

23. **MALUS** Miller, Gard. Dict. Abr., ed. 4, [835]. 1754.

苹果属 ping guo shu

Gu Cuizhi (谷粹芝 Ku Tsue-chih); Stephen A. Spongberg

Sinomalus Koidzumi.

Trees or shrubs, deciduous or semievergreen, usually unarmed; buds ovoid, with several imbricate scales. Leaves alternate, simple, petiolate, stipulate, venation craspedodromous or camptodromous and merely toothed, margin serrate or lobed, folded or convolute in bud. Inflorescences corymbose-racemose. Flowers pedicellate. Hypanthium bowl-shaped. Sepals 5, persistent or caducous. Petals 5, white, pink, or red, suborbicular or obovate. Stamens 15–50, with white filaments and yellow anthers. Ovary inferior, 3–5-loculed, with 2 ovules in each cell; styles 3–5, connate at base, glabrous or pubescent. Pome usually not containing stone cells or present in a few species, 3–5-loculed, 1- or 2-seeded in each cell, with cartilaginous endocarp (core). Seeds brown or black, cotyledons plano-convex.

About 55 species: widely distributed in N temperate zone; 26 species (16 endemic) in China.

- 1a. Leaf blade not lobed, convolute in bud; pome without stone cells.
 - 2a. Sepals caducous in fruit; styles 3–5; pome usually less than 1.5 cm in diam.
 - 3a. Sepals triangular-ovate, ca. as long as or slightly shorter than hypanthium.
 - 4a. Hypanthium, sepals, branchlets, petiole, and pedicel tomentose 9. *M. daochengensis*
 - 4b. Hypanthium and sepals abaxially glabrous; branchlets, petiole, and pedicel slightly pubescent when young, soon glabrescent.
 - 5a. Leaf blade ovate-lanceolate or broadly lanceolate, apex caudate-acuminate; pome cylindrical 8. *M. muliensis*
 - 5b. Leaf blade ovate, ovate-elliptic, rarely narrowly elliptic, apex acuminate to long acuminate; pome ellipsoid, pyriform, or subglobose, rarely obovoid.
 - 6a. Leaf blade acutely serrulate; sepals apically acuminate or acute; styles 3, rarely 4; pome ellipsoid to subglobose 6. *M. hupehensis*
 - 6b. Leaf blade obtusely serrulate; sepals apically obtuse; styles 4 or 5; pome pyriform or obovoid 7. *M. halliana*
 - 3b. Sepals lanceolate, longer than hypanthium.
 - 7a. Branchlets glabrous or puberulous; leaf blade initially puberulous, glabrescent or subglabrous later.
 - 8a. Petiole, leaf veins, pedicel, and hypanthium often sparsely pubescent; pome ellipsoid or obovoid 3. *M. mandshurica*
 - 8b. Petiole, leaf veins, pedicel, and hypanthium glabrous; pome subglobose or obovoid.
 - 9a. Sepals lanceolate, apex long acuminate; styles 5 or 4, basally densely villous, pome subglobose with an obscure small scar at apex 1. *M. baccata*
 - 9b. Sepals ovate, apex caudate, rarely acuminate; styles (3 or)4, basally slightly pilose or glabrous, pome obovoid, with a large scar at apex 2. *M. jinxianensis*
 - 7b. Branchlets and leaf blade abaxially often tomentose or pubescent.
 - 10a. Styles basally glabrous, pome obovoid or pyriform, white punctate; leaf blade abaxially densely tomentose 4. *M. sikkimensis*
 - 10b. Styles basally pubescent or glabrous, pome subglobose, not punctate; leaf blade abaxially pubescent.
 - 11a. Leaf margin appressed serrate, blade abaxially densely puberulous, base rounded or broadly cuneate; petals white but pink abaxially; pome ovoid or subglobose, slightly convex at apex; sepals caducous 5. *M. rockii*
 - 11b. Leaf margin acutely serrate, blade abaxially pubescent when young, glabrescent, base cuneate; petals pink; pome subglobose, impressed at apex; sepals caducous or persistent 15. *M. ×micromalus*
 - 2b. Sepals persistent in fruit; styles (4 or)5; pome larger, usually more than 2 cm in diam.
 - 12a. Sepals apically acute, shorter than or ca. as long as hypanthium.
 - 13a. Leaf base broadly cuneate or subrounded; petiole 1.5–2 cm; pome yellow, without cavity at base; sepals persistent 14. *M. spectabilis*
 - 13b. Leaf base cuneate; petiole 2–3.5 cm; pome red with cavity at base; sepals caducous or persistent 15. *M. ×micromalus*
 - 12b. Sepals apically acuminate, longer than hypanthium.
 - 14a. Leaf margin obtusely serrate; pome depressed-globose or globose, often projected at apex.
 - 15a. Cultivated species; pome large, with short pedicel; leaf blade serrate; branchlets, buds, and leaves with many hairs 10. *M. pumila*
 - 15b. Native species; pome small, with long pedicel; leaf blade serrulate; branchlets, buds, and leaves with few hairs 11. *M. sieversii*
 - 14b. Leaf margin often acutely serrate; pome ovoid, attenuate at apex, not or slightly projected at apex.
 - 16a. Pome large, 4–5 cm in diam., with 1.5–2 cm pedicel; leaf blade abaxially densely puberulous 12. *M. asiatica*
 - 16b. Pome smaller, 2–2.5 cm in diam., with 3.2–3.5 cm pedicel; leaf blade abaxially puberulous or subglabrous only along veins 13. *M. prunifolia*

- 1b. Leaf blade usually lobed, rarely not lobed, folded in bud; pome without or with few stone cells.
- 17a. Sepals caducous.
- 18a. Styles basally villous; pome subglobose 16. *M. sieboldii*
- 18b. Styles basally glabrous; pome ellipsoid or obovoid, rarely subglobose.
- 19a. Leaf blade often 3–5-lobed, doubly serrate at margin; pome with few stone cells.
- 20a. Lobes of leaf blade triangular-ovate; leaf blade rounded or truncate at base; fruiting pedicel 2–3.5 cm 17. *M. kansuensis*
- 20b. Lobes of leaf blade oblong-ovate; leaf blade cordate or subcordate at base; fruiting pedicel 1.2–1.5 cm 18. *M. komarovii*
- 19b. Leaf blade 3–5-parted, not doubly serrate at margin; pome without stone cells.
- 21a. Young branches puberulous, soon glabrescent; leaf blade undivided or sometimes parted, both surfaces pubescent; flower 2–2.5 cm in diam. 19. *M. toringoides*
- 21b. Young branches tomentose; leaf blade parted, tomentose on both surfaces; flowers 1.5–2 cm in diam. 20. *M. transitoria*
- 17b. Sepals persistent.
- 22a. Pome projected at apex, core separated.
- 23a. Pedicel, hypanthium, and sepals abaxially tomentose 25. *M. doumeri*
- 23b. Pedicel, hypanthium, and sepals abaxially glabrous 26. *M. leiocalyca*
- 22b. Pome with cupular cavity at apex, core not separated.
- 24a. Leaf margin not lobed; inflorescence subcorymbiform.
- 25a. Leaf margin serrulate, abaxially glabrous or sparsely puberulous; pome 1–1.5 cm in diam.; fruiting pedicel glabrous 21. *M. prattii*
- 25b. Leaf margin doubly serrate, abaxially tomentose; pome 1.5–2 cm in diam.; fruiting pedicel villous 22. *M. ombrophila*
- 24b. Leaf margin 3–6-lobed, acutely doubly serrate; inflorescence subracemose.
- 26a. Styles 3 or 4; leaf blade abaxially puberulous; hypanthium and pedicel sparsely pubescent 23. *M. honanensis*
- 26b. Styles 5; leaf blade abaxially tomentose; hypanthium and pedicel tomentose 24. *M. yunnanensis*

1. *Malus baccata* (Linnaeus) Borkhausen, Theor. Prakt. Handb. Forstbot. 2: 1280. 1803.

