

1. PINUS Linnaeus, Sp. Pl. 2: 1000. 1753.

松属 song shu

Trees or rarely shrubs, evergreen, with regularly whorled branches; branchlets strongly dimorphic: long branchlets bearing scalelike leaves and spreading leaf bundles; short branchlets bearing leaves in bundles of 2–5(–7); winter buds large, with numerous scales. Leaves needlelike, slender or stout, straight or twisted, triangular, flabellate-triangular, or semiorbicular in cross section, stomatal lines several, on 1, 2, or all surfaces, vascular bundles 1 or 2, resin canals 2–10 or more, marginal or median, rarely internal, base enclosed by persistent or deciduous, membranous sheath. Pollen cones usually borne in spikelike clusters at base of 1st-year branchlets, sessile, cylindrical or ovoid; pollen 2-saccate. Seed cones pedunculate or subsessile, erect or pendulous, cylindrical or ovoid, maturing in 2nd or 3rd year. Seed scales spirally arranged, woody, exposed apex thickened and ridged (the apophysis), with a prominent protuberance (umbo), usually terminating in a spine or prickle, persistent. Bracts minute. Seeds variable in color, shape, and size, winged or not; wing adnate or articulated to seed. Cotyledons 3–18. Germination epigeal. $2n = 24^*$.

About 110 species: N Africa, Asia, Europe, North America; 39 species (seven endemic, 16 introduced) in China.

- 1a. Needles with basal sheath deciduous and basal scalelike leaves not decurrent, cross section with 1 vascular bundle; umbo terminal or dorsal.
 - 2a. Umbo dorsal; needles 3–5 per bundle.
 - 3a. Needles 4 or 5 per bundle; bark dark brown, flaking 25. *P. squamata*
 - 3b. Needles 3 per bundle; bark white, irregularly flaking.
 - 4a. Seed cones 12–20 cm; seeds cylindrical, ca. 2.5 cm 26. *P. gerardiana*
 - 4b. Seed cones 5–7 cm; seeds ovoid, ca. 1 cm 27. *P. bungeana*
 - 2b. Umbo terminal; needles (2–)5 per bundle.
 - 5a. Seeds wingless or only shortly winged.
 - 6a. Seed cones dehiscent at maturity; branchlets glabrous.
 - 7a. Seeds wingless or ridged along abaxial margin; seed coat thick; apophyses not or slightly reflexed at margin 31. *P. armandii*
 - 7b. Seeds with a rudimentary wing 2–7 mm; seed coat thin; apophyses obviously reflexed at margin 32. *P. fenzeliana*
 - 6b. Seed cones indehiscent or imperfectly dehiscent; branchlets densely pubescent.
 - 8a. Needles slender, 4–8 cm × 0.5–1 mm; resin canals 2, marginal; shrubs 28. *P. pumila*
 - 8b. Needles stout, 7–12 cm × 1–1.5 mm; resin canals 3, median; trees.
 - 9a. First-year branchlets with red-brown hairs; needles with 6–8 blue-gray stomatal lines along each abaxial surface; seed cones 9–14 cm; seed scales acuminate at apex, recurved 29. *P. koraiensis*
 - 9b. First-year branchlets with yellow-brown hairs; needles with 3–5 gray-white stomatal lines along each abaxial surface; seed cones 5–8 cm; seed scales rounded at apex, incurved 30. *P. sibirica*
 - 5b. Seeds long winged.
 - 10a. Needles 7–20 cm; seed cones cylindrical to narrowly cylindrical, 7–25 cm.
 - 11a. Needles not pendulous, 6–14 cm; seed cones 7–20 cm 38. *P. strobus*
 - 11b. Needles pendulous, (6–)11–24 cm; seed cones 10–30 cm.
 - 12a. Needles dark green adaxially; 1st-year branchlets green with faint bloom, glabrous; abaxial resin canal of needles always median 34. *P. wallichiana*
 - 12b. Needles grass green adaxially, conspicuously whitish bloomed on 2 abaxial surfaces; 1st-year branchlets conspicuously whitish bloomed, glandular pubescent; 1(or 2) abaxial resin canal(s) of needles always asymmetrically placed 33. *P. bhutanica*
 - 10b. Needles less than 8 cm; seed cones ovoid, ovoid-ellipsoid, or ellipsoid-cylindrical, usually less than 10 cm.
 - 13a. Needles less than 1 mm in diam.; seed cones sessile or shortly pedunculate.

- 25b. Seed cones sessile or subsessile.
 - 27a. Branchlets ca. 1 cm in diam.; terminal bud lanceolate-cylindric, mostly less than 1 cm wide, slightly resinous; seed cones mostly dull yellow-brown, narrowly ovoid when open 17. *P. taeda*
 - 27b. Branchlets 1–2 cm in diam.; terminal bud ovoid, ca. 1 cm wide, very resinous; seed cones mostly reddish brown, broadly ovoid when open 18. *P. ponderosa*
- 17b. Needles 2(or 3) per bundle.
 - 28a. Needles mostly 20–30 cm or more.
 - 29a. Umbo blunt or with sunken, short mucro.
 - 30a. Needle with 2 resin canals; seed cones red-brown at maturity 6. *P. latteri*
 - 30b. Needle with up to 9 resin canals; seed cones pale brown at maturity 19. *P. tropicalis*
 - 29b. Umbo ± spiny or pointed at apex.
 - 31a. Seed cones borne on stalks to 3 cm, chocolate brown; apophyses lustrous 15. *P. elliotii*
 - 31b. Seed cones sessile or subsessile, brown, yellow-, or red-brown; apophyses rarely lustrous.
 - 32a. Branchlets ca. 1 cm in diam.; terminal bud lanceolate-cylindric, usually less than 1 cm wide, slightly resinous; seed cones usually dull yellow-brown, narrowly ovoid when open 17. *P. taeda*
 - 32b. Branchlets 1–2 cm in diam.; terminal bud ovoid, ca. 1 cm wide, very resinous; seed cones usually reddish brown, broadly ovoid when open 18. *P. ponderosa*
 - 28b. Needles mostly less than 20 cm.
 - 33a. Seed cones 9–18 cm 20. *P. pinaster*
 - 33b. Seed cones usually not more than 8 cm.
 - 34a. Needles slender and pliant, ca. 1 mm in diam.; apophyses relatively thin, flat or slightly raised.
 - 35a. Trunk and branches usually with adventitious sprouts; umbo with a stout, sharp prickle 11. *P. echinata*
 - 35b. Trunk and branches usually without adventitious sprouts; umbo flat or blunt.
 - 36a. Needles 12–20 cm, slightly twisted 2. *P. massoniana*
 - 36b. Needles 5–12 cm, straight 7. *P. densiflora*
 - 34b. Needles stout, 1–2 mm in diam.; apophyses ± swollen or pyramidal.
 - 37a. Needles shorter, longest ones not more than 8 cm, strongly twisted.
 - 38a. Seed cones strongly asymmetric, curved forward on branches; needles 2–5 cm 23. *P. banksiana*
 - 38b. Seed cones symmetric or nearly so; needles usually longer.
 - 39a. Bark on distal sections of trunk orange, plated; needles blue-, gray-, or yellow-green, stomatal lines conspicuous; branchlets initially dull green or orange-brown, not glaucous; adaxial surface of seed scales lacking contrasting border distally 10. *P. sylvestris*
 - 39b. Bark on distal sections of trunk reddish, scaly; needles deep to pale yellow-green, stomatal lines inconspicuous; branchlets initially red or purple tinged, often glaucous; adaxial surface of seed scales with strong purple-red or -brown border distally 24. *P. virginiana*
 - 37b. Needles (5–)9–16 cm, straight or rarely slightly twisted.
 - 40a. Seed cones deciduous..
 - 41a. Winter buds silvery white, cylindric-ellipsoid or cylindric 21. *P. thunbergii*
 - 41b. Winter buds brown, ovoid or oblong-ovoid 22. *P. nigra*

- 40b. Seed cones persistent.
- 42a. Needle with resin canals median, rarely also marginal; needles 4.5–17 cm; seed cones 3–6 cm 8. *P. taiwanensis*
- 42b. Needle with resin canals marginal, occasionally 1 or 2 median; needles 6–15 cm; seed cones 2.5–9 cm.
- 43a. Bark initially reddish brown, becoming dark grayish brown; 1st-year branchlets shiny yellowish brown; needle sheaths initially 0.5–1 cm; resin canals 3 or 4; pollen cones 1–1.8 cm; seed cones shiny chocolate brown at maturity 5. *P. densata*
- 43b. Bark dull grayish brown or dark gray; 1st-year branchlets light grayish brown, light brown, or yellowish brown; needle sheaths initially 1–2 cm; resin canals 5–9; pollen cones 0.5–0.9 cm; seed cones yellowish brown to brown at maturity 9. *P. tabuliformis*

1. *Pinus roxburghii* Sargent, *Silva N. Amer.* 11: 9. 1897.

须弥长叶松 *xu mi chang ye song*

Trees to 55 m tall; trunk to over 1 m d.b.h.; bark dark red-brown, thick, deeply and longitudinally fissured, scaly; winter buds brown, small, ovoid, not resinous. Needles 3 per bundle, slender, flabellate-triangular in cross section, 20–30 cm × ca. 1.5 mm, resin canals 2, median, base with persistent sheath 2–3 cm. Seed cones shortly pedunculate, ovoid, 10–20 × 6–9 cm. Seed scales oblong, thick, stiff; apophyses strongly swollen, conspicuously transversely ridged; umbo triangular, protruding. Seeds 8–12 mm; wing ca. 2.5 cm. Seed maturity Oct–Nov.

Mountains; 2100–2200 m. S Xizang [Bhutan, N India, Kashmir, Nepal, Pakistan, Sikkim].

A rare plant in China. The timber is used for construction, furniture, etc., and the trunk as a source of resin.

2. *Pinus massoniana* Lambert, *Descr. Pinus* 1: 17. 1803.

马尾松 *ma wei song*

Trees to 45 m tall; trunk to 1.5 m d.b.h.; bark red-brown toward apex of trunk, gray- or red-brown toward base, irregularly scaly and flaking; crown broadly pyramidal or umbrellalike; branchlets usually growing twice per year, yellowish brown, occasionally glaucous; winter buds brown, ovoid-cylindric or cylindric. Needles 2(or 3) per bundle, slightly twisted, 12–20 cm, stomatal lines present on all surfaces, resin canals 4–8, marginal, base with persistent sheath. Seed cones pendulous, shortly pedunculate, green, turning chestnut brown at maturity, ovoid, conical-ovoid, or ovoid-cylindric, 2.5–7 × 2.5–5 cm. Seed scales suboblong-obovoid or subsquare; apophyses rhombic, slightly swollen or flat, slightly transversely ridged; umbo flattened, slightly sunken, blunt or shortly mucronate in apical part of cone. Seeds narrowly ovoid, 4–6 mm; wing 1.6–2.1 cm. Pollination Apr–May, seed maturity Oct–Dec of 2nd year.

