

CUPRESSACEAE

柏科 bai ke

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Trees or shrubs evergreen, monoecious or dioecious. Leaves decussate or in whorls of 3, scalelike and then often dimorphic with flattened facial leaves and keeled lateral leaves, or needlelike particularly in juvenile plants, often with an abaxial resin gland. Pollen cones terminal or axillary, solitary, maturing and shed annually; microsporophylls 6–16, decussate or whorled, each bearing (2 or)3–6(–9) pollen sacs; pollen wingless. Seed cones usually terminal, solitary, globose, ovoid, or oblong, dehiscent or indehiscent when mature in 1st or 2nd(or 3rd) year; cone scales developing after ovules originate in bract axils; bracts almost completely enveloped by cone scales, free only at apex; ovules 1–numerous per bract axil, erect; cone scales of mature cones 3–16, flat or peltate, woody, ± leathery, or succulent, 1–20-seeded. Seeds winged or not; wings derived from seed coat. Cotyledons usually 2, rarely 3–6. Germination epigeal.

Nineteen genera and ca. 125 species: worldwide; eight genera (one introduced) and 46 species (16 endemic, 13 introduced) in China.

In this account, the Cupressaceae is treated *sensu stricto*, i.e., excluding those taxa that are traditionally classified in Taxodiaceae. A merger of these two families is substantially supported by both morphological and molecular evidence (the Cupressaceae forms a clearcut monophyletic group derived from within the Taxodiaceae). No consistent characters separate them, while the homology of the reproductive organs, so fundamentally different from other conifer families, appears to unite them phylogenetically. However, the traditional family concept, as adopted in FRPS, has been maintained here for pragmatic reasons.

In FRPS, it was stated that *Microbiota decussata* Komarov had been said to grow in NE China, but that no material had been seen. This species is known with certainty only from the Sikhote Alin range of E Russia (Primorye), not far from the Chinese border, where it grows on mountains above the timberline. It resembles a spreading *Juniperus* but has minute, dehiscent, 1-seeded cones, and should be searched for in comparable areas in E Heilongjiang. One endemic species, *Thuja sutchuenensis*, has apparently become extinct in the wild in historic times. *Sabina*, which was recognized in FRPS as a distinct genus, is reduced to the synonymy of *Juniperus* in this account.

For the species that bear scalelike leaves, the branchlets described are those bearing such leaves.

Wang Wen-tsai, Cheng Wan-chün, Fu Li-kuo & Chu Cheng-de. 1978. Cupressaceae. In: Cheng Wan-chün & Fu Li-kuo, eds., Fl. Reipubl.

Popularis Sin. 7: 313–398.

- 1a. Seed cones succulent, indehiscent or slightly dehiscent when mature; seeds wingless 8. *Juniperus*
 1b. Seed cones woody or leathery, dehiscent when mature; seeds usually winged, rarely wingless.
 2b. Seed cones with peltate scales, maturing in 1st or 2nd year.
 3a. Leaves 2–10 mm; seeds with 2 apical, unequal wings 7. *Fokienia*
 3b. Leaves up to 3 mm; seeds with lateral, narrow wings.
 4a. Branchlets usually not arranged in a plane; seed cones maturing in 2nd year, fertile cone scales with 3–numerous seeds 5. *Cupressus*
 4b. Branchlets arranged in a plane; seed cones maturing in 1st year, fertile cones scales with (1 or)2(–5) seeds 6. *Chamaecyparis*
 2a. Seed cones with flattened scales, maturing in 1st year.
 5a. Lateral leaves 4–7 mm, with conspicuous, white stomatal bands abaxially; fertile cone scales each with 3–5 seeds 1. *Thujaopsis*
 5b. Lateral leaves usually less than 4 mm, without conspicuous, white stomatal bands abaxially; fertile cone scales each with 1 or 2 seeds.
 6a. Seed cones with only middle pair of scales fertile; seeds with 2 subapical, unequal wings 4. *Calocedrus*
 6b. Seed cones with middle 2 or 3 pairs of scales fertile; seeds with 2 lateral, narrow wings, a very narrow wing, or wingless.
 7a. Seed cones with 8 or 10 thin scales; bracts almost completely enveloped by cone scales, free apex, a very short mucro; seeds with 2 lateral, narrow wings 2. *Thuja*
 7b. Seed cones with 6 or 8 thick scales; bracts partly enveloped by cone scales, free apex a long, recurved cusp; seeds wingless, rarely with a very narrow wing 3. *Platycladus*

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1. THUJOPSIS Siebold & Zuccarini ex Endlicher, Gen. Pl. Suppl. 2: 24. 1842, nom. cons. prop.

罗汉柏属 *luo han bai shu*

Trees monoecious; branchlets arranged in a plane, flattened, lower side with white powder. Leaves decussate, scalelike, dimorphic along branchlets; lateral leaves boat-shaped, 4–7 mm, overlapping margins of facial leaves, with conspicuous, white stomatal bands abaxially, apex slightly incurved. Cones terminal, solitary. Pollen cones cylindrical; microsporophylls 12–20. Seed cones subglobose; cones scales 6–8, flat, woody, usually mucronate below apex, each fertile scale with 3–5 seeds. Seeds with 2 lateral, narrow wings. Cotyledons 2.

One species: Japan; introduced in China.

1. *Thujaopsis dolabrata* (Thunberg ex Linnaeus f.) Siebold & Zuccarini, Fl. Jap. 2: 34. 1844.

罗汉柏 *luo han bai*

Thuja dolabrata Thunberg ex Linnaeus f., Suppl. Pl. 420. 1782; *Platyclusus dolabrata* (Thunberg ex Linnaeus f.) Spach; *Thujaopsis dolabrata* var. *australis* A. Henry.

Trees to 15 m tall; bark thin, gray or reddish brown, peeling off in long strips; crown pyramidal; branches

ascending; branchlets 4–6 mm in diam. Leaves lustrous; facial leaves appressed, broadly obovate; lateral leaves ascending, deep green adaxially, ovate-lanceolate, 4–7 × 1.5–2.2 mm, with a white stomatal band abaxially, apex obtuse, slightly incurved. Seed cones 1–1.6 cm. Seeds ellipsoid, 4–5 × 3–3.5 mm; wing thick. Cultivated for ornament. Fujian, Guangxi, Guizhou, Hubei, Jiangsu, Jiangxi, Shandong, Yunnan, Zhejiang [native to Japan].

2. THUJA Linnaeus, Sp. Pl. 2: 1002. 1753.

崖柏属 *ya bai shu*

Trees or shrubs evergreen, monoecious; branchlets arranged in a plane, flattened. Leaves 4-ranked, scalelike, base decurrent only on leading branchlets, dimorphic along branchlets: facial pairs obovate-rhombic; lateral pairs boat-shaped, ridged abaxially, less than 4 mm, overlapping facial pairs, without conspicuous, white stomatal bands abaxially. Pollen cones with (4 or)6–10(–16) microsporophylls, each with (2 or)3 or 4 pollen sacs. Seed cones terminal, solitary, dehiscent when mature in 1st year; cone scales 8 or 10, decussate, flat, only middle, larger 2 or 3 pairs fertile, each fertile scale bearing 1 or 2 seeds; free bract apex a very short mucro. Seeds flat, with 2 lateral, narrow wings. Cotyledons 2.

Five species: E Asia, E and W North America; five species (one endemic, three introduced) in China.

1a. Leaves obtuse at apex, rarely subacute.

2a. Facial leaves without a gland; young branchlets not glaucous 1. *T. sutchuenensis*

2b. Facial leaves with a gland; young branchlets ± glaucous 2. *T. koraiensis*

1b. Leaves subacute to acuminate at apex.

3a. Leaves acuminate at apex; lateral leaves longer than facial leaves, apex straight 3. *T. plicata*

3b. Leaves acute or subacute at apex, lateral leaves slightly shorter than or as long as facial leaves, apex incurved.

4a. Facial leaves with a conspicuous abaxial gland 4. *T. occidentalis*

4b. Facial leaves without a gland 5. *T. standishii*

1. *Thuja sutchuenensis* Franchet, J. Bot. (Morot) 13: 262. 1899.

崖柏 *ya bai*

Shrubs or trees to 20 m tall; bark orange-brown when young, turning gray-brown, thin, soon flaking; branches spreading, densely arranged; branchlets not glaucous. Facial leaves 1.5–4 × 1–1.5 mm (to 7 mm on leading branchlets), abaxial gland absent, apex obtuse; lateral leaves of ultimate branchlets slightly shorter than facial leaves, 0.8–1 mm wide, apex incurved. Pollen cones yellowish, subglobose, ca. 2.5 mm; microsporophylls 6–8, each with (2 or)3 pollen sacs. Seed cones ellipsoid, 5–7 × 3–4 mm; fertile cone scales 4. Seeds ovoid-oblong, ca. 3.5 mm; wings 0.5 mm wide, apex acute.

• Probably now extinct in the wild owing to forest clearance; recorded at 1400 m. NE Sichuan (Chengkou Xian).

Not collected in the wild since the original gatherings from the only known locality by P. G. Farges in 1892 and 1900. Repeated searches for the species have been unsuccessful.

2. *Thuja koraiensis* Nakai, Bot. Mag. (Tokyo) 33: 196. 1919.

朝鲜崖柏 *chao xian ya bai*

Shrubs (when on mountain ridges), or small trees to 10 m tall; trunk to 80 cm d.b.h.; bark reddish brown and smooth when young, grayish brown and fissured when old, soon flaking; branches ascending or spreading; young branchlets ± glaucous, soon becoming green. Facial leaves 1–2 mm, to 15 mm on leading branchlets, abaxial gland near base, apex obtuse; lateral leaves as long as or shorter than facial leaves, apex incurved. Pollen cones purplish, subglobose, 2–3 mm; microsporophylls 6–10, each with 3 or 4 pollen sacs. Seed

cones dark brown when ripe, ellipsoid-globose, 7–10 × 6–8 mm; basal pair of cone scales subellipsoid, middle pairs suboblong, apical pair long and narrow. Seeds ellipsoid, flattened, ca. 4 × 1.5 mm; wings 1–1.5 mm wide. Pollination May, seed maturity Sep.

Valleys, slopes, mountain ridges; 700–1800 m. S Jilin (Changbai Shan) [Korea].

A vulnerable species in China.

3. *Thuja plicata* Donn ex D. Don in Lambert, Descr. Pinus 2: [19]. 1824.

北美乔柏 bei mei qiao bai

Thuja gigantea Nuttall.

Trees to 50(–75) m tall; trunk to 2(–5) m d.b.h., often buttressed at base; bark reddish brown or grayish brown, fibrous, fissured; crown conical; branches arching; branchlets pendulous. Leaves on upper side of branchlets glossy green, (1–)3–6 mm, apex acuminate; lateral leaves longer than facial leaves, apex straight. Pollen cones reddish, 1–3 mm. Seed cones brown, ellipsoid, 1–1.4 cm; fertile cone scales 4–6. Seeds reddish-brown, 4–7.5 mm (including wings).

Cultivated. Jiangsu, Jiangxi [native to W Canada, NW United States].

4. *Thuja occidentalis* Linnaeus, Sp. Pl. 2: 1002. 1753.

北美香柏 bei mei xiang bai

Thuja obtusa Moench; *T. theophrasti* C. Bauhin ex Nieuwland.

Trees to 15(–38) m tall; trunk 0.9(–1.8) m d.b.h.; bark reddish brown or grayish brown, fibrous, fissured; crown conical. Leaves on both sides of branchlets dull yellowish-green; facial leaves (1.5–)3–5 mm, abaxial gland conspicuous, apex acute; lateral leaves slightly shorter than or as long as facial leaves, apex incurved. Pollen cones reddish, 1–2 mm. Seed cones brown, ellipsoid, (0.6–)0.9–1.4 cm; fertile cone scales ca. 4. Seeds reddish-brown, 4–7 mm including wings.

