

ULMACEAE

榆科 yu ke

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Trees or shrubs, evergreen or deciduous. Winter buds with scales, rarely naked; axillary buds developed; terminal bud usually dying back early. Stipules usually membranous, caducous. Leaves simple, alternate or rarely opposite, usually distichous, petiolate; leaf blade pinnately veined, basally 3(or 5)-veined, margin entire or serrate. Inflorescences axillary. Flowers monochlamydeous, bisexual, or rarely unisexual or polygamous. Perianth lobes 4–9, imbricate or rarely valvate, persistent or caducous. Stamens usually equal in number to and opposite perianth lobes, opposite, basally adnate to tepals; filaments distinct; anthers 2-celled, longitudinally fissured. Pistil 2-carpellate; ovary superior, 1(or 2)-loculed; ovule 1, suspended, anatropous; integuments 2. Style very short; stigmas 2, linear. Fruit samara, drupes, or winged nutlets, apically usually with persistent stigmas. Endosperm scanty or absent; embryo erect, curved, or involute; cotyledons flat, curved, or flexed. Seedling epigeous.

About 16 genera and ca. 230 species: widespread in temperate and tropical areas; eight genera (one endemic) and 46 species (23 endemic) in China.

Recent research strongly suggests that the subfamily Celtidoideae (*Aphananthe*, *Celtis*, *Gironniera*, *Pteroceltis*, and *Trema*) is not the closest relative of the subfamily Ulmoideae (*Hemiptelea*, *Ulmus*, and *Zelkova*). It would probably be more accurate to exclude Celtidoideae from Ulmaceae, and move it to Cannabaceae, rather than treating it as a separate family, Celtidaceae. More data are needed before a stable, new classification of the Urticales can be produced. Until these data are available, it is more practical to retain the traditional circumscription of Ulmaceae.

Most species of this family yield fine timber, the cortex is a good substitute for hemp, the fruit are edible, and the seed oil is used medicinally and industrially. Many species of Ulmaceae are cultivated, and it is not always certain whether specimens are from wild or cultivated plants.

Fu Likuo, Chen Chiajui & Tang Yancheng. 1998. Ulmaceae. In: Chun Woonyong & Huang Chengchiu, eds., Fl. Reipubl. Popularis Sin. 22: 334–413.

- 1a. Fruit dry, broadly winged at least on one side.
 - 2a. Flowers unisexual; anthers apically pubescent; leaves 3-veined from base; secondary veins curving inward, not reaching margin 3. *Pteroceltis*
 - 2b. Flowers bisexual or polygamous; anthers apically glabrous; leaves pinnately veined; secondary veins straight, each ending in a marginal tooth.
 - 3a. Fruit symmetric, winged on both sides; seed round; branchlets without spines 1. *Ulmus*
 - 3b. Fruit asymmetric, winged only on one side; seed elongate and curved; branchlets with spines 2. *Hemiptelea*
- 1b. Fruit drupes (scarcely fleshy in *Zelkova*), not winged.
 - 4a. Leaf blade 3(or 5)-veined from base.
 - 5a. Lateral veins extending to margin, each ending in a tooth (*Aphananthe aspera*) 6. *Aphananthe*
 - 5b. Lateral veins anastomosing before reaching margin.
 - 6a. Flowers unisexual (polygamous in *Trema cannabina*), shortly pedicellate; fruit 1.5–4 mm in diam., with persistent tepals and stigmas, stalk short; leaf blade margin denticulate 7. *Trema*
 - 6b. Flowers polygamous, long pedicellate; fruit 5–15 mm in diam., without persistent tepals and stigmas, stalk long; leaf blade margin entire or serrate 8. *Celtis*
 - 4b. Leaf blade pinnately veined.
 - 7a. Flowers polygamous; leaf blade serrate to crenate; secondary veins extending to margin, each ending in a tooth 4. *Zelkova*
 - 7b. Flowers unisexual; leaf blade entire, shallowly serrate, or denticulate; secondary veins anastomosing before reaching margin.
 - 8a. Stipules usually basally connate, enclosing bud, leaving a single transverse scar that completely encircles stem at each node 5. *Gironniera*
 - 8b. Stipules not connate, nor enclosing bud, leaving two small transverse scars one on each side of leaf base.
 - 9a. Leaf blade narrowly ovate, ovate, or oblong-lanceolate, margin usually entire or occasionally inconspicuously serrate; drupe 13–20 mm (*Aphananthe cuspidata*) 6. *Aphananthe*
 - 9b. Leaf blade elliptic-lanceolate to narrowly lanceolate, margin denticulate; drupe 1.5–2.5 mm (*Trema levigata*) 7. *Trema*

1. ULMUS Linnaeus, Sp. Pl. 1: 225. 1753.

榆属 yu shu

Trees or shrubs, deciduous or evergreen. Branchlets never spinose, sometimes with a thick and irregularly longitudinally

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ULMACEAE

fissured corky layer or with 2 flat opposite corky wings. Bud scales imbricate, glabrous or pubescent. Stipules 2, lanceolate-ovate to linear, membranous, caducous, leaving a short transverse scar on each side of leaf base. Leaves distichous, blade base ± oblique, margin doubly or simply serrate; venation pinnate; secondary veins extending to margin, each ending in a tooth. Bracteoles at base of pedicels, membranous. Pedicel shorter than to almost as long as perianth, pubescent or rarely glabrous. Flowers bisexual or polygamous, appearing in spring before leaves, rarely in autumn or winter. Perianth 4–9-lobed, usually campanulate; tepals membranous, usually persistent, apex usually laciniate. Stamens equal in number to tepals; filaments flat; anthers extrorse. Ovary flat; ovule pendulous, amphitropous. Style very short or rarely slightly elongate and bifid; stigmas 2, linear, pubescent. Samara flat, orbicular, obovate, oblong, elliptic, or rarely shuttle-shaped, wings membranous, apex with notch and persistent stigmas. Seed at center or toward apex of samara, compressed or ± convex, without endosperm; embryo erect; cotyledon flat or ± convex.

About 40 species: Asia, Europe, North America; 21 species (14 endemic) in China.

Many species yield fine woods, edible fruit, and medicinal products.

Many Chinese *Ulmus* species are cultivated in areas beyond their native range. In addition, the non-native species *Ulmus americana* Linnaeus, *U. densa* Litvinov, and *U. laevis* Pallas are grown as cultivated plants in China.

- 1a. Evergreen trees; samaras strongly asymmetric, orange-brown 20. *U. lanceifolia*
- 1b. Deciduous trees; samaras symmetric or weakly asymmetric, tan, light brown, pale green, or whitish (rarely slightly orange- or red-brown in *U. macrocarpa* and *U. parvifolia*).
 - 2a. Flowers and fruit appearing late summer to early autumn 21. *U. parvifolia*
 - 2b. Flowers and fruit appearing in spring.
 - 3a. Inflorescences racemose cymes or short cymes; peduncle slightly elongated to very noticeably elongated, pendulous; pedicel 2–4 × as long as perianth 1. *U. elongata*
 - 3b. Inflorescences fascicled cymes or fasciculate; peduncle extremely short, not pendulous; pedicel almost as long as or rarely longer than perianth.
 - 4a. Seed at center or toward apex of samara; seed apex reaching notch (apex sometimes only nearly to notch in *U. glaucescens*).
 - 5a. Flowers developed from mixed buds thus samaras usually on short shoots with one or a few leaves; leaves 1–3 cm wide, both surfaces pubescent or subglabrous, often with tufts of hairs abaxially in forkings of secondary veins (never in vein axils); samara wings relatively thick; seed broader than wings 12. *U. glaucescens*
 - 5b. Flowers developed from floral buds thus no leaves attached within each cluster of samaras; leaves 1.5–10 cm wide, variously pubescent or glabrous but often with tufts of hairs abaxially in vein axils (never in forkings of secondary veins); samara wings thin; seed narrower than wings.
 - 6a. Samara ± pubescent 13. *U. chenmoui*
 - 6b. Samara glabrous except for notch or pubescent only on seed.
 - 7a. Leaf blade abaxially densely pubescent 19. *U. castaneifolia*
 - 7b. Leaf blade abaxially glabrous or sparsely pubescent.
 - 8a. Branchlets densely pubescent 18. *U. androssowii*
 - 8b. Branchlets glabrous or sparsely pubescent.
 - 9a. Samara obovate to ± obovate or oblong-elliptic to oblong-obovate.
 - 10a. Samara obovate to ± obovate; branchlets sometimes with a corky layer 14. *U. davidiana*
 - 10b. Samara oblong-elliptic to oblong-obovate; branchlets without a corky layer 15. *U. prunifolia*
 - 9b. Samara ± orbicular to ovate-orbicular.
 - 11a. Samara 7–8 × 7–8 mm; leaf blade 8.5–17 cm; petiole ca. 5 mm 16. *U. microcarpa*
 - 11b. Samara 11–16 × 9–13 mm; leaf blade 2–9 cm; petiole 5–12 mm 17. *U. szechuanica*
 - 4b. Seed at center or slightly toward base of samara; seed apex not reaching notch (apex sometimes near to notch in *U. pumila*).
 - 12a. Samara pubescent.
 - 13a. Leaf blade abaxially glabrous and ± scabrous, adaxially sparsely pubescent when young but glabrescent, margin serrate with acute teeth; bud scales glabrous 5. *U. changii*
 - 13b. Leaf blade abaxially ± pubescent and scabrous or not, adaxially scabrous and densely hirsute, margin rounded serrate; bud scales ± pubescent.
 - 14a. Flowers developed from mixed buds; bark irregularly exfoliating, gray to grayish white 4. *U. lamellosa*
 - 14b. Flowers developed from floral buds or mixed buds; bark longitudinally fissured, gray to blackish gray.
 - 15a. Branchlets pubescent; leaf blade apex obtuse-acuminate to acute; samara 1.8–2.8 × 1.7–2.7 cm 2. *U. gaussonii*

- 15b. Branchlets glabrous or sparsely pubescent; leaf blade apex acuminate or shortly caudate; samara 1.5–4.7 × 1–3.9 cm 3. *U. macrocarpa*
- 12b. Samara glabrous or pubescent only on stigmatic surface.
- 16a. Leaf blade apically 3–7-lobed; pedicel glabrous 6. *U. laciniata*
- 16b. Leaf blade apically not lobed; pedicel pubescent.
- 17a. Leaf blade 5–18 × 3–8.5 cm, apically narrowly acuminate to caudate; winter buds glabrous or variously pubescent.
- 18a. Winter buds ± pubescent, margin of bud scales prominently long ciliate; twigs sometimes conspicuously winged; samaras 1.5–4.7 × 1–3.9 cm 3. *U. macrocarpa*
- 18b. Winter buds finely and inconspicuously puberulent, margin of bud scales entire or inconspicuously short-ciliate; twigs never winged; samaras 1–1.8 × 0.8–1.6 cm.
- 19a. Leaf blade 5–11 × 3–4.5 cm, abaxially pubescent, base ± oblique to ± symmetric; secondary veins 11–20 on each side of midvein; samara 8–10 mm wide 8. *U. uyematsui*
- 19b. Leaf blade 6–18 × 3–8.5 cm, abaxially glabrous or pubescent, base distinctly oblique; secondary veins 17–26 on each side of midvein; samara 10–16 mm wide 7. *U. bergmanniana*
- 17b. Leaf blade 2–8 × 1.2–3.5 cm, apically acuminate to cuspidate; winter bud scale margin usually white-ciliate.
- 20a. Leaf blade pubescent; petiole pubescent; samara wings relatively thick 11. *U. pseudopropinqua*
- 20b. Leaf blade smooth and glabrous or with tufts of hair in vein axils; petiole glabrous or pubescent; samara wings relatively thin.
- 21a. Leaf blade margin simply serrate or sparsely doubly serrate; base symmetric to ± oblique 9. *U. pumila*
- 21b. Leaf blade margin doubly serrate; base oblique 10. *U. harbinensis*

1. *Ulmus elongata* L. K. Fu & C. S. Ding, Acta Phytotax. Sin. 17(1): 46. 1979.

长序榆 chang xu yu

Trees, to 30 m tall, d.b.h. to 80 cm, deciduous. Bark brownish gray, exfoliating. Branchlets chestnut brown, sometimes with a corky layer, with scattered lenticels. Winter buds narrowly ovoid; inner bud scale margin apically pubescent. Stipules lanceolate to narrowly lanceolate, 0.7–1.8 cm. Petiole 3–11 mm, pubescent; leaf blade elliptic to lanceolate-elliptic, 7–19 × 3–8 cm, abaxially densely pubescent, adaxially glabrous or glabrescent, base cuneate and ± oblique, margin doubly serrate with teeth incurved and cuspidate, apex acuminate; secondary veins 16–30 on each side of midvein. Inflorescences racemose cymes; rachis elongated, pendulous, sparsely pubescent. Flowers from floral buds on second year branchlets. Pedicel 2–4 × as long as perianth. Perianth funnelform; tepals 6. Samaras yellowish green, shuttle-shaped, 2–2.5 cm × ca. 3 mm, basally with a long gynophore, margin densely white ciliate; stalk slender, unequally long, 0.5–2.2 cm. Seed at center or slightly toward apex of samara. Fl. Feb, fr. Mar.

• Scattered in evergreen broad-leaved forests; 200–900 m. Anhui, N Fujian, Jiangxi, Zhejiang.

2. *Ulmus gaussonii* W. C. Cheng, Trav. Lab. Forest. Toulouse 3(3): 110. 1939.

醉翁榆 zui weng yu

Trees, to 25 m tall, d.b.h. to 80 cm, deciduous. Bark dark gray to blackish, longitudinally fissured, scabrous. Branchlets densely pubescent in first or second year, sometimes with op-

posite flat corky wings, with scattered yellowish brown lenticels. Winter buds ± globose to ovoid; bud scale margin ciliate. Petiole 4–8 mm, pubescent; leaf blade oblong-obovate, elliptic-obovate, or rhombic-elliptic, 3–11 × 1.8–5.5 cm, abaxially scabridulous and densely pubescent when young but only on veins with age, adaxially scabrous and densely hirsute, base oblique, margin simply or doubly serrate, apex obtuse-acuminate to acute; secondary veins 8–10 on each side of midvein. Flowers from floral buds, rarely from mixed buds. Perianth campanulate, 4- or 5-lobed, pubescent, margin ciliate. Samaras orbicular to obovate-orbicular, 1.8–2.8 × 1.7–2.7 cm, pubescent, base broadly rounded to rounded; stalk 1–2 mm, densely pubescent; perianth persistent. Seed at center of samara. Fl. and fr. Mar–Apr.

