer, Rec. Bot. Surv. India 3: 345. 1907.

心叶鳞花木 xin ye lin hua mu

Trees, small, ca. 6 m tall. Leaves with petiole to 75 cm or longer; petioles strong, stout, to 1.5 cm in diam. at base, axis reddish brown, with 2 evident furrows adaxially, pilose; leaflets often 5 or 6 pairs; petiolules inflated, less than 1 cm, tomentose; blades narrowly lanceolate or sometimes narrowly elliptic, 20–42 × 5–10 cm, thinly leathery, abaxially ferruginous hirsute on midvein, lateral veins, and reticulate veins, adaxially pilosulose on midvein, lateral veins 15–30 pairs, base slightly oblique cordate, apex acute to shortly acuminate. Inflorescences cauliflorous, to 65 cm when fruiting, ferruginous tomentose; rachis strong, ridged. Flower buds subglobose. Sepals 5, pilose abaxially. Petals 4, broadly obovate, clawed, abaxial surface of claw villous, adaxially with 1 reflexed cristate appendage. Disk semilunar. Stamens 8; filaments villous. Fruit (not thoroughly mature) subglobose or broadly ellipsoid, 1.5–2 cm, with 3 obtuse angles, densely ferruginous tomentose, 3-loculed, with 1 seed per locule. Seeds ellipsoid; hilum long. Fl. autumn.

Forests; ca. 200 m. W Yunnan (Yingjiang) [Myanmar].

7. *Lepisanthes cauliflora* C. F. Liang & S. L. Mo, Guihaia 2: 66. 1982.

茎花赤才 jing hua chi cai

Shrubs to small trees, 2–6 m tall. Branches few, reddish brown to brown, grayish yellow tomentose, glabrescent, shallowly furrowed. Leaves paripinnate, alternate, 25–40 cm with petioles; axis and petioles grayish yellow tomentose; leaflets usually 4 pairs, opposite; petiolules 3–4 mm, densely tomentose; blades adaxially deep green, oblong or ovate-oblong, 13–30 × 5–11 cm, papery, abaxially sparsely tomentose along midveins and lateral veins, adaxially sparsely tomentose along midveins, or glabrous on both sides, lateral veins 17–22 pairs, prominent on both sides when dry, base slightly cordate, margin entire, apex caudate-acuminate. Inflorescence racemose or thyrsoid, on stems and old branches, 1.5–4 cm, densely grayish yellow to grayish brown pubescent. Flowers polygamous, small; pedicels 2–3 mm, bracteolate. Sepals 5. Petals 5. Stamens 8. Bisexual flowers: sepals elliptic or boat-shaped, 3–4 × 1.5–3 mm, puberulent abaxially; petals oblong or ovate-oblong, 4–5 × 1.5–4 mm, abaxially puberulent, adaxially with hairy scales on middle; scales with a coroniform appendage at apex; stamens 3–4 mm; filaments puberulent; ovary subglobose, 3-locular, ca. 2 mm in diam., densely grayish yellow pubescent; styles ca. 1.5 mm, puberulent; stigma capitate; disk disklike. Male flowers: sepals and petals larger, oblong. Fruit globose to compressed globose, with 3 obtuse angles; pericarp thin, rigid, densely grayish yellow pubescent abaxially. Seeds 1–3, subglobose or semiglobose; testa membranous, reticulate veined, with ca. 1.5 × 0.6–0.7 cm spatulate scars on outer side. Fl. Sep–Oct.

- Forests. Guangxi (Longzhou).

- 1a. Leaflets blades hairy adaxially along midveins and abaxially along midveins and lateral veins 7a. var. *cauliflora*
 1b. Leaflets glabrous on both surfaces 7b. var. *glabrifolia*

7a. *Lepisanthes cauliflora* var. *cauliflora*

茎花赤才(原变种) jing hua chi cai (yuan bian zhong)

Leaflet blades adaxially deep green, 13–30 × 5–11 cm, abaxially sparsely tomentose along midveins and lateral veins, adaxially sparsely tomentose along midveins, or glabrous on both surfaces.

- Forests. Guangxi (Longzhou).

7b. *Lepisanthes cauliflora* var. *glabrifolia* S. L. Mo & X. X. Lee, *Guihaia* 2: 67. 1982.

光叶茎花赤才 guang ye jing hua chi cai

Leaflet blades narrower, glabrous on both surfaces.

- Forests. Guangxi (Longzhou).

8. *Lepisanthes unilocularis* Leenhouts, *Blumea* 17: 73. 1969.

爪耳木 zhao er mu

Otophora unilocularis (Leenhouts) H. S. Lo.

Shrubs, ca. 3 m tall. Branches terete, ca. 5 mm in diam., densely ferruginous tomentose. Leaves imparipinnate, 22–30 cm, axis densely shortly tomentose; leaflets 12–14 pairs; petioles very short, tomentose; blades papery, first pair stipulelike, ovate, small, ca. 1.5 × 1 cm, others lanceolate, 5–7 × 1–1.5 cm, both surfaces with small, scattered glands, base oblique, side toward leaf base obtuse, that toward leaf apex cuneate, apex acuminate; midvein prominent adaxially, strigose, lateral veins 8–10 per side, netted ca. 2 mm apart from margin. Flowers unknown. Inflorescences terminal, lower part of main rachis with some horizontal branches. Fruit ellipsoid, 1–1.2 cm × 8–9 mm, smooth, glabrous. Seeds 1, brown, ca. 8 mm; hilum orbicular.

- Forests. Hainan.

11. DIMOCARPUS Loureiro, Fl. Cochinch. 1: 233. 1790.

龙眼属 long yan shu

Euphoria Commerson ex Jussieu; *Pseudonephelium* Radlkofer.

Trees or shrubs, usually monoecious. Leaves paripinnate; leaflets opposite or subopposite, entire or serrate. Thyrses usually large, terminal, or fascicles, stellate or tomentose; bracts and bracteoles subulate, small. Flowers unisexual, actinomorphic. Calyx cupular; sepals 5, imbricate, stellate or tomentose. Petals 5 or 1–4, sometimes absent, usually spatulate or lanceolate, without scales. Disk acetabuliform. Stamens (male flowers) often 8, exserted; filaments hirsute; anthers ellipsoid. Ovary (female flowers) obcordiform, 2- or 3-lobed and 2- or 3-loculed, densely tuberculate, tufted stellate and tomentose on tubercles; ovules 1 per locule; style between ovary lobes; stigma 2- or 3-lobed. Fruit deeply lobed into 2 or 3 schizocarps, usually 1 or 2 developed; fertile schizocarp berrylike, subglobose, with small sterile schizocarps at base, pericarp leathery (crustaceous when dry), endocarp papery. Seeds subglobose or ellipsoid; testa leathery, smooth; hilum elliptic, slightly large; pseudotesta fleshy, embedding all or half of seed; embryo straight, cotyledons thick. $2n = 30$.

About seven species: S and SE Asia from Sri Lanka and India to E Malesia; Australia; cultivated in subtropical regions; four species (one endemic) in China.

See the revision by Leenhouts (*Blumea* 19: 113–131. 1971).

- 1a. Inflorescences and calyx stellate; petals 5; fruit abaxially rugose and with slightly prominent tubercles 1. *D. longan*
 1b. Inflorescences and calyx pilose or tomentose (inflorescences and flowers of *D. yunnanensis* not seen); petals absent or 1–4 abnormally developed; fruit abaxially with many conical short spines.
 2a. Leaflet blades abaxially thoroughly hairy 2. *D. confinis*
 2b. Leaflet blades glabrous or only slightly pilosulose at lower part of midvein and lateral veins.
 3a. Leaflet blades 10–14 cm; branches terete 3. *D. fumatus*
 3b. Leaflet blades 23–44 cm; branches with obtuse ridges 4. *D. yunnanensis*

1. *Dimocarpus longan* Loureiro, Fl. Cochinch. 1: 233. 1790.

龙眼 long yan

Euphoria longan (Loureiro) Steudel; *E. longana* Lamarck; *Nephelium longana* (Lamarck) Cambessèdes.

