

2. FRAXINUS Linnaeus, Sp. Pl. 2: 1057. 1753.

□ 属 qin shu

Wei Zhi¹; Peter S. Green

Trees or rarely shrubs, deciduous or rarely evergreen. Leaves odd-pinnate, opposite or rarely whorled at branch apices; petiole and petiolule often basally thickened. Inflorescences terminal or axillary toward end of branches, or lateral on branches of previous year, paniculate; bracts linear to lanceolate, caducous or absent. Flowers small, unisexual, bisexual, or polygamous. Calyx 4-toothed or irregularly lobed, sometimes absent. Corolla white to yellowish, 4-lobed, divided to base or absent. Stamens 2, inserted at base of corolla lobes; filaments short, exerted at anthesis. Ovules 2 in each locule, pendulous. Style short; stigma ± 2-cleft. Fruit a samara with apically elongated wing. Seeds usually 1, ovate-oblong; endosperm fleshy; radicle erect.

About 60 species: mostly in temperate regions and subtropics of the Northern Hemisphere; 22 species in China.

Some species are widely used in China for commercial timber and the bark for medicinal drugs.

- 1a. Panicles from lateral leafless buds of previous year; flowers appear before leaves.
 - 2a. Leaflet blade 1.7–5(–5.5) × 0.5–1.5 cm; panicles congested, 0.5–1.5 cm.
 - 3a. Leaflets crenate distally, entire proximally; 4 primary veins on each side of midrib 11. *F. xanthoxyloides*
 - 3b. Leaflets sharply serrate; 6 or 7 primary veins on each side of midrib 12. *F. hupehensis*
 - 2b. Leaflet blade (2.5–)5–14(–20) × (1–)2–5 cm; panicles lax, 5–20 cm.
 - 4a. Flowers with calyx; samara not twisted 13. *F. platypoda*
 - 4b. Flowers without calyx; samara conspicuously twisted.
 - 5a. Branchlets nearly 4-angled; leaves opposite; leaflets subsessile; inflorescences 15–20 cm, spreading 14. *F. manschurica*
 - 5b. Branchlets terete; leaves in whorls of 3 at top of branches; leaflets petiolulate; inflorescences ca. 5 cm 15. *F. sogdiana*
- 1b. Panicles terminal or from lateral buds of this year; flowers appearing with or after leaves.
 - 6a. Flowers without corolla.
 - 7a. Leaflets broadly ovate, ovate, to lanceolate, 2–7 cm wide 9. *F. chinensis*
 - 7b. Leaflets narrowly lanceolate, 1–1.8(–2.2) cm wide 10. *F. baroniana*
 - 6b. Flowers with corolla.
 - 8a. Bracts persistent; winter buds naked.
 - 9a. Leaflets 3(–5), serrate to crenate; calyx teeth deltate.
 - 10a. Leaflets regularly serrate, abaxially tomentose 5. *F. trifoliolata*
 - 10b. Leaflets remotely crenate, abaxially glabrous 6. *F. punctata*
 - 9b. Leaflets 5 or more, entire; calyx lobes truncate or broadly deltate.
 - 11a. Leaflets 5–7(–11), petiole 5–10 mm, usually glabrous on both surfaces 2. *F. griffithii*
 - 11b. Leaflets 9–25, petiole 0–5 mm, midrib at least abaxially hairy.
 - 12a. Leaf rachis rusty tomentose; leaflets scurfy hairy or glabrescent 1. *F. ferruginea*
 - 12b. Leaf rachis and adaxial surface of leaflets densely brown tomentose, leaflets sometimes glabrescent.
 - 13a. Leaflets 9–15, densely tomentose adaxially 3. *F. malacophylla*
 - 13b. Leaflets (11–)15–25, tomentose or glabrescent 4. *F. retusifoliolata*
 - 8b. Bracts caducous or absent; winter buds scaly or tomentose.
 - 14a. Petiolules 5–15 mm.
 - 15a. Leaflets 2–5 cm, margin deeply serrate to incised 15. *F. bungeana*
 - 15b. Leaflets 8–15 cm, margin serrate or serrulate.
 - 16a. Leaflets 7 or 9, abaxially hairy; samara densely red scurfy hairy 10. *F. floribunda*
 - 16b. Leaflets 3–5(–7), glabrous; samara not as above 11. *F. insularis*
 - 14b. Petiolules 0–5 mm.
 - 17a. Leaflets 7 or 9.

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- 18a. Leaflets lanceolate, abaxially densely felty; leaf axis subterete 7. *F. sikkimensis*
 18b. Leaflets ovate-oblong, glabrous or villous on veins abaxially; leaf axis
 grooved 9. *F. paxiana*
 17b. Leaflets 3–5(–7).
 19a. Leaflets 2–5 cm, broadly ovate, rhomboid to ovate or broadly lanceolate
 to broadly
 elliptic, with 4–6 primary veins on each side of midrib, margin deeply serrate
 to incised 15. *F. bungeana*
 19b. Leaflets 3–12 cm, elliptic, lanceolate, or ovate-lanceolate to broadly
 lanceolate,
 with 6–12 veins on each side of midrib, margin coarsely serrate, serrate, or
 entire.
 20a. Young shoots puberulent; petiolules pubescent or sparsely crisped hairy.
 21a. Petiolules 8–15 mm, sparsely crisped hairy; leaflets with 10–12
 primary
 veins on each side of midrib, margin irregularly and coarsely serrate 8. *F. depauperata*
 21b. Petiolules 0–5 mm, pubescent; leaflets with 7–10 primary veins on
 each
 side of midrib, margin entire or serrulate in upper part 14. *F. sieboldiana*
 20b. Young shoots glabrous; petiolules glabrous.
 22a. Leaflet margin serrate, blade sparsely dotted abaxially 12. *F. odontocalyx*
 22b. Leaflet margin serrulate, blade not dotted abaxially 13. *F. stylosa*