• River banks, limestone mountains. Anhui (Langya Shan).

This species is cultivated in Jiangsu (Nanjing).

3. *Ulmus macrocarpa* Hance, J. Bot. 6: 332. 1868.

大果榆 da guo yu

Shrubs or trees, to 20 m tall, d.b.h. to 40 cm, deciduous. Bark gray to blackish gray, longitudinally fissured. Branchlets tan to red-brown, sometimes with corky wings, glabrous or sparsely pubescent when young, with scattered lenticels. Winter buds dark brown, sometimes hoary from pubescence, ovoid-orbicular to ± globose; bud scales ± pubescent, margin prominently long ciliate. Petiole 2–14 mm, pubescent; leaf blade broadly obovate, obovate-orbicular, obovate-rhombic, or obovate, 4–11 × 3.5–6 cm, leathery, margin obtusely doubly or simply serrate; secondary veins 6–16 on each side of midvein. Inflorescences fascicled cymes on second year branchlets or

scattered at base of new branchlets. Flowers from floral buds or mixed buds. Perianth campanulate, 5-lobed, pubescent or not, margin ciliate. Samaras tan to light brown, rarely slightly orange-brown, broadly obovate-orbicular, \pm orbicular, or broadly elliptic, $1.5\text{--}4.7 \times 1\text{--}3.9$ cm; perianth persistent. Seed at center of samara. Fl. Mar–May, fr. Apr–Jun.

Mixed forests, slopes, valleys; 700–1800 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, N Jiangsu, Jilin, Liaoning, Nei Mongol, E Qinghai, Shaanxi, Shandong, Shanxi [Korea, Mongolia, Russia (Far East, E Siberia)].

- 1a. Samara pubescent; leaf blade abaxially sparsely pubescent, adaxially hirsute or with convex trichome scars, base attenuated to rounded, apex shortly caudate 3a. var. *macrocarpa*
 1b. Samara glabrous; leaf blade surfaces smooth and glabrous with tufted hairs on veins, base oblique, apex acuminate to narrowly acuminate 3b. var. *glabra*

3a. *Ulmus macrocarpa* var. *macrocarpa*

大果榆(原变种) da guo yu (yuan bian zhong)

Ulmus macrocarpa var. *mandshurica* Skvortsov; *U. macrocarpa* var. *mongolica* Liou & Li; *U. macrocarpa* var. *nana* Liou & Li; *U. macrophylla* Nakai; *U. taihangshanensis* S. Y. Wang.

Leaf blade abaxially sparsely pubescent with hairs tufted in axils and forks of secondary veins, adaxially hirsute or with convex trichome scars, base attenuated to rounded, apex shortly caudate. Samaras pubescent, apically concave or rounded, wings thick, stigmas pubescent. Fl. Mar, fr. Apr.

Slopes, valleys; 700–1800 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, N Jiangsu, Jilin, Liaoning, Nei Mongol, E Qinghai, Shaanxi, Shandong, Shanxi [Korea, Mongolia, Russia (Far East, E Siberia)].

Ulmus taihangshanensis, described from Henan, differs in having more pubescent twigs that never develop corky wings, and thinner leaves (papery rather than leathery).

3b. *Ulmus macrocarpa* var. *glabra* S. Q. Nie & K. Q. Huang, Bull. Bot. Res., Harbin 7(1): 153. 1987.

光秃大果榆 guang tu da guo yu

Leaf blade \pm elliptic, smooth, with tufted hairs in vein axils, base oblique, apex acuminate to narrowly acuminate. Samaras smooth, glabrous, wings thin. Fl. Apr–May, fr. May–Jun.

- Mixed forests. Heilongjiang (Harbin).

4. *Ulmus lamellosa* C. Wang & S. L. Chang, Acta Phytotax. Sin. 17(1): 47. 1979.

脱皮榆 tuo pi yu

Trees, 8–12 m tall, d.b.h. 15–20 cm, deciduous. Bark gray to grayish white, exfoliating in irregular flakes. Branchlets brown to grayish brown, glabrous, unwinged, sometimes with a corky layer. Winter buds ovoid-orbicular to \pm orbicular; bud

scales \pm pubescent, margin ciliate. Stipules linear to lanceolate, pubescent, caducous. Petiole 3–8 mm; leaf blade obovate, 5–10 \times 2.5–5.5 cm, abaxially \pm scabrous and densely pubescent when young, adaxially scabrous and densely hirsute or with trichome scars, base \pm oblique, margin simply or doubly serrate with blunt teeth, apex caudate to cuspidate. Flowers from mixed buds, appearing at same time as leaves. Perianth campanulate, 6-lobed, pubescent. Samara usually scattered near base of branchlets, orbicular to \pm orbicular, 2.5–3.5 \times 2–2.7 cm, densely pubescent, apically concave; stigmas beak-shaped, densely pubescent; stalk 3–4 mm, densely pubescent or with elongate glandular hairs; perianth persistent. Seed at center of samara. Fl. Mar–Apr, fr. Apr–May.

- Mountain ravines; ca. 1200 m. Hebei, Henan, Nei Mongol, Shanxi.

This species is cultivated in Beijing and Liaoning (Xiongyuecheng).

5. *Ulmus changii* W. C. Cheng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 10: 94. 1936.

杭州榆 hang zhou yu

Trees, to 20 m tall, d.b.h. to 90 cm, deciduous. Bark dark gray, grayish brown, or grayish black. Branchlets reddish brown, pubescent when young, unwinged. Winter buds dark reddish brown, ovoid-orbicular to \pm globose, glabrous. Petiole 2–8 mm, pubescent; leaf blade ovate to ovate-elliptic, 3–11 \times 1.7–4.5 cm, abaxially often scabrous and with hairs tufted in forks of secondary veins and sometimes also scattered along major veins, adaxially sparsely appressed villous or scattered hispidulous when young but glabrescent and smooth or \pm scabrous with age, base obliquely rounded to obtuse, margin sharply simply serrate or rarely doubly serrate, apex slenderly acuminate to mucronate; secondary veins 9–20(–24) on each side of midvein. Flowers from floral buds or mixed buds. Perianth campanulate, 4- or 5-lobed, margin ciliate. Samaras tan, \pm orbicular to narrowly elliptic-orbicular, 1.5–3.5 \times 1.3–2.2 cm, pubescent; stalk as long as or slightly shorter than perianth, densely pubescent; perianth persistent. Seed at center or slightly toward base of samara. Fl. Mar–Apr, fr. Mar–Apr.

- Montane forests; 200–1800 m. Anhui, Fujian, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Yunnan, Zhejiang.

- 1a. Flowers in fascicled cymes from floral buds; leaf blade abaxially glabrous or pubescent on veins 5a. var. *changii*
 1b. Flowers from mixed buds, scattered in basal or subbasal bract axil of young branches; leaf blade abaxially with tufted hairs in axils of veins 5b. var. *kunmingensis*

5a. *Ulmus changii* var. *changii*

杭州榆(原变种) hang zhou yu (yuan bian zhong)

Leaf blade abaxially glabrous or pubescent on veins. Flowers from floral buds, fascicled cymes. Fl. Mar–Apr, fr. Mar–Apr.

- 200–800 m. Anhui, Fujian, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Zhejiang.

5b. *Ulmus changii* var. *kunmingensis* (W. C. Cheng) W. C. Cheng & L. K. Fu, Acta Phytotax. Sin. 17(1): 49. 1979.

昆明榆 kun ming yu

Ulmus kunmingensis W. C. Cheng, Sci. Silv. Sin. 8(1): 12. 1963; *U. kunmingensis* var. *qingchengshanensis* T. P. Yi.

Branches of sprout sometimes with swelling and irregularly longitudinally fissured corky layer. Leaf blade abaxially with tufted hairs in axil of veins. Flowers from mixed buds, scattered in basal or subbasal bract axil of young branches. Fl. and fr. same as for autonym variety but slightly earlier in season.

• Montane forests; 600–1800 m. Guangxi, Guizhou, Sichuan, Yunnan.

6. *Ulmus laciniata* (Trautvetter) Mayr, Fremdländ Wald-Park-bäume, 523. 1906.

裂叶榆 lie ye yu

Ulmus montana Withering var. *laciniata* Trautvetter, Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 9: 246. 1859; *U. major* Hohenacker var. *heterophylla* Maximowicz.

Trees, to 27 m tall, d.b.h. to 50 cm, deciduous. Bark dark grayish brown to gray, longitudinally fissured, slightly longitudinally exfoliating in flakes. Branchlets pale brownish gray, grayish brown, or reddish brown, pubescent when young, glabrate or glabrescent, unwinged. Winter buds brown, ovoid-orbicular to elliptic; inner bud scales pubescent. Petiole 2–5 mm, glabrous or pubescent; leaf blade obovate, obtriangular-elliptic, or long obovate-orbicular, 7–18 × 4–14 cm, abaxially pubescent, adaxially hirsute but sparsely so late in season, base oblique, margin ciliate and deeply doubly serrate, apex ± truncate, abruptly caudate-acuminate, and often with 1–3 caudate lobes on each side, or sometimes apex rounded; secondary veins 10–17 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth campanulate, 5-lobed, glabrous or tips of lobes ciliate. Samaras tan or pale green, elliptic to orbicular-elliptic, 1.5–2 × 1–1.4 cm, glabrous except for pubescence on stigmatic surface; stalk shorter than perianth, glabrous; perianth persistent. Seed at center or slightly toward base of samara. Fl. and fr. Apr–May. $2n = 28$.

700–2200 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong [Japan, Korea, Russia (Far East, E Siberia)].

7. *Ulmus bergmanniana* C. K. Schneider, Illustr. Handb. Laubholz. 2: 902. 1912.

兴山榆 xing shan yu

Trees, to 26 m tall, d.b.h. to 90 cm, deciduous. Bark grayish white, dark gray, or grayish brown, longitudinally fissured. Branchlets purplish brown to tan, glabrous or pubescent, unwinged. Winter buds brown, ovoid-orbicular to oblong-ovoid; bud scales glabrous or finely and inconspicuously puberulent, margin entire or inconspicuously short-ciliate. Petiole 1–13 mm, glabrous or pubescent; leaf blade elliptic, long orbicular-elliptic, narrowly elliptic, obovate-oblong, or ovate, 6–18 × 3–8.5 cm, abaxially pubescent in vein axils or over whole blade,

adaxially glabrous and often scabrous, base ± oblique, margin doubly serrate, apex caudate, acuminate-caudate, or cuspidate-caudate; secondary veins (15–)17–26 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Flowers from floral buds. Perianth campanulate, 4–6-lobed, margin ciliate. Samaras tan to light brown, broadly obovate, obovate-orbicular, orbicular, or long orbicular, 1.2–1.8 × 1–1.6 cm, glabrous except for pubescence on stigmatic surface in notch; stalk shorter than perianth, ± pubescent; perianth persistent. Seed at center or slightly toward base of samara. Fl. and fr. Feb–Apr.

• Forests; 1500–2900 m. Anhui, Gansu, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Shanxi, Sichuan, SE Xizang, Yunnan, Zhejiang.

- 1a. Leaf blade abaxially densely hirsute when young, glabrescent with tufted hairs remaining only in axil of veins 7a. var. *bergmanniana*
- 1b. Leaf blade abaxially with dense pubescence of curved or crisped hairs 7b. var. *lasiophylla*

7a. *Ulmus bergmanniana* var. *bergmanniana*

兴山榆(原变种) xing shan yu (yuan bian zhong)

Leaf blade abaxially densely hirsute when young, glabrescent with tufted hairs only remaining in axil of veins. Fl. and fr. Feb–Apr.

• 1500–2600 m. Anhui, Gansu, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang.

7b. *Ulmus bergmanniana* var. *lasiophylla* C. K. Schneider in Sargent, Pl. Wilson. 3: 241. 1916.

蜀榆 shu yu

Ulmus lasiophylla (C. K. Schneider) W. C. Cheng.

Leaf blade abaxially with dense pubescence of curved or crisped hairs. Fl. and fr. Feb–Apr.

• Forests; 2100–2900 m. Gansu, Shaanxi, NW Sichuan, SE Xizang, NW Yunnan.

8. *Ulmus uyematsui* Hayata, Icon. Pl. Formosan. 3. 174. 1913.

阿里山榆 a li shan yu

Trees, to 25 m tall, d.b.h. to 80 cm, deciduous. Bark dark gray, longitudinally fissured, scabrous, exfoliating in irregular flakes. Branchlets brown to dark brown, glabrous or pubescent when young, soon glabrescent, unwinged and without a corky layer, with scattered lenticels. Winter buds dark purplish brown, ovoid; bud scales finely and inconspicuously puberulent, margin entire or inconspicuously short-ciliate. Petiole 2–6 mm, pubescent; leaf blade elliptic to oblong-elliptic, 5–11 × 3–4.5 cm, abaxially densely pubescent with conspicuous tufts in vein axils, adaxially smooth and glabrous or with scattered hairs, base obtuse to obliquely truncate, margin doubly serrate, apex caudate; secondary veins 11–20 on each side of midvein, tufted pubescent in axils. Inflorescences fascicled cymes on second year branchlets. Perianth campanulate, 5- or 6-lobed. Samaras tan, obovate to obovate-orbicular, 1–1.5 × 0.8–1 cm, glabrous

except for pubescence on stigmatic surface in notch; stalk almost as long as or slightly shorter than perianth, pubescent; perianth persistent. Seed at center of samara. Fl. and fr. Feb–Mar.

- Forests in mountains; 800–2500 m. C Taiwan.

9. *Ulmus pumila* Linnaeus, Sp. Pl. 1: 326. 1753.

榆树 yu shu

Ulmus campestris Linnaeus var. *pumila* (Linnaeus) Maximowicz; *U. pumila* var. *microphylla* Persoon; *U. manshurica* Nakai.