Trees, evergreen, usually ca. 10 m tall, sometimes to 40 m tall, ca. 1 m d.b.h. Branches strong, pilosulose, with scattered, glaucous lenticels. Leaves with petiole 15–30 cm or longer; leaflets (3 or)4 or 5(or 6) pairs; petiolules less than 5 mm; blades abaxially powdery green, adaxially deep green and shiny, oblong-elliptic to oblong-lanceolate, often bilaterally asymmetrical, 6–15 × 2.5–5 cm, thinly leathery, both surfaces

glabrous, lateral veins 12–15 pairs, only prominent abaxially, base extremely asymmetrical, cuneate at side toward leaf base, broadly cuneate to truncate at side toward leaf apex, almost parallel to axis, apex acute, sometimes slightly obtuse. Inflorescences terminal or axillary near apex, large, many branched, densely stellate. Pedicels short. Calyx stellate; sepals triangular-ovate, ca. 2.5 mm, subleathery, both surfaces brownish yellow tomentose with tufts of stellate hairs. Petals 5, milky-white, lanceolate, nearly as long as sepals, only pilosulose abaxially. Filaments hirsute. Fruit usually yellowish brown or sometimes grayish yellow, subglobose, 1.2–2.5 cm in diam., abaxially slightly rugose, or with few slightly prominent tubercles. Seeds brown, nitid, with fleshy arillode. Fl. spring–summer, fr. summer.

Native in Guangdong, Guangxi, Hainan, and Yunnan; widely cultivated in S China [Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, New Guinea (naturalized), Philippines, Sri Lanka, Thailand, Vietnam; cultivated in subtropical regions].

The edible fruit (longan) is famous in S China.

2. *Dimocarpus confinis* (F. C. How & C. N. Ho) H. S. Lo, Acta Phytotax. Sin. 17(2): 32. 1979.

龙荔 long li

Pseudonephelium confine F. C. How & C. N. Ho, Acta Phytotax. Sin. 3: 390. 1955.

Trees, large, evergreen, to 20 m tall, ca. 1 m d.b.h. Branches stramineous when dry, strong, stout, with 5 conspicuous ridges, subglabrous. Leaves with petiole 35–50 cm or longer, axis terete, inconspicuously striate, often with scattered lenticels; leaflets 3–5 pairs, sometimes 2 pairs; petiolules short, 3–8 mm, stout; blades adaxially deep green and shiny, leathery, first pair (near base) often smaller, ovate, others narrowly elliptic-lanceolate or oblong-elliptic, usually asymmetrical, outer lateral narrower, 9–18 cm or longer, 4–7.5 cm wide, abaxially slightly glaucous and pilose, lateral veins 12–15 pairs, prominent abaxially, base cuneate at side toward leaf base, subrounded or broadly cuneate at side toward leaf apex, apex acute to shortly acuminate. Inflorescences terminal and axillary, erect, nearly as long as leaves, main rachis and branches grooved, densely tomentose. Flowers shortly pedicellate. Sepals ca. 2 mm, leathery. Petals usually absent or 1–4 abnormally developed, often spoon-shaped. Disk matlike, tomentose. Stamens 7 or 8; filaments ca. 3 mm, densely villous below middle part. Ovary 2-lobed, 2-loculed; style slightly short and stout. Drupes ovoid, 2–2.3 cm. Seeds reddish brown, thoroughly embedded in arillodes. Fl. summer, fr. late summer–early autumn.

Forests; 400–1000 m. Guangdong, Guangxi, Guizhou, Hunan, Yunnan [Vietnam].

3. *Dimocarpus fumatus* (Blume) Leenhouts subsp. **callicola** C. Y. Wu, Fl. Yunnan. 1: 269. 1977.

灰岩肖韶子 hui yan xiao shao zi

Trees, large, 20–25 m tall, to 80 cm d.b.h. Branches pale brownish red, subterete, lenticellate. Leaf axis green, 12–20 cm, inconspicuously striate; leaflets 3–5 pairs, subopposite; blades oblong or oblong-lanceolate, 10–14 × 3.5–5 cm, leathery, glabrous or subglabrous, lateral veins dense, intervals between veins less than 10 mm, vein axils with pellucid glands, base broadly cuneate, margin entire, slightly revolute when dry, apex nearly acuminate or obtuse. Inflorescences not seen. Fruit subglobose, slightly compressed, ca. 2 cm in diam., with conical short spines.

• Limestone mountains; ca. 1400 m. Yunnan (Malipo, Xichou).

4. *Dimocarpus yunnanensis* (W. T. Wang) C. Y. Wu & T. L. Ming, Fl. Yunnan. 1: 269. 1977.

滇龙眼 dian long yan

Xerospermum yunnanense W. T. Wang, Acta Phytotax. Sin. 6: 287. 1957.

Trees, evergreen, ca. 10 m tall. Branches reddish brown, grooved. Leaves with petiole ca. 40 cm or longer; leaflets 4 pairs, alternate; petiolules 5–8 mm; blades oblong-lanceolate or lanceolate, 23–44 × 5–10 cm, thinly leathery, glabrous, lateral veins 12–19 pairs, slightly curved, ascending, prominent abaxially, reticulate veins inconspicuous, base cuneate, slightly asymmetrical, margin entire, apex acute. Flowers and inflorescences not seen. Drupes subglobose or compressed-globose, ca. 1.8 × 2.1 cm; pericarp brown and crustaceous when dry, abaxially with tubercles. Seeds 1, compressed-globose, arillode distinct from testa. Fr. late summer–early autumn.

• Forests; ca. 1000 m. Yunnan (Jinping).

12. LITCHI Sonnerat, Voy. Indes Orient. 3: 255. 1782.

荔枝属 li zhi shu

Scytalia Gaertner.

Trees, monoecious. Leaves paripinnate, alternate, stipulate. Thyrses terminal, golden tomentose; bracts and bracteoles small. Flowers unisexual, actinomorphic. Calyx cupular, 4- or 5-lobed, valvate, opening early. Petals absent. Disk acetabuliform, entire. Stamens (male flowers) 6–8, exserted; filaments filiform, pilose. Ovary (female flowers) shortly stalked, obcordiform, 2(or 3)-lobed, 2(or 3)-loculed; ovules 1 per locule; style inserted between ovary lobes; stigma 2- or 3-lobed. Fruit deeply parted into 2 or 3 schizocarps, usually only 1 or 2 developed, ovoid or subglobose; pericarp leathery (crustaceous when dry), abaxially with tortoise-shell-like fissure, with scattered conical prominents, sometimes nearly smooth. Seeds nearly same shape as schizocarps; testa brown, nitid, leathery, arillode fleshy, wrapping all or lower half of seed; embryo erect. $2n = 28, 30$.

One species: SE Asia; widely cultivated in subtropical regions.

See the notes on *Litchi* by Leenhouts (Blumea 24: 398–402. 1978).

1. *Litchi chinensis* Sonnerat, Voy. Indes Orient. 3: 255. 1782.

荔枝 li zhi

Dimocarpus lichi Loureiro; *Litchi chinensis* var. *eusponta-*

nea H. H. Hsue; *Nephelium chinense* (Sonnerat) Druce; *N. litchi* Cambessèdes; *Scytalia chinensis* (Sonnerat) Gaertner.

Trees, evergreen, often less than 10 m tall, sometimes to 15 m tall or more. Bark grayish black; branches brownish red,

terete, with dense white lenticels. Leaves with petiole 10–25 cm or longer; leaflets 2 or 3(or 4) pairs; petiolules 7–8 mm; blades adaxially deep green and shiny, lanceolate or ovate-lanceolate, sometimes elliptic-lanceolate, 6–15 × 2–4 cm, thinly leathery or leathery, abaxially glaucous, glabrous, lateral veins often slender, conspicuous or slightly prominent abaxially, margin entire, apex cuspidate or shortly caudate-acuminate. Inflorescences terminal, large, many branched. Pedicels 2–4 mm, slender, sometimes short and stout. Calyx golden tomentose. Stamens 6 or 7, sometimes 8; filaments ca. 4 mm. Ovary densely tuberculous

and hispid. Fruit usually dark red to fresh red when mature, globose to subglobose, 2–3.5 cm. Seeds thoroughly covered by fleshy arillode. Fl. spring, fr. summer.