山荆子 shan jing zi

Trees to 10–14 m tall, with arching or pendulous branches. Branchlets reddish brown, terete, glabrous; buds reddish brown, ovoid, scales tomentose at margin. Stipules caducous, lanceolate, ca. 3 mm, membranous, margin entire or with sparse glandular teeth, apex acuminate; petiole 2–5 cm, puberulous, with few glands when young, glabrescent; leaf blade elliptic or ovate, 3–8 × 2–3.5 cm, glabrous or slightly puberulous when young, base cuneate or rounded, margin serrate, apex acuminate, rarely caudate-acuminate. Corymb at apices of branchlets, umbel-like, 5–7 cm in diam., 4–6-flowered; bracts caducous, linear-lanceolate, membranous, glabrous, margin glandular denticulate, apex acuminate. Pedicel 1.5–4 cm, slender, glabrous. Flowers 3–3.5 cm in diam. Hypanthium campanulate, glabrous. Sepals lanceolate, 5–7 mm, longer than hypanthium, abaxially glabrous, adaxially tomentose, margin entire, apex long acuminate. Petals white, obovate, 2–2.5 cm, base shortly clawed, apex obtuse-rounded. Stamens 15–20, unequal, ca. 1/2 as long as petals. Ovary 5- or 4-loculed, with 2 ovules per locule; styles 5 or 4, longer than stamens, densely villous basally. Pome red or yellow, subglobose, 8–10 mm in diam., with an obscure scar at apex; fruiting pedicel 3–4 cm, glabrous; sepals caducous. Fl. Apr–Jun, fr. Sep–Oct. $2n = 34^*$.

Mixed forests on slopes, among shrubs in valleys; sea level to 1500 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Xinjiang, Xizang [Bhutan, India, Kashmir, Korea, Mongolia, Nepal, Russia (Siberia)].

This is a beautiful, ornamental tree grown for its showy flowers and red or yellow fruit. It is commonly used as stock to graft *Malus pumila* and *M. asiatica* in N and NE China.

- 1a. Trees to 10–14 m tall; branchlets slender, slightly curved, not pendulous; leaf margin acutely serrate; flowers 3–3.5 cm in diam.; styles 5 or 4 1a. var. *baccata*
- 1b. Small trees, 4–6 m tall; branchlets pendulous; leaf margin obtusely serrate; flowers ca. 3 cm in diam.; styles 3 or 4 1b. var. *gracilis*

1a. *Malus baccata* var. *baccata*

山荆子(原变种) shan jing zi (yuan bian zhong)

Pyrus baccata Linnaeus, Mant. Pl. 75. 1767; *M. baccata* var. *sibirica* (Maximowicz) C. K. Schneider; *M. sibirica* Borkhausen.

Trees, to 10–14 m tall. Branchlets slender, slightly curved. Leaf blade 3–8 cm, margin acutely serrate. Flowers 3–3.5 in diam. Styles 5 or 4.

Mixed forests on slopes, among shrubs in valleys; sea level to 1500 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi [Korea, Mongolia, Russia (Siberia)].

1b. *Malus baccata* var. *gracilis* (Rehder) T. C. Ku, **comb. et stat. nov.**

垂枝山荆子 chui zhi shan jing zi

Basionym: *Malus baccata* f. *gracilis* Rehder, J. Arnold Arbor. 2: 49. 1920.

Trees, small, 4–6 m tall. Branchlets pendulous. Leaf margin obtusely serrate. Flowers ca. 3 cm in diam. Styles 3 or 4.

- Gansu, Shaanxi.

2. *Malus jinxianensis* J. Q. Deng & J. Y. Hong, Acta Phytotax. Sin. 25: 326. 1987.

金具山荆子 jin xian shan jing zi

Malus baccata (Linnaeus) Borkhausen var. *jinxianensis* (J. Q. Deng & J. Y. Hong) C. Y. Li.

Trees small. Branchlets dark brown, terete, slender, subglabrous; buds reddish brown, ovoid; scales slightly pubescent at margin. Stipules usually caducous, lanceolate, ca. 1 cm, membranous, margin serrulate, apex acuminate; petiole 1–1.5 cm, pubescent when young, glabrescent; leaf blade elliptic to ovate, rarely suborbicular, 4–8 × 2–5 cm, both surfaces initially pubescent, soon glabrous, base broadly cuneate or subrounded, margin serrulate, sometimes shortly curved-serrate, apex acuminate or caudate-acuminate. Corymbs clustered at ends of short shoots, 3–5 cm in diam., 3–6-flowered; bracts caducous, linear-lanceolate, adaxially pilose, margin sparsely glandular serrate, apex acuminate. Pedicel 2–3.3 cm, slender, glabrous. Flowers 1–2 cm in diam. Hypanthium campanulate, abaxially glabrous. Sepals ovate, 3–4 mm, longer than hypanthium, tomentose adaxially, margin entire, apex caudate, rarely acuminate. Petals pink, ovate, 1–1.5 cm, base shortly clawed, apex rounded. Stamens 20–30, unequal, ca. 1/2 as long as petals. Ovary (3- or)4-loculed, with 2 ovules per locule; styles (3 or)4, slightly connate at base, longer than stamens, sparsely white pilose, rarely glabrous. Pome purplish red, obovoid, ca. 1 cm in diam., with a large scar at apex; fruiting pedicel 3–3.5 cm; sepals caducous. Fl. May, fr. Oct.

- Cultivated. S Liaoning (Jin Xian).

3. *Malus mandshurica* (Maximowicz) Komarov ex Juzepczuk, Fl. URSS 9: 371. 1939.

毛山荆子 mao shan jing zi

Pyrus baccata Linnaeus var. *mandshurica* Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg 19: 170. 1874; *Malus baccata* (Linnaeus) Borkhausen subsp. *mandshurica* (Komarov) Likhonos; *M. baccata* var. *mandshurica* (Maximowicz) C. K. Schneider.

Trees to 15 m tall. Branchlets purplish brown, terete, densely puberulous when young, glabrescent; buds reddish brown, ovoid, glabrous or scales slightly puberulous at margin. Stipules caducous, linear-lanceolate, 5–7 mm, herbaceous or membranous, adaxially sparsely puberulous, margin sparsely glandular denticulate, apex acuminate; petiole 3–4 cm, sparsely puberulous; leaf blade ovate, elliptic, or obovate, 5–8 × 3–4 cm, abaxially puberulous or subglabrous along midvein and lateral veins, base cuneate or subrounded, margin serrulate, apex acute or acuminate. Corymb sessile, at ends of branchlets, umbel-like, 6–8 cm in diam., 3–6-flowered; bracts caducous, linear-lanceolate, small, membranous, margin entire or glandular denticulate, apex acuminate. Pedicel 3–5 cm, sparsely puberulous. Flowers 3–3.5 cm in diam. Hypanthium campanulate, abaxially

pubescent. Sepals lanceolate, 5–7 mm, slightly longer than hypanthium, adaxially tomentose, margin entire, apex acuminate. Petals white, narrowly obovate, 1.5–2 cm, base shortly clawed, apex rounded. Stamens 30, unequal, ca. 1/2 as long as petals or longer. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4(or 5), slightly longer than stamens, tomentose basally. Pome red, ellipsoid or obovoid, 0.8–1.2 cm in diam.; fruiting pedicel 3–5 cm, slightly puberulous; sepals caducous, with a small scar at apex. Fl. May–Jul, fr. Aug–Sep. $2n = 34^*$.

Mixed forests on slopes, mountain summits, valleys; 100–2100 m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shaanxi, Shanxi [Russia].

In NE China, this species is often used as stock for grafting *Malus pumila* and *M. asiatica*.

4. *Malus sikkimensis* (Wenzig) Koehne, Gatt. 5 Pomac. 27. 1890.

锡金海棠 xi jin hai tang

Pyrus pashia Buchanan-Hamilton ex D. Don var. *sikkimensis* Wenzig, Linnaea 38: 49. 1874; *Malus baccata* subsp. *sikkimensis* (Wenzig) Likhonos; *P. sikkimensis* (Wenzig) J. D. Hooker.