• Plains, hills, mountains; near sea level to 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, W Henan, Hubei, Hunan, S Jiangsu, Jiangxi, SE Shaanxi, Sichuan, Taiwan, E Yunnan, Zhejiang.

An important tree for afforestation in S China. The timber is used for construction, railway sleepers, mine timber, furniture, wood pulp, etc., and the trunk as a source of resin and tannin, and for cultivating fungi.

1a. Umbo spiny 2c. var. *shaxianensis*

1b. Umbo usually flattened or obtuse.

2a. Seed cones ovoid or conical-ovoid; bark gray-brown toward base of trunk, irregularly scaly and flaking 2a. var. *massoniana*

2b. Seed cones ovoid-cylindric; bark red-brown, irregularly flaking 2b. var. *hainanensis*

2a. *Pinus massoniana* var. *massoniana*

马尾松(原变种) *ma wei song (yuan bian zhong)*

Pinus argyi Lemée & H. Léveillé; *P. argyi* var. *longevaginans* H. Léveillé; *P. canaliculata* Miquel; *P. cavaleriei* Lemée & H. Léveillé; *P. crassicornicea* Y. C. Zhong & K. X. Huang; *P. nepalensis* J. Forbes (1839), not Chambray (1845); *P. sinensis* D. Don (1828), not Mayr (1894) nor (Beissner) Voss (1913).

Bark gray-brown toward base of trunk, irregularly scaly and flaking. Branches of 1st order spreading horizontally or ascending. Needles slender, 12–20 cm, pliant. Seed cones ovoid or conical-ovoid, 4–7 × 2.5–4 cm.

• Plains, hills, mountains; near sea level to 2000 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, W Henan, Hubei, Hunan, S Jiangsu, Jiangxi, SE Shaanxi, Sichuan, Taiwan, E Yunnan, Zhejiang.

2b. *Pinus massoniana* var. *hainanensis* W. C. Cheng & L. K. Fu in W. C. Cheng & al., *Acta Phytotax. Sin.* 13(4): 85. 1975.

雅加松 *ya jia song*

Bark red-brown toward base of trunk, irregularly flaking. Branches of 1st order spreading horizontally; branchlets ascending. Needles slender, 12–20 cm, pliant. Seed cones ovoid-cylindric, 4–7 × 2.5–5 cm.

• Hills. Hainan.

An endangered plant.

2c. *Pinus massoniana* var. *shaxianensis* D. X. Zhou, Bull. Bot. Res., Harbin 11(3): 41. 1991.

沙黄松 sha huang song

Trunk straight; bark red-brown, flaking. Winter buds red-brown, slightly covered with bloom. Seed cones ovoid-ellipsoid, 5–9 × 2–3 cm. Seed scales obovate-cuneate; apophyses slightly swollen; umbo spiny. Seeds black-brown, almost obovate, ca. 9 mm; wing 2.5–3 cm.

• C Fujian (Sha Xian).

3. *Pinus kesiya* Royle ex Gordon, Gard. Mag. & Reg. Rural Domest. Improv. 16: 8. 1840.

卡西松 ka xi song

Pinus insularis Endlicher var. *khasyana* (Griffith) Silba; *P. insularis* var. *langbianensis* (A. Chevalier) Silba; *P. kesiya* var. *langbianensis* (A. Chevalier) Gaussen ex Bui; *P. langbianensis* A. Chevalier.

Trees to 30 m tall; trunk to 60 cm d.b.h.; bark brown, irregularly flaking; crown broadly domed; branchlets yellowish brown, shiny, aging to orange-brown, initially covered with scale bases (which are shed in 2nd or 3rd year), producing 2 or more nodes each year; winter buds red-brown, conical, slightly resinous. Needles 3 per bundle, slender, triangular in cross section, 10–22 cm × 0.7–1 mm, pliant, resin canals 3–6, marginal, base with persistent sheath 1–2 cm. Seed cones usually solitary or paired, ovoid, 5–6 × ca. 3.5 cm, persistent for many years. Seed scales narrowly suboblong, 2.5–3 × 1–1.5 cm; apophyses ± pyramidal, obviously transversely ridged; umbo small, ellipsoid, slightly protruded into a tiny recurved spine. Seeds black-brown, slightly appressed, ellipsoid, 5–6 × 3–4 mm.

Plateaus; 700–1200 m. SE Xizang, Yunnan [NE India, Laos, Myanmar, Philippines, Thailand, Vietnam].

4. *Pinus yunnanensis* Franchet, J. Bot. (Morot) 13: 253. 1899.

云南松 yun nan song

Trees or rarely shrubs; bark brown-gray, longitudinally fissured, scaly; branchlets reddish brown, thick, glabrous; winter buds red-brown, ovoid, large, not resinous. Needles (2 or)3 per bundle, flabellate-triangular or semiorbicular in cross section, 7–30 cm × 1–1.2 mm, stomatal lines present on all surfaces, resin canals 4 or 5, median and marginal, base with persistent sheath. Seed cones shortly pedunculate, green, maturing to brown or chestnut brown, conical-ovoid, 5–11 cm, dehiscent or indehiscent at maturity. Seed scales oblong-ellipsoid, ca. 3 × 1.5 cm; apophyses usually swollen, cross keeled, rarely recurved; umbo slightly sunken or slightly protruded, ending in a minute prickle. Seeds brown, slightly appressed, nearly ovoid or obovoid, 4–5 mm; wing 1.2–1.4 cm. Pollination Apr–May, seed maturity Oct.

• Mountains, river basins, dry and sunny slopes; 400–3100 m. Guangxi, Guizhou, SW Sichuan, SE Xizang, Yunnan.

The timber is used for construction, railway sleepers, boards, furniture, and wood pulp. The trunk can be used as a source of resin, the roots for cultivating fungi, and the bark for producing tannin.

- 1a. Shrubs; seed cones indehiscent at maturity; needles 7–13 cm 4c. var. *pygmaea*
- 1b. Trees; seed cones dehiscent at maturity; needles to 30 cm.
 - 2a. Needles not or slightly pendulous, ca. 1.2 mm in diam. 4a. var. *yunnanensis*
 - 2b. Needles pendulous, less than 1 mm in diam. 4b. var. *tenuifolia*

4a. *Pinus yunnanensis* var. *yunnanensis*

云南松(原变种) yun nan song (yuan bian zhong)

Pinus insularis Endlicher var. *yunnanensis* (Franchet) Silba; *P. sinensis* D. Don var. *yunnanensis* (Franchet) Shaw; *P. tabuliformis* Carrière var. *yunnanensis* (Franchet) Dallimore & A. B. Jackson.

Trees to 30 m. Needles not or slightly pendulous, 10–30 cm × ca. 1.2 mm. Seed cones dehiscent at maturity.

• Mountains, river basins; 600–3100 m. Guangxi, Guizhou, SE Xizang, Yunnan.

4b. *Pinus yunnanensis* var. *tenuifolia* W. C. Cheng & Y. W. Law in W. C. Cheng & al., Acta Phytotax. Sin. 13(4): 85. 1975.

细叶云南松 xi ye yun nan song

Pinus insularis var. *tenuifolia* (W. C. Cheng & Y. W. Law) Silba.

Trees to 30 m. Needles pendulous, 20–30 cm × less than 1 mm. Seed cones dehiscent at maturity.

• River basins; 400–1200 m. Guangxi, Guizhou.

4c. *Pinus yunnanensis* var. *pygmaea* (Hsüeh) Hsüeh in W. C. Cheng & L. K. Fu, Fl. Reipubl. Popularis Sin. 7: 258. 1978.

地盘松 di pan song

Pinus densata Masters var. *pygmaea* Hsüeh in W. C. Cheng & al., Acta Phytotax. Sin. 13(4): 85. 1975; *P. tabuliformis* var. *pygmaea* (Hsüeh) Silba.

Shrubs to 2 m, branched from base. Needles 7–13 cm, stiff, resin canals 2, marginal or 1 median. Seed cones clustered, 4–5 cm, persistent, indehiscent at maturity.

• High mountains, dry and sunny slopes; 2200–3100 m. SW Sichuan, Yunnan.

5. *Pinus densata* Masters, J. Linn. Soc., Bot. 37: 416. 1906.

高山松 gao shan song

Pinus prominens Masters; *P. sinensis* D. Don var. *densata* (Masters) Shaw; *P. tabuliformis* Carrière var. *densata* (Masters) Rehder; *P. wilsonii* Shaw (1911), not Roezl (1857).

Trees to 30 m tall; trunk to 1.3 m d.b.h.; bark reddish brown, scaly and plated when young, finally dark grayish brown, forming irregular, square, thick plates; crown ovoid-conical, broadly ovoid in old trees; branches spreading; 1st-year branchlets shiny yellowish

brown, stout; 2nd- and 3rd-year branchlets reddish brown; winter buds dull brown, ovoid-conical, ca. 15 × 6 mm, slightly resinous, scales white fringed at margin, acuminate at apex. Needles persisting for 3 years, usually 2(or 3) per bundle, straight, slightly twisted, 8–14 cm × 1–1.5 mm, stomatal lines present on all surfaces, resin canals 3 or 4, marginal, occasionally 1 or 2 median, base with persistent sheath initially 5–10 mm, margin finely serrulate, apex acute. Pollen cones yellowish brown, cylindrical, 10–18 × 3–4.5 mm. Seed cones solitary or in pairs, pendulous, sessile or very shortly pedunculate, shiny chocolate brown at maturity, narrowly ovoid before opening, ovoid or broadly ovoid when open, 4–6 × 4–7 cm, persistent. Seed scales with apophyses prominent, rhombic, 4–7 mm thick, sharply transversely keeled; umbo dorsal, with a short prickle. Seeds light grayish brown, ellipsoid-ovoid, 4–6 mm; wing 1.5–2 cm. Pollination May, seed maturity Oct of 2nd year.

- Open forests in high mountains, forming pure stands or (below 3000 m) mixed with *Pinus armandii* and *P. yunnanensis*; 2600–3500 (–4200) m. S Qinghai, W Sichuan, SE Xizang, Yunnan.

Morphologically intermediate between *Pinus yunnanensis* of lower elevations and *P. tabuliformis* of more northerly latitudes. Molecular evidence supports the hypothesis that *P. densata* originated as a Tertiary natural hybrid involving the former two species and a third, unknown species.