1. Fraxinus ferruginea Lingelsheim, Bot. Jahrb. Syst. 40: 212. 1907.

锈毛 □ xiu mao qin

Trees to 15 m. Branchlets nearly 4-angled, rusty tomentose at first, glabrescent; buds naked. Leaves 10–20(–25) cm; petiole 3–5 cm; leaf rachis and petiolule rusty tomentose; leaflets 9–11(–15); petiolule 2–5 mm; leaflet blade ovate-lanceolate to obliquely oblong, 3–6 × 1–2.5 cm, thin leathery, sparsely scurfy hairy or glabrescent, base attenuate to petiolule or broadly cuneate, margin entire to subentire, apex acuminate to obtuse; primary veins 6–9 on each side of midrib, often villous abaxially. Panicles terminal, to 20 cm in diam., many flowered, congested; bracts lanceolate-linear, 2–6 mm, ± glabrous, persistent. Flowers polygamous, appearing after leaves. Pedicel ca. 3 mm. Calyx cupular, ca. 1.5 mm, apically truncate, puberulent. Corolla white, ca. 3 mm. Stamens subequal to corolla lobes. Samara linear-spatulate, ca. 3.2 cm × 4–5 mm, densely scurfy hairy; wing decurrent to middle of nutlet. Fl. Jun–Jul, fr. Jun–Aug.

Secondary mixed woods on slopes; 1300–1800 m. S Guizhou, Xizang (Chayu Xian), Yunnan [Myanmar].

2. Fraxinus griffithii C. B. Clarke in J. D. Hooker, Fl. Brit. India 3: 605. 1882.

光蜡树 guang la shu

Fraxinus bracteata Hemsley; *F. formosana* Hayata; *F. guilingensis* S. Lee & F. N. Wei; *Ligustrum vaniotii* H. Léveillé.

Trees 10–20 m, nearly evergreen. Branchlets pubescent, glabrescent; buds naked. Leaves 10–25 cm; petiole 3–8 cm; axis glabrous or puberulent; leaflets 5–7(–11); petiolule 5–10 mm; leaflet blade ovate to lanceolate, 2–10(–14) × 1–5 cm (basal pair usually smaller), leathery or thin leathery, adaxially glabrous, abaxially glandular dotted, base blunt to rounded, attenuate to petiolule, or oblique, margin entire, apex obliquely cuspidate to acuminate; primary veins 5 or 6(–10) on each side of midrib, obscure or rarely obvious. Panicles terminal, 10–25 cm, spreading, many flowered; bracts spatulate-linear, 3–10 mm, leafy, puberulent at first. Flowers bisexual, appearing after leaves. Pedicel slender, 2–4 mm. Calyx cupular, ca. 1 mm, puberulent or glabrous, subentire to broadly deltate toothed. Corolla white; lobes navicular, ca. 2 mm. Stamens ca. equal to corolla lobes. Samara broadly lanceolate-spatulate, 2.5–3 cm × 4–5 mm; wing decurrent to about middle of nutlet. Fl. May–Jul, fr. Jul–Nov. *2n* = 46.

Dry slopes, forest margins, near villages, by rivers; 100–2000 m. Fujian, Guangdong, Guangxi, Hainan, Hubei, Hunan, Taiwan [Bangladesh, India, Indonesia, Japan (Ryukyu Islands), Myanmar, Philippines, Vietnam].

3. Fraxinus malacophylla Hemsley, Hooker's Icon. Pl. 26: t. 2598. 1899.

白枪杆 bai qiang gan

Fraxinus retusifoliolata Feng ex P. Y. Bai.

Trees to ca. 10 m. Branchlets ridged, 4-angled when young, brown tomentose; buds naked. Leaves to ca. 25 cm; petiole 2–5 cm; axis densely brown tomentose; leaflets 9–15, sessile or subsessile; leaflet blade elliptic to lanceolate-

elliptic, (1.5–)3–8(–10) × (1–)1.5–4 cm, thin leathery, adaxially densely brown tomentose to glabrescent, abaxially densely pale villous to yellow tomentose, especially denser along veins and margin, base cuneate to broadly cuneate, rarely rounded, oblique, margin entire, apex acute or obtuse to retuse; primary veins 7–10 on each side of midrib. Panicles terminal or lateral, ca. 16 cm, many flowered; bracts linear, 2–3 mm. Flowers bisexual, appearing after leaves. Pedicel ca. 3 mm. Calyx cupular, ca. 1 mm, apically truncate or with broadly deltate teeth. Corolla white; lobes linear, ca. 3 mm. Stamens scarcely exceeding corolla lobes. Samara narrowly spatulate, 3–4 cm × 6–7 mm; wing decurrent to about middle of nutlet. Fl. Jun, fr. Sep–Oct.