Trees small, 6–8 m tall. Branchlets reddish brown when young, blackish brown when old, terete, gray tomentose when young, subglabrous when old; buds reddish brown, ovoid; scales tomentose at margin. Stipules caducous, lanceolate, 6–8 mm, membranous, glandular at margin, apex acuminate; petiole 2–3 cm, initially densely tomentose, glabrescent; leaf blade elliptic, ovate, or ovate-lanceolate, 5–7 × 2–3 cm, abaxially gray tomentose, densely so along veins, later subglabrous, adaxially glabrous, base rounded or broadly cuneate, margin sharply serrate, apex acuminate or caudate-acuminate. Corymbs 5–9 cm in diam., 6–10-flowered; bracts caducous, lanceolate, membranous, margin entire or serrate, apex acuminate. Pedicel 1.5–5 cm, tomentose, later subglabrous. Flowers 2.5–3 cm in diam. Hypanthium campanulate, adaxially tomentose, later subglabrous. Sepals ovate-lanceolate, 5–6 mm, longer than hypanthium, both surfaces tomentose, later subglabrous, margin entire, apex acuminate. Petals white adaxially, pink abaxially, suborbicular, 1.2–1.5 cm, base shortly clawed, apex rounded. Stamens 25–30, unequal, ca. 1/2 as long as petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, longer than stamens, connate at base, glabrous. Pome dark red, white punctate, obovoid or pyriform, 1–1.8 cm in diam., with a small scar at apex; fruiting pedicel 2–2 × ca. 8 cm, slightly tomentose or subglabrous; sepals caducous. Fl. May–Jul, fr. Sep–Oct. $2n = 34^*$, 51^* , 68^* .

Open forests on slopes, mixed forests in valleys; 2500–3000 m. W Sichuan, S and SE Xizang, NW Yunnan [Bhutan, NE India, Nepal, Sikkim].

This is a rare species with small, isolated populations threatened by forest clearing.

5. *Malus rockii* Rehder, J. Arnold Arbor. 14: 206. 1933.

丽江山荆子 li jiang shan jing zi

Malus baccata (Linnaeus) Borkhausen subsp. *himalaica* (Maximowicz) Likhonos; *M. baccata* var. *himalaica* (Maximowicz) C. K. Schneider; *Pyrus baccata* Linnaeus var. *himalaica* Maximowicz.

Trees 8–10 m tall, pendulous. Branchlets dark brown, terete, villous when young, glabrescent; buds reddish brown, ovoid, subglabrous or scales puberulous at margin. Stipules caducous, lanceolate, 5–6 mm, membranous, subglabrous, margin slightly glandular denticulate, apex acuminate; petiole 2–4 cm, villous; leaf blade elliptic, ovate-elliptic, or oblong-ovate, 6–12 × 3.5–7 cm, abaxially puberulous along midvein and lateral veins, adaxially sparsely pubescent along midvein, base rounded or broadly cuneate, margin irregularly appressed serrulate, apex acuminate. Corymbs umbel-like, 4–6 cm in diam., 4–8-flowered; bracts caducous, lanceolate, membranous, margin sparsely glandular serrate, apex acuminate. Pedicel 2–4 cm, pubescent. Flowers 2.5–3 cm in diam. Hypanthium campanulate, densely villous. Sepals triangular-lanceolate, 5–7 mm, slightly longer than or ca. as long as hypanthium, abaxially sparsely pubescent or subglabrous, adaxially densely pubescent, margin entire, apex acute or acuminate. Petals white, obovate, 1.2–1.5 cm, base shortly clawed, apex rounded. Stamens 25, unequal, shorter than petals. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4 or 5, slightly longer than stamens, villous basally. Pome red, ovoid or subglobose, 1–1.5 cm in diam. with a small scar at apex; sepals caducous; fruiting pedicel 2–4 cm, puberulous. Fl. May–Jun, fr. Sep. $2n = 34^*$, 51^* .

Mixed forests in valleys; 2400–3800 m. SW Sichuan, SE Xizang, NW Yunnan [Bhutan].

6. *Malus hupehensis* (Pampanini) Rehder, J. Arnold Arbor. 14: 207. 1933.

湖北海棠 hu bei hai tang

Pyrus hupehensis Pampanini, Nuovo Giorn. Bot. Ital., n.s., 17: 291. 1910, not (C. K. Schneider) Bean (1933); *Malus domestica* Borkhausen var. *hupehensis* (Pampanini) Likhonos; *Malus theifera* Rehder.

Trees to 8 m tall. Branchlets initially dark green, purple or purplish brown when old, terete, initially puberulous, glabrous when old; buds dark purple, ovoid; scales sparsely ciliate at margin. Stipules caducous, linear-lanceolate, 5–6 mm, herbaceous or membranous, sparsely pubescent, margin sparsely glandular denticulate, apex acuminate; petiole 1–3 cm, sparsely puberulous when young, glabrescent; leaf blade ovate or ovate-elliptic, 5–10 × 2.5–4 cm, sparsely puberulous when young, glabrescent, base broadly cuneate, rarely rounded, margin acutely serrulate, apex acuminate. Corymb 4–6 cm in diam., 4–6-flowered; bracts caducous, lanceolate, membranous, margin sparsely glandular serrate when young, apex acuminate. Pedicel 3–6 cm, sparsely villous when young, later glabrous. Flowers 3.5–4 cm diam. Hypanthium campanulate, adaxially glabrous or sparsely villous. Sepals triangular-ovate, 4–5 mm, ca. as long as or shorter than hypanthium, abaxially glabrous, adaxially pubescent, margin entire, apex acuminate or acute. Petals pink in bud, becoming white, obovate, ca. 1.5 cm, base shortly clawed, apex rounded. Stamens 20 unequal, ca. 1/2 as long as petals.

Ovary 3- or 4-loculed, with 2 ovules per locule; styles 3(or 4), slightly longer than stamens, tomentose basally. Pome yellowish green, tinged red, ellipsoid or subglobose, ca. 1 cm in diam.; fruiting pedicel 3–6 cm, glabrous; sepals caducous, with a small scar at apex. Fl. Apr–May, fr. Aug–Sep. $2n = 51^*$, 68^* .

• Slopes, valley thickets; sea level to 2900 m. Anhui, Fujian, Gansu, Guangdong, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Shanxi, Zhejiang.

This species is used as grafting stock for apple trees in Hubei and Sichuan. Its young leaves can be processed as a tea substitute. It has showy flowers in the spring and abundant, beautiful fruit in the autumn, and can be used as an ornamental tree.

7. *Malus halliana* Koehne, Gatt. Pomac. 27. 1890.

垂丝海棠 chui si hai tang

Malus domestica Borkhausen var. *halliana* (Koehne) Likhonos; *M. floribunda* Siebold ex Van Houtte var. *parkmanni* Koehne; *Pyrus halliana* (Koehne) Voss.

Trees to 5 m tall. Branchlets purple or purplish brown, terete, slender, puberulous when young, glabrescent; buds purplish brown, ovoid, glabrous or scales ciliate at margin. Stipules caducous, lanceolate, small, 4–6 mm, membranous, puberulous adaxially, margin glandular denticulate when young, apex acuminate; petiole 0.5–2.5 cm, sparsely pubescent when young, glabrescent; leaf blade dark green and often tinged purple adaxially, ovate, elliptic, or narrowly elliptic, 3.5–8 × 2.5–4.5 cm, glabrous except sometimes puberulous along midvein, base cuneate or subrounded, margin obtusely serrulate, apex long acuminate. Corymb 4–6 cm in diam., 4–6-flowered; bracts caducous, lanceolate, membranous, margin entire, apex acuminate. Pedicel pendulous, purple, 2–4 cm, slender, sparsely pubescent. Flowers 3–3.5 cm diam. Hypanthium glabrous abaxially. Sepals triangular-ovate, 3–5 mm, ca. as long as or slightly shorter than hypanthium, abaxially glabrous, adaxially tomentose, margin entire, apex obtuse. Petals often more than 5, pink, obovate, ca. 1.5 cm, base shortly clawed, apex rounded. Stamens 20–25, unequal, ca. 1/2 as long as petals. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4 or 5, slightly longer than stamens, long tomentose basally. Pome purplish, pyriform or obovoid, 6–8 mm in diam.; fruiting pedicel 2–4 cm, subglabrous; sepals caducous, with a small scar at apex. Fl. Mar–Apr, fr. Sep–Oct. $2n = 34^*$, 51^* .

• Thickets on slopes or by streams; sea level to 1200 m. Anhui, Guizhou, Hubei, Jiangsu, Shaanxi, Sichuan, Yunnan, Zhejiang.

This species has been used as an ornamental because of its purplish red young branches and leaves and pink, showy flowers in the spring.

According to Bean (Trees Shrubs Hardy Brit. Isles, ed. 8, 2: 699. 1981), this is a Japanese species and does not occur in China. Further study is required on Chinese specimens attributed to *Malus halliana*.