Planted for timber. Anhui, Guizhou, Hebei, Henan, Hubei, Jiangsu, Jiangxi, Shandong, Sichuan, Zhejiang [native to E Canada, NE United States].

5. *Thuja standishii* (Gordon) Carrière, Traité Gén. Conif., ed. 2, 1: 108. 1867.

日本香柏 ri ben xiang bai

Thujopsis standishii Gordon, Pinetum Suppl. 100. 1862;

Thuja gigantea Nuttall var. *japonica* (Maximowicz) Franchet & Savatier; *T. japonica* Maximowicz.

Trees to 18 m tall; bark reddish brown; crown broadly pyramidal; branches spreading; branchlets thick, flattened, 1.5–2.5 mm wide. Leaves deep green, facial leaves without abaxial gland, apex subacute; lateral leaves slightly shorter than or as long as facial leaves, apex incurved. Seed cones deep brown, obovoid, 8–10 mm; cone scales 10–12, middle 4–6 scales fertile, each with 3 seeds. Seeds 5–6 mm; wings 6–7 × 2–2.5 mm. Cultivated. Jiangsu, Jiangxi, Shandong, Zhejiang [native to Japan].

3. PLATYCLADUS Spach, Hist. Nat. Vég. Phan. 11: 333. 1841.

侧柏属 ce bai shu

Biota D. Don ex Endlicher.

Trees evergreen, monoecious; branchlets arranged in a plane, spreading or ascending, flattened. Leaves decussate, 4-ranked, scalelike, base decurrent, with an abaxial resin gland, dimorphic along branchlets; lateral leaves without conspicuous, white stomatal bands abaxially but with a median groove. Pollen cones with 8–12 microsporophylls, each with 3–6 pollen sacs. Seed cones terminal, solitary, dehiscent when mature in 1st year; cone scales 6 or 8, decussate, flat, thick, woody, only the middle 2 pairs fertile; free bract apex a long, recurved cusp. Seeds wingless, rarely with a very narrow wing. Cotyledons 2.

One species: China, Korea, E Russia.

1. *Platycladus orientalis* (Linnaeus) Franco, Portugaliae Acta Biol., ser. B, Sist. Vol. “Júlio Henriques”: 33. 1949.

侧柏 ce bai

Thuja orientalis Linnaeus, Sp. Pl. 2: 1002. 1753; *Biota orientalis* (Linnaeus) Endlicher; *Platycladus stricta* Spach; *Thuja chengii* Bordères & Gaussen; *T. orientalis* var. *argyi* Lemée & H. Léveillé.

Trees to more than 20 m tall; trunk to 1 m (or more) d.b.h.; bark reddish brown to light grayish brown, thin, flaking in long strips; crown ovoid-pyramidal when young, broadly rounded or irregular when old. Leaves 1–3 mm, apex bluntly pointed; facial leaves rhomboid, with a conspicuous, linear, glandular groove at center abaxially; lateral leaves overlapping facial ones, boat-

shaped, ridged, apex slightly incurved. Pollen cones yellowish green, ovoid, 2–3 mm. Seed cones when immature bluish green, subglobose, ca. 3 mm in diam., when ripe reddish brown, subovoid, 1.5–2(–2.5) × 1–1.8 cm; proximal 2 fertile cone scales 2-seeded, distal 2 fertile scales 1-seeded. Seeds grayish brown or purplish brown, ovoid or subellipsoid, 5–7 × 3–4 mm, slightly ridged. Pollination Mar–Apr, seed maturity Oct.

Natural occurrences difficult to distinguish from local introductions, owing to extensive cultivation and planting in the past; 300–3300 m. Native in S Gansu, Hebei, Henan, Shaanxi, Shanxi; introduced or status uncertain in Anhui, Fujian, N Guangdong, N Guangxi, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, S Nei Mongol, Shandong, Sichuan, Xizang, Yunnan, Zhejiang [Korea, E Russia].

4. CALOEDRUS Kurz, J. Bot. 11: 196. 1873.

翠柏属 cui bai shu

Trees evergreen, monoecious; branchlets arranged in a plane, spreading or ascending, flattened, prominently jointed. Leaves decussate, almost in whorls of 4, scalelike, base decurrent, dimorphic along branchlets: facial pairs flattened; lateral pairs boat-shaped, usually less than 4 mm, overlapping facial pairs, without conspicuous, white stomatal bands abaxially. Pollen cones terminal, solitary; microsporophylls 10–16, each with 2–5 pendulous pollen sacs. Seed cones terminal, solitary, oblong or ellipsoid-cylindric, dehiscent when mature in 1st year; cone scales 6, decussate, flat, only middle pair fertile, each fertile scale bearing 1 or 2 seeds; free bract apex a short mucro. Seeds with 2 subapical, unequal wings. Cotyledons 2.

Two species: China, Laos, Myanmar, Thailand, Vietnam, Mexico, United States; one species in China.

1. *Calocedrus macrolepis* Kurz, J. Bot. 11: 196. 1873.

翠柏 cui bai

Trees to 35 m tall; trunk to 1.5 m d.b.h.; bark grayish brown or reddish brown, smooth when young, fissured and exfoliating when old; crown pyramidal when young, broadly rounded when old; branches spreading and ascending. Leaves (1.5–)3–4(–8) mm. Pollen cones yellow, ovoid or oblong, 4–8 × 2–3 mm; microsporophylls each with (3 or)4(or 5) pollen sacs. Seed cones reddish brown when ripe, 10–20 × 4–6 mm; cone scales flattened, woody, fertile scales 2-seeded, basal pair small, ca. 3 mm, recurved, apical pair connate. Seeds subovoid or ellipsoid, slightly flattened, 5–6 mm. Pollination Mar–Apr, seed maturity Sep–Oct.

Forests; 300–2000 m. ?Guangdong, W Guangxi, S Guizhou, Hainan, N Taiwan, Yunnan [N India, Laos, NE Myanmar, NE Thailand, Vietnam].

- 1a. Seed-cone-bearing branchlets terete or 4-angled 1a. var. *macrolepis*
- 1b. Seed-cone-bearing branchlets flattened 1b. var. *formosana*

1a. *Calocedrus macrolepis* var. *macrolepis*

翠柏(原变种) cui bai (yuan bian zhong)

Heyderia macrolepis (Kurz) H. L. Li; *Libocedrus macrolepis* (Kurz) Bentham & J. D. Hooker; *Thuja macrolepis* (Kurz) Voss.

Seed-cone-bearing branchlets terete or 4-angled.

Forests in mountain regions; 1000–2000 m. ?Guangdong, W Guangxi (Jingxi Xian), S Guizhou, Hainan, Yunnan [N India, Laos, NE Myanmar, NE Thailand, Vietnam].

A vulnerable plant in China.

1b. *Calocedrus macrolepis* var. *formosana* (Florin) W. C. Cheng & L. K. Fu, Fl. Reipubl. Pop. Sin. 7: 327. 1978.

台湾翠柏 tai wan cui bai

Libocedrus formosana Florin, Svensk. Bot. Tidskrift 24: 126. 1930; *Calocedrus formosana* (Florin) Florin; *Heyderia formosana* (Florin) H. L. Li; *Libocedrus macrolepis* var. *formosana* (Florin) Kudó.

Seed-cone-bearing branchlets flattened. $2n = 22^*$.

• Forests; 300–1900 m. N Taiwan.

5. CUPRESSUS Linnaeus, Sp. Pl. 2: 1002. 1753.

柏木属 bai mu shu

Trees (rarely shrubs) evergreen, monoecious; branchlets ascending, rarely pendulous, often decussately arranged, terete or 4-angled in cross section. Leaves decussate, 4-ranked; juvenile leaves needlelike; adult leaves scalelike, with an abaxial resin gland, usually not dimorphic along branchlets. Pollen cones ovoid or oblong; microsporophylls 6–16, each with 2–6 pollen sacs. Seed cones terminal, solitary, globose or subglobose, dehiscent when mature in 2nd year; cone scales 8–16, decussate, peltate, woody, each fertile scale bearing 3–20 seeds; free bract apex a short mucro. Seeds slightly flattened, ridged, with lateral, narrow wings. Cotyledons 2–5.

About 17 species: N Africa, Asia, S Europe, SW North America; nine species (four endemic, four introduced) in China.

Cupressus cashmeriana Royle ex Carrière (Traité Gén. Conif., ed. 2, 1: 161. 1867) known with certainty only from Bhutan, might possibly extend into China, in SE Xizang. That is if *Cupressus assamica* Silba (J. Intern. Conifer Preserv. Soc. 1: 19. 1994) described from SE Xizang with *Kingdon Ward 12449* (BM) as the holotype, is indeed a synonym of *C. casmeriana*, as was given by A. Farjon (World Checkl. Bibliogr. Conif. 45. 1998).

- 1a. Branchlets flattened; seed cones 0.8–1.5 cm in diam.; seeds 3–5(or 6) per cone scale 9. *C. funebris*
- 1b. Branchlets terete or 4-angled; seed cones 1–3 cm in diam.; seeds more than 8 per cone scale.
 - 2a. Branchlets terete.
 - 3a. Branchlets loosely or densely arranged, ultimate ones pendulous or irregularly spreading, slender, 1–1.4 mm in diam.; seed cones dark grayish brown at maturity, 1–1.8 cm in diam. 6. *C. torulosa*

- 3b. Branchlets densely arranged, ultimate ones spreading, ascending, or drooping but not pendulous, stout,
1.2–2 mm in diam.; seed cones brown or reddish brown at maturity, 1.2–2 cm in diam.
- 4a. Branchlets not glaucous; bracts with a small, free mucro at apex 7. *C. chengiana*
- 4b. Branchlets often glaucous; bracts with a prominent, large, free mucro at apex 8. *C. gigantea*
- 2b. Branchlets 4-angled.
- 5a. Leaves with a conspicuous abaxial gland 5. *C. arizonica*
- 5b. Leaves without a conspicuous abaxial gland.
- 6a. Leaves green, not glaucous.
- 7a. Leaves obtuse or subacute at apex; seed cones 2–3 cm in diam.; cone scales 8–14 3. *C. sempervirens*
- 7b. Leaves acute at apex; seed cones 1–1.5 cm in diam.; cone scales 6–10 4. *C. goveniana*
- 6b. Leaves bluish green or grayish green, glaucous.
- 8a. Seed cones with ca. 12 cone scales; branchlets stout, ultimate ones 1.5–2 mm in diam. 8. *C. gigantea*
- 8b. Seed cones with 6–10 seed scales; branchlets thin, ultimate ones 0.8–1 mm in diam.
- 9a. Branchlets spreading or drooping but not pendulous; seed cones 1.5–3.2 cm in diam., with
with
(6–)8–10 cone scales 1. *C. duclouxiana*
- 9b. Branchlets pendulous; seed cones 1–1.5 cm in diam., with 6–8 cone scales 2. *C. lusitanica*

1. *Cupressus duclouxiana* Hickel in A. Camus, [Les Cyprès] Encycl. Econ. Sylvicult. 2 : 91, f. 419–424. 1914.

干香柏 gan xiang bai

Cupressus austrotibetica Silba.

Trees to 25 m tall; trunk to 80 cm d.b.h.; crown conical when young, rounded or broadly domed when old; branches densely arranged; branchlets spreading or drooping but not pendulous, thin, ultimate ones 4-angled, 0.8–1 mm in diam. Leaves closely appressed, slightly glaucous abaxially, 1–2 mm on ultimate branchlets, ridged or ± gibbous with an inconspicuous or more visible abaxial gland, base long decurrent on leading branchlets, apex acute or slightly obtuse. Pollen cones subglobose or oblong, (4–)5–7 mm; microsporophylls (12–)16–20. Seed cones dark brown or purplish brown when ripe, glaucous, globose, 1.5–3.2 cm in diam.; cone scales (6–)8–10, each fertile scale with numerous seeds. Seeds brown or purplish brown, 3–5 mm, with 3 ridges. $2n = 22^*$.