Native in SW Guangdong (Xuwen) and Hainan; widely cultivated in S China, especially in S Fujian and Guangdong [Laos, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Vietnam; widely cultivated in subtropical regions].

Long cultivated in China, this species is famous for its fruit (litchi, lichee, lychee). Nowadays there are about ten cultivars in China.

13. POMETIA J. R. Forster & G. Forster, Char. Gen. Pl. 55. 1775.

番龙眼属 fan long yan shu

Trees, large, monoecious, usually with buttress roots, with red exudate when cut. Leaves paripinnate, alternate, sessile; leaflets usually in many pairs, first pair (near base) small, like stipules, others evidently larger, usually serrate; lateral veins often many, extending to tips of dentate margins, parallel. Thyrses terminal or axillary. Flowers unisexual, actinomorphic. Calyx cupular; sepals half connate, valvate. Petals 5, usually broadly obovate or subtriangular, without scales or with 1 gland adaxially. Disk annular, 5-lobed. Stamens (male flowers) 5, long exserted; filaments glabrous or hairy at base; anthers small. Ovary (female flowers) obcordiform, 2-lobed, 2-loculed, lobes subglobose, glabrous or tomentose; ovules 1 per locule; style filiform, very long, apex twisted. Fruit deeply parted into 2 schizocarps, usually only 1 developed, ellipsoid; pericarp thick, spongy in middle, smooth adaxially. Seeds same shape as schizocarps; testa leathery, seeds fully covered by an aril and adnate to testa; embryo curved.

One species: tropical Asia, Pacific islands.

See the treatments by Jacobs (Reinwardtia 6: 109. 1962, and in Adema et al., Fl. Males., ser. 1, 11(3): 698–704. 1994).

1. *Pometia pinnata* J. R. Forster & G. Forster, Char. Gen. Pl. 110. 1775.

番龙眼 fan long yan

Irina tomentosa Blume; *Pometia pinnata* f. *tomentosa* (Blume) M. Jacobs; *P. tomentosa* (Blume) Teijsmann & Binnendijk.

Trees, large, ca. 20 m tall, to 50 m tall. Crown large, broad, with evident buttress roots; branches grooved, sometimes hirsute. Leaves rather large, with petiole to 1.5 m, axis and leaflets subglabrous to tomentose; leaflets dense, 5–9 pairs, sometimes to 15 pairs, subopposite; petiolules short, inflated; blades:

first pair orbicular, small, base cordate, stipulelike; others oblong or upper ones nearly cuneate, 15–40 × 5–10 cm, margin regularly serrate, apex acute or acuminate. Inflorescences terminal or axillary; rachis and branches strong, straight, 30–50 cm, pilosulose. Pedicels ca. 6 mm, base jointed. Sepals ca. 1 mm, pilosulose. Petals obovate-triangular, ca. 2 × 2 mm. Stamens ca. 5 mm. Fruit shiny, ellipsoid or sometimes subglobose, ca. 3 × 2 cm, glabrous.

Taiwan, Yunnan [India (Andaman Islands, Nicobar Islands), Indonesia, Malaysia, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; Pacific islands (Fiji, Samoa, Tonga)].

This species is used for its timber.

14. XEROSPERMUM Blume, Rumphia 3: 99. 1849.

干果木属 gan guo mu shu

Trees or shrubs. Leaves paripinnate, alternate, petiolate; leaflets usually 1 or 2 pairs, sometimes 3 pairs, entire. Thyrses axillary or terminal, unbranched or many branched; bracts and bracteoles small. Flowers unisexual, actinomorphic, small. Sepals 4 or 5, suborbicular, concave, imbricate. Petals 4 or 5, usually jointed long villous. Disk annular, crenately lobed, lobes opposite to sepals. Stamens (male flowers) 8, inserted on disk, exserted; filaments villous; anthers broadly ovoid, small. Ovary (female flowers) obcordiform, 2-lobed, 2-loculed, abaxially tuberculous; ovules 1 per locule; style inserted between ovary lobes, short, apex inflated, inconspicuously 2-lobed. Fruit deeply lobed into 2 schizocarps, usually only 1 developed, ellipsoid or subglobose, abaxially usually tuberculous, rarely smooth. Seeds same as schizocarps in shape; arillode adnate to testa; embryo thick.

About 20 species: tropical Asia; one species in China.

1. *Xerospermum bonii* (Lecomte) Radlkofer, Repert. Spec. Nov. Regni Veg. 18: 341. 1922.

干果木 gan guo mu

Mischocarpus fuscescens Blume var. *bonii* Lecomte, Fl. Indo-Chine 1: 1029. 1912.

Trees, small, to 6 m tall, ca. 28 cm d.b.h. Branches dark

brown, terete, glabrous, slightly striate. Leaves paripinnate; petiole 2.5–4 cm, reddish brown including axis; leaflets often 2(or 3) pairs; petiolules ca. 4 mm; blades: those on lower part of axis ovate, those on upper part of axis elliptic-lanceolate or subovate, 7–16 × 2.5–5.5 cm, papery, both surfaces glabrous and with slightly visible reticulate veins, base cuneate, margin entire, apex shortly acuminate. Thyrses terminal, ca. 10 cm or

longer. Sepals 4, imbricate, ovate, outer 2 smaller, ca. 1.5 mm in diam., inner 2 ca. 2.5 mm in diam., glabrous, margin ciliate. Petals 4, spoon-shaped, ca. 1 mm, abaxially glabrous, adaxial surface and margin brown villous. Disk 4-lobed, glabrous. Stamens 8; filaments ca. 1.5 mm, densely brown villous except

at apex. Ovary globose, ca. 1.8 mm in diam., tuberculous, white tomentose. Fruit (immature) ovoid, with conical tubercles. Fl. spring.

Forests; 400–500 m. S Guangxi, SE and SW Yunnan [Vietnam].

15. *NEPHELIUM* Linnaeus, Syst. Nat., ed. 12, 2: 623; Mant. Pl. 1: 18, 125. 1767.

韶子属 shao zi shu

Trees, rarely shrubs, monoecious or dioecious. Leaves paripinnate, alternate, petiolate; leaflets entire. Thyrses terminal or axillary. Flowers unisexual, actinomorphic, small; bracts and bracteoles small. Calyx cupular, 5- or 6-lobed; sepals small, valvate or imbricate, often opening early. Petals absent or 5 or 6. Disk annular, entire or lobed. Stamens (male flowers) 6–8, exserted; filaments villous. Ovary (female flowers) obcordiform, 2(or 3)-lobed, 2(or 3)-loculed, densely tuberculous; ovules 1 per locule; style inserted between ovary lobes; stigma 2- or 3-lobed. Fruit deeply parted into 2 or 3 schizocarps, usually 1 developed, ellipsoid; pericarp leathery, with soft spines. Seeds same as schizocarps in shape; arilode fleshy, adnate to testa, thoroughly covering seeds; embryo arched or slightly straight, cotyledons thick. $2n = 22$.

About 22 species: SE Asia; three species (one endemic, one introduced) in China.

See the revision by Leenhouts (Blumea 31: 373–436. 1986).

- 1a. Leaflet blades elliptic or obovate, glabrous, lateral veins 7–9 pairs 1. *N. lappaceum*
 1b. Leaflet blades oblong, abaxially pilose, lateral veins 9–14 pairs or more.
 2a. Fruit 4–5 × 3–4 cm including spines, spines ca. 1 cm or longer 2. *N. chryseum*
 2b. Fruit smaller than 3 × 2 cm including spines, spines 3.5–5 mm 3. *N. topengii*

1. *Nephegium lappaceum* Linnaeus, Syst. Nat., ed. 12, 2: 623; Mant. Pl. 1: 125 [*“lappacea”*]. 1767.