Malus halliana is similar to *M. baccata*, which differs by its serrulate leaves, white petals, and apically acuminate sepals larger than the hypanthium.

8. *Malus muliensis* T. C. Ku, Acta Phytotax. Sin. 29: 83. 1991.

木里海棠 mu li hai tang

Trees small, 3–4 m tall. Branchlets black-gray, terete; buds purple-red, ellipsoid-ovoid, apex acute; scales several, exposed, abaxially pubescent. Stipules caducous, lanceolate, pubescent, apex acuminate; petiole 2–2.5 cm, densely pubescent; leaf blade pale green abaxially, deep green adaxially, ovate-lanceolate or broadly lanceolate, 4–6 × 1.5–2.3 cm, abaxially sparsely pubescent, densely so on midvein, adaxially glabrous, base broadly cuneate or rounded, margin shallowly obtusely serrate, apex caudate-acuminate. Flowers not seen. Pome purplish red, cylindrical, 6.5–7.5 × 4.5–5 mm; fruiting pedicel 3–3.5 cm, pilose or subglabrous; sepals deciduous. Fr. Aug–Sep.

- *Picea* forests; ca. 3200 m. SW Sichuan (Muli Xian).

9. *Malus daochengensis* C. L. Li, Acta Phytotax. Sin. 27: 301. 1989.

稻城海棠 dao cheng hai tang

Trees to 5–7 m tall. Branchlets grayish brown when old, terete, densely grayish white tomentose when young, glabrous when old; buds purplish brown, long elliptic-ovoid; scales pubescent at margin, tomentose abaxially. Stipules caducous, linear-lanceolate, 4–6 mm, membranous, pubescent, margin sparsely glandular serrate, apex acuminate; petiole 1–3 cm, gray tomentose; leaf blade pale green abaxially, green adaxially, elliptic-lanceolate or elliptic, 4–9.5 × 2–4 cm, abaxially tomentose when young, glabrescent, adaxially gray tomentose along veins when young, soon glabrescent, base cuneate or rounded, margin obtusely serrate, apex acuminate, acute, or obtuse. Corymbs umbel-like, 3–5 cm in diam., 3–6-flowered; bracts caducous, linear-lanceolate, membranous, both surfaces tomentose, margin entire, apex acuminate. Pedicel 3.5–4 cm, densely grayish white tomentose. Flowers 3.5–4 cm in diam. Hypanthium densely grayish white tomentose. Sepals triangular-lanceolate, 4–6 mm, nearly as long as hypanthium, both surfaces grayish white tomentose, margin entire, apex acuminate. Petals white or pinkish white, broadly elliptic, ca. 2 cm, base shortly clawed, apex rounded. Stamens 25, unequal, ca. 1/2 as long as petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, slightly longer than stamens, tomentose basally. Pome yellowish red, pyriform, 1–1.5 cm in diam.; fruiting pedicel 3.5–4 cm, grayish white tomentose; sepals caducous, with a small scar at apex. Fl. Jun, fr. Aug.

- Thickets, field margins; ca. 2800 m. W Sichuan, NW Yunnan.

10. *Malus pumila* Miller, Gard. Dict., ed. 8, *Malus* no. 3. 1768.

苹果 ping guo

Malus communis Poir.; *M. dasyphylla* Borkhausen; *M. dasyphylla* var. *domestica* Koidzumi; *M. domestica* Borkhausen; *M. domestica* subsp. *pumila* (Miller) Likhonos; *M. pumila* var. *domestica* C. K. Schneider; *M. niedzwetzkyana* Dieck ex Koehne; *M. sylvestris* Miller subsp. *mitis* Mansfeld; *Pyrus malus* Linnaeus; *P. malus* var. *pumila* Henry.

Trees to 15 m tall. Branchlets purplish brown when old, terete, robust, short, densely tomentose when young, glabrous when old; buds purplish brown, ovoid, densely puberulous.

Stipules caducous, lanceolate, 3–5 mm, herbaceous, densely puberulous, margin entire, apex acuminate; petiole robust, 1.5–3 cm, puberulous; leaf blade elliptic, ovate, or broadly elliptic, 4.5–10 × 3–5.5 cm, both surfaces densely puberulous when young, adaxially glabrescent, base broadly cuneate or rounded, margin obtusely serrate, apex acute. Corymb at apices of branchlets, 4–6 cm in diam., 3–7-flowered; bracts caducous, linear-lanceolate, membranous, tomentose, margin entire, apex acuminate. Pedicel 1–2.5 cm, tomentose. Flowers 3–4 cm in diam. Hypanthium tomentose abaxially. Sepals triangular-lanceolate or triangular-ovate, 6–8 mm, longer than hypanthium, both surfaces tomentose, margin entire, apex acuminate. Petals white, obovate, 1.5–1.8 cm, base shortly clawed, apex rounded. Stamens 20, unequal, ca. 1/2 as long as petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, slightly longer than stamens, gray tomentose basally. Pome red or yellow, depressed-subglobose, ca. 2 cm in diam., impressed at base; fruiting pedicel short and thickened; sepals persistent. Fl. May, fr. Jul–Oct. $2n = 24^*$, 34^* , 51^* , 68 .

Commonly cultivated in N, NW, and SW China [Bhutan; Native to SW Asia and Europe].

11. *Malus sieversii* (Ledebour) M. Roemer, Syn. Rosifl. 216. 1830.

新疆野苹果 xin jiang ye ping guo

Pyrus sieversii Ledebour, Fl. Altaic. 2: 222. 1830.

Trees 2–10(–14) m tall; branchlets dark grayish red when old, terete, short, robust, puberulous when young, slightly curved, glabrescent when old; buds dark red, ovoid, villous abaxially. Stipules caducous, lanceolate, 3–5 mm, membranous, margin white ciliate, apex acuminate; petiole 1.2–3.5 cm, sparsely pubescent; leaf blade ovate or broadly elliptic, rarely obovate, 6–11 × 3–5.5 cm, abaxially densely villous when young, sparsely pubescent when old, adaxially sparsely pubescent along veins, base cuneate, rarely rounded, margin obtusely serrate, apex acute. Corymb umbel-like, 4–6 cm in diam., 3–6-flowered; bracts caducous, lanceolate, membranous, margin glandular serrate when young, apex acuminate. Pedicel ca. 1.5 cm, white tomentose. Flowers 3–3.5 cm in diam. Hypanthium campanulate, abaxially tomentose. Sepals broadly lanceolate or triangular-lanceolate, ca. 6 mm, longer than hypanthium, both surfaces tomentose, margin entire, apex acuminate. Petals pinkish, tinged rose when in bud, obovate, 1.5–2 cm, base shortly clawed, apex rounded. Stamens 20, unequal, ca. 1/2 as long as petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, ca. as long as or slightly longer than stamens, white tomentose basally. Pome yellowish green, tinged red, globose or depressed-globose, 3–4.5(–7) cm in diam.; fruiting pedicel 3.5–4 cm, white tomentose; sepals persistent, reflexed, with cavity at apex. Fl. May, fr. Aug–Oct. $2n = 34^*$.

Mountain summits, slopes, valleys, often the dominant tree of forests; 1200–1300 m. W Xinjiang [Kazakhstan, Russia].

This species is vulnerable to extinction because of its limited range and exploitation. It is believed to be the principal ancestor of commercially grown apples.

12. Malus asiatica Nakai in Matsumura, Icon. Pl. Koisikav. 3: 19. 1915.

花红 hua hong

Malus domestica Borkhausen var. *asiatica* (Nakai) V. V. Ponomarenko; *M. domestica* var. *rinki* (Koidzumi) H. Ohle; *M. dulcissima* Koidzumi var. *asiatica* Koidzumi; *M. dulcissima* var. *rinki* (Koidzumi) Koidzumi; *M. matsumurae* Koidzumi; *M. prunifolia* Borkhausen var. *rinki* (Koidzumi) Rehder; *M. pumila* Miller var. *rinki* Koidzumi; *Pyrus matsumurae* (Koidzumi) Cardot; *P. ringo* Wenzig.