Trees, to 25 m tall, d.b.h. to 1 m, deciduous. Bark dark gray, irregularly longitudinally fissured. Branchlets yellowish gray, glabrous or pubescent, unwinged and without a corky layer, with scattered lenticels. Winter buds dark brown to red-brown, ± globose to ovoid; inner bud scale margin usually white ciliate. Petiole 4–10 mm, pubescent; leaf blade elliptic-ovate to elliptic-lanceolate, 2–8 × 1.2–3.5 cm, abaxially pubescent when young but glabrescent or with tufts of hairs in vein axils or sometimes a few hairs on midvein and in forks of secondary veins, adaxially glabrous, base obliquely to symmetrically obtuse to rounded, margin simply or sometimes doubly serrate, apex acute to acuminate; secondary veins 9–16 on each side of midvein. Inflorescences fascicled cymes on second year branchlets, appearing before leaves. Perianth 4-lobed, margin ciliate. Samaras whitish tan, ± orbicular to rarely broadly obovate or elliptical, 1–2 × 1–1.5 cm, glabrous except for pubescence on stigmatic surface; stalk 1–2 mm; perianth persistent. Seed at center of samara or occasionally slightly toward apex but not reaching the apical notch. Fl. and fr. Mar–May. $2n = 28$.

Slopes, valleys, plains; 1000–2500 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang [Korea, Mongolia, E Russia; C Asia].

This species is cultivated throughout China.

10. *Ulmus harbinensis* S. Q. Nie & K. Q. Huang, Bull Bot. Res., Harbin 7(1): 151. 1987.

哈尔滨榆 ha er bin yu

Trees, to 15 m tall, d.b.h. to 32 cm, deciduous. Bark dark gray, irregularly and finely fissured. Branchlets grayish brown in first year, gray and glabrous in second year. Winter floral buds dark brown, cordate-globose, ca. 5 × 4 mm; bud scales lustrous. Leaf buds dark brown, conic, 3–4 × ca. 2.3 mm; bud scales pilose. Petiole pubescent; leaf blade obovate, 2–5.5 × 2–3.5 cm, abaxially with white tufted hairs in veins axils, margin doubly serrate; secondary veins 9–15 on each side of midvein. Inflorescences fascicled cymes, 20–30-flowered. Perianth tubular, 4–6-lobed, margin ciliate. Stamens 4 or 5. Stigmas 2-parted, pinnatifid. Samaras orbicular, broadly obovate, or ± orbicular, narrowly winged, glabrous except for stigmatic surface in notch; stalk ca. 2 mm. Seed at center of samara. Fl. Apr, fr. Jun.

- Mixed woods. Heilongjiang (Harbin).

This poorly understood species should be reinvestigated. It may be a hybrid between *Ulmus pumila* and another species.

11. *Ulmus pseudopropinqua* Wang & Li, Ill. Fl. Lign. Pl. N.-E. China 561. 1955.

假春榆 jia chun yu

Trees, to 10 m tall, deciduous. Branchlets yellowish gray, unwinged, without a corky layer when young, densely or sparsely black lenticellate. Winter buds ± orbicular to ovoid-orbicular; bud scale margin densely white ciliate. Petiole 5–7 mm, pubescent; leaf blade ovate to ± obovate, 2–5.5 × 1–2.5 cm, abaxially pubescent, adaxially densely hirsute or with trichome scars, base oblique, margin doubly serrate, apex acuminate; secondary veins 12–17 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth campanulate, glabrous, 4-lobed. Samara elliptic-oblong, obovate-oblong, or obovate-orbicular, 2–2.5 × 1.5–2 cm, glabrous except for pubescence on stigmatic surface in notch; stalk ca. 2 mm, pubescent; wings ± thick; perianth persistent. Seed at center of samara. Fl. and fr. Apr–Jun.

- Heilongjiang (Harbin).

This poorly understood species should be reinvestigated. It may be of hybrid origin.

12. *Ulmus glaucescens* Franchet, Nouv. Arch. Mus. Hist. Nat., sér. 2, 7: 77. 1884.

旱榆 han yu

Trees or shrubs, to 18 m, deciduous. Bark ± longitudinally fissured. Branchlets glabrous or pubescent, unwinged and without a corky layer; second year branchlets grayish yellow, yellowish gray, or yellowish brown. Winter buds brown, ovoid-orbicular to ± globose; inner scales pubescent or puberulent. Petiole 3–8 mm, pubescent; leaf blade elliptic, rhombic-ovate, narrowly ovate, or elliptic-lanceolate, 2.5–5 × 1–3 cm, both surfaces pubescent or subglabrous and often with tufts of hairs in forkings of secondary veins but never in vein axils, base asymmetrically acute to obliquely truncate, margin obtusely and regularly simply serrate or ± doubly serrate, apex weakly to strongly acuminate; secondary veins 6–12(–14) on each side of midvein. Inflorescences fascicled cymes on second year branchlets, 3–5-flowered. Flowers from mixed buds or floral buds, scattered at base or near base of branchlets. Perianth campanulate, ca. 4-lobed, glabrous or lobe margins ciliate. Samaras tan, elliptic, broadly elliptic, or obovate, 2–2.5 × 1.5–2 cm, glabrous or pubescent; stalk 2–4 mm, pubescent; wings thick; perianth persistent. Seed at center or toward apex of samara. Fl. and fr. Mar–May.

- Along rivers, mountain slopes; 2000–2600 m. Gansu, Hebei, Henan, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi.

- 1a. Samara glabrous except stigmatic surface pubescent in notch 12a. var. *glaucescens*
- 1b. Samara densely pubescent when young, with scattered hairs when mature 12b. var. *lasiocarpa*

12a. *Ulmus glaucescens* var. *glaucescens*

旱榆(原变种) han yu (yuan bian zhong)

Samaras glabrous except stigmatic surface pubescent in notch. Fl. and fr. Mar–May.

• 2000–2400 m. Gansu, Hebei, Henan, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi.

12b. *Ulmus glaucescens* var. *lasiocarpa* Rehder, J. Arnold Arbor. 11: 157. 1930.

毛果旱榆 mao guo han yu

Samaras densely pubescent when young, with scattered hairs when mature. Fl. and fr. Mar–May.

• Along rivers, mountain slopes; 2500–2600 m. Hebei, Henan, Nei Mongol, Ningxia (Helan Shan), E Qinghai, Shanxi.

13. *Ulmus chenmoui* W. C. Cheng, Nanjing Forest. Inst. 1(1): 68. 1958.

琅琊榆 lang ya yu

Trees, to 20 m tall, d.b.h. to 50 cm, deciduous. Bark grayish brown, exfoliating in irregular oblong flakes. Branchlets densely pubescent when young, glabrescent, unwinged and without a corky layer. Winter buds ovoid; bud scales partly pubescent. Petiole 1–1.5 cm, densely villous; leaf blade broadly obovate, oblong-obovate, oblong, or oblong-elliptic, 6–18 × 3–10 cm, scabrous, abaxially densely pubescent, adaxially densely hirsute and pubescent along midvein, base oblique, margin doubly serrate, apex shortly caudate to caudate-acuminate; secondary veins 15–21 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth glabrous, apically 4-lobed. Samara narrowly obovate, oblong-obovate, or broadly obovate, 1.5–2.5 × 1–1.7 cm, pubescent; stalk 1–2 mm; perianth persistent. Seed at center or toward apex of samara. Fl. and fr. Mar–Apr.

• 100–200 m. Anhui (Chuxian), Jiangsu (Jurong).

Species 13 through 19 share many characters in common, and differ in relatively minor characters. There has been much disagreement in the past about species delimitation in this group.

14. *Ulmus davidiana* Planchon in Candolle, Prodr. 17: 158. 1873.

黑榆 hei yu

Trees or shrubs, to 15 m tall, d.b.h. to 30 cm, deciduous. Bark longitudinally fissured. Branchlets pubescent when young, glabrescent or ± pubescent, sometimes with irregularly longitudinally fissured corky layer. Winter buds ovoid; bud scales partly pubescent. Petiole 5–10(–17) mm, pubescent; leaf blade obovate to obovate-elliptic, 4–9(–10) × 1.5–4(–5.5) cm, abaxially densely pubescent when young but glabrescent with tufted hairs only in axil of veins, adaxially sparsely hirsute when young but glabrescent, base oblique, margin doubly serrate, apex caudate-acuminate to acuminate; secondary veins 12–22 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth glabrous, 4-lobed. Samaras tan, obovate to ± obovate, 1–1.9 × 0.7–1.4 cm; stalk pubescent, ca. 2 mm; wings usually glabrous. Seed toward apex and in center of samara.

Slopes, wetlands near streams, valleys; below 2300 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jilin, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi, Zhejiang [Japan, Korea, Mongolia, Russia (Far East, E Siberia)].

1a. Bark pale gray to gray; samara densely pubescent over seed 14a. var. *davidiana*
1b. Bark blackish; samara glabrous 14b. var. *japonica*

14a. *Ulmus davidiana* var. *davidiana*

黑榆(原变种) hei yu (yuan bian zhong)

Ulmus davidiana var. *mandshurica* Skvortsov; *U. davidiana* var. *pubescens* Skvortsov.

Bark pale gray to gray. Samaras densely pubescent over seed. Fl. and fr. Mar–May.

• Hebei, Henan, Liaoning, Shaanxi, Shanxi.

14b. *Ulmus davidiana* var. *japonica* (Rehder) Nakai, Fl. Sylv. Kor. 19: 26. 1932.

春榆 chun yu

Ulmus campestris Linnaeus var. *japonica* Rehder in Bailey, Cycl. Amer. Hort. 4: 1882. 1902; *U. davidiana* var. *levigata* (C. K. Schneider) Nakai; *U. japonica* (Rehder) Sargent; *U. japonica* var. *levigata* C. K. Schneider; *U. propinqua* Koidzumi; *U. wilsoniana* C. K. Schneider.

Bark blackish. Samaras glabrous. Fl. and fr. Feb–May.

Slopes, wetlands near streams, valleys; below 2300 m. Anhui, Gansu, Hebei, Heilongjiang, Henan, Hubei, Jilin, Liaoning, Nei Mongol, Ningxia, E Qinghai, Shaanxi, Shandong, Shanxi, Zhejiang [Japan, Korea, Mongolia, Russia (Far East, E Siberia)].

15. *Ulmus prunifolia* W. C. Cheng & L. K. Fu, Acta Phytotax. Sin. 17(1): 48. 1979.

李叶榆 li ye yu

Trees, to 30 m tall, d.b.h. to 45 cm, deciduous. Bark dark gray, smooth. Branchlets pilose when young, glabrescent, with scattered lenticels; second branchlets gray to brownish gray. Winter buds ovoid, glabrous. Petiole 0.6–1.6 cm, pubescent when young, glabrescent; leaf blade narrowly elliptic, oblong-elliptic, elliptic-lanceolate, or ovate-lanceolate, 5–11(–14) × 2–4(–5.5) cm, abaxially pilose when young but glabrescent with age or pubescent only in vein axils, adaxially pubescent when young but glabrescent, base ± oblique, margin doubly serrate, apex acuminate; secondary veins 12–22 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth glabrous, 4-lobed. Samaras oblong-elliptic to oblong-obovate, 1.2–2 × 0.8–1.3 cm, glabrous except for pubescence on stigmatic surface in notch; stalk 1–2 mm; perianth persistent. Seed at center or slightly toward apex of samara. Fl. and fr. Feb–May.

• 1000–1500 m. Chongqing Zhixiashi, W Hubei.

16. *Ulmus microcarpa* L. K. Fu, Acta Phytotax. Sin. 17(1): 48. 1979.

小果榆 xiao guo yu

Trees, to 30 m tall, d.b.h. to 80 cm, deciduous. Branchlets of first year with very short hairs. Winter buds narrowly ovate; bud scales glabrous. Petiole ca. 5 mm, pubescent to subglabrous; leaf blade oblong-elliptic, elliptic, or rarely oblong-

obovate, 8.5–17 × 5–8 cm, abaxially sparsely pubescent and with tufted hairs in vein axils, adaxially ± scabrous and hirsute when young but glabrescent with trichome scars, base oblique, margin doubly serrate, apex shortly caudate; secondary veins 18–25 on each side of midvein. Perianth campanulate, 4-lobed, glabrous except for margin of tepals. Filament nearly twice as long as perianth. Samara ± orbicular, 7–8 × 7–8 mm, glabrous except for pubescence on stigmatic surface in notch, tip long beak-shaped; perianth persistent. Seed near center of samara. Fl. and fr. Mar–May. $2n = 28^*$.

- Broad-leaved forests; ca. 2800 m. SE Xizang (Zayü).

17. *Ulmus szechuanica* W. P. Fang, Commem. Vol. 22. 1947.

红果榆 hong guo yu

Ulmus erythrocarpa W. C. Cheng.

Trees, to 18 m tall, d.b.h. to 80 cm, deciduous. Bark dark gray, grayish black, or brownish gray, irregularly longitudinally fissured, scabrous. Branchlets pale gray to gray, pubescent when young, sometimes with an irregularly longitudinally fissured corky layer, with pale yellow lenticels. Winter buds ovoid; inner bud scale margin long ciliate. Petiole 5–12 mm, glabrous or pubescent; leaf blade obovate, elliptic-obovate, ovate-oblong, or elliptic-ovate, 2–9 × 1.7–5.5 cm, abaxially sparsely pubescent and densely hairy along main secondary veins when young but glabrescent, adaxially pubescent and villos along midvein when young but glabrescent, base oblique, margin doubly serrate, apex acute to acuminate; secondary veins 9–19 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth campanulate, 4-lobed, glabrous. Samaras tan, ± orbicular to obovate-orbicular, 1.1–1.6 × 0.9–1.3 cm, glabrous except for pubescence on stigmatic surface in notch; stalk shorter than perianth, 1–2 mm, pubescent; perianth persistent. Seed at or near center of samara. Fl. and fr. Feb–Mar.

- Anhui, Jiangu, Jiangxi, C Sichuan, Zhejiang.

18. *Ulmus androssowii* Litvinov var. ***subhirsuta*** (C. K. Schneider) P. H. Huang et al., Bull. Bot. Res., Harbin 11(3): 43. 1991.