红毛丹 hong mao dan

Trees, evergreen, ca. 10 m tall. Branches grayish brown, terete, rugose, ferruginous pilosulose when young. Leaves with petiole 15–45 cm, axis slightly strong, rugose when dry; leaflets (1 or) 2 or 3(or 4) pairs; petiolules ca. 5 mm; blades elliptic or obovate, 6–18 × 4–7.5 cm, thinly leathery, glabrous, lateral veins 7–9 pairs, brownish red when dry, only prominent abaxially, net veins slightly honeycombed, visible on both surfaces when dry, base cuneate, margin entire, apex obtuse or slightly rounded, sometimes nearly acute. Inflorescences many branched, nearly as long as or longer than leaves, ferruginous tomentose. Pedicels short. Calyx ca. 2 mm, leathery; sepals ovate, tomentose. Petals absent. Stamens ca. 3 mm. Fruit reddish yellow, broadly ellipsoid, including spines ca. 5 × 4.5 cm, spines ca. 1 cm. Fl. early summer, fr. early autumn.

Cultivated in Guangdong and Hainan [native to Indonesia, Malaysia, Philippines, and Thailand; cultivated in SE Asia].

The fruit is edible.

2. *Nephegium chryseum* Blume, Rumphia 3: 105. 1847.

韶子 shao zi

Trees, evergreen, 10–20 m tall or more. Branches striate, grayish brown when dry, ferruginous pubescent when young. Leaves with petiole 20–40 cm; leaflets (2–) 4 pairs; petiolules 5–8 mm; blades 6–18 × 2.5–7.5 cm, thinly leathery, glaucous, pilose abaxially, lateral veins 9–14 pairs or more, prominent and nitid abaxially, smooth or slightly concave adaxially, base

and apex nearly acute. Inflorescences many branched, male ones nearly as long as leaves, female ones shorter. Calyx ca. 1.5 mm, densely pilose. Disk pilose. Stamens 7 or 8; filaments ca. 3 mm, villous. Ovary 2-lobed, 2-loculed, pilose. Fruit red, ellipsoid, 4–5 × 3–4 cm including spines; spines ca. 1 cm or longer, bilaterally compressed, base broad, apex acute, hooklike. Fl. spring, fr. summer.

Dense forests; 500–1500 m. W Guangdong, S Guangxi, S Yunnan [Borneo, Philippines, Vietnam].

The fruit is edible.

3. *Nephegium topengii* (Merrill) H. S. Lo, Fl. Hainan. 3: 574. 1974.

海南韶子 hai nan shao zi

Xerospermum topengii Merrill, Philipp. J. Sci. 23: 250. 1923; *Nephegium chryseum* Blume var. *topengii* (Merrill) C. Y. Wu; *N. lappaceum* Linnaeus var. *topengii* (Merrill) F. C. How & C. N. Ho.

Trees, evergreen, 5–20 m tall. Branches reddish brown when dry, often pilosulose. Leaflets 2–4 pairs; petiolules 5–8 mm; blades oblong or oblong-lanceolate, 6–18 × 2.5–7.5 cm, thinly leathery, glaucous, pilose abaxially, lateral veins 10–15 pairs, straight, nearly parallel, base slightly obtuse to broadly cuneate, margin entire, apex acute. Inflorescences and flowers similar to *N. chryseum*. Fruit reddish yellow, ellipsoid, including spines ca. 3 × 2 cm, spines 3.5–5 mm.

• Forests. Hainan.

This species is used for its timber.

16. *ARYTERA* Blume, Rumphia 3: 169. 1849 [*“1847”*].

滨木患属 bin mu huan shu

Trees, rarely shrubs, monoecious or dioecious. Leaves paripinnate, alternate, estipulate; leaflets entire, domatia usually present

in axils of major veins. Thyrses axillary; bracts and bracteoles small. Flowers unisexual, actinomorphic. Calyx cupular, 5-lobed; lobes valvate. Petals (4 or)5, nearly as long as or slightly shorter than calyx, clawed, with 2 scales adaxially. Disk annular, entire or sometimes lobed. Stamens (male flowers) (7 or)8(–10), exserted; filaments filiform, hairy. Ovary (female flowers) obovoid, 2- or 3-loculed; ovules 1 per locule; style 2- or 3-lobed at apex. Capsules lobed into 2 or 3 schizocarps, usually only 1 or 2 developed, fertile schizocarps loculicidal, pericarp leathery. Seeds with crustaceous testa, wrapped with arillode; embryo curved.

About 28 species: SE Asia (also NE India), Australia, Pacific islands; one species in China.

1. *Arytera littoralis* Blume, Rumphia 3: 170. 1849.

滨木患 bin mu huan

Trees, small, rarely shrubs, evergreen, 3–10 m tall, rarely to 13 m tall. Branches terete, striate, pubescent when young, lenticels many, dense, yellowish white. Leaves with petiole 15–35 cm; leaflets 2 or 3(or 4) pairs, subopposite; petiolules less than 1 cm; blades oblong-lanceolate to lanceolate-ovate, 8–18 × 2.5–7.5 cm, thinly leathery, abaxially glabrous or hairy at vein axils, lateral veins 7–10 pairs, nearly ascending to margin and arched upward, prominent abaxially, base broadly cuneate to

nearly obtuse, apex cuspidate and mucronate. Inflorescences compact, multiflowered, shorter than leaves, rarely longer than leaves, ferruginous tomentose. Flowers fragrant. Pedicels 1–2 mm. Sepals ca. 1 mm, pilose. Petals 5, nearly as long as calyx; scales villous. Disk lobed. Stamens often 8; filaments unequal in length, 3–4 mm. Ovary appressed pilose. Fertile schizocarps red or orange, ellipsoid, 1–1.5 cm × 7–9 mm. Seeds dark red, arillode pellucid. Fl. early summer, fr. autumn.

Primary and secondary forests. Guangdong, Guangxi, Hainan, Yunnan [India and SE Asia to Solomon Islands].

This species is used for its timber.

17. MISCHOCARPUS Blume, Bijdr. 238. 1825, nom. cons.

柄果木属 bing guo mu shu

Mischocodon Radlkofer; *Pedicellia* Loureiro.

Trees or shrubs, monoecious or dioecious. Leaves paripinnate, petiolate, estipulate; leaflets 1–5 pairs, with pellucid glands at lateral vein axils abaxially, entire. Thyrses axillary or fascicled near apex; bracts and bracteoles small. Flowers unisexual, actinomorphic. Calyx cupular, 5-lobed; sepals valvate. Petals 5 or sometimes only 1–3 imperfectly developed, rarely absent, scaly or hairy at base adaxially, rarely glabrous. Disk annular, sometimes lobed. Stamens (male flowers) 7–10, usually 8, exserted; filaments often hairy. Ovary (female flowers) shortly petiolate, obovoid, trigonous, 3(or 4)-loculed; ovules 1 per locule; style terminal, very short; stigmas 3, recurved. Capsules pear-shaped or clavate, ± trigonous, base or below middle part stalklike, loculicidal to 3 carpels, 1–3-loculed; pericarp leathery. Seeds 1 per locule; testa usually dark red, crustaceous, fully covered with fleshy and transparent arillode; embryo arched.

About 15 species: SE Asia, Australia; three species (one endemic) in China.

- 1a. Capsules large, part bearing seed 1.4–1.5 cm wide; leaflets 3- or 4-jugate, elliptic or oblong-elliptic, reticulate veins conspicuously visible on both surfaces when dry; shrubs or trees ca. 2 m tall 3. *M. hainanensis*
 1b. Capsules small, part bearing seed less than 1 cm wide; trees or shrubs 3–10 m tall.
 2a. Leaflets often 2-jugate, ovate or oblong-ovate; filaments and disk glabrous; leaflets shiny, smooth, reticulate veins invisible when dry adaxially; trees 1. *M. sundaicus*
 2b. Leaflets often 3–5-jugate, rarely 2-jugate; filaments and disk hairy; leaflets dull on both surfaces, with visible reticulate veins on both surfaces; usually shrubs 2. *M. pentapetalus*

1. *Mischocarpus sundaicus* Blume, Bijdr. 238. 1825.

