

BETULACEAE

桦木科 hua mu ke

Li Peiqiong (李沛琼 Li Pei-chun)¹; Alexei K. Skvortsov²

Trees or shrubs deciduous, monoecious. Stipules present, free, often deciduous, rarely persistent. Leaves alternate, simple, petiolate, usually doubly serrate, rarely simply serrate, lobulate, or entire; veins pinnate. Flowers unisexual. Male inflorescence precocious, elongate, pendulous, with numerous overlapping bracts; each bract usually subtending a small dichasium with 1–3 male flowers; stamens as many as and opposite sepals or, if sepals obsolete, then stamens of inflorescence to 20; filaments very short, connate or nearly so; anthers 2-loculed, thecae connate or separate, opening by longitudinal slits. Female inflorescence pendulous or erect, with numerous overlapping bracts; each bract subtending a small dichasium with 2 or 3 flowers; calyx with 1–6 scalelike lobes, or obsolete; petals absent; ovary inferior, 2-loculed; styles 2, free; ovules 2, or 1 by abortion, pendulous from near apex of each locule. Fruit a nut or nutlet, winged or not. Seed 1, with straight embryo and flat or thickened cotyledons, without endosperm.

Six genera and 150–200 species: mainly in Asia, Europe, and North and South America; six genera (one endemic) and 89 species (56 endemic) in China.

Because of evolutionary divergence within the Betulaceae, the family has often been divided into tribes (i.e., Betuleae, Carpineae, and Coryleae) or more recently into subfamilies (J. J. Furlow, *J. Arnold Arbor.* 71: 1–67. 1990).

Li Pei-chun & Cheng Sze-hsu. 1979. Betulaceae. *In*: Kuang Ko-zen & Li Pei-chun, eds., *Fl. Reipubl. Popularis Sin.* 21: 44–137.

- 1a. Male flowers 3 in a small dichasium, calyx present; female flowers without calyx; fruit a nutlet, winged; cotyledons flat.
- 2a. Female inflorescence conelike; bracts woody, persistent, 5-lobed at apex, each bract subtending 2 flowers; male flower with (1 or 3 or)4 stamens 5. *Alnus*
- 2b. Female inflorescence spicate; bracts leathery, deciduous, 3-lobed at apex, each bract subtending 3 flowers; male flower with 2 stamens 6. *Betula*
- 1b. Male flower 1, calyx absent; female flowers with calyx adnate to ovary; fruit a nut or nutlet, wingless; cotyledons thick, fleshy.
- 3a. Female inflorescence capitulate (a compact cluster of several flowers) or racemose-capitulate.
- 4a. Fruit a nut; male flowers with 2 bracteoles; thecae separate, pubescent at apex; bracts campanulate or forming a tubular sheath 1. *Corylus*
- 4b. Fruit a nutlet; male flowers without bracteoles; thecae not separate, glabrous at apex; bracts forming a tubular sheath 2. *Ostryopsis*
- 3b. Female inflorescence racemose.
- 5a. Bracts not saccate; nutlet naked or seminaked; male inflorescence enclosed by buds during winter 3. *Carpinus*
- 5b. Bracts saccate; nutlet completely enclosed by bracts; male inflorescence naked during winter ... 4. *Ostrya*

1. CORYLUS Linnaeus, *Sp. Pl.* 2: 998. 1753.

榛属 zhen shu

Shrubs or trees deciduous. Leaves alternate, petiolate, margin doubly serrate or lobulate. Male inflorescence pendulous, subsessile, cylindrical, spicate-cymose, naked during winter, with numerous overlapping bracts; bracts each usually subtending 2 bracteoles and 1 male flower; stamens 2–8, inserted at middle part of bracts; anthers with 2 separate thecae, often pubescent at apex. Female inflorescence a compact cluster of several flowers; bracts campanulate or forming a tubular sheath, apex usually lobed; flowers paired, enclosed by a bract; calyx adnate to ovary, 4–8-lobed at apex; ovary with 1 or rarely 2 ovules in each cell; style 2-cleft to base. Fruit a subglobose or ovoid nut, enclosed or surrounded by enlarged bracts.

About 20 species: China, Japan, Korea, Mongolia, Russia; Europe, North America; seven species (four endemic) in China.

Corylus formosana Hayata (*Gen. Ind. Pl. Form.* 72. 1916) was described from Taiwan but no specimen is extant. It was treated as an uncertain species by J. C. Liao in *Fl. Taiwan*, ed. 2.

- 1a. Bracts forming a tubular sheath, constricted above nut; nut enclosed by bracts.
- 2a. Shrubs; leaf margin lobed distally 7. *C. mandshurica*
- 2b. Trees; leaf margin irregularly and doubly serrate.

¹ Herbarium, Shenzhen Fairy Lake Botanical Garden, Liantang, Shenzhen, Guangdong 518004, People's Republic of China.

² Herbarium, Main Botanic Garden, Russian Academy of Sciences, Botanicheskaya Street 4, Moscow 127276, Russia.

- 3a. Bracts pubescent, with prominent ribs, divided into linear lobes, usually forked at apex 5. *C. chinensis*
- 3b. Bracts tomentose, with faint ribs, divided into triangular-lanceolate lobes, usually not forked at apex 6. *C. fargesii*
- 1b. Bracts together campanulate, not constricted above nut; nut surrounded by bracts.
 - 4a. Lobes of bracts forming dense, branching spines 1. *C. ferox*
 - 4b. Lobes of bracts not forming spines.
 - 5a. Bract limb deeply divided into linear, lobulate lobes, lobes often reflexed 2. *C. wangii*
 - 5b. Bract limb shallowly divided into ovate or ovate-lanceolate lobes, lobes not reflexed.
 - 6a. Branchlets yellow tomentose; petiole 0.7–2.2 cm, yellow tomentose; leaves suborbicular to broadly ovate or obovate, abaxially tomentose, margin irregularly and doubly serrate; bracts ca. as long as or shorter than fruit 3. *C. yunnanensis*
 - 6b. Branchlets sparsely villous; petiole 1–3 cm, loosely villous or glabrescent; leaves ovate, oblong, or elliptic, pilose along veins abaxially, margin lobulate or incised distally; bracts longer than fruit 4. *C. heterophylla*

1. *Corylus ferox* Wallich, Pl. Asiat. Rar. 1: 77. 1830.

刺榛 ci zhen

Trees to 20 m tall; trunk to 30 cm d.b.h.; bark dark gray or gray, fissured. Branchlets purplish brown, pubescent, sometimes stipitate glandular, glabrescent, with scattered, minute lenticels. Petiole 1–3.5 cm, densely pilose when young, glabrescent; leaf blade ovate-oblong, obovate-oblong, obovate, or elliptic, 5–15 × 3–9 cm, papery, abaxially bearded in axils of lateral veins, pilose and sparsely glandular, adaxially sparsely pilose especially along impressed midvein when young, base very obliquely rounded or subcordate, margin sharply and doubly mucronate serrate, apex long acuminate to caudate-acuminate; lateral veins 8–14 on each side of midvein. Male inflorescence ca. 2 cm; bracts broadly ovate, tomentulose, apex acute to acuminate; anthers purple. Female flowers 4–6 in a cluster; bracts campanulate, densely pubescent, sometimes stipitate glandular, with lacinate segments forming branching, pungent spines. Nut ovoid-globose, subcompressed, 1–1.5 cm in diam., apex pubescent. Fl. May–Jul, fr. Jul–Sep. $2n = 22$.

Forests on mountain slopes; 1500–3800 m. SE Gansu, Guizhou, W Hubei, Ningxia, Shaanxi, E and SW Sichuan, Xizang, Yunnan [Bhutan, NE India, N Myanmar, Nepal, Sikkim].

- 1a. Scales of buds white villous; leaves ovate-oblong or obovate-oblong 1a. var. *ferox*
- 1b. Scales of buds glabrous; leaves obovate or elliptic 1b. var. *thibetica*

1a. *Corylus ferox* var. *ferox*

刺榛(原变种) ci zhen (yuan bian zhong)

Scales of buds white villous. Leaves ovate-oblong or obovate-oblong; lateral veins 10–14 on each side of midvein.

Forests on mountain slopes; 1700–3800 m. Guizhou (Fanjing Shan), SW Sichuan, NW and W Yunnan [Bhutan, ?NE India, ?N Myanmar, Nepal, Sikkim].

1b. *Corylus ferox* var. *thibetica* (Batalin) Franchet, J. Bot. (Morot) 13: 200. 1899.

藏刺榛 zang ci zhen

Corylus thibetica Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 102. 1893.

Scales of buds glabrous. Leaves obovate or elliptic; lateral veins 8–12 on each side of midvein.

- Mixed forests; 1500–3600 m. SE Gansu, Guizhou, W Hubei, Ningxia, Shaanxi, E Sichuan, Xizang, Yunnan.
- 2. ***Corylus wangii*** Hu, Bull. Fan Mem. Inst. Biol., n.s., 8: 31. 1938.

维西榛 wei xi zhen

Trees small, to 7 m tall. Branchlets purplish brown, pilose and stipitate glandular when young, soon glabrous, with scattered, white lenticels. Petiole 7–20 cm, slender, pilose and stipitate glandular; leaf blade oblong or ovate-oblong, rarely obovate-oblong, 5–10 × 2.5–7 cm, papery, abaxially pubescent along veins, adaxially glabrous or sparsely pilose, base subcordate or obliquely subcordate, margin sharply and doubly serrate, apex acuminate to caudate-acuminate; lateral veins 9–13 on each side of midvein. Female flowers 4–8 in a cluster; peduncle ca. 1 cm, villous; bracts campanulate, 3–3.5 cm, striate, yellow tomentose when young, glabrescent, densely stipitate glandular, apex deeply divided into linear lobes, lobes often reflexed, ca. 2 cm × 2 mm, forked and pinnately lobulate. Nut ovoid-globose, ca. 1.5 cm in diam., glabrous. Fl. Jun–Aug, fr. Aug–Sep.

• Temperate broad-leaved forests; ca. 3000 m. NW Yunnan (Weixi Xian).

An endangered species. The similar *Corylus jacquemontii* Decaisne, from the Himalayas, differs in having bract lobes ovate-lanceolate, usually not reflexed, without lobules.

3. *Corylus yunnanensis* (Franchet) A. Camus, Bull. Mus. Hist. Nat., sér. 2, 1: 438. 1929.

滇榛 dian zhen

Corylus heterophylla Fischer var. *yunnanensis* Franchet, J. Bot. (Morot) 13: 198. 1899.

Shrubs or small trees to 7 m tall; trunk to 10 cm d.b.h.; bark dark gray, fissured. Branchlets purplish brown or brown, densely tawny tomentose, stipitate glandular, glabrescent, with scattered, white lenticels. Petiole 7–12(–22) mm, densely tomentose, sparsely stipitate glandular; leaf blade ovate-orbicular to broadly ovate or obovate, 4–12 × 3–9 cm, papery, abaxially stipitate glandular when young, densely tomentose, adaxially sparsely pubescent especially along veins, base cordate, margin irregularly and doubly serrate, apex abruptly acuminate from suborbicular, apical portion of leaf; lateral veins 5–7 on each side of midvein. Male inflorescences 2 or 3 in a cluster, pendulous, cylindrical, 2.5–3 cm; bracts ovate, densely gray tomentose. Female flowers 2 or 3 in a cluster; peduncle ca. 1 cm, tomentose; bracts campanulate, 1.3–2 cm, striate, densely yellow or gray tomentose, stipitate glandular, with triangular lobes. Nut ovoid-globose, 1.5–2 cm in diam., densely tomentose. Fl. May–Jul, fr. Jul–Sep.

• Thickets on mountain slopes; 1600–3700 m. W Guizhou, Hubei, SW and W Sichuan, W Yunnan (Dali Xian).

The nuts are edible.

4. *Corylus heterophylla* Fischer ex Trautvetter, Pl. Imag. Descr. 10. 1844.

榛 zhen

Shrubs or small trees, to 7 m tall; bark gray. Branchlets pubescent and stipitate glandular, with white lenticels. Petiole slender, 1–2(–3) cm, sparsely pubescent; leaf blade oblong, elliptic, elliptic-obovate, broadly ovate, or obovate to suborbicular, 4–13 × 2.5–10 cm, papery, abaxially pilose along veins, adaxially glabrous, base cordate, margin irregularly and doubly serrate, usually lobed, apex mucronate to caudate; lateral veins 3–7 on each side of midvein. Male inflorescences 2–5 in a cluster, pendulous, slender, ca. 4 cm; bracts reddish brown, obovate, densely pubescent, apex acuminate from nearly truncate, apical portion of leaf. Female flowers 2–6 in a cluster; bracts campanulate, 1.5–2.5 cm, striate, densely pubescent and stipitate glandular near base, with triangular-ovate, entire or dentate lobes. Nut ovoid-globose, ca. as long as bracts, 0.7–1.5 cm in diam., apex villous. Fl. May–Jul, fr. Jul–Aug. $2n = 22$.

Temperate broad-leaved forests, thickets on mountain slopes; 400–2500 m. Anhui, E and S Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, E Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, NE Sichuan, Zhejiang [Japan, Korea, Russia (E Siberia)].

The hazelnut of commerce.

1a. Leaves oblong or obovate, apex mucronate or caudate to nearly truncate; lobes of bracts usually entire 4a. var. *heterophylla*

1b. Leaves elliptic-obovate, broadly ovate, or suborbicular, apex subrounded, mucronate; lobes of bracts usually dentate 4b. var. *sutchuanensis*

4a. *Corylus heterophylla* var. *heterophylla*

榛(原变种) zhen (yuan bian zhong)

Corylus avellana Linnaeus var. *davurica* Ledebour; *C. heterophylla* var. *thunbergii* Blume.

Leaves oblong or obovate, apex mucronate to caudate, nearly truncate. Lobes of bracts entire, rarely sparsely dentate.

Temperate broad-leaved forests; 400–2400 m. E Gansu, Hebei, Heilongjiang (Dailing, Daxinganling), Henan, Jilin (Changbai Shan), Liaoning, E Nei Mongol, Ningxia (Liupan Shan), Shanxi [Japan, ?Korea, Russia (E Siberia)].

4b. *Corylus heterophylla* var. *sutchuanensis* Franchet, J. Bot. (Morot) 13: 199. 1899.

川榛 chuan zhen

Corylus heterophylla var. *cristagallii* Burkill; *C. kweichowensis* Hu.

Leaves elliptic-obovate, broadly ovate, or suborbicular, apex subrounded, mucronate. Lobes of bracts usually dentate.

• Thickets on mountain slopes; 500–2500 m. Anhui, S Gansu, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, NE Sichuan (Chengkou Xian), Zhejiang.

5. *Corylus chinensis* Franchet, J. Bot. (Morot) 13: 197. 1899.

华榛 hua zhen

Corylus chinensis var. *macrocarpa* Hu; *C. colurna* Linnaeus var. *chinensis* (Franchet) Burkill; *C. papyracea* Hickel.

Trees to 40 m tall; bark gray-brown, fissured. Branchlets purplish brown, slender, sparsely villous, stipitate glandular, glabrescent. Petiole 1–2.5 cm, densely villous, stipitate glandular; leaf blade ovate, ovate-elliptic, or obovate-elliptic, 8–18 × 6–12 cm, base obliquely cordate, margin irregularly and doubly serrate, apex mucronate or shortly caudate, abaxially bearded in axils of lateral veins, villous along veins, adaxially glabrous; lateral veins 7–11 on each side of midvein. Male inflorescences 4–6 in a cluster, cylindrical, 1.5–2 cm; bracts rhombic-ovate, pubescent. Female inflorescences 2–6 in a cluster; bracts forming a tubular sheath, 2–6 cm, striate, pilose, stipitate glandular, much constricted above nut and deeply divided into linear lobes, usually forked at apex. Nut enclosed by bracts, ovoid-globose, 1–1.5 cm in diam., glabrous.

• Forests on moist mountain slopes; 1200–3500 m. Gansu, Guizhou, Hubei, Shaanxi, SW Sichuan, Xizang, NW Yunnan.

This species is vulnerable because of its rarity.

6. *Corylus fargesii* C. K. Schneider, Ill. Handb. Laubholz. 2: 896. 1912.

披针叶榛 pi zhen ye zhen

Corylus mandshurica Maximowicz var. *fargesii* (Franchet) Burkill; *C. rostrata* Aiton var. *fargesii* Franchet.

Trees to 25 m tall; bark yellow-brown, fissured. Branchlets gray, slender, pubescent. Petiole 1–1.5 cm, densely pubescent; leaf blade oblong-lanceolate, obovate-oblong, or lanceolate, 6–9 × 3–5 cm, both surfaces sparsely pilose especially along midvein and lateral veins, base obliquely cordate or subrounded, margin coarsely and irregularly doubly serrate, apex acuminate; lateral veins 8–10 on each side of midvein. Male inflorescences 2–8 in a cluster, cylindric, 2–6 cm; bracts ovate-triangular, apex acute with a stipitate gland. Female flowers 2–4 in a cluster; bracts forming a tubular sheath, 2–5 cm, densely yellow tomentose, sparsely stipitate glandular when young, with faint veins, apex divided into triangular-lanceolate lobes usually not forked at apex. Nut enclosed by bracts, ovoid-globose, 1–1.5 cm in diam., gray-white pubescent at apex. Fl. May–Jul, fr. Jul–Aug.

• Forests in mountain valleys; 800–3000 m. S Gansu, Guizhou, Henan, Hubei, Jiangxi, S Ningxia, Shaanxi, NE Sichuan (Chengkou Xian).

7. *Corylus mandshurica* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 15: 137. 1856.

毛榛 mao zhen

Corylus rostrata Aiton var. *mandshurica* (Maximowicz) Regel; *C. sieboldiana* Blume var. *mandshurica* (Maximowicz) C. K. Schneider.

Shrubs to 6 m tall; bark gray-brown, fissured. Branchlets pubescent, villous, stipitate glandular, glabrescent. Petiole 1–3 cm, slender, pubescent, villous, stipitate glandular; leaf blade broadly ovate, oblong, or oblong-obovate, 6–12 × 4–9 cm, abaxially pilose especially along veins, adaxially pilose or glabrous, base cordate, margin irregularly and coarsely serrate, lobed above middle, apex mucronate-acuminate or caudate; lateral veins 9 or 10 on each side of midvein. Male inflorescences 2–4 in a cluster; peduncle short; bracts ovate-triangular, densely pubescent. Female flowers 2–4 in a cluster; bracts forming a tubular sheath, 3–6 cm, densely yellow setose, white pubescent, and stipitate glandular, much constricted above nut and divided into lanceolate lobes at apex. Nut enclosed by bracts, ovoid-globose, ca. 1.5 cm in diam., white pubescent. Fl. May–Jul, fr. Jul–Sep.

Temperate forests, thickets; 400–2600 m. E Gansu, Hebei, Heilongjiang (Daxinganling), Henan (Funiu Shan), ?Hubei, Jilin (Changbai Shan), Liaoning, Nei Mongol, Shaanxi, Sichuan [Japan, Korea, Russia (Far East)].

The nuts are edible.

2. **OSTRYOPSIS** Decaisne, Bull. Soc. Bot. France 20: 155. 1873.

虎榛子属 hu zhen zi shu

Shrubs deciduous. Leaves alternate, petiolate, usually irregularly and doubly serrate or incised. Male inflorescence enclosed by buds during winter, subsessile, terminal or lateral, spicate-cymose, cylindric; bracts numerous, overlapping; each bract subtending 1 male flower; bracteoles absent; stamens 4–8, inserted at base of bracts; anthers with 2 connate thecae, without hairs at apex. Female inflorescence terminal or axillary, racemose-capitulate; bracts forming a tubular sheath, leathery, lobed at apex; flowers paired, enclosed by bracts. Nutlet ovoid-globose, with prominent ribs, completely enclosed by bracts.

• Two species: China.

- 1a. Leaves ovate or elliptic-ovate, densely white pubescent abaxially, margin doubly serrate and usually incised above middle, apex acuminate or acute; bracts of male and female flowers pubescent 1. *O. davidiana*
- 1b. Leaves broadly ovate or ovate-orbicular, densely yellow-brown tomentose abaxially, margin irregularly and doubly serrate, apex obtuse or rounded; bracts of male and female flowers yellow-brown tomentose 2. *O. nobilis*

1. *Ostryopsis davidiana* Decaisne, Bull. Soc. Bot. France 20: 155. 1873.

虎榛子 hu zhen zi

Corylus davidiana (Decaisne) Baillon.

Shrubs to 3 m tall. Branches gray, glabrous; branchlets brown, striate, densely pubescent. Petiole 3–12 mm, densely pubescent; leaf blade ovate or elliptic-ovate, rarely broadly ovate or broadly obovate, 2–6.5 × 1.5–5 cm, subleathery, abaxially bearded in axils of lateral veins, densely white pubescent, with yellow or brown resinous glands, adaxially sparsely pubescent, base

cordate, obliquely cordate, or subrounded, margin doubly serrate and usually incised above middle, apex acuminate or acute; lateral veins 7–9 on each side of midvein. Male inflorescence 1; bracts pubescent. Female inflorescence terminal, racemose-capitulate; peduncle to 2.5 cm, slender, densely pubescent, sparsely hirsute; bracts forming a tubular sheath, 1–1.5 cm, leathery, densely pubescent, striate, lobed at apex. Nutlet brown, ovoid or subglobose, 4–6 × 4–5 mm, shiny, sparsely pubescent, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Sparse forests, thickets; 800–2800 m. Gansu, Hebei, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shanxi, W Sichuan.
Commonly planted for erosion control; the branches are used for making agricultural tools.

2. *Ostryopsis nobilis* I. B. Balfour & W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 8: 194. 1914.

滇虎榛 dian hu zhen

Ostryopsis davidiana Decaisne var. *cinerascens* Franchet.