• Forests on mountain slopes; 1400–3300 m. ?Guizhou, SW Sichuan, C and NW Yunnan, SE Xizang.

2. *Cupressus lusitanica* Miller, Gard. Dict., ed. 8, *Cupressus* no. 3. 1768.

墨西哥柏木 mo xi ge bai mu

Trees to 30 m tall; trunk to 1 m d.b.h.; bark reddish brown, longitudinally fissured; branchlets not arranged in a plane, pendulous, thin, ultimate ones 4-angled, ca. 1 mm in diam. Leaves bluish green, glaucous, without a conspicuous abaxial gland, apex pointed. Seed cones brown, glaucous, globose, 1–1.5 cm in diam.; cone scales 6–8, each fertile scale with numerous seeds.

Cultivated for ornament. Jiangsu, Jiangxi [native to Guatemala, Honduras, Mexico].

3. *Cupressus sempervirens* Linnaeus, Sp. Pl. 2: 1002. 1753.

地中海柏木 di zhong hai bai mu

Trees to 30 m tall; bark grayish brown, shallowly fissured; branches ascending or horizontally spreading; branchlets not arranged in a plane, ultimate ones 4-

angled, ca. 1 mm in diam. Leaves in 4 ranks, densely appressed, dark green, not glaucous, 0.5–1 mm, ridged abaxially, without a conspicuous abaxial gland, apex obtuse or subacute. Pollen cones 4–8 mm. Seed cones yellowish gray when ripe, subglobose or ellipsoid, 2.5–4 × 2–3 cm; cone scales 8–14, each fertile scale with 8–20 seeds.

Cultivated. Jiangsu, Jiangxi [native to W Asia, E Mediterranean region].

4. *Cupressus goveniana* Gordon, J. Hort. Soc. London 4: 295. 1849.

加州柏木 jia zhou bai mu

Shrubs or small trees to 5 m tall; bark smooth or rough, fibrous; crown globose to columnar, dense or sparse; branchlets not arranged in a plane, ultimate ones 4-angled, ca. 1 mm in diam. Leaves green, not glaucous, without a conspicuous abaxial gland, apex acute. Pollen cones 3–4 × 1.5–2 mm; microsporophylls each with 3–6 pollen sacs. Seed cones grayish brown, not glaucous, globose, 1–2.5(–3) × 1–1.5 cm; cone scales 6–10, each fertile scale with numerous seeds. Seeds 3–4(–5) mm.

Cultivated. Jiangsu [native to W United States].

5. *Cupressus arizonica* Greene, Bull. Torrey Bot. Club 9: 64. 1882.

绿干柏 lu gan bai

Trees to 25 m tall; bark smooth when young, remaining so or becoming rough, furrowed, and fibrous; crown conical when young, becoming broadly columnar with age, dense; branches ascending, stout; ultimate branchlets 4-angled, 1–2 mm in diam. Leaves bluish green, slightly glaucous, ridged abaxially, with a conspicuous abaxial gland, apex acute. Pollen cones 2–5 × ca. 2 mm; microsporophylls mostly each with 4–6 pollen sacs. Seed cones gray or brown, often glaucous initially, globose or oblong, mostly 2–3 cm; cone scales 6–8, each fertile scale with numerous seeds. Seeds mostly 4–6 mm.

Cultivated. Guangxi, Jiangsu, Jiangxi [native to N Mexico, SW United States].

6. *Cupressus torulosa* D. Don in Lambert, Descr. Pinus 2: 18. 1824.

西藏柏木 xi zang bai mu

Cupressus tongmaiensis Silba; *C. tongmaiensis* var. *ludlowii* Silba; *C. tonkinensis* Silba.

Trees to 45 m tall; trunk to 3.5 m d.b.h.; branchlets loosely or densely arranged, terete, ultimate ones pendulous or irregularly spreading, slender, 1–1.4 mm in diam. Leaves closely arranged, scalelike, 1–1.8 mm, flat or slightly gibbous and with a rounded, sometimes inconspicuous central abaxial gland, apex usually slightly obtuse. Pollen cones 3–6 mm; microsporophylls 14–18. Seed cones dark grayish brown when ripe, not glaucous, broadly ovoid or subglobose, 1.2–2 × 1–1.8 cm; cone scales (8–) 10–12, each fertile scale with numerous seeds; bracts with a prominent umbo or mucro at apex. Seeds ovate-oblong, flattened, 3–5 mm. $2n = 22$.

Mountains; 1800–2800 m. E and S Xizang [?Bhutan, N India, Kashmir, Nepal, ?Sikkim, ?Vietnam].

7. *Cupressus chengiana* S. Y. Hu, Taiwania 10: 57. 1964.

岷江柏木 min jiang bai mu

Trees to 30 m tall; trunk to 1 m d.b.h.; branchlets densely arranged, not glaucous, terete, ultimate ones spreading, ascending, or drooping but not pendulous, stout, 1.2–2 mm in diam. Leaves in 4 ranks, scalelike, 1–1.5 mm on ultimate branchlets, arched (gibbous) and with a conspicuous, often darker central abaxial gland, apex usually slightly obtuse, dull green, not glaucous. Pollen cones 2–4 mm; microsporophylls 12–16. Seed cones brown or reddish brown when ripe, not glaucous, globose to subglobose or oblong-ovoid, 1.2–2 cm in diam.; cone scales 8–14, each fertile scale with numerous seeds; bracts with a small, free mucro at apex. Seeds ovate-triangular, flattened, 3–5 × 2–4 mm. $2n = 22^*$.

• Mountain slopes, valleys; 800–2900 m. S Gansu, N and W Sichuan. A vulnerable species.

1a. Seed cones globose to subglobose; cone scales 8–10 7a. var. *chengiana*

1b. Seed cones oblong-ovoid; cone scales 10–14 7b. var. *jiangeensis*

7a. *Cupressus chengiana* var. *chengiana*

岷江柏木(原变种) min jiang bai mu (yuan bian zhong)

Cupressus chengiana var. *kansouensis* Silba; *C. chengiana* var. *wenchuanhsiensis* Silba; *C. fallax* Franco.

Branchlets terete. Seed cones globose to subglobose; cone scales 8–10.

• Mountain slopes, valleys; 900–2900 m. S Gansu, N and W Sichuan.

7b. *Cupressus chengiana* var. *jiangeensis* (N. Zhao) Silba, Phytologia 49: 394. 1981.

剑阁柏木 jian ge bai mu

Cupressus jiangeensis N. Zhao, Acta Phytotax. Sin. 18: 210. 1980.

Branchlets subterete. Seed cones oblong-ovoid; cone scales 10–14.

• About 800 m. N Sichuan (Jiange Xian).

8. *Cupressus gigantea* W. C. Cheng & L. K. Fu in W. C. Cheng & al., Acta Phytotax. Sin. 13(4): 85. 1975.

巨柏 ju bai

Trees to 45 m tall; trunk 3(–6) m d.b.h.; branchlets densely arranged, often glaucous, stout, usually 4-angled, rarely terete, ultimate ones not drooping, 1.5–2 mm in diam. Leaves closely arranged, in 4 ranks, glaucous, scalelike, obtusely ridged or arched (gibbous) and with a rounded central abaxial gland. Seed cones usually glaucous, oblong-globose, 1.5–2 × 1.3–1.6 cm; cone scales ca. 12, each fertile scale with numerous seeds; bracts with a prominent, large, free mucro at apex. $2n = 22^*$.

• Mountain slopes, along rivers; 3000–3400 m. SE Xizang. An endangered species. Perhaps better treated as a variety of *Cupressus torulosa*, from which it differs mainly in its thicker ultimate branchlets, which are not drooping but spreading (xeromorphy), and in that some stands in SE Xizang contain very massive trees. However, some herbarium specimens of *C. torulosa* collected outside China in the W Himalayan region have similarly thick foliage, while another specimen from SE Xizang has ultimate branchlets only 0.8 mm wide.

9. *Cupressus funebris* Endlicher, Syn. Conif.: 58. 1847.

柏木 bai mu

Chamaecyparis funebris (Endlicher) Franco; *Cupressus funebris* var. *gracilis* Carrière.

Trees to 35 m tall; trunk to 2 m d.b.h.; branchlets arranged in a plane, pendulous, green, slender, flattened, ca. 1 mm wide. Leaves densely appressed, scalelike, dimorphic, 1–1.5 mm, apex sharply pointed; facial pairs with a linear abaxial gland; lateral pairs folded face-to-face, overlapping basal part of facial pairs, ridged abaxially. Pollen cones ellipsoid or ovoid, 2.5–5 mm; microsporophylls 10–14. Seed cones dark brown when ripe, globose, 0.8–1.5 cm in diam.; cone scales 6–8(–12), 5-angular, each fertile scale with 3–5(or 6) seeds. Seeds light brown, lustrous, obovate-rhombic or suborbicular, flattened, 2.5–3.5 mm. Cotyledons 2. Pollination Mar–May, seed maturity May–Jun. $2n = 22^*$.

• Below 2000 m. Anhui, Fujian, Gansu, N Guangdong, N Guangxi, E Guizhou, Henan, W Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Yunnan, Zhejiang; also widely cultivated in S China.

Often classified in *Chamaecyparis* on account of its flattened foliage sprays and relatively few seeds in small cones; however, it is here placed in *Cupressus* because of its developmental characters (cones maturing in 2nd year) and chemical composition of biflavones.

6. CHAMAECYPARIS Spach, Hist. Nat. Vég. Phan. 11: 329. 1841.扁柏属 *bian bai shu*

Trees evergreen, monoecious; branchlets arranged in a plane, flattened. Leaves decussate, scalelike, usually dimorphic along branchlets: facial pairs closely appressed, ovate or rhombic-ovate; lateral pairs boat-shaped, overlapping margins of facial pairs. Pollen cones ovoid or oblong; microsporophylls 6–8, each with 2–4 pollen sacs. Seed cones terminal on branchlets, solitary, globose or oblong, dehiscent when mature in 1st year; cone scales 8–12, peltate, woody, each fertile scale bearing (1 or)2(–5) seeds; free bract apex a small mucro. Seeds with lateral, narrow wings. Cotyledons 2.

Six species: E Asia, North America; five species (one endemic, three introduced) in China.

1a. Leaves on lower side of branchlets not or only slightly glaucous.

2a. Seed cones 4–9 mm in diam.; leaves usually with circular gland 1. *C. thyoides*

2b. Seed cones 8–12 mm in diam.; leaves with linear to circular abaxial gland, or gland absent . 2. *C. lawsoniana*

1b. Leaves on lower side of branchlets glaucous.

3a. Facial leaves eglandular, obtuse or subacute at apex 5. *C. obtusa*

3b. Facial leaves with an abaxial, sometimes obscure gland, acute to acuminate at apex.

4a. Seed cones globose, ca. 6 mm in diam. 3. *C. pisifera*

4b. Seed cones oblong or oblong-ovoid, 5–9 mm in diam. 4. *C. formosensis*

1. Chamaecyparis thyoides (Linnaeus) Britton & al., Prelim. Cat. Anth. Pter. New York 71. 1888.

美国尖叶扁柏 *mei guo jian ye bian bai*

Cupressus thyoides Linnaeus, Sp. Pl. 2: 1003. 1753. Trees to 20(–28) m tall; trunk to 0.8(–1.5) m d.b.h.; bark dark reddish brown, irregularly furrowed and ridged; leafy branchlets fan-shaped. Leaves to 2 mm, usually with circular abaxial gland, apex acute to acuminate; leaves on lower side of branchlets not or only slightly glaucous. Pollen cones dark brown, 2–4 mm; pollen sacs yellow. Seed cones bluish purple to reddish brown, glaucous, globose, 4–9 mm in diam.; cone scales 5–7, fertile scales each with 1 or 2 seeds. Seeds 2–3 mm; wing narrower than seed.