毛枝榆 mao zhi yu

Ulmus wilsoniana C. K. Schneider var. *subhirsuta* C. K. Schneider in Sargent, Pl. Wilson. 3: 257. 1916; *U. androssowii* var. *virgata* (Wallich ex Planchon) Grudzinskaja; *U. chunlia* Melville & Heybroek; *U. pumila* var. *pilosa* Rehder; *U. virgata* Wallich ex Planchon.

Trees, to 20 m tall, d.b.h. to 50 cm, deciduous. Bark blackish gray, longitudinally fissured. Branchlets densely pubescent when young but second year ± pubescent, sometimes with an irregularly longitudinally fissured corky layer, with scattered lenticels. Winter buds ovoid; bud scales pubescent. Petiole 2–10 mm, pubescent or glabrous; leaf blade ovate to elliptic to rarely rhombic or obovate, 3–8 × 2–2.5 cm, abaxially sparsely pubescent or glabrous and somewhat pubescent or glabrous on veins and with tufted hairs in vein axils, adaxially ± scabrous, hirsute when young, glabrescent with trichome scars, and puberulous along veins or glabrous, base slightly oblique, apex

usually acuminate. Inflorescences fascicled cymes on second year branchlets. Perianth campanulate, 5-lobed, margin ciliate. Samaras orbicular to ± orbicular, 8–15 × 6–10 mm, glabrous except for pubescence on stigmatic surface in notch; stalk shorter than perianth, pubescent; perianth persistent. Seed at center of samara. Fl. and fr. Feb–Apr.

- Broad-leaved forests on mountain slopes and in valleys; 1200–2800 m. Sichuan, Xizang, Yunnan.

Ulmus androssowii var. *androssowii* occurs in C Asia (not China).

19. *Ulmus castaneifolia* Hemsley, J. Linn. Soc., Bot. 26: 466. 1894.

多脉榆 duo mai yu

Ulmus ferruginea W. C. Cheng; *U. multinervis* W. C. Cheng.

Trees, to 20 m, d.b.h. to 50 cm, deciduous. Bark pale gray to blackish brown, thick, with a corky layer, longitudinally fissured. Branchlets thick, unwinged and usually without a corky layer, with yellow to brownish yellow lenticels; first year branchlets white to reddish brown, densely villous; second year branchlets grayish brown to dark brownish gray, ± pubescent or glabrescent. Winter buds ovoid, usually slightly compressed; bud scales densely pubescent. Petiole 1–12 mm, densely pubescent; leaf blade oblong-elliptic, narrowly elliptic, oblong-ovate, obovate-oblong, or obovate-elliptic, 8–15 × 3.5–6.5 cm, abaxially densely pubescent and with tufted hairs in vein axils, adaxially smooth or ± scabrous, densely hirsute when young, and glabrescent but ± pubescent on main secondary veins with age, base distinctly oblique, margin doubly serrate, apex long acute to cuspidate; main secondary veins depressed; secondary veins 16–35 on each side of midvein. Inflorescences fascicled cymes on second year branchlets. Perianth 4- or 5-lobed, glabrous or margin ciliate. Samaras tan, oblong-obovate, obtriangular-obovate, or obovate, 1.6–3 × 1–1.6 cm, glabrous except for pubescence on stigmatic surface in notch; stalk shorter than perianth, densely pubescent; perianth persistent. Seed toward apex of samara. Fl. and fr. Feb–Apr.

- Broad-leaved forests; 500–1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang.

20. *Ulmus lanceifolia* Roxburgh ex Wallich, Pl. Asiat. Rar. 2: 86. 1831.

常绿榆 chang lü yu

Ulmus tonkinensis Gagnepain.

Trees, to 30 m tall, d.b.h. 40–80 cm, evergreen. Bark yellowish gray to chestnut brown, exfoliating in irregular flakes. Branchlets brown to red-brown, pubescent when young, ± pubescent with age, unwinged and without a corky layer, with scattered lenticels. Winter buds dark brown to red-brown, ovoid-orbicular, pubescent or glabrous. Petiole 2–7 mm, pubescent; leaf blade lanceolate, ovate-lanceolate, or narrowly orbicular-lanceolate, 3–10(–11) × 1.5–3.5 cm, thick, abaxially pea green and pubescent only near petiole or occasionally with a few hairs on midvein, adaxially lustrous green and pubescent only on midvein, base rounded or ± oblique and asymmetric,

margin obtusely regularly simply serrate, apex acuminate; midvein depressed; secondary veins 6–18 on each side of midvein. Inflorescences fascicled cymes, 3–11-flowered. Flowers from floral buds. Perianth glabrous or margin ciliate. Samaras orange-brown, obovate, orbicular-obovate, or ± orbicular, strongly oblique, $1.2\text{--}2.8 \times 1.2\text{--}2.1$ cm, glabrous except for pubescence on stigmatic surface in notch; stalk shorter than perianth, glabrous or pubescent; perianth persistent. Seed at center or toward apex of samara. Fl. and fr. winter or early spring, rarely in autumn. $2n = 28$.

300–1500 m. Guangxi, Hainan, Yunnan [Bhutan, India, Laos, Myanmar, Sikkim, Thailand, Vietnam].

Ulmus lanceifolia has been reported from Nepal (Hara et al., Enum. Fl. Pl. Nepal 3: 205. 1982), but this identity is uncertain.

21. *Ulmus parvifolia* Jacquin, Pl. Hort. Schoenbr. 3: 262. 1798.

榔榆 lang yu

Microptelea parvifolia (Jacquin) Spach; *Planera parvifolia* (Jacquin) Sweet; *Ulmus campestris* Linnaeus var. *chinensis* Loudon; *U. chinensis* Persoon; *U. coreana* Nakai; *U. japonica* Siebold; *U. sieboldii* Daveau; *Ulmus shirasawana* Daveau.

2. HEMIPTELEA Planchon, Compt. Rend. Hebd. Séances Acad. Sci. 74: 131. 1872.

刺榆属 ci yu shu

Shrubs or trees, deciduous. Branchlets often rigid and spinose. Stipules 2, membranous, caducous, leaving a short transverse scar on each side of leaf base. Leaves distichous; leaf blade margin obtusely serrate; venation pinnate; secondary veins extending to margin, each ending in a tooth. Flowers appearing at same time as leaves, solitary or 2–4-clustered in leaf axil of young branches, polygamous, pedicellate. Perianth cupular, 4- or 5-parted. Stamens equal in number to tepals. Ovary laterally compressed, 1-loculed. Nutlet oblique, laterally compressed on both sides; perianth persistent, winged on apical half; wings crestlike. Embryo erect; cotyledons broad.

One species: China, Korea.

1. *Hemiptelea davidii* (Hance) Planchon, Compt. Rend. Hebd. Séances Acad. Sci. 74: 132. 1872.

刺榆 ci yu

Planera davidii Hance, J. Bot. 6: 333. 1868; *Hemiptelea davidiana* Priemer; *Zelkova davidiana* (Priemer) Bean; *Z. davidii* (Hance) Hemsley.

Shrubs or trees, to 10 m tall. Bark dark gray to grayish brown. Branchlets grayish brown to brownish purple, pubescent; spines 2–10 cm. Winter buds ovate, usually 3-clustered in leaf axil. Stipules oblong to lanceolate, 3–4 mm. Petiole 3–5 mm, pubescent; leaf blade elliptic, elliptic-oblong, or rarely

Trees, to 25 m tall, d.b.h. to 100 cm, deciduous. Crown broadly orbicular. Bark gray to grayish brown, ± smooth, exfoliating into irregular scale-like flakes. Branchlets dark brown, densely pubescent when young, never winged. Winter buds reddish brown, ovoid-orbicular, glabrous. Petiole 2–6 mm, pubescent; leaf blade lanceolate-ovate to narrowly elliptic, lamina on two sides of midvein unequal in length and width, $2.5\text{--}5 \times 1\text{--}2$ cm, thick, abaxially pea green and pubescent when young, adaxially dark green, lustrous, and pubescent only on midvein, base oblique, margin obtusely and irregularly simply serrate, apex acute to obtuse; midvein depressed; secondary veins 10–15 on each side of midvein. Inflorescences fascicled cymes, 3–6-flowered. Pedicel very short, pubescent. Perianth funnellform; tepals 4. Samaras tan to brown, occasionally dark red-brown, elliptic to ovate-elliptic, $10\text{--}13 \times 6\text{--}8$ mm, glabrous except for pubescence on stigmatic surface in notch; stalk 1–3 mm, shorter than perianth, sparsely pubescent; perianth persistent or tardily deciduous. Seed at center or toward apex of samara. Fl. and fr. Aug–Oct. $2n = 28$.

Below 800 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Zhejiang [India, Japan, N Korea, Vietnam].

obovate-elliptic, $4\text{--}7 \times 1.5\text{--}3$ cm, base ± cordate to rounded, margin with teeth obtuse, apex acute to obtuse; secondary veins 8–12 on each side of midvein. Fruit asymmetric, yellowish green, ovoid, 5–7 mm, winged only on one side; seed elongate and curved; stalk slender, 2–4 mm. Fl. Apr–May, fr. Sep–Oct. $2n = 56$.

Hill slopes, trail sides, planted around houses; below 2000 m. Anhui, Gansu, N Guangxi, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Zhejiang [Korea].

The hard wood is used for utensils, the bark fiber is used for manufacturing staple rayon and sacks, the tender leaves make a good beverage, and oil is extracted from the seeds.

3. PTEROCELTIS Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 18: 292. 1873.

青檀属 qing tan shu

Trees, deciduous, monoecious. Branchlets never spinose, never corky or winged. Stipules 2, free, linear, caducous, leaving a short transverse scar on each side of leaf base. Leaves often distichous, blade serrate, 3-veined from base; secondary veins branching and often anastomosing before reaching marginal teeth. Male flowers: clustered in proximal leaf axil of one-year-old branchlets. Perianth 5-parted, tepals imbricate. Stamens 5; filaments erect; anthers apically pubescent. Female flowers: solitary in distal leaf axil of one-year-old branchlets. Perianth 4-parted, tepals lanceolate. Ovary laterally compressed. Nut broadly winged, endocarp bony. Endosperm scarce; embryo curved; cotyledons broad.

• One species.

1. *Pteroceltis tatarinowii* Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 18: 293. 1873.

青檀 qing tan

Pteroceltis tatarinowii Maximowicz var. *pubescens* Handel-Mazzetti; *Ulmus cavaleriei* H. Léveillé.

Trees, to 20 m tall, d.b.h. 70–100 cm or more. Bark grayish white to dark gray. Branchlets with distinct lenticels. Winter buds ovoid. Petiole 0.5–1.5 cm, pubescent; leaf blade broadly ovate to oblong, 3–10 × 2–5 cm, base oblique, margin irregularly serrate, apex acuminate; secondary veins 4–6 on each side

of midvein. Nut yellowish green to yellowish brown, ± globose to oblong, 1–1.7 cm in diam., glabrous or pubescent, base truncate or cordate, apex notched; perianth and style persistent; stalk 1–2 cm; wings ± woody. Fl. Mar–May, fr. Aug–Oct.

• Mountainous regions on limestone, river and stream banks; 100–1500 m. Anhui, Fujian, S Gansu, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning (Dalian), SE Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Zhejiang.

This species is grown as an ornamental and for its fine timber, the bark fiber is used in the manufacturing of Xuan Paper, and oil is extracted from the seeds.

4. **ZELKOVA** Spach, Ann. Sci. Nat., Bot., sér. 2, 15: 356. 1841, nom. cons.

榉属 ju shu

Trees, deciduous. Branchlets never spinose, never corky or winged. Stipules 2, free, linear-lanceolate, caducous, leaving a short transverse scar on each side of leaf base. Leaves distichous, margin serrate to crenate; venation pinnate; secondary veins extending to margin, each ending in a tooth. Flowers appearing at same time as leaves, polygamous. Male flowers: clustered in proximal leaf axil of young branchlets. Perianth campanulate, 4–6(or 7)-lobed. Stamens equal in number to perianth lobes; filaments short, erect. Female and bisexual flowers: usually solitary or rarely 2–4-clustered in distal leaf axil of young branchlets. Perianth 4–6-parted, tepals imbricate. Staminodes absent or rarely developed. Ovary sessile; ovule pendulous, slightly amphitropous. Style excentric. Drupes oblique, dorsally keeled; endocarp hard; perianth persistent; stigmas beak-shaped. Seed slightly compressed, apex concave; endosperm absent; embryo curved; cotyledons broad, apically slightly notched to 2-lobed. $2n = 28$.

Five species: E and SW Asia, SE Europe; three species (two endemic) in China.

We are following traditional usage in referring to the fruits as drupes. The exocarp is green but not fleshy, and the fruit resembles the samara of *Hemiptelea* but has no wing.

- 1a. Drupe 5–7 mm in diam., obovoid-globose, surface smooth, apex only slightly oblique 3. *Z. sinica*
 1b. Drupe 2.5–3.5 mm in diam., irregularly and obliquely ovate-conic, surface covered by an irregular network of low ridges, apex strongly oblique.
 2a. Young branchlets brownish purple to brown, glabrous or sparsely pubescent; leaf blade smooth and glabrous or abaxially sparsely pubescent along veins and adaxially sparsely hispid 1. *Z. serrata*
 2b. Young branchlets gray to grayish brown, densely covered with grayish white pubescence; leaf blade abaxially densely pubescent, adaxially strigose 2. *Z. schneideriana*

1. *Zelkova serrata* (Thunberg) Makino, Bot. Mag. (Tokyo) 17: 13. 1903.

榉树 ju shu

Abelicea hirta C. K. Schneider; *Corchorus serrata* Thunberg; *Planera acuminata* Lindley; *P. japonica* Miquel; *Ulmus keaki* Siebold; *Zelkova acuminata* Planchon; *Z. formosana* Hayata; *Z. hirta* C. K. Schneider; *Z. keaki* Maximowicz; *Z. serrata* (Thunberg) Makino var. *tarokoensis* (Hayata) Li; *Z. tarokoensis* Hayata.