Shrubs to 5 m tall. Branches gray, glabrous; branchlets brown, densely gray tomentose. Petiole 2–5 mm, densely tomentose; leaf blade broadly ovate or ovate-orbicular, rarely ovate, subleathery, abaxially densely yellow-brown tomentose, adaxially densely pubescent

when young, glabrescent, base cordate or obliquely cordate, margin irregularly and doubly serrate, apex obtuse or rounded; lateral veins 5–9 on each side of midvein, raised abaxially, deeply impressed adaxially. Male inflorescences 1 or 2; bracts densely yellow-brown tomentose. Female inflorescence terminal, racemose-capitulate; peduncle 3–5 mm, densely yellow-brown tomentose; bracts forming a tubular sheath, ca. 1 cm, leathery, densely yellow-brown tomentose, striate, 2-lobed at apex, dehiscent on 1 side when mature. Nutlet ovoid, ca. 4 × 3 mm, sparsely pubescent, ribbed. Fl. May–Jul, fr. Jul–Sep.

• Thickets on sunny mountain slopes; 1500–3000 m. SW Sichuan, NW Yunnan.

3. *CARPINUS* Linnaeus, Sp. Pl. 2: 998. 1753.

鹅耳枥属 e er li shu

Trees, sometimes shrubs, deciduous; bark fissured or smooth. Stipules deciduous. Leaves alternate, irregularly and doubly or simply serrate. Male inflorescence pendulous, spicate-cymose, cylindrical, enclosed by buds during winter, with many overlapping bracts; flowers without bracteoles or perianth; stamens 3–12, inserted at base of bracts; filaments forked at apex; anthers 2-loculed, thecae separate, pubescent at apex. Female inflorescence terminal or axillary on dwarf shoots, racemose; flowers paired; bracts leaflike, complanate, overlapping, 2- or 3-lobed at base. Nutlet ribbed, enclosed by lobes of bracts or not.

About 50 species: China, India, Japan, Korea, Laos, Myanmar, Nepal, Thailand, Vietnam; Europe, North and South America; 33 species (27 endemic) in China.

Because of inadequate material, *Carpinus fargesiana* has not been included in the key.

- 1a. Bracts of female flowers densely overlapping, with an inflexed lobe or auricle at base of inner margin, completely covering nutlet; nutlet with very faint ribs.
 - 2a. Female inflorescence to 50 cm; leaves ovate-lanceolate or elliptic-lanceolate, lateral veins 24–34 on each side of midvein 1. *C. fangiana*
 - 2b. Female inflorescence to 15 cm; leaves ovate, ovate-oblong, elliptic, or ovate-elliptic, lateral veins (10–)15–25 on each side of midvein.
 - 3a. Leaves with 20–25 lateral veins on each side of midvein; inner margin of bracts subentire 2. *C. rankanensis*
 - 3b. Leaves with (10–)15–20 lateral veins on each side of midvein; inner margin of bracts serrate . 3. *C. cordata*
- 1b. Bracts of female flowers loosely overlapping, with an inflexed or flattened lobe or auricle at base of inner margin, not completely covering nutlet; nutlet with prominent ribs.
 - 4a. Bracts with lobes at bases of inner and outer margins.
 - 5a. Bracts 2.5–3 cm, with subequal lobes at bases of both margins; nutlet 5–6 mm 4. *C. tientaiensis*
 - 5b. Bracts 1.5–2(–2.5) cm, with unequal lobes at bases of both margins; nutlet 3–4 mm.
 - 6a. Petiole robust, 4–7 mm, densely pubescent; nutlet with dense, brown, resinous glands and light yellow resin; outer margin of bracts entire or undulate-serrate 5. *C. londoniana*
 - 6b. Petiole slender, (1–)1.5–3 cm, glabrous; nutlet with sparse, brown, resinous glands; outer margin of bracts dentate 6. *C. viminea*
 - 4b. Bracts with an inflexed lobe or auricle at base of inner margin.
 - 7a. Bracts with an inflexed lobe at base of inner margin.
 - 8a. Bracts more than 2 cm, apex rounded or obtuse; nutlet ca. 5 mm or more.
 - 9a. Nutlet glabrous; bracts broadly semiovate; leaves elliptic or broadly elliptic, 5–10 × 3.5–5 cm, irregularly and doubly setiform serrate 7. *C. putoensis*
 - 9b. Nutlet densely white pubescent; bracts semiovate-oblong or falcate-oblong; leaves elliptic, narrowly elliptic, oblong, or narrowly oblong, 8–12 × 3.5–5.5 cm, irregularly and doubly minutely serrate 8. *C. kweichowensis*

- 8b. Bracts less than 2 cm, apex acute or acuminate; nutlet 3–4 mm.
- 10a. Nutlet sparsely pubescent at apex; leaves ovate, broadly ovate, ovate-elliptic, ovate-rhombic, or ovate-lanceolate, 2–6 × 1.3–4 cm 9. *C. turczaninowii*
- 10b. Nutlet densely villous at apex; leaves oblong-lanceolate or ovate-lanceolate, 4–5 × 1.8–2.5 cm 10. *C. kawakamii*
- 7b. Bracts with an inflexed auricle at base of inner margin.
- 11a. Leaves doubly or simply setiform serrate along margin.
- 12a. Nutlet with dense, brown or orange, resinous glands; peduncles and rachis densely yellow hirsute; bracts densely hispidulous 25. *C. monbeigiana*
- 12b. Nutlet without resinous glands; peduncles and rachis pubescent or glabrescent; bracts pubescent.
- 13a. Bracts 2.5–5 cm, nutlet 4–5 mm, glabrous; leaves 5–12 × 2.5–5 cm, lateral veins 14–16 on each side of midvein 26. *C. tschonoskii*
- 13b. Bracts 8–15 mm; nutlet less than 3.5 mm, pubescent or villous at apex; leaves 4–8 × 1.5–3.5 cm, lateral veins 12–20 on each side of midvein.
- 14a. Leaves leathery, lateral veins distinctly impressed adaxially 33. *C. rupestris*
- 14b. Leaves papery, lateral veins not impressed adaxially.
- 15a. Leaves glaucous abaxially 32. *C. omeiensis*
- 15b. Leaves not glaucous abaxially.
- 16a. Leaves rust-colored softly villous abaxially; branchlets, petioles, and peduncles white or light rust-colored softly villous; nutlet densely villous 31. *C. mollicoma*
- 16b. Leaves pubescent abaxially; branchlets, petioles, and peduncles glabrous; nutlet pubescent or glabrous.
- 17a. Leaves elliptic-lanceolate, oblong-lanceolate, lanceolate, or ovate-lanceolate, lateral veins 16–20 on each side of midvein; nutlet pubescent or villous only at apex.
- 18a. Leaves elliptic-lanceolate or oblong-lanceolate, 4–8 × 1.5–2.5 cm, margin doubly setiform serrate; nutlet pubescent 27. *C. polyneura*
- 18b. Leaves lanceolate or ovate-lanceolate, 2.5–4.5 × 1–1.5 cm, margin simply setiform serrate; nutlet glabrous except villous at apex 28. *C. dayongina*
- 17b. Leaves ovate, ovate-elliptic, elliptic, or elliptic-oblong, lateral veins 12–16 on each side of midvein; nutlet glabrous.
- 19a. Leaves ovate or ovate-elliptic, 4–5 × 2–2.5 cm, apex acuminate, lateral veins 12–15 on each side of midvein 29. *C. sungpanensis*
- 19b. Leaves elliptic or elliptic-oblong, 5–9 × 3.4–4 cm, apex caudate-acuminate, lateral veins 15 or 16 on each side of midvein 30. *C. tsunyiensis*
- 11b. Leaves doubly or simply serrate along margin.
- 20a. Bracts broadly semiovate, 2.5–3 × 1.5–1.8 cm; nutlet 5–6 mm, densely pubescent, with orange resinous glands 11. *C. tsaiiana*
- 20b. Bracts semiovate or broadly semiovate, 2–2.5 × 0.6–0.8 cm; nutlet ca. 4 mm or less, pubescent or glabrous, with brown, resinous glands or not.
- 21a. Rachis of female inflorescence densely hirsute 12. *C. chuniana*
- 21b. Rachis of female inflorescence sparsely pubescent or villous.
- 22a. Nutlet densely resinous glandular 13. *C. minutiserrata*
- 22b. Nutlet sparsely resinous glandular distally or not resinous glandular.
- 23a. Bracts less than 1.5 cm; leaves ovate-lanceolate, oblong-lanceolate, lanceolate, or narrowly lanceolate, 0.9–5 × 0.7–1.8 cm.
- 24a. Leaves simply serrate along margin; branchlets glabrous; nutlet sparsely pubescent, with resinous glands distally; bracts semiovate, loosely and irregularly dentate along outer margin 22. *C. purpurinervis*
- 24b. Leaves doubly serrate along margin; branchlets densely pubescent; nutlet densely pubescent, sparsely resinous glandular or not resinous glandular, bracts broadly

- semiovate,
incised-dentate or minutely dentate.
- 25a. Nutlet with resinous glands; bracts 7–10 × ca. 5 mm, incised-dentate along outer margin; leaves lanceolate, 5–5.5 × 1.4–1.8 cm; trees 23. *C. hebestroma*
- 25b. Nutlet without resinous glands; bracts 7–13 × 4–6 mm, minutely serrate along outer margin; leaves ovate-lanceolate, 0.9–3.8 × 0.7–1.2 cm; shrubs 24. *C. microphylla*
- 23b. Bracts 1.5–2.5(–3) cm; leaves ovate, elliptic, oblong, or lanceolate, 5–10 × 2.5–4.5 cm.
- 26a. Leaves oblong or obovate-oblong; nutlet sparsely resinous glandular, villous distally 14. *C. shensiensis*
- 26b. Leaves elliptic-lanceolate, ovate-lanceolate, rarely elliptic or ovate; nutlet without resinous glands, glabrous or densely pubescent.
- 27a. Leaves and bracts without glands abaxially; leaves acutely doubly serrate along margin 21. *C. fargesiana*
- 27b. Leaves and bracts distinctly glandular abaxially; leaves doubly or simply mucronate serrate along margin.
- 28a. Nutlet densely pubescent except villous at apex.
- 29a. Leaves papery, oblong, oblong-lanceolate, ovate-lanceolate, or ovate-elliptic, 5–10 × 2–3.5 cm, lateral veins not impressed adaxially 15. *C. pubescens*
- 29b. Leaves leathery, ovate or elliptic, (2.7–)4–5 × 2–3.5 cm, lateral veins distinctly impressed adaxially 16. *C. firmifolia*
- 28b. Nutlet glabrous except sparsely villous at apex.
- 30a. Leaves doubly serrate along margin.
- 31a. Leaves ovate-lanceolate, ovate-elliptic, or elliptic-lanceolate, 6–10 × 2.5–4.5 cm; petiole gray villous 17. *C. hupeana*
- 31b. Leaves obovate-oblong or oblong, 3.5–7 × 2.5–3.5 cm; petiole densely yellow villous 18. *C. oblongifolia*
- 30b. Leaves simply serrate along margin.
- 32a. Leaves narrowly lanceolate, narrowly elliptic-lanceolate, or oblong-lanceolate, 5–8 × 2–3 cm, margin subincurved serrate, apex acuminate or caudate-acuminate 19. *C. henryana*
- 32b. Leaves ovate, ovate-elliptic, or ovate-lanceolate, margin 2–3.5 × 1–3 cm, mucronate serrate, apex acuminate 20. *C. stipulata*

1. *Carpinus fangiana* Hu, J. Arnold Arbor. 10: 154. 1929.川黔千斤榆 *chuan qian qian jin yu*

Trees to 20 m tall; bark dark gray or gray-brown. Branchlets purple-brown, glabrescent. Petiole glabrous, ca. 1.5 cm; leaf blade ovate-lanceolate or elliptic-lanceolate, 6–27 × 2.5–8 cm, both surfaces glabrous except sparsely villous along midvein and lateral veins, bearded in axils of lateral veins, base cordate, subrounded, or broadly cuneate, margin irregularly and doubly setiform serrate, apex acuminate; lateral veins 24–34 on each side of midvein. Female inflorescence 45–50 × 3–4 cm; peduncle 3–5 cm, densely pubescent and sparsely villous; bracts densely overlapping, obliquely elliptic, 1.8–2.5 × 1–1.2 cm, papery, both surfaces sparsely villous along veins, abaxially bearded at base, outer margin remotely serrate and slightly inflexed, inner margin remotely minutely serrate proximally, with small, inflexed basal lobe covering nutlet, apex acute; veins 5 from base, reticulate veins faint. Nutlet oblong, ca. 3.5 mm, glabrous, faintly ribbed. Fl. May–Jun, fr. Jul–Sep.

• Forests in mountain valleys and on shaded slopes; 900–2000 m. N Guangxi, Guizhou, Sichuan, E Yunnan.

2. *Carpinus rankanensis* Hayata, Icon. Pl. Formosan. 6: 63. 1916.兰邯千斤榆 *lan han qian jin yu*

Trees; bark dark gray. Branchlets brown, glabrous. Petiole 5–10 mm, glabrous; leaf blade oblong, ovate-oblong, or elliptic, 8–10 × 3–4 cm, abaxially villous along midvein and lateral veins, adaxially glabrous except hirtellous along midvein, base cordate, margin irregularly and doubly setiform serrate, apex acuminate or caudate-acuminate; lateral veins 20–25 on each side of midvein. Female inflorescence terminal, 10–12 cm; peduncle 2–3 mm, hirtellous; bracts densely overlapping, ovate-oblong or lanceolate, ca. 13 × 7 mm, abaxially bearded at base, outer margin remotely serrate and inflexed, without basal lobe, inner margin entire or remotely serrate distally, with small, inflexed basal lobe covering nutlet, apex acute or acuminate; veins 3 from base, reticulate veins faint. Nutlet oblong or ovoid, ca. 3.5 mm, with very faint ribs. Fl. May–Jun, fr. Jul–Aug.

• Mixed forests; 1000–2000 m. Taiwan.

- 1a. Bracts ovate-oblong, apex acute; nutlet ovoid 2a. var. *rankanensis*
- 1b. Bracts lanceolate, apex acuminate; nutlet oblong 2b. var. *matsudae*

2a. *Carpinus rankanensis* var. *rankanensis*

兰郎千斤榆(原变种) lan han qian jin yu (yuan bian zhong)

Bracts ovate-oblong, apex acute. Nutlet ovoid.

- Mixed forests; 1000–2000 m. Taiwan.

2b. *Carpinus rankanensis* var. *matsudae* Yamamoto, Suppl. Icon. Pl. Formos. 5: 15. 1932.

细叶兰郎千斤榆 xi ye lan han qian jin yu

Bracts lanceolate, apex acuminate. Nutlet oblong.

- Mixed forests; ca. 1000 m. Taiwan (Gaoxiong Shi).

This variety is not treated as distinct from typical *Carpinus rankanensis* by J. C. Liao in Fl. Taiwan, ed. 2.

3. *Carpinus cordata* Blume, Mus. Bot. 1: 309. 1850.

千斤榆 qian jin yu

Trees to 18 m tall; bark gray or black-gray, scaly fissured. Branchlets brown or yellow-brown, glabrous or sparsely villous when young and glabrescent or densely pubescent and villous. Petiole 1.5–2 cm, glabrescent or sparsely villous to densely pubescent or tomentose; leaf blade ovate, ovate-oblong, or obovate-oblong, 8–15 × 4–5 cm, abaxially sparsely to densely villous along midvein and lateral veins or densely pubescent and tomentose, adaxially sparsely villous or glabrescent, base unequally cordate, margin irregularly and doubly setiform serrate, apex acuminate or caudate-acuminate; lateral veins 15–20 on each side of midvein. Female inflorescence 5–12 × 4–4.5 cm; peduncle 3–4 cm, sparsely pubescent or glabrescent; bracts densely overlapping, broadly ovate-oblong, 1.5–2.5 × 1–1.3 cm, glabrous except abaxially bearded at base, outer margin remotely serrate and inflexed, inner margin remotely serrate distally, with oblong basal lobe enclosing nutlet; veins 5, reticulate veins faint. Nutlet oblong, 4–6 × ca. 2 mm, glabrous, faintly ribbed. Fl. May–Jun, fr. Jul–Aug. $2n = 16$.

Forests on moist mountain slopes; 200–2500 m. Anhui, Gansu, Guizhou, Hebei, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, S Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Zhejiang [Japan, Korea, Russia].

The wood is used for making agricultural tools and furniture.

- 1a. Branchlets, petioles, and rachis of inflorescence glabrous or sparsely villous when young 3a. var. *cordata*
- 1b. Branchlets, petioles, and rachis of inflorescence densely villous.
 - 2a. Leaves sparsely villous along midvein and lateral veins abaxially ... 3b. var. *chinensis*
 - 2b. Leaves densely pubescent and tomentose abaxially 3c. var. *mollis*

3a. *Carpinus cordata* var. *cordata*

千斤榆(原变种) qian jin yu (yuan bian zhong)

Carpinus erosa Blume; *Ostrya mandshurica* Budischtschew ex Trautvetter.

Branchlets, petioles, and rachis of inflorescence glabrous or sparsely villous when young.

Forests on moist mountain slopes; 200–2500 m. SE Gansu, Hebei, Liaoning, Shaanxi, Shandong (Kunyu Shan), Shanxi [Japan, Korea, Russia].

3b. *Carpinus cordata* var. *chinensis* Franchet, J. Bot. (Morot) 13: 202. 1899.

华千斤榆 hua qian jin yu

Carpinus chinensis (Franchet) Pei.

Branchlets, petioles, and rachis of inflorescence densely pubescent and villous. Leaves sparsely villous along midvein and lateral veins abaxially.

• Forests on moist mountain slopes; 700–2400 m. Anhui, SE Gansu, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, SW Shaanxi (Taibai Shan), Sichuan, Zhejiang.

3c. *Carpinus cordata* var. *mollis* (Rehder) W. C. Cheng ex Chun in Y. Chen, Ill. Manual Chin. Trees & Shrubs 163. 1937.

毛叶千斤榆 mao ye qian jin yu

Carpinus mollis Rehder, J. Arnold Arbor. 11: 154. 1930.

Branchlets, petioles, and rachis of inflorescence densely villous. Leaves densely pubescent and tomentose abaxially.

• Forests on moist mountain slopes; 1700–2400 m. Gansu, S Ningxia, Shaanxi (Hua Shan).

4. *Carpinus tientaiensis* W. C. Cheng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 8: 135. 1932.

天台鹅耳枥 tian tai e er li

Carpinus laxiflora Siebold & Zuccarini var. *tientaiensis* (W. C. Cheng) Hu.

Trees 16–20 m tall; bark smooth, gray. Branchlets yellow-brown, pilose, glabrescent in 2nd year. Petiole 0.8–1.5 cm, densely villous in furrow; leaf blade ovate or elliptic, rarely ovate-lanceolate, 5–10 × 3–5.5 cm, subleathery, abaxially bearded in axils of lateral veins, glabrescent except villous along midvein and lateral veins, adaxially glabrous except pilose along midvein, base subcordate or subrounded, margin doubly and obtusely shortly serrate, apex acute, rarely acuminate; lateral veins 12–15 on each side of midvein. Female inflorescence 5–10 cm; peduncle ca. 2.5 cm, densely villous when young; bracts loosely overlapping, 2.5–3 cm × 7–8 mm, sparsely pubescent along veins, 3-lobed, middle lobe subobliquely or straight oblong or lanceolate, outer margin obtusely serrate, with broadly ovate, 1–3-toothed basal lobe, inner margin entire or subundulate, with ovate, entire basal lobe slightly smaller than lobe of outer margin, apex obtuse, rarely acute; veins 5–7, reticulate veins present. Nutlet broadly ovoid or triangular-ovoid, 5–6 × 4.5–5.5 mm, villous at apex, 7–11-ribbed. Fl. Apr–Jun, fr. Jul–Aug.

• Forests on mountain slopes; 800–1000 m. NW Zhejiang (Tianmu Shan).

5. *Carpinus londoniana* H. Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 32. 1904.

短尾鹅耳枥 *duan wei e er li*

Trees 10–13 m tall; bark dark gray or gray-white. Branchlets drooping, black-brown, densely pubescent, filamentous villous. Petiole 4–7 mm, densely pubescent; leaf blade elliptic-lanceolate, oblong-lanceolate, narrowly lanceolate, lanceolate, or oblong, 6–12 × 1.7–3.5(–5) cm, subleathery, abaxially bearded in axils of lateral veins, adaxially glabrous, base rounded-cuneate, cuneate, or subrounded, rarely subcordate or rounded, margin irregularly and doubly mucronate serrate, rarely incised-serrate, apex acuminate, caudate-acuminate, or caudate; lateral veins 11–13 on each side of midvein. Female inflorescence 8–10 mm; peduncle ca. 2.5 cm, densely villous when young, glabrescent; bracts loosely overlapping, 2.5–3 cm × 7–8 mm, glabrous, 3-lobed, middle lobe narrowly oblong, falcate-oblong, lanceolate, or falcate-lanceolate, outer margin entire or undulate-serrate, with ovate, flattened basal lobe 2–3 mm, inner margin entire, with inflexed basal lobe equal to lobe of outer margin, apex obtuse, acute, or subrounded; veins 3–5, reticulate veins present. Nutlet broadly ovoid, 3–4 × 2.5–3.5 mm, with dense, brown, resinous glands and light yellow resin, prominently ribbed. Fl. Apr–Jun, fr. Jul–Sep.

Forests on moist mountain slopes, subtropical forests; 300–1800 m. S Anhui, Fujian, N Guangdong, Guangxi, SE Guizhou, Hainan, Hunan, Jiangxi, SC Sichuan, S Yunnan, Zhejiang [Laos, SE Myanmar, N Thailand, Vietnam].

1a. Leaves oblong, base rounded, apex caudate

..... 5d. var. *latifolius*

1b. Leaves elliptic-lanceolate, oblong-lanceolate, or narrowly lanceolate, base rounded-cuneate, cuneate, rarely subrounded or subcordate, apex acuminate, caudate-acuminate, obtuse, or acute.

2a. Leaves 6–8 × 1.7–2.6 cm; middle lobe of bracts 4–5 mm wide 5c. var. *lanceolata*

2b. Leaves 6–12 × 2.5–3.5 cm; middle lobe of bracts 6–7 mm wide.