Can be used for afforestation in the alpine zones of W Sichuan and E Xizang.

6. *Pinus latteri* Mason, J. Asiat. Soc. Bengal 18: 74. 1849.
南亚松 nan ya song

Pinus ikedae Yamamoto; *P. merkusii* Junghuhn & de Vriese subsp. *latteri* (Mason) D. Z. Li; *P. merkusii* var. *latteri* (Mason) Silba; *P. merkusii* var. *tonkinensis* (A. Chevalier) Gaussen ex Bui; *P. tonkinensis* A. Chevalier. Trees to 30 m tall; trunk to 2 m d.b.h.; bark gray-brown, thick, scaly; crown globose or umbrellalike; branchlets dark brown, glabrous; winter buds brown, cylindrical. Needles 2 per bundle, semiorbicular in cross section, 15–27 cm × ca. 1.5 mm, stomatal lines present on all surfaces, resin canals 2, median, base with persistent sheath 1–2 cm. Seed cones pedunculate (peduncle ca. 1 cm), green, turning red-brown at maturity, conical or ovoid-cylindrical, 5–10 cm. Seed scales oblong, ca. 3 × 1.2–1.5 cm; apophyses subrhombic or pentagonal-rhombic, slightly swollen, shiny, slightly recurved toward apex, flat toward base, obviously radially ridged; umbo usually slightly sunken. Seeds gray-brown, slightly appressed, ellipsoid-ovoid, 5–8 × ca. 4 mm; wing 1.7–2 cm. Pollination May–Apr, seed maturity Oct of 2nd year.

Hills, terraces; below 1200 m. SW Guangdong, S Guangxi, Hainan [Cambodia, Laos, SE Myanmar, Thailand, Vietnam].

The timber is used for construction, bridge building, and making poles and instruments. The trunk can be used as a source of resin, the bark for tannin, and the needles for turpentine.

7. *Pinus densiflora* Siebold & Zuccarini, Fl. Jap. 2: 22. 1842.
赤松 chi song

Trees to 30 m tall; trunk to 1.5 m d.b.h.; bark orange-red, red-brown, or brown-yellow, flaking and scaly; crown umbrellalike; 1st-year branchlets pale yellow or red-yellow, slightly glaucous, glabrous, white powdery or not; vegetative buds dark red-brown, oblong-ovoid, slightly resinous; scales slightly reflexed at apex. Needles 2 per bundle, twisted or not, semiorbicular in cross section, 5–15 cm × ca. 1 mm, vascular bundles 2, resin canals 3–9, marginal, margin inflexed or not. Seed cones erect or pendulous, shortly pedunculate, dark yellow-brown or brownish yellow, ovoid or ovoid-conical, 3–5.5 × 2.5–4.5 cm, dehiscent at maturity.

Seed scales usually thin; apophyses usually appressed, broadly rhombic, flat or recurved at apex, rarely pyramidal and slightly ridged; umbo flat or slightly protruding into a minute spine. Seeds obovoid-ellipsoid or ovoid, 3–7 × ca. 3 mm; wing 1–2 cm × 5–7 mm.

Pollination Apr–Jun, seed maturity Sep–Oct of 2nd year. Coastal regions to mountains, lakesides, rocky hillsides; near sea level to 900 m. E and S Heilongjiang, NE Jiangsu, SE Jilin, Liaoning, E and N Shandong [Japan, Korea, E Russia].

The timber is used for construction, poles, and furniture; the trunk can be used as a source of resin.

- 1a. First-year branchlets not white powdery; needles not or only slightly twisted, 13–15 cm, margin usually inflexed 7c. var. *zhangwuensis*
- 1b. First-year branchlets white powdery; needles twisted, 5–12 cm, margin usually not inflexed.
 - 2a. Seed cones erect; apophyses flat 7a. var. *densiflora*
 - 2b. Seed cones pendulous; apophyses ± pyramidal, apex recurved in apophyses toward base of cones 7b. var. *ussuriensis*

7a. *Pinus densiflora* var. *densiflora*

赤松(原变种) chi song (yuan bian zhong)

Pinus densiflora var. *brevifolia* Liou & Q. L. Wang; *P. densiflora* var. *funbris* (Komarov) Liou & Q. L. Wang ex Silba; *P. densiflora* f. *liaotungensis* (Liou & Q. L. Wang) Kitagawa; *P. densiflora* var. *liaotungensis* Liou & Q. L. Wang; *P. funbris* Komarov; *P. scopifera* Miquel.

Bark orange-red or red-brown. First-year branchlets white powdery. Needles twisted, 5–12 cm, resin canals 4–6, margin usually not inflexed. Seed cones erect. Apophyses usually flat. Seeds obovoid-ellipsoid or ovoid, 3–7 mm; wing 1.5–2 cm. Pollination Apr, seed maturity Sep–Oct of 2nd year.

Coastal regions to mountains; near sea level to 900 m. E Heilongjiang, NE Jiangsu, SE Jilin, C and S Liaoning, E and N Shandong [Japan, Korea, E Russia].

7b. *Pinus densiflora* var. *ussuriensis* Liou & Q. L. Wang in Liou, Ill. Fl. Lign. Pl. N. E. China 98, 548. 1958.

兴凯赤松 xing kai chi song

Pinus densiflora f. *ussuriensis* (Liou & Q. L. Wang) Kitagawa; *P. takahasii* Nakai.

Trees to 20 m tall; bark red-brown or yellow-brown. First-year branchlets white powdery. Needles twisted, 5–12 cm, resin canals 8, margin usually not inflexed. Seed cones pendulous. Apophyses ± pyramidal, obviously ridged, apex recurved in apophyses toward base of cones. Seeds pale brown with black spots, slightly appressed, obovoid, 3–5 mm; wing 1–1.2 cm. Pollination May–Jun, seed maturity Sep–Oct of 2nd year.

Lakesides, rocky hillsides. S Heilongjiang [E Russia].

7c. *Pinus densiflora* var. *zhangwuensis* S. J. Zhang & al., Bull. Bot. Res., Harbin 15: 338. 1995.

彰武赤松 zhang wu chi song

First-year branchlets not white powdery. Needles not or only slightly twisted, 13–15 cm, resin canals 3–9, margin usually inflexed. Seed cones pendulous when immature. Seeds 5–7 mm; wing ca. 1.5 cm.

• About 230 m. N Liaoning (N of Zhangwu).

8. *Pinus taiwanensis* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(1): 307. 1911.

台湾松 tai wan song

Pinus brevispica Hayata; *P. hwangshanensis* W. Y. Hsia; *P. luchuensis* Mayr subsp. *hwangshanensis* (W. Y. Hsia) D. Z. Li; *P. luchuensis* var. *hwangshanensis* (W. Y. Hsia) C. L. Wu; *P. luchuensis* subsp. *taiwanensis* (Hayata) D. Z. Li; *P. taiwanensis* var. *damingshanensis* W. C. Cheng & L. K. Fu.

Trees to 50 m tall; trunk straight or ± tortuous, to 1 m d.b.h.; bark dark gray or grayish brown; crown broadly ovoid, finally umbrellalike; branches spreading or spreading-ascending; 1st-year branchlets brown to yellowish brown, slender; winter buds pinkish brown or reddish brown, cylindrical, ovoid-ellipsoid, or ovoid, 1–1.5 cm × 5–6 mm, ± resinous, scales white or long white fringed at margin. Needles 2 per bundle, not or slightly twisted, 4.5–17 cm × 0.6–1 mm, resin canals 2–7 (or 8), median, rarely also marginal, base with sheath 0.5–1.4 cm, margin serrulate, with 26–57 teeth per cm in middle part of needle. Pollen cones reddish brown or yellowish brown, 1–2 cm × 3–4 mm. Seed cones light brown to chocolate brown, lustrous, narrowly ovoid or ovoid conical before opening, 3–6 × (2.5–)3–5 cm (closed), persistent. Seed scales ca. 1.8 × 0.8–1 cm, apophyses at middle of closed cones shield- or lozenge-shaped or pentagonal, with 2 or 3 distinct, ± straight or concave proximal edges and a distal end with either 2 distinct, straight or curved edges or a single, rounded margin; umbos depressed or flat, with a minute but distinct and persistent, mucronate prickle, or with a tiny, deciduous prickle, or unarmed. Seeds ellipsoid or ovoid, compressed, 5–6 × 2.6–3.4 mm (excluding wing); wing

1–1.4 cm × 5–6 mm. Pollination Apr–May, seed maturity Oct of 2nd year.

• Mixed warm-temperate and montane forests, open areas and sunny ridges on sandy, acidic mountains, co-dominant with species of Fagaceae; 600–3400 m. Anhui, Fujian, C Guangxi, Guizhou, S Henan, Hubei, Hunan, Jiangsu, Jiangxi, Taiwan, SE Yunnan, Zhejiang.

An important timber tree in Taiwan, *Pinus taiwanensis* is very close to *P. luchuensis*, from Japan (Ryukyu Islands). *Pinus taiwanensis* var. *damingshanensis*, described from C Guangxi (Shanglin: Daming Shan) and also recorded from Guizhou, is here included in synonymy. It has both marginal and median resin canals in the needles, but this character was considered unreliable by D. Z. Li (Edinburgh J. Bot. 54: 343. 1997). R. R. Mill prefers to treat all material from the Chinese mainland as a separate species, *P. hwangshanensis*, which differs from typical *P. taiwanensis* (from Taiwan) as follows: needle sheaths 0.5–1 cm (not 1–1.4 cm); middle part of margin with (37–)43–57 teeth per cm (not 26–35(–39)); pollen cones reddish brown (not yellowish brown); umbo of seed scales depressed, with a minute but distinct and persistent, mucronate prickle (not flat, with a tiny, deciduous prickle or unarmed).

9. *Pinus tabuliformis* Carrière, Traité Gén. Conif., ed. 2, 1: 510. 1867.

油松 you song

Trees to 25 m tall; trunk to over 1 m d.b.h.; bark grayish brown or dark gray, scaly; crown flat topped; 1st-year branchlets light grayish brown, light brown, or yellowish brown, thick, glabrous; winter buds oblong, slightly resinous. Needles 2 (or 3) per bundle, dark green, semiorbicular in cross section, 6–15 cm × 1–1.5 mm, resin canals 5–9, marginal, rarely 1 or 2 median, base with persistent sheath initially 1–2 cm. Pollen cones 5–9 mm. Seed cones shortly pedunculate, initially green, turning yellowish brown to brown at maturity, ovoid to ovoid-globose, 2.5–9 × 4–9 cm, usually persistent for a few years. Seed scales suboblong-obovate, 1.6–2 × ca. 1.4 cm; apophyses swollen, broadly or irregularly rhombic, ridged or not, cross keeled; umbo protruding into a spine. Seeds pale brown, mottled, ovoid or narrowly so, 6–8 × 4–5 mm (1.5–1.8 cm including wing). Pollination Apr–May, seed maturity Oct of 2nd year.