Trees, to 30 m tall, d.b.h. to 1 m, deciduous. Bark grayish white to grayish brown, exfoliating. Branchlets brownish purple to brown, pubescent or glabrescent. Winter buds conic-ovoid to ovoid. Stipules brownish purple, lanceolate, 7–9 mm. Petiole 2–6 mm, pubescent; leaf blade elliptic to ovate-lanceolate, 3–10 × 1.5–5 cm, papery to thickly papery, glabrous or abaxially sparsely pubescent along veins, adaxially sparsely hispid, base slightly oblique, rounded, or shallowly cordate, margin serrate to crenate, apex caudate-acuminate; secondary veins 9–15 on each side of midvein. Male flowers: shortly pedicellate, ca. 3 mm in diam. Perianth (5 or 7)(or 8)-parted to middle. Female flowers: subsessile, ca. 1.5 mm in diam. Perianth 4- or 5(or 6)-parted. Ovary pubescent. Drupes pea green, subsessile, 2.5–3.5

mm in diam., surface covered by an irregular network of low ridges. Fl. Apr, fr. Sep–Nov. $2n = 28$.

Valleys, beside streams; 500–2000 m. Anhui, Fujian, Gansu (Qin Ling), N Guangdong, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning (Dalian), Shaanxi (Qin Ling), Shandong, Sichuan, Taiwan, Zhejiang [Japan, Korea, Russia (Kuril Islands)].

The bark and leaves are used medicinally.

2. *Zelkova schneideriana* Handel-Mazzetti, Symb. Sin. 7: 104. 1929

大叶榉树 da ye ju shu

Trees to 35 m tall, d.b.h. to 80 cm. Bark grayish brown to dark gray, exfoliating. Young branchlets gray to grayish brown, densely covered with grayish white pubescence. Winter buds usually united, ovoid to ovate. Stipules linear-lanceolate, to 9 mm. Petiole 3–7 mm, pubescent; leaf blade ovate to elliptic-lanceolate, 3–10 × 1.5–4 cm, thickly papery, abaxially green to reddish purple and densely pubescent, adaxially green to brown and strigose, base slightly oblique, margin serrate to crenate, apex acuminate to acute; secondary veins 8–15 on each side of midvein. Male flowers: solitary or 2- or 3-clustered, shortly pedicellate. Female and bisexual flowers: usually solitary in

distal leaf axil of young branchlets. Drupes pea green, subsessile, 2.5–3.5 mm in diam., surface covered by an irregular network of low ridges. Fl. Apr, fr. Sep–Nov. $2n = 28^*$.

• Beside streams; 200–1100 m (1800–2800 m in Xizang and Yunnan). Anhui, Fujian, S Gansu, Guangdong, Guangxi, Guizhou, S Henan, Hubei, Hunan, Jiangsu, Jiangxi, S Shaanxi, SE Sichuan, SE Xizang, Yunnan, Zhejiang.

The high quality timber is resistant to decay and the bark fiber is used for manufacturing ropes and paper.

3. *Zelkova sinica* C. K. Schneider in Sargent, Pl. Wilson. 3: 286. 1916.

大果榉 *da guo ju*

Trees to 30 m tall, d.b.h. to 60 cm. Bark grayish white,

smooth or exfoliating. Branchlets brown to brownish gray, grayish white pubescent or glabrescent. Winter buds globose to ovoid. Stipules brown, linear-lanceolate, 5–10 mm. Petiole slender, 2–10 mm, gray pubescent; leaf blade ovate to elliptic, (1.5–)3–6(–8) × (1–)1.5–3(–3.5) cm, papery to thickly papery, glabrous except for a few hairs on major veins, base rounded to broadly cuneate, margin crenate, apex acuminate or rarely acute; secondary veins 6–10 on each side of midvein. Male flowers: solitary or 1- or 3-clustered, 2–3 mm in diam. Tepals (5 or)6(or 7), ovate-oblong. Stamens basally white pubescent. Female flowers: solitary. Tepals 5 or 6. Ovary pubescent. Drupes irregularly obovoid-globose, 5–7 mm in diam., smooth; stalk 0–3 mm, pubescent. Fl. Apr, fr. Aug–Sep. $2n = 28^*$.

• Valleys, beside rivers; 800–2500 m. Gansu, Hebei, Henan, NW Hubei, Shaanxi, S Shanxi, N Sichuan.

5. *GIRONNIERA* Gaudichaud-Beaupré, Voy. Bonite, Bot., Atlas, t. 85. 1844.

白颜树属 *bai yan shu shu*

Trees or shrubs, evergreen, dioecious or rarely monoecious. Branchlets never spinose, never corky or winged. Stipules firm, caducous, usually basally connate, enclosing bud, leaving a single transverse scar that completely encircles stem at each node. Leaves alternate, in several ranks; leaf blade margin entire or shallowly serrate; venation pinnate; secondary veins anastomosing before reaching margin. Inflorescences cymes or 1-flowered. Flowers unisexual. Male flowers: tepals 5, imbricate. Stamens 5; filaments short and erect. Ovary rudimentary, hair-shaped. Female flowers: tepals 5. Ovary sessile. Stigmas papillate. Drupes compressed or not; endocarp bony. Seed with endosperm or not; embryo twisted; cotyledons narrow.

About six species: SE Asia, Pacific Islands, Sri Lanka; one species in China.

1. *Gironniera subaequalis* Planchon, Ann. Sci. Nat., Bot., sér. 3, 10: 339. 1848.

白颜树 *bai yan shu*

Gironniera chinensis Benthams; *G. nervosa* Planchon var. *subaequalis* (Planchon) Kurz.

Trees, 10–20(–30) m tall, d.b.h. 25–50(–100) cm, dioecious. Bark gray to dark gray, smooth. Branchlets yellowish green or brown, covered with hirsute hairs. Stipules opposite, lanceolate, 1–2.7 cm, abaxially strigose. Petiole 4–12 mm, strigose; leaf blade elliptic to elliptic-oblong, 10–25 × 4.5–10 cm, leathery, abaxially green, scabridulous, and with appressed hairs on major veins, adaxially pale green and glabrous, base ± symmetric, margin bluntly serrate or subentire, apex shortly

caudate-acuminate; secondary veins 8–12 on each side of midvein. Rachis sparsely strigose. Male inflorescences highly branched. Female inflorescences racemose. Male flowers: ca. 2 mm in diam., tepals and anthers strigose. Infructescences with 1–5 drupes. Drupes subsessile or short-stalked, broadly ovoid to broadly ellipsoid, 4–8 mm in diam., laterally compressed; perianth and style persistent; endocarp reddish orange when mature, with 2 obtuse ribs. Fl. Feb–Apr, fr. most of the year.

Valleys, beside streams; 100–800 m. Guangdong, Guangxi, Hainan, Yunnan [Cambodia, Laos, Malaysia, Myanmar, Thailand, Vietnam].

The wood is used for furniture and other purposes, the bark fiber is used for manufacturing staple rayon, and the leaves are used medicinally.

6. *APHANANTHE* Planchon, Ann. Sci. Nat., Bot., sér. 3, 10: 265, 337. 1848, nom. cons., not Link (1821).

糙叶树属 *cao ye shu shu*

Trees or shrubs, deciduous or semi-evergreen, dioecious or monoecious. Branchlets never spinose, never corky or winged. Stipules 2, free, caducous, leaving a short transverse scar on each side of the leaf base. Leaves alternate, distichous or in several ranks; papery to leathery, margin serrate or entire. Flowers appearing at same time as leaves, unisexual. Male inflorescences cymes. Female inflorescences 1-flowered. Male flowers: perianth 4- or 5-parted, tepals imbricate. Ovary absent or inconspicuous and hair-shaped. Stamens equal in number to tepals; filaments erect or apically incurved; anthers oblong. Female flowers: perianth 4- or 5-parted, tepals narrow and ± imbricate. Drupes ovoid to ± globose; exocarp ± fleshy; endocarp bony. Seed with thin endosperm or not; embryo involute; cotyledons narrow.

About five species: tropical and subtropical areas of E Asia, Madagascar, Mexico, and Pacific Islands; two species in China.

1a. Leaves leathery, pinnately veined; secondary veins anastomosing before reaching margin, margin entire or inconspicuously serrate; drupes 1.3–2 cm including beak, glabrous 1. *A. cuspidata*

- 1b. Leaves papery, 3-veined from base; secondary veins extending to margin, each ending in a tooth, margin sharply serrate; drupes 0.8–1.3 cm including beak, pubescent 2. *A. aspera*

1. *Aphananthe cuspidata* (Blume) Planchon in Candolle, Prodr. 17: 209. 1873

滇糙叶树 dian cao ye shu

Aphananthe lissophylla Gagnepain; *A. yunnanensis* (Hu) Grudzinskaja; *Cyclostemon cuspidatum* Blume; *Galumpita cuspidata* (Blume) Blume; *Gironniera cuspidata* (Blume) Kurz; *G. lucida* Kurz; *G. nitida* Benth; *G. reticulata* Thwaites; *G. yunnanensis* Hu.

Trees, to 15–20(–33) m tall, d.b.h. 50–80(–150) cm. Bark grayish brown, usually smooth. Branchlets slender, sparsely pubescent or glabrous. Stipules lanceolate, 6–10 mm, abaxially pubescent. Petiole 7–12 mm, slender, glabrous; leaf blade narrowly ovate, ovate, or oblong-lanceolate, (5–)10–15 × (2–)3–5(–7) cm, base rounded to broadly cuneate, margin usually entire but occasionally inconspicuously serrate, apex caudate-acuminate; venation pinnate; secondary veins 6–10(–17) on each side of midvein, anastomosing before reaching margin. Male flowers: in pairs or in 3–7 cm cymes, ca. 2 mm in diam. Tepals 5, obovate-oblong. Anthers glabrous. Female flowers: solitary. Perianth 5-lobed; tepals narrowly ovate, ca. 2 mm. Drupes brownish red when mature, ovoid, 1.3–2 × 0.7–1.2 cm, hardly compressed, glabrous; perianth and styles persistent; stalk as long as or slightly longer than drupe. Fl. Mar–Apr or Sep–Nov, fr. Jul–Sep or Nov–Dec.

Slopes on hills; 100–900(–1800) m. S Guangdong, Hainan, S Yunnan [Bhutan, India, Indonesia, Malaysia, Myanmar, Sikkim, Sri Lanka, Thailand, Vietnam].

2. *Aphananthe aspera* (Thunberg) Planchon in Candolle, Prodr. 17: 208. 1873.

糙叶树 cao ye shu

Trees or rarely shrubs, to 25 m tall, d.b.h. to 50 cm, deciduous. Bark brown or grayish brown, scabrous, longitudinally fissured. Branchlets yellowish green when young, brownish red in second year, old ones grayish brown, with distinct rounded lenticels. Stipules linear, 5–8 mm. Petiole 0.5–1.5 cm, puberulous; leaf blade ovate to ovate-elliptic, 5–10 × 3–5 cm, base broadly cuneate to ± cordate, margin serrate, apex acuminate to narrowly acuminate; 3-veined from base; secondary veins 6–10 on each side of midvein, extending to margin, each ending in a

tooth. Male flowers: in proximal leaf axil of young branchlets. Tepals obovate-rounded, ca. 1.5 mm, with clustered hairs at center. Female flowers: solitary in distal leaf axil of young branchlets. Tepals linear-lanceolate, ca. 2 mm. Ovary pubescent. Drupes green or black, ± globose, ellipsoid, or ovoid-globose, 8–13 × 6–9 mm, pubescent; perianth and styles persistent; stalk 5–10 mm, pubescent.

Hills, valleys, streamsides, slopes; 100–1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea, Vietnam].

The wood is fine and strong, the fiber is used for manufacturing ropes and staple rayon, and the leaves are used as feed for horses.

- 1a. Young branchlets, petioles, and leaf blades abaxially sparsely pubescent 2a. var. *aspera*
 1b. Young branchlets and petioles covered with gray pubescence of elongate hairs, leaf blades abaxially densely with erect pubescence 2b. var. *pubescens*

2a. *Aphananthe aspera* var. *aspera*

糙叶树(原变种) cao ye shu (yuan bian zhong)

Prunus aspera Thunberg in Murray, Syst. Veg., ed. 14, 463. 1784; *Homoioceltis aspera* (Thunberg) Blume.

Young branchlets and petioles sparsely pubescent. Leaf blade abaxially sparsely pubescent, adaxially scabrous with bristles. Fl. Mar–May, fr. Aug–Oct.

Valleys, streamsides; 100–600 m in E and N China, 500–1000 m in SE and SC China. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Sichuan, SE Taiwan, Yunnan, Zhejiang [Japan, Korea, Vietnam].

2b. *Aphananthe aspera* var. *pubescens* C. J. Chen, Acta Phytotax. Sin. 17(1): 49. 1979.

柔毛糙叶树 rou mao cao ye shu

Young branchlets and petioles covered with gray pubescence of elongate hairs. Leaf blade abaxially densely covered with erect pubescence.

• Hills, slopes, valleys; 300–1600 m. W Guangxi, Jiangxi, Taiwan, S Yunnan, Zhejiang.

7. **TREMA** Loureiro, Fl. Cochinch. 2: 539, 562. 1790.

山黄麻属 shan huang ma shu

Trees or large shrubs, evergreen. Branchlets never spinose, never corky or winged. Stipules 2, free, caducous, leaving a short transverse scar on each side of leaf base. Leaves alternate in several ranks; leaf blade ovate to narrowly lanceolate, margin denticulate; usually 3(–5)-veined from base (venation pinnate in *T. levigata*); secondary veins anastomosing before reaching margin. Inflorescences subsessile. Flowers unisexual or polygamous, shortly pedicellate. Male flowers: (4 or)5-lobed; tepals incurved, valvate, or ± imbricate. Stamens equal in number to tepals. Ovary rudimentary, basally with perigynous pubescence. Female flowers: (4 or)5-lobed. Ovary sessile, basally with perigynous pubescence. Drupes 1.5–5 mm in diam., erect, elliptic to ± globose; tepals and stigmas persistent or rarely perianth caducous; exocarp ± fleshy, endocarp bony. Endosperm fleshy; embryo curved or involute; cotyledons narrow.

About 15 species: tropical and subtropical areas; six species (two endemic) in China.

ULMACEAE

Trema species are often found in E and SW China, particularly in disturbed and degraded habitats.