3a. Leaves irregularly and doubly mucronate serrate at margin; middle lobe of bracts oblong or falcate-oblong, apex obtuse or acute 5a. var. *londoniana*

3b. Leaves irregularly and doubly incised-serrate at margin; middle lobe of bracts lanceolate or falcate-lanceolate, apex acuminate 5b. var. *xiphobracteata*

5a. *Carpinus londoniana* var. *londoniana*

短尾鹅耳枥(原变种) *duan wei e er li* (*yuan bian zhong*)

Carpinus poilanei A. Camus.

Leaves elliptic-lanceolate, oblong-lanceolate, or narrowly lanceolate, 6–12 × 2.5–3.5 cm, base rounded-cuneate or cuneate, rarely subrounded or subcordate, margin irregularly and doubly mucronate serrate. Middle lobe of bracts oblong or falcate-oblong, apex obtuse or acute.

Forests on moist mountain slopes; 300–1800 m. S Anhui, Fujian, N Guangdong, Guangxi, SE Guizhou, Hunan, Jiangxi, SC Sichuan, S Yunnan, Zhejiang [Laos, SE Myanmar, N Thailand, Vietnam].

5b. *Carpinus londoniana* var. *xiphobracteata* P. C. Li, Acta Phytotax. Sin. 17(1): 87. 1979.

剑苞鹅耳枥 *jian bao e er li*

Leaves oblong-lanceolate or elliptic-lanceolate, 6–12 × 2.5–3 cm, margin irregularly and doubly incised-serrate. Middle lobe of bracts lanceolate or falcate-lanceolate, apex acuminate.

• Forests on moist mountain slopes; ca. 700 m. Zhejiang (Yin Xian).

5c. *Carpinus londoniana* var. *lanceolata* (Handel-Mazzetti) P. C. Li in P. C. Li & S. H. Cheng, Fl. Reipubl. Popularis Sin. 21: 68. 1979.

海南鹅耳枥 *hai nan e er li*

Carpinus lanceolata Handel-Mazzetti, Oesterr. Bot. Z. 80: 22. 1931.

Leaves lanceolate, 6–8 × 1.7–2.6 cm. Middle lobe of bracts 4–5 mm wide.

• Subtropical forests; 600–800 m. Hainan.

5d. *Carpinus londoniana* var. *latifolia* P. C. Li, Acta Phytotax. Sin. 17(1): 87. 1979.

宽叶鹅耳枥 *kuan ye e er li*

Leaves oblong, 6–7 × 4–5 cm, base rounded, apex caudate.

• Forests on moist mountain slopes; ca. 600 m. Zhejiang (Ningbo Xian).

6. *Carpinus viminea* Lindley in Wallich, Pl. Asiat. Rar. 2: 4. 1830.

雷公鹅耳枥 *lei gong e er li*

Trees 10–20 m tall; bark dark gray. Branchlets brown, glabrous. Petiole (1–)1.5–3 cm, glabrous, rarely sparsely pubescent; leaf blade elliptic, oblong, or ovate-lanceolate, 6–11 × 3–5 cm, abaxially sparsely villous along midvein and lateral veins, sometimes bearded in axils of lateral veins, adaxially glabrous, base subcordate, rarely rounded-cuneate or subrounded, margin doubly mucronate serrate or setiform serrate, apex acuminate, acute, or caudate; lateral veins 12–15 on each side of midvein. Female inflorescence 5–15 × 2.5–3 cm; peduncle slender, 1.5–4 cm, sparsely pubescent; bracts semiovate-lanceolate, 1.5–2.5(–3) cm, subglabrous, unequally 3-lobed, middle lobe semiovate-lanceolate or oblong, straight or subfalcate, outer margin coarsely dentate, with ovate, flattened basal lobe ca. 3 mm, inner margin entire, with ovate, inflexed

basal lobe 3–3.5 mm, apex acute or obtuse; veins 4, reticulate veins prominent. Nutlet broadly ovoid, 3–4 × 2.5–3.5 mm, glabrous except villous at apex, sparsely resinous glandular, prominently ribbed. Fl. Apr–Jun, fr. Jul–Sep. $2n = 16$.

Subtropical broad-leaved forests; 400–2000 m. Anhui, Fujian, N Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang [Bhutan, India, Kashmir, Myanmar, Nepal, Sikkim, Thailand, Vietnam].

1a. Leaves regularly or irregularly doubly mucronate serrate, apex acute, acuminate, or caudate 6a. var. *viminea*

1b. Leaves regularly and doubly setiform serrate, apex long caudate .. 6b. var. *chiukiangensis*

6a. *Carpinus viminea* var. *viminea*

雷公鹅耳枥(原变种) lei gong e er li (yuan bian zhong) *Carpinus fargesii* Franchet; *C. laxiflora* (Siebold & Zuccarini) Blume var. *dauidii* Franchet; *C. laxiflora* var. *macrostachya* Oliver ex Hu; *C. tehchingensis* Hu. Leaves regularly or irregularly doubly mucronate serrate, apex acute, acuminate, or caudate.

Subtropical broad-leaved forests; 400–900 m. Anhui, Fujian, N Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Xizang, Yunnan, Zhejiang [Bhutan, India, Kashmir, Myanmar, Nepal, Sikkim, Thailand, Vietnam].

6b. *Carpinus viminea* var. *chiukiangensis* Hu, Acta Phytotax. Sin. 9: 282. 1964.

贡山鹅耳枥 gong shan e er li
Leaves regularly and doubly setiform serrate, apex long caudate.

• Subtropical broad-leaved forests in valleys; ca. 2000 m. SE Xizang, NW Yunnan.

7. *Carpinus putoensis* W. C. Cheng, Contr. Biol. Lab. Chin. Assoc. Advancem. Sci., Sect. Bot. 8: 72. 1932.

普陀鹅耳枥 pu tuo e er li

Trees to 15 m tall; bark brown-gray. Branchlets brown, sparsely villous. Petiole 5–10 mm, sparsely pubescent; leaf blade elliptic or broadly elliptic, 5–10 × 3.5–5 cm, abaxially sparsely pubescent especially along midvein and lateral veins, bearded in axils of lateral veins, adaxially sparsely villous when young, base rounded or broadly cuneate, margin irregularly and doubly setiform serrate, apex acute or acuminate; lateral veins 11–14 on each side of midvein. Female inflorescence 3–8 × 4–5 cm; peduncle 1.5–3 cm, sparsely villous or glabrescent; bracts semiovalate, 2.8–3 cm × ca. 8 mm, middle lobe semiovalate, outer margin irregularly remotely serrate, without basal lobe, inner margin entire or subundulate, with ovate, inflexed basal lobe, apex rounded or obtuse; veins 3–5, reticulate veins prominent. Nutlet broadly ovoid, ca. 6 × 4 mm, glabrous, except villous at apex, sometimes with sparse glands, prominently ribbed. Fl. May–Jun, fr. Jul–Sep.

• Subtropical broad-leaved forests; 200–300 m. Zhejiang (Zhoushan Dao).

An endangered species, with only one individual known in the wild.

8. *Carpinus kweichowensis* Hu, Sinensia 2: 79. 1931.

贵州鹅耳枥 gui zhou e er li

Carpinus austroyunnanensis Hu.

Trees to 28 m tall; bark gray, smooth. Branchlets gray-brown, densely villous when young, glabrescent. Petiole 1.2–1.5 cm, densely yellow villous; leaf blade elliptic, narrowly elliptic, oblong, or narrowly oblong, 8–12 × 3.5–5.5 cm, abaxially sparsely pubescent along veins, bearded in axils of lateral veins, adaxially densely pubescent along midvein when young, base subrounded, rarely rounded-cuneate or subcordate, margin irregularly and doubly minutely serrate, apex acuminate or acute; lateral veins 10–16 on each side of midvein. Female inflorescence 8–15 × ca. 5 cm; peduncle ca. 2 cm, densely yellow villous; bracts semi-ovate-oblong or falcate-oblong, 2.8–3 × 0.9–1 cm, sparsely villous, outer margin remotely serrate, without basal lobe, inner margin entire, with ovate, flattened basal lobe ca. 3 mm; veins 3–5, reticulate veins prominent. Nutlet broadly ovoid, ca. 6 × 5 mm, densely pubescent, villous at apex, 8- or 9-ribbed. Fl. May–Jun, fr. Jul–Sep.

• Subtropical broad-leaved forests; 1100–1200 m. SW Guizhou (Zhenfeng Xian), SE Yunnan.

9. *Carpinus turczaninowii* Hance, J. Linn. Soc., Bot. 10: 203. 1869.

鹅耳枥 e er li

Carpinus chowii Hu; *C. tuczaninowii* var.

chungnanensis P. C. Kuo.

Trees 10–15 m tall; bark dark gray. Branchlets gray-brown, slender, pubescent when young, glabrescent. Petiole 4–10 mm, sparsely pubescent; leaf blade ovate, broadly ovate, ovate-elliptic, or ovate-rhombic, rarely ovate-lanceolate, 2–6 × 1.3–4 cm, abaxially sparsely villous along veins, bearded in axils of lateral veins, adaxially glabrous or sparsely villous along midvein, base subrounded or broadly cuneate, rarely subcordate or cuneate, margin regularly or irregularly doubly serrate, rarely simply serrate, apex acute or acuminate; lateral veins 8–12 on each side of midvein. Female inflorescence 3–6 cm; bracts semiovalate, semioblong, or broadly semiovalate, 6–20 × 4–10 mm, sparsely pubescent, outer margin irregularly incised-dentate, sometimes lobulate, without basal lobe, inner margin entire or remotely minutely dentate, with ovate, inflexed basal lobe 2–3 mm, apex acute, acuminate, or obtuse; veins 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 3 × 2 mm, glabrous except sparsely villous at apex, resinous glandular, prominently ribbed. Fl. May–Jul, fr. Jul–Sep.

Temperate forests; 500–2400 m. Beijing Shi (Jinshan), S Gansu, Henan, Jiangsu, S Liaoning, Shaanxi, Shandong [Japan, Korea].

The wood is very hard, dense, close grained, and fine textured, and is used for making agricultural tools and furniture.

10. *Carpinus kawakamii* Hayata, Icon. Pl. Formosan. 3: 175. 1913.

阿里山鹅耳枥 a li shan e er li

Carpinus hogoensis Hayata; *C. sekii* Yamamoto. Trees; bark dark gray. Branchlets brown, glabrous or sparsely pubescent. Petiole 0.8–1.5 cm, sparsely pubescent; leaf blade ovate-lanceolate or oblong-lanceolate, 4–5 × 1.8–2.5 cm, abaxially sparsely villous along veins, adaxially sparsely pubescent when young, glabrescent, base subrounded or subcordate, sometimes unequal, margin regularly and doubly serrate, sometimes simply serrate distally, apex acuminate or caudate-acuminate; lateral veins 10–15 on each side of midvein. Female inflorescence 4–6 × 2–2.5 cm; peduncle ca. 1 cm, densely pubescent; bracts semiovate, 1.8–2 cm, densely pubescent adaxially, outer margin irregularly coarsely dentate, without basal lobe, inner margin subfalcate or straight, entire, with ovate, inflexed basal lobe ca. 3 mm, apex acuminate; veins 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 3 mm, sparsely resinous glandular, densely villous at apex, 6-ribbed. Fl. May–Jan, fr. Jul–Aug.

• Sunny places within subtropical forests; 500–2000 m. Fujian (Liancheng Xian), Taiwan (Alishan).

11. *Carpinus tsaiiana* Hu, Bull. Fan Mem. Inst. Biol., n.s., 1: 141. 1948.

宽苞鹅耳枥 *kuan bao e er li*

Carpinus sichouensis Hu.

Trees to 30 m tall; bark gray, dissected. Branchlets purplish red, glabrescent. Petiole ca. 1.5 cm, glabrous or sparsely villous; leaf blade elliptic, oblong, oblong-lanceolate, or ovate-lanceolate, 7–14 × 4.5–6 cm, abaxially sparsely villous along veins, bearded in axils of lateral veins, adaxially glabrous, densely glandular punctate, base cordate or obliquely cordate, margin irregularly and doubly minutely serrate, apex acuminate; lateral veins 14–16 on each side of midvein. Female inflorescence 10–14 cm; peduncle ca. 3 cm, glabrous; bracts broadly semiovate, 2.5–3 × 1.5–1.8 cm, sparsely villous, outer margin coarsely dentate-lobulate, without basal lobe, inner margin entire or remotely minutely serrate, with inflexed basal auricle, apex acute or acuminate; veins 5, reticulate veins obvious. Nutlet triangular-ovoid or broadly ovoid, 5–6 mm, densely pubescent, densely villous at apex, orange resinous glandular, prominently ribbed. Fl. May–Jun, fr. Jul–Sep.

• Subtropical forests; 1200–1500 m. SW Guizhou, SE Yunnan (Pingbian Miaozu Zizhixian).

12. *Carpinus chuniana* Hu, J. Arnold Arbor. 13: 334. 1932.

粤北鹅耳枥 *yue bei e er li*

Trees to 10 m tall; bark black-gray. Branchlets purplish brown, densely yellow villous when young, glabrescent. Petiole robust, 6–12 mm, densely yellow villous; leaf blade elliptic, oblong, or obovate-oblong, 7–11 × 5–5.5 cm, abaxially villous along veins, bearded in axils of lateral veins, adaxially densely villous along midvein when young, densely glandular punctate, base cordate, sometimes unequal, margin regularly or irregularly doubly minutely serrate, apex acute or acuminate;

lateral veins 14–18 on each side of midvein. Female inflorescence 5–11 × ca. 2.5 cm; peduncle 1.5–2.5 cm, densely hirsute and pubescent; bracts broadly semiovate, 2–2.5 × ca. 1.3 cm, both surfaces densely villous along veins, outer margin irregularly dentate, without basal lobe, inner margin entire or remotely minutely serrate, with inflexed basal auricle, apex acute; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4 × 3 mm, densely pubescent, sparsely brown resinous glandular, apex villous. Fl. May–Jun, fr. Jul–Aug.

• Subtropical forests on limestone mountain slopes or in valleys. N Guangdong (Lechang Xian), Guizhou (Fanjing Shan), SE Hubei.

13. *Carpinus minutiserrata* Hayata, Icon. Pl. Formosan. 3: 177. 1913.

细齿鹅耳枥 *xi chi e er li*

Trees; bark dark gray. Branchlets purplish brown, glabrous. Petiole ca. 7 mm, glabrous or sparsely villous; leaf blade elliptic-lanceolate, oblong, or ovate-elliptic, 6–11 × ca. 2.5 cm, abaxially villous along veins, adaxially sparsely villous along midvein, base subcordate or subrounded, sometimes unequal, margin doubly and densely minutely serrate, apex acuminate; lateral veins 15–17 on each side of midvein. Female inflorescence 3–4 cm; peduncle ca. 1.5 cm, sparsely pubescent; bracts semiovate, 1.3–1.4 cm × 6–7 mm, villous along veins, outer margin irregularly dentate, without basal lobe, inner margin entire or simply or doubly dentate, with inflexed basal auricle, apex acute; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 3 × 2 mm, glabrous except sparsely villous at apex, resinous glandular, 10-ribbed. Fl. May–Jun, fr. Jul–Sep.

• Forests on mountain slopes. Taiwan.

Included in the synonymy of *Carpinus kawakamii* by J. C. Liao in Fl. Taiwan, ed. 2.

14. *Carpinus shensiensis* Hu, Bull. Fan Mem. Inst. Biol., n.s., 1: 145. 1948.

陕西鹅耳枥 *shan xi e er li*

Trees to 15 m tall; bark dark gray. Branchlets purplish brown, densely pubescent when young. Petiole 0.7–1.7 cm, densely pubescent; leaf blade oblong or obovate-oblong, 6–9 × 3–4.5 cm, abaxially sparsely pubescent along veins, bearded in axils of lateral veins, adaxially glabrous, densely glandular punctate, base cordate, rarely subrounded, margin regularly and doubly minutely serrate, apex acuminate or acute; lateral veins 14–16 on each side of midvein. Female inflorescence 7–9 × 4–4.5 cm; peduncle 1.5–3 cm, densely pubescent intermixed with sparse, long hairs; bracts semiovate, 2.5–3 × 1–1.2 cm, villous along veins, outer margin irregularly dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acuminate; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4 × 3 mm, glabrous except villous at apex, with sparse, brown, resinous glands and prominent ribs. Fl. May–Jun, fr. Jul–Aug.

• Temperate broad-leaved forests; 800–1000 m. S Gansu, S Shaanxi (Nanwutai).

15. *Carpinus pubescens* Burkill in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 502. 1899.

云桂鹅耳枥 *yun gui e er li*

Carpinus austrosinensis Hu; *C. kweitingensis* Hu; *C. kweiyangensis* Hu; *C. lancilimba* Hu; *C. marlipoensis* Hu; *C. parva* Hu; *C. pilosinucula* Hu; *C. pinfaensis* Hu; *C. pingpienensis* Hu; *C. seemeniana* Diels; *C. tsiangiana* Hu; *C. tsoongiana* Hu; *C. tungtzeensis* Hu; *C. wangii* Hu & W. C. Cheng.

Trees to 17 m tall; bark brown-gray. Branchlets dark brown, sparsely villous or glabrescent. Petiole 4–15 mm, sparsely pubescent or subglabrous; leaf blade oblong, oblong-lanceolate, ovate-lanceolate, or ovate-elliptic, rarely ovate or elliptic, 5–10 × 2–3.5 cm, abaxially sparsely villous along veins, bearded in axils of lateral veins, adaxially glabrous, base subrounded-cuneate, subrounded, or subcordate, sometimes unequal, margin regularly and doubly minutely serrate, apex acuminate, rarely acute; lateral veins 12–14 on each side of midvein. Female inflorescence 5–7 × 1–2.5 cm; peduncle 2–3 cm, sparsely villous or glabrous; bracts semiovate, rarely broadly semiovate, 1–2.5 cm, sparsely villous along veins, outer margin irregularly dentate, without basal lobe, inner margin entire, straight, or subfalcate, with inflexed basal auricle, apex obtuse or acute; veins 5, reticulate veins prominent. Nutlet broadly ovoid, 3–4 × 2–3 mm, densely pubescent, rarely glabrescent, villous at apex, sparsely resinous glandular, prominently ribbed. Fl. May–Jun, fr. Jul–Sep. Forests in valleys, thickets on mountain summits, on limestone; 450–2000 m. Guizhou, Shaanxi, S Sichuan, E Yunnan (Mile Xian) [N Vietnam].

The shape, size, and pubescence of the leaves and bracts is variable. The plants from Guizhou that were described as separate species by Hu appear to represent variants or abnormal suites of specimens, rather than distinct taxa.

16. *Carpinus firmifolia* (H. Winkler) Hu, Bull. Fan Mem. Inst. Biol., n.s., 1: 144. 1948.

厚叶鹅耳枥 *hou ye e er li*

Carpinus turczaninowii Hance var. *firmifolia* H. Winkler in Engler, Bot. Jahrb. Syst. 50(Suppl.): 505. 1914; *C. pubescens* Burkill var. *bigiehensis* Hu; *C. pubescens* var. *firmifolia* (H. Winkler) Hu ex P. C. Li. Trees to 10 m tall; bark dark gray. Branchlets black-gray, slender, densely yellow-brown villous when young, becoming sparsely pilose. Petiole ca. 5 mm, densely villous; leaf blade ovate, ovate-elliptic, or ovate-oblong, 2.7–5 × 1.5–2(–3.5) cm, leathery, abaxially sericeous-villous along veins, bearded in axils of lateral veins, adaxially villous along midvein, base subcordate or subrounded, margin regularly and doubly minutely serrate, apex acuminate; lateral veins 11 or 12 on each side of midvein, raised abaxially, impressed adaxially. Female inflorescence 4–5 × 1.5–2 cm; peduncle short, ca. 2 mm, densely villous; bracts

semiovate, 1.4–1.6 cm × 5–6 mm, sparsely villous, outer margin irregularly dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acute; veins 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4 × 3 mm, glabrous except sparsely villous at apex, prominently ribbed. Fl. May–Jul, fr. Jul–Sep.

• Forests on limestone mountain slopes; 1500–1600 m. C Guizhou (Guiyang Shi).

17. *Carpinus hupeana* Hu, Sunyatsenia 1: 118. 1933.

湖北鹅耳枥 *hu bei e er li*

Carpinus funiushanensis P. C. Kuo; *C. huana* W. C. Cheng; *C. longipes* Hu.

Trees to 18 m tall; bark gray. Branchlets dark purplish, glabrous. Petiole short, 0.7–1.5 cm, densely or sparsely villous; leaf blade ovate-lanceolate, ovate-elliptic, or narrowly elliptic, 6–10 × 2.4–4.5 cm, abaxially glandular punctate, sericeous-villous along veins, bearded in axils of lateral veins, adaxially sparsely villous, base rounded or subcordate, margin doubly dentate-serrate, apex acute or acuminate, sometimes subobtuse; lateral veins (11–)13–16 on each side of midvein. Female inflorescence 6–11 × 2–3 cm; peduncle 1.5–2 cm, densely villous; bracts semiovate, 1–1.6 cm × 7–10 mm, sparsely villous along reticulate veins, outer margin remotely serrate-dentate or incised-serrate, without basal lobe, inner margin entire, with inflexed basal auricle, apex obtuse or acute; veins 5. Nutlet broadly ovoid, ca. 5 × 4 mm, glabrous except villous at apex, prominently ribbed. Fl. May–Jun, fr. Jul–Aug.

• Subtropical forests; 700–1800 m. Anhui, S Henan, W Hubei, N Hunan, Jiangxi, Shaanxi, Zhejiang.

This species may easily be confused with *Carpinus fargesiana*, *C. pubescens*, and *C. turczaninowii*. However, it differs from *C. fargesiana* and *C. turczaninowii* in its larger leaves, from *C. pubescens* in its glabrous nutlet, and from all three species in its glandular-dotted abaxial leaf surface.

18. *Carpinus oblongifolia* (Hu) Hu & W. C. Cheng, Bull. Fan Mem. Inst. Biol., n.s., 1: 146. 1948.