Hills, mountains; 100–2600 m. Gansu, Hebei, Henan, W Hubei, Hunan, S Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan [Korea].

The timber is used for construction, poles, mine timber, ship building, and furniture. The trunk can be used as a source of resin, the bark for tannin, and the needles for medicine.

- 1a. Seed cones ovoid-globose, 2.5–5 cm; apophyses slightly swollen; needles slender, 7–12 cm × ca. 1 mm, pliant; 1st-year branchlets usually glaucous 9d. var. *henryi*
- 1b. Seed cones ovoid, 4–9 cm; apophyses obviously swollen; needles stout, 6–15 cm × 1.2–1.5 mm, stiff; 1st-year branchlets not

glaucous or

glaucous only when very young.

2a. Trunk monopodial only toward base, branched in middle part; crown flabellate 9c. var. *umbraculifera*

2b. Trunk monopodial; crown conical when young, flat topped at maturity.

3a. Bark gray or brown-gray toward base of trunk, red-brown toward apex, pale brown inside 9a. var. *tabuliformis*

3b. Bark dark gray 9b. var. *mukdensis*

9a. *Pinus tabuliformis* var. *tabuliformis*

油松(原变种) you song (yuan bian zhong)

Pinus densiflora Siebold & Zuccarini var. *tabuliformis* (Carrière) Masters; *P. leucosperma* Maximowicz; *P. sinensis* Mayr (1894), not D. Don (1828) nor (Beissner) Voss (1913); *P. tabuliformis* var. *bracteata* Takenouchi; *P. tabuliformis* f. *jeholensis* Liou & Q. L. Wang; *P. tabuliformis* f. *purpurea* Liou & Q. L. Wang; *P. tabuliformis* var. *tokunagai* (Nakai) Takenouchi; *P. taihangshanensis* Hu & Yao; *P. tokunagai* Nakai. Trunk monopodial; bark gray or brown-gray toward base of trunk, red-brown toward apex, pale brown inside; crown conical when young, flat topped at maturity; 1st-year branchlets brownish yellow, not glaucous or glaucous only when very young. Needles stout, 10–15 cm × ca. 1.5 mm, stiff. Seed cones 4–9 × 4–9 cm. Apophyses swollen, obviously ridged.

• Hills, mountains; 100–2600 m. Gansu, Hebei, Henan, S Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan.

9b. *Pinus tabuliformis* var. *mukdensis* (Uyeki ex Nakai) Uyeki, J. Chôsen Nat. Hist. Soc. 3: 45. 1925.

黑皮油松 hei pi you song

Pinus mukdensis Uyeki ex Nakai, Bot. Mag. (Tokyo) 33: 195. 1919.

Trunk monopodial; bark dark gray, longitudinally or irregularly fissured; crown conical when young, flat topped at maturity; 1st-year branchlets brownish yellow, not glaucous or glaucous only when very young. Needles stout, 10–15 cm × ca. 0.5 mm, stiff. Seed cones 4–9 × 4–9 cm. Apophyses swollen, obviously ridged.

Hills, mountains. NE Hebei (Chengde Shi), ?Jilin, C Liaoning (Shenyang Shi) [Korea].

9c. *Pinus tabuliformis* var. *umbraculifera* Liou & Q. L. Wang in Liou, Ill. Fl. Lign. Pl. N. E. China 97, 548. 1958.

扫帚油松 sao zhou you song

Trunk monopodial only toward base, branched from middle part; crown flabellate; branches of 1st order inclined-ascending; 1st-year branchlets brownish yellow, not glaucous or glaucous only when very young. Needles stout, 6–15 cm × ca. 1.5 mm, stiff. Seed cones 4–9 × 4–9 cm. Apophyses swollen, obviously ridged.

• Hills. Hebei, C Liaoning (Anshan Shi).

9d. *Pinus tabuliformis* var. *henryi* (Masters) C. T. Kuan, Fl. Sichuan. 2: 113. 1983.

巴山松 ba shan song

Pinus henryi Masters in F. B. Forbes & Hemsley, J. Linn. Soc., Bot. 26: 550. 1902; *Pinus massoniana* Lambert var. *henryi* (Masters) C. L. Wu; *P. massoniana* var. *wulingensis* C. J. Qi & Q. Z. Lin.

Trunk monopodial; bark gray or brown-gray toward base of trunk, red-brown toward apex, pale brown inside; crown conical when young, flat topped at maturity; 1st-year branchlets red-brown, usually glaucous. Needles 7–12 cm × ca. 1 mm, slightly stiff. Seed cones ovoid-globose, 2.5–5 cm. Apophyses slightly swollen.

• Mountains; 1100–2000 m. W Hubei, Hunan, S Shaanxi, NE Sichuan.

10. *Pinus sylvestris* Linnaeus, Sp. Pl. 2: 1000. 1753.

欧洲赤松 ou zhou chi song

Trees to 40 m tall; bark red-brown, flaking; branchlets dark gray-brown; winter buds red-brown or pale to yellowish brown, ovoid to oblong-ovoid, resinous. Needles 2 per bundle, blue-green, semiorbicular in cross section, (0.5–)3–14 cm × 1–2 mm, stiff, stomatal lines present on all surfaces, vascular bundles 2, resin canals 6–8, marginal, base usually twisted, with persistent sheath. Seed cones dull yellow-brown at maturity, conical-ovoid, 3–6 cm. Apophyses broadly rhombic, flat or shortly pyramidal; umbo small, blunt or mucronate.

Mountains, river basins, dry rocky slopes; 400–1600 m. Heilongjiang, Jilin, N Nei Mongol; cultivated in Beijing Shi, Liaoning (Gai Xian) [Kazakhstan, N Mongolia, Russia; SW Asia, Europe].

The timber is used for construction, railway sleepers, ship building, and making poles and furniture. The trunk can be used as a source of resin, and the bark for tannin.

1a. Winter buds brown or pale yellowish brown; needles 4–12 cm 10c. var. *mongolica*

1b. Winter buds red-brown; needles (0.5–)3–8 cm.

2a. Needles stout, (0.5–)3–7 cm × ca. 2 mm; winter buds oblong-ovoid 10a. var. *sylvestris*

2b. Needles slender, 5–8 cm × 1–1.5 mm; winter buds ovoid 10b. var. *sylvestriformis*

10a. *Pinus sylvestris* var. *sylvestris*

欧洲赤松(原变种) ou zhou chi song (yuan bian zhong)

Winter buds red-brown, oblong-ovoid. Needles stout, (0.5–)3–7 cm × ca. 2 mm.

Mountains, dry rocky slopes; 400–800(–900) m. Heilongjiang, Jilin, NE Nei Mongol; cultivated in Beijing Shi, Liaoning (Gai Xian) [Kazakhstan, ?Mongolia, Russia; SW Asia, Europe].

10b. *Pinus sylvestris* var. *sylvestriformis* (Takenouchi) W. C. Cheng & C. D. Chu in W. C. Cheng & L. K. Fu, Fl. Reipubl. Popularis Sin. 7: 246. 1978.

长白松 chang bai song

Pinus densiflora Siebold & Zuccarini f. *sylvestriformis* Takenouchi, J. Jap. Forest. Soc. 24: 120. 1942; *P. densiflora* var. *sylvestriformis* (Takenouchi) Q. L. Wang.

Winter buds red-brown, ovoid. Needles slender, 5–8 cm × 1–1.5 mm.

• Mountains, river basins; 800–1600 m. SE Jilin.

A vulnerable plant.

10c. *Pinus sylvestris* var. *mongolica* Litvinov, Sched. Herb. Fl. Ross. 5: 160. 1905.

樟子松 zhang zi song

Pinus sylvestris var. *manguiensis* S. Y. Li & Adair; *P. yamazutai* Uyeki.

Winter buds brown or pale yellowish brown. Needles 4–12 cm × 0.5–2 mm.

Sandy mountains; 400–900 m. NW Heilongjiang, N Nei Mongol (N Da Hinggan Ling) [N Mongolia, E Russia].

A vulnerable plant in China.

11. *Pinus echinata* Miller, Gard. Dict., ed. 8, *Pinus* no. 12. 1768.

萌芽松 meng ya song

Trees to 40 m tall; trunk to 1.2 m d.b.h. in native range, usually with adventitious sprouts; bark red-brown, plates scaly with evident resin pockets; crown rounded-conical; 2nd-year branchlets greenish brown or red-brown, aging red-brown or gray, slender, to 5 mm in diam., roughened and cracking below leafy portion; winter buds red-brown, ovoid or cylindrical, resinous. Needles 2 (or 3) per bundle, gray- or yellow-green, straight, slightly twisted, (5–)7–11(–13) cm × ca. 1 mm, stomatal lines present on all surfaces, base with persistent sheath 0.5–1(–1.5) cm. Seed cones solitary or clustered, subsessile or shortly pedunculate (peduncle to 1 cm), red-brown, aging gray, ovoid-conical when open, 4–7 cm, maturing in 2 years. Seed scales lacking contrasting dark border adaxially distally; umbo with an elongated or stout and short, sharp prickle. Seeds gray or nearly black, ellipsoid, ca. 6 mm; wing 1.2–1.6 cm.

Cultivated. Fujian (Minhou Xian), Jiangsu (Nanjing Shi), Zhejiang (Fuyang Xian) [native to SE United States].

This tree is very fast growing and is highly valued as a source of timber and wood pulp. It is also a promising species for afforestation.

12. *Pinus serotina* Michaux, Fl. Bor.-Amer. 2: 205. 1803.

晚松 wan song

Pinus rigida Miller var. *serotina* (Michaux) Loudon ex Hoopes.

Trees to 21 m tall; trunk to 0.6 m d.b.h. in native range, usually with adventitious sprouts; bark red-brown, irregularly furrowed into oblong, flat, scaly plates; crown often rounded or flat; branchlets orange- or yellow-brown, often glaucous, stout; winter buds red-brown, ovoid or narrowly ovoid, 1–1.5 (–2) cm.

Needles tufted at branchlet tips, 3 (or 5 in adventitious or disturbed growth) per bundle, slightly twisted, (12–)15–21 cm × 0.3–1.5(–2) mm, stomatal lines present on all surfaces, fine, base with persistent sheath 1–2 cm, margin serrulate. Seed cones whorled, sessile or pedunculate (when peduncles to 1 cm), pale red-brown or creamy brown, broadly ovoid or globose when open, 5–8 cm, maturing in 2 years, late dehiscent. Seed scales with dark red-brown border adaxially distally; apophyses rhombic, low cross keeled; umbo with a short, weak prickle, sometimes unarmed. Seeds pale brown, mottled darker or nearly black, somewhat compressed, ellipsoid, 5–6 mm, apex oblique; wing to 2 cm.