Secondary forests and dry rocky slopes in calcareous montane regions; 500–1900 m. Guangxi, Yunnan [Thailand].

4. *Fraxinus retusifoliolata* Feng ex P. Y. Bai, *Acta Bot. Yunnan.* 5: 177. 1983.

楷叶□ kai ye qin

Trees to ca. 7 m. Branchlets ridged, 4-angled when young, brown tomentose; buds naked. Leaves 9–16 cm; petiole 2–3 cm; axis brown tomentose; leaflets (11–)15–25, subsessile; leaflet blade elliptic to oblong, (1.5–)2.5–4.5 × 1–2 cm, thin leathery, adaxially glabrescent, abaxially yellowish tomentose along veins, base cuneate to broadly cuneate, rarely rounded, oblique, margin entire, apex acute or retuse; primary veins 6–8 on each side of midrib. Panicles terminal or lateral, 5–9 cm, many flowered; bracts subspatulate, 5–7 mm. Flowers bisexual, appearing after leaves. Pedicel ca. 2 mm. Calyx cupular, ca. 1 mm, apically truncate or with broadly deltate teeth. Corolla white; lobes linear, ca. 3 mm. Samara narrowly spatulate, 2–2.5 cm × 4–5 mm; wing decurrent to about middle of nutlet. Fl. Jun, fr. Sep–Nov.

* Dry rocky slopes; ca. 2000 m. Yunnan.

The bark is used for the treatment of malaria.

Further work may show that *Fraxinus retusifoliolata* is not specifically distinct from *F. malacophylla*.

5. *Fraxinus trifoliolata* W. W. Smith, *Notes Roy. Bot. Gard. Edinburgh* 9: 106. 1916.

三叶□ san ye qin

Fraxinus punctata S. Y. Hu.

Shrubs or small trees to 8 m, erect. Branches subterete or slightly compressed, glabrous; buds naked or scurfy hairy. Leaves 15–18 cm; petiole 5–6 cm, hirsute or glabrous; axis angled; leaflets 3(–7), terminal 1 larger, with petiolule 1.5–3 cm; leaflet blade ovate to elliptic, 8–12(–15) × 3.5–5(–7) cm, thick papery to leathery, adaxially glabrous, abaxially densely tomentose, base broadly cuneate, decurrent onto petiolule, margin serrate to serrate-crenate, apex acuminate; primary veins (10–)12–14 on each side of midrib. Panicles terminal or lateral, 10–15 cm, densely flowered; bracts linear, glabrous or lanate. Flowers unisexual, ca. 3 mm, appearing after leaves. Staminate flowers: calyx campanulate, ca. 1 mm, teeth deltate; corolla white, lobes linear, equal to stamens, 6–7 mm. Pistillate flowers not seen. Samara spatulate, ca. 3 cm × 5 mm;

wing densely scurfy hairy, decurrent to about middle of nutlet, apex rounded or retuse. Fl. May, fr. Jul–Oct.

* Along rivers, dry rocky mountains; 1500–3500 m. Sichuan, Yunnan.

6. *Fraxinus punctata* S. Y. Hu, J. Arnold *Arbor.* 61: 86. 1980.

斑叶□ ban ye qin

Shrubs or small trees. Branches stout; buds scurfy hairy. Leaves to 20 cm; petiole 3.5–6 cm; axis somewhat terete; leaflets 3–5(–7), terminal 1 larger, with petiolule ca. 3 mm; leaflet blade broadly ovate, 8.5–12 × 4–5(–7) cm, leathery, adaxially glabrous; base attenuate to cuneate, margin remotely crenate, apex long acuminate; primary veins 6–10 on each side of midrib. Panicles terminal. Calyx shallowly cupular, ca. 2 mm; teeth deltate. Samara spatulate, 2.5–3 cm × ca. 5 mm. Fr. Sep.

* Mixed woods on slopes; 1000–1500 m. Hubei

Doubtfully specifically distinct from *Fraxinus trifoliolata*.

7. *Fraxinus sikkimensis* (Lingelsheim) Handel-Mazzetti, *Symb. Sin.* 7: 1004. 1936.

锡金□ xi jin qin

Fraxinus paxiana Lingelsheim var. *sikkimensis* Lingelsheim, *Bot. Jahrb. Syst.* 40: 214. 1907; *F. suaveolens* W. W. Smith.

Trees ca. 17 m tall. Branchlets nearly 4-angled, brown tomentose to glabrescent. Leaves 25–35 cm; petiole ca. 10 cm; axis subterete; leaflets 7–9; petiolule 1–2 mm or absent, densely rusty tomentose; leaflet blade lanceolate, 5.5–12 × 2–4.5 cm (terminal larger), papery to leathery, abaxially densely felty, villose at vein axils, base broadly cuneate or blunt, sparsely serrate, apex acuminate or long acuminate; primary veins 10–12(–18) on each side of midrib, abaxially raised. Panicles terminal or lateral, 15–30 cm, lax; bracts absent. Flowers unisexual, appearing after leaves. Pedicel 3–5 mm. Calyx cupular, ca. 1 mm, shallowly toothed. Staminate flowers: corolla lobes oblong-linear, ca. 3 mm; stamens exceeding lobes. Pistillate flowers: corolla lobes caducous. Samara spatulate, 3–3.5 cm × 4–6 mm; wing decurrent to middle of nutlet. Fl. May, fr. Jul–Oct.