Cultivated for ornament. Jiangsu, Jiangxi, Sichuan, Zhejiang [native to E United States].

2. Chamaecyparis lawsoniana (A. Murray bis) Parlatores, Ann. Mus. Imp. Fis. Firenze 1: 181. 1864.

美国扁柏 *mei guo bian bai*

Cupressus lawsoniana A. Murray bis, Edinburgh New Philos. J., n.s., 1: 292. 1855.

Trees to 50 m tall; trunk to 3 m d.b.h.; bark reddish brown; leafy branchlets predominantly pinnately arranged. Leaves mostly 2–3 mm, with linear to circular abaxial gland, or eglandular, apex acute to acuminate; leaves on lower side of branchlets not or only slightly glaucous. Pollen cones dark brown, 2–4 mm; pollen sacs red. Seed cones purplish to reddish brown, glaucous, globose, 8–12 mm in diam.; cone scales 5–9, each fertile scale with 2–4 seeds. Seeds 2–5 mm; wing equal to or wider than seed.

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

3. Chamaecyparis pisifera (Siebold & Zuccarini) Endlicher, Syn. Conif. 64. 1847.

日本花柏 *ri ben hua bai*

Retinispora pisifera Siebold & Zuccarini, Fl. Jap. 2: 39. 1844.

Trees to 50 m tall; bark reddish brown; crown pyramidal. Leaves acute at apex; facial leaves with an obscure abaxial gland; leaves on upper and lowersides of branchlets glaucous; lateral leaves slightly longer than facial ones. Seed cones dark brown, globose, ca. 6 mm in diam.; cone scales 10–12, each fertile scale with 1 or 2 seeds. Seeds narrowly obovoid to transversely ellipsoid, ca. 2 mm; wing ca. 4 mm.

Cultivated for ornament. Guangxi, Guizhou, Jiangsu, Jiangxi, Shandong, Sichuan, Yunnan, Zhejiang [native to Japan].

4. Chamaecyparis formosensis Matsumura, Bot. Mag. (Tokyo) 15: 137. 1901.

红桧 *hong gui*

Cupressus formosensis (Matsumura) A. Henry.

Trees to 60 m tall; trunk to 6.5 m d.b.h.; bark light reddish brown; branches spreading to pendulous. Facial leaves of ultimate branchlets rhomboid, 1–3 mm, apex acute to acuminate; leaves on upper side of branchlets green, with a gland abaxially; leaves on lower side of branchlets glaucous; lateral leaves slightly larger than others, mostly eglandular, apex incurved. Seed cones oblong or oblong-ovoid, (0.6–)1–1.2 cm × 5–9 mm; cone scales 8–12. Seeds reddish brown, ovate-orbicular, flattened, 1.5–2.5 mm in diam., including wings. $2n = 22^*$.

• Forests in mountain regions; 1000–2900 m. Taiwan.

A rare species.

5. Chamaecyparis obtusa (Siebold & Zuccarini) Endlicher, Syn. Conif. 63. 1847.

日本扁柏 *ri ben bian bai*

Trees to 40 m tall; trunk to 3 m d.b.h.; bark light reddish brown, peeling off in thin strips; crown

narrowly pyramidal; branches drooping to pendulous. Leaves of ultimate branchlets ridged abaxially, apex obtuse or subacute; facial leaves green or yellowish green, rhomboid, 1–1.5 mm, abaxial gland absent; leaves on lower side of branchlets glaucous, with a whitish basal part; lateral leaves 1–3 mm, apex incurved. Pollen cones ellipsoid, ca. 3 mm; microsporophylls ca. 12; pollen sacs yellow. Seed cones reddish brown when ripe, globose, 1–1.2 cm in diam.; cone scales 8–10, each fertile scale with 2–5 seeds. Seeds lustrous reddish brown, obovoid or suborbicular, flattened, 3–3.5 mm in diam., including wings. Pollination Apr, seed maturity Oct–Nov.

Forests in mountain regions, also cultivated for ornament and planted for timber and afforestation; below 2800 m. Native in Taiwan; introduced in Guangdong, Guangxi, Henan, Jiangsu, Jiangxi, Shandong, Yunnan, Zhejiang [Japan].

- 1a. Leaves of ultimate branchlets thick, apex obtuse; facial leaves 1–1.5 mm; lateral leaves ca. 3 mm; seeds suborbicular, ca. 3 mm (including wings) 5a. var. *obtusa*
- 1b. Leaves of ultimate branchlets thin, apex subacute; facial leaves 1–1.2 mm; lateral leaves 1–2 mm; seeds obovoid, 3–3.5 mm (including wings) 5b. var. *formosana*

5a. *Chamaecyparis obtusa* var. *obtusa*

日本扁柏(原变种) ri ben bian bai (yuan bian zhong)

Retinispora obtusa Siebold & Zuccarini, Fl. Jap. 2: 38. 1844; *Chamaecyparis breviramea* Maximowicz; *C. pendula* Maximowicz; *Cupressus obtusa* (Siebold & Zuccarini) F. Mueller.

Leaves of ultimate branchlets thick, apex obtuse; facial leaves 1–1.5 mm; lateral leaves ca. 3 mm. Seed cones 1–1.2 cm in diam. Seeds suborbicular, ca. 3 mm, including wings.

Cultivated for ornament and planted for timber and afforestation. Guangdong, Guangxi, Henan, Jiangsu, Jiangxi, Shandong, Taiwan, Yunnan, Zhejiang [native to Japan].

5b. *Chamaecyparis obtusa* var. *formosana* (Hayata) Hayata, Fedde's Repert. Sp. Nov. Regni Veg. 8: 365. 1910.

台湾扁柏 tai wan bian bai

Chamaecyparis obtusa f. *formosana* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 208. 1908; *C. obtusa* subsp. *formosana* (Hayata) H. L. Li; *C. taiwanensis* Masamune & S. Suzuki; *Cupressus obtusa* f. *formosana* (Hayata) Clinton-Baker; *C. obtusa* var. *formosana* (Hayata) Dallimore & A. B. Jackson.

Leaves of ultimate branchlets thin, apex subacute; facial leaves 1–1.2 mm; lateral leaves 1–2 mm. Seed cones 1–1.1 cm in diam. Seeds obovoid, 3–3.5 mm, including wings.

- Forests in mountain regions; 1300–2800 m. Taiwan.

7. FOKIENIA A. Henry & H. H. Thomas, Gard. Chron., ser. 3, 49: 67. 1911.

福建柏属 fu jian bai shu

Trees evergreen, monoecious; branchlets arranged in a plane, flattened, prominently jointed. Leaves decussate, almost in whorls of 4, scalelike, dimorphic along branchlets: facial pairs closely appressed; lateral pairs boat-shaped, overlapping margins of facial pairs, with 2 white, depressed stomatal bands abaxially. Pollen cones with (6–)10–12 microsporophylls each with 3 pollen sacs. Seed cones terminal on branchlets, solitary, subglobose, dehiscent when mature in 2nd year; cone scales 12–16, decussate, peltate, woody, fertile scales 2-ovulate; free bract apex a mucro. Seeds ovoid, with a prominent umbilicus and 2 apical, unequal wings. Cotyledons 2.

One species: China, N Laos, Vietnam.

1. Fokienia hodginsii (Dunn) A. Henry & H. H. Thomas, Gard. Chron., ser. 3, 49: 66–68. 1911.

福建柏 fu jian bai

Cupressus hodginsii Dunn, J. Linn. Soc., Bot. 38: 367. 1908; *Fokienia kawaii* Hayata; *F. maclurei* Merrill.

Trees to 30 m tall; trunk to 1 m d.b.h.; bark purplish brown, nearly smooth or irregularly fissured. Facial leaves on young plants bluish green adaxially, narrowly oblanceolate, 4–7 × 1–1.2(–2) mm, with an elevated midvein; lateral leaves almost as long as or slightly longer than facial leaves, usually straight, 5–10 × 2–3

mm, on adult plants small, 2–7 mm, ridged and with a white, depressed stomatal band abaxially. Pollen cones yellowish green, subglobose, 4–5 mm. Seed cones brown when ripe, subglobose, 1.5–2.5 × 1.2–2.2 cm. Seeds 4–5 mm, 3- or 4-ridged; larger wing ovate-dolabriform, ca. 5 mm, smaller wing ca. 1.5 mm or a mere strip. Pollination Mar–Apr, seed maturity Oct–Nov.

Forests on mountains; 100–1800 m. Fujian, N Guangdong, Guangxi, Guizhou, S Hunan (Yizhang Xian), W Jiangxi (Jinggang Shan), SE Sichuan (Jiangjin Xian), SE Yunnan, S Zhejiang [N Laos, Vietnam].

A vulnerable species in China.

8. JUNIPERUS Linnaeus, Sp. Pl. 2: 1038. 1753.

刺柏属 ci bai shu

Sabina Miller.

Trees or shrubs evergreen, monoecious or dioecious; bark thin, exfoliating in long strips; branchlets not arranged in a plane, terete or 3-, 4-, or 6-angled in cross section. Leaves decussate or in whorls of 3, decurrent or non-decurrent; juvenile leaves always needlelike; adult leaves scalelike or needlelike, usually not dimorphic along branchlets but sometimes different on juvenile and adult branchlets, with 1 or 2 pale stomatal bands adaxially, or in addition a few stomata near base abaxially. Pollen cones yellow, ovoid or oblong; microsporophylls 6–16, each with 2–8 pollen sacs. Seed cones terminal or axillary, berrylike, globose or ovoid, indehiscent or slightly dehiscent when mature in (1st or)2nd(or 3rd) year; cone scales connate or fused, succulent; each fertile scale bearing 1–3 seeds; free bract apex a small point. Seeds 1–6(–10) per cone, wingless, usually with resin pits. Cotyledons 2–6.

About 60 species: N hemisphere; 23 species (ten endemic, two introduced) in China.

- 1a. Leaves always needlelike, base jointed, not decurrent; cones axillary; seed cones with 3 whorled cone scales.
- 2a. Leaves adaxially with 2 whitish stomatal bands separated by a green midvein 1. *J. formosana*
- 2b. Leaves adaxially with 1 white stomatal band, without a green midvein.
- 3a. Leaves “V”-shaped in cross section, 10–23 × ca. 1 mm, rigid, deeply grooved adaxially, white stomatal bands narrower than green margins 2. *J. rigida*
- 3b. Leaves nearly flat in cross section, 4–10 × 1–2 mm, white stomatal band broader than green margins 3. *J. sibirica*
- 1b. Leaves needlelike, scalelike, or both, base of needlelike leaves not jointed, decurrent; cones terminal; seed cones with 3–8 decussate or whorled cone scales.
- 4a. All leaves needlelike.
- 5a. Leaves decussate or in whorls of 3, very short, 2–4.5 mm; seed cones 1–3-seeded 4. *J. gaussenii*
- 5b. Leaves in whorls of 3 only; seed cones either 1-seeded or 2- or 3-seeded.
- 6a. Seed cones 2- or 3-seeded 5. *J. procumbens*
- 6b. Seed cones 1-seeded.
- 7a. Leaves abaxially keeled, without longitudinal grooves 6. *J. pingii*
- 7b. Leaves abaxially convex or obtusely ridged, with thin longitudinal grooves along ridge or at base.