柄果木 bing guo mu

Trees, small, evergreen, 3–10 m tall. Branches darkish red, glabrous. Leaves with petiole 10–20 cm, axis and branchlets concolorous; leaflets often 2-jugate, sometimes 1-jugate; petiolules ca. 1 cm; blades adaxially shiny, ovate or oblong-ovate, 5–13 × 2–5 cm, leathery, adaxially smooth, reticulate veins delicate and visible abaxially, invisible when dry adaxially, base rounded or sometimes broadly cuneate, apex shortly acuminate. Inflorescences compound racemose, branched near base, sometimes racemose and unbranched, densely pubescent. Pedicels 1–2 mm. Calyx pilose. Petals absent. Filaments and disk glabrous. Capsules pear-shaped, including stalk 8–9 mm, stalk 2–2.5 mm, usually 1-loculed, with 1 seed. Fl. Oct–Nov, fr. spring–summer.

Coastal forests. Guangxi, Hainan [widely distributed in SE Asia].

2. *Mischocarpus pentapetalus* (Roxburgh) Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 646. 1879.

褐叶柄果木 he ye bing guo mu

Schleichera pentapetala Roxburgh, Fl. Ind., ed. 1832, 2: 275. 1832; *Cupania pentapetala* (Roxburgh) Wight & Arnott; *Mischocarpus fuscescens* Blume; *M. productus* H. L. Li.

Trees, evergreen, 4–10 m tall or more. Branches brownish red when dry, strong, stout, only pubescent when young. Leaves with petiole 20–45 cm, axis striate, petioles inflated at base; leaflets (2 or)3–5-jugate; petiolules 8–10 mm; blades dull when dry, lanceolate or oblong-lanceolate to oblong, 10–25 × 2.5–7.5 cm, papery or thinly leathery, glabrous, reticu-

late veins visible, slightly prominent, lateral veins 10–15 pairs, slightly curved, base broadly cuneate to subrounded, apex acuminate or shortly acuminate, mucronate. Inflorescences often multibranched, rarely racemose, solitary and axillary or several fascicled near branch apices, nearly as long as leaves or longer, main rachis and branches ± hairy. Pedicels 2–5 mm. Sepals triangular-ovate, ca. 1.5 mm, both surfaces pilose. Petals 1–5 or absent, lanceolate or scalelike. Disk hirsute. Filaments unequal in length, 2–3 mm, pilose. Capsules pear-shaped or clavate, 1.2–2.5 cm, part bearing seed 7–10 mm in diam., usually 1-loculed, with 1 seed. Fl. spring, fr. summer.

Primary and secondary forests. Guangdong, Guangxi, Yunnan [widely distributed in tropical Asia].

This species is used for its timber.

3. *Mischocarpus hainanensis* H. S. Lo, Fl. Hainan. 3: 574. 1974.

海南柄果木 hai nan bing guo mu

Shrubs, sometimes small trees, usually ca. 2 m tall. Branches dark red, strong, stout, subglabrous, with scattered orbicular lenticels. Leaves with petiole 13–20 cm, axis terete, slightly ridged adaxially, concolorous with branches; leaflets (2 or 3- or 4-jugate, opposite or subopposite; petiolules 1–1.5 cm, strong, stout; blades elliptic or oblong-elliptic, sometimes elliptic-lanceolate, 17–25 × 3–7.5 cm, leathery, glabrous, reticulate veins honeycombed when dry, lateral veins 12–14 pairs, netted near margin, apex cuspidate, mucronate or slightly concave. Flowers not seen. Infructescences almost without peduncles, branched near base; rachis and branches stout, golden pubescent. Capsules few, yellow, pear-shaped, part bearing seed 1.4–1.5 cm wide, often 2-loculed, each locule with 1 subglobose seed. Fr. Apr–May.

• Forests. Hainan.

18. *PAVIEASIA* Pierre, Fl. Forest. Cochinch. ad t. 317. 1895.

檀栗属 tan li shu

Trees, dioecious. Leaves paripinnate, alternate, estipulate, axis carinate abaxially, flat adaxially, triangular in transverse section; leaflets usually many jugate, entire or obtusely dentate. Thyrses axillary near apex, solitary or several fascicled; bracts and bracteoles small. Flowers unisexual, actinomorphic. Calyx shallowly cupular, deeply 5-lobed; sepals ovate or triangular, imbricate. Petals 5, ovate or subovate, with 1 large scale adaxially, scale thick, apex reflexed, abaxial surface and margin hirsute. Disk deeply cupular, slightly fleshy, margin thin, deeply wavy. Stamens (male flowers) 8, sometimes 7; filaments filiform, densely hairy; anthers broadly ovoid or ellipsoid-ovoid, connectives prominent and glandlike. Ovary (female flowers) 3-loculed; ovule 1 per locule, campylo-tropous; style terminal, longer than ovary; stigma inconspicuously 3-lobed. Capsules loculicidal into 3 schizocarps, 3-loculed or 1 or 2 small and sterile (without seed). Seeds 1–3; testa brown, shiny, leathery; hilum transversely elliptic, large, broad.

Three species: S China, N Vietnam; two species (one endemic) in China.

- 1a. Capsules subglobose, without ridges; branches glabrous 1. *P. kwangsiensis*
 1b. Capsules shortly fusiform, 3-ridged; branches hirsute 2. *P. yunnanensis*

1. *Pavieasia kwangsiensis* H. S. Lo, Acta Phytotax. Sin. 17(2): 35. 1979.

广西檀栗 guang xi tan li

Trees, evergreen. Bark brownish dark; branches pale grayish brown, slightly strong, minutely ridged, rugose when dry, glabrous. Leaves paripinnate, axis (including petiole) 25–39 cm, triangular in transverse section, nearly smooth; leaflets 5–7-jugate, subopposite; petiolules short, inflated; blades oblong-lanceolate to narrowly oblong, 9–19 × 3–5.5 cm, thinly leathery, lateral veins 15–20 pairs, tips netted near margin, reticulate veins conspicuous only abaxially, base cuneate to slightly obtuse, margin usually inconspicuously sparsely serrate at upper part, rarely entire, apex cuspidate, mucronate, mucro 5–10 mm. Flowers not seen. Infructescences terminal, conical, large, more than 30 cm; branches few, very long. Capsules sparse, with short, inflated stalk, subglobose, 2–2.5 cm or more in diam., not ridged, apex without beak, loculicidal into 3 schizocarps when mature, 1–3-loculed; schizocarps unequal, brown, 1–1.5 mm thick, nearly woody, abaxially slightly rugose. Seeds compressed-globose; testa brown, shiny, leathery; hilum transversely elliptic, large, broad. Fr. late summer.

• Dense forests and ravines. Guangxi (Longzhou).

This species is used for its timber.

2. *Pavieasia yunnanensis* H. S. Lo, Acta Phytotax. Sin. 17(2): 34. 1979.

云南檀栗 yun nan tan li

Trees, to 25 m tall. Branches strong, stout, hollow, furrowed, obtusely ridged, hirsute. Leaves paripinnate; petioles strong, adaxially shallowly furrowed, base enlarged, hirsute; leaflets 5- or 6-jugate, opposite or subopposite; petiolules inflated, ca. 4 mm; blades grayish brown when dry, oblong-ovate or oblong-lanceolate, rarely ovate, 15–25 × 6–9 cm, leathery, glabrous, lateral veins 16–18 per side, arched, netted near margin, base obtuse or subrounded, slightly asymmetrical, margin sparsely and obtusely serrate, sometimes entire below middle. Inflorescences axillary or nearly terminal; rachis strong, furrowed, tomentose; branches slightly sparse, slender; bracts and bracteoles subulate, small. Pedicels 2–3 mm, with hairy joints near base. Sepals triangular, ca. 1.2 mm, abaxially pilosulose. Petals red, ovate or obliquely ovate, ca. 2.5 mm, thin, 3-veined, glabrous or pilosulose; scale obovate-cuneate, nearly as long as 2/3 of petals, margin above middle and abaxial surface brown tomentose. Disk glabrous. Stamens 7 or 8, purplish red; filaments ca. 6.5 mm. Ovary pilose. Capsules shortly fusiform,

4–5.5 × ca. 4 cm, 3-ridged, base and apex acute, sometimes apex beaked; pericarp woody, ca. 5 mm thick, abaxially yellowish brown and rugose, adaxially brown and shiny, stalks strong, ca. 8 mm. Seeds 1–3, brown, usually compressed-glo-

bose, 1–1.5 cm or slightly longer. Fl. early summer, fr. early autumn.