Cultivated. Jiangsu, Jiangxi, Zhejiang [native to SE United States].

13. *Pinus rigida* Miller, Gard. Dict., ed. 8, *Pinus* no. 10. 1768.

刚松 gang song

Trees to 30 m tall; trunk straight or crooked, to 0.9 m d.b.h. in native range, usually with adventitious sprouts; bark red-brown, with deeply and irregularly oblong, flat, scaly ridges; crown rounded or irregular; 2nd-year branchlets orange-brown, aging darker brown, stout, mostly more than 5 mm wide, rough; winter buds red-brown, ovoid or ovoid-cylindrical, resinous, scales fringed at margin. Needles 3(–5) per bundle, deep or pale yellow-green, twisted, 5–10(–15) cm × 1–1.5(–2) mm, stomatal lines present on all surfaces, base with persistent sheath 0.9–1.2 cm. Seed cones often clustered, sessile or shortly pedunculate, dull brown or pale red-brown, conical or ovoid before opening, broadly ovoid with flat or slightly convex base when open, 3–9 cm, maturing in 2 years, dehiscent. Seed scales with dark red-brown border adaxially distally; apophyses rhombic, slightly raised, strongly cross keeled; umbo low pyramidal, with a slender, reflexed prickle. Seeds dark brown, mottled darker or nearly black, broadly obliquely obovoid-deltoid, 4–6 mm; wing 1.5–2 cm.

Cultivated. Fujian, Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Liaoning, Shandong (Qingdao Shi) [native to SE Canada, E United States].

14. *Pinus palustris* Miller, Gard. Dict., ed. 8, *Pinus* no. 14. 1768.

长叶松 chang ye song

Pinus australis F. Michaux; *P. longifolia* Salisbury.

Trees to 45 m tall; trunk to 1.2 m d.b.h. in native range; bark orange-brown, with coarse, oblong, scaly plates; crown rounded; branches spreading-descending, upcurved at tips; branchlets orange-brown, aging darker brown, stout, rough; winter buds silvery white, ovoid, 3–4 cm, scales fringed at margin. Needles spreading-recurved, (2 or)3 per bundle, yellow-green, slightly twisted, 20–45 cm × ca. 1.5 mm, stomatal lines present on all surfaces, base with persistent sheath 2–2.5(–3) cm, margin finely serrulate. Seed cones solitary or paired toward branchlet tips, sessile or rarely shortly pedunculate, dark brown, ovoid-cylindrical when

open, 15–25 cm, maturing in 2 years, then quickly shedding seeds and falling. Apophyses dull, nearly rhombic, slightly thickened and raised, strongly cross keeled; umbo broadly triangular, with a short, stiff, reflexed prickle. Seeds pale brown, mottled darker, truncate-obovoid, ca. 1 cm; wing 3–4 cm.

Cultivated. Fujian, Jiangsu, Jiangxi (Lu Shan), Shandong (Qingdao Shi), Zhejiang [native to SE United States].

15. *Pinus elliotii* Engelmann, Trans. Acad. Sci. St. Louis 4: 186. 1880.

湿地松 shi di song

Trees to 30 m tall; trunk to 0.8 m d.b.h. in native range; bark orange- or purple-brown, furrowed into irregularly oblong, large, papery, scaly plates; crown conical, becoming rounded or flat topped; branchlets orange-brown, aging darker brown, stout, roughly scaly, producing 3 or 4 nodes each year; winter buds silvery brown, cylindrical, scales fringed at margin. Needles 2 or 3 per bundle, slightly twisted, yellow- or blue-green, 15–20 (–24) cm × 0.2–1.5 mm, stomatal lines present on all surfaces, base with persistent sheath 1–2 cm, margin finely serrulate. Seed cones solitary or paired, pedunculate (peduncle to 3 cm), pale brown, ovoid or ovoid-cylindrical when open, (7–)9–18(–20) cm, maturing in 2 years, then falling the year after seeds shed. Apophyses lustrous, slightly raised, strongly cross keeled; umbo depressed-pyramidal, with a short, stout prickle. Seeds dark brown, ellipsoid, 6–7 mm, apex oblique; wing to 2 cm.

Cultivated. Anhui (Jing Xian), Fujian (Minhou Xian), Guangdong, Guangxi, Hubei (Wuhan Shi), Hunan, Jiangsu, Jiangxi (Ji'an Xian), Taiwan, Yunnan (Kunming Shi), Zhejiang [native to SE United States].

16. *Pinus caribaea* Morelet, Rev. Hort. Côte d'Or 1: 107. 1851.

加勒比松 jia le bi song

Trees to 40 m tall; trunk to 1 m d.b.h. in native range; bark gray or pale reddish brown, fissured and shed in large, flat, wide plates; crown ovoid or irregularly shaped; branchlets initially green and glaucous, aging orange-brown, producing a few short nodes each year; winter buds cylindrical, scales white fringed at margin. Needles (2 or)3 per bundle, usually 4 or 5 per bundle on young trees, dull green or pale yellow-green, 15–30 cm × ca. 1.5 mm, stomatal lines present on all surfaces, resin canals (2 or)3 or 4(–8), internal, base with persistent sheath 1–1.5 cm, margin serrulate. Seed cones almost terminal, ovoid-cylindrical, 5–10(–12) × 3–6 cm, often leaving a few basal scales. Seed scales reflexed or spreading; apophyses lustrous, tan or reddish brown, swollen, cross keeled; umbo slightly projecting, ending in a straight, minute prickle. Seeds usually narrowly mottled gray or light brown, rhombic-ovoid, 6–7 mm; wing dull gray, 2–2.5 cm, usually remaining attached.

Cultivated. Fujian, Guangdong, Guangxi, Jiangsu, Jiangxi [native to Caribbean region, Central America].

17. *Pinus taeda* Linnaeus, Sp. Pl. 2: 1000. 1753.

火炬松 huo ju song

Trees to 45 m tall; trunk to 1.6 m d.b.h. in native range; bark red-brown, forming square or irregularly oblong, scaly plates; crown broadly conical or rounded; branchlets orangish or yellow-brown, aging darker brown, ca. 1 cm in diam., rough; winter buds pale red-brown, conical-cylindrical, slightly resinous, scales white fringed at margin. Needles ascending or spreading, dark yellow-green, slightly twisted, (10–)12–18(–23) cm × 1–2 mm, pliant, stomatal lines present on all surfaces, base with persistent sheath 1–2.5 cm, margin finely serrulate. Seed cones nearly terminal, solitary or in small clusters, sessile or subsessile, mostly dull yellow-brown, narrowly ovoid when open, 6–12 cm, maturing in 2 years, then soon shedding seeds. Seed scales without dark border adaxially distally; apophyses dull, rhombic, slightly thickened, variously raised but more so toward base of cone, strongly cross keeled; umbo strongly pyramidal, recurved, tapering to a stoutly based, sharp prickle. Seeds red-brown, obdeltoid, 5–6 mm; wing to 2 cm.

Cultivated. Anhui, Fujian, Guangdong (Guangzhou Shi), Guangxi, Henan, Hubei (Wuhan Shi), Hunan, Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Taiwan, Zhejiang [native to SE United States].

18. *Pinus ponderosa* Douglas ex C. Lawson, Agric. Man. 354. 1836.

西黄松 xi huang song

Trees to 70 m tall; trunk to 2.5 m d.b.h. in native range; bark yellow- to red-brown, deeply and irregularly furrowed into broadly oblong, scaly plates; crown broadly conical to rounded; branchlets orange-brown, aging darker, stout, rough; winter buds red-brown, ovoid, very resinous, scales white fringed at margin. Needles tufted at apex of branchlets, spreading to erect, (2 or)3(–5) per bundle, deep yellow-green, slightly twisted, 7–25(–30) cm × (1–)1.2–2 mm, pliant, stomatal lines present on all surfaces, base with persistent sheath 1.5–3 cm, margin serrulate. Seed cones solitary or rarely paired, sessile or subsessile, mostly reddish brown, broadly ovoid when open, symmetric or asymmetric, 5–15 cm, maturing in 2 years, then soon shedding seeds, leaving rosettes of scales on branchlets. Apophyses dull or lustrous, thickened, variously raised, cross keeled; umbo usually pyramidal or truncate, rarely depressed or with a reflexed prickle. Seeds brown or yellow-brown, often mottled darker, ellipsoid-obovoid, 3–9 mm; wing 1.5–2.5 cm.

Cultivated. Henan (Jigong Shan), Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Liaoning [native to W North America].

This species is economically important and is grown for its fine timber.

19. *Pinus tropicalis* Morelet, Rev. Hort. Côte d'Or 1: 106. 1851.

热带松 re dai song

Trees to 20 m tall; trunk to 1.8 m d.b.h. in native range; bark grayish red, irregularly furrowed into large, oblong plates; crown broadly rounded; branchlets orange-brown initially, aging gray-brown or gray, stout, rough; winter buds stout, scales reflexed. Needles very erect, 2 (or 3) per bundle, stiff, 10–30 cm × ca. 1 mm, resin canals 2–9, large, touching both endodermis and hypodermis and forming a septum, margin serrulate. Seed cones erect or spreading, shortly pedunculate, pale brown, ovoid-conical, 5–8 cm. Apophyses orange-brown, pyramidal, cross ridged; umbo not spinose.

Cultivated. Guangdong (Zhanjiang Shi) [native to W Cuba].

20. *Pinus pinaster* Aiton, Hort. Kew. 3: 367. 1789.

海岸松 hai an song

Trees to 30 m in native range; bark brown, deeply and irregularly longitudinally furrowed; branches sometimes pendulous, forming a pyramidal crown; branchlets pale reddish brown, producing 1–few nodes each year; winter buds brown, oblong, resinous. Needles 2 per bundle, bright green, usually twisted, 10–20 cm × ca. 2 mm, stiff, resin canals 6, median. Seed cones clustered, shortly pedunculate, conical- or ellipsoid-ovoid, symmetric or asymmetric, 9–18 cm. Apophyses brown, lustrous, conspicuously pyramidal; umbo slightly projecting and pungent.

Cultivated. Jiangsu, Jiangxi (Lu Shan) [native to N Africa, S Europe].

21. *Pinus thunbergii* Parlatore in A. de Candolle, Prodr. 16(2): 388. 1868.