宝华鹅耳枥 *bao hua e er li*

Carpinus turczaninowii Hance var. *oblongifolia* Hu, Sunyatsenia 1: 115. 1933.

Trees to 12 m tall; bark brown-gray. Branchlets dark purplish, densely yellow villous when young, glabrescent. Petiole 1–1.5 cm, slender, densely yellow villous; leaf blade obovate-oblong, 3.5–7 × 2.5–3.5 cm, adaxially sparsely villous especially along midvein, abaxially villous along veins, glandular punctate elsewhere, bearded in axils of lateral veins, base rounded or subcordate, margin irregularly and doubly serrate, apex acute or obtuse; lateral veins 12–14 on each side of midvein. Female inflorescence 6.5–7.5 × 2–2.5 cm; peduncle ca. 1.5 cm, densely yellow villous; bracts semiovate, 1–1.5 cm × 6–8 mm, sparsely villous along reticulate veins, outer margin irregularly and

obtusely serrate, without basal lobe, inner margin entire or remotely and obscurely serrate, with inflexed basal auricle, apex obtuse or acute; veins 4 or 5. Nutlet broadly ovoid, ca. 4×3 mm, glabrous except villous at apex, sparsely resinous glandular or not, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Subtropical forests; ca. 400 m. Jiangsu (Baohua Shan, Nanjing Shi).

19. *Carpinus henryana* (H. Winkler) H. Winkler in Engler, Bot. Jahrb. Syst. 50(Suppl.): 507. 1914.

川鄂鹅耳枥 *chuan e e er li*

Carpinus tschonoskii Maximowicz var. *henryana* H. Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 36. 1904; *C. hupeana* Hu var. *henryana* (H. Winkler) P. C. Li.

Trees to 18 m tall; bark gray, fissured. Branchlets purplish brown, sericeous-villous, glabrescent. Petiole 1–1.7 cm, glabrous or sparsely sericeous-villous; leaf blade narrowly lanceolate, elliptic-lanceolate, or oblong-lanceolate, 5–8 \times 2–3 cm, subleathery, abaxially sericeous-villous along veins, glandular punctate elsewhere, bearded in axils of lateral veins, adaxially sparsely sericeous-villous, base rounded or subcordate, sometimes unequal, margin subincurved simply dentate, apex acuminate or caudate-acuminate; lateral veins 14–16 on each side of midvein. Female inflorescence 6–7 \times 2–2.5 cm; peduncle ca. 2 cm, pubescent; bracts semiovalate, villous along reticulate veins, outer margin irregularly and remotely serrate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acute or acuminate; veins 4 or 5. Nutlet ovoid, ca. 4×3 mm, glabrous except sparsely villous at apex, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Temperate forests; 1600–2900 m. E Gansu, W Guizhou, Henan, W Hubei, S Shaanxi, E Sichuan, Yunnan.

20. *Carpinus stipulata* H. Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 35. 1904.

小叶鹅耳枥 *xiao ye e er li*

Carpinus hupeana Hu var. *simplicidentata* (Hu) P. C. Li; *C. simplicidentata* Hu; *C. turczaninowii* Hance var. *stipulata* (H. Winkler) H. Winkler.

Trees to 8 m tall; bark gray. Branchlets dark purplish, glabrous. Petiole ca. 1 cm, sparsely villous; leaf blade ovate, ovate-elliptic, or ovate-lanceolate, 2–3.5 \times 1–3 cm, abaxially sericeous-villous along veins, bearded in axils of lateral veins, adaxially glabrous, base subrounded or subcordate, margin simply mucronate serrate, apex acuminate, rarely acute; lateral veins 11–13 on each side of midvein. Female inflorescence ca. 5 \times 2 cm; peduncle ca. 1 cm, densely villous; bracts broadly semiovalate, ca. 15 \times 3 mm, sparsely villous, outer margin irregularly dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acute; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4×2.5 mm, glabrous except villous at apex, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Temperate forests; 800–2100 m. E Gansu, W Hubei, S Shaanxi.

21. *Carpinus fargesiana* H. Winkler in Engler, Bot. Jahrb. Syst. 50(Suppl.): 507. 1914.

川陕鹅耳枥 *chuan shan e er li*

Trees to 20 m tall; bark gray. Branchlets dark brown, sparsely villous. Petiole slender, 6–10 mm, sparsely villous; leaf blade ovate-lanceolate, ovate-elliptic, elliptic, or oblong, rarely narrowly lanceolate or narrowly oblong, 2.5–7.5(–8) \times 2–2.5 cm, abaxially villous along veins, bearded in axils of lateral veins, adaxially sparsely villous when young, glabrescent, base rounded or subcordate, margin irregularly and doubly mucronate serrate, apex acute or acuminate; lateral veins 12–16 on each side of midvein. Female inflorescence 4–7 \times 2.5–3 cm; peduncle 1–1.5 cm, sparsely villous; bracts semiovalate or broadly semiovalate, 1.3–1.5 cm \times 6–8 mm, villous along reticulate veins, outer margin irregularly dentate-serrate or lobulate-serrate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acuminate; veins 5. Nutlet broadly ovoid, ca. 3×2.5 mm, glabrous except sparsely villous at apex, sometimes sparsely resinous glandular, ribbed. Fl. May–Jun, fr. Jul–Sep.

• Temperate forests in mountain valleys, streambanks; 1000–2600 m. S Gansu, W Henan, W Hubei, S Shaanxi, Sichuan.

1a. Leaves ovate-lanceolate, ovate-elliptic, elliptic,

or oblong, 3.5–7.5 \times 2–2.5 cm 21a. var. *fargesiana*

1b. Leaves narrowly lanceolate or narrowly oblong, 7–8 \times 2–2.2 cm 21b. var. *hwai*

21a. *Carpinus fargesiana* var. *fargesiana*

川陕鹅耳枥(原变种) *chuan shan e er li* (yuan bian zhong)

Carpinus daginensis Hu.

Leaves ovate-lanceolate, ovate-elliptic, elliptic, or oblong, 3.5–7.5 \times 2–2.5 cm.

• Temperate forests in mountain valleys, streambanks; 1000–2600 m. S Gansu, W Henan, W Hubei, S Shaanxi, Sichuan.

21b. *Carpinus fargesiana* var. *hwai* (Hu & W. C. Cheng) P. C. Li, Fl. Reipubl. Popularis Sin. 21: 82. 1979.

狭叶鹅耳枥 *xia ye e er li*

Carpinus hwai Hu & W. C. Cheng, Bull. Fan Mem. Inst. Biol., n.s., 1: 148. 1948.

Leaves narrowly lanceolate or narrowly oblong, 7–8 \times 2–2.2 cm.

• Broad-leaved forests; ca. 1200 m. W Hubei (Lichuan Xian), E Sichuan (Wan Xian).

22. *Carpinus purpurinervis* Hu, Acta Phytotax. Sin. 9: 293. 1964.

紫脉鹅耳枥 *zi mai e er li*

Trees to 5 m tall; bark dark gray. Branchlets purplish brown, glabrous or nearly so. Petiole 5–7 mm, sparsely villous; leaf blade oblong-lanceolate, lanceolate, or narrowly lanceolate, 2–6 \times 1–1.7 cm, abaxially sparsely villous along veins, adaxially glabrous, base subrounded or subcordate, margin irregularly (rarely doubly) mucronate serrate, apex acuminate; lateral

veins 11–13 on each side of midvein, light purplish. Female inflorescence ca. 4×1.5 cm; peduncle ca. 2.5 cm, sparsely pubescent or glabrescent, light purplish; bracts semiovalate, ca. 1.5×7 mm, subglabrous, outer margin irregularly dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acuminate or subobtusate; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4×3 mm, sparsely pubescent except villous at apex, sometimes resinous glandular, ribbed. Fl. May–Jun, fr. Jul–Sep.

• Sparse forests or thickets on limestone; 600–1000 m. Guangxi (Du'an Yaozu Zizhixian), Guizhou (Dushan Xian, Xingyi Xian).

23. *Carpinus hebestroma* Yamamoto, Suppl. Icon. Pl. Formos. 5: 14. 1932.

太鲁阁鹅耳枥 *tai lu ge e er li*

Trees to 8 m tall; bark dark gray. Branchlets purplish brown, slender, pubescent. Petiole slender, 7–10 mm, pubescent; leaf blade lanceolate or ovate-lanceolate, $5-5.5 \times 1.4-1.5(-1.8)$ cm, subglabrous, base subrounded, margin irregularly and simply serrate, apex acuminate; lateral veins 11 or 12 on each side of midvein. Female inflorescence $3-3.5 \times ca. 1.5$ cm; peduncle 1.5–2 cm, pubescent; bracts broadly semiovalate, $7-10 \times ca. 5$ mm, sparsely pubescent along reticulate veins, outer margin incised-dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex obtuse; veins 4 or 5. Nutlet ovoid, ca. 2.5×1.5 mm, densely pubescent, villous at apex, sparsely resinous glandular, ribbed. Fl. May–Jul, fr. Jul–Sep.

• Forests on mountain slopes; 1000–1500 m. E Taiwan (Hualian Xian).

24. *Carpinus microphylla* Z. C. Chen ex Y. S. Wang & J. P. Huang, Guihaia 5: 15. 1985.

田阳鹅耳枥 *tian yang e er li*

Shrubs to 3 m tall; bark gray. Branchlets gray-brown, densely yellow-brown villous. Petiole 1–1.2 cm, densely villous; leaf blade ovate-lanceolate, $0.9-1.3 \times 0.7-1.2$ cm, subleathery, both surfaces villous along midvein, base subrounded, margin irregularly and doubly serrate, apex acuminate; lateral veins 7–11 on each side of midvein, raised abaxially, impressed adaxially. Female inflorescence $2-3.3 \times 1-1.2$ cm; peduncle 0.5–1.5 cm, densely yellow-brown villous; bracts broadly semiovalate, $(0.7-1.1)-1.1-1.3$ cm $\times 4-6$ mm, both surfaces sparsely villous along reticulate veins, outer margin minutely serrate, without basal lobe, inner margin entire or simply or doubly serrate distally, with inflexed basal auricle, apex acute; veins 3 or 4. Nutlet ovoid, ca. 2.5×2 mm, sparsely pubescent, densely villous at apex, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Thickets; ca. 2500 m. W Guangxi (Tianyang Xian).

25. *Carpinus monbeigiana* Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 61: 162. 1924.

云南鹅耳枥 *yun nan e er li*

Carpinus likiangensis Hu; *C. monbeigiana* Handel-Mazzetti var. *weisiensis* Hu.

Trees to 16 m tall; bark gray. Branchlets dark gray-brown, densely pubescent when young, glabrescent. Petiole ca. 1 cm, densely yellow pubescent; leaf blade oblong-lanceolate, ovate-lanceolate, or elliptic-lanceolate, rarely elliptic, $5-10 \times 2.5-4$ cm, abaxially sericeous-villous along veins, glabrous elsewhere, bearded in axils of lateral veins, adaxially densely villous along midvein, base rounded, subcordate, or rounded-cuneate, margin irregularly and doubly setiform mucronate serrate, apex acute, acuminate, or caudate-acuminate; lateral veins 14–18 on each side of midvein. Female inflorescence $5-8 \times 2-2.5$ cm; peduncle 1.5–2 cm, densely yellow hirsute; bracts semiovalate, $1.6-2$ cm $\times 6-8$ mm, abaxially densely yellow hirsute along reticulate veins, outer margin coarsely dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acute or obtuse; veins 5. Nutlet broadly ovoid, $3-4$ mm, sparsely pubescent, villous at apex, densely brown or orange resinous glandular, prominently ribbed. Fl. May–Jun, fr. Jul–Aug.

• Subtropical broad-leaved forests on mountain slopes, sometimes on limestone; 1700–2800 m. Xizang, C and NW Yunnan.

26. *Carpinus tschonoskii* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 27: 534. 1881.

昌化鹅耳枥 *chang hua e er li*

Carpinus falcatisbracteata Hu; *C. mianningensis* Yi; *C. obovatifolia* Hu; *C. paohsingensis* Hu; *C. tschonoskii* var. *falcatisbracteata* (Hu) P. C. Li.

Trees to 25 m tall; bark dark gray. Branchlets brown, sparsely villous when young. Petiole 0.8–1.5 cm, pubescent; leaf blade elliptic, oblong, or ovate-lanceolate, $5-12 \times 2.5-5$ cm, abaxially bearded in axils of lateral veins, both surfaces villous when young, becoming sparsely villous along veins, glabrescent elsewhere, base subrounded or subrounded-cuneate, margin doubly setiform serrate, apex acuminate or caudate-acuminate; lateral veins 14–16 on each side of midvein. Female inflorescence $6-10 \times 3-4$ cm; peduncle 1–4 cm, sparsely villous; bracts $(2.5-3)-3.5(-5) \times 0.8-1.2$ cm, ovate-lanceolate or falcate-lanceolate, adaxially sparsely sericeous-villous along reticulate veins, outer margin remotely dentate, without basal lobe, inner margin entire, straight or falcate, with small, inflexed basal auricle, apex acute or acuminate; veins 4 or 5. Nutlet broadly ovoid, $4-5 \times 3-4$ mm, glabrous except sparsely villous at apex, sometimes resinous glandular, prominently ribbed. Fl. May–Jun, fr. Jul–Aug.

Broad-leaved forests; 1100–2400 m. Anhui, Guangxi, Guizhou, W Henan, Hubei, Hunan, Jiangsu, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan, Korea].

27. *Carpinus polyneura* Franchet, J. Bot. (Morot) 13: 202. 1899.

多脉鹅耳枥 *duo mai e er li*

Carpinus handelii Rehder; *C. turczaninowii* Hance var. *polyneura* (Franchet) H. Winkler.

Trees to 15 m tall; bark gray. Branchlets dark purplish, slender, sparsely white pubescent or not. Petiole 5–10 mm, sparsely pubescent or glabrescent; leaf blade elliptic-lanceolate, oblong-lanceolate, or ovate-lanceolate, rarely elliptic or oblong, 4–8 × 1.5–2.5 cm, abaxially densely villous along veins, bearded in axils of lateral veins, adaxially densely pubescent along midvein, sparsely villous elsewhere when young, base broadly cuneate or subrounded, margin doubly and regularly setiform serrate; lateral veins 16–20 on each side of midvein. Female inflorescence 3–6 × 1–2 cm; peduncle ca. 2 cm, slender, sparsely pubescent; bracts broadly semiovate, 0.8–1.5 cm × 4–6 mm, sparsely villous along reticulate veins, outer margin remotely dentate, without basal lobe, inner margin entire, with small, inflexed basal auricle, apex acute; veins 5. Nutlet broadly ovoid, 2–3 × 1.5–2.5 mm, sparsely pubescent, villous at apex, ribbed. Fl. May–Jun, fr. Jul–Sep.

• Subtropical broad-leaved forests or thickets; 400–2300 m. Fujian, N Guangdong, Guizhou, Hubei, Hunan, Jiangxi, Shaanxi, NE Sichuan (Chengkou Xian), Zhejiang.

28. *Carpinus dayongina* K. W. Liu & Q. Z. Lin, Bull. Bot. Res., Harbin 6(2): 143. 1986.

大庸鹅耳枥 *da yong e er li*

Trees to 4 m tall; bark gray. Branchlets dark purplish, glabrous. Petiole 5–7 mm, pubescent; leaf blade lanceolate or ovate-lanceolate, 2.5–4.5 × 1–1.5 cm, abaxially villous along veins, glabrous elsewhere, adaxially villous when young, base broadly cuneate or subrounded, margin simply setiform serrate, apex long acuminate; lateral veins 18–20 on each side of midvein. Female inflorescence 1.4–2.5 × 1–1.2 cm; peduncle 1.4–2.1 cm, slender, pubescent; bracts semiovate, 5–8 × 3–4 mm, pubescent at base adaxially, outer margin remotely dentate, without basal lobe, inner margin entire, with inflexed basal auricle, apex acute; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, 2–3 × 1.5–2.5 mm, glabrous except sparsely villous at apex, prominently ribbed. Fl. Apr–May, fr. Jun–Aug.

• Subtropical broad-leaved forests; ca. 1100 m. Hunan (Dayong Xian).

29. *Carpinus sungpanensis* W. Y. Hsia, Contr. Inst. Bot. Natl. Acad. Peiping 2: 180. 1934.

松潘鹅耳枥 *song pan e er li*

Carpinus polyneura Franchet var. *sungpanensis* (W. Y. Hsia) P. C. Li.

Trees to 10 m tall; bark gray. Branchlets light brown, densely villous when young. Petiole 0.7–1.5 cm, slender, pubescent; leaf blade ovate or ovate-elliptic, 4–5 × 2–2.2 cm, abaxially villous along veins, adaxially glabrescent, base rounded, rarely subcordate, margin

regularly and doubly setiform serrate, apex acuminate; lateral veins 12–15 on each side of midvein. Female inflorescence 4–6 × 1–3 cm; peduncle 2–2.5 cm, sparsely villous; bracts semiovate, 1–1.8 cm × 5–8 mm, glabrous, outer margin irregularly dentate-serrate, without basal lobe, inner margin entire or remotely minutely serrate distally, with small, inflexed basal auricle, apex acute; veins 4 or 5. Nutlet broadly ovoid, ca. 4 × 3 mm, glabrous except villous at apex, ribbed. Fl. Jun–Jul, fr. Jul–Sep.

• Temperate broad-leaved forests; 2000–2100 m. N Sichuan (Songpan Xian).

30. *Carpinus tsunyahensis* Hu, Acta Phytotax. Sin. 9: 296. 1964.

遵义鹅耳枥 *zun yi e er li*

Carpinus polyneura Franchet var. *tsunyahensis* (Hu) P. C. Li.

Trees to 7 m tall; bark gray. Branchlets brown, densely villous when young. Petiole slender, 4–9 mm, glabrous or sparsely pubescent; leaf blade elliptic or elliptic-oblong, 5–9 × 3.4–4 cm, abaxially densely villous along veins, adaxially glabrous, base rounded or rounded-cuneate, margin irregularly and doubly setiform serrate, apex caudate-acuminate; lateral veins 15 or 16 on each side of midvein. Female inflorescence 4.5–6 × 1–2 cm; peduncle ca. 2 cm, subglabrous; bracts semiovate, 1.2–1.5 cm × 5–7 mm, glabrous or nearly so, apex acute, outer margin remotely dentate, without basal lobe, inner margin entire with small, inflexed basal auricle; veins 4 or 5, reticulate veins prominent. Nutlet broadly ovoid, ca. 4 × 3 mm, glabrous except villous at apex, ribbed. Fl. May–Jul, fr. Jul–Sep.

• Mixed forests; 900–1100 m. Guizhou (Zunyi Shi).

31. *Carpinus mollicoma* Hu, Bull. Fan Mem. Inst. Biol., n.s., 1: 216. 1948.

软毛鹅耳枥 *ruan mao e er li*

Trees to 10 m tall; bark dark gray. Branchlets dark brown, densely light rust-colored villous. Petiole 3–8 mm, densely rust-colored villous; leaf blade oblong-lanceolate or elliptic-lanceolate, 5–6.5 × 2–2.5 cm, abaxially densely white or light rust-colored appressed villous, adaxially villous especially along midvein, base rounded or rounded-cuneate, margin irregularly or rarely doubly recurved setiform serrate, apex acuminate or caudate-acuminate; lateral veins 14–17 on each side of midvein. Female inflorescence 2.5–3 × 1–1.5 cm; peduncle 1–2 cm, densely white or rust-colored villous; bracts semiovate, ca. 1.5 cm × 5 mm, densely soft villous along reticulate veins on both surfaces, apex acuminate, outer margin remotely dentate, without basal lobe, inner margin entire, with small, inflexed basal auricle; veins 4 or 5. Nutlet broadly ovoid, ca. 4 × 3 mm, densely villous, prominently ribbed. Fl. May–Jun, fr. Jul–Sep.

• Mixed forests on mountain slopes, sometimes on limestone; 1400–2900 m. Sichuan (Emei Shan), E Xizang (Bomi Xian), SE Yunnan (Malipo Xian).

32. *Carpinus omeiensis* Hu & Fang in Hu, Acta Phytotax. Sin. 9: 296. 1964.

峨眉鹅耳枥 *e mei e er li*

Trees to 7 m tall; bark gray. Branchlets dark brown, glabrescent. Petiole 5–8 mm, densely light yellow villous; leaf blade elliptic or ovate-elliptic, 6–8 × 2.5–3.5 cm, abaxially appressed villous and bearded in axils of lateral veins, adaxially glabrescent, base rounded or broadly cuneate, margin simply setiform serrate, apex acuminate or caudate-acuminate; lateral veins 12–16 on each side of midvein. Female inflorescence 6–8 × 1.5–2 cm; peduncle 2–3 cm, densely villous, glabrescent; bracts semiovate, 1.5–1.6 cm × 4–5 mm, sparsely villous along reticulate veins, apex acuminate, outer margin remotely dentate, without basal lobe, inner margin entire, with small basal auricle; veins 4 or 5. Nutlet broadly ovoid, ca. 4 × 3 mm, densely pubescent, villous at apex, prominently ribbed. Fl. May–Jun, fr. Jul–Aug.

• Broad-leaved forests; 1000–1900 m. Guizhou (Dejiang Xian), Sichuan (Emei Shan, Junlian Xian).

33. *Carpinus rupestris* A. Camus, Bull. Soc. Bot. France 76: 966. 1929.

岩生鹅耳枥 *yan sheng e er li*

Trees 2–4 m tall; bark dark gray. Branches gray-black, glabrous; branchlets gray, densely white or brown villous. Petiole 1–3 mm, densely white or brown villous; leaf blade lanceolate or oblong-lanceolate, 4–5 × 1.5–2 cm, subleathery, abaxially densely white or brown villous, adaxially glabrous except sparsely villous along midvein, base subrounded or broadly cuneate, margin minutely simply setiform serrate, apex acuminate; lateral veins 14–17 on each side of midvein, raised abaxially, impressed adaxially. Female inflorescence 2–3 × 1–1.2 cm; peduncle ca. 1 cm, densely villous; bracts semiovate or semirounded, 9–10 × 3–5 mm, abaxially pubescent intermixed with long hairs along reticulate veins, adaxially pubescent, outer margin remotely minutely serrate, without basal lobe, inner margin entire, with small, inflexed basal auricle, apex acuminate; veins 5. Nutlet ovoid, ca. 3 mm, densely villous, ribbed. Fl. May–Jun, fr. Jun–Aug.