Forests; 100–900 m. Yunnan [N Vietnam].

19. AMESIODENDRON Hu, Bull. Fan Mem. Inst. Biol. 7: 207. 1936.

细子龙属 xi zi long shu

Trees, evergreen, monoecious. Leaves paripinnate, estipulate, rachis terete; leaflets serrate or entire. Thyrses often multi-branched, axillary or several fascicled near apex. Flowers unisexual or polygamous, actinomorphic. Sepals 5, free, valvate. Petals 5, sometimes 6 or 7, not or hardly clawed, with 1 large scale adaxially. Disk cupular, contracted above middle, margin thin, deeply wavy. Stamens (male and bisexual flowers) 8, sometimes 9, exserted; filaments filiform, usually unequal in length; anthers ellipsoid, connectives large, slightly prominent. Ovary (female and bisexual flowers) turbinate, 3-lobed and 3-loculed; ovules 1 per locule; style inserted between ovary lobes, nearly as long as or slightly longer than ovary. Capsules deeply lobed into 3 schizocarps, only 1 or 2 developed, loculicidal into 3 carpels; pericarp rigid, woody. Seeds subglobose or slightly flat; testa pale brown, shiny, leathery, arillode absent; hilum transversely elliptic, large; embryo curved.

One species: S China, Indonesia (Sumatra), Laos, Malaysia, Myanmar, Thailand, Vietnam.

Lo (Acta Phytotax. Sin. 17(2): 36. 1979) recognized *Amesiodendron integrifoliolatum* and *A. tienlinense*, but the distinctive features of each have been recorded for *A. chinense* elsewhere and are regarded here as synonyms of *A. chinense* (see also Leenhouts in Adema et al., Fl. Males., ser. 1, 11(3): 465–467. 1994).

1. Amesiodendron chinense (Merrill) Hu, Bull. Fan Mem. Inst. Biol. 7: 209. 1936.

细子龙 xi zi long

Paranephelium chinense Merrill, Lingnan Sci. J. 14: 30. 1935; *Amesiodendron integrifoliolatum* H. S. Lo; *A. tienlinense* H. S. Lo.

Trees, 5–25 m tall. Bark dark gray, nearly smooth; branches dark reddish brown, strong, stout, shallowly furrowed, pubescent. Leaves with petiole 15–30 cm, axis pubescent or subglabrous; leaflets (3 or)4–6(or 7)-jugate; petiolules 4–8 mm; blades brown when dry, thinly leathery, first pair (near base) ovate, others oblong or oblong-lanceolate, sometimes lanceolate, bilaterally slightly asymmetrical, 6–12 × 1.5–3 cm or

slightly larger, abaxially sometimes pilosulose, lateral veins 10–12 pairs, slender, base broadly cuneate, margin rugose wavy, hardly to sharply serrate, apex shortly acuminate or sometimes cuspidate. Inflorescences often several fascicled at branch apex, occasionally solitary and axillary, densely tomentose. Flowers unisexual. Pedicels 2–3 mm. Sepals ca. 1 mm. Petals white, ovate, ca. 2 mm; scale entire, apex reflexed, abaxial surface and margin densely rugose long hairy. Stamens 8 or sometimes 9; filaments 3–4 mm, densely villous; anthers pilose. Ovary and style tomentose. Schizocarps black or brown, subglobose, 2–2.5 cm in diam., slightly to coarsely tuberculous and with dense, pale brown small lenticels. Seeds ca. 2 cm wide. Fl. May, fr. Oct–Sep.

Rain forests; 300–1000 m. Guangxi, Hainan [Indonesia (Sumatra), Laos, Malaysia, Myanmar, Thailand, Vietnam].

20. ALLOPHYLUS Linnaeus, Sp. Pl. 1: 348. 1753.

异木患属 yi mu huan shu

Shrubs, rarely trees [rarely woody climbers], monoecious or dioecious. Leaves digitate, stipules absent; leaflets 1–5, petiolate or sessile, usually serrate, sometimes entire. Thyrses axillary, racemose or compound racemose; bracts and bracteoles subulate or lanceolate, small. Flowers unisexual, zygomorphic, closed, small. Sepals 4, concurred, outer 2 elliptic, slightly smaller, inner 2 suborbicular. Petals 4, each 2 in a pair, adaxially with scales at base. Disk 4-sect, lobes glandlike, apex truncate or obtuse. Stamens (male flowers) 8, sometimes fewer, exserted; filaments free or connate below middle. Ovary (female flowers) 2(or 3)-partitioned, 2-loculed, lobes subglobose or obovate; ovules 1 per locule, inserted near base of middle axis; style basilar, entire or 2- or 3-lobed nearly to base; stigma recurved. Fruit parted into 2 or 3 schizocarps, often only 1 developed, berrylike, subglobose or obovoid, base with rudimentary style and small, globose, sterile schizocarp, exocarp fleshy, juicy, endocarp crustaceous. Seeds nearly same as schizocarp in shape; embryo arched, reflexed. $2n = 28$.

About 200 species: widely distributed in tropical and subtropical regions; 11 species (two endemic) in China.

This is a genus in need of taxonomic revision. Leenhouts (Blumea 15: 301–358. 1967), noting the clinal variation and regional intergradation, considered that the genus is monotypic comprising a single polymorphic species. Verdcourt (Fl. Trop. E. Africa, Sapindaceae, 75. 1998) noted that some species are easier to delimit than others, particularly between forest and bushland species. Within China, the 11 species are very distinct.

1a. Leaves 1-foliolate.

2a. Inflorescences in pairs or fascicles; leaflets sparsely wavy serrate 3. *A. chartaceus*

2b. Inflorescences solitary.

3a. Leaflets adaxially shallowly wavy toothed or wavy shallowly parted 1. *A. repandifolius*

3b. Leaflets adaxially sparsely serrulate 2. *A. petelotii*

- 1b. Leaves 3(–5)-foliolate.
- 4a. Leaflets 5, sometimes 3 or 4; filaments each 2 connate below middle; petals adaxially with 1 entire scale; inflorescences racemose, main rachis unbranched 11. *A. dimorphus*
- 4b. Leaflets 3; filaments free; petals adaxially with 1 or 2 scales.
- 5a. Main rachis of inflorescences at least with one branch.
- 6a. Terminal leaflet apically acute, mucronate, base rounded; leaflets abaxially with a villous tuft in lateral vein axils; inflorescences densely flowered 10. *A. timoriensis*
- 6b. Terminal leaflet apically caudate-acuminate, base cuneate; inflorescences sparsely flowered.
- 7a. Leaflets abaxially without tufts of hairs in lateral vein axils, margin shallowly wavy toothed 5. *A. caudatus*
- 7b. Leaflets abaxially usually tufted villous in lateral vein axils, margin serrulate 9. *A. longipes*
- 5b. Main rachis unbranched, inflorescences racemose.
- 8a. Leaflets abaxially glabrous or only with tufts of hairs in lateral vein axils.
- 9a. Leaflets abaxially with tufts of hairs in lateral vein axils, margin serrulate 4. *A. viridis*
- 9b. Leaflets abaxially glabrous, margin shallowly wavy toothed 5. *A. caudatus*
- 8b. Leaflets densely tomentose abaxially or pubescent on veins of both surfaces.
- 10a. Leaflets abaxially hispid, lateral leaflets sharply serrate from base; plants monoecious 8. *A. hirsutus*
- 10b. Leaflets villous, lateral leaflets serrulate from middle; plants dioecious.
- 11a. Leaflets only pubescent on veins 6. *A. cobbe*
- 11b. Leaflets villous throughout 7. *A. trichophyllus*

1. *Allophylus repandifolius* Merrill & Chun, Sunyatsenia 5: 113. 1940.