- 8a. Branchlets pendulous; leaves loosely appressed, 3–6 mm, to 10 mm in young plants, convex with longitudinal grooves at base abaxially 7. *J. recurva*
- 8b. Branchlets not pendulous; leaves spreading, ascending, or appressed, 1–10 mm, obtusely ridged with longitudinal grooves on ridge (or at base) abaxially.
 - 9a. Leaves closely appressed, small, 1–2 × 0.5–1.2 mm; branchlets 4- or 6-angled 8. *J. chengii*
 - 9b. Leaves spreading or ascending, larger, 4–10 × 1–1.3 mm; branchlets not angled.
 - 10a. Leaves ascending, 4–6 × ca. 1 mm; branchlets loosely arranged, usually straight, long 9. *J. baimashanensis*
 - 10b. Leaves spreading or ascending, 5–10 × 1–1.3 mm; branchlets densely arranged, straight or curved, usually short 10. *J. squamata*
- 4b. Leaves scalelike, both scalelike and needlelike, or needlelike only on young plants.
 - 11a. Seed cones (1 or)2- or 3(–5)-seeded.
 - 12a. Leaves scalelike, needlelike only on young plants.
 - 13a. Shrubs erect or decumbent, rarely small trees; branchlets densely arranged, slender, 0.8–1 mm in diam. 14. *J. sabina*
 - 13b. Trees, rarely shrubs; branchlets loosely arranged, stout, 1–2 mm in diam. .. 15. *J. semiglobosa*
 - 12b. Leaves both scalelike and needlelike, sometimes one form predominates.
 - 14a. Shrubs decumbent.
 - 15a. Leaves of both types present 13. *J. davurica*
 - 15b. Mostly scalelike leaves present 12. *J. chinensis*
 - 14b. Trees.
 - 16a. Leaves predominantly scalelike on mature plants, gland basal on scalelike leaves 11. *J. virginiana*
 - 16b. Leaves both scalelike and needlelike on mature plants, gland central on scalelike leaves 12. *J. chinensis*
 - 11b. Seed cones 1-seeded.
 - 17a. Abaxial gland of scalelike leaves basal.
 - 18a. Branchlets 4-angled, curved 19. *J. saltuaria*
 - 18b. Branchlets terete, straight, rarely curved.
 - 19a. Branchlet systems tapering, ultimate branchlets gradually shorter toward apex of system; leaves without cuticular wax covering 17. *J. komarovii*
 - 19b. Branchlet systems not tapering ultimate branchlets of equal length or irregularly unequal; leaves covered with cuticular wax 18. *J. przewalskii*
 - 17b. Abaxial gland of scalelike leaves central.
 - 20a. Ultimate branchlets thin, ca. 1 mm in diam.; seed cones small, 5–8(–10) × 5–6 mm 16. *J. convallium*
 - 20b. Ultimate branchlets thicker than 1 mm (to 2 mm); seed cones larger, (7–)8–16 × 8–13 mm.
 - 21a. Branchlets terete or slightly 4-angled 20. *J. tibetica*
 - 21b. Branchlets 4-angled, sometimes ± terete.
 - 22a. Branchlet systems not tapering; scalelike leaves decussate or sometimes in whorls of 3 21. *J. indica*
 - 22b. Branchlet systems tapering; scalelike leaves decussate.
 - 23a. Shrubs procumbent to small trees 22. *J. pseudosabina*
 - 23b. Shrubs or trees to 15 m 23. *J. centrasiatca*

1. *Juniperus formosana* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 209. 1908.

刺柏 ci bai

Juniperus chekiangensis Nakai; *J. formosana* var. *concolor* Hayata; *J. formosana* f. *tenella* Handel-Mazzetti; *J. mairei* Lemée & H. Léveillé.

Shrubs or trees to 15 m tall; bark brown; crown usually pyramidal or cylindrical; branches spreading or

ascending; branchlets pendulous, 3-angled. Leaves in whorls of 3, linear-lanceolate or linear-needlelike, 1.2–2 cm × 1.2–2 mm, slightly concave adaxially, with 2 white, broad stomatal bands separated by a narrow, green midvein, green and obtusely keeled abaxially, base jointed, not decurrent, apex sharply pointed. Pollen cones axillary, globose or ellipsoid, 4–6 mm; microsporophylls 9–12, in whorls of 3, each with 4 or more pollen sacs. Seed cones axillary, light reddish brown when ripe, glaucous or not, subglobose or broadly ovoid, 6–9 × 6–8 mm, with 6 fused scales in 2 alternating whorls, often 3-seeded, with a single seed on each scale of apical whorl. Seeds ovoid-triangular, 4–5 × 3–3.5 mm, 3- or 4-ridged, base with 3 or 4 resin pits, apex pointed.

• Forests; 200–3400 m. S Anhui, W Fujian, E Gansu, Guizhou, W Hubei, S Hunan, S Jiangsu, Jiangxi, NE Qinghai, S Shaanxi, Sichuan, Taiwan, S Xizang, Yunnan, Zhejiang.

2. *Juniperus rigida* Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4(3): 233. 1846.

杜松 du song

Juniperus utilis Koidzumi; *J. utilis* var. *modesta* Nakai. Shrubs erect, or small trees to 10 m, dioecious; crown pyramidal or cylindrical; branches ascending; branchlets pendulous, 3-angled when young. Leaves in whorls of 3, green abaxially, linear-needlelike, thick, “V”-shaped in cross section, 1–2.3 cm × ca. 1 mm, rigid, deeply grooved with a narrow, white stomatal band adaxially, prominently keeled abaxially, base jointed, not decurrent, apex sharply pointed. Pollen cones axillary, ellipsoid or subglobose, 3–5 mm; microsporophylls 9–12 (or more), in whorls of 3, each with 4–6 pollen sacs. Seed cones axillary, light brownish blue or bluish black when ripe, usually glaucous, globose, 6–8 mm in diam. Seeds often subovoid, ca. 5 mm, indistinctly 4-ridged, apex obtuse or rounded.

Dry areas in mountains; below 2200 m. Gansu, N Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shanxi [Japan, Korea].

Only subsp. *rigida*, described here, occurs in China; subsp. *conferta* (Parlatore) Kitamura (*J. conferta* Parlatore) is a decumbent, coastal shrub that occurs in Japan and E Russia (Sakhalin).

3. *Juniperus sibirica* Burgsdorff, Anleit. Sich. Erzieh. Holzart. 2: 124. 1787.

鲜卑刺柏 xian bei ci bai

Juniperus communis Linnaeus var. *montana* Aiton (1789), not Neilreich (1859); *J. communis* var. *nana* (Willdenow) Baumgarten; *J. communis* var. *saxatilis* Pallas; *J. nana* Willdenow.

Shrubs procumbent, to 70 cm; branchlets densely arranged, 3-angled, thick, ca. 2 mm in diam. Leaves in whorls of 3, ascending, lanceolate or linear, usually subfalcate, 4–10 × 1–2 mm, slightly concave adaxially with a single white stomatal band broader than green marginal bands, keeled abaxially, base jointed, not decurrent. Pollen cones axillary, subglobose or

ellipsoid, 3–5 mm; microsporophylls 9–12, each with 3–6 pollen sacs. Seed cones brownish black when ripe, glaucous, globose or subglobose, 4–7 mm in diam. Seeds 1–3 per cone, 3–4 mm.

Mountain areas; 600–4200 m. Heilongjiang, Jilin, Liaoning, Nei Mongol, Xinjiang, Xizang [Korea, Japan, Mongolia, Russia (Far East, Siberia); C and W Asia to W Himalaya, Europe, W North America]. Records of *Juniperus communis* Linnaeus from China (e.g., in FRPS) are probably referable to *J. sibirica* (which some authors treat as *J. communis* var. *saxatilis*); however, typical *J. communis* is distributed from Europe to Siberia, E to the Amur River.

4. *Juniperus gaussonii* W. C. Cheng, Trav. Lab. Forest. Toulouse T. 1(3, 8): 3. 1940.

昆明柏 kun ming bai

Juniperus chinensis Linnaeus var. *gaussonii* (W. C. Cheng) Silba; *Sabina gaussonii* (W. C. Cheng) W. C. Cheng & W. T. Wang.

Shrubs or small trees to 8 m tall; branches ascending or spreading; branchlets spreading or drooping, straight or slightly curved. Leaves toward base of branchlets, decussate or in whorls of 3, all needlelike, 2–4.5 mm, usually keeled abaxially, with a rhombic or oblong gland, base decurrent, apex sharply pointed; leaves toward apex of branchlets 6–8 mm, grooved along midvein abaxially. Pollen cones not seen. Seed cones terminal on very short branchlets, usually glaucous, bluish black when ripe, ovoid, ca. 6 mm, 1- or 2 (or 3)-seeded, apex rounded or slightly 2-lobed. Seeds ovoid, ca. 5 mm, with a few shallow resin pits, apex indistinctly ridged.

• 1200–2000 m. C Yunnan.

A little-known species found in C Yunnan and in part described from planted trees in or near Kunming. It is in need of further collection and study.

5. *Juniperus procumbens* (Siebold ex Endlicher) Miquel in Siebold & Zuccarini, Fl. Jap. 2: 59. 1870.

铺地柏 pu di bai

Juniperus chinensis Linnaeus var. *procumbens* Siebold ex Endlicher, Syn. Conif. 21. 1847; *Sabina procumbens* (Siebold ex Endlicher) Iwata & Kusaka.

Shrubs procumbent, to 70 cm; branches creeping, much elongated, leading shoots and branchlets ascending. Leaves in whorls of 3, all needlelike, unequal in length, 6–8 mm, rigid, slightly concave adaxially, with 2 white stomatal bands adaxially, base decurrent apex sharply pointed. Pollen cones not seen. Seed cones black when ripe, glaucous, subglobose, 8–9 mm in diam., 2- or 3-seeded. Seeds ca. 4 mm, ridged.

Cultivated for ornament. Anhui, Fujian, Jiangsu, Jiangxi, Liaoning, Shandong, Yunnan, Zhejiang [native to Japan (including Bonin Islands)].

6. *Juniperus pingii* W. C. Cheng ex Ferré, Bull. Soc. Hist. Nat. Toulouse 79: 76. 1944.

垂枝香柏 chui zhi xiang bai

Shrubs or trees monoecious; branchlets prominently 6-angled or not. Leaves in whorls of 3, 3–5(–7) × 1–1.5 mm, glaucous, all needlelike, concave and with a faint green midvein adaxially, keeled and without longitudinal grooves abaxially, base decurrent, apex acuminate. Pollen cones axillary, ovoid or globose, 3–4 mm; microsporophylls 6–9, whorled, each with 2–3 pollen sacs. Seed cones axillary, black when ripe, lustrous, ovoid or subglobose, 7–9 mm, 1-seeded. Seeds ovoid or subglobose, 5–7 mm, with prominent resin pits, base rounded, apex obtuse.

• Forests or thickets on mountain slopes; 2600–4900 m. S Gansu, NW Hubei, S Qinghai, S Shaanxi, Sichuan, Xizang, Yunnan.

1a. Branchlets pendulous, usually slender; trees 6a. var. *pingii*

1b. Branchlets not pendulous, usually stout; shrubs or small trees.

2a. Leaves appressed, strongly arched, 3–4 mm; branchlets prominently 6-angled 6b. var. *wilsonii*

2b. Leaves ascending, straight or slightly arched, 4–7 mm; branchlets usually not 6-angled 6c. var. *carinata*

6a. *Juniperus pingii* var. *pingii*

垂枝香柏(原变种) *chui zhi xiang bai* (yuan bian zhong) *Sabina pingii* (W. C. Cheng ex Ferré) W. C. Cheng & W. T. Wang.

Trees to 30 m tall; branchlets pendulous, usually slender, prominently 6-angled. Leaves slightly curved or straight on young trees, 3–4 mm.

• Forests on mountain slopes; 2600–3800 m. SW Sichuan, NW Yunnan.

6b. *Juniperus pingii* var. *wilsonii* (Rehder) Silba, *Phytologia* Mem. 7: 36. 1984.

香柏 *xiang bai*

Juniperus squamata Buchanan-Hamilton ex D. Don f. *wilsonii* Rehder, *J. Arnold Arbor.* 1: 190. 1920; *Sabina pingii* var. *wilsonii* (Rehder) W. C. Cheng & L. K. Fu; *S. squamata* (Buchanan-Hamilton ex D. Don) Antoine var. *wilsonii* (Rehder) W. C. Cheng & L. K. Fu.