Trees small, 4–6 m tall. Branchlets purplish brown when old, terete, robust, densely pubescent when young, glabrous when old; buds grayish red, ovoid, initially densely pubescent, glabrescent. Stipules caducous, lanceolate, small, 3–5 mm, membranous, margin glandular serrate when young, apex acuminate; petiole 1.5–5 cm, puberulous; leaf blade ovate or elliptic, 5–11 × 4–5.5 cm, abaxially densely puberulous, adaxially initially puberulous, glabrescent, base rounded or broadly cuneate, margin serrulate, apex acute or acuminate. Corymb at apices of branchlets, umbel-like, 3–5 cm in diam., 4–7(–10)-flowered; bracts caducous, lanceolate, membranous, pubescent, apex acuminate. Pedicel 1.5–2 cm, densely pubescent. Flowers 3–4 cm in diam. Hypanthium densely pubescent abaxially. Sepals triangular-lanceolate, 4–5 mm, slightly longer than hypanthium, both surfaces densely pubescent, margin entire, apex acuminate. Petals pinkish, obovate or oblong-obovate, 0.8–1.3 cm, base shortly clawed, apex rounded. Stamens 17–20, unequal, shorter than petals. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4(or 5), longer than stamens, tomentose basally. Pome yellow or red, ovoid or subglobose, 4–5 cm in diam., impressed at base; fruiting pedicel 1.5–2.5 cm, pubescent; sepals persistent. Fl. Apr–May, fr. Aug–Sep. $2n = 34^*$, 51^* , 68^* .

• Open slopes, sandy soils of plains; sea level to 2800 m. Gansu, Guizhou, Hebei, Henan, Hubei, Jiangsu, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Yunnan, Zhejiang.

This species is a famous fruit tree in N and NE China. During its long cultivation, many cultivars have been bred, the fruit of which differ in shape, color, size, and ripening period.

13. Malus prunifolia (Willdenow) Borkhausen, Theor. Prakt. Handb. Forstbot. 2: 1278. 1803.

秋子 qiu zi

Trees small, to 3–8 m tall. Branchlets grayish purple or grayish brown when old, terete, robust, densely puberulous when young, glabrous when old; buds purplish brown, ovoid, sparsely pubescent. Stipules caducous, lanceolate, small, 4–5 mm, membranous, margin glandular serrate when young, apex acuminate; petiole 1–5 cm, initially densely puberulous, glabrescent; leaf blade ovate or elliptic, 5–9 × 4–5 cm, pubescent along veins when young, pubescent only along midvein or subglabrous when old, base broadly cuneate, margin serrulate, apex acuminate or acute. Corymb umbel-like, 4–8 cm in diam., 4–10-flowered; bracts caducous, linear-lanceolate, membranous, sparsely pubescent, margin entire, apex acuminate. Pedicel 2–3.5 cm; puberulous. Flowers 4–5 cm in diam. Hypan-

thium campanulate, abaxially puberulous. Sepals lanceolate or triangular-lanceolate, 7–9 mm, slightly longer than hypanthium, both surfaces puberulous, margin entire, apex acuminate. Petals white, pink in bud, obovate or elliptic, 2.5–3 cm, base shortly clawed, apex rounded. Stamens 20, unequal, ca. 1/3 as long as petals. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4(or 5), longer than stamens, tomentose basally. Pome yellow, red, ovoid, 2–2.5 cm in diam., with cavity at base; fruiting pedicel 2–3.5 cm, puberulous, apex sometimes thickened and oblique; sepals persistent, partly so, or caducous. Fl. Apr–May, fr. Aug–Sep. $2n = 34^*$, 51^* .

• Slopes, plains; sea level to 1300 m, Gansu, Guizhou, Hebei, Henan, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, ?Xinjiang.

- 1a. Fruiting pedicel thickened and oblique at apex; sepals persistent or partly so 13b. var. *obliquipedicellata*
- 1b. Fruiting pedicel neither thickened nor oblique at apex; sepals caducous 13a. var. *prunifolia*

13a. Malus prunifolia var. **prunifolia**

秋子(原变种) qiu zi (yuan bian zhong)

Pyrus prunifolia Willdenow, Phytogr. 8. 1794; *Malus domestica* Borkhausen subsp. *prunifolia* (Willdenow) Likhonos.

Fruiting pedicel neither thickened nor oblique at apex; sepals caducous.

• Slopes, plains; sea level to 1300 m, Gansu, Guizhou, Hebei, Henan, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, ?Xinjiang.

This variety is an excellent stock for grafting apple trees. Many varieties have also been bred as good fruit trees.

13b. Malus prunifolia var. **obliquipedicellata** X. W. Li & J. W. Sun, Bull. Bot. Res., Harbin 13: 336. 1993.

歪把海棠 wai ba hai tang

Fruiting pedicel thickened and oblique at apex; sepals persistent or partly so. Fl. May, fr. Aug.

• About 300 m. C Shandong (Tai Shan).

14. Malus spectabilis (Aiton) Borkhausen, Theor. Prakt. Handb. Forstbot. 2: 1279. 1803.

海棠花 hai tang hua

Pyrus spectabilis Aiton, Hort. Kew 2: 175. 1789; *Malus domestica* Borkhausen var. *spectabilis* (Aiton) Likhonos; *M. microcarpa* A. Savatier var. *spectabilis* (Aiton) Carrière.

Trees to 8 m tall. Branchlets reddish brown or purplish brown when old, terete, puberulous when young, glabrous when old; buds purplish brown, ovoid, sparsely pubescent. Stipules caducous, narrowly lanceolate, 4–6 mm, membranous, adaxially villous, margin entire, apex acuminate; petiole 1.5–2 cm, puberulous; leaf blade elliptic or narrowly elliptic, 5–8 × 2–3 cm, both surfaces sparsely puberulous when young, glabre-

scent, base broadly cuneate or subrounded, margin appressed serrulate, apex shortly acuminate or rounded-obtuse. Corymb subumbel-like, 4–6 cm in diam., 4–6-flowered; bracts caducous, lanceolate, membranous, margin entire, apex acuminate. Pedicel 2–3 cm, pubescent. Flowers 4–5 cm in diam. Hypanthium campanulate, abaxially glabrous or white tomentose. Sepals triangular-ovate, 2–4 mm, slightly shorter than hypanthium, abaxially glabrous or pubescent, adaxially white tomentose, margin entire, apex acute. Petals white, pink in bud, ovate, 2–2.5 cm, base shortly clawed, apex rounded. Stamens 20–25, unequal, ca. 1/2 as long as petals. Ovary (4- or)5-loculed; with 2 ovules per locule; styles (4 or)5, slightly longer than stamens, white tomentose basally. Pome yellow, subglobose, ca. 2 cm in diam., not impressed at apex, convex at base; fruiting pedicel 3–3.5 cm, thickened distally, subglabrous; sepals persistent. Fl. Apr–May, fr. Aug–Sep. $2n = 34^*$, 51^* .

• Plains, mountain regions; 500–2000 m. Hebei, Jiangsu, Liaoning, Qinghai, Shaanxi, Shandong, Yunnan, Zhejiang.

This species is one of the most famous ornamental trees in China, widely cultivated in the E and N regions. The cultivated var. *roversis* (G. Kirchner) Rehder has double, pink flowers, and var. *albipena* Schelle, also cultivated, has double, white flowers.

15. *Malus* ×*micromalus* Makino, Bot. Mag. (Tokyo) 22: 69. 1908.

西府海棠 xi fu hai tang

Malus domestica Borkhausen var. *micromalus* (Makino) Likhonos; *M. microcarpa* A. Savatier var. *kaido* (Siebold) Carrière; *M. spectabilis* Borkhausen var. *kaido* Siebold; *M. spectabilis* var. *micromalus* (Makino) Koidzumi; *Pyrus micromalus* (Makino) Makino.