• Thickets on stony hills; 1100–1700 m. W Guangxi, SW Guizhou (Xingyi Xian), SE Yunnan.

4. *OSTRYA* Scopoli, Fl. Carniol. 414. 1760, nom. cons.

铁木属 *tie mu shu*

Trees deciduous; bark scaly, rough. Buds ovoid, with many overlapping scales. Leaves irregularly and doubly serrate, sometimes lobulate. Male inflorescence pendulous, clustered at apex of branchlets, slender, naked during winter; bracts overlapping, each subtending 1 flower; perianth absent; stamens 3–14; filaments 2-cleft at apex, inserted at base of bracts; anthers each with 2 separate locules, pubescent at apex. Female inflorescence terminal, racemose; flowers paired; bracts overlapping, saccate, inflated, membranous, with reticulate veins and rigid hairs at base, usually lobed at apex; calyx adnate to ovary. Nutlet narrowly oblong, narrowly ovoid, ovoid-ellipsoid, or obovoid, ribbed, completely enclosed in bracts.

About 8 species: China, Japan, Korea; Europe, North America; five species (four endemic) in China.

- 1a. Bracts narrowly elliptic or obovate-lanceolate, (20–)25–26 mm, constricted into a stipe at base; female inflorescence loosely racemose 1. *O. rehderiana*
- 1b. Bracts elliptic, ovate-oblong, or obovate-oblong, 1.5–2.5 mm, not constricted into a stipe at base; female inflorescence densely racemose.
 - 2a. Leaves with 10–15 lateral veins 5–10 mm apart on each side of midvein 2. *O. japonica*
 - 2b. Leaves with 14–25 lateral veins 3–5 mm apart on each side of midvein.
 - 3a. Leaves ovate, acuminate at apex, with 14–20 lateral veins on each side of midvein; bracts elliptic, 1.5–2.4 cm; nutlet obovoid, densely pubescent 3. *O. trichocarpa*
 - 3b. Leaves ovate-lanceolate or oblong-lanceolate, caudate or caudate-acuminate at apex, with 18–25 lateral veins on each side of midvein; bracts narrowly elliptic or ovate-oblong, 1.5–2 cm; nutlet ovoid-ellipsoid, glabrous.
 - 4a. Leaves densely pubescent adaxially, cordate, subrounded, or rarely broadly cuneate at base, lateral veins 18–25 on each side of midvein; bracts narrowly elliptic, 10–15 × 5–6 mm 4. *O. multinervis*
 - 4b. Leaves sparsely pilose adaxially, broadly cuneate or rarely subrounded at base, lateral veins 18–20 on each side of midvein; bracts ovate-elliptic, 15–20 × 7–9 mm 5. *O. yunnanensis*

1. *Ostrya rehderiana* Chun, J. Arnold Arbor. 8: 19. 1927.

天目铁木 *tian mu tie mu*

Trees to 15 m tall; bark gray, rough. Branchlets brown-gray, slender, sericeous-pubescent when young, becoming glabrous and intensely purplish. Petiole 3–5

mm, densely pubescent; leaf blade elliptic-oblong or narrowly oblong, 3–10 × 1.8–4 cm, abaxially sparsely pubescent and hirtellous, densely pubescent along midvein, adaxially glabrous except pubescent along midvein, base subrounded or broadly cuneate, margin irregularly and doubly sharply serrate, sometimes setiform serrate, apex acuminate or caudate-acuminate; lateral veins 13–16 on each side of midvein, 4–7 mm apart. Female inflorescence loosely racemose, 2–3 cm; peduncle 1.5–2 cm, densely pubescent, bracts obovate-elliptic or obovate-lanceolate, saccate, 2–2.6 cm × 6–8 mm, membranous, minutely pubescent along veins and reticulate veins, base constricted into a stipe, setose, apex rounded, apiculate. Nutlet red-brown, narrowly oblong, 7–10 × 2.5–3 mm, shiny, glabrous, obscurely ribbed. Fl. May–Jun, fr. Jul–Aug.

• Subtropical forests; 200–400 m. NW Zhejiang (Tianmu Shan). This species is endangered; only one tree is known at a roadside.

2. *Ostrya japonica* Sargent, Garden and Forest 6: 383. 1893.
铁木 tie mu

Ostrya liana Hu.

Trees to 20 m tall; bark dark gray. Branchlets gray-brown, densely pubescent when young, glabrescent. Petiole 1–1.5 cm, densely pubescent; leaf blade ovate or ovate-lanceolate, 3.5–12 × 1.5–5.5 cm, abaxially densely pubescent, glabrescent, bearded in axils of lateral veins, adaxially pilose especially along midvein, base subrounded, cordate, obliquely cordate, or broadly cuneate, margin irregularly and doubly serrate, apex acuminate; lateral veins 10–15 on each side of midvein, 5–10 mm apart. Female inflorescence racemose, 1.5–2.5 cm; peduncle 2–2.5 cm, densely pubescent; bracts overlapping, saccate, obovate-oblong or elliptic, 1–2 cm × 6–12 mm, membranous, glabrescent, base without a stipe, setose, apex apiculate; veins reticulate. Nutlet light brown, narrowly ovoid, 6–7 mm, shiny, glabrous, ribbed. Fl. May–Jul, fr. Jul–Sep.

Temperate forests; 1000–2800 m. S Gansu, Hebei, Henan, Hubei, Shaanxi, Sichuan [Japan, Korea].

The wood is hard and shiny, and is used in construction and making furniture.

3. *Ostrya trichocarpa* D. Fang & Y. S. Wang, Guihaia 3: 189. 1983.

毛果铁木 mao guo tie mu

Trees to 18 m tall; bark gray-brown. Branchlets purplish brown, densely yellow pilose when young. Petiole 3–5 mm, densely brown-yellow pilose; leaf blade ovate or ovate-elliptic, 5–10.5 × 2.5–5 cm, abaxially gray-green, densely pubescent, adaxially sparsely pilose or glabrous, base subobliquely cordate, margin irregularly and doubly setiform serrate, apex acuminate; lateral veins 14–20 on each side of midvein,

ca. 5 mm apart. Female inflorescence densely racemose, 4.5–8 × 2–3 cm; peduncle densely yellow-brown pilose; bracts elliptic, saccate, 1.5–2.4 × 1–1.5 cm, membranous, sparsely pubescent, base rounded, setose, apex acute; veins reticulate. Nutlet light brown, obovoid, 5.5–9 × 2.5–3.5 mm, densely pubescent, obscurely ribbed; persistent perianth more than 1.5–5 mm as long as nutlet, densely pubescent, toothed at apex. Fl. Apr–May, fr. Jun–Aug.

• Subtropical forests on limestone mountains; 800–1300 m. SW Guangxi.

4. *Ostrya multinervis* Rehder, J. Arnold Arbor. 19: 71. 1938.
多脉铁木 duo mai tie mu

Trees to 25 m tall; bark dark gray-brown, fissured. Branchlets purplish brown, sparsely appressed pilose. Petiole 4–7 mm, densely appressed pilose; leaf blade ovate-lanceolate or oblong-lanceolate, 4.5–12 × 2.5–4.5 cm, papery, abaxially densely pubescent, bearded in axils of lateral veins, adaxially sparsely pilose or glabrous except densely pubescent along midvein, base subcordate, subrounded, or broadly cuneate, margin irregularly and sharply setiform serrate, apex caudate or caudate-acuminate; lateral veins 18–25 on each side of midvein, 3–4 mm apart. Female inflorescence erect, racemose, 3–6 cm; peduncle 1.5–2.5 cm, sparsely appressed pilose; bracts narrowly elliptic, saccate, 1–1.5 cm × 5–6 mm, membranous, sparsely appressed pilose, base rounded, setose, apex acute; veins reticulate. Nutlet light brown, ovoid-ellipsoid, 5–7 × 2–3 mm, glabrous except villous at apex, ribbed. Fl. May–Jun, fr. Jul–Aug.

• Mixed forests; 600–1300 m. Guizhou, S Hunan (Xinning Xian: Junyun Shan), Jiangsu, SE Sichuan, Zhejiang.

5. *Ostrya yunnanensis* Hu ex P. C. Li, Acta Phytotax. Sin. 17(1): 87. 1979.

云南铁木 yun nan tie mu

Trees to 20 m tall; bark dark gray. Branchlets purplish brown, striate, densely pubescent, glabrescent. Petiole 5–10 mm, densely yellow tomentose; leaf blade lanceolate or oblong-lanceolate, 5–10 × 2–2.5 cm, abaxially densely yellow tomentose, bearded in axils of lateral veins, adaxially sparsely pilose, base cuneate, rarely subrounded, margin doubly mucronate serrate, apex caudate-acuminate; lateral veins 18–20 on each side of midvein, 4–5 mm apart. Female inflorescence erect, densely racemose, 4–6 cm; peduncle ca. 2 cm, densely yellow tomentose; bracts ovate-elliptic, saccate, 1.5–2 cm × 7–9 mm, membranous, appressed pilose, base rounded, setose, apex acute, mucronate; veins reticulate. Nutlet light brown, ovoid-ellipsoid, 6–7 × ca. 3 mm, glabrous except villous at apex, ribbed. Fl. Jun–Jul, fr. Jul–Aug.

• Moist forests; ca. 2600 m. NW Yunnan (Luquan Xian).

5. **ALNUS** Miller, Gard. Dict., Abr. ed. 4, 1: [51]. 1754.

槲木属 qi mu shu

Trees or shrubs deciduous. Buds stalked with 2(or 3) scales or sessile with several overlapping scales. Leaves usually serrate or dentate, rarely incised or entire. Male inflorescence elongate, pendulous, cylindrical, with numerous overlapping bracts, each bract subtending (3 or)4(or 5) bracteoles and 3 flowers; calyx 4-lobed; stamens (1–)4; anthers 2-loculed, thecae connate, apex glabrous. Female inflorescence 1, or 2–numerous in a raceme or panicle, ovoid or ellipsoid, conelike; bracts numerous, overlapping, woody, persistent, apex 5-lobulate, each bract subtending 2 flowers. Nutlets 2 in each bract axil, compressed, with membranous or papery wings. Fl. mainly spring, *Alnus formosana* and *A. nepalensis* autumn.

About 40 species: Bangladesh, Bhutan, China, India, Japan, Korea, Nepal, Sikkim; Europe, North and South America; ten species (five endemic) in China.

Three or more divergent subgroups (subgenera) of *Alnus* are often treated as separate genera (J. J. Furlow, J. Arnold Arbor. 71: 1–67. 1990).

Various *Alnus* species are grown to protect dikes, some are valued for timber, and the roots have nodules with nitrogen-fixing bacteria.

1a. Female inflorescence 1.

2a. Nutlet with papery wings, 1/4–1/3 as wide as nutlet; peduncle usually erect, 1–3 cm 1 *A. ferdinandi-coburgii*

2b. Nutlet with membranous wings, ca. 1/2 as wide as nutlet; peduncle slender, pendulous, 3–8 cm.

3a. Branchlets, petioles, peduncles, and leaves sparsely white pubescent abaxially when young 2. *A. cremastogyne*

3b. Branchlets, petioles, peduncles, and leaves densely yellow-brown tomentose abaxially,

especially

when young 3. *A. lanata*

1b. Female inflorescences 2–numerous, in a raceme or panicle.

4a. Female inflorescences in a panicle.

5a. Female inflorescences numerous; nutlet with membranous wings; leaves entire or remotely minutely serrate 4. *A. nepalensis*

5b. Female inflorescences 5–13; nutlet with papery wings; leaves remotely serrate 5. *A. henryi*

4b. Female inflorescences in a raceme.

6a. Buds sessile, with 3–6 scales; peduncle long 6. *A. mandshurica*

6b. Buds stipitate, with 2 scales; peduncle very short.

7a. Leaves suborbicular, brownish pubescent abaxially, margin undulate-incised 7. *A. hirsuta*

7b. Leaves oblong, obovate-oblong, ovate-elliptic, or ovate-lanceolate, glabrous or sparsely pubescent on both surfaces when young, margin minutely serrate.

8a. Peduncle of female inflorescence 3–5 mm 8. *A. formosana*

8b. Peduncle of female inflorescence 10–20 mm.

9a. Leaves obovate, obovate-elliptic, or obovate-lanceolate, base cuneate 9. *A. japonica*

9b. Leaves obovate-oblong, oblanceolate-oblong, or oblong, base subrounded, subcordate,

or

broadly cuneate 10. *A. trabeculosa*

1. *Alnus ferdinandi-coburgii* C. K. Schneider, Bot. Gaz. 64: 147. 1917.

川滇槲木 chuan dian qi mu

Trees to 20 m tall; bark dark gray, smooth. Branches dark gray or gray-brown; branchlets red-brown, densely pubescent when young, glabrescent. Buds stipitate, with 2 glabrous scales. Petiole 1–2 cm, densely yellow pubescent; leaf blade ovate, ovate-elliptic, or obovate-oblong, rarely lanceolate, 5–16 × 3–7 cm, both surfaces yellow pubescent along veins, abaxially bearded in axils of lateral veins, base subrounded or cuneate, margin obscurely and remotely minutely serrate or subentire, apex abruptly acute; lateral veins 12–17 on each side of midvein. Female inflorescence 1, globose or oblong, 1.5–3 × 1–1.5 cm; peduncle erect, robust, 1.5–3 cm;

bracts woody, 3–4 mm, base cuneate, apex rounded, 5-lobed. Nutlet narrowly elliptic, ca. 3 mm, with papery wings ca. 1/3 as wide as nutlet. Fl. May–Jul, fr. Aug–Sep.

• Forests on mountain slopes, streamsides; 1500–3000 m. Guizhou, SW Sichuan, Yunnan.

2. *Alnus cremastogyne* Burkill in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 499. 1899.

槲木 qi mu

Trees to 40 m tall; bark gray, smooth. Branchlets gray or gray-brown, glabrous. Buds stipitate, with 2 scales, glabrous. Petiole 1–2 cm, glabrous, sometimes light yellow pubescent when young; leaf blade obovate, obovate-oblong, oblong, or oblanceolate, 4–14 × 3.5–8 cm, abaxially densely glandular, subglabrous, bearded in axils of lateral veins, adaxially sparsely glandular,

villous when young, glabrescent, base cuneate or subrounded, margin obscurely and remotely obtusely serrate, apex abruptly acute; lateral veins 8–10 on each side of midvein. Female inflorescence 1, axillary, oblong, 1–3.5 × 0.5–2 cm; peduncle pendulous, slender, 4–8 cm, glabrous, sometimes pubescent when young. Nutlet ovate, ca. 3 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. May–Jul, fr. Aug–Sep.

• Forests on mountain slopes or along streambanks; 500–3000 m. SE Gansu, N Guizhou, S Shaanxi, Sichuan, Zhejiang; cultivated in Jiangsu.

3. *Alnus lanata* Duthie ex Bean, Bull. Misc. Inform. Kew 1913: 164. 1913.

毛栲木 mao qi mu

Trees to 20 m tall; bark yellow-gray, smooth. Branchlets gray-brown or purplish brown, striate, densely yellow-brown tomentose when young. Buds stipitate; stipe densely yellow-brown tomentose; scales 2, sparsely pubescent. Petiole 1–2 cm, densely yellow-brown tomentose when young, becoming sparsely pubescent in furrow; leaf blade obovate-oblong or oblong, 5–14 × 3–8 cm, abaxially densely yellow-brown tomentose, with dense, resinous glands, adaxially sparsely villous, base subrounded, rarely broadly cuneate, margin irregularly minutely serrate, apex abruptly acute; lateral veins 10–13 on each side of midvein. Female inflorescence 1, oblong, 1.5–4 × 0.8–2 cm; peduncle slender, densely yellow-brown tomentose when young; bracts 3–5 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet ovate-elliptic, ca. 3 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. May–Jul, fr. Aug–Sep.

• Streamsides in forests; 1600–2300 m. W Sichuan (Kangding Xian, Luding Xian).

4. *Alnus nepalensis* D. Don, Prodr. Fl. Nepal. 58. 1825.

尼泊尔栲木 ni po er qi mu

Alnus boshia Buchanan-Hamilton ex D. Don;
Clethropsis nepalensis (D. Don) Spach.

Trees to 15 m tall; bark gray or dark gray, smooth. Branchlets dark brown, sparsely yellow pubescent when young, glabrescent. Buds stipitate, with 2 glabrous, ribbed scales. Petiole robust, 1–2.5 cm, subglabrous; leaf blade obovate-lanceolate, obovate-oblong, ovate, or elliptic, 4–16 × 2.5–10 cm, abaxially with dense, resinous glands, yellow pubescent along veins, bearded in axils of lateral veins, adaxially glabrous, base cuneate or broadly cuneate, rarely subrounded, margin entire or remotely minutely serrate, apex abrupt or acute, rarely acuminate; lateral veins 8–16 on each side of midvein. Female inflorescences numerous, in a panicle, ellipsoid, 2–2.2 cm × 7–8 mm; peduncle robust, 2–8 mm, glabrous; bracts ca. 4 mm, woody, persistent, base cuneate, apex rounded, 5-lobed.

Nutlet oblong, ca. 2 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. May–Jun, fr. Jul–Sep. $2n = 28, 56$.

Riverbanks or village margins, often forming pure stands; 200–2800 m. Guangxi, Guizhou, SW Sichuan, Xizang, Yunnan [Bangladesh, Bhutan, India, Myanmar, Nepal, Sikkim, N Thailand, N Vietnam].

The wood is light and soft and is used for making inexpensive furniture and boxes.

5. *Alnus henryi* C. K. Schneider in Sargent, Pl. Wilson. 2: 495. 1916.

台北栲木 tai bei qi mu

Trees. Branchlets yellow-green, sparsely pubescent when young. Petiole slender, 1–1.6 cm, pubescent in furrow; leaf blade broadly ovate, ovate, or elliptic, 4–8 × 2.5–5 cm, both surfaces subglabrous, base rounded, rarely rounded-cuneate, margin remotely minutely serrate, apex obtuse or acute; lateral veins 7–9 on each side of midvein. Female inflorescences 5–13 in a panicle, ellipsoid, 1.3–1.5 cm, subsessile; bracts persistent, ca. 4 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet elliptic, with papery wings ca. 1/3 as wide as nutlet. Fl. Jun–Jul, fr. Aug–Sep.

• Taiwan (Tanshui).

Treated by J. C. Liao in Fl. Taiwan, ed. 2 as an uncertain species. A. K. Skvortsov indicates that *Alnus henryi* is very similar to *A. formosana*, and further studies may show that they are conspecific.

6. *Alnus mandshurica* (Callier ex C. K. Schneider) Handel-Mazzetti, Oesterr. Bot. Z. 81: 306. 1932.

东北栲木 dong bei qi mu

Alnus fruticosa Ruprecht var. *mandshurica* Callier ex C. K. Schneider, Ill. Handb. Laubholz. 1: 121. 1904;
Duschekia mandshurica (Callier ex C. K. Schneider) Pouzar.

Shrubs or trees to 10 m tall; bark dark gray, smooth. Branchlets gray-brown, glabrous. Buds sessile, with 3–6 scales. Petiole robust, 0.5–2 cm, glabrous or sparsely pubescent, sometimes resinous glandular; leaf blade broadly ovate, ovate, elliptic, or broadly elliptic, 4–10 × 2.5–8 cm, both surfaces glabrous except bearded in axils of lateral veins abaxially, base rounded or subcordate, rarely broadly cuneate or unequal, margin densely minutely doubly or simply serrate, apex acute; lateral veins 7–13 on each side of midvein. Female inflorescences 3–6 in a raceme, oblong or globose, 1–2 cm; peduncles pendulous, 0.5–2(–3) cm, slender, glabrous or sparsely pubescent; bracts 3–4 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet ca. 2 mm, with membranous wings ca. as wide as nutlet. Fl. May–Jul, fr. Jul–Aug.

Temperate forests, streamsides; 200–1900 m. Heilongjiang, Jilin, Liaoning, Nei Mongol [N Korea, Russia (Far East)].

7. *Alnus hirsuta* Turczaninow ex Ruprecht, Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg, sér. 2, 15: 376. 1857.
辽东栎木 *liao dong qi mu*

Alnus hirsuta var. *sibirica* (Fischer ex Turczaninow) C. K. Schneider; *A. incana* (Linnaeus) Moench var. *glauca* Regel; *A. incana* var. *hirsuta* Spach; *Alnus incana* var. *sibirica* Spach; *A. sibirica* Fischer ex Turczaninow; *A. sibirica* var. *hirsuta* (Turczaninow ex Ruprecht) Koidzumi; *A. sibirica* var. *oxyloba* C. K. Schneider; *A. sibirica* var. *paucinervis* C. K. Schneider; *A. tinctoria* Sargent.

Trees to 20 m tall; bark gray-brown, smooth. Branchlets dark gray, angular, densely gray pubescent when young, glabrescent. Buds stipitate, with 2 scales, sparsely pubescent. Petiole 1.5–5.5 cm, densely pubescent; leaf blade suborbicular, rarely broadly ovate, 4–9 × 2.5–9 cm, abaxially light green or glaucescent, densely or sparsely brown hispidulous, rarely subglabrous, sometimes bearded in axils of lateral veins, adaxially dark green, sparsely villous, base rounded or broadly cuneate, rarely cuneate or subcordate, margin undulate-serrate, apex rounded, rarely acute; lateral veins 5–10 on each side of midvein. Female inflorescences 2–8 in a raceme, subglobose or oblong, 1–2 cm; peduncle 2–3 mm; bracts 3–4 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet broadly ovate, ca. 3 mm, with papery wings ca. 1/4 as wide as nutlet. Fl. May–Jul, fr. Jul–Aug.

Temperate forests, along streambanks; 700–1500 m. Heilongjiang, Jilin, Liaoning, Nei Mongol, Shandong [Japan, Korea, Russia (Siberia)].