Shrubs erect or procumbent, or small trees to 6 m tall; branchlets not pendulous, stout, prominently 6-angled. Leaves appressed, strongly arched, (2–)3–4 mm.

• Thickets in mountain regions; 2600–4900 m. S Gansu, NW Hubei, S Qinghai, S Shaanxi, Sichuan, Xizang, Yunnan.

6c. *Juniperus pingii* var. *carinata* Y. F. Yu & L. K. Fu, *Novon* 7: 443. 1998.

直叶香柏 *zhi ye xiang bai*

Shrubs procumbent or erect to 4 m, rarely small trees; branchlets not pendulous, stout, usually not 6-angled. Leaves ascending, straight or slightly arched, 4–7 mm.

• Montane forests and thickets; 2700–4500 m. S Gansu, S Shaanxi, Sichuan, Xizang, Yunnan.

7. *Juniperus recurva* Buchanan-Hamilton ex D. Don, *Prodr.* Fl. Nepal. 2: 55. 1825.

垂枝柏 *chui zhi bai*

Shrubs or trees monoecious or rarely dioecious; bark light grayish brown or brown; crown conical or broadly pyramidal; branches ascending in apical part of plant and spreading toward base; branchlets pendulous, curved. Leaves in whorls of 3, loosely appressed, greenish white or slightly glaucous adaxially, all needlelike, nearly straight, slightly incurved, 3–10 × ca. 1 mm, concave adaxially, base decurrent, convex with longitudinal grooves at base abaxially, apex sharply pointed. Pollen cones axillary, yellow, ovoid-oblong or ellipsoid-ovoid; microsporophylls 10–16, decussate, each with 3 pollen sacs. Seed cones axillary, slightly glaucous when young, maturing purplish black and not glaucous, ovoid, 6–12 × 5–9 mm, 1-seeded. Seeds ovoid or conical-ovoid, 5–9 × 3–6 mm.

Forests or thickets; 1800–3900 m. SE Xizang, NW Yunnan [Afghanistan, Bhutan, N India, Kashmir, N Myanmar, Nepal, Pakistan, Sikkim].

Seed cones 7–12 × 6–9 mm; seeds ovoid, 6–8 × 5–6 mm; leaves without a green midvein adaxially 7a. var. *recurva*

1b. Seed cones 6–8 × 5–6 mm; seeds conical-ovoid, 5–6 × 3–4 mm; leaves with a prominent, green midvein adaxially .. 7b. var. *coxii*

7a. *Juniperus recurva* var. *recurva*

垂枝柏(原变种) *chui zhi bai* (yuan bian zhong) *Sabina recurva* (Buchanan-Hamilton ex D. Don)

Antoine.

Trees small, rarely shrubs. Branchlets short, pendulous. Leaves 3–8 mm long, adaxial surface of leaves greenish white, slightly glaucous, with an obscure midvein. Seed cones 7–12 × 6–9 mm. Seeds ovoid, 6–8 × 5–6 mm.

Forests or thickets; 2700–3900 m. SE Xizang, NW Yunnan [Afghanistan, Bhutan, N India, Kashmir, Nepal, Pakistan, Sikkim].

7b. *Juniperus recurva* var. *coxii* (A. B. Jackson) Melville, *Kew Bull.* 13: 533. 1959.

小果垂枝柏 *xiao guo chui zhi bai*

Juniperus coxii A. B. Jackson, *New Fl. & Silva* 5: 33. 1932; *Sabina recurva* var. *coxii* (A. B. Jackson) W. C. Cheng & L. K. Fu.

Shrubs, rarely trees. Branchlets long, pendulous. Leaves 6–10 mm, adaxial surface of leaves with 2 greenish white stomatal bands and a prominent, green midvein. Seed cones 6–8 × 5–6 mm. Seeds conical-ovoid, 5–6 × 3–4 mm, 3-ridged.

Forests; 1800–3800 m. SE Xizang, NW Yunnan [Bhutan, N Myanmar, Sikkim].

8. *Juniperus chengii* L. K. Fu & Y. F. Yu, *Novon* 7: 443. 1998.

万钧柏 *wan jun bai*

Trees to 9 m tall; branchlets usually arched, not pendulous, thin, 4- or 6-angled, 1.1–2 mm in diam.

Leaves decussate or in whorls of 3, closely appressed, lustrous abaxially, ovate, strongly arched, 1–2 × 0.5–1.2 mm, concave adaxially, obtusely ridged, with longitudinal grooves on ridges abaxially, base decurrent,

apex obtuse or acute. Pollen cones not seen. Seed cones purplish black when ripe, oblong to globose, 9–11 × ca. 9 mm, 1-seeded. Seeds triangular-ovoid, ca. 9 × 7 mm, ridged.

• 3100–3200 m. NW Yunnan (Zhongdian Xian).

This recently described species is known from a single collection, with very small leaves but otherwise close to *Juniperus pingii*, of which it may be a variety. More material needs to be collected and studied.

9. *Juniperus baimashanensis* Y. F. Yu & L. K. Fu, Novon 7: 443. 1998.

德钦柏 de qin bai

Shrubs to 60 cm; branches glaucous; branchlets ascending, loosely arranged and almost parallel, thin, usually straight, long, not angled. Leaves in whorls of 3, ascending, needlelike, straight or slightly incurved, 4–6 × ca. 1 mm, concave, with a white stomatal band and without a green midvein adaxially, obtusely ridged with longitudinal, thin grooves on ridges abaxially, base decurrent, apex sharply acuminate. Pollen cones not seen. Seed cones brownish black when ripe, globose, ca. 6 × 6 mm, 1-seeded. Seeds triangular-ovoid, ca. 5 × 5 mm.

• Mountain slopes; ca. 3400 m. NW Yunnan (Dêqên Xian).

This recently described species is known from a single collection, with non-pendulous branchlets but otherwise close to *Juniperus pingii*, of which it may be a variety. More material needs to be collected and studied.

10. *Juniperus squamata* Buchanan-Hamilton ex D. Don in Lambert, Descr. Pinus 2: 17. 1824.

高山柏 gao shan bai

Shrubs erect or procumbent, or small trees to 12 m tall; branches ascending or horizontally spreading; branchlets densely arranged, straight or curved, usually short, not angled. Leaves in whorls of 3, spreading or ascending, sometimes nearly appressed, needlelike, straight or slightly curved, (2.5–) 5–10 × 1–1.5 mm, slightly concave, with white stomatal bands adaxially, obtusely ridged with longitudinal, thin groove on ridge or at base abaxially, base decurrent, apex acute or acuminate. Pollen cones ovoid, 3–4 mm; microsporophylls 9–12, each with 3 pollen sacs. Seed cones black or bluish black when ripe, ovoid or subglobose, 4–8 × 4–6 mm, 1-seeded. Seeds ovoid, 3.5–6 × 2–5 mm, ridged, with resin pits.

Forests, thickets, valleys, and roadsides in mountain areas; 1600–4500 m. S Anhui, W Fujian, S Gansu, E Guizhou, W Hubei, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan [Afghanistan, Bhutan, N India, Kashmir, N Myanmar, Nepal, Pakistan, Sikkim].

Four varieties occur in China: var. *squamata* and var. *fargesii* are commonly recognized, whereas the other two were recently described from single collections and need further study, given the wide geographical range and considerable variation found in the foliage of this species.

1a. Leaves straight or slightly curved.

2a. Leaves ascending or nearly appressed, usually short and broad 10a. var. *squamata*

2b. Leaves spreading or ascending, usually long and narrow 10b. var. *fargesii*

1b. Leaves strongly curved.

3a. Leaves ascending or nearly appressed, densely arranged, internodes not exposed 10c. var. *parvifolia*

3b. Leaves spreading, loosely arranged, internodes exposed 10d. var. *hongxiensis*

10a. *Juniperus squamata* var. *squamata*

高山柏(原变种) gao shan bai (yuan bian zhong)
Juniperus morrisonicola Hayata; *J. squamata* var. *morrisonicola* (Hayata) H. L. Li & H. Keng; *J. recurva* Buchanan-Hamilton ex D. Don var. *squamata* (Buchanan-Hamilton ex D. Don) Parlatores; *Sabina squamata* (Buchanan-Hamilton ex D. Don) Antoine.

Shrubs. Leaves ascending or nearly appressed, usually short and broad, straight or slightly incurved, 5–7 × 1.2–1.5 mm at base.

Montane thickets; 2300–4400 m. W Hubei, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan [Afghanistan, Bhutan, N India, Kashmir, N Myanmar, Nepal, Pakistan, Sikkim].

10b. *Juniperus squamata* var. *fargesii* Rehder & E. H. Wilson in Sargent, Pl. Wilson. 2: 59. 1914.

长叶高山柏 chang ye gao shan bai

Juniperus fargesii (Rehder & E. H. Wilson) Komarov; *J. kansuensis* Komarov; *J. lemeeana* H. Léveillé & Blinovskij.

Shrubs erect or procumbent, or trees. Leaves spreading or ascending, usually long and narrow, straight or slightly curved, 6–10 × 0.8–1 mm at base.

• Forests, valleys, roadsides; 1600–4500 m. S Anhui (Huang Shan), W Fujian (Liancheng Xian), S Gansu, E Guizhou (Jiangkou), SW Shaanxi (Taibai Shan), Sichuan, Yunnan.

10c. *Juniperus squamata* var. *parviflora* Y. F. Yu & L. K. Fu, Novon 7: 444. 1998.

小叶高山柏 xiao ye gao shan bai

Shrubs. Leaves ascending or appressed, densely arranged, internodes not exposed, strongly curved, thick, small, 2.5–3.5 × 0.8–1.2 mm.

• Montane forests and thickets; 3200–3800 m. SW Sichuan.

10d. *Juniperus squamata* var. *hongxiensis* Y. F. Yu & L. K. Fu, Novon 7: 444. 1998.

洪溪高山柏 hong xi gao shan bai

Shrubs; branchlets with exposed internodes. Leaves spreading, loosely arranged, internodes exposed, strongly arched, small, 3.5–4.5 × 1–1.3 mm.

• Mountains; 3600–3700 m. S Sichuan (Meigu Xian).

11. *Juniperus virginiana* Linnaeus, Sp. Pl. 2: 1039. 1753.

北美圆柏 bei mei yuan bai

Sabina virginiana (Linnaeus) Antoine.

Trees to 30 m, dioecious; bark reddish brown; crown columnar-conical or conical; branches erect or spreading; branchlets thin, 4-angled, ca. 0.8 mm in

diam. Leaves both scalelike and needlelike; needlelike leaves usually present on young plants, rarely present on adult plants, decussate or in whorls of 3, ascending, glaucous, 5–6 mm, concave adaxially; scalelike leaves decussate, rhombic-ovate, 1.5–3 mm, concave, abaxial gland basal, elliptic or ovate. Pollen cones 2–3 × ca. 1.5 mm; microsporophylls 8–12, each with 3 or 4 pollen sacs. Seed cones bluish green when ripe, glaucous, globose to ovoid, 4–6(–7) × 3–5.5 mm, 1- or 2-seeded. Seeds ovoid, 3–5 × 3–4 mm.

Cultivated for ornament and planted for afforestation. Anhui, Fujian, Jiangsu, Jiangxi, Shandong, Zhejiang [native to E Canada, E United States].

12. *Juniperus chinensis* Linnaeus, Syst. Nat., ed. 12, 2: 660; Mant. Pl. 1: 127. 1767.