Forests by river valleys, 2000–2800 m. Sichuan, Xizang, Yunnan [India (Assam), Sikkim].

8. *Fraxinus depauperata* (Lingelsheim) Z. Wei, *Fl. Reipubl. Popularis Sin.* 61: 19. 1991.

疏花□ shu hua qin

Fraxinus paxiana Lingelsheim var. *depauperata* Lingelsheim in Engler, *Pflanzenr.* IV. 243(Heft 72): 22. 1920.

Trees ca. 5 m. Branchlets puberulent, later glabrescent; buds ovoid, densely brown tomentose. Leaves 15–25 cm; petiole 5–6 cm; axis sparsely brown tomentose; leaflets 3–5(–7); petiolule 1–2 mm, sparsely crisped hairy; leaflets blade ovate-lanceolate or elliptic, 5–12 × 2–4 cm (terminal larger,

basal pair smaller), papery, abaxially sparsely crisped hairy along midrib, base blunt or broadly cuneate, slightly irregularly coarse serrate, apex long acuminate; primary veins 10–12 on each side of midrib. Panicles terminal and lateral, 8–12 cm, lax. Flowers unisexual, appearing after leaves. Pedicel 4–5 mm. Calyx campanulate, ca. 1.5 mm, teeth sharp triangular, longer than tube. Staminate flowers: corolla white, lobes linear, ca. 3 mm, caducous; stamens exceeding lobes. Samara oblanceolate-linear, ca. 3.5 cm × 6 mm; wing decurrent to above middle of nutlet. Fl. May, fr. Jul–Sep.

* Mixed woods on slopes, 400–1100 m. Hubei, Hunan, Shaanxi.

9. Fraxinus paxiana Lingelsheim, Bot. Jahrb. Syst. 40: 213. 1907.

秦岭 □ qin ling qin

Trees up to 20 m. Branchlets nearly 4-angled, glabrous to tomentose; buds broadly ovoid, scurfy to tomentose, becoming dark brown when dry. Leaves 25–35 cm; petiole 5–10 cm; axis grooved to subterete, glabrous or pilose; leaflets 7–9; petiolule 0–2 mm, sparingly to densely tomentose; leaflet blade lanceolate to ovate-oblong, 5–18 × 2–6 cm, papery, glabrous or villous along veins abaxially, base rounded to attenuate, margin crenate, apex acuminate; primary veins 2–16 on each side of midrib. Panicles terminal and lateral, 8–20 cm, lax. Flowers polygamodioecious, appearing after leaves. Pedicel ca. 2 mm. Calyx cupular, membranous, 1–1.5 mm; teeth truncate or broadly deltate. Corolla white; lobes linear-spatulate, ca. 3 mm. Stamens of staminate flowers equal to or slightly longer than corolla lobes, those of bisexual flowers exceeding corolla lobes. Samara linear-spatulate, 2.5–3 cm × ca. 4 mm; wing decurrent to upper part of nutlet. Fl. May–Jul, fr. Sep–Oct.

* Slopes, forests in valleys; 400–1100 m. Hubei, Hunan, Shaanxi.

Fraxinus depauperata and *F. sikkimensis* are very similar to *F. paxiana*, and further studies may show that they are conspecific.

10. Fraxinus floribunda Wallich in Roxburgh, Fl. Ind. 1: 150. 1820.

多花 □ duo hua qin

Trees to ca. 25 m. Buds densely brown tomentose. Leaves 15–30 cm; petiole 5–8 cm; leaflets 7–9; petiolule 0.5–1.5 cm; leaflet blade ovate-lanceolate to elliptic, 8–12(–15) × (1–)2–4(–6) cm, thin leathery, adaxially glabrous, abaxially glabrous or pilose along midrib, base broadly cuneate, oblique, margin serrate, serrulate, or basally entire, apex caudate-acuminate; primary veins 10–12 on each side of midrib. Panicles terminal, spreading, many flowered, 20–30 cm. Flowers appearing after leaves. Pedicel 3–4 mm. Calyx cupular, 1–1.5 mm; teeth broadly deltate. Corolla white; lobes oblong, (1.5–)3–4 mm, obtuse. Stamens exceeding corolla lobes. Samara linear, 2–4 cm × 4–5 mm; wing decurrent to about middle or distal part of nutlet. Fl. Feb–Apr, fr. Jul–Oct. *2n* = 46.

Dense forests, mixed woods of valleys, roadsides; sea level to 2600 m. Guangdong, Guangxi, Guizhou, Xizang, Yunnan, Zhejiang

[Afghanistan, Bhutan, India, Japan (Ryukyu Islands), Kashmir, Laos, Myanmar, Nepal, Thailand, Vietnam].