黑松 hei song

Pinus thunbergiana Franco.

Trees to 30 m tall; trunk to 2 m d.b.h. in native range; bark dull gray when young, aging gray-black, rough and thick, scaly and deciduous; crown broadly conical or umbrellalike; 1st-year branchlets pale brown-yellow, glabrous; winter buds silvery white, cylindric-ellipsoid or cylindric, scales fringed at margin. Needles 2 per bundle, dull green, shiny, 6–12 cm × 0.5–2 mm, rigid, stomatal lines present on all surfaces, resin canals 6–11, median, base with persistent sheath, margin serrulate. Seed cones solitary or 2 or 3 together, shortly pedunculate, brown, conical-ovoid or ovoid, 4–6 × 3–4 cm, deciduous. Seed scales ovate-elliptic; apophyses slightly swollen, obviously cross keeled; umbo slightly concave, apex blunt. Seeds obovoid-ellipsoid, 5–7 × 2–3.5 mm; wing gray-brown, 1–1.1 cm.

Pollination Apr–May, seed maturity Oct of 2nd year.

Cultivated in cities, used for afforestation on mountain slopes; to 1400 m. Beijing Shi, Hubei (Wuhan Shi, Yingshan Xian), Jiangsu (Nanjing Shi), Jiangxi, Liaoning, Shandong, Yunnan (Kunming Shi), Zhejiang [native to Japan, Korea].

22. *Pinus nigra* J. F. Arnold, Reise Mariazell 8. 1785.

欧洲黑松 ou zhou hei song

Trees to 50 m in native range; bark gray or dark brown; branchlets pale brown or orange-brown, glabrous; winter buds ovoid or cylindric-ovoid, slightly resinous.

Needles 2 per bundle, pale or dark green, straight or curved, 4–19 cm × 1–2 mm, somewhat rigid, resin canals 3–17, median, base with persistent sheath. Seed cones sessile, yellowish or pale brown, shiny, 3–8 × 2–4 cm, deciduous. Apophyses slightly or obtusely keeled; umbo mucronate.

Widely cultivated. Beijing Shi, Hubei (Wuhan Shi), Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Liaoning, Shandong, Zhejiang [native to NW Africa, SW Asia, S Europe].

23. *Pinus banksiana* Lambert, Descr. Pinus 1: 7. 1803.

北美短叶松 bei mei duan ye song

Trees to 25 m tall; trunk straight or crooked, to 0.6 m d.b.h. in native range; bark orange- or red-brown, scaly; crown irregularly rounded or flat topped; branchlets orange-red or red-brown, aging gray-brown, slender, rough; winter buds red-brown, ovoid, resinous. Needles 2 per bundle, yellow-green, twisted, 2–5 cm × 1–1.5 (–2) mm, stomatal lines present on all surfaces, fine, base with semipersistent sheath 3–6 mm, margin finely serrulate. Seed cones upcurved, nearly sessile or shortly pedunculate, tan to pale brown or greenish yellow, ovoid when open, asymmetric, 3–5.5 cm, maturing in 2 years, then soon shedding seeds or often long serotinous and shedding seeds only with age or after fire. Apophyses mostly depressed but increasingly mamillate toward outer part, basal of cone; umbo depressed, sunken centrally, small, unarmed or with a small, reflexed apicula. Seeds brown or nearly black, compressed obovoid, oblique, 4–5 mm; wing 1–1.2 cm.

Cultivated. Beijing Shi, Heilongjiang (Harbin Shi), Henan (Jigong Shan), Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Liaoning, Shandong [native to N North America].

24. *Pinus virginiana* Miller, Gard. Dict., ed. 8, *Pinus* no. 9. 1768.

矮松 ai song

Trees to 20 m tall; trunk to 0.5 m d.b.h. in native range; bark gray-brown, with irregular, scaly, plated ridges, reddish and scaly toward apex of trunk; crown irregularly rounded or flattened; branchlets red or purple tinged, often glaucous, aging red-brown or gray, slender, rough; winter buds red-brown, ovoid or cylindric, resinous or not, scales white fringed at margin. Needles 2 per bundle, deep to pale yellow-green, strongly twisted, 2–8 cm × 1–1.5 mm, stomatal lines present on all surfaces, inconspicuous, base with persistent sheath 4–10 mm, margin serrulate. Seed cones sessile or shortly pedunculate (peduncle to 1 cm), dull red-brown, ovoid when open, symmetric, 3–7 (–8) cm, maturing in 2 years, then soon shedding seeds. Seed scales with strong purple-red or purple-brown border adaxially distally, rigid; apophyses slightly elongated and thickened; umbo low pyramidal, with a slender, stiff prickle. Seeds pale brown, mottled darker, compressed obovoid, 4–7 mm, apex oblique; wing to 2 cm, narrow.

Cultivated. Jiangsu (Nanjing Shi), Jiangxi (Lu Shan) [native to E United States].

25. *Pinus squamata* X. W. Li, Acta Bot. Yunnan. 14: 259. 1992.

巧家五针松 qiao jia wu zhen song

Trees; bark gray-green, aging dark brown, flaking, smooth when young, inner bark pale; branchlets red-brown, densely yellow- or gray-brown pubescent or glabrous; winter buds red-brown, ovoid, resinous, scales triangular-lanceolate. Needles 4 or 5 per bundle, 9–17 cm × ca. 0.8 mm, stomatal lines present on all surfaces, vascular bundle 1, resin canals 3–5, marginal, base with sheath shed, margin serrulate. Seed cones pedunculate (peduncle 1.5–2 cm), conical-ovoid, ca. 9 × 6 cm, dehiscent at maturity. Seed scales oblong-elliptic, ca. 2.7 × 1.8 cm; apophyses swollen, obviously transversely ridged; umbo dorsal, sunken, not spiny. Seeds black, longitudinally striate, oblong or obovate; wing ca. 1.6 cm, black striate, articulate. Pollination Apr–May, seed maturity Sep–Oct of 2nd year.

• NE Yunnan (Qiaojia Xian).

A highly endangered species known only from a population of little more than 20 trees.

26. *Pinus gerardiana* Wallich ex D. Don in Lambert, Descr. Pinus, ed. 8°, 2: p. s.n. inter 144 & 145. 1832.

须弥白皮松 xu mi bai pi song

Trees; bark white, fissured into irregular, thin plates; 1st-year branchlets pale green-yellow, glabrous, with projected leaf scars. Needles 3 per bundle, triangular-flabellate in cross section, 6–10 cm, stiff, vascular bundle 1, resin canals 5–7, marginal, base with sheath shed. Seed cones shortly pedunculate, almost brown at maturity, oblong or ovoid, 12–20 × 9–11 cm. Seed scales 4–5 cm; apophyses broad, swollen, ± recurved, obviously ridged; umbo dorsal, apex obtuse. Seeds cylindrical, ca. 2.5 cm; wing rudimentary, usually adhering to adjacent scale.

Mountains; ca. 2700 m. S Xizang [E Afghanistan, N India, Kashmir, N Pakistan].

27. *Pinus bungeana* Zuccarini ex Endlicher, Syn. Conif. 166. 1847.

白皮松 bai pi song

Trees to 30 m tall; trunk monopodial or forked near base, to 3 m d.b.h.; bark irregularly flaking, inner bark pale, exfoliating in irregular, thin, scaly patches; crown broadly pyramidal or umbrellalike; 1st-year branchlets gray-green, glabrous; winter buds red-brown, ovoid, not resinous. Needles 3 per bundle, triangular-flabellate in cross section, 5–10 cm × 0.5–2 mm, stiff, vascular bundle 1, resin canals 6 or 7, marginal, rarely 1 or 2 median, base with sheath shed. Seed cones solitary, shortly pedunculate or sessile, usually pale green, yellowish brown at maturity, ovoid or conical-ovoid, 5–7 × 4–6 cm. Seed scales broadly oblong-cuneate, apex thickened; apophyses subrhombic, obviously

transversely ridged; umbo dorsal, triangular, protruding, usually terminating in a recurved spine. Seeds gray-brown, subobovoid, ca. 10 × 5–6 mm; wing loosely attached, ca. 5 mm. Pollination Apr–May, seed maturity Oct–Nov of 2nd year.

• Mountains, hills; 500–1800 m. S Gansu, W Henan, W Hubei (Badong Xian), S Shaanxi, Shandong, Shanxi, N Sichuan.

28. *Pinus pumila* (Pallas) Regel in Kuester & al., Index Sem. Hort. Bot. Imp. Petrop. 1858: 23. 1859.

偃松 yan song

Pinus cembra Linnaeus var. *pumila* Pallas, Fl. Ross. 1(1): 5. 1784; *P. cembra* var. *pygmaea* Loudon.

Shrubs to 6 m tall, usually with creeping branches to 10 m; bark gray-brown, flaking; branchlets initially brown, dark red-brown in 2nd or 3rd year, densely pubescent; winter buds red-brown, conical-ovoid, slightly resinous. Needles 5 per bundle, trapeziform in cross section, 4–6(–8.3) cm × ca. 1 mm, stiff, vascular bundle 1, resin canals (1 or)2, marginal, base with sheath shed. Seed cones erect, maturing to pale purple- or red-brown, conical-ovoid or ovoid, 3–4.5 × 2.5–3 cm, indehiscent or imperfectly dehiscent at maturity. Seed scales broadly subrhombic or rhombic-obovate; apophyses broadly triangular, thick, swollen, margin slightly recurved; umbo purple-black, distinct, ending in a slightly recurved protuberance. Seeds dark brown, triangular-obovoid, 7–10 × 5–7 mm, wingless, abaxial margin ridged.

Mountains; 1000–2300 m. Heilongjiang, Jilin, Nei Mongol [Japan, Korea, N Mongolia, E Russia].

29. *Pinus koraiensis* Siebold & Zuccarini, Fl. Jap. 2: 28. 1842.

红松 hong song

Pinus koraiensis (Siebold & Zuccarini) Moldenke; *Pinus mandschurica* Ruprecht; *P. prokoraiensis* Y. T. Zhao & al.; *Strobilus koraiensis* (Siebold & Zuccarini) Moldenke.

Trees to 50 m tall; trunk to 1 m d.b.h.; bark gray-brown or gray, fissured longitudinally into irregularly oblong plates, inner bark red-brown; branchlets densely red-brown, occasionally yellow pubescent; winter buds reddish brown, oblong-ovoid, slightly resinous. Needles 5 per bundle, dark green, straight, almost triangular in cross section, 6–12 cm, stomatal lines 6–8 along each abaxial surface, blue-gray, vascular bundle 1, resin canals 3, median, base with sheath shed, margin serrulate. Seed cones solitary or several clustered near apex of 1st-year branchlets, erect, pedunculate (peduncle 1–1.5 cm), conical-ovoid or ovoid-oblong, 9–14 × 6–8 cm, indehiscent or slightly dehiscent at maturity, with seeds exposed but not shed. Seed scales reflexed at apex. Seeds triangular-obovoid, 1.2–1.6 cm, wingless.