圆柏 yuan bai

Shrubs or trees to 25 m, dioecious, rarely monoecious; bark grayish brown; crown of trees pyramidal to open, broad and irregular; branches spreading; branchlets straight or slightly curved, terete or 4-angled, 1–1.2 mm in diam. Leaves both scalelike and needlelike; needlelike leaves present on both young and adult plants, decussate or in whorls of 3, loosely arranged, ascending, nearly lanceolate, (3–)6–12 mm, with 2 white stomatal bands adaxially; scalelike leaves present on adult plants, decussate, closely appressed, 1.5–3 mm, abaxial gland near center, elliptic, slightly concave. Pollen cones yellow, ellipsoid, 4–6 × 2–3 mm; microsporophylls 14–18, each with 3 or 4 pollen sacs. Seed cones brown when ripe, usually glaucous, subglobose, 4–9 mm in diam., (1 or)2- or 3(or 4)-seeded. Seeds ovoid, 3–6 × 2–5 mm, slightly flattened, ridged, with resin pits, apex blunt.

Mountains; 1400–2300 m. Anhui, Fujian, S Gansu, Guangdong, N Guangxi, Guizhou, Hebei, Heilongjiang, Henan, W Hubei, Hunan, Jiangsu, Jiangxi, Nei Mongol, S Shaanxi, Shandong, Shanxi, Sichuan, E Taiwan, Yunnan, Zhejiang [Japan, Korea, Myanmar, E Russia].

- 1a. Trees or erect shrubs; needlelike leaves in whorls of 3, loosely arranged, 8–12 mm
- 12a. var. *chinensis*
- 1b. Shrubs procumbent; needlelike leaves decussate or in whorls of 3, densely arranged, 3–6 mm.
 - 2a. Needlelike leaves sparse or absent on mature plants, decussate
 - 12b. var. *sargentii*
 - 2b. Needlelike leaves usually present on mature plants, often in whorls of 3
 - 12c. var. *tsukusiensis*

12a. *Juniperus chinensis* var. *chinensis*

圆柏(原变种) yuan bai (yuan bian zhong)
Juniperus fortunei Carrière; *J. sinensis* J. F. Gmelin (1791), not *J. chinensis* Linnaeus (1767); *J. thunbergii* Hooker & Arnott; *Sabina chinensis* (Linnaeus) Antoine; *S. chinensis* f. *pendula* (Franchet) W. C. Cheng & W. T. Wang.

Trees or erect shrubs. Needlelike leaves in whorls of 3, loosely arranged, 0.8–1.2 cm.

Below 2300 m. Anhui, Fujian, S Gansu, Guangdong, N Guangxi, Guizhou, Hebei, Henan, W Hubei, Hunan, Jiangsu, Jiangxi, Nei Mongol, S Shaanxi, Shandong, Shanxi, Sichuan, Yunnan, Zhejiang [Japan, Korea, Myanmar].

12b. *Juniperus chinensis* var. *sargentii* A. Henry in Elwes & A. Henry, Trees Gr. Brit. Ireland 6: 1432. 1912.

偃柏 yan bai

Juniperus sargentii (A. Henry) Takeda ex Nakai;
Sabina chinensis var. *sargentii* (A. Henry) W. C. Cheng & L. K. Fu; *S. sargentii* (A. Henry) Miyabe & Tatewaki.

Shrubs procumbent. Needlelike leaves sparse or absent on mature plants, decussate, densely arranged, 3–6 mm.

1400–2200 m. Heilongjiang [Japan, E Russia].

12c. *Juniperus chinensis* var. *tsukusiensis* (Masamune) Masamune, J. Soc. Trop. Agric. Formosa 2: 152. 1930.

清水圆柏 qing shui yuan bai

Juniperus tsukusiensis Masamune, Bot. Mag. (Tokyo) 44: 50. 1930.

Shrubs procumbent. Needlelike leaves usually present on mature plants, often in whorls of 3, densely arranged, ca. 6 mm.

Mountains; ca. 2200 m. E Taiwan (Hualian Xian) [Japan]. This variety was described by G. Masamune as only differing in its procumbent habit from var. *chinensis*; the latter taxon has a variable habit from a shrub to a tall tree.

13. *Juniperus davurica* Pallas, Fl. Ross. 1(2): 13. 1789.

兴安圆柏 xing an yuan bai

Sabina davurica (Pallas) Antoine.

Shrubs procumbent; bark purplish brown; branchlets densely arranged, ca. 1 mm in diam. Leaves both scalelike and needlelike, decussate; needlelike leaves loosely arranged, narrowly lanceolate or linear-lanceolate, (3–)4–6(–9) mm, concave, with broad, white stomatal bands adaxially, arched and obtusely ridged abaxially, apex acuminate or occasionally acute; scalelike leaves densely arranged, 1–3 mm, abaxial gland central, elliptic or oblong. Pollen cones ovoid-oblong, 4–5 mm; microsporophylls 12–18, each with 2–4 pollen sacs. Seed cones borne on curved branchlets, dark brown or bluish purple when ripe, glaucous, irregularly globose, 4–6 × 6–8 mm, 1–4-seeded. Seeds ovoid, 3–5 mm, slightly flattened, apex acute.

Thickets or forests on rocky mountains, sand dunes; 400–1400 m. Heilongjiang [Korea, ?Mongolia, E Russia].

Only subsp. *davurica*, described here, occurs in China; subsp. *maritima* Urossov is a decumbent shrub that occurs in E Russia (Primorye). *Juniperus davurica* is very similar to *J. sabina* but has both scalelike and needlelike leaves on mature plants; it is probably a variety of that very widespread species; similar specimens have been found in Europe (e.g., Austria: Tirol).

14. *Juniperus sabina* Linnaeus, Sp. Pl. 2: 1039. 1753.

叉子圆柏 cha zi yuan bai

Shrubs, rarely small trees, dioecious, rarely monoecious; bark grayish brown; branchlets densely arranged, ascending, slender, 0.8–1 mm in diam. Leaves both scalelike and needlelike; needlelike leaves usually present on young plants, rarely present on adult plants, decussate or in whorls of 3, closely appressed, 3–7 mm, concave adaxially, convex abaxially, apex sharply pointed; scalelike leaves decussate, rhombic or rhombic-ovate, 1–2.5 mm, abaxial gland central, prominent, elliptic. Pollen cones ellipsoid or oblong, 3–4 mm; microsporophylls 10–14, each with 2–4 pollen sacs. Seed cones light brownish green, brown, purplish blue, or black when ripe, often glaucous, usually irregularly globose, 5–8 × 5–9 mm, (1 or) 2-seeded. Seeds ovoid, slightly flattened, 4–5 mm, ridged, with resin pits, apex blunt or slightly pointed.

Forests or thickets on rocky mountain slopes and sand dunes; 1000–3300 m. Gansu, Nei Mongol, Ningxia, NE Qinghai, N Shaanxi, N Sichuan, Xinjiang [Kazakhstan, Mongolia, Russia (Far East, Siberia); SW Asia, Europe].

At least 12 varieties have been described in this very wide-ranging species; it must be noted that ± straight fertile branchlets are occasionally found on specimens from C Asia and Europe.

- 1a. Seed-cone-bearing branchlets apically curved 14a. var. *sabina*
 1b. Seed-cone-bearing branchlets straight.
 2a. Shrubs 14b. var. *yulinensis*
 2b. Small trees 14c. var. *erectopatens*

14a. *Juniperus sabina* var. *sabina*

叉子圆柏(原变种) *cha zi yuan bai* (*yuan bian zhong*)
Juniperus arenaria (E. H. Wilson) Florin; *J. chinensis* Linnaeus var. *arenaria* E. H. Wilson; *J. sabina* var. *monosperma* C. Y. Yang; *Sabina officinalis* Garcke; *S. vulgaris* Antoine.

Shrubs procumbent, to 1 m, rarely small trees; seed-cone-bearing branchlets apically curved.

Forests or thickets on rocky mountain slopes and sand dunes; 1000–3300 m. Gansu, Nei Mongol, Ningxia (Helan Shan), NE Qinghai, N Shaanxi, Xinjiang [Kazakhstan, Mongolia, Russia (Far East, Siberia); SW Asia, Europe].

14b. *Juniperus sabina* var. *yulinensis* (T. C. Chang & C. G. Chen) Y. F. Yu & L. K. Fu, *Novon* 7: 444. 1998.

榆林圆柏 *yu lin yuan bai*

Sabina vulgaris var. *yulinensis* T. C. Chang & C. G. Chen, *Acta Phytotax. Sin.* 19: 263. 1981.

Shrubs; seed-cone-bearing branchlets straight.

• Thickets. N Shaanxi.

14c. *Juniperus sabina* var. *erectopatens* (W. C. Cheng & L. K. Fu) Y. F. Yu & L. K. Fu, *Novon* 7: 444. 1998.

松潘圆柏 *song pan yuan bai*

Sabina vulgaris var. *erectopatens* W. C. Cheng & L. K. Fu in W. C. Cheng & al., *Acta Phytotax. Sin.* 13(4): 86. 1975.

Trees small; seed-cone-bearing branchlets straight. Seed cones light brownish green at maturity.

• About 2700 m. N Sichuan (Songpan Xian).

15. *Juniperus semiglobosa* Regel, *Trudy Imp. S.-Peterburgsk. Bot. Sada* 6: 487. 1879.

昆仑多子柏 *kun lun duo zi bai*

Juniperus jarkendensis Komarov; *J. sabina* Linnaeus var. *jarkendensis* (Komarov) Silba; *Sabina vulgaris* Antoine var. *jarkendensis* (Komarov) C. Y. Yang.

Trees, occasionally shrubs, dioecious, rarely monoecious; branchlets loosely arranged, spreading, straight, stout, terete, 1–2 mm in diam. Leaves both scalelike and needlelike; needlelike leaves usually present on young plants, rarely present on adult plants, decussate or in whorls of 3, directed forward, 3–7 mm, concave adaxially, convex abaxially; scalelike leaves decussate, closely appressed, ± rhombic-ovate, 1–2.5 mm, abaxial gland near center. Pollen cones ± ellipsoid, 3–5 mm; microsporophylls 8–10, each with 3 or 4 pollen sacs. Seed cones light brown to bluish black when ripe, glaucous, ± obovoid-globose or nearly triangular and widest near apex, 2- or 3-seeded. Seeds 3–6 × 2–3.5 mm, angular ovoid, apices often diverging.

Forest borders; 2500–3300 m. SW Xinjiang, W Xizang [Afghanistan, N India, Kashmir, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan].

16. *Juniperus convallium* Rehder & E. H. Wilson in Sargent, *Pl. Wilson*. 2: 62. 1914.

密枝圆柏 *mi zhi yuan bai*

Trees, rarely shrubs, dioecious or monoecious; branchlets densely arranged, straight or curved, terete, rarely slightly 4-angled, thin, ultimate ones usually about 1 mm in diam. Leaves grayish green, both scalelike and needlelike; needlelike leaves present only on young plants, decussate or in whorls of 3, ascending, 3–8 mm, concave adaxially; scalelike leaves decussate, rarely in whorls of 3, closely appressed, 1.5–2 × 0.8–1 mm, abaxial gland near center, convex or concave. Pollen cones 1.5–3 mm; microsporophylls 6–8, each with 2 or 3 pollen sacs. Seed cones terminal on short, curved or erect branchlets, reddish brown to purplish black when ripe, glaucous or not, ovoid, conical-ovoid, or globose, 5–8(–10) × 5–6 mm, 1-seeded. Seeds conical-globose or flattened ovoid, 3–5 mm in diam., with or without resin pits.

• High mountains; 2200–4300 m. S Qinghai, NW Sichuan, E Xizang.

- 1a. Scalelike leaves with a concave abaxial gland; seed cones conical-ovoid or globose; seeds conical-globose, ca. 5 mm in diam. 16a. var. *convallium*
 1b. Scalelike leaves with a convex abaxial gland; seed cones ovoid; seeds flattened ovoid, ca. 3 mm in diam. 16b. var. *microsperma*

16a. *Juniperus convallium* var. *convallium*

密枝圆柏(原变种) *mi zhi yuan bai* (*yuan bian zhong*)
Juniperus mekongensis Komarov; *J. ramulosa* Florin; *Sabina convallium* (Rehder & E. H. Wilson) W. C. Cheng & L. K. Fu.