The wood is hard and dense, and is used for making agricultural tools and furniture.

8. *Alnus formosana* (Burkill) Makino, Bot. Mag. (Tokyo) 26: 390. 1912.

台湾栎木 *tai wan qi mu*

Alnus maritima (Marshall) Nuttall var. *formosana* Burkill in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 500. 1899; *A. japonica* (Thunberg) Steudel var. *formosana* Callier.

Trees to 20 m tall; bark dark gray-brown. Branches purplish brown, glabrous, striate; branchlets sparsely pubescent. Buds stipitate, with 2 glabrous, ribbed scales. Petiole 1.2–2.2 cm, slender, densely pubescent in furrow; leaf blade elliptic or oblong-lanceolate, rarely ovate-oblong, 6–12 × 2–5 cm, abaxially bearded in axils of lateral veins, adaxially subglabrous, base rounded or broadly cuneate, margin irregularly minutely serrate, apex acuminate or acute; lateral veins 6 or 7 on each side of midvein. Female inflorescence 1, or 2–4 in a raceme, ellipsoid, 1–2.5 cm; peduncle 3–5 mm, robust; bracts 3–4 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet obovate, 2–3 mm, with papery

wings 1/4–1/3 as wide as nutlet. Fl. May–Jun, fr. Jul–Sep.

• Riverbanks, forming pure stands, common; near sea level to 2900 m. Taiwan (Tanshui).

9. *Alnus japonica* (Thunberg) Steudel, Nomencl. Bot., ed. 2, 1: 55. 1840.

日本栎木 *ri ben qi mu*

Betula japonica Thunberg, Nov. Act. Soc. Sci. Upsal. 6: 45. 1799; *Alnus japonica* var. *latifolia* Callier; *A. maritima* (Marshall) Nuttall var. *arguta* Regel; *A. maritima* var. *japonica* Regel; *A. reginosa* Nakai.

Trees to 20 m tall; bark gray-brown, smooth. Branches dark gray or gray-brown, striate, glabrous; branchlets brown, glabrous or yellow pubescent when young, sometimes resinous glandular. Buds stipitate, with 2 glabrous, ribbed scales. Petiole 1–3 cm, sparsely resinous glandular and pubescent; leaf blade obovate or obovate-elliptic on dwarf shoots, obovate-lanceolate on branchlets, 4–14 × 2.5–4 cm, abaxially sparsely pubescent at first, glabrescent, sometimes resinous glandular and bearded in axils of lateral veins, adaxially glabrous, base cuneate, margin remotely minutely serrate, apex mucronate, acute, or acuminate; lateral veins 7–11 on each side of midvein. Female inflorescences 2–5 in a raceme, ellipsoid, ca. 2 × 1–1.5 cm; peduncle robust, ca. 1 cm; bracts 3–5 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet obovate, 2–3 mm, with papery wings ca. 1/4 as wide as nutlet. Fl. May–Jul, fr. Jul–Aug.

Temperate forests, streambanks, roadsides; 800–1500 m. Anhui, Hebei, Henan, Jiangsu, Jilin, Liaoning, Shandong, Taiwan [Japan (including Ryukyu Islands), Korea, Russia (Far East)].

10. *Alnus trabeculosa* Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 59: 51. 1922.

江南栎木 *jiang nan qi mu*

Alnus jackii Hu.

Trees to 10 m tall; bark gray or gray-brown, smooth. Branches dark gray-brown, glabrous; branchlets gray-brown, yellow pubescent. Buds stipitate, with 2 glabrous, ribbed scales. Leaves obovate-oblong, oblanceolate-oblong, or oblong, 6–16 × 2.5–7 cm, abaxially resinous glandular, glabrous except bearded in axils of lateral veins, adaxially glabrous, base subrounded, subcordate, or broadly cuneate, margin remotely minutely serrate, apex acute or acuminate to caudate; lateral veins 6–13 on each side of midvein. Female inflorescences 2–4 in a raceme, oblong, 1–2.5 × 1–1.5 cm; peduncle 1–2 cm, glabrous; bracts 5–7 mm, woody, base cuneate, apex rounded, 5-lobed. Nutlet broadly ovate, 3–4 × 2–2.5 mm, with papery wings ca. 1/4 as wide as nutlet. Fl. May–Jun, fr. Jul–Aug.

Forests on mountain valleys, riverbanks; 200–1000 m. Anhui, Fujian, N Guangdong, Guizhou, S Henan, Hubei, E Hunan, Jiangsu, Jiangxi, Zhejiang [Japan].

6. BETULA Linnaeus, Sp. Pl. 2: 982. 1753.

桦木属 hua mu shu

Trees or shrubs deciduous. Buds sessile, with several overlapping scales. Leaves often glandular punctate abaxially, usually serrate or dentate, rarely lobulate. Male inflorescence pendulous, elongate, cylindrical, with numerous overlapping bracts, each bract subtending 2 bracteoles and 3 flowers; calyx 4-lobed; stamens 2; anthers 2-loculed; thecae connate, apex pubescent or glabrous. Female inflorescence 1, or 2–several in a raceme, spicate, ellipsoid, or cylindrical; bracts numerous, overlapping, leathery, deciduous, apex deeply 3-lobed, each bract subtending 3 flowers. Nutlet compressed, usually with membranous wings.

Between 50 and 60 species: Afghanistan, China, Japan, Kazakstan, Korea, Kyrgyzstan, Mongolia, Nepal, Russia, Sikkim; Europe, North and South America; 32 species (14 endemic) in China.

- 1a. Female inflorescence narrowly cylindrical; lateral lobes of bracts reduced; wings of nutlet partly exerted, much wider than nutlet; leaves irregularly and doubly setiform serrate.
 - 2a. Female inflorescences 2–5 in a raceme; bracts densely pubescent abaxially; leaves lanceolate or ovate-lanceolate, apex acuminate or caudate-acuminate 1. *B. alnoides*
 - 2b. Female inflorescences 1 or 2.
 - 3a. Female inflorescence 1(or 2) 4. *B. luminifera*
 - 3b. Female inflorescences 2.
 - 4a. Scales of buds glabrous; petiole glabrous except villous in furrow; bracts rhombic, 4–5 × ca. 3 mm, glabrous; nutlet 3–5 × 1.5–3 mm 2. *B. rhombibracteata*
 - 4b. Scales of buds villous; petiole densely yellow villous; bracts oblong-lanceolate, 2–3 × 1.5–1.7 mm, pubescent at base; nutlet ca. 2 × 1–1.5 mm 3. *B. cylindrostachya*
- 1b. Female inflorescence oblong-cylindric, oblong, or subglobose; lateral lobes of bracts distinct; wings of nutlet included; leaves irregularly or regularly doubly serrate.
 - 5a. Nutlet narrowly bordered, not distinctly winged.
 - 6a. Leaves leathery, midvein and lateral veins deeply impressed adaxially, distinctly raised abaxially.
 - 7a. Trees to 12 m tall; bracts of male inflorescence yellow-brown tomentose 8. *B. juilungensis*
 - 7b. Shrubs or small trees to 5 m tall; bracts of male inflorescence yellow or white villous.
 - 8a. Leaves orbicular or broadly ovate, apex rounded or obtuse; petiole 1–2 mm; bracts of female inflorescence densely yellow villous 7. *B. calcicola*
 - 8b. Leaves ovate-lanceolate or elliptic, apex acuminate or acute; petiole 3–5 mm; bracts of female inflorescence glabrous or pubescent.
 - 9a. Scales of buds glabrous; leaves densely yellow or white villous along veins except on reticulate veins abaxially, margin with 2 acute teeth between lateral veins 5. *B. potaninii*
 - 9b. Scales of buds densely white tomentose; leaves densely yellow-brown tomentose along veins abaxially, margin with 1(or 2) obtuse teeth between lateral veins 6. *B. trichogemma*
 - 6b. Leaves papery, midvein and lateral veins sometimes slightly impressed adaxially, raised abaxially.
 - 10a. Female inflorescences 4 in a raceme, cylindrical; leaves 12–13 × 7–8 cm, densely yellow tomentose abaxially 9. *B. gynoterminalis*
 - 10b. Female inflorescence 1, subglobose, ovoid, ovoid-oblong, or oblong-cylindric; leaves less than 10 × 5 cm, villous or glabrescent abaxially.
 - 11a. Trees to 35 m tall.
 - 12a. Trees to 35 m tall; bark black or black-brown; female inflorescence oblong-cylindric; peduncle 3–6 mm; bracts 4–5 mm, with lateral lobes ca. 1/2 as long as middle lobe 10. *B. schmidtii*
 - 12b. Trees to 15 m tall; bark dark gray; female inflorescence ovoid or ovoid-oblong; peduncle 1–2 mm; bracts 5–10 mm, with lateral lobes subequal to middle lobe 11. *B. fargesii*
 - 11b. Shrubs usually to 5 m tall.
 - 13a. Female inflorescence oblong-cylindric or oblong; lobes of bracts with apex not reflexed; leaves with 9–21 lateral veins on each side of midvein 12. *B. delavayi*
 - 13b. Female inflorescence subglobose, rarely oblong; lobes of bracts with apex usually reflexed; leaves with 8 or 9 lateral veins on each side of midvein 13. *B. chinensis*
 - 5b. Nutlet with distinct, membranous wings.

- 14a. Leaves with 8–15 lateral veins on each side of midvein.
- 15a. Bud scales densely silky villous; leaves triangular-ovate, broadly ovate, or ovate; bark grayish white 20. *B. ermanii*
- 15b. Bud scales glabrous; leaves ovate, elliptic, oblong, or lanceolate; bark grayish black, dark brown, red-brown, or dark red-brown.
- 16a. Wings of nutlet 1/4–1/2 as wide as nutlet; female inflorescence sessile 14. *B. insignis*
- 16b. Wings of nutlet ca. 1/2 as wide as nutlet or more; female inflorescence pedunculate.
- 17a. Wings of nutlet ca. 1/2 as wide as nutlet; female inflorescence 1–2.5 cm in diam.; peduncle only
2–3 mm or obscure; branchlets without resinous glands.
- 18a. Female inflorescence 1, or 2 or 3 in a cluster, 4–5 × ca. 1 cm; bracts with a tuft of yellow hairs
at base 15. *B. jinpingensis*
- 18b. Female inflorescence 1, 2.5–6 × 1.2–2.5 cm; bracts densely pubescent 16. *B. austrosinensis*
- 17b. Wings of nutlet ca. as wide as nutlet; female inflorescence less than 1 cm in diam.; peduncle 8–15 mm; branchlets densely resinous glandular.
- 19a. Female inflorescence 1; bracts ciliate; bark grayish 19. *B. costata*
- 19b. Female inflorescence 1, or 2–4 in a raceme; bracts sparsely pubescent; bark red-brown or dark red-brown.
- 20a. Leaves densely bearded in axils of lateral veins abaxially; bark dark red-brown 17. *B. utilis*
- 20b. Leaves usually not bearded in axils of lateral veins abaxially; bark orange-red or orange 18. *B. albosinensis*
- 14b. Leaves with 3–8 lateral veins on each side of midvein.
- 21a. Trees.
- 22a. Bark black-brown, fissured; wings of nutlet ca. 1/2 as wide as nutlet 26. *B. dahurica*
- 22b. Bark gray-white, yellow-white, light yellow-brown, or grayish brown, exfoliating; wings of nutlet
ca. as wide as or wider than nutlet.
- 23a. Leaves triangular, triangular-ovate, or triangular-rhombic, apex acuminate or caudate-acuminate.
- 24a. Branches usually pendulous in mature trees; wings of nutlet ca. 2 × as wide as nutlet 22. *B. pendula*
- 24b. Branches not pendulous; wings of nutlet about as wide as nutlet 21. *B. platyphylla*
- 23b. Leaves ovate, rhombic, ovate-rhombic, or broadly ovate-rhombic, apex acute or acuminate.
- 25a. Bark grayish brown; leaves ovate; wings of nutlet 1.5–2 × as wide as nutlet 23. *B. halophila*
- 25b. Bark grayish white, yellow-white, or yellow-brown; leaves rhombic, ovate-rhombic, or broadly
ovate-rhombic; wings of nutlet ca. as wide as nutlet.
- 26a. Bark grayish white; leaves rhombic or obovate-rhombic, base cuneate 24. *B. microphylla*
- 26b. Bark yellow-white or light yellow-brown; leaves broadly ovate-rhombic, base broadly
cuneate 25. *B. tianschanica*
- 21b. Shrubs or dwarf shrubs.
- 27a. Leaves suborbicular or broadly obovate.
- 28a. Leaves suborbicular; peduncle 3–4 mm; wings of nutlet ca. as wide as or slightly narrower
than
nutlet 31. *B. rotundifolia*
- 28b. Leaves broadly obovate; peduncle 8–10 mm; wings of nutlet slightly wider than nutlet 32. *B. middendorffii*
- 27b. Leaves ovate, broadly ovate, ovate-rhombic, elliptic-rhombic, obovate-elliptic, or broadly
elliptic.
- 29a. Wings of nutlet 1–2 × as wide as nutlet 30. *B. gmelinii*
- 29b. Wings of nutlet ca. 1/2 as wide as nutlet.
- 30a. Branchlets densely villous and pubescent; leaves obovate-elliptic, ovate-rhombic, elliptic-
rhombic,
or broadly elliptic, densely white villous on both surfaces when young; lateral lobes of
bracts
suberect or slightly spreading 27. *B. ovalifolia*
- 30b. Branchlets scabrous; leaves ovate, broadly ovate, or ovate-elliptic, glabrous; lateral lobes of
bracts spreading or horizontal.
- 31a. Bark grayish white; leaves densely glandular punctate on both surfaces, margin minutely
serrate; peduncle (2–)3–10 mm 28. *B. fruticosa*

31b. Bark dark brown; leaves not glandular punctate, margin roughly serrate; peduncle 1–3 mm 29. *B. humilis*

1. *Betula alnoides* Buchanan-Hamilton ex D. Don, Prodr. Fl. Nepal. 58. 1825.

西桦 xi hua

Betula acuminata Wallich; *B. alnoides* var. *acuminata* (Wallich) H. Winkler; *Betulaster acuminata* (Wallich) Spach.

Trees to 30 m tall; bark gray, exfoliating. Branchlets densely white villous and resinous glandular. Petiole 1.5–3(–4) cm, densely villous and glandular punctate; leaf blade lanceolate, ovate-lanceolate, or ovate-elliptic, 4–12 × 2.5–5.5 cm, papery, abaxially densely glandular punctate, sparsely villous along veins, bearded in axils of lateral veins, adaxially glabrous, base cuneate, broadly cuneate, or subrounded, rarely subcordate, margin irregularly incurved setiform serrate, apex acuminate or caudate-acuminate; lateral veins 10–13 on each side of midvein. Female inflorescences 3–5 in a raceme, pendulous, narrowly cylindrical, 5–10 cm × 4–6 mm when mature; peduncle 2–3 mm, densely yellow villous; bracts ca. 3 mm, densely pubescent and ciliolate, becoming spongy at base, 3-lobed, middle lobe oblong or obtuse, lateral lobes reduced, auriculate. Nutlet obovate, 1.5–2 mm, sparsely pubescent at apex, with membranous wings ca. 2 × as wide as nutlet. Fl. Oct–Jan, fr. Mar–May. $2n = 28$.

Subtropical forests; 700–2100 m. Fujian, Guangxi, Hainan, Hubei, Sichuan, S Yunnan [Bhutan, India, Myanmar, Nepal, Thailand, Vietnam].

2. *Betula rhombibracteata* P. C. Li, Acta Phytotax. Sin. 17(1): 88. 1979.

菱苞桦 ling bao hua

Trees to 7 m tall; bark dark yellow-brown. Branchlets purplish brown, densely white villous and resinous glandular. Petiole 1–1.5 cm, sparsely villous and resinous punctate; leaf blade oblong or ovate-lanceolate, 8–13 × 5–7.5 cm, abaxially densely resinous punctate and villous along veins, bearded in axils of lateral veins, adaxially sparsely villous when young, becoming villous and resinous punctate along midvein, base rounded, rarely subcordate or broadly cuneate, margin irregularly mucronate serrate or setiform serrate, apex acuminate; lateral veins 11–15 on each side of midvein. Female inflorescences 2, sometimes 3 in a raceme, narrowly cylindrical, ca. 10 cm × 8 mm when mature; peduncle 0.5–1.5 cm, densely pubescent; bracts rhombic, 4–5 × ca. 3 mm, glabrous, ciliolate along margin, 3-lobed, middle lobe rhombic, lateral lobes triangular, small, ca. 1/2 as long as middle lobe. Nutlet oblong, 3–5 × 1.5–3 mm, sparsely pubescent, with membranous wings ca. 2 × as wide as nutlet. Fl. May–Jun, fr. Jul–Aug.

• Broad-leaved forests; 2500–2800 m. NW Yunnan (Dêqên Xian, Weixi Xian).

An endangered species. A. K. Skvortsov indicates that *Betula rhombibracteata* is very similar to *B. cylindrostachya*, and further studies may show that they are conspecific.

3. *Betula cylindrostachya* Lindley in Wallich, Pl. Asiat. Rar. 2: 7. 1831.

长穗桦 chang sui hua

Betula acuminata Wallich var. *cylindrostachya* (Lindley) Regel; *B. alnoides* Buchanan-Hamilton var. *cylindrostachya* (Lindley) H. Winkler; *Betulaster cylindrostachya* (Lindley) Spach.

Trees to 30 m tall; bark brown or grayish black. Branchlets yellow-brown, densely yellow villous. Petiole 0.8–1.5 cm, densely yellow pubescent; leaf blade ovate-elliptic, oblong, or ovate-lanceolate, 5–14 × 2–8 cm, both surfaces densely villous when young, abaxially densely resinous punctate and bearded in axils of lateral veins, base rounded or subcordate, margin irregularly and doubly subincurved setiform serrate; apex acuminate; lateral veins 13 or 14 on each side of midvein. Female inflorescences 2, narrowly cylindrical, 2.5–10 cm × 5–7(–10) mm; peduncle 7–10 mm, densely yellow pubescent; bracts oblong-lanceolate, 2–3 × 1.5–1.7 mm, sparsely pubescent at base, ciliolate, spongy at base when mature, 3-lobed, middle lobe ovate-lanceolate, lateral lobes ± reduced, ca. 1/3 as long as middle lobe. Nutlet ovate or oblong, ca. 2 × 1–1.5 mm, densely pubescent at apex, with membranous wings ca. 2 × as wide as nutlet. Fl. Apr–Jun, fr. Jul–Aug. $2n = 28$.

Subtropical and warm temperate broad-leaved forests; 1400–2800 m. ?Sichuan, SE Xizang, NW Yunnan [Bhutan, India].

4. *Betula luminifera* H. Winkler in Engler, Pflanzenr. IV. 61 (Heft 19): 91. 1904.

亮叶桦 liang ye hua

Betula acuminata Wallich var. *pyrifolia* Franchet; *B. alnoides* Buchanan-Hamilton var. *pyrifolia* (Franchet) Burkill; *B. baeumkeri* H. Winkler; *B. cylindrostachya* Lindley var. *resinosa* Diels; *B. hupehensis* C. K. Schneider; *B. luminifera* var. *baeumderi* (H. Winkler) P. C. Kuo.

Trees to 25 m tall; bark dark brown, smooth. Branchlets yellow-brown, densely yellow pubescent, sparsely resinous glandular, glabrescent. Petiole 1–2 cm, densely villous and resinous punctate; leaf blade oblong, broadly oblong, or oblong-lanceolate, rarely elliptic or ovate, 4.5–10 × 2.5–6 cm, abaxially densely resinous punctate, bearded in axils of lateral veins, adaxially densely pubescent when young, base rounded, subcordate, or broadly cuneate, margin irregularly and

doubly setiform serrate, apex mucronate or caudate; lateral veins 12–14 on each side of midvein. Female inflorescence 1(–2), pendulous, narrowly cylindrical, 3–9 cm × 6–10 mm; peduncle 1–2 mm, densely pubescent and resinous punctate; bracts 2–3 mm, sparsely pubescent and ciliolate, spongy at base, 3-lobed, middle lobe oblong or lanceolate, lateral lobes ± reduced, 1/4–1/3 as long as middle lobe. Nutlet obovate, ca. 2 mm, sparsely pubescent, with membranous wings 1–2 × as wide as nutlet. Fl. May–Jun, fr. Jun–Aug.

• Broad-leaved forests on sunny mountain slopes; 200–2900 m. Anhui, Fujian, Gansu, N Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Yunnan, Zhejiang.

The wood is hard, close grained, and fine textured, and is used for construction and making agricultural tools and furniture.

5. *Betula potaninii* Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 101. 1893.

矮桦 ai hua

Betula wilsonii Bean.

Shrubs or trees to 5 m tall; bark grayish brown. Branches decumbent and prostrate or slender and pendulous; branchlets brown, very slender, densely yellow or white pubescent. Bud scales glabrous. Petiole 3–5 mm, densely yellow villous; leaf blade ovate-lanceolate or oblong-lanceolate, 2–2.5 × 1–2.5 cm, leathery, abaxially densely yellow-brown or white sericeous-villous along veins, adaxially densely villous when young, base rounded, margin acutely doubly serrate, apex acuminate or acute; lateral veins 9–21 on each side of midvein, distinctly raised abaxially, deeply impressed adaxially. Female inflorescence oblong-cylindrical, 1–2 cm × 5–6 mm; peduncle ca. 2 mm, densely yellow villous; bracts 4–5 mm, densely pubescent and ciliolate, 3-lobed, middle lobe ovate-oblong, with a tuft of long hairs at apex, lateral lobes ovate, slightly shorter than middle lobe. Nutlet obovate, ca. 1.5 × 1 mm, pubescent, with very narrow wings. Fl. May–Jun, fr. Jul–Aug.

• Thickets on moist cliffs; 1900–3100 m. SE Gansu, Shaanxi, N and W Sichuan.

6. *Betula trichogemma* (Hu ex P. C. Li) T. Hong in W. C. Cheng, Silva Sin. 2: 2133. 1985.