Mountains; 200–1800 m. Heilongjiang, Jilin [Japan, Korea, E Russia]. The timber is used for construction, bridge building, vehicles, furniture, and wood pulp. The seeds are edible, medicinal, and used as a

source of soap and lubricating oil. Turpentine is obtained from the timber and roots, and the bark yields tannin.

30. *Pinus sibirica* Du Tour in Déterville, *Nouv. Dict. Hist. Nat.* 18: 18. 1803.

鲜卑五针松 xian bei wu zhen song

Pinus cembra Linnaeus subsp. *sibirica* (Du Tour) Krylov; *P. cembra* var. *sibirica* (Du Tour) G. Don; *P. hinganensis* H. J. Zhang; *P. sibirica* var. *hinganensis* (H. J. Zhang) Silba.

Trees to 35 m tall; trunk to 1.8 m d.b.h.; bark pale brown or gray-brown; branchlets yellow or brownish yellow, thick, densely pale yellow pubescent; winter buds red-brown, conical. Needles 5 per bundle, slightly curved, almost triangular in cross section, 6–11 cm × 0.5–1.7 mm, stiff, stomatal lines 3–5 along each abaxial surface, gray-white, vascular bundle 1, resin canals 3, median, base with sheath shed, margin serrulate. Seed cones erect, conical-ovoid, 5–8 × 3–5.5 cm, indehiscent or slightly dehiscent at maturity. Seed scales widely cuneate proximally, thickened distally; apophyses purple-brown, broadly rhombic or broadly triangular-semiorbicular, densely pilose; umbo yellow-brown, obvious. Seeds yellow-brown, obovoid, ca. 10 × 5–6 mm, slightly ridged, wingless. Pollination Apr, seed maturity Sep–Oct of 2nd year.

Mountains, river basins; 800–2400 m. Heilongjiang (Tuqiang), Nei Mongol, Xinjiang [Kazakhstan, Mongolia, E Russia].

A vulnerable species in China. Plants named as *Pinus hinganensis* represent the E limits of *P. sibirica*; they are considerably disjunct from the main distribution center, and grow at lower elevations (800–1300 m), but are nevertheless indistinguishable from *P. sibirica*.

The timber is used for construction and furniture.

31. *Pinus armandii* Franchet, *Nouv. Arch. Mus. Hist. Nat.*, sér. 2, 7: 95. 1884.

华山松 hua shan song

Trees to 35 m tall; trunk to 1 m d.b.h.; bark gray, fissured into square plates or shed; crown conical or cylindrical-pyramidal; branchlets green, gray-green, or brown, glaucous, turning brown when dry, glabrous; winter buds almost cylindrical, slightly resinous. Needles 5(–7) per bundle, triangular in cross section, 8–15 cm × 1–1.5 mm, vascular bundle 1, resin canals 3(–7), median or 2 marginal. Pollen cones erect or drooping, slender or stout, cylindrical or ovoid-ellipsoid. Seed cones pedunculate (peduncle 2–3 cm), green, maturing yellow or brown-yellow, conical-cylindrical, dehiscent at maturity, shedding seeds. Seed scales rhombic-obovate, 3–4 × 2.5–3 cm; apophyses rhombic or triangular, not ridged, apex obtuse-rounded or acuminate, not recurved or slightly recurved; umbo not obvious. Seeds yellow-brown, dark brown, or black, obovoid, 1–1.5 cm × 6–10 mm, wingless or abaxial margin ridged, rarely shortly winged. Pollination Apr–May, seed maturity Sep–Oct of 2nd year.

Mountains, river basins; 1000–3300 m. S Gansu, C and NW Guizhou, Hainan, SW Henan, W Hubei, S Shaanxi, S Shanxi, Sichuan, C Taiwan, SE Xizang, Yunnan [N Myanmar].

The timber is used for construction, railway sleepers, furniture, and wood fiber.

- 1a. Pollen cones erect, stout, ovoid-ellipsoid; branchlets green or gray-green, drying brown; apophyses yellow or brown-yellow when mature, rhombic, not recurved distally or recurved only at umbo 31a. var. *armandii*
- 1b. Pollen cones drooping, slender, cylindrical; branchlets gray-brown; apophyses brown or reddish brown when mature, triangular, usually slightly recurved distally 31b. var. *mastersiana*

31a. *Pinus armandii* var. *armandii*

华山松(原变种) hua shan song (yuan bian zhong)

Pinus excelsa Wallich ex D. Don var. *chinensis* Patschke; *P. levis* Lemée & H. Lévillé; *P. scipioniformis* Masters.

Branchlets green or gray-green, drying brown. Pollen cones erect, stout, ovoid-ellipsoid. Apophyses yellow or brown-yellow when mature, rhombic, not recurved distally or recurved only at umbo.

Mountains, river basins; 1000–3300 m. S Gansu, C and NW Guizhou, Hainan, SW Henan, W Hubei, S Shaanxi, S Shanxi, Sichuan, SE Xizang, Yunnan [N Myanmar].

31b. *Pinus armandii* var. *mastersiana* (Hayata) Hayata, *J. Coll. Sci. Imp. Univ. Tokyo* 25(19): 217. 1908.

台湾果松 tai wan guo song

Pinus mastersiana Hayata, *Gard. Chron.*, ser. 3, 43: 194. 1908.

Branchlets gray-brown. Pollen cones drooping, slender, cylindrical. Apophyses brown or reddish brown when mature, triangular, usually slightly recurved distally.

- Mountains, on well-drained, acidic soils; 1800–3300 m. C Taiwan.

32. *Pinus fenzeliana* Handel-Mazzetti, *Oesterr. Bot. Z.* 80: 337. 1931.

海南五针松 hai nan wu zhen song

Trees to 50 m tall; trunk to 1 m d.b.h.; bark dark brown or gray-brown, flaking; 1st-year branchlets pale brown (drying dark red-brown), rarely glaucous, slender, glabrous, longitudinally furrowed; winter buds cylindrical-conical or ovoid, slightly resinous. Needles 5 per bundle, slender, triangular in cross section, 5–18 cm × 0.5–0.7 cm, flexible, vascular bundle 1, resin canals 3, 2 marginal and 1 median. Seed cones solitary or 2–4 clustered at base of branchlets, pedunculate (peduncle 1–2 cm), green, maturing to yellow-brown, narrowly ovoid, ellipsoid-ovoid, or cylindrical-ellipsoid, 6–14 × 3–6 cm, usually resinous, dehiscent. Seed scales almost cuneate or oblong-obovoid, 2–2.5 × 1.5–2 cm at middle of cone; apophyses broadly subrhombic, distal margin obviously reflexed, apex thickened. Seeds chestnut or

pale brown, obovoid-ellipsoid, 0.8–1.5 cm × 5–8 mm; seed coat thin; wing rudimentary, 2–4(–7) mm or much shorter. Pollination Apr, seed maturity Oct–Nov of 2nd year.

Mountains, usually scattered on ridges, rocks, or cliffs; 900–1600 m. SW Anhui, Guangxi, C and N Guizhou, Hainan, SE Henan, E Hubei, SE Sichuan [Vietnam].

The timber is used for construction and producing turpentine.

- 1a. Needles 10–18 cm; seed cones narrowly ovoid or ovoid-ellipsoid, 6–9 cm; seeds chestnut brown, wing 2–4(–7) mm 32a. var. *fenzeliana*
1b. Needles 5–14 cm; seed cones cylindrical-ellipsoid, ca. 14 cm; seeds pale brown, wing very short, woody ... 32b. var. *dabeshanensis*

32a. *Pinus fenzeliana* var. *fenzeliana*

海南五针松(原变种) hai nan wu zhen song (yuan bian zhong)

Pinus parviflora Siebold & Zuccarini var. *fenzeliana* (Handel-Mazzetti) C. L. Wu.

Needles 10–18 cm. Seed cones narrowly ovoid or ovoid-ellipsoid, 6–9 cm. Seeds chestnut brown; wing 2–4(–7) mm.

Mountains, usually scattered on ridges and rocks; 1000–1600 m. Guangxi, C and N Guizhou, Hainan, SE Sichuan (Wulong Xian) [Vietnam].

32b. *Pinus fenzeliana* var. *dabeshanensis* (W. C. Cheng & Y. W. Law) L. K. Fu & Nan Li, *Novon* 7: 262. 1997.

大别五针松 da bie wu zhen song

Pinus dabeshanensis W. C. Cheng & Y. W. Law in W. C. Cheng & al., *Acta Phytotax. Sin.* 13(4): 85. 1975; *P. armandii* Franchet var. *dabeshanensis* (W. C. Cheng & Y. W. Law) Silba.

Needles 5–14 cm. Seed cones cylindrical-ellipsoid, ca. 14 cm. Seeds pale brown; wing very short, woody.

• Mountains, sometimes on cliffs or rocks; 900–1400 m. SW Anhui (Jinzhai Xian, Yuexi), SE Henan (Shangcheng Xian), E Hubei (Luotian Xian, Yingshan Xian).

An endangered plant.

33. *Pinus bhutanica* Grierson & al., *Notes Roy. Bot. Gard. Edinburgh* 38: 299. 1980.

不丹松 bu dan song

Trees to 25 m or more; crown moderately open, not twiggy; branches spreading, drooping, sinuous; 1st-year branchlets conspicuously whitish bloomed, glandular pubescent; 2nd-year branchlets with thin, pale gray-green bark. Needles shed in 2nd year, 5 per bundle, pendulous, very slender, curved, triangular in cross section, 15–24 cm, adaxial surface grass green with no stomata, 2 abaxial surfaces conspicuously whitish bloomed, each with 4–7 stomatal lines, resin canals 3(or 4), adaxial 2 marginal or submarginal, abaxial 1(or 2)

marginal or submarginal and always asymmetrically placed. Seed cones pedunculate (peduncle (1–) 4.5–6 cm), elongate-cylindric, 12–20 × 3–4 cm (5–7 cm wide when open). Seed scales rather elongate, thinly woody, base cuneate; apophyses rhombic, 1–1.5 × 1.5–2.5 cm, keeled, apex subacute. Seeds brown, obovoid, compressed, 6–8 × 4–5 mm; wing persistent, ca. 2 × 0.7–1 cm.

SE Xizang [Bhutan].

34. *Pinus wallichiana* A. B. Jackson, *Bull. Misc. Inform. Kew* 1938: 85. 1938.