Trees small, to 2.5–5 m tall. Branchlets purplish brown or dark brown, terete, slender, puberulous when young, glabrescent; buds dark purple, ovoid, glabrous, or scales tomentose at margin. Stipules caducous, linear-lanceolate, 4–6 mm, membranous, subglabrous, margin sparsely glandular denticulate, apex acuminate; petiole 2–3.5 cm, pubescent when young, glabrescent; leaf blade narrowly elliptic or elliptic, 5–10 × 2.5–5 cm, puberulous when young, glabrescent, base cuneate, rarely subrounded, margin serrate, apex acute or acuminate. Corymb umbel-like, 4–6 cm in diam., 4–7-flowered; bracts caducous, linear-lanceolate, membranous, margin entire, apex acuminate. Pedicel 2–3 cm, villous when young, glabrescent. Flowers ca. 4 mm in diam. Hypanthium white tomentose abaxially. Sepals triangular-ovate or triangular-lanceolate, 5–8 mm, ca. as long as or slightly shorter than hypanthium, abaxially pubescent, adaxially white tomentose, margin entire, apex acute or shortly acuminate. Petals pink, suborbicular or narrowly elliptic, ca. 1.5 cm, base shortly clawed, apex rounded. Stamens ca. 20, unequal, slightly shorter than petals. Styles 5, ca. as long as stamens, tomentose basally. Pome red, subglobose, 1–1.5 cm in diam.; impressed at apex, with cavity at base; fruiting pedicel 2–3 cm, subglabrous; sepals caducous or a few persistent. Fl. Apr–May, fr. Aug–Sep. $2n = 34^*$, 51^* .

• Commonly cultivated. Gansu, Guizhou, Hebei, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Yunnan, Zhejiang.

According to Bean (Trees Shrubs Hardy Brit. Isles, ed. 8, 2: 710), this taxon is a hybrid between *Malus spectabilis* and probably *M. baccata*.

In N China, this taxon is usually planted in gardens and parks for ornamental purposes and for its edible fruit. It is used as stock to graft *Malus asiatica* and *M. pumila* in some regions.

16. *Malus sieboldii* (Regel) Rehder in Sargent, Pl. Wilson. 2: 293. 1915.

三叶海棠 san ye hai tang

Pyrus sieboldii Regel, Index Sem. Hort. Petrop. 1858: 51. 1859; *Crataegus cavaleriei* H. Léveillé & Vaniot; *C. taquetii* H. Léveillé; *Malus baccata* (Linnaeus) Borkhausen subsp. *toringo* (K. Koch) Koidzumi; *M. sieboldii* (Regel) Rehder var. *toringo* (K. Koch) Siebold ex C. K. Schneider; *M. toringo* (K. Koch) Carrière; *Photinia rubrolutea* H. Léveillé; *Pyrus esquirollii* H. Léveillé; *P. subcrataegifolia* H. Léveillé; *P. toringo* (K. Koch) Miquel; *Sorbus toringo* K. Koch.

Shrubs 2–6 m tall. Branchlets spreading, dark purple or purplish brown, terete, puberulous when young, glabrescent; buds purplish brown, ovoid, glabrous or only terminal scales puberulous at margin. Stipules narrowly lanceolate, 4–6 mm, herbaceous, slightly puberulous, margin entire, apex acuminate; petiole 1–2.5 cm, puberulous; leaf blade ovate, elliptic, or narrowly elliptic, 3–7.5 × 2–4 cm, both surfaces puberulous when young, abaxially puberulous along midvein and lateral veins when old, adaxially subglabrous, base rounded or broadly cuneate, margin serrate, often 3-lobed, rarely 5-lobed on new branches, apex acute. Corymb at apices of branchlets, 4–6 cm in diam., 4–8-flowered; bracts caducous, linear-lanceolate, membranous, adaxially pubescent, margin entire, apex acuminate. Pedicel 2–2.5 cm, pubescent or subglabrous. Flowers 2–3 cm in diam. Hypanthium campanulate, subglabrous or pubescent. Sepals ca. as long as or slightly longer than hypanthium, abaxially glabrous, adaxially tomentose, margin entire, apex caudate-acuminate. Petals pinkish, elliptic-obovate, 1.5–1.8 cm, base shortly clawed, apex rounded. Stamens 20, unequal, ca. 1/2 as long as petals. Ovary 3–5-loculed, with 2 ovules per locule; styles 3–5, slightly longer than stamens, villous basally. Pome red or brownish yellow, subglobose, 6–8 mm in diam.; sepals caducous; fruiting pedicel 2–3 cm. Fl. Apr–May, fr. Aug–Sep. $2n = 34^*$, 51^* .

Mixed forests, among shrubs, slopes; 150–2000 m. Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Liaoning, Shaanxi, Shandong, Sichuan, Zhejiang [Korea, Japan].

This species can be used as an ornamental tree for its showy flowers in the spring. In Liaoning and Shandong provinces, it is sometimes used as stock for grafting apple trees.

17. *Malus kansuensis* (Batalin) C. K. Schneider, Repert. Spec. Nov. Regni Veg. 3: 178. 1906.

陇东海棠 long dong hai tang

Shrubs or small trees, 3–5 m tall; branchlets purplish brown or dark brown when old, terete, puberulous when young, glabrous when old; buds dark purple, ovoid; scales tomentose at margin. Stipules linear-lanceolate, 6–10 mm, herbaceous, sparsely pubescent, margin sparsely glandular denticulate, apex

acuminate; petiole 1.5–4 cm, sparsely puberulous; leaf blade ovate or broadly ovate, 5–8 × 4–6 cm, abaxially sparsely puberulous or glabrous, base rounded or truncate, margin doubly serrulate, often 3-lobed, rarely irregularly or not lobed, apex acute or acuminate. Corymb 5–6.5 cm in diam., 4–10-flowered; bracts caducous, linear-lanceolate, membranous, margin entire, apex acuminate. Pedicel 2.5–3.5 cm, sparsely pubescent or glabrous. Flowers 1.5–2 cm in diam. Hypanthium campanulate, abaxially villous or glabrous. Sepals triangular-ovate or triangular-lanceolate, 5–6 mm, ca. as long as or slightly longer than hypanthium, abaxially glabrous, adaxially villous, margin entire, apex acuminate. Petals white, broadly obovate, 0.8–1 cm, base shortly clawed, apex rounded. Stamens 20, unequal, ca. 1/2 as long as petals. Styles (2 or)3(or 4), slightly longer than stamens, glabrous basally. Pome yellowish red, ellipsoid or obovoid, 1–1.5 cm in diam.; sepals caducous; fruiting pedicel 2–3.5 cm. Fl. May–Jun, fr. Jul–Aug. $2n = 34^*$.

• Mixed forests, scrub; 1500–3300 m. Gansu, Henan, Hubei, Qinghai, Shaanxi, Sichuan.

This species is similar to *Malus honanensis*, which differs in its more lobed leaf margin, glabrous or sparsely villous corymb, and subglobose fruit often with a persistent calyx.

- 1a. Pedicel and leaves abaxially sparsely puberulous, hypanthium villous outside 17a. var. *kansuensis*
- 1b. Pedicel, hypanthium, and leaves abaxially glabrous 17b. var. *calva*

17a. *Malus kansuensis* var. *kansuensis*

陇东海棠(原变种) long dong hai tang (yuan bian zhong)

Pyrus kansuensis Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 94. 1893; *Eriolobus kansuensis* (Batalin) C. K. Schneider; *Malus komarovii* var. *funiushanensis* S. Y. Wang.

Pedicel and leaves abaxially sparsely puberulous; hypanthium villous outside.

• Mixed forests, scrub; 1500–3000 m. Gansu, Henan, Shaanxi, Sichuan.

17b. *Malus kansuensis* var. *calva* (Rehder) T. C. Ku & Sponberg, **comb. et stat. nov.**

光叶陇东海棠 guang ye long dong hai tang

Basionym: *Malus kansuensis* f. *calva* Rehder, J. Arnold Arbor. 2: 50. 1920.

Pedicel, hypanthium outside and leaves abaxially glabrous.

• 2300–3300 m. Hubei, Shaanxi, Sichuan.

18. *Malus komarovii* (Sargent) Rehder, J. Arnold Arbor. 2: 51. 1920.

山楂海棠 shan zha hai tang

Crataegus komarovii Sargent, Pl. Wilson. 1: 183. 1912.