- 1a. Leaf blade abaxially glabrous except for appressed hairs on major veins.
 - 2a. Perianth caducous in fruit; leaf blade elliptic-lanceolate to narrowly lanceolate, rarely 3-veined from base 1. *T. levigata*
 - 2b. Perianth persistent in fruit; leaf blade ovate, ovate-oblong, or rarely lanceolate (in *T. cannabina* var. *cannabina*), strongly 3-veined from base 6. *T. cannabina*
- 1b. Leaf blade abaxially pubescent over its whole surface.
 - 3a. Leaf blade 3–7 × 1–2 cm, abaxially densely white-tomentose, with inconspicuous rust-colored glandular hairs on veins, adaxially very scabrous; petiole 2–5 mm; male flower tepals densely hirsute inside 5. *T. angustifolia*
 - 3b. Leaf blade (5–)7–22 × 1.5–9(–11) cm, adaxially ± smooth to ± scabrous, without rust-colored glandular hairs on veins; petiole 4–20 mm; male flower tepals not hirsute inside.
 - 4a. Leaf blade abaxially sparsely pubescent, usually with crowded minute dark red sessile glands; petiole 4–8 mm (in *T. cannabina* var. *dielsiana*) 6. *T. cannabina*
 - 4b. Leaf blade abaxially densely pubescent, not glandular; petiole 7–20 mm.
 - 5a. Leaf blade lanceolate to narrowly lanceolate, 1.5–4.5 cm wide; inflorescences shorter than petiole 4. *T. nitida*
 - 5b. Leaf blade ovate, ovate-oblong, or rarely broadly lanceolate, 3–9(–11) cm wide; inflorescences as long as or longer than petiole.
 - 6a. Plant to 10 m tall; fruit rounded-ovoid, 2–3 mm in diam.; leaf blade ± concolor, abaxially with grayish brown pubescence, surface of blade visible between hairs under magnification, adaxially very scabrous with erect bristles 2. *T. tomentosa*
 - 6b. Plant to 20 m tall; fruit ovoid-globose to ± globose, 3–5 mm in diam.; leaf blade grayish white to grayish green abaxially much paler than adaxially and pubescent, surface completely hidden by hairs, adaxially ± scabrous and usually rugate 3. *T. orientalis*

1. *Trema levigata* Handel-Mazzetti, Symb. Sin. 7: 107. 1929.

羽脉山黄麻 *yu mai shan huang ma*

Trees or shrubs, 4–7(–10) m. Branchlets covered with grayish white silky pubescence of loosely appressed hairs, with distinct ± rounded lenticels; old branchlets grayish brown. Stipules linear-lanceolate to filiform, 4–6 mm. Petiole 4–8 mm, with grayish white silky pubescence, hairs loosely appressed; leaf blade elliptic-lanceolate to narrowly lanceolate, 5–12 × 1.5–3 cm, papery, abaxially green and glabrous except for sparse silky pubescence on veins, adaxially dark green and nearly smooth or ± scabrous, base obtuse-rounded to ± cordate and symmetric or ± oblique, margin denticulate, apex acuminate; rarely 3-veined from base; secondary veins 3–5(–7) on each side of midvein, ± equally conspicuous. Cymes about as long as petiole. Male flowers: ca. 1 mm in diam.; tepals 5, obovate-navicular. Ovary rudimentary, narrowly obovate. Drupes reddish orange, black when mature, ± globose, compressed, 1.5–2.5 mm in diam.; perianth caducous. Fl. Apr–May, fr. Sep–Dec.

• Forests, scrub on sunny mountain slopes; 100–2800 m. Guangxi (Longlin), Guizhou, W Hubei, Sichuan, Yunnan.

The fiber is used to make ropes and staple rayon.

2. *Trema tomentosa* (Roxburgh) H. Hara, Fl. E. Himal., 2nd. Rep. 19. 1971.

山黄麻 *shan huang ma*

Celtis tomentosa Roxburgh, Fl. Ind., ed. 1832, 2: 66. 1832; *C. amboinensis* Willdenow, p.p.; *Sponia amboinensis* (Willdenow) Decaisne, p.p.; *S. tomentosa* (Roxburgh) Planchon; *S. velutina* Planchon; *Trema amboinensis* (Willdenow) Blume, p.p.; *T. dunniana* H. Léveillé; *T. velutina* (Planchon) Blume.

Trees or shrubs, to 10 m tall. Bark grayish brown, smooth or fissured. Branchlets grayish brown to brown, densely grayish

brown to gray pubescent. Stipules linear-lanceolate, 6–9 mm. Petiole 0.7–1.8 cm, pubescent; leaf blade grayish brown to black-brown when dry, 7–15(–20) × 3–7(–8) cm, abaxially with grayish brown pubescence, surface of blade visible between hairs under magnification, adaxially very scabrous with erect bristles, base cordate and oblique, margin denticulate, apex acuminate, caudate-acuminate, or rarely acute; basally 3-veined; secondary veins 4 or 5 on each side of midvein. Male inflorescences 2–4.5 cm. Female inflorescences 1–2 cm. Male flowers: subsessile, 1.5–2 mm in diam. Ovary rudimentary, obovate-oblong, compressed, transparent. Female flowers: shortly pedicellate. Tepals 4 or 5, triangular-ovate, 1–1.5 mm. Ovary glabrous. Drupes brownish purple to blackish purple when mature, compressed, 2–3 mm in diam., irregularly rugate, glabrous; perianth persistent. Seed broadly ovoid, compressed, 1.5–2 mm, ribbed. Fl. Mar–Jun (but year-round in tropical zones), fr. Sep–Nov.

Forests, moist valleys, open slopes; 100–2000 m. S Fujian, Guangdong, Guangxi, Guizhou, Hainan, SW Sichuan, Taiwan, S Xizang, Yunnan [Bangladesh, Bhutan, Cambodia, Japan (Ryukyu Islands), Laos, Malaysia, Myanmar, Nepal, Pakistan, Sikkim, Vietnam; NE Australia, E Africa, Madagascar, Pacific Islands].

The pubescence of the leaves is very variable, and it is often difficult to distinguish *Trema tomentosa* and *T. orientalis*. Some authors have considered *T. tomentosa* to be a synonym of *T. orientalis*.

The wood is fine and strong, tannin is extracted from the bark, the fibers are used for manufacturing paper, ropes, and staple rayon, and the leaves are used as emery cloth.

3. *Trema orientalis* (Linnaeus) Blume, Mus. Bot. 2: 62. 1856.

异色山黄麻 *yi se shan huang ma*

Celtis orientalis Linnaeus, Sp. Pl. 2: 1044. 1753; *C. discolor* Brongniart; *C. rigida* Blume; *Sponia argentea* Planchon; *S. orientalis* (Linnaeus) Decaisne; *S. wightii* Planchon; *Trema polygama* Z. M. Wu & J. Y. Lin.

Trees or shrubs, to 20 m tall, d.b.h. to 80 cm. Bark gray, smooth, irregularly fissured on old branchlets. Branchlets grayish brown, pubescent. Stipules linear-lanceolate, 5–9 mm. Petiole 0.8–2 cm, pubescent; leaf blade 10–18(–22) × 5–9(–11) cm, leathery and fragile, abaxially grayish white to grayish green when dry, pubescent, and surface completely hidden by hairs, adaxially green to grayish green when dry, ± scabrous, and usually rugate, base cordate and oblique, margin denticulate, apex acuminate to acute; basally 3-veined; secondary veins 4–6 on each side of midvein. Male inflorescences 1.8–2.5(–3.5) cm, pubescent. Female inflorescences 1–2.5 cm. Male flowers: 1.5–2 mm in diam.; tepals 5. Ovary rudimentary, obovate-conic, ± compressed. Female flowers: pedicellate; tepals 4 or 5, triangular-ovate, 1–1.5 mm. Drupes black when mature, ± globose to ovoid-globose, ± compressed, 3–5 × 2.5–3.5 mm, rugose; perianth persistent. Seed broadly ovoid, ± compressed, 2–5 mm in diam. Fl. Mar–May(–Jun), fr. Jun–Nov.

Moist forests, dry scrub of open slopes; 400–1900 m. Fujian, Guangdong, W Guangxi, SW Guizhou, Hainan, Sichuan, Taiwan, Xizang, Yunnan [India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Sikkim, Sri Lanka, Thailand, Vietnam; Australia, Pacific Islands].

Trema polygama, described from Yunnan, differs in having the inflorescences shorter than the adjacent petioles.

4. *Trema nitida* C. J. Chen, Acta Phytotax. Sin. 17(1): 49. 1979.

银毛叶山黄麻 yin mao ye shan huang ma

Trees, 5–10 m tall, dioecious or monoecious. Branchlets brownish purple to grayish brown, with appressed grayish white pubescence. Stipules linear, 8–10 mm, pubescent, caducous. Petiole 0.8–2 cm, with adnate pubescence; leaf blade lanceolate to narrowly lanceolate, 7–15 × 1.5–4.5 cm, thinly papery, abaxially completely covered with silver gray to grayish yellow appressed shiny pubescence, adaxially dark green and smooth or ± scabrous, base ± rounded to rarely ± cordate and symmetric or ± oblique, margin denticulate, apex acuminate to acute; basally 3-veined; secondary veins 3–5 on each side of midvein. Cymes shorter than petiole; peduncles with adnate pubescence. Male flowers: ca. 1 mm in diam. Ovary rudimentary, apically sparsely pubescent. Female flowers: shortly pedicellate. Tepals 5, triangular-ovate. Drupes blackish purple when mature, ± globose to broadly ellipsoid, ± compressed, 2–3 mm in diam., glabrous; perianth persistent. Fl. Apr–Jul, fr. Aug–Nov.

• Moist forests on limestone slopes; 600–1800 m. Guangxi, W Guizhou, Sichuan, S Yunnan.

The wood is fine and strong, tannin is extracted from the bark, the fibers are used for manufacturing paper, ropes, and staple rayon, and the leaves are used as emery cloth.

5. *Trema angustifolia* (Planchon) Blume, Mus. Bot. 2: 58. 1856.

狭叶山黄麻 xia ye shan huang ma

Sponia angustifolia Planchon, Ann. Sci. Nat., Bot., sér. 3, 10: 326. 1848; *Celtis angustifolia* Lindley; *S. sampsonii* Hance;

Trema lanceolata Merrill; *T. sampsonii* (Hance) Merrill & Chun.

Shrubs or small trees to 7 m tall, dioecious or monoecious. Branchlets slender, reddish purple, gray when dry, densely hirsute. Stipules filiform, to 3 mm. Petiole 2–5 mm, densely hirsute; leaf blade lanceolate to narrowly lanceolate, 3–7 × 1–2 cm, papery to somewhat leathery, abaxially grayish white when dry, surface completely hidden by tomentose hairs, and with inconspicuous rust-colored glandular hairs on veins, adaxially dark green, very scabrous, and blackening when dry, base rounded to rarely ± cordate, margin denticulate, apex acuminate to caudate-acuminate; basally 3-veined; secondary veins 2–5 on each side of midvein. Flowers unisexual, clustered in cymelets as long as or longer than petiole. Male flowers: subsessile, ca. 1 mm in diam.; tepals 5, narrowly ovate, incurved, inside densely hirsute. Drupes reddish orange when mature, ± compressed, 1.5–2.5 mm, rugate, glabrous; perianth persistent. Fl. Apr–Jun, fr. Aug–Nov.

Forests or scrub on sunny slopes; 100–1600 m. Guangdong, Guangxi, Hainan, S Yunnan [India, Indonesia, Malaysia, Thailand, Vietnam].

The fiber is used for manufacturing paper and textiles and the leaves are used as emery cloth.

6. *Trema cannabina* Loureiro, Fl. Cochinch. 2: 563. 1790.

光叶山黄麻 guang ye shan huang ma

Shrubs or small trees to 6 m tall, monoecious. Bark grayish brown, smooth. Branchlets green, brown, or purplish, variously pubescent or glabrescent. Stipules linear-lanceolate, 2–5 mm. Petiole 4–8 mm, slender, variously pubescent; leaf blade yellow-green to brownish green or brown (never blackish) when dry, ovate, ovate-oblong, or rarely lanceolate, 4–9 × 1.5–4 cm, base rounded to ± cordate or rarely broadly cuneate, margin crenate-serrate, apex acuminate to caudate-acuminate; basally 3-veined; secondary veins 2 or 3 on each side of midvein. Male inflorescences usually in proximal leaf axil of branchlets. Female or androgynous inflorescences usually distal. Male flowers: pedicellate, ca. 1 mm in diam.; tepals 5, obovate. Drupes reddish orange when mature, ± compressed, 2–3 mm in diam.; perianth persistent. Fl. Mar–Jun, fr. Sep–Oct.

Sunny moist forests, scrub on sunny slopes, riversides, open places; 100–1100 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, S Jiangsu, Jiangxi, Sichuan, Taiwan, Yunnan, Zhejiang [Cambodia, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; Australia, Pacific Islands].

The fiber is used for manufacturing ropes and paper and the seed oil is used for soaps and lubricants.

- 1a. Leaf blade ± membranous, abaxially glabrous except for scattered tightly appressed hairs on main veins, adaxially ± smooth to ± scabrous; branchlets with appressed pubescence; cymes as long as or shorter than petiole; anthers without purple variegations 6a. var. *cannabina*
- 1b. Leaf blade thinly papery, abaxially sparsely pubescent, usually with crowded minute dark red sessile glands, adaxially scabrous; branchlets

with spreading pubescence; cymes longer than petiole; tepals inside strigose; anthers with purple variegations 6b. var. *dielsiana*

6a. *Trema cannabina* var. *cannabina*

光叶山黄麻(原变种) *guang ye shan huang ma* (yuan bian zhong)

Celtis amboinensis Willdenow, p.p.; *C. virgata* Roxburgh ex Wallich; *Sponia amboinensis* (Willdenow) Decaisne, p.p.; *Sponia virgata* Planchon; *Trema amboinensis* (Willdenow) Blume, p.p.; *T. timorensis* Blume; *T. virgata* (Roxburgh ex Wallich) Blume.

Branchlets greenish yellow, with appressed pubescence, glabrescent. Petiole with appressed pubescence; leaf blade ± membranous, drying light yellow-green or yellow-brown, abaxially glabrous except for scattered tightly appressed hairs on main veins, adaxially ± smooth to ± scabrous. Cymes as long as or shorter than petiole. Tepals glabrous or sparsely tomentose.