The differences between *Fraxinus floribunda* and each of *F. insularis*, *F. odontocalyx*, and *F. stylosa* are so minor that further studies may show that the last three are synonyms of *F. floribunda*.

11. Fraxinus insularis Hemsley in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 86. 1889.

苦槠木 □ ku li mu

Fraxinus championii Little; *F. floribunda* subsp. *insularis* (Hemsley) S. S. Sun; *F. insularis* var. *henryana* (Oliver) Z. Wei; *F. retusa* Champion ex Benthams; *F. retusa* var. *callicola* C. Y. Wu ex P. Y. Bai; *F. retusa* var. *henryana* Oliver; *F. taiwaniana* Masamune.

Trees 20–30 m. Buds narrowly conical, densely dark-brown tomentose, becoming shiny when dry; branchlets compressed when young. Leaves 10–30 cm; petiole 5–8 cm; leaf axis adaxially plane; leaflets 3–5(–7); petiolule (0.5–)1–1.5 cm; leaflet blade oblong, elliptic-lanceolate, or lanceolate, 6–9(–13) × 2–3.5(–4.5) cm, papery becoming lathery, glabrous, base cuneate or blunt, serrate or entire below the middle, apex acute, acuminate, to caudate; primary veins 7–11 on each side of midrib. Panicles terminal or terminal and lateral, 20–30 cm, many flowered. Flowers appearing after leaves. Pedicel filiform, ca. 3 cm. Calyx campanulate, ca. 1 × 1.5 mm; teeth truncate. Corolla white; lobes spatulate, ca. 2 mm. Stamens longer than corolla lobes. Samara red to brown, long spatulate, 2–4 cm × 3.5–4.5 mm; wing decurrent to upper part of nutlet. Fl. Apr–May, fr. Jul–Sep.

Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan (Kyushu, Okinawa)].

12. Fraxinus odontocalyx Handel-Mazzetti ex E. Peter, Oesterr. Bot. Z. 90: 125. 1941.

尖萼 □ jian e qin

Fraxinus huangshanensis S. S. Sun; *F. nanchuanensis* S. S. Sun & J. L. Wu.

Trees 10–20 m, subglabrous. Branchlets terete, scabrous. Leaves in whorls of 3 at branch tips; petiole 4–5 cm; axis adaxially with ridges expanding into narrow wings; leaflets 7–11(–13); petiolule 5–12 mm; leaflet blade ovate, lanceolate, or narrowly lanceolate, 2.5–8(–12) × 1.5–4 cm, papery, adaxially glabrous, abaxially with dense minute glandular dots, sometimes puberulent along midrib, base cuneate, attenuate to petiolule, margin irregularly deltate dentate, apex acuminate or long acuminate; primary veins 10–14 on each side of midrib. Cymose panicles lateral at branches of previous year, ca. 5 cm. Flowers polygamous, appearing before leaves,

opposite or in whorls of 3; without calyx and corolla. Samara oblanceolate, 3–5 cm × 5–8 mm; wing decurrent to base of nutlet, strongly twisted. Fl. Apr–Jun, fr. Jul–Oct. $2n = 46$.

* On open fields of mountainous regions, roadsides; 800–2400 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hubei, Shaanxi, Sichuan, Zhejiang.

13. *Fraxinus stylosa* Lingelsheim in Engler, Pflanzenr. IV. 243(Heft 72): 23. 1920.

宿柱 □ shu zhu qin

Fraxinus fallax Lingelsheim; *F. fallax* var. *stylosa* (Lingelsheim) Chun & J. L. Wu.

Trees up to 8 m. Branchlets and leaf axis straight and smooth; buds ovoid, dark brown, shiny when dry. Leaves 6–15 cm; petiole 2–5 cm; leaflets 3–5; petiolule 2–3 mm, glabrous; leaflet blade ovate-lanceolate to broadly lanceolate, 3.5–8 × 0.8–2 cm, papery, glabrous or white puberulent along veins abaxially, base broadly cuneate, tapered to petiolule, sometimes blunt, margin serrulate, apex long acuminate; primary veins 8–10 on each side of midrib. Panicles terminal or lateral, 8–10(–14) cm, loose. Flowers appearing after leaves. Pedicel ca. 3 mm. Calyx cupular, ca. 1 mm; teeth narrowly triangular. Corolla yellowish; lobes linear-lanceolate, blunt, ca. 2 mm. Staminate flowers with stamens slightly longer than corolla lobes. Pistillate flowers not seen. Samara oblanceolate, 1.5–2(–3.5) cm × 2.5–3(–5) mm; wing decurrent to above middle of nutlet. Fl. May, fr. Sep.

* Mixed woods on slopes, 1300–3200 m. Gansu, Henan, Shaanxi, Sichuan.

14. *Fraxinus sieboldiana* Blume, Ann. Mus. Bot. Lugduno-Batavi 1: 311. 1850.

庐山 □ lu shan qin

Fraxinus mariesii J. D. Hooker.