单叶异木患 dan ye yi mu huan

Shrubs, ca. 1 m tall. Branchlets slightly zigzag, grayish white, with scattered orbicular lenticels, only young leaves sparsely pubescent. Leaves unifoliolate; petiole 2–3.1 cm; leaflets shortly petiolate; blades abaxially pale green, adaxially deep green, obovate-cuneate, 20–30 × 7–10 cm, papery, abaxially glabrous, lateral veins 15 pairs per side, arched, upper several pairs reaching tips of teeth, base narrowly cuneate, upper 1/3 shallowly wavy toothed or lobed, apex caudate-acuminate. Flowers unknown. Infructescences unbranched or with 1 or 2 short branches, erect, 4–10 cm, sparsely pubescent. Fruit obovoid, ca. 8 mm, glabrous or pilosulose. Fr. autumn.

- Forests; ca. 400 m. Hainan (Wanning).

2. *Allophylus petelotii* Merrill, J. Arnold Arbor. 19: 46. 1938.

广西异木患 guang xi yi mu huan

Shrubs, to 3.5 m tall. Branchlets grayish white, only upper part pilosulose. Leaves unifoliolate; petioles 1–4 cm; leaflets shortly petiolate; blades broadly oblanceolate or obovate, 13–20 × 4–7 cm, thinly papery, glabrous, midvein and 10 pairs of lateral veins prominent on both surfaces, base cuneate or sometimes slightly obtuse, margin sparsely serrate above middle, apex caudate-acuminate. Inflorescences solitary, racemose, main rachis unbranched, 5–7 cm, pubescent; peduncles ca. 1.5 cm, glabrous. Flowers white, shortly pedicellate. Sepals: outer 2 ovate, ca. 1 mm, pilosulose; inner 2 obovate, ca. 2 mm. Petals 1.5–1.8 mm; scales ca. 1 mm. Fruit unknown. Fl. early summer.

Forests. Guangxi (Fangcheng) [N Vietnam].

3. *Allophylus chartaceus* (Kurz) Radlkofer in Engler & Prantl, Nat. Pflanzenfam. III(5): 313. 1895.

大叶异木患 da ye yi mu huan

Schmidelia chartacea Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43: 183. 1874; *Allophylus zeylanicus* Linnaeus var. *grandifolius* Hiern.

Shrubs, small. Branchlets brown, gradually becoming grayish white, terete. Leaves unifoliolate (sometimes lateral rudimentary leaflets extant); petioles 2–8 cm, stout, strong, grooved; leaflets petiolate; blades shiny, broadly lanceolate or elliptic, 18–32 × 8–14 cm, membranous-papery, glabrous, lateral veins slightly sparse, ascending to tooth-tips, prominent abaxially, veinlets reticulate, margin wavy toothed. Thyrses unbranched, in pairs or fascicles, nearly as long as petioles or sometimes nearly as long as leaves; rachis striate, glabrous. Flower buds ca. 2 mm in diam. Sepals subglabrous. Petals cuneate, claws hairy; scales with long red hairs. Fruit red, subglobose, ca. 1 cm in diam.

Thickets; ca. 1100 m. SE Xizang (Médog) [Bhutan, India].

4. *Allophylus viridis* Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 38: 229. 1909.

异木患 yi mu huan

Shrubs, 1–3 m tall. Branchlets grayish white, pilosulose. Leaves trifoliolate; petioles 2–4.5 cm or longer, pilose; leaflets with petiolules 5–8 mm; blades adaxially blackish brown when dry, papery, abaxially with tufts of hairs in lateral vein axils, margin serrulate; terminal blade narrowly elliptic or lanceolate-elliptic, rarely ovate or broadly ovate, 5–15 × 2.5–4.5 cm, base cuneate, apex acuminate; lateral ones smaller, lanceolate-ovate or ovate, bilaterally slightly asymmetrical, base obtuse. Inflorescences racemose, main rachis unbranched, densely flowered, suberect or ascending, nearly as long as or slightly longer than petioles, pilose; peduncles 1–1.5 cm. Flowers small, 1–1.5 mm wide; bracts subulate, shorter than pedicels. Sepals glabrous. Petals broadly cuneate, ca. 1.5 mm; scales deeply 2-lobed, ciliate. Disk, bases of filaments, and ovary hairy. Fruit red, globose, 6–7 mm in diam. Fl. Aug–Sep, fr. Nov.

Forests, thickets. Guangdong, Hainan [N Vietnam].

This species is used medicinally.

5. *Allophylus caudatus* Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 38: 231. 1909.

波叶异木患 bo ye yi mu huan

Trees, small, or shrubs, usually not more than 5 m tall. Branchlets with slightly dense lens-shaped lenticels, pubescent. Leaves trifoliate; petioles 6–12.5 cm; leaflets with petiolules 5–15 mm; blades membranous or thinly papery, abaxially glabrous, adaxially hairy on midvein, lateral veins ca. 10 pairs, prominent on both surfaces, margin shallowly wavy toothed; terminal blade oblong-lanceolate, 8–22 (or more) × 3.5–7.5 cm, base cuneate, apex caudate-acuminate; lateral ones smaller, ovate, extremely asymmetrical, base broadly cuneate to subrounded. Inflorescences racemose, main rachis unbranched, rarely with 1 slender branch at base, longer than leaves, sometimes nearly as long as or slightly longer than petioles; rachis slender, tips usually pendulous; peduncles 1.5–2.5 cm. Pedicels ca. 1 mm. Petals narrowly cuneate; scales deeply 2-parted. Disk subglabrous. Filaments villous at lower part. Fruit red, subglobose, 7–8 mm in diam. Fl. Aug–Sep, fr. Sep–Nov.

Forests, thickets. SE and SW Yunnan (Hekou, Maguan) [Vietnam].

6. *Allophylus cobbe* (Linnaeus) Raeuschel var. ***velutinus*** Corner, Gard. Bull. Straits Settlement. 10: 41. 1939.

滇南异木患 dian nan yi mu huan

Shrubs, 1.5–3 m tall. Branchlets grayish brown, terete, with small orbicular lenticels, ± hairy when young. Leaves trifoliate; petioles 5–11 cm, pilosulose; leaflets with petiolules 3–12 mm; blades thinly papery, both surfaces pubescent on veins, abaxially ciliate at vein axils, margin sparsely serrulate, apex acuminate or caudate-acuminate; terminal blade elliptic or elliptic-lanceolate, 9–20 × 4–6.5 cm; lateral ones smaller, obliquely ovate or obliquely ovate-lanceolate. Inflorescences axillary, unbranched, usually ca. as long as leaves, shortly tomentose. Flowers white, small. Sepals suborbicular, 1–1.5 mm in diam. Petals spoon-shaped, ca. 1 mm; scales 2, villous. Disk pilose. Filaments hairy at base. Fruit red, subglobose, 5–7 mm in diam. Fl. Jun–Sep, fr. Dec.

Dense forests; 300–1200 m. Yunnan (Mengla) [India, Malaysia, Myanmar, Thailand, Vietnam].

7. *Allophylus trichophyllus* Merrill & Chun, Sunyatsenia 2: 270. 1935.

毛叶异木患 mao ye yi mu huan

Shrubs, 1–3 m tall, monoecious. Branchlets grayish yellow pilose. Leaves trifoliate; petioles 5–8 cm, slightly denser hairy than branchlets; leaflets with petiolules 5–10 mm; blades abaxially dark brown and adaxially black when dry, papery, abaxially densely pilose, adaxially only densely hairy on midvein and lateral veins, sometimes thoroughly scattered adnate pilose, lateral veins slender, 10–12 pairs, prominent on both sides, margin sharply serrulate above middle; terminal blade oblong or broadly lanceolate to elliptic-obovate, 8–15 × 2.5–6 cm, base cuneate or slightly obtuse, apex acuminate; lateral ones smaller. Inflorescences racemose, main rachis unbranched, solitary, longer than petioles, sometimes those on lateral veins longer than leaves. Pedicels ca. 1 mm, slender. Sepals ciliate. Petals oblong-obovate, ca. 1 mm; scales 2-lobed. Filaments slightly hairy at lower part. Fruit red, subglobose, 5–6 mm in diam. Fl. Jul, fr. Oct.

• Forests. S Hainan (Sanya).

8. *Allophylus hirsutus* Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 38: 228. 1909.