Sunny moist forests, scrub on sunny slopes, riversides, open places; 100–600 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, SE Hunan, S Jiangxi, Sichuan, Taiwan, S Zhejiang [Cambodia, India, In-

donesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Thailand, Vietnam; Australia, Pacific Islands].

6b. *Trema cannabina* var. *dielsiana* (Handel-Mazzetti) C. J. Chen, Acta Phytotax. Sin. 17(1) : 50. 1979.

山油麻 *shan you ma*

Trema dielsiana Handel-Mazzetti, Symb. Sin. 7: 106. 1929; *T. calcicola* S. X. Ren.

Branchlets reddish purple, brown with age, densely hirsute with obliquely spreading hairs. Petiole hirsute with obliquely spreading hairs; leaf blade thinly papery, abaxially sparsely pubescent, surface of blade visible between hairs, usually with crowded minute dark red sessile glands, adaxially green or brown when dry, scabrous. Male cymes longer than petiole. Male flowers: tepals ovate, inner surface strigose. Anthers with purple variegations.

• Scrub on sunny slopes; (100–)600–1100 m. Anhui (Dabie Shan), Fujian, Guangdong, Guangxi, Guizhou, Hubei, Hunan, S Jiangsu, Jiangxi, E Sichuan, Yunnan, Zhejiang.

8. *CELTIS* Linnaeus, Sp. Pl. 2: 1043. 1753.

朴属 *po shu*

Solenostigma Endlicher.

Trees, deciduous or evergreen. Branchlets never spinose, never corky or winged. Winter buds with scales or not. Stipules 2, free, membranous or thickly papery, leaving a short transverse scar on each side of leaf base, caducous or terminal ones persistent and enveloping winter buds. Leaves alternate in several ranks; leaf blade margin entire or serrate; 3-veined from base; secondary veins anastomosing before reaching margin. Inflorescences panicles, racemes, or clustered cymelets. Flowers small, unisexual or bisexual. Tepals 4 or 5, basally slightly connate, caducous. Stamens equal in number to tepals. Style short; stigmas 2, linear. Ovary unilocular; ovule 1, anatropous. Male flowers: cauliflorous or clustered in proximal leaf axil of one-year-old branchlets. Female and bisexual flowers: usually borne apically in polygamous inflorescences. Fruit a drupe; endocarp bony, reticulately foveolate or nearly smooth. Endosperm scanty or lacking; embryo curved; cotyledons broad.

About 60 species: tropical and temperate areas; 11 species (four endemic) in China.

Most species yield fine timber, the bark is utilized for the manufacturing of ropes and paper, and the seed oil of most species is used for soaps and lubricants.

- 1a. Trees, evergreen; flowers in dense cymes; infructescences often branched, each with 3 or 4 drupes and several prominent scars from fallen flowers.
- 2a. Styles apically broadened and 2-cleft or emarginate; drupes globose to ellipsoid, apex and base rounded to obtuse; stipules ovate-lanceolate to ovate, enfolding naked terminal bud; leaf blade base symmetric or weakly asymmetric 1. *C. philippensis*
- 2b. Styles linear, undivided; drupes broadly ovoid, base rounded, apex conic-acute; stipules linear-lanceolate to linear, not enclosing scaly bud; leaf blade base distinctly asymmetric 2. *C. timorensis*
- 1b. Trees or shrubs, deciduous (sometimes evergreen in *C. tetrandra*); flowers solitary, fascicled, or in few-flowered racemes; infructescences simple, rarely forked, with 1(–3) drupes, rarely showing scars from fallen male flowers.
- 3a. Drupe 9–15 mm; leaf blade margin toothed on apical half or almost to base, each margin with 13–28 teeth; petiole adaxially with a narrow and sharply defined furrow.
- 4a. Leaf blade margin deeply lacinate-toothed, teeth 4–8 mm, apex truncate with a caudate tip 6. *C. koraiensis*
- 4b. Leaf blade margin evenly toothed, teeth no more than 2 mm, apex never truncate.
- 5a. Leaf blade margin sharply toothed to near base, teeth 1–2 mm; drupe blackish blue, globose 9. *C. cerasifera*
- 5b. Leaf blade margin finely toothed in apical 1/3–2/3, teeth less than 1 mm; drupe yellow to orange, ellipsoid to globose.
- 6a. Petiole and leaf blade abaxially golden pubescent 4. *C. julianae*
- 6b. Petiole glabrous and leaf blade abaxially with tufts of hairs in vein axils or glabrous 5. *C. vanderhoetiana*

- 3b. Drupe 5–9 mm; leaf blade margin toothed only on apical half or sometimes entire, each margin with 0–16 teeth (to 24 in *C. chekiangensis*); petiole adaxially with a broad and shallow furrow.
- 7a. Bud scales densely strigose; leaf blade with inconspicuous scattered appressed hairs on both surfaces or adaxially glabrous except sometimes for major veins 3. *C. biondii*
- 7b. Bud scales glabrous or inconspicuously puberulent; leaf blade adaxially glabrous except sometimes for major veins.
- 8a. Fruiting pedicel 0.4–1.5 cm, 1–2 × as long as subtending petiole; mature fruit yellow to orange.
- 9a. Drupe 7–8 mm in diam.; leaf blade base oblique, apex acuminate to shortly caudate-acuminate 7. *C. tetrandra*
- 9b. Drupe 5–7 mm in diam.; leaf blade base slightly oblique or not, apex shortly acuminate 8. *C. sinensis*
- 8b. Fruiting pedicel 1–2.5 cm, 1.7–5 × as long as subtending petiole; mature fruit red or purple.
- 10a. Drupe blackish blue; fruit stalks solitary in leaf axils 10. *C. bungeana*
- 10b. Drupe brownish red; fruit stalk often 2 or 3 per leaf axil 11. *C. chekiangensis*

1. *Celtis philippensis* Blanco, Fl. Filip. 197. 1837.

大果油朴 da guo you po

Trees to 30 m tall, evergreen. Bark grayish white to grayish brown or gray. Branchlets brown or tan, glabrous or pubescent. Winter buds naked, without differentiated scales. Stipules ovate-lanceolate to ovate, 2–8 mm, glabrous or pubescent, enfolding naked terminal bud, apex attenuate. Petiole glabrous, 0.5–1.5(–2) cm, adaxial furrow deep and narrow or broad and shallow; leaf blade lanceolate-elliptical, ovate-elliptical, or oblong, 4.5–18 × 2.5–11.5 cm, papery to leathery, glabrous or with a scattering of inconspicuous appressed hairs, base acute, obtuse, or rounded, symmetric or weakly asymmetric, margin entire, apex rounded-obtuse to gradually or abruptly acuminate; secondary veins 1 or 2 on each side of midvein. Cymes 1 or 2 per leaf axil, densely flowered, much branched, each with ca. 5 bisexual flowers and 5 or more male flowers. Styles 2, apically broadened and 2-cleft or emarginate. Infructescences 1–3 per leaf axil, stout, branched or unbranched, with 1–3 drupes and prominent scars from fallen flowers, glabrous, 2.5–5 cm, 3–6 × as long as subtending petiole. Drupe orange to red, 0.8–1.4 cm, globose to ellipsoid, base rounded to obtuse, apex rounded to obtuse. Stone ovoid to ± globose, 6–13 mm, conspicuously to inconspicuously ribbed.

Monsoon rain forests in limestone areas, forests, slopes; near sea level to 1000 m. Guangdong, Hainan, Taiwan, S Yunnan [India, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, Vietnam; Africa, Australia, Pacific Islands].

- 1a. Trees to 30 m tall; leaf blade 8–18 cm, each side with 1 conspicuous lateral vein reaching blade apex; drupe 1–1.5 cm 1a. var. *philippensis*
- 1b. Trees 3–12 m tall; leaf blade 3–10 cm, each side with 2 conspicuous lateral veins and basal lateral vein reaching to 2/3 of blade; drupe 0.8–1.2 cm 1b. var. *wightii*

1a. *Celtis philippensis* var. *philippensis*

大果油朴(原变种) da guo you po (yuan bian zhong)

Trees to 30 m tall, glabrous except for tomentose stipules. Bark grayish white to grayish brown. Branchlets dark gray, with scattered lenticels. Stipules ovate-lanceolate, 4–8 mm. Petiole 0.5–1.5(–2) cm, robust; leaf blade greenish yellow when dry, oblong, 8–18 × 3–7 cm, each side with 1 conspicuous

lateral vein reaching blade apex. Drupe 1–1.5 cm. Stone ovoid, to 1.3 cm, conspicuously 4–6(–8)-ribbed. Fl. Feb–Mar, fr. May–Oct.

Monsoon rain forests in limestone areas; 500–1000 m. Taiwan, S Yunnan [S India, Indonesia, Philippines, Sri Lanka, S Vietnam; Africa, Australia, Pacific Islands].

The seed oil is edible.

1b. *Celtis philippensis* var. *wightii* (Planchon) Soepadmo, Fl. Malesiana, Ser. 1, Spermatoph. 8(2): 62. 1977.

铁灵花 tie ling hua

Celtis wightii Planchon, Ann. Sci. Nat., Bot., sér. 3, 10: 307. 1848; *C. collinsiae* Craib; *C. philippensis* var. *consimilis* (Blume) J.-F. Leroy; *C. wightii* var. *consimilis* (Blume) Gagne-pain; *Solenostigma consimile* Blume.

Trees 3–12 m tall. Bark gray. Young branchlets tomentose, glabrate. Stipules ovate, ca. 3 mm. Petiole 3–6 mm; leaf blade elliptic to oblong, 3–10 × 2–4.5 cm, with 2 conspicuous lateral veins on each side, basal lateral vein reaching to 2/3 of blade. Drupes 0.8–1.2 cm. Stone ± globose, ca. 6 mm, inconspicuously ribbed. Fl. Apr–Jul, fr. Oct–Dec.

Littoral forests, slopes; near sea level. Guangdong, Hainan [India, Indonesia, Malaysia, Thailand, Vietnam; Africa, Australia, Pacific Islands].

2. *Celtis timorensis* Spanoghe, Linnaea 15: 343. 1841.

假玉桂 jia yu gui

Celtis cinnamomea Lindley ex Planchon.

Trees, to 20 m tall, evergreen. Bark grayish white, gray, or grayish brown. Branchlets golden brown pubescent when young, brown and glabrescent with age, with scattered short linear lenticels. Winter buds brown, ca. 2 mm; scales at least inner ones pubescent. Stipules linear-lanceolate to linear, 2–7 mm, not enclosing bud, caducous. Petiole 3–12 mm, pubescent, glabrescent; leaf blade usually golden brown pubescent when young, ovate-elliptic to ovate-oblong, 5–15 × 2.5–7.5 cm, ± coriaceous, base broadly cuneate to ± rounded and distinctly asymmetric, margin entire or weakly serrate above middle and with 15 low rounded teeth on each side, apex acuminate to caudate-acuminate; secondary veins 1 or 2 on each side of midvein. Inflorescence a branched cyme, ca. 10-flowered, golden brown pubescent when young; proximal inflorescences with male flowers, distal inflorescences with male and female

flowers. Styles 2, linear, undivided. Infructescences branched, 2–3.5 cm, pubescent or glabrous, with 3 or 4 drupes and several prominent scars from fallen flowers. Drupe yellow, becoming red to orange-red when mature, broadly ovoid, 7–9 mm, base rounded, apex conic-acute. Stone white, ovoid, ca. 6 mm, reticulately foveolate, conspicuously 4-ribbed.

Roadsides, slopes; near sea level to 200 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Sichuan (Leshan), SW Xizang, Yunnan [Bangladesh, N India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam].

3. *Celtis biondii* Pampanini, Nuovo Giorn. Bot. Ital., n.s., 17: 252. 1910.

紫弹树 *zi dan shu*

Celtis biondii var. *cavaleriei* (H. Léveillé) C. K. Schneider; *C. biondii* var. *heterophylla* (H. Léveillé) C. K. Schneider; *C. biondii* var. *holophylla* (Nakai) E. W. Ma; *C. bungeana* Blume var. *heterophylla* H. Léveillé; *C. cavaleriei* H. Léveillé; *C. chuanchowensis* F. P. Metcalf; *C. emuyaca* F. P. Metcalf var. *cuspidatophylla* (F. P. Metcalf) C. P'ei; *C. guangxiensis* Chun; *C. leveillei* Nakai; *C. leveillei* var. *cuspidatophylla* F. P. Metcalf; *C. leveillei* var. *heterophylla* (H. Léveillé) Nakai; *C. leveillei* var. *hirtifolia* Handel-Mazzetti; *C. leveillei* var. *holophylla* Nakai; *C. rockii* Rehder; *C. trichocarpa* W. C. Cheng & E. W. Ma.

Trees, to 18 m tall, deciduous. Bark gray. Branchlets yellowish brown, brown with age, densely pubescent when young, with scattered lenticels. Winter buds blackish brown, 3–5 mm, densely strigose; scales at least inner ones hispid with appressed parallel hairs. Stipules linear-lanceolate, pubescent, caducous. Petiole 3–6 mm, pubescent when young, adaxially with a broad and shallow furrow; leaf blade broadly ovate, ovate, or ovate-elliptic, 2.5–8 × 2–4 cm, thinly coriaceous, strigose or sericeous early in season, with inconspicuous scattered appressed hairs, often glabrescent except for major veins and abaxial vein axils, base obtuse to ± rounded and slightly oblique, margin shallowly serrate on apical half, teeth (0–)6–11(–14) on each side, apex slenderly acuminate to caudate-acuminate; secondary veins 2(or 3) on each side of midvein. Style branches linear, undivided. Infructescences 1–3 per leaf axil, slender, unbranched, pubescent, 1–2 cm, 2–5 × as long as subtending petiole. Drupe yellow to reddish orange, ± globose, 5–7 mm. Stones slightly compressed, ca. 4 mm in diam., reticulately foveolate, 4-ribbed. Fl. Apr–May, fr. Sep–Oct.

Forests and among shrubs on mountains, limestone areas; near sea level to 2000 m. S Anhui, Fujian, SE Gansu, N Guangdong, Guangxi, Guizhou, S and W Henan, Hubei, Jiangsu, Jiangxi, S Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea].

Celtis guangxiensis differs in having entire leaves and a more or less smooth stone in the drupe.