Trees 5–8 m. Branchlets and leaf rachis puberulent and scurfy hairy; buds ovoid, yellowish tomentose, becoming black. Leaves 7–15 cm; petiole purple, 2–3 cm, puberulent; leaflets 3–5(–7), sessile or with petiolule ca. 5 mm; leaflet blade ovate to lanceolate, 2.5–8 × 1.5–4.5 cm (terminal one largest), papery to thin leathery, glabrous or densely white pubescent along midrib abaxially, base blunt or attenuate, margin entire or serrate over middle, apex acute or acuminate; primary veins 7–10 on each side of midrib. Panicles terminal or lateral, 7–12 cm, many flowered, congested. Flowers polygamous, appearing after leaves. Staminate flowers: calyx inconspicuous; corolla white to yellowish, lobes linear-lanceolate, 3–5 mm, acute. Bisexual flowers with shorter corolla lobes. Samara purple, linear or linear-spatulate, ca. 2.5 cm × 4 mm, usually red glandular dotted and scurfy hairy; wing decurrent to middle of nutlet, apex rounded or retuse. Fl. May–Jun, fr. Sep.

Woods on slopes and by streams in ravines; 500–1200 m. Anhui, Fujian, Jiangsu, Jiangxi, Zhejiang [Japan].

15. *Fraxinus bungeana* A. de Candolle, Prodr. 8: 275. 1844.

小叶 □ xiao ye qin

Fraxinus bungeana var. *parvifolia* Wenzig; *F. parvifolia* (Wenzig) Lingelsheim.

Trees or shrubs 2–5 m. Branchlets puberulent, sometimes densely so, gradually glabrescent; terminal bud conical, lateral ones broadly ovoid. Leaves 5–15 cm; petiole 1.5–4.5 cm; axis finely puberulent; leaflets 5–7; petiolule 0.2–1.5 cm, pubescent; leaflet blade broadly ovate, rhomboid to ovate, broadly lanceolate, or elliptic, 2–5 × 1.5–3 cm, papery, glabrous, base broadly cuneate, margin deeply serrate to incised, apex caudate; primary veins 4–6 on each side of midrib. Panicles terminal or lateral, 5–9 cm, sparsely to sometimes densely puberulent. Flowers polygamous, appearing after leaves. Pedicel ca. 3 mm. Staminate flowers: calyx cupular, 0.5 mm, teeth irregular, small; corolla white to yellowish, lobes linear, 4–6 mm. Bisexual flowers: calyx teeth subulate, larger; corolla lobes 6–8 mm. Samara spatulate-oblong, 2–3 cm × 3–5 mm; wing decurrent to lower part of nutlet. Fl. May, fr. Aug–Sep. $2n = 46$.

* Dry sandy soils, rock crevices; sea level to 1500 m. Anhui, Hebei, Henan, Liaoning, Shandong, Shanxi.

The bark is used as an astringent, antidiarrheal, and anti-phlogistic.

16. *Fraxinus chinensis* Roxburgh, Fl. Ind. 1: 150. 1820.

白蜡树 bai la shu

Trees 3–20 m. Branchlets glabrous, sparsely villous puberulent or tomentose; buds broadly ovoid or conical, brown tomentose, pubescent or glandular hairy. Leaves 12–35 cm; petiole 3–9 cm; axis puberulent or pilose at first, leaflet joint glabrous or densely tomentose; leaflets 3–7(–9); petiolule 2–15 mm; leaflet blade broadly ovate, ovate, to lanceolate or elliptic to obovate-lanceolate, 4–16 × 2–7 cm (terminal much larger), papery to somewhat leathery, glabrous or villous, sometimes villous only along veins abaxially, base blunt or cuneate, margin regularly serrate to crenate-serrate, sometimes entire in lower half, apex acute to long acuminate or caudate; primary veins 5–10 on each side of midrib. Panicles terminal or lateral, 5–10 cm. Flowers dioecious, opening with leaves. Staminate flowers congested; calyx cupular, 1–1.5 mm; corolla absent. Pistillate flowers lax; calyx tubular, 2–3 mm. Samara spatulate to very narrowly so, 2.5–4 cm × 3–7(–15) mm; wing decurrent to middle or lower part of nutlet.

Slopes, along rivers, roadsides, mixed woods; 800–2300 m. China [Japan, Korea, Russia, Vietnam].

Fraxinus chinensis, *F. rhynchophylla*, and *F. szaboana*, which have been recognized as distinct species in most of the Chinese literature, are here recognized as one species.

1a. Terminal leaflets 2–4(–6) cm broad, ovate,

ovate-lanceolate, to lanceolate or elliptic to

ovate-oblong, short to long acuminate, margin

distinctly serrate 16a. subsp. *chinensis*

1b. Terminal leaflets (2.5–)3.5–5(–7) cm broad,

usually broadly ovate to elliptic, sometimes ±

lanceolate, short acuminate to acuminate or caudate,

margin crenate-serrate 16b. subsp. *rhynchophylla*

16a. *Fraxinus chinensis* subsp. *chinensis*

白蜡树(原亚种) bai la shu (yuan ya zhong)

Fraxinus caudata J. L. Wu; *F. chinensis* var. *acuminata* Lingelsheim; *F. chinensis* var. *rotundata* Lingelsheim; *F. chinensis* var. *tomentosa* Lingelsheim; *F. lingelsheimii* Rehder; *F. medicinalis* S. S. Sun; *F. rhynchophylla* Hance var. *huashanensis* J. L. Wu & Z. W. Xie; *F. sargentiana* Lingelsheim; *F. szaboana* Lingelsheim; *F. velutina* Lingelsheim (1907), not Torrey (1848); *F. yunnanensis* Lingelsheim.