Scalelike leaves with an oblong or elliptic, concave gland abaxially. Seed cones conical-ovoid or globose,

6–8(–10) × 5–8 mm. Seeds conical-globose, ca. 5 mm in diam., with resin pits.

- High mountains; 2200–4300 m. S Qinghai, NW Sichuan, E Xizang.
- 16b. *Juniperus convallium* var. *microsperma*** (W. C. Cheng & L. K. Fu) Silba, *Phytologia Mem.* 7: 33. 1984.

小子圆柏 xiao zi yuan bai

Sabina convallium var. *microsperma* W. C. Cheng & L. K. Fu in W. C. Cheng & al., *Acta Phytotax. Sin.* 13(4): 86. 1975.

Scaleglike leaves with an elliptic, ovate, or orbicular, convex gland abaxially. Seed cones ovoid, 5–7 × ca. 5 mm. Seeds flattened ovoid, ca. 4 × 3 mm.

- High mountains; 3200–4000 m. E Xizang.

- 17. *Juniperus komarovii*** Florin, *Acta Hort. Gothob.* 3: 3. 1927.

塔枝圆柏 ta zhi yuan bai

Juniperus glaucescens Florin; *Sabina komarovii* (Florin) W. C. Cheng & W. T. Wang.

Trees to 20 m, monoecious; bark brownish gray or gray; branches drooping to pendulous; branchlet systems tapering and gradually becoming shorter from base to apex of system; branchlets loosely arranged, ascending, straight or slightly curved, terete or 4-angled, thick, ultimate ones 1.2–1.5 mm in diam. Leaves decussate, occasionally in whorls of 3 on leading branches, scalelike, ovate-triangular or triangular-lanceolate, 1.5–3.5(–6) mm, without cuticular wax, abaxial gland near base, ovate or elliptic, leaf apex acute, rarely obtuse, slightly incurved but free. Pollen cones ovoid or globose, 2–3 mm; microsporophylls usually 10, each with 2 or 3 pollen sacs. Seed cones erect, purplish black or black when ripe, slightly glaucous, lustrous, ovoid or subglobose, 8–10(–12) mm, 1-seeded. Seeds ovoid, rarely obovoid, 6–8.5 mm, obtusely ridged, narrowed by resin pits toward base.

- Forests on high mountains; 3000–4000 m. S Qinghai, NW Sichuan.

- 18. *Juniperus przewalskii*** Komarov, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 5: 28. 1924.

祁连圆柏 qi lian yuan bai

Sabina przewalskii (Komarov) W. C. Cheng & L. K. Fu; *S. przewalskii* f. *pendula* W. C. Cheng & L. K. Fu.

Trees to 20 m, rarely shrubs, monoecious; branchlet systems not tapering and subequal in length throughout system; branchlets loosely arranged, straight or slightly curved, terete or 4-angled, thick, ultimate ones 1.2–1.5 mm in diam. Leaves both scalelike and needlelike: all needlelike on young trees, both types on adult trees, nearly all scalelike on old trees; needlelike leaves in whorls of 3, spreading, free part 4–8 mm; scalelike leaves decussate, usually glaucous, rhombic-ovate, 1.2–3 mm, usually with cuticular wax, abaxial gland basal, orbicular, ovate, or elliptic, convex, leaf apex acute, free. Pollen cones ovoid, ca. 2.5 mm; microsporophylls 6–10, each with 2 or 3 pollen sacs. Seed cones bluish black or black when ripe, ovoid or subglobose, 0.8–1.3

cm, 1-seeded. Seeds slightly flattened globose, occasionally subglobose, 7–12 × 6–10 mm, obscurely or prominently ridged, with resin pits.

- Forests on mountain slopes; 2600–4300 m. Gansu, Qinghai, N Sichuan (Songpan Xian).

- 19. *Juniperus saltuaria*** Rehder & E. H. Wilson in Sargent, *Pl. Wilson.* 2: 61. 1914.

方枝柏 fang zhi bai

Sabina saltuaria (Rehder & E. H. Wilson) W. C. Cheng & W. T. Wang.

Trees to 20 m, rarely shrubs, monoecious; branches spreading or ascending; branchlets usually curved, 4-angled, 1–1.7 mm in diam. Leaves both scalelike and needlelike; needlelike leaves present on young plants, in whorls of 3, 4.5–6 mm, ridged abaxially, apex sharply pointed; scalelike leaves decussate, 4-ranked, closely appressed, triangular-rhombic, gibbous, 1–2 mm, abaxial gland basal, inconspicuous, orbicular or ovate, slightly depressed leaf apex obtuse. Pollen cones subglobose, ca. 2 mm; microsporophylls 6–8, each with 2 or 3 pollen sacs. Seed cones erect, black or bluish black when ripe, ovoid or subglobose, 4–8(–10) mm, 1-seeded. Seeds irregularly ovoid-globose, 3.5–7 × 3–5 mm, ridged and pitted.

- Forests or thickets on mountains; 2700–4600 m. S Gansu, SE Qinghai, W Sichuan, E Xizang, NW Yunnan.

- 20. *Juniperus tibetica*** Komarov, *Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR* 5: 27. 1924.

大果圆柏 da guo yuan bai

Juniperus distans Florin; *J. potaninii* Komarov; *J. zaidamensis* Komarov; *Sabina tibetica* (Komarov) W. C. Cheng & L. K. Fu.

Trees to 30 m, rarely shrubs, monoecious, rarely dioecious; branchlets densely or loosely arranged, mostly straight, terete or slightly 4-angled, 1–2 mm in diam. Leaves both scalelike and needlelike; needlelike leaves usually present on seedlings and young plants, in whorls of 3, 4–8 mm; scalelike leaves decussate, sometimes in whorls of 3, ovate-rhombic, obtuse, 1–3 mm, abaxial gland central, conspicuous, slightly depressed, linear-elliptic or linear. Pollen cones subglobose, ca. 2 mm in diam.; microsporophylls 6–8, each with 2 or 3 pollen sacs. Seed cones erect, brown, black, or purplish black when ripe, ovoid or subglobose, 0.9–1.6 × 0.7–1.3 cm, 1-seeded. Seeds ovoid, rarely obovoid or globose, 7–11 × 6–8 mm, with deep resin pits.

- Forests on mountain slopes or in valleys; 2700–4800 m. S Gansu, S Qinghai, Sichuan, E and S Xizang.

- 21. *Juniperus indica*** Bertoloni, *Misc. Bot.* 23: 16. 1862.

滇藏方枝柏 dian zang fang zhi bai

Juniperus wallichiana J. D. Hooker & Thomson ex E. Brandis; *J. wallichiana* var. *meionocarpa* Handel-

Mazzetti; *Sabina wallichiana* (J. D. Hooker & Thomson ex E. Brandis) W. C. Cheng & L. K. Fu; *S. wallichiana* var. *meionocarpa* (Handel-Mazzetti) W. C. Cheng & L. K. Fu.

Shrubs erect or procumbent, to 2 m, rarely small trees, dioecious; ultimate branchlets densely arranged, mostly straight, usually 4-angled, sometimes terete. Leaves both scalelike and needlelike; needlelike leaves usually present on young trees, in whorls of 3, ascending, 3–8 mm, apex acuminate; scalelike leaves decussate or sometimes in whorls of 3, closely appressed, rhombic, 1.2–2 mm, abaxial gland central, or basal in needlelike leaves, oblong or linear, depressed, leaf apex obtuse. Pollen cones subglobose or ovoid, 2–3 mm; microsporophylls 6–8, each with 2 or 3 pollen sacs. Seed cones erect, black-brown when ripe, subglobose or ovoid, 6–13 × 5–8 mm, 1(or 2)-seeded. Seeds ovoid, slightly flattened, 5–6 × ca. 4 mm, smooth or obscurely ridged.

Forests or thickets on mountain slopes; 2600–5100 m. E and S Xizang, NW Yunnan [Bhutan, N India, Kashmir, Nepal, Sikkim].

22. *Juniperus pseudosabina* Fischer & C. A. Meyer, Index Sem. Hort. Petrop. 1842: 15, 65. 1842.

新疆方枝柏 xin jiang fang zhi bai

Shrubs erect or procumbent, or small trees to 12 m, dioecious; ultimate branchlets densely arranged, mostly straight, 4-angled or sometimes ± terete. Leaves both scalelike and needlelike; needlelike leaves usually present on seedlings and young trees, decussate or in whorls of 3, ascending, 4–8 mm, apex acuminate; scalelike leaves decussate, appressed or with free apex, rhombic, obtuse, 1.5–2 mm, abaxial gland central, or basal in needlelike leaves, oblong or broadly linear, depressed. Pollen cones ovoid or subglobose, 2–3 mm; microsporophylls 6–8, each with 2 or 3 pollen sacs. Seed cones bluish black or brownish black when ripe, ± glaucous, ovoid or broadly ovoid, 0.7–1.4 cm × 6–10 mm, 1-seeded. Seeds ovoid or ellipsoid, slightly flattened, 6–7 × 4–6 mm, ridged, base rounded or pointed, apex blunt.

Thickets on mountains; 2000–4000 m. Xinjiang [Afghanistan, Kazakstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Uzbekistan].

1a. Shrubs with procumbent branches

..... 22a. var. *pseudosabina*

1b. Trees or shrubs with prominent

trunk 22b. var. *turkestanica*

22a. *Juniperus pseudosabina* var. *pseudosabina*

新疆方枝柏(原变种) xin jiang fang zhi bai (yuan bian zhong)

Sabina fischeri Antoine; *S. pseudosabina* (Fischer & C. A. Meyer) W. C. Cheng & W. T. Wang.

Shrubs; branches procumbent.

Thickets on mountains; 2000–3300 m. Xinjiang [Afghanistan, Kazakstan, Kyrgyzstan, Mongolia, Pakistan, Tajikistan, Uzbekistan].

22b. *Juniperus pseudosabina* var. *turkestanica* (Komarov) Silba, Phytologia Mem. 7: 36. 1984.

喀什方枝柏 ka shi fang zhi bai

Juniperus turkestanica Komarov, Bot. Mater. Gerb.

Glavn. Bot. Sada RSFSR 5: 26. 1924; *Sabina*

pseudosabina var. *turkestanica* (Komarov) C. Y. Yang.

Trees or shrubs; trunk prominent.

Mountains; 2800–4000 m. Xinjiang [Afghanistan, Kazakstan,

Kyrgyzstan, Pakistan, Tajikistan, Uzbekistan].

23. *Juniperus centrasiatica* Komarov, Bot. Mater. Gerb.

Glavn. Bot. Sada RSFSR 5: 27. 1924.

昆仑方枝柏 kun lun fang zhi bai

Sabina centrasiatica (Komarov) W. C. Cheng & L. K. Fu.

Trees to 15 m tall; crown dense; ultimate branchlets usually glaucous, 4-angled, 1.2–1.5 mm in diam.

Leaves grayish green; scalelike leaves decussate,

closely appressed, 1.5–2 mm, with a prominent, blunt

abaxial ridge, abaxial gland central, often

inconspicuous. Pollen cones ovoid or subglobose, 2–3

mm; microsporophylls 6–8, each with 2 or 3 pollen sacs.

Seed cones brownish yellow or black-brown when ripe,

slightly glaucous, ovoid, 0.9–1.3 cm × 8–10 mm, 1-

seeded. Seeds ovoid, slightly flattened, 8–11 × 5–7 mm,

base rounded.

Mountain slopes, valleys, river banks; 2600–4000 m. Xinjiang

[Afghanistan, Pakistan].

This species is doubtfully distinct from *Juniperus pseudosabina* (tree form, although the habit is not a good character, as it is ecologically determined). That species, in turn, has very few and minor characters, all of a continuous nature, distinguishing it from *J. indica*. These three taxa only marginally occur in China (Xinjiang, Xizang, NW Yunnan), where the variation does not match that found in populations outside China surrounding the Xizang plateau.

Flora of China 4: 62–77. 1999.