峨眉矮桦 e mei ai hua

Betula potaninii Batalin var. *trichogemma* Hu ex P. C. Li, Acta Phytotax. Sin. 17(1): 91. 1979.

Shrubs or trees to 4 m tall; bark gray-brown. Branchlets brown, densely grayish tomentose. Bud scales densely grayish tomentose. Petiole ca. 2 mm, densely villous; leaf blade ovate-elliptic or elliptic, 1.5–3 × 0.8–1.5 cm, abaxially yellow-brown tomentose along veins, adaxially pubescent along midvein, base rounded or broadly cuneate, margin obtusely simply serrate, rarely mucronate serrate, apex acute or obtuse; lateral veins 11–14 on each side of midvein, raised abaxially, deeply impressed adaxially. Female inflorescence oblong-cylindrical, 1.2–1.6 cm × 3–4 mm; bracts ca. 4 mm, densely pubescent and ciliolate, 3-lobed, middle lobe

ovate-oblong, lateral lobes obovate, ca. 2/3 as long as middle lobe. Nutlet suborbicular, 2–2.5 × 1.8–2.2 mm, sparsely pubescent, with very narrow wings. Fl. Jun, fr. Jul–Aug.

• Thickets on cliffs; 2400–3100 m. Sichuan (Emei Shan).

A. K. Skvortsov indicates that this species is very similar to *Betula calcicola* and *B. jiu lungensis*, and further studies may show that it is conspecific with one of them.

7. *Betula calcicola* (W. W. Smith) P. C. Li in P. C. Li & S. H. Cheng, Fl. Reipubl. Popularis Sin. 21: 137. 1979.
岩桦 yan hua

Betula delavayi Franchet var. *calcicola* W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 8: 333. 1915; *B. forrestii* (W. W. Smith) Handel-Mazzetti var. *calcicola* (W. W. Smith) Handel-Mazzetti.

Shrubs to 4 m tall; bark gray-black. Branches erect or prostrate; branchlets grayish brown, densely white or yellow villous. Petiole 1–2 mm, densely yellow sericeous-villous; leaf blade suborbicular or broadly ovate, rarely oblong, 2–3.2 × 1.5–2.5 cm, leathery, abaxially densely yellow sericeous-villous along veins, sparsely resinous punctate, adaxially densely white or yellow sericeous-villous, base rounded or broadly cuneate, margin obtusely doubly serrate, apex rounded or obtuse; lateral veins 9–16 on each side of midvein, distinctly raised abaxially, deeply impressed adaxially. Female inflorescence oblong-cylindrical, 1.5–2 cm × 7–10 mm; peduncle ca. 2 mm; bracts ca. 5 mm, densely sericeous-villous, base hispidulous, margin densely and long ciliate, middle lobe oblong, lateral lobes ovate, 1/3–1/2 as long as middle lobe. Nutlet suborbicular, ca. 2.5 × 2 mm, with very narrow wings. Fl. Jun–Jul, fr. Jul–Aug.

• Thickets on cliffs; 2800–3800 m. SW Sichuan, NW Yunnan.

8. *Betula jiu lungensis* Hu ex P. C. Li, Acta Phytotax. Sin. 17(1): 90. 1979.

九龙桦 jiu long hua

Trees to 12 m tall. Branches gray-brown, glabrous; branchlets brown, densely yellow villous. Petiole 3–5 mm, yellow sericeous-villous; leaf blade ovate, ovate-elliptic, ovate-oblong, or ovate-lanceolate, 2–5 × 1–2.7 cm, subleathery, abaxially sparsely yellow sericeous-villous, adaxially sparsely white villous, base subrounded, margin doubly serrate, apex acuminate; lateral veins 16–19(–21) on each side of midvein, distinctly raised abaxially, deeply impressed adaxially. Male inflorescence 1, or 2 or 3 in a cluster, to 4.7 cm; bracts densely yellow tomentose. Female inflorescence oblong-cylindrical, 1–2 cm × 5–8 mm; peduncle ca. 2 mm; bracts ca. 5 mm, ciliolate, 3-lobed, middle lobe oblong, lateral lobes spreading, ovate, ca. 1/2 as long as middle lobe. Nutlet ovate, ca. 2 × 1.5 mm, with very narrow wings. Fl. Jun, fr. Jul–Aug.

• Broad-leaved forests; ca. 2400 m. SW Sichuan (Jiulong Xian).

9. *Betula gynoterminalis* Y. C. Hsu & C. J. Wang, Acta Bot. Yunnan. 5: 381. 1983.

贡山桦 gong shan hua

Trees to 7 m tall. Branches dark purplish, glabrous. Petiole ca. 5 mm, densely villous; leaf blade broadly ovate or broadly oblong, 12–13 × 7–8 cm, leathery or papery, abaxially densely yellow tomentose, villous along veins, adaxially glabrous, base broadly cuneate, margin irregularly and simply serrate, apex acuminate; lateral veins 16–18 on each side of midvein, raised abaxially, slightly impressed adaxially. Female inflorescences 4 in a raceme, terminal, pendulous, cylindrical, 5–7 × ca. 1 cm; peduncle obscure; bracts ca. 8 × 4 mm, long ciliate at apex, 3-lobed, middle lobe oblanceolate, lateral lobes spreading, narrowly oblong, ca. 1/2 as long as middle lobe. Nutlet ca. 2 × 1.5 mm, with very narrow wings. Fl. Jun–Jul, fr. Jul–Aug.

• Broad-leaved forests; ca. 2600 m. NW Yunnan (Gongshan Drungzu Nuzu Zizhixian).

10. *Betula schmidtii* Regel, Bull. Soc. Imp. Naturalistes Moscou 38(2): 412. 1865.

赛黑桦 sai hei hua

Trees to 35 m tall; bark black or black-brown, fissured. Branchlets purplish brown, densely villous, sparsely resinous glandular. Petiole 5–10 mm, villous; leaf blade ovate, ovate-elliptic, or elliptic, 4–8 × 2.5–4.5 cm, subleathery, shiny, abaxially densely resinous punctate and sparsely villous along veins, adaxially glabrous, base rounded, margin irregularly and doubly or simply minutely serrate; lateral veins 8–10 on each side of midvein. Female inflorescence erect, oblong-cylindrical, 2–3 cm × 7–8 mm; peduncle robust, 3–6 mm, sparsely pubescent; bracts 4–5 mm, glabrous, 3-lobed, middle lobe lanceolate, lateral lobes spreading, ovate-lanceolate, ca. 1/2 as long as middle lobe. Nutlet ovate, ca. 2 × 1.5 mm, sparsely pubescent, with very narrow wings. Fl. Jun, fr. Jul–Aug.

Temperate broad-leaved forests; 700–800 m. E Jilin (Linjiang), NE Liaoning [Japan, N Korea, E Russia (Primorye)].

11. *Betula fargesii* Franchet, J. Bot. (Morot) 13: 205. 1899.

狭翅桦 xia chi hua

Betula chinensis Maximowicz var. *fargesii* (Franchet) P. C. Li.

Trees to 15 m tall; bark dark gray. Branchlets brown, sparsely pubescent. Petiole 4–6 mm, pubescent; leaf blade ovate or ovate-lanceolate, 4.5–6 × 2.5–4.5 cm, papery, abaxially villous along veins, adaxially scattered pilose, base rounded, margin irregularly and doubly mucronate serrate, apex acute or acuminate; veins 9–11 on each side of midvein. Female inflorescence ovoid or ovoid-oblong, 1–1.5 × 0.5–1.5 cm; peduncle 1–2 mm; bracts 5–10 mm, ciliate, with 3 subequal lobes. Nutlet obovate, pubescent, with very narrow wings. Fl. May–Jun, fr. Jul–Aug.

• Broad-leaved forests or thickets on hilltops; 1500–2600 m. W Hubei, E Sichuan (Chengkou Xian).

12. *Betula delavayi* Franchet, J. Bot. (Morot) 13: 205. 1899.

高山桦 gao shan hua

Shrubs or trees to 8 m tall; bark dark gray. Branches diagonal or prostrate, sometimes erect; branchlets brown, densely yellow villous. Petiole 5–10 mm, sparsely villous; leaf blade elliptic, oblong, ovate, or broadly ovate, (1.5–)2–7 × 1–4 cm, abaxially sparsely resinous punctate and white sericeous-villous along veins, adaxially densely yellow sericeous-villous when young, base rounded, margin doubly minutely serrate, apex acuminate or subrounded; lateral veins (5–)9–21 on each side of midvein. Female inflorescence oblong or oblong-cylindrical, 1–2.5 cm × 5–10 mm; peduncle ca. 5 mm, villous; bracts 5–10 mm, pubescent, ciliate, sometimes densely villous, 3-lobed, middle lobe lanceolate or oblong, lateral lobes spreading, ovate, ca. 1/2 as long as middle lobe. Nutlet obovate or elliptic, 2.5–3 × 1.5–2 mm, pubescent, with very narrow wings. Fl. Jun, fr. Jul–Aug.

• Broad-leaved forests, thickets; 2400–4000 m. ?Gansu, W Hubei, ?Qinghai, W Sichuan, E Xizang, NW Yunnan.

- 1a. Leaves 1.5–2 cm, lateral veins 5–10 on each side of midvein; female inflorescence ca. 10 × 5 mm 12c. var. *microstachya*
- 1b. Leaves 3–7 cm, lateral veins 10–21 on each side of midvein; female inflorescence 15–25 × 7–10 mm.
 - 2a. Leaves with 10–14 lateral veins on each side of midvein; bracts not densely villous, ciliate 12a. var. *delavayi*
 - 2b. Leaves with 19–21 lateral veins on each side of midvein; bracts densely villous and ciliate 12b. var. *polyneura*

12a. *Betula delavayi* var. *delavayi*

高山桦(原变种) gao shan hua (yuan bian zhong)

Betula chinensis Maximowicz var. *delavayi* (Franchet) C. K. Schneider; *B. delavayi* var. *forrestii* W. W. Smith; *B. forrestii* (W. W. Smith) Handel-Mazzetti.

Leaves 3–7 × 2–4 cm; lateral veins 10–14 on each side of midvein. Female inflorescence oblong-cylindrical, 1.5–2.5 cm × 7–10 mm; bracts ciliate.

• Thickets; 2400–4000 m. ?Gansu, W Sichuan, SE Xizang (Zayü Xian), NW Yunnan.

Further studies of material named *Betula forrestii* are required to better understand its placement.

12b. *Betula delavayi* var. *polyneura* Hu ex P. C. Li, Acta Phytotax. Sin. 17(1): 90. 1979.

多脉高山桦 duo mai gao shan hua

Leaves 3–7 × 2–4 cm; lateral veins 19–21 on each side of midvein. Female inflorescence oblong-cylindrical, 1.5–2.5 cm × 7–10 mm; bracts densely villous and ciliate.

• Broad-leaved forests; ca. 2600 m. NW Yunnan (Lijiang Naxizu Zizhixian).

12c. *Betula delavayi* var. *microstachya* P. C. Li, Acta Phytotax. Sin. 17(1): 90. 1979.

细穗高山桦 xi sui gao shan hua

Betula bomiensis P. C. Li.

Leaves 2–2.5 × 1–1.5 cm; lateral veins 5–10 on each side of midvein. Female inflorescence oblong, 1–1.5 cm × 5–10 mm.

• W Hubei, Qinghai (?Nangqên Xian), W Sichuan, NE Xizang (?Qamdo Xian).

13. *Betula chinensis* Maximowicz, Bull. Soc. Imp. Naturalistes Moscou 54(1): 47. 1879.

坚桦 jian hua

Betula ceratoptera G. H. Liu & Y. C. Ma; *B. chinensis* var. *angusticarpa* H. Winkler; *B. chinensis* var. *nana* Liou; *B. exalata* S. Moore; *B. jiaodongensis* S. B. Liang; *B. liaotungensis* Baranov.

Shrubs to 5 m tall; bark black-gray. Branchlets brown or yellow-brown, densely villous. Petiole 0.2–2 cm, densely villous; leaf blade ovate, broadly ovate, or ovate-elliptic, 1.5–6 × 1–5 cm, abaxially villous, sometimes resinous punctate, sparsely bearded in axils of lateral veins, adaxially densely villous when young, base rounded or broadly cuneate, margin irregularly and doubly dentate-serrate, apex acute or obtuse; lateral veins 8 or 9 (or 10) on each side of midvein. Female inflorescence subglobose, rarely oblong, 1–2 × 0.6–1.5 cm; peduncle 1–2 mm; bracts 5–9 mm, pubescent, ciliate, 3-lobed, lobes reflexed, middle lobe lanceolate, lateral lobes spreading, ovate, 1/3–1/2 as long as middle lobe. Nutlet obovate or ovate, with very narrow wings, sometimes horn-shaped at apex. Fl. May–Jun, fr. Jul–Aug.

Broad-leaved forests in mountain valleys, shaded, rocky mountain slopes; 700–3000 m. E Gansu, Hebei, Henan, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi [Korea].

This species is one of the most valuable timber trees in N China. The wood is extremely hard and dense, close grained, very fine textured, and is used for making pestles and wagon axles.

14. *Betula insignis* Franchet, J. Bot. (Morot) 13: 206. 1899.

香桦 xiang hua

Betula kweichowensis Hu.

Trees to 25 m tall; bark grayish black, fragrant. Branchlets brown, yellow pubescent at first, soon glabrescent, fragrant. Petiole 0.8–2 cm; leaf blade elliptic or ovate-lanceolate, 8–13 × 3–6 cm, abaxially densely resinous punctate, villous along veins, bearded in axils of lateral veins, adaxially sparsely villous, base subrounded or subcordate, margin doubly mucronate serrate, apex acuminate or caudate-acuminate; lateral veins 12–15 on each side of midvein. Female inflorescence erect or recurved, oblong, 2.5–4 × 1.5–2 cm; peduncle obscure; bracts 7–12 mm, densely pubescent and ciliate, 3-lobed, lobes lanceolate, lateral lobes erect, ca. 1/2 as long as middle lobe. Nutlet

narrowly oblong, ca. 4 × 1.5 mm, glabrous, with membranous wings 1/4–1/2 as wide as nutlet. Fl. May–Jun, fr. Jul–Aug.

• Broad-leaved forests; 1400–3400 m. Guizhou, W Hubei, Sichuan.

The bark, timber, leaves, and buds yield fragrant oil.

15. *Betula jinpingsensis* P. C. Li, Acta Phytotax. Sin. 17(1): 89. 1979.

金平桦 jin ping hua

Trees. Branches dark gray; branchlets grayish, glabrous. Petiole robust, ca. 1.5 cm; leaf blade oblong-lanceolate, 7–10 × 3.5–5 cm, papery, abaxially sparsely resinous punctate, villous along veins, adaxially glabrous, base rounded, margin irregularly and doubly minutely serrate, apex acuminate; lateral veins ca. 13 on each side of midvein. Female inflorescence 1, or 2 or 3 in a cluster, oblong or oblong-cylindric, 4–5 × 1–1.2 cm; peduncle 6–7 mm or ± obscure; bracts 6–7 mm, with a tuft of coarse hairs at base, ciliate, 3-lobed, middle lobe ovate-lanceolate, lateral lobes spreading, ovate, ca. 1/3 as long as middle lobe. Nutlet elliptic, ca. 2 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. Apr–May, fr. Jun–Aug.

• Subtropical forests; ca. 2200 m. SE Yunnan (Jinping Xian). A. K. Skvortsov indicates that this species is similar to *Betula utilis*, and further studies may show that they are conspecific.

16. *Betula austrosinensis* Chun ex P. C. Li, Acta Phytotax. Sin. 17(1): 89. 1979.

华南桦 hua nan hua

Trees to 25 m tall; bark brown or gray-brown, fissured. Branchlets yellow-brown, sparsely pubescent. Petiole 1–2 cm; leaf blade ovate-elliptic, elliptic, or oblong-lanceolate, 5–14 × 2–7 cm, papery, abaxially densely resinous punctate, villous along veins, bearded in axils of lateral veins, adaxially glabrous, base rounded or subcordate, sometimes asymmetric, margin irregularly and doubly minutely serrate, apex acuminate or caudate-acuminate; lateral veins 12–14 on each side of midvein. Female inflorescence 1, erect, oblong or oblong-cylindric, 2.5–6 × 1.2–2.5 cm; peduncle 2–3 mm; bracts 0.8–1.3 cm, densely pubescent and ciliate, 3-lobed, middle lobe oblong-lanceolate, lateral lobes spreading, oblong, ca. 1/2 as long as middle lobe. Nutlet narrowly elliptic or oblong-obovate, 4–5 × ca. 2 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. May–Jun, fr. Jun–Aug.

• Broad-leaved forests; 700–1900 m. Fujian, Guangdong, Guangxi (Lingui Xian), Guizhou, Hubei, Hunan, Jiangxi, Sichuan, Yunnan.

17. *Betula utilis* D. Don, Prodr. Fl. Nepal. 58. 1825.

糙皮桦 cao pi hua

Betula albosinensis Burkill var. *septentrionalis* C. K. Schneider; *B. bhojpatra* Lindley in Wallich; *B.*

bhojpattra var. *latifolia* Regel; *B. utilis* var. *prattii* Burkill.

Trees to 35 m tall; bark dark red-brown, exfoliating in thin flakes. Branches red-brown, glabrous; branchlets brown, densely resinous glandular and pubescent. Petiole 0.8–2 cm; leaf blade ovate, ovate-elliptic, or oblong, 4–9 × 2.5–6 cm, abaxially densely resinous punctate and pubescent, bearded in axils of lateral veins, adaxially densely villous when young, base rounded or subcordate, margin irregularly and doubly mucronate serrate, apex acuminate or caudate-acuminate; lateral veins 8–14 on each side of midvein. Female inflorescence 1, or 2 or 3 in a raceme, pendulous, oblong-cylindric, 3–5 cm × 7–12 mm; peduncle 0.5–1.5 cm; bracts 5–8 mm, pubescent, ciliate, 3-lobed, middle lobe lanceolate, lateral lobes ovate, ca. 1/3 as long as middle lobe. Nutlet obovate, 2–3 × 1.5–2 mm, with membranous wings ca. as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug. $2n = 56$.

Temperate broad-leaved forests; 2500–3800 m. Gansu, Hebei, Ningxia, Qinghai, Shaanxi, W Sichuan, E and S Xizang, NW Yunnan [Afghanistan, Bhutan, India, Nepal].

A valuable timber tree of commercial importance. The wood is hard, dense, and rather brittle, with the heartwood pinkish or light reddish brown, with a silky luster.

18. *Betula albosinensis* Burkill in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 497. 1899.

红桦 hong hua

Betula bhojpattra Lindley var. *sinensis* Franchet; *B. utilis* D. Don var. *sinensis* (Franchet) H. Winkler. Trees to 30 m tall; bark orange-red or orange, shiny, exfoliating in papery flakes. Branchlets reddish brown, glabrous, sometimes resinous glandular. Petiole 0.5–1.5 cm; leaf blade ovate, ovate-elliptic, or ovate-oblong, 3–8 × 2–5 cm, abaxially densely resinous punctate, sparsely villous, adaxially glabrous, base rounded or subcordate, rarely broadly cuneate, margin irregularly and doubly mucronate serrate, apex acuminate; lateral veins 10–14 on each side of midvein. Female inflorescence 1, or 2 or 3 in a raceme, oblong-cylindric, 3–4 × 1–1.2 cm; peduncle slender, ca. 1 cm; bracts 4–7 mm, 3-lobed, middle lobe oblong or lanceolate, lateral lobes spreading, suborbicular, ca. 1/3 as long as middle lobe. Nutlet ovate, 2–3 mm, with membranous wings ca. as wide as nutlet. Fl. May–Jun, fr. Jul–Aug.

• Temperate broad-leaved forests; 1000–3400 m. S Gansu, Hebei, Henan, W Hubei, S Ningxia (Liupan Shan), Qinghai, S Shaanxi (Hua Shan, Taibai Shan), Shanxi, E Sichuan.

The wood is hard, dense, and rather brittle, with the heartwood pinkish or light red-brown; it is used for many purposes.

19. *Betula costata* Trautvetter, Mém. Acad. Imp. Sci. St. Pétersbourg Divers Savans 9: 253. 1895.

硕桦 shuo hua

Betula ermanii Chamisso var. *costata* (Trautvetter) Regel; *B. ulmifolia* Siebold & Zuccarini var. *costata* (Trautvetter) Regel.

Trees to 30 m tall; bark grayish brown, exfoliating in papery flakes. Branches red-brown, glabrous; branchlets brown, densely yellow resinous glandular, sparsely pubescent. Petiole 0.8–2 cm; leaf blade ovate or ovate-elliptic, 3.5–7 × 1.5–4.5 cm, abaxially densely resinous punctate, villous, bearded in axils of lateral veins, adaxially glabrous, base rounded or subcordate, margin irregularly and doubly minutely serrate, apex acuminate or caudate-acuminate; lateral veins 9–16 on each side of midvein. Female inflorescence 1, oblong, 1.5–2.5 × ca. 1 cm; peduncle 2–5 mm; bracts 5–8 mm, ciliate, 3-lobed, middle lobe oblong-lanceolate, lateral lobes spreading, oblong, ca. 1/3 as long as middle lobe. Nutlet obovate, ca. 2.5 mm, glabrous, with membranous wings ca. 1/2 as wide as nutlet. Fl. May–Jun, fr. Jul–Sep.

Mixed forests of coniferous and broad-leaved trees; 600–2500 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol [Korea, E Russia (Primorye)].

The wood is straight grained, coarse textured, and cracks easily; it is used for making carrying poles and for fuel and charcoal.

20. *Betula ermanii* Chamisso, Linnaea 6: 537. 1831.

岳桦 yue hua

Trees to 20 m tall; bark grayish white, exfoliating in thin sheets. Branches red-brown, glabrous; branchlets brown-green, densely villous, resinous glandular; bud scales densely silky villous. Petiole 1–2.4 cm; leaf blade ovate, broadly ovate, or triangular-ovate, 2–7 × 1.2–5 cm, abaxially resinous punctate and villous, adaxially sparsely villous, base subrounded, truncate, broadly cuneate, or subcordate, margin irregularly and doubly mucronate serrate, apex acute, acuminate, or caudate-acuminate; lateral veins 8–12 on each side of midvein. Female inflorescence ovoid or oblong, 1.5–2.7 × 0.8–1.5 cm; peduncle 3–6 mm or obscure; bracts 5–8 mm, 3-lobed, lobes oblanceolate, lateral lobes spreading or erect, slightly shorter than middle lobe. Nutlet obovate or ovate-elliptic, 2.5–3 × 1.8–2 mm, with membranous wings ca. 1/2 as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug. $2n = 56$.