Leaflets (3–)5–7(–9), ovate, ovate-lanceolate, to lanceolate or elliptic to obovate-oblong, terminal leaflet (4–)7–10 (–12) × 2–4(–6) cm, villous beside basal part of midrib abaxially, rarely tomentose or almost glabrous, margin distinctly serrate, apex short to long acuminate; primary veins 6–12 on each side of midrib. Samara spatulate to very narrowly so, 3–3.5(–4) cm × 3.5–7(–15) mm. Fl. Apr–May, fr. Jul–Sep.

Mixed woods in montane regions; 800–2300 m. Throughout China [Korea, Vietnam].

A variable subspecies, cultivated for a long time in China for leaves to feed a species of scale insects that secretes commercial candle wax.

16b. *Fraxinus chinensis* subsp. *rhynchophylla* (Hance) E. Murray, *Kalmia* 13: 6. 1983.

花曲柳 hua qu liu

Fraxinus rhynchophylla Hance, *J. Bot.* 7: 164. 1869; *F. chinensis* var. *rhynchophylla* (Hance) Hemsley; *F. hopeiensis* Tang; *F. japonica* Blume ex K. Koch.

Leaflets 3–7, terminal leaflet broadly ovate to elliptic, sometimes ± lanceolate, (4–)5–9(–12) × (2.5–)3.5–5(–7) cm, villous to tomentose beside basal part of midrib abaxially, sometimes brownish, margin crenate-serrate, apex short acuminate to acuminate or caudate; primary veins (5 or)6–9 on each side of midrib. Samara narrowly to very narrowly spatulate, 2.5–4 cm × 4.5–7 mm. Fl. Apr–May, fr. Sep–Oct.

Slopes, along rivers, roadsides; below 1500 m. Gansu, Hebei, Heilongjiang, Henan, Jilin, Liaoning, Shaanxi, Shandong, Shanxi [Japan, Korea, Russia].

The wood is used for cabinet making.

17. *Fraxinus baroniana* Diels, *Bot. Jahrb. Syst.* 36(Beibl. 82): 86. 1905.

狭叶□ xia ye qin

Shrubs or small trees to 4 m. Branchlets smooth. Leaves 12–18(–20) cm; petiole 2–3 cm; axis broadly grooved; leaflets 7–9; petiolule 3–5 mm; leaflet blade narrowly lanceolate, (3.5–)5–8(–10) × 1–1.8(–2.2) cm, leathery, adaxially glabrous, abaxially white or yellow barbate along base of midrib, long acuminate at both ends, margin regularly and remotely serrate; primary veins 8–12 on each side of midrib. Panicles terminal or lateral, 8–12 cm, lax. Flowers dioecious, opening with leaves. Pedicel 2–3 mm. Calyx campanulate, ca. 1.5 mm; teeth deltate, membranous. Corolla absent. Samara linear-spatulate, 1.8–2.5 cm × 4–5 mm; wing decurrent to upper part of nutlet. Fl. Apr, fr. May–Jul.

* Thickets on slopes, along streams and rivers; 700–1300 m. Gansu, Shaanxi, Sichuan.

18. *Fraxinus xanthoxyloides* (G. Don) A. de Candolle, *Prodr.* 8: 275. 1884.

椒叶□ jiao ye qin

Ornus xanthoxyloides G. Don, *Gen. Hist.* 4: 57. 1837.

Shrubs or small trees to 7 m. Branchlets terete and smooth. Leaves 8–12 cm, sometimes only 2 cm on shrubby twigs; petiole 1–1.5 cm; axis with winged ridges; leaflets (5–)7–11(–13), sessile or subsessile; leaflet blade ovate-lanceolate or narrowly elliptic, (0.5–)3–4(–5.5) × 0.5–1.5 cm, subleathery, glabrous except for white puberulent abaxial base of midrib, base cuneate, slightly oblique, margin crenate, lower part entire, apex obtuse or acute; primary veins ca. 4 on each side of midrib. Cymose panicles lateral at branches of previous year, ca. 5 mm. Flowers polygamous, appearing before leaves. Corolla absent. Staminate flowers without calyx. Bisexual flowers with a minute, cupular calyx persistent in fruit. Samara oblong-linear, 3–5 cm × ca. 5 mm; wing decurrent to lower part of nutlet. Fl. Apr, fr. Oct. *2n* = 46.

Dry slopes in valleys; 1000–2800 m. Xizang [Afghanistan, India, Kashmir, Pakistan; N Africa].

19. *Fraxinus hupehensis* Ch'ü, Shang, & Su, *Acta Phytotax. Sin.* 18: 366. 1980.