4. *Celtis julianae* C. K. Schneider in Sargent, Pl. Wilson. 3: 265. 1916.

珊瑚朴 *shan hu po*

Celtis julianae C. K. Schneider var. *calvescens* C. K. Schneider.

Trees, to 30 m tall, deciduous. Bark gray. Branchlets dark brown, densely brownish yellow pubescent, rarely glabrous. Winter buds brown, 1–4 mm; scales at least inner ones brownish red hispid with appressed, parallel hairs. Petiole 0.7–1.5 cm, robust, densely golden pubescent, adaxially with a deep and narrow furrow; leaf blade broadly ovate to narrowly ovate-elliptic, 6–13 × 3.5–8 cm, thickly papery, abaxially densely golden pubescent or rarely so only on veins, adaxially smooth or scabrous, base ± rounded and slightly oblique, margin finely toothed above middle to rarely subentire, teeth 13–23 on each side and less than 1 mm, apex shortly acuminate to caudate-acuminate; secondary veins 4–6 on each side of midvein. Flowers densely fascicled. Style branches linear, undivided. Infructescence solitary, stout, unbranched, densely brownish yellow pubescent, rarely glabrous, 1–3 cm, 1.5–2.5 × as long as subtending petiole. Drupe 1 per infructescence, golden to orange-yellow, ellipsoid to ± globose, 1.1–1.4 cm. Stone milky white, obovate to broadly obovate, compressed slightly on both sides, 7–9 mm, reticulately foveolate, base acute to slightly obtuse, 2-ribbed on apical half. Fl. Mar–Apr, fr. Sep–Oct.

• Forests, valleys, slopes; 300–1300 m. S Anhui, Fujian, N Guangdong, Guizhou, S and W Henan, W Hubei, NW Hunan, Jiangxi, S Shaanxi, N Sichuan, Yunnan, Zhejiang.

Plants with glabrous twigs and infructescences have been called var. *calvescens*. They do not seem to differ from the species in any other way.

5. *Celtis vandervoetiana* C. K. Schneider in Sargent, Pl. Wilson. 3: 267. 1916.

西川朴 *xi chuan po*

Celtis pruniputaminea E. W. Ma.

Trees, to 20 m tall, deciduous. Bark gray to brownish gray. Branchlets brown, glabrous, with scattered elliptic lenticels. Winter buds 1–5 mm, glabrous or brown hirsute. Petiole 0.9–1.5(–2) cm, robust, brown, glabrous, adaxially with a deep and narrow furrow; leaf blade ovate-elliptic to ovate-oblong, 8–14 × 3.5–7.5 cm, thickly papery, glabrous or abaxially with tufts of hairs in vein axils, base ± rounded and slightly oblique, margin finely toothed on apical 1/3–2/3, teeth 20–27 on each side, apex acuminate to shortly caudate-acuminate; secondary veins (2 or)3 or 4 on each side of midvein. Infructescence solitary, unbranched, robust, glabrous, 1.7–3.5 cm, 2.5–3 × as long as subtending petiole. Drupe 1 per infructescence, yellow to orange, ellipsoid to globose, 0.9–1.5 cm. Stone milky white to yellow, ± globose to broadly ellipsoid, 8–9 mm in diam., reticulately foveolate, 4-ribbed. Fl. Apr, fr. Sep–Oct.

• Forests, valleys, usually in shaded places; 600–1400 m. Fujian, N and W Guangdong, Guangxi, Guizhou, Hubei, NW Hunan, S Jiangxi, Sichuan, E Yunnan, E Zhejiang.

6. *Celtis koraiensis* Nakai, Bot. Mag. (Tokyo) 23: 191. 1909.

大叶朴 *da ye po*

Celtis aurantiaca Nakai; *C. koraiensis* var. *aurantiaca* (Nakai) Kitagawa.

Trees, to 15 m tall, deciduous. Bark gray. Branchlets brown, glabrous or with a few hairs near nodes, with scattered small elliptic lenticels. Winter buds brown, 2–4 mm; inner scales brown pubescent. Petiole brown, 0.5–1.5 cm, adaxially with a narrow and sharply defined furrow, glabrous or sparsely pubescent; leaf blade elliptic, obovate-elliptic, or rarely broadly obovate, 7–12 × 3.5–10 cm, papery, glabrous or abaxially sparsely pubescent but sometimes only on veins and vein axils, base broadly cuneate, ± rounded, or ± cordate and slightly oblique, margin deeply lacinate-toothed, teeth 15–24 on each side and 4–8 mm, apex truncate with a caudate tip; secondary veins 3 or 4 on each side of midvein. Flowers solitary or fascicled. Style branches linear, undivided. Infructescence stout, solitary, glabrous or sparsely pubescent, 1.5–2.5 cm, 2–2.5 × as long as subtending petiole. Drupe 1 per infructescence, orangish yellow, dark brown when mature, ± globose to ellipsoid, 1–1.3 cm, basally and apically obtuse. Stone grayish brown, ovoid-elliptic, ca. 8 mm in diam., reticulately foveolate, 4-ribbed. Fl. Apr–May, fr. Sep–Oct.

Forests, valleys, slopes; 100–1500 m. N Anhui, E Gansu, Hebei, W Henan, Jiangsu, S Liaoning, S Shaanxi, Shandong, S Shanxi [Korea].

7. *Celtis tetrandra* Roxburgh, Fl. Ind., ed. 1832, 2: 63. 1832.

四蕊朴 si rui po

Celtis fengqingensis Hu ex E. W. Ma; *C. formosana* Hayata; *C. kunningensis* W. C. Cheng & T. Hong; *C. salvatiana* C. K. Schneider; *C. xizangensis* E. W. Ma; *C. yunnanensis* C. K. Schneider.

Trees, to 30 m tall, deciduous or sometimes evergreen. Bark grayish white. Branchlets densely yellowish brown pubescent when young, brown, usually glabrescent with age; lenticels few or none. Winter buds brown, 1–3 mm; scales glabrous, margin ciliate. Stipules narrowly lanceolate, caducous, to 7 mm, never enclosing buds. Petiole 6–13 mm, brown, broadly sulcate, puberulous at least near adaxial furrow; leaf blade ovate-elliptic, ovate-lanceolate, or ± rhombic, 5–13 × 2.5–5.5 cm, thickly papery to ± papery, abaxially usually inconspicuously yellowish brown puberulent when young, with hairs scattered on major veins and sometimes tufted in vein axils with age, base oblique with one side ± rounded and other cuneate, margin entire or obtusely serrate, teeth 0–13 on each side, apex acuminate to shortly caudate-acuminate; secondary veins 3 or 4 on each side of midvein. Flowers fascicled, occasionally in racemes of 2 or 3 flowers. Style branches linear, undivided. Infructescences unbranched or seldom forked, rarely showing a small scar from a fallen male flower, 1–3 per leaf axil, rather slender, glabrous or pubescent, 0.8–1.5 cm; fruiting pedicel 1 or 2 × as long as subtending petiole. Drupe yellow to orange when mature, ± globose, 7–8 mm in diam. Stone ± globose, ca. 5 mm in diam., 4-ribbed. Fl. Mar–Apr, fr. Sep–Oct.

Mesophytic mixed forests, valleys, slopes; 700–1500 m. W Guangxi, Hainan, Taiwan, Sichuan (Xichang), S Xizang, C, E, and S Yunnan [Bhutan, Bangladesh, India, Indonesia, Myanmar, Nepal, Thailand, Vietnam].

8. *Celtis sinensis* Persoon, Syn. Pl. 1: 292. 1805.

朴树 po shu

Celtis bodinieri H. Léveillé; *C. bungeana* var. *pubipedicella* G. H. Wang; *C. cercidifolia* C. K. Schneider; *C. hunanensis* Handel-Mazzetti; *C. labilis* C. K. Schneider; *C. nervosa* Hemsley; *C. tetrandra* Roxburgh subsp. *sinensis* (Persoon) Y. C. Tang.

Trees, to 20 m tall, deciduous. Bark gray. Branchlets brown, brown pubescent, sometimes glabrescent late in season. Winter buds dark brown, 1–3 mm, glabrous or inconspicuously puberulent. Stipules linear to lanceolate, 3–5 mm, pubescent, fugacious. Petiole brown, 3–10 mm, pubescent, adaxially with a broad and shallow furrow; leaf blade ovate to ovate-elliptic, 3–10 × 3.5–6 cm, thickly papery, abaxially usually inconspicuously yellowish brown puberulent when young, abaxially with hairs scattered on major veins and sometimes tufted in vein axils with age, base rounded, obtuse, or obliquely truncate, ± symmetric to moderately oblique, margin subtire to crenate on apical half, teeth 0–16 on each side, apex acute to shortly acuminate; secondary veins 3 or 4 on each side of midvein. Flowers fascicled in leaf axils and stem bases. Style branches linear, undivided. Infructescences unbranched, 1(–3) per leaf axil, rather stout, pubescent at least proximally, 4–10 mm; fruiting pedicel 1–1.5 × as long as subtending petiole. Drupe ± globose, 5–7(–8) mm in diam. Stone white, ± globose, reticulately foveolate, ribbed. Fl. Mar–Apr, fr. Sep–Oct.

Roadsides, slopes; 100–1500 m. Anhui, Fujian, Gansu, Guangdong, Guizhou, Henan, Jiangsu, Jiangxi, NE Shandong, Sichuan, Taiwan, Zhejiang [Japan].

9. *Celtis cerasifera* C. K. Schneider in Sargent, Pl. Wilson. 3: 271. 1916.

小果朴 xiao guo po

Celtis taiyuanensis E. W. Ma.

Trees, to 35 m tall, deciduous. Bark grayish brown. Branchlets green, glabrous, brown with age, with scattered lenticels. Winter buds brown to dark brown, 2–3 mm, glabrous; buds on two-year-old branchlets ca. 6 mm, apex acute. Petiole 5–10(–17) mm, adaxially with a narrow and sharply defined furrow, glabrous or furrow sparsely pubescent; leaf blade ovate to ovate-elliptic, 5–15 × 2.5–7.5 cm, papery, glabrous or with hairs scattered along major veins and tufted in abaxial vein axils, base ± rounded and slightly to strongly oblique, margin sharply and evenly toothed almost to base, teeth 15–28 on each side and 1–2 mm, apex long acuminate to shortly caudate-acuminate; secondary veins 3 or 4 on each side of midvein. Infructescences solitary, unbranched, 2–4.5 mm, rather stout, glabrous or sparsely pubescent at base, ca. 4 × as long as subtending petiole. Drupes 1(–3) per infructescence, blackish blue when mature, globose, 1–1.3 cm in diam. Stone ± globose, ca. 9 mm in diam., shallowly foveolate-reticulate, 4-ribbed. Fl. Apr, fr. Sep–Oct.

• Forests, among shrubs, slopes, valleys; 800–2400 m. Guangxi, Guizhou, N Hunan, S Shaanxi, Sichuan, SE Xizang, Yunnan, Zhejiang.

10. *Celtis bungeana* Blume, Mus. Bot. 2: 71. 1856.

黑弹树 hei dan shu

Celtis amphibola C. K. Schneider; *C. bungeana* var. *deqinensis* X. W. Li & G. S. Fan; *C. bungeana* var. *lanceolata* E. W. Ma; *C. chinensis* Bunge (1833), not Persoon (1805); *C. davidiana* Carrière; *C. gongshanensis* X. W. Li & G. S. Fan; *C. mairei* H. Léveillé; *C. yangquanensis* E. W. Ma.

Trees, to 10 m tall, deciduous. Bark gray. Branchlets brown, glabrous, with scattered elliptic lenticels, grayish brown on following year. Winter buds brown, 1–3 mm, glabrous. Petiole 0.5–1.5 cm, pale yellow or brown, sometimes pubescent when young, adaxial furrow broad; leaf blade narrowly ovate, oblong, or ovate, 3–7(–15) × 2–4(–5) cm, thickly papery, glabrous except for tufts of hairs abaxially in axils of main veins and occasional hairs scattered on veins, base broadly cuneate to ± rounded and slightly oblique or not, margin irregularly shallowly serrate on apical half, sometimes entire, teeth 0–10(–15) on each side, apex acute to acuminate; secondary veins 2 or 3 on each side of midvein. Style branches linear, undivided. Infructescence solitary, slender, glabrous, 1–2.5 cm; fruiting pedicel 1.7–4 × as long as subtending petiole. Drupe 1 or 2 per infructescence, blackish blue when mature, ± globose, 6–8 mm in diam. Stone ± globose, 4–5 mm in diam., nearly smooth, inconspicuously ribbed. Fl. Apr–May, fr. Oct–Nov.

Forests, among shrubs, roadsides, mountain slopes; 100–2300 m. Anhui, Gansu, Hebei, Henan, Hubei, Jiangsu, Jiangxi, Liaoning, Nei

Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, E Xizang, Yunnan, Zhejiang [Korea].

Celtis bungeana var. *deqinensis*, described from Yunnan, differs chiefly in having a thicker leaf blade.

11. *Celtis chekiangensis* W. C. Cheng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 9: 245. 1934.

天目朴树 tian mu po shu

Trees, to 20 m tall, deciduous. Bark white or grayish brown. Branchlets glabrous or densely grayish brown pubescent in first year, brown and with lenticels with age. Winter buds small; scales glabrous or puberulous. Stipules lanceolate, 3–5 mm, pubescent, caducous. Petiole 3–4 mm, pubescent, broadly sulcate; leaf blade ovate-elliptic to ovate-oblong, 3–11.5 × 2.5–4.5 cm, abaxially sparsely pubescent on veins, adaxially glabrous, base obtuse to ± rounded and slightly oblique, margin shallowly serrate on apical half, teeth 8–24 on each side, apex long acuminate; secondary veins 3 on each side of midvein. Flowers fascicled. Style branches linear, undivided. Infructescence 1(–3) per leaf axil, slender, unbranched, pubescent at least proximally, 1–2 cm; fruiting pedicel 3–5 × as long as subtending petiole. Drupe red when mature, ± globose, 5–7 mm. Stone ± globose, 4–5 mm, reticulately foveolate, conspicuously ribbed on both sides. Fl. Apr, fr. Aug–Sep.

• Rocks in forests; (700–)1100–1500 m. Anhui, Zhejiang (Tianmu Shan).

ULMACEAE