Shrubs or small trees, to 3 m tall. Branchlets dark red when young, reddish brown or purplish brown when old, terete,

pubescent when young, glabrous when old; buds dark red, ovoid; scales pubescent at margin. Stipules caducous, linear-lanceolate, 4–6 mm, membranous, margin glandular denticulate, apex acuminate; petiole 1–3 cm, pubescent; leaf blade broadly ovate, rarely narrowly elliptic, 4–8 × 3–7 cm, abaxially densely pubescent along veins when young, adaxially sparsely pubescent, base cordate or subcordate, margin doubly serrate, usually 3-parted at middle, 1-lobed on each side near base, irregularly lobed or undivided apically, apex acuminate or acute. Corymb 4–6 cm in diam., 6–8-flowered; bracts caducous, linear-lanceolate, membranous, margin sparsely glandular serrate, apex acuminate. Pedicel ca. 2 cm, villous. Flowers ca. 3.5 cm in diam. Hypanthium campanulate, abaxially tomentose. Sepals triangular-lanceolate, 2–3 mm, slightly longer than hypanthium, abaxially subglabrous, adaxially tomentose, margin entire, apex acuminate. Petals white, obovate, ca. 1.8 cm, base shortly clawed, apex rounded. Stamens 20–30, ca. 1/2 as long as petals. Ovary 3- or 4-loculed, with 2 ovules per locule; styles 3 or 4, slightly longer than stamens, glabrous basally. Pome red, ellipsoid, 1–1.5 × 0.8–1 cm, core free at apex; sepals caducous; fruiting pedicel 1.2–1.5 cm. Fl. May, fr. Sep. $2n = 34^*$.

Among shrubs; 1100–1300 m. S Jilin (Changbai Shan) [N Korea].

This species is resistant to cold temperatures. It is also endangered because of habitat loss.

19. *Malus toringoides* (Rehder) Hughes, Bull. Misc. Inform. Kew 1920: 205. 1920.

变叶海棠 bian ye hai tang

Malus transitoria C. K. Schneider var. *toringoides* Rehder in Sargent, Pl. Wilson. 2: 286. 1915; *Pyrus toringoides* (Rehder) Osborn; *P. transitoria* Batalin var. *toringoides* (Rehder) Bailey; *Sinomalus toringoides* (Rehder) Koidzumi.

Shrubs or small trees, 3–6 m tall. Branchlets purplish brown or dark brown when old, terete, puberulous when young, glabrous when old; buds purplish brown, ovoid, pubescent, apex acute. Stipules lanceolate, 4–6 mm, sparsely pubescent, margin entire, apex acuminate; petiole 1–3 cm, puberulous; leaf blade variable in shape, ovate or narrowly elliptic, 3–8 × ca. 1.5 cm, abaxially densely pubescent along midvein and lateral veins, adaxially sparsely pubescent, base broadly cuneate or subcordate, margin obtusely serrate, often 3–5-parted, sometimes undivided, apex acute. Corymb umbel-like, 3–5 cm in diam., 3–5-flowered; bracts caducous, linear, membranous, adaxially pubescent when young, margin sparsely glandular serrate, apex acuminate. Pedicel 1.8–2.5 cm, sparsely villous. Flowers 2–2.5 cm in diam. Hypanthium tomentose abaxially. Sepals triangular-lanceolate or narrowly triangular, 3–4 mm, nearly as long as hypanthium, both surfaces white tomentose, margin entire, apex acuminate. Petals white, ovate or elliptic-obovate, 8–11 mm, adaxially sparsely pubescent or glabrous, base shortly clawed, apex rounded. Stamens ca. 20; filaments unequal, shorter than petals. Styles 3(or 4 or 5), not exceeding stamens, glabrous. Pome yellow, tinged red, obovoid or narrowly ellipsoid, 1–1.3 cm; sepals caducous; fruiting pedicel 3–4 cm, glabrous. Fl. Apr–May, fr. Sep. $2n = 34^*$, 51^* , 68^* .

• Thickets on slopes; 2000–3000 m. SE Gansu, W Sichuan, SE Xizang.

20. *Malus transitoria* (Batalin) C. K. Schneider, Ill. Handb. Laubholz. 1: 726. 1906.

花叶海棠 hua ye hai tang

Shrubs or small trees, to 8 m tall. Branchlets dark purple or purplish brown when old, terete, slender, tomentose when young; buds dark purple, ovoid, tomentose. Stipules ovate-lanceolate, 4–6 mm, herbaceous, tomentose, margin entire, apex acute; petiole 1.5–3.5 cm, tomentose; leaf blade ovate or broadly ovate, 2.5–5 × 2–4.5 cm, both surfaces tomentose or adaxially subglabrous, base rounded or broadly cuneate, margin irregularly serrate, usually irregularly 3–5-parted; lobes narrowly ovate or narrowly elliptic, apex acute. Corymb umbel-like, 3–5 cm in diam., 3–6-flowered; bracts caducous, linear-lanceolate, membranous, pubescent, margin entire, apex acuminate. Pedicel 1.5–2 cm, tomentose. Flowers 1–2 cm in diam. Hypanthium campanulate, tomentose. Sepals caducous, triangular-ovate, ca. 3 mm, slightly shorter than hypanthium, both surfaces tomentose, margin entire, apex rounded-obtuse or slightly acute. Petals white, ovate, 8–10 mm, base shortly clawed, apex rounded. Stamens 20–25, unequal, slightly shorter than petals. Styles 3–5, slightly longer than or nearly as long as stamens, glabrous. Pome yellowish red, subglobose or oblong-ellipsoid to oblong-ovoid, 6–8 mm in diam., impressed at apex; sepals caducous; fruiting pedicel 1.5–2 cm, tomentose. Fl. May, fr. Sep. $2n = 34^*$, 51^* .

• Thickets, slopes, hills of the Loess Plateau, roadsides; 1500–3900 m. Gansu, Nei Mongol, Qinghai, Shaanxi, Sichuan, E Xizang.

This species is resistant to drought and cold temperatures. It has been used as stock to graft apple trees in NE and NW Shaanxi.

Malus setok Vassilczenko might be an allied species or an ecotype of *M. transitoria*.

- 1a. Pome oblong-elliptic or oblong-ovate, 10–12 × 6–8 mm 20c. var. *centralasiatica*
- 1b. Pome subglobose, 6–8 mm in diam.
 - 2a. Leaf blade abaxially densely tomentose, adaxially sparsely tomentose or subglabrous; pedicel and hypanthium densely tomentose 20a. var. *transitoria*
 - 2b. Leaf blade abaxially glabrous; pedicel and hypanthium abaxially sparsely pubescent 20b. var. *glabrescens*

20a. *Malus transitoria* var. *transitoria*

花叶海棠(原变种) hua ye hai tang (yuan bian zhong)

Pyrus transitoria Batalin, Trudy Imp. S.-Peterburgsk. Bot. Sada 13: 95. 1893; *Sinomalus transitoria* (Batalin) Koidzumi.

Leaf blade densely tomentose abaxially, sparsely tomentose or subglabrous adaxially. Pedicel and hypanthium densely tomentose. Pome subglobose.

• Thickets, slopes, hills of the Loess Plateau; 1500–3900 m. Gansu, Nei Mongol, Qinghai, Shaanxi, Sichuan.

20b. *Malus transitoria* var. *glabrescens* T. T. Yu & T. C. Ku, Acta Phytotax. Sin. 18: 496. 1980.

少毛花叶海棠 shao mao hua ye hai tang

Leaf blade glabrous abaxially. Pedicel and hypanthium abaxially sparsely pubescent.

• Roadsides; 3500–3700 m. E Xizang (Qamdo Xian).

20c. *Malus transitoria* var. *centralasiatica* (Vassilczenko) T. T. Yu, Fl. Reipubl. Popularis Sin. 36: 394. 1974.

长圆果花叶海棠 chang yuan guo hua ye hai tang

Malus centralasiatica Vassilczenko, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 19: 202. 1959.

Pome oblong-ellipsoid or oblong-ovoid, 10–12 × 6–8 mm.

• 3300–3900 m. Gansu, Qinghai, Shaanxi.

21. *Malus prattii* (Hemsley) C. K. Schneider, Ill. Handb. Laubholz. 1: 719. 1906.

西蜀海棠 xi shu hai tang

Pyrus prattii Hemsley, Bull. Misc. Inform. Kew 1895: 16. 1895; *Docyniopsis prattii* (Hemsley) Koidzumi.