湖北□ hu bei qin

Trees to 19 m. Branchlets glabrous or puberulent, turning into thorns when old. Leaves 7–15 cm; petiole ca. 3 cm; axis narrowly winged; leaflets 7–9(–11); petiolule 3–4 mm, puberulent; leaflet blade lanceolate to ovate-lanceolate, 1.7–5 × 0.6–1.8 cm, leathery, adaxially glabrous, abaxially pubescent along base of midrib, base cuneate, margin sharply serrate, apex acuminate; primary veins 6 or 7 on each side of midrib. Cymose panicles lateral at branches of previous year, ca. 1.5 cm. Flowers polygamous, congested, fascicled, appearing before leaves. Corolla absent. Staminate flowers with campanulate calyx. Bisexual flower with minute calyx and truncate calyx teeth. Samara spatulate, 4–5 cm × 5–8 mm. Fl. Feb–Mar, fr. Sep.

* Hills; 100–600 m. Hubei.

20. Fraxinus platypoda Oliver, Hooker's
Icon. Pl. 20: t. 1929. 1890.

象蜡树 xiang la shu

Fraxinus inopinata Lingelsheim; *F. spaethiana* Lingelsheim.

Trees to 28 m. Branchlets puberulent or glabrous. Leaves 10–25(–30) cm; petiole 5–6 cm, dilated and semiamplexicaul at base; axis densely pubescent, glabrescent; leaflets 7–11, sessile or subsessile; leaflet blade oblong-elliptic, (4–)6–14 × (1–)2–3.5 cm, thin leathery, adaxially glabrous, densely yellowish villous along midrib abaxially or glabrescent, base blunt or broadly cuneate, slightly oblique, margin obscurely serrulate, apex acuminate to short acuminate; primary veins 10–15 on each side of midrib. Cymose panicles lateral at branches of previous year, 12–15 cm. Flowers polygamodioecious, appearing before leaves. Corolla absent. Calyx of bisexual flowers campanulate, ca. 1.5 mm; teeth deltate. Samara oblong-elliptic, 4–6 cm × 7–10 mm; wing decurrent to base of nutlet. Fl. Apr–May, fr. Aug.

Mixed woods on slopes or in valleys; 1200–2800 m. Gansu, Guizhou, Hubei, Shaanxi, Sichuan, Yunnan [Japan].

21. Fraxinus mandschurica Ruprecht. Bull.
Phys. Math. Acad. Sci. Saint Pétersburg 15:
371. 1857.

水曲柳 shui qu liu

Fraxinus mandschurica subsp.
brevipedicellata S. Z. Qu & T. C. Cui; *F.*
nigra Marshall subsp. *mandschurica*
(Ruprecht) S. S. Sun; *F. nigra* var.
mandschurica (Ruprecht) Lingelsheim.

Trees to 30 m. Branchlets 4-angled, glabrous. Leaves 25–35(–40) cm; petiole 6–8 cm; axis with ridges sometimes subulate, leaflet joint brown curly hairy; leaflets 7–11(–13), subsessile; leaflet blade oblong to ovate-oblong, 5–20 × 2–5 cm, papery, adaxially glabrous or sparsely white hirsute, abaxially curly hairy along veins, especially denser at base of midrib, base cuneate to blunt, slightly oblique, margin serrulate, apex acuminate or caudate; primary veins 8–11 on each side of midrib. Panicles lateral at branches of previous year, 15–20 cm; staminate panicles congested; bisexual ones somewhat lax. Pedicel 3–5 mm in staminate panicles, longer in bisexual. Flowers polygamodioecious, appearing before leaves, without calyx and corolla. Samara oblong to obovate-lanceolate, 3–3.5(–4) cm × 6–9 mm; wing decurrent to middle or base of nutlet, obviously twisted. Fl. Apr–Jun, fr. Aug–Sep.

Sparse woods on slopes, open valleys of montane regions; 700–2100 m. Gansu, Hebei, Heilongjiang, Henan, Hubei, Jilin, Liaoning, Shaanxi, Shanxi [Japan, Korea, E Russia].

Fraxinus mandschurica is quite similar to the North American *F. nigra*, and most authors, including P. S. Green, prefer to treat the former as a subspecies of the latter.

Important commercial timber.

22. Fraxinus sogdiana Bunge, Mem. Acad.
Imp. Sci. St. Pétersbourg Divers Savana 7:
390. 1852.

天山□ tian shan qin

Trees 10–20 m, subglabrous. Branchlets terete, scabrous. Leaves in whorls of 3 at branch tips; petiole 4–5 cm; axis adaxially with ridges expanding into narrow wings; leaflets 7–11(–13); petiolule 5–12 mm; leaflet blade ovate, lanceolate, or narrowly lanceolate, 2.5–8(–12) × 1.5–4 cm, papery, adaxially glabrous, abaxially with dense minute glandular dots, sometimes puberulent along midrib, base cuneate, attenuate to petiolule, margin irregularly deltate dentate, apex acuminate or long acuminate; primary veins 10–14 on each side of midrib. Cymose panicles lateral at branches of previous year, ca. 5 cm. Flowers polygamous, appearing before leaves, opposite or in whorls of 3; without calyx and corolla. Samara oblanceolate, 3–5 cm × 5–8 mm; wing decurrent to base of nutlet, strongly twisted. Fl. Apr–Jun, fr. Jul–Oct. $2n = 46$.

Along rivers, open deciduous forests; ca. 500 m. W Xinjiang [Kazakstan, Kyrgyzstan, Tajikistan, Uzbekistan].