Forming pure forest stands, but also in mixed forests of coniferous and broad-leaved trees; 1000–1700 m. Heilongjiang, Jilin, Liaoning, Nei Mongol [Japan, N Korea, Russia (Kamchatka)].

The wood is hard and dense, and is used for construction and making furniture.

- 1a. Lateral lobes of bracts spreading, apex obtuse, with a lobule at base 20c. var. *yingkiliensis*
- 1b. Lateral lobes of bracts erect, apex acute, without a lobule at base.

- 2a. Female inflorescence oblong; peduncle 3–6 mm 20a. var. *ermanii*
- 2b. Female inflorescence ovoid; peduncle obscure 20b. var. *macrostrobila*

20a. *Betula ermanii* var. *ermanii*

岳桦(原变种) yue hua (yuan bian zhong)
Betula ermanii var. *lanata* Regel; *B. ulmifolia* Siebold & Zuccarini var. *glandulosa* H. Winkler.
 Leaves acute or acuminate at apex. Female inflorescence oblong; peduncle 3–6 mm; lateral lobes of bracts erect, apex acute, without a lobule at base.

Forming pure forest stands, but also in mixed forests of coniferous and broad-leaved trees; 1000–1700 m. Heilongjiang, Jilin, Liaoning, E Nei Mongol [Japan, N Korea, Russia (Kamchatka)].

20b. *Betula ermanii* var. *macrostrobila* Liou, Gen. Chin. Woody Pl. 200. 1955.

帽儿山岳桦 mao er shan yue hua
 Leaves caudate-acuminate at apex. Female inflorescence ovoid; peduncle obscure; lateral lobes of bracts erect, apex acute, without a lobule at base.

• Mixed forests. Heilongjiang (Mao'ershan, Shangzhi Xian).
20c. *Betula ermanii* var. *yingkiliensis* Liou & Z. Wang, Gen. Chin. Woody Pl. 200. 1955.

英吉里岳桦 ying ji li yue hua
 Female inflorescence ovoid; peduncle ca. 6 mm; lateral lobes of bracts spreading, apex obtuse, with a lobule at base.

• Mixed forests. Heilongjiang, Nei Mongol (Daxinganling, Yingjili Shan).
21. *Betula platyphylla* Sukaczew, Trav. Mus. Bot. Acad. Imp. Sci. St.-Petersbourg 8: 220. 1911.

白桦 bai hua
Betula alba Linnaeus subsp. *latifolia* Regel; *B. alba* subsp. *mandshurica* Regel; *B. alba* subsp. *tauschii* Regel; *B. japonica* Siebold ex H. Winkler; *B. japonica* var. *mandshurica* (Regel) H. Winkler; *B. japonica* var. *rockii* Rehder; *B. japonica* var. *szechuanica* C. K. Schneider; *B. latifolia* Komer; *B. mandshurica* (Regel) Nakai; *B. platyphylla* var. *japonica* Hara; *B. platyphylla* var. *mandshurica* (Regel) Hara; *B. platyphylla* var. *szechuanica* (C. K. Schneider) Rehder; *B. szechuanica* (C. K. Schneider) Jansen; *B. verrucosa* Ehrhart var. *platyphylla* (Sukaczew) Lindley ex Jansson.
 Trees to 30 m tall; bark grayish white, exfoliating in sheets. Branches not pendulous, dark gray or dark brown, glabrous; branchlets brown, sparsely resinous glandular. Petiole slender, 1–2.5 cm; leaf blade triangular, ovate-triangular, rhombic-triangular, rhombic-ovate, or broadly ovate, 3–9 × 2–7.5 cm, abaxially densely resinous punctate, glabrous, bearded in axils of lateral veins, adaxially sparsely pubescent and resinous glandular when young, base truncate, broadly cuneate, or cuneate and subcordate, margin doubly or simply serrate, or incised-serrate, apex acute, acuminate, or caudate-acuminate; lateral veins 5–7(–9) on each side of midvein. Female inflorescence

pendulous, oblong or oblong-cylindric, 2–5 × 0.6–1.4 cm; peduncle slender, 1–2.5 cm; bracts 5–7 mm, densely pubescent and ciliate, 3-lobed, middle lobe triangular-ovate, lateral lobes erect or spreading to recurved, ovate or suborbicular, slightly shorter to longer than middle lobe. Nutlet narrowly oblong, oblong, or ovate, 1.5–2 × 1–1.5 mm, sparsely pubescent, with membranous wings slightly longer than and about as wide as nutlet. Fl. Jun–Jul, fr. Jul–Sep. *2n* = 28.
 Temperate broad-leaved forests, shaded, S-facing slopes, ridges, dry, sunny slopes, marshes, forming vast, pure stands or mixed with *Acer*, *Larix*, *Picea*, *Tilia*, and other species of *Betula*; 700–4200 m. Gansu, Hebei, Heilongjiang, Henan, Jiangsu, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi, SW and W Sichuan, SE Xizang, NW Yunnan [Japan, N Korea, E Mongolia, Russia (Far East, Siberia)].

This species has been divided into varieties or separate species (*B. japonica*, *B. mandshurica*, and *B. szechuanica*); however, the morphological characters are not distinct; therefore, the entities are all treated here as *B. platyphylla*. A. K. Skvortsov considers *B. platyphylla* to be synonymous with *B. pendula*.

A very important timber tree. The wood is soft and light, close grained, and fine to coarse textured; it is used for making agricultural tools, wooden ware, and tobacco boxes, and rarely for house construction. The white, papery bark is made into canoes and fancy articles, food baskets, and is also used as a substitute for tiles; the inner bark contains much resin.

22. *Betula pendula* Roth, Tent. Fl. Germ. 1: 405. 1788.

垂枝桦 chui zhi hua

Betula verrucosa Ehrhart.

Trees to 25 m tall; bark grayish white, exfoliating in sheets. Branches usually pendulous, dark brown, slender, glabrous, shiny; branchlets brown, slender, glabrous, sparsely resinous glandular or not. Petiole slender, 2–3 cm; leaf blade triangular-ovate or rhombic-ovate, 3–7.5 × 1.5–6 cm, abaxially densely resinous punctate, adaxially glabrous, base truncate, broadly cuneate, or cuneate, margin coarsely or incised doubly serrate, apex acuminate or caudate-acuminate; lateral veins 6–8 on each side of midvein. Female inflorescence oblong or oblong-cylindric, 1–3.3 cm × 8–10 mm; peduncle pendulous, 1–2 cm; bracts 5–6 mm, densely pubescent, ciliate, 3-lobed, middle lobe ovate or triangular-ovate, lateral lobes recurved, slightly longer than middle lobe. Nutlet obovate-elliptic, ca. 2 × 1 mm, sparsely pubescent, with membranous wings slightly longer than and ca. 2 × as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug. *2n* = 28, (42), 56.

Temperate broad-leaved forests; 500–2300 m. N Xinjiang (Altay Shan) [Kazakhstan, Mongolia, Russia (W Siberia); Europe]. May easily be confused with *Betula platyphylla*; however, in that species, the branches are not pendulous and the wings of the nutlet are about as wide as the nutlet. The name *B. alba* Linnaeus, nom. rej. prop., has been widely and persistently misapplied in the sense of *B. pendula*; the lectotype of *B. alba* belongs to the species currently known as *B. pubescens* Ehrhart, which does not occur in China.

23. *Betula halophila* Ching in P. C. Li, Acta Phytotax. Sin. 17(1): 88. 1979.

盐桦 yan hua

Shrubs to 3 m tall; bark grayish brown. Branches brown; branchlets densely pubescent and resinous glandular. Petiole slender, ca. 1 cm, densely pubescent; leaf blade ovate, rarely ovate-rhombic, 2.5–4.5 × 1.2–3 cm, abaxially sparsely resinous punctate and pubescent, adaxially glabrous, base subrounded, broadly cuneate, or cuneate, margin irregularly and doubly mucronate serrate, apex acuminate or acute; lateral veins 6 or 7 on each side of midvein. Female inflorescence pendulous, oblong, 2–3 × 1–1.2 cm; peduncle 5–8 mm, densely pubescent; bracts ca. 7 mm, densely pubescent and ciliate, 3-lobed, middle lobe triangular, lateral lobes horizontal or recurved, oblong-ovate, ca. as long as middle lobe. Nutlet ovate, ca. 2 × 1.5 mm, sparsely pubescent, with membranous wings 1.5–2 × as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug.

• Saline soils; ca. 1500 m. N Xinjiang (Altay Xian).

An endangered species. A. K. Skvortsov believes it is probably a variety of *Betula microphylla*.

24. *Betula microphylla* Bunge, Mém. Acad. Imp. Sci. St.-Pétersbourg Divers Savans 2: 506. 1835.

小叶桦 xiao ye hua

Betula fruticosa Pallas var. *cuneifolia* Regel.

Trees to 6 m tall; bark grayish white, exfoliating in flakes. Branches grayish or grayish brown, resinous glandular; branchlets yellow-brown, densely pubescent and resinous glandular. Petiole slender, ca. 1 cm, densely pubescent; leaf blade rhombic or rhombic-obovate, 1.5–5 × 1–3.5 cm, both surfaces sparsely pubescent and resinous punctate when young, base cuneate, rarely broadly cuneate, margin irregularly and doubly or simply roughly serrate, apex acute or obtuse; lateral veins 4–6 on each side of midvein. Female inflorescence oblong-cylindric, 1–2.5 cm × 7–8 mm; peduncle erect, 5–10 mm; bracts 5–6 mm, sparsely pubescent and ciliate, 3-lobed, middle lobe oblong, lateral lobes erect or slightly spreading, ovate or oblong, ca. 1/2 as long as middle lobe. Nutlet ovate, ca. 2.5 × 1.5 mm, densely pubescent, with membranous wings ca. as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug.

Temperate broad-leaved forests; 1200–1600 m. Xinjiang (Altay Shan, Hami Xian) [Kazakhstan, Mongolia].

25. *Betula tianschanica* Ruprecht, Mém. Acad. Imp. Sci. Saint Pétersbourg, sér. 7, 4: 72. 1867.

天山桦 tian shan hua

Betula alba Linnaeus subsp. *soongarica* var. *microphylla* Regel; *B. jarmolenkoana* Goloskokov.

Trees to 12 m tall; bark yellow-white or yellow-brown, exfoliating in flakes. Branches gray-brown or dark brown, glabrous; branchlets densely pubescent and villous, sparsely resinous glandular. Petiole 5–7 mm; leaf blade broadly ovate-rhombic or ovate-rhombic, rarely ovate or rhombic, 2–7 × 1–6 cm, both surfaces sparsely resinous punctate and villous when young,

base broadly cuneate or cuneate, margin doubly and coarsely mucronate serrate, apex acute or acuminate; lateral veins 4–7 on each side of midvein. Female inflorescence oblong-cylindric, 1–4 cm × 5–10 mm; peduncle pendulous, 0.5–1.7 cm, densely pubescent; bracts 5–8 mm, pubescent, ciliate, 3-lobed, middle lobe triangular or oblong, lateral lobes slightly spreading to horizontal or recurved, ovate, oblong, or subrhombic, slightly wider and shorter than middle lobe. Nutlet obovate, ca. 2.5 mm, with membranous wings ca. as wide as or slightly wider and longer than nutlet. Fl. Jun–Jul, fr. Jul–Aug.

Temperate broad-leaved forests, streambanks, valleys, shaded or rocky slopes; 1300–2500 m. Xinjiang (Tian Shan) [Kyrgyzstan, Tajikistan].

26. *Betula dahurica* Pallas, Reise Russ. Reich. 3: 224. 1776.

黑桦 hei hua

Betula dahurica var. *oblongifolia* Liou; *B. dahurica* var. *ovalifolia* Liou; *B. dahurica* var. *tiliifolia* Liou; *B. maackii* Ruprecht; *B. maximowiczii* Ruprecht.

Trees to 20 m tall; bark black-brown, fissured. Branches red-brown or dark brown, shiny, glabrous; branchlets red-brown, villous, with dense, resinous glands. Petiole 0.5–1.5 cm; leaf blade ovate, broadly ovate, rhombic-ovate, or elliptic, 4–8 × 3.5–5 cm, abaxially densely resinous glandular along veins, bearded in axils of lateral veins, adaxially glabrous, base subrounded, broadly cuneate, or cuneate, margin irregularly and acutely doubly serrate, apex acute or acuminate; lateral veins 6–8 on each side of midvein. Female inflorescence erect or pendulous, oblong-cylindric, 2–2.5 × ca. 1 cm; peduncle 5–12 mm; bracts 5–6 mm, ciliate, 3-lobed, middle lobe oblong-lanceolate, lateral lobes spreading or recurved, ovate or broadly ovate, ca. as long as middle lobe. Nutlet broadly elliptic, glabrous, with membranous wings ca. 1/2 as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug. $2n = 56$.

Mixed or coniferous forests, dry or moist, sunny slopes, rocks on mountain summits; 400–1300 m. Hebei, Heilongjiang, E Jilin, N Liaoning, Nei Mongol, Shaanxi, Shanxi [Japan, Korea, E Mongolia, Russia (Far East)].

The wood is hard and dense, and is used in house construction and for making agricultural tools and furniture.

27. *Betula ovalifolia* Ruprecht, Bull. Acad. Imp. Sci. Saint-Pétersbourg 15: 378. 1857.

油桦 you hua

Betula fruticosa Pallas var. *ruprechtiana* Trautvetter; *B. humilis* Schrank var. *ovalifolia* Regel; *B. humilis* var. *reticulata* Regel; *B. humilis* var. *ruprechtii* Regel; *B. reticulata* Ruprecht.

Shrubs to 2 m tall; bark gray-brown. Branches dark brown, sparsely pubescent and resinous glandular; branchlets brown, densely yellow villous and pubescent,

± resinous glandular. Petiole 3–7 mm; leaf blade elliptic, ovate-elliptic, rhombic-elliptic, rhombic-ovate, or obovate, 3–3.5 × 2–4 cm, both surfaces densely resinous glandular and white villous when young, abaxially glabrous, base broadly cuneate, cuneate, or subrounded, margin simply minutely serrate, apex acute or obtuse; lateral veins 5–7 on each side of midvein. Female inflorescence erect, oblong, rarely globose, 1.5–3 cm × 7–12 mm; peduncle 2–6 mm, sparsely pubescent; bracts 5–6 mm, ciliate, 3-lobed, middle lobe oblong, lateral lobes erect or subspreading, oblong or ovate, slightly shorter than middle lobe. Nutlet elliptic, ca. 3 × 1.5 mm, with membranous wings 1/3–1/2 as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug.

Peat bogs, marshes, moist places; 500–1200 m. S Heilongjiang, Jilin (Changbai Shan), Nei Mongol [Japan, Korea, Russia (Far East)].

28. *Betula fruticosa* Pallas, Reise Russ. Reich. 3: 758. 1776.

柴桦 *chai hua*

Shrubs to 3 m tall; bark grayish white. Branches dark purplish brown or gray-black, glabrous; branchlets brown, scabrous, with dense, resinous glands. Petiole 2–10 mm, glabrous; leaf blade ovate or ovate-elliptic, rarely broadly ovate, 1.5–3 (–4.5) × 1–2 (–3.5) cm, abaxially densely resinous glandular, adaxially sparsely pubescent along veins, base subrounded or broadly cuneate, margin irregularly and simply minutely serrate, apex acute, rarely subrounded or obtuse; lateral veins 5–8 on each side of midvein. Female inflorescence erect or spreading, oblong or oblong-cylindric, 1–2 cm × 5–8 mm; peduncle 2–5 (–10) mm, densely pubescent; bracts 4–7 mm, ciliate, 3-lobed, middle lobe oblong, lateral lobes spreading or suberect, oblong, ca. 1/2 as long as middle lobe. Nutlet elliptic, ca. 1.5 × 1 mm, with membranous wings 1/3–1/2 as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug.

Swamps in forests, streambanks; 600–1100 m. N Heilongjiang, Nei Mongol [Korea, Mongolia, Russia (E Siberia)].

29. *Betula humilis* Schrank, Bayer. Fl. 1: 420. 1789.

甸生桦 *dian sheng hua*

Betula humilis var. *vulgaris* Perfiljev; *B. sibirica* Watson.

Shrubs to 2 m tall; bark dark brown. Branches black-brown, glabrous, densely resinous glandular; branchlets brown, densely pubescent and yellow resinous glandular. Petiole ca. 5 mm, pubescent; leaf blade ovate, broadly ovate, or ovate-elliptic, 1–2.5 (–4) × 0.6–1.5 (–2) cm, both surfaces glabrous, base broadly cuneate or cuneate, rarely subrounded, margin irregularly and doubly coarsely serrate, apex acute; lateral veins 4 or 5 on each side of midvein. Female inflorescence erect, oblong, 1–1.5 cm × 4–6 mm; peduncle 1–3 mm, sparsely pubescent and resinous glandular; bracts 3–4 mm, ciliate, 3-lobed, middle lobe oblong, lateral lobes spreading, ovate or oblong, ca. 1/2 as long as or subequal to middle lobe. Nutlet oblong, ca. 2 × 1.5 mm,

with membranous wings ca. 1/2 as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug. $2n = 28$.

Swamps and meadows in forests, 1400–1800 m. Xinjiang (Altay Shan) [Kazakstan, N Mongolia, Russia (Siberia); Europe].

A. K. Skvortsov believes that this species is a synonym of *Betula fruticosa*.

30. *Betula gmelinii* Bunge, Mém. Acad. Imp. St.-Petersbourg Divers Savans 2: 607. 1835.

砂生桦 *sha sheng hua*

Betula fruticosa Pallas var. *gmelinii* Regel.

Shrubs to 3 m tall; bark gray-black. Branches dark brown or gray-brown, glabrous; branchlets densely pubescent and villous, sometimes slightly scabrous, with dense, resinous glands. Petiole slender, 2–7 mm; leaf blade elliptic, ovate, or broadly ovate, 1.5–4 × 1–2.5 cm, glabrous, abaxially resinous punctate when young, base cuneate or broadly cuneate, margin irregularly acutely minutely serrate, apex acute or rounded-obtuse; lateral veins 4–6 on each side of midvein. Female inflorescence erect, oblong, 1–2.2 cm × 8–9 mm; peduncle 3–6 mm or ± obscure; bracts 5–6 mm, 3-lobed, middle lobe oblong, lateral lobes spreading, ovate, slightly shorter than and ca. 2 × as wide as middle lobe. Nutlet obovate-elliptic, ca. 3 × 1.5 mm, with membranous wings 1–2 × as wide as nutlet. Fl. Jun–Jul, fr. Jul–Aug.

Sandy hills, deserts; 500–1000 m. N Heilongjiang, N Liaoning, Nei Mongol [N Mongolia, Russia (E Siberia)].

31. *Betula rotundifolia* Spach, Ann. Sci. Nat., Bot., sér. 2, 15: 194. 1841.

圆叶桦 *yuan ye hua*

Betula glandulosa Michaux var. *rotundifolia* (Spach) Regel.

Shrubs to 2 m tall; bark gray-black. Branches dark gray, glabrous, densely yellow resinous glandular; branchlets red-brown, densely white pubescent and resinous glandular. Petiole 5–7 mm, slender, densely pubescent; leaf blade suborbicular, rarely broadly obovate, 1–2.5 × 0.8–2 cm, both surfaces glabrous and densely resinous punctate, base rounded or broadly cuneate, margin obtusely serrate, apex subrounded; lateral veins 3 or 4 on each side of midvein. Female inflorescence erect, oblong-cylindric, 1.5–2.4 cm × 6–8 mm; peduncle 3–4 mm, densely pubescent; bracts ca. 6 mm, ciliate, 3-lobed, middle lobe oblong, lateral lobes slightly spreading, elliptic, slightly shorter than middle lobe. Nutlet oblong, ca. 2.5 × 1.8 mm, with membranous wings slightly narrower than nutlet. Fl. Jun–Jul, fr. Jul–Aug. $2n = 28$.

Thickets on mountain slopes; ca. 2300 m. Xinjiang (Altay Shan) [Kazakstan, N Mongolia, Russia (Siberia)].

A. K. Skvortsov believes that this species should be treated as a variety of the circumboreal *Betula nana* Linnaeus.

32. *Betula middendorffii* Trautvetter & C. A. Meyer in Middendorff, Reise Sibir. 1(2), Fl. Ochot. Phaenog. 2: 84. t. 21. 1856.

扇叶桦 shan ye hua

Shrubs to 2 m tall; bark red-brown, shiny. Branches spreading, dark red-brown, glabrous, shiny, becoming glaucous; branchlets black-brown, densely pubescent and resinous glandular. Petiole ca. 3 mm, densely pubescent; leaf blade broadly obovate, $1.5-2.7 \times 1.2-2.1$ cm, abaxially light green, sparsely resinous punctate, glabrous, adaxially dark green and shiny, base broadly cuneate or rounded-cuneate, margin irregularly and obtusely doubly serrate, apex obtuse or subrounded; lateral veins 3–5 on each side of midvein. Female inflorescence spreading or pendulous, oblong, $1.2-1.5$ cm \times 8–9 mm; peduncle 8–10 mm, slender, densely pubescent and resinous glandular, bracts ca. 6 mm, ciliate, 3-lobed, middle lobe ovate, lateral lobes erect, obovate, ca. as long as middle lobe. Nutlet ovate, ca. 2×1.5 mm, glabrous, with membranous wings slightly wider than nutlet. Fl. Jun–Jul, fr. Aug–Sep. $2n = 42, 48, 56$.

Thickets; 1000–1200 m. Heilongjiang (Daxinganling), Nei Mongol [Russia (E Siberia)].