乔松 qiao song

Pinus excelsa Wallich ex D. Don (1828), not Lamarck (1778); *P. griffithii* M'Clelland (1854), not (J. D. Hooker) Parlatore (1868); *P. nepalensis* Chambray (1845), not J. Forbes (1839).

Trees to 70 m tall; trunk to 1 m or more d.b.h.; bark dark gray-brown, minutely scaly and flaking; crown broadly pyramidal; 1st-year branchlets green (drying red-brown), shiny, faintly whitish bloomed, glabrous; winter buds red-brown, cylindrical-obovoid or cylindrical-conical, slightly resinous. Needles 5 per bundle, pendulous, slender, triangular in cross section, (6–)11–18(–20) cm × ca. 1 mm, soft, adaxial surface dark green, vascular bundle 1, resin canals 3, adaxial 2 marginal, abaxial 1 always median. Seed cones pendulous, pedunculate (peduncle 2.5–4 cm), cylindrical, straight or curved, 10–30 × 3–4 cm (5–9 cm wide when open), resinous. Seed scales cuneate-obovate, 3–5 × 2–3 cm at middle of cone; apophyses shiny, often glaucous, rhombic, slightly thickened; umbo dark brown, slightly projecting, apex obtuse, obviously incurved. Seeds brown or black-brown, ellipsoid-obovoid, 3–9 × 4–5 mm; wing 1–3 cm × 8–9 mm. Pollination Apr–May, seed maturity autumn of 2nd year.

Mountains, temperate rainforests; 1600–3300 m. S Xizang, NW Yunnan [Afghanistan, Bhutan, N India, Kashmir, Myanmar, Nepal, Pakistan, Sikkim].

Pinus wallichiana var. *parva* K. C. Sahni (*Indian J. Forest.* 12(1): 40. 1989) was described from SE Xizang, where it apparently grows in temperate rainforests with species of *Rhododendron* at ca. 3000 m. It is an insufficiently understood taxon, known only from the type, which was not seen by the authors. It is said to differ from typical *P. wallichiana* as follows: needles mostly less than 11 cm; seed cones straight (not curved), smaller (ca. 10 cm); seeds smaller (ca. 3 mm); wing shorter (ca. 10 mm).

The timber is used for construction, furniture, and for producing turpentine.

35. *Pinus morrissonicola* Hayata, *Gard. Chron.*, ser. 3, 43: 194. 1908.

台湾五针松 tai wan wu zhen song

Pinus formosana Hayata; *P. parviflora* Siebold & Zuccarini var. *morrissonicola* (Hayata) C. L. Wu; *P. uyematsui* Hayata.

Trees to 30 m tall; trunk to 1.2 m d.b.h.; bark dark gray, flaking; crown conical; 1st-year branchlets red-brown, initially yellowish pubescent, glabrescent; winter buds pale brown, ovoid, not resinous. Needles 5 per bundle, triangular in cross section, 4–9 cm × 0.6–1 mm, vascular bundle 1, resin canals 2, marginal, base with sheath shed. Seed cones 3 or 4 clustered at base of branchlets, pedunculate (peduncle 0.5–1 cm), conical-ellipsoid or ovoid-ellipsoid, 7–11 × 5–7 cm, resinous, dehiscent. Seed scales cuneate-elliptic, 3–3.5 × 1.5–2 cm; apophyses brown, shiny, broadly rhombic, middle portion thickened, apex recurved. Seeds ellipsoid-ovoid or narrowly ovoid, 8–10 × 5–6 mm; wing pale brown, 1.5–2 cm × 5–8 mm.

• Mountain slopes, ridges; 300–2300 m. Taiwan.

The timber is used for construction, bridge building, and making poles and furniture.

36. *Pinus wangii* Hu & W. C. Cheng, Bull. Fan Mem. Inst. Biol., n.s., 1: 191. 1948.

毛枝五针松 mao zhi wu zhen song

Trees to 20 m tall; trunk to 60 cm d.b.h. branchlets slender, dark red-brown, turning dark gray-brown, initially densely brown pubescent, glabrous in 2nd or 3rd year; winter buds brown, not resinous. Needles 5 per bundle, thick, slightly incurved, triangular in cross section, 2.5–6 cm × 1–1.5 mm, stiff, vascular bundle 1, resin canals 3, median, base with sheath shed. Seed cones solitary or 2 or 3 clustered at base of branchlets, pedunculate (peduncle 1.5–2 cm), yellowish brown, brown, or dark gray-brown at maturity, oblong-ellipsoid or cylindrical-ovoid, 4.5–9 × 2–4.5 cm. Seed scales subobovate, 2–3 × 1.5–2 cm; apophyses transversely rhombic, margin thin, slightly incurved, rarely slightly recurved on middle or basal seed scales; umbo sunken, not swollen. Seeds pale brown, ellipsoid-ovoid, 8–10 × ca. 6 mm; wing ca. 16 × 7 mm.

Scattered in evergreen broad-leaved forests on limestone hillsides, where only fragmented populations remain on inaccessible cliffs; 500–1800 m. SE Yunnan (Malipo Xian, Xichou Xian) [?Vietnam].

An endangered species in China. The Vietnamese plants may represent a different taxon, perhaps better placed within *Pinus dalatensis* Ferré, which is endemic to Vietnam.

The timber is used for construction, bridge building, and making poles and furniture.

37. *Pinus kwangtungensis* Chun & Tsiang, Sunyatsenia 7: 113. 1948.

华南五针松 hua nan wu zhen song

Trees to 30 m tall; trunk to 1.5 m d.b.h.; bark brown, scaly; 1st-year branchlets pale brown; old branchlets grayish brown or yellow-brown, glabrous, rarely puberulent; winter buds black-brown, slightly resinous. Needles 2–5 per bundle, triangular in cross section, 3.5–7 cm × 1–1.5 mm, vascular bundle 1, resin canals 2, marginal, sometimes also 1 median, base with sheath shed. Seed cones usually solitary, pedunculate

(peduncle 0.7–2 cm), reddish brown at maturity, cylindrical-oblong or cylindrical-ovoid, 3–9(–17) × 1.5–7 cm, slightly resinous. Seed scales cuneate-obovate, 2.5–3.5 × 1.5–2.3 cm; apophyses rhombic, apex thin, straight or slightly incurved. Seeds ellipsoid or obovoid, 0.8–1.2 cm, together with wing subequal to seed scales. Pollination Apr–May, seed maturity Oct of 2nd year.

Hills, slopes, mountain ridges, summits; 500–1600 m. N Guangdong, SW Guangxi, S Guizhou, Hainan, S Hunan [Vietnam].

A vulnerable species in China. It has often been confused, and even united, with *Pinus fenzieliana* (to which the records from Hainan might belong); however, the two species are not considered here to be conspecific.

- 1a. Needles usually 5 per bundle, with white stomatal bands abaxially; seed cones 5–9(–17) × 3–7 cm 37a. var. *kwangtungensis*
- 1b. Needles 2 or 3(–5) per bundle, with inconspicuous stomatal bands abaxially; seed cones 3–4 × 1.5–2 cm 37b. var. *varifolia*

37a. *Pinus kwangtungensis* var. *kwangtungensis*

华南五针松(原变种) hua nan wu zhen song (yuan bian zhong)

Pinus wangii Hu & W. C. Cheng var. *kwangtungensis* (Chun & Tsiang) Silba.

Needles usually 5 per bundle, with white stomatal bands abaxially. Seed cones 5–9(–17) × 3–7 cm.

Hills, slopes, mountain ridges; 700–1600 m. N Guangdong, S Guizhou, Hainan, S Hunan [Vietnam].

37b. *Pinus kwangtungensis* var. *varifolia* Nan Li & Y. C. Zhong, Novon 7: 262. 1997.

变叶华南五针松 bian ye hua nan wu zhen song

Needles 2 or 3(–5) per bundle, with inconspicuous stomatal bands abaxially. Seed cones 3–4 × 1.5–2 cm.

Summits of limestone mountains; ca. 500 m. SW Guangxi (Longlin Gezu Zizhixian, Tiandeng Xian) [Vietnam].

Perhaps not a distinct taxon; the lower number of leaves per bundle may be the result of poor growth.

38. *Pinus strobus* Linnaeus, Sp. Pl. 2: 1001. 1753.

北美乔松 bei mei qiao song

Trees to 65 m tall; trunk to 1.8 m d.b.h.; bark gray-brown, deeply furrowed, with irregularly oblong, long, scaly plates; crown conical, becoming rounded or flattened on top; winter buds light red-brown, ovoid-cylindrical, slightly resinous. Needles 5 per bundle, not pendulous, deep green to blue-green, slightly twisted, 6–14 cm × 0.7–1 mm, pliant, stomatal lines present on all surfaces, base with early shed sheath 1–1.5 cm, margin finely serrulate. Seed cones clustered, pedunculate (peduncle 2–3 cm), gray-brown or pale brown with purple or gray tints, cylindrical, ellipsoid, or lanceolate-cylindrical when open, 7–20 cm, maturing in 2

years, then soon shedding seeds and falling. Apophyses slightly raised, apex resinous; umbo terminal. Seeds red-brown, black mottled, broadly and obliquely obovoid, compressed, 5–6 mm; wing pale brown, 1.8–2.5 cm.

Cultivated. Beijing Shi, Jiangsu (Nanjing Shi), Jiangxi (Lu Shan), Liaoning [native to E Canada, Guatemala, S Mexico, E United States].

39. *Pinus parviflora* Siebold & Zuccarini, Fl. Jap. 2: 27. 1842.

日本五针松 ri ben wu zhen song

Trees to 25 m tall; trunk to 1 m d.b.h.; bark pale gray, aging dull gray, smooth when young, furrowed with age into scaly plates; crown conical; 1st-year branchlets initially green, aging yellow-brown, densely pale yellow pubescent; winter buds ovoid, not resinous. Needles 5 per bundle, slightly curved, triangular in cross section, 3.5–5.5 cm × 0.7–0.9 mm, stomatal lines present along abaxial surfaces, white, vascular bundle 1, base with sheath shed. Seed cones sessile, ovoid or ovoid-ellipsoid, 4–7.5 × 3.5–4.5 cm. Seed scales obovate-rhombic or oblong-obovate, 2–3 × 1.8–2 cm; apophyses pale brown or dull gray-brown, almost rhombic; umbo terminal, sunken, margin recurved distally. Seeds nearly brown, mottled with black, irregularly obovoid, 8–10 × ca. 7 mm; wing ca. 1 cm.

Widely cultivated in cities in the Chang Jiang basin and Shandong [native to Japan].

Commonly used as a garden tree or for bonsai.