云南异木患 yun nan yi mu huan

Shrubs, 1–4 m tall, dioecious. Branchlets, petioles, and rachis densely brownish yellow hispid. Leaves trifoliate; petioles 5–11 cm or longer; leaflets with petiolules 5–12 mm; blades brownish yellow when dry, membranous, abaxially densely irregularly and shiny hispid, adaxially sparsely adnate hispid; terminal blade oblong-lanceolate or elliptic-obovate, 6–18 × 2–6 cm, base cuneate, margin sharply serrate above middle, apex acuminate; lateral ones smaller, obliquely ovate, base obtuse, bilaterally asymmetrical, margin sharply serrate from base. Inflorescences racemose, unbranched; female ones strong, stout, sparsely flowered, nearly as long as or slightly shorter than leaves; male ones slender, densely flowered, nearly as long as petioles. Pedicels 1–2 mm. Petals broadly cuneate, ca. 1.5 mm; scales 2-lobed. Fruit red, broadly obovoid, ca. 9 × 8 mm. Fl. summer, fr. autumn.

Sparse forests. Yunnan (Xishuangbanna) [Cambodia, Thailand].

9. *Allophylus longipes* Radlkofer, Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 38: 233. 1909.

长柄异木患 chang bing yi mu huan

Trees, small, or shrubs, to 10 m tall. Branchlets pale white or yellowish gray, subglabrous. Leaves trifoliate; petioles 4–10 cm; leaflets with petiolules 5–10 mm; blades abaxially olive-green, adaxially brown when dry, papery, abaxially with tufts of hairs in lateral vein axils, margin sparsely serrulate above middle; terminal blade lanceolate or narrowly elliptic-lanceolate, 12–24 × 3–9 cm, base cuneate or broadly so, apex caudate-acuminate; lateral ones ovate or broadly ovate, bilaterally asymmetrical. Inflorescences compound racemose, usually with several or numerous branches, solitary, or sometimes accompanied with 1 or 2 unbranched inflorescences, rachis and branches grooved, grayish yellow pubescent; peduncles 3–4.5 cm; female ones ascending, male ones slender and curved. Pedicels 2–3 mm. Petals shortly cuneate, ca. 1.3 mm, claw villous; scales 2-lobed. Filaments slightly stouter proximally. Ovary (2 or)3-lobed, (2 or)3-loculed, lobes often unequal. Fruit red, ellipsoid, 9–10 × 6–7 mm. Fl. summer–autumn, fr. autumn–winter.

Dense forests; 1100–1600 m. S Guizhou, S Yunnan [N Vietnam].

10. *Allophylus timoriensis* (Candolle) Blume, Rumphia 3: 130. 1847 [*“timorensis”*].

海滨异木患 hai bin yi mu huan

Schmidelia timoriensis Candolle, Prodr. 1: 611. 1824.

Shrubs, 1–3 m tall. Branchlets grayish white, slightly zigzag, strong, stout, glabrous or pilosulose. Leaves trifoliate; petioles 1–6 cm; leaflets with petiolules 5–18 mm; blades abaxially brown and adaxially black when dry, papery or slightly fleshy, broadly ovate, abaxially only with tufts of hairs in lateral vein axils, lateral veins 8 pairs, prominent abaxially; terminal blade 6–10 × 3–6.5 cm, base rounded, margin sparsely toothed, apex

acute and mucronate; lateral ones slightly smaller, same as terminal one in shape. Inflorescences compound racemose, usually with one pair of branches at lower part of main rachis, solitary, erect, longer than petioles, glabrous or pilosulose. Pedicels 1–2 mm. Sepals glabrous. Petals spoon-shaped, ca. 1 mm, abaxially villous, apex rounded or slightly emarginate; scales shallowly 2-lobed, densely long hairy. Fruit red, ovoid or subglobose, 8–10 × 7–8 mm. Fl. Jul, fr. Oct–Nov.

Seaside sparse forests or thickets. Hainan, Taiwan [Indonesia, Malaysia, Myanmar, New Guinea, Philippines, Thailand, Timor].

11. *Allophylus dimorphus* Radlkofer, Actes Congrès Int. Bot., Amsterdam 1877: 126. 1879.

五叶异木患 wu ye yi mu huan

Shrubs, 2–4 m tall. Stems slender, few branched; branch

lets green, pubescent. Leaves digitate, (3–)5-foliolate; petioles 5–9 cm, pubescent; leaflets with petiolules 1–1.5 cm, outermost one nearly sessile; blades papery, abaxially with tufts of hairs in lateral vein axils, lateral veins 9 or 10 per side, slightly prominent on both sides; terminal blade broadly lanceolate or narrowly elliptic, 8–18 × 3–6.5 cm, base cuneate, margin sharply serrulate above middle, apex caudate-acuminate; lateral ones smaller, outermost pair usually much smaller or undeveloped. Inflorescences racemose, unbranched, densely flowered, solitary, suberect or sometimes spreading, slightly longer than petioles, densely pubescent; peduncles 1–2 cm. Pedicels 1.5–2 mm. Sepals sparsely pilose at base. Petals spoon-shaped; scales entire. Filaments connate in pairs below middle. Fruit red, globose or subglobose, sparsely hairy. Fl. Sep.

Rubber plantations. Hainan [Philippines, Vietnam].

21. *CARDIOSPERMUM* Linnaeus, Sp. Pl. 1: 366. 1753.

倒地铃属 dao di ling shu

Herbaceous or woody climbers, rarely shrubs. Leaves usually biternate or bitrilobate; stipules small, deciduous; leaflets pinnately lobed or dentate, usually with pellucid glands. Panicles axillary; peduncles rather long, first pair of branches forming tendrils or spines; bracts and bracteoles subulate. Flowers unisexual, zygomorphic, with slender noded pedicels. Sepals 4 or 5, imbricate, outer 2 smaller. Petals 4, with a large scale inside and slightly above base; scales of abaxial petals with broadly winged appendage, scales of adaxial petals simple. Disk lobed into 2 large glandular lobes at base of petals. Stamens (male flowers) 8, slightly longer than petals. Ovary (female flowers) ellipsoid, trigonous, 3-loculed; ovules 1 per locule, inserted at middle of middle axis; style short; stigma 3-lobed. Capsules inflated, saclike, 3-loculed; pericarp membranous or papery, veined. Seeds 1 per locule, subglobose; hilum cordate or suborbicular; embryo with large cotyledons, outer one arched, inner one reflexed. $2n = 20, 22$.

About 12 species: mostly in tropical and subtropical America; one species in China.

1. *Cardiospermum halicacabum* Linnaeus, Sp. Pl. 1: 366. 1753.

倒地铃 dao di ling

Cardiospermum halicacabum var. *microcarpum* (Kunth) Blume; *C. microcarpum* Kunth.

Climbers, herbaceous, 1–1.5 m. Stems and branches green, 5- or 6-sulcate, slender, glabrous or sparsely hairy. Leaves biternate, triangular in outline; petioles 3–4 cm; leaflets subsessile; blades thinly papery, margin sparsely serrate or pinnately parted, abaxially sparsely villous on midvein and lateral veins, adaxially subglabrous or sparsely pilosulose; terminal blade obliquely lanceolate or subrhombic, 3–8 × 1.5–2.5 cm, apex acuminate; lateral ones slightly smaller, ovate or narrowly elliptic. Panicles few flowered, ca. as long as or slightly longer than

leaves; peduncles straight, 4–8 cm, tendrils spiralled. Sepals 4, ciliate, outer 2 ovate, 8–10 mm, inner 2 narrowly elliptic, ca. 2 × as long as outer ones. Petals milky-white, obovate. Stamens (male flowers) ca. as long as or slightly longer than petals; filaments sparsely long villous. Ovary (female flowers) obovoid or sometimes subglobose, pubescent. Capsules brown, pearlike, turbinate-obtriangular or sometimes nearly ellipsoid, 1.5–3 × 2–4 cm, pubescent. Seeds black, shiny, ca. 5 mm in diam.; hilum green when fresh, white when dry, cordate. Fl. summer–autumn, fr. autumn–early winter.

Forest margins, shrublands, grasslands, cultivated areas, wastelands. Common in E, S, and SW China, rare in N China [common weed widely distributed in tropical and subtropical regions].

This species is used medicinally.