Trees to 10 m tall. Branchlets dark red or purplish brown when old, short, robust, pubescent when young, glabrous when old; buds purplish brown, ovoid; scales pubescent at margin. Stipules linear-lanceolate, 1–1.3 cm, membranous, glabrous or subglabrous, margin sparsely glandular denticulate, apex acuminate; petiole 1.5–3 cm, sparsely pubescent or subglabrous; leaf blade ovate, elliptic, or narrowly elliptic-ovate, 6–15 × 3.5–7.5 cm, both surfaces puberulous when young, glabrescent, abaxially sparsely puberulous or glabrous when old, base rounded, margin serrulate, apex acuminate. Corymb umbel-like, 5–9 cm in diam., 5–12-flowered; bracts caducous, linear-lanceolate, membranous, margin entire, apex acuminate. Pedicel 1.5–3 cm, sparsely pubescent. Flowers 1.5–2 cm in diam. Hypanthium campanulate, abaxially densely pubescent when young, glabrescent. Sepals triangular-ovate, 4–5 mm, slightly longer than or ca. as long as hypanthium, abaxially subglabrous, adaxially tomentose, margin entire, apex acuminate or caudate-acuminate. Petals white, suborbicular, 0.8–1 cm, base shortly clawed, apex rounded. Stamens 20, unequal, slightly shorter than petals. Ovary (4- or)5-loculed, with 2 ovules per locule; styles (4 or)5, nearly as long as stamens, glabrous basally. Pome red or yellow, ovoid or subglobose, 1–1.5 cm in diam.; fruiting pedicel 2.5–3 cm, glabrous; sepals persistent. Fl. Jun, fr. Aug. $2n = 34^*$.

• Mixed forests on slopes; 1400–3500 m. W Sichuan, NW Yunnan.

22. *Malus ombrophila* Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 63: 8. 1926.

沧江海棠 cang jiang hai tang

Trees to 10 m tall. Branchlets dark purple or purplish brown when old, terete, densely puberulous when young, glabrous when old; buds dark purple, ovoid, subglabrous or scales puberulous at margin. Stipules caducous, linear-lanceolate, membranous, 6–8 mm, glabrous or subglabrous, margin entire,

apex acuminate; petiole 2–3.5 cm, tomentose; leaf blade ovate, 9–13 × 5–6.5 cm, abaxially white tomentose, adaxially rarely sparsely puberulous along midvein and lateral veins when young, base truncate, rounded or subcordate, margin doubly serrate, apex acuminate. Corymb umbel-like, 5–8 cm in diam., 4–13-flowered; bracts caducous, linear or lanceolate, membranous, tomentose, margin entire, apex acuminate. Pedicel 2–2.5 cm, densely pubescent. Flowers 1.5–1.8 cm in diam. Hypanthium campanulate, abaxially densely pubescent. Sepals triangular, ca. 3 mm, slightly shorter than hypanthium, abaxially pubescent, adaxially glabrous or sparsely puberulous, margin entire, apex acute. Petals white, ovate, ca. 8 mm, base shortly clawed, apex rounded. Stamens 15–20, unequal, slightly shorter than petals. Ovary 3–5-loculed, with 2 ovules per locule; styles 3–5, slightly longer than stamens, glabrous basally. Pome red, subglobose, 1.5–2 cm in diam., with cupular cavity at apex; fruiting pedicel ca. 3 cm, villous; sepals persistent. Fl. Jun, fr. Aug. $2n = 34^*$.

• Mixed stream side forests, valleys; 2000–3500 m. SW Sichuan, Xizang, NW Yunnan.

23. Malus honanensis Rehder, J. Arnold Arbor. 2: 51. 1920.

河南海棠 he nan hai tang

Sinomalus honanensis (Rehder) Koidzumi.

Shrubs or small trees, to 5–7 m tall. Branchlets reddish brown when old, terete, slender, pubescent when young, soon glabrescent, glabrous when old; buds reddish brown, ovoid; scales villous at margin. Stipules caducous, linear-lanceolate, ca. 6 mm, membranous, pubescent, margin entire, apex acuminate; petiole 1.5–2.5 cm, pubescent; leaf blade broadly ovate, narrowly elliptic, or ovate, 4–7 × 3.5–6 cm, both surfaces puberulous, adaxially soon glabrescent, base rounded, cordate, or truncate, margin doubly serrate, 3–6-lobed, apex acute. Corymb umbel-like, 4–6.5 cm in diam., 5–10-flowered; bracts caducous, linear-lanceolate, 5–6 mm, membranous, pubescent, margin entire, apex acuminate. Pedicel 1.5–3 cm, slender, pubescent when young, soon glabrescent. Flowers ca. 1.5 cm in diam. Hypanthium campanulate, abaxially sparsely pubescent. Sepals triangular-ovate, ca. 2 mm, shorter than hypanthium, abaxially glabrous, adaxially densely villous, margin entire, apex acute. Petals pinkish white, ovate, 7–8 mm, base subcordate and shortly clawed, apex rounded. Stamens ca. 20, ca. as long as or slightly shorter than petals. Ovary 3- or 4-loculed, with 2 ovules per locule; styles 3 or 4, connate at base, glabrous. Pome yellowish red, subglobose, ca. 8 mm in diam.; fruiting pedicel 1.5–3 cm, subglabrous; sepals persistent. Fl. May, fr. Aug–Sep. $2n = 34^*$.

• Thickets in valleys or on slopes; 800–2600 m. Gansu, Hebei, Henan, Hubei, Shaanxi, Shanxi.

In floral structure, this species is most similar to *Malus kansuensis*, which is distinguished by its leaves with fewer lobes and coarser serration, caducous sepals, and ellipsoid fruit.

24. Malus yunnanensis (Franchet) C. K. Schneider, Repert. Spec. Nov. Regni Veg. 3: 179. 1906.

滇池海棠 dian chi hai tang

Trees to 10 m tall. Branchlets dark purple or purplish

brown when old, terete, robust, tomentose when young, glabrous when old; buds dark purple, ovoid, glabrous or scales sparsely puberulous at margin. Stipules caducous, linear, 6–8 mm, membranous, white tomentose adaxially, margin sparsely glandular denticulate, apex acute; petiole 2–3.5 cm, tomentose; leaf blade ovate, broadly ovate, or narrowly elliptic-ovate, 6–12 × 4–7 cm, abaxially tomentose or subglabrous, adaxially subglabrous, base rounded or cordate, margin doubly serrate, each side 3–5-lobed, apex acute. Corymb umbel-like, 5–9 cm in diam., 8–12-flowered; bracts caducous, linear-lanceolate, membranous, adaxially tomentose, margin sparsely glandular denticulate, apex acuminate. Pedicel 1.5–3 cm, tomentose. Flowers ca. 1.5 cm in diam. Hypanthium campanulate, abaxially tomentose. Sepals triangular-ovate, 3–4 mm, ca. as long as hypanthium, both surfaces tomentose, margin entire, apex acuminate. Petals white, suborbicular, ca. 8 mm, base shortly clawed, apex rounded. Stamens 20–25, unequal, slightly shorter than petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, nearly as long as stamens, glabrous basally. Pome red, globose, 1–1.5 cm in diam., white punctate; fruiting pedicel 2–3 cm; sepals persistent. Fl. May, fr. Aug–Sep. $2n = 34^*$.

Mixed forests on slopes or by streams in valleys; 1600–3800 m. Guizhou, Hubei, Shaanxi, Sichuan, Xizang, Yunnan [Myanmar].

In autumn, this is an ornamental tree with red leaves and abundant, red fruit. It is very adaptable to poor environmental conditions and can be used as stock for grafting apple trees in W China.

- 1a. Leaf blade ovate, broadly ovate, or narrowly elliptic-ovate, abaxially tomentose, base rounded or cordate, lobes apically shortly acuminate 24a. var. *yunnanensis*
- 1b. Leaf blade ovate, abaxially subglabrous, base usually cordate, lobes apically acute 24b. var. *veitchii*

24a. Malus yunnanensis var. **yunnanensis**

滇池海棠(原变种) dian chi hai tang (yuan bian zhong)

Pyrus yunnanensis Franchet, Pl. Delavay. 228. 1890; *Cormus yunnanensis* (Franchet) Koidzumi; *Docyniopsis yunnanensis* (Franchet) Koidzumi; *Eriolobus yunnanensis* (Franchet) C. K. Schneider.

Leaf blade ovate, broadly ovate, or elliptic-ovate, abaxially tomentose, base rounded or cordate, lobes shortly acuminate at apex.

Mixed forests on slopes or by streams in valleys; 1600–3800 m. Sichuan, Yunnan [Myanmar].

24b. Malus yunnanensis var. **veitchii** (Osborn) Rehder, J. Arnold Arbor. 4: 115. 1923.

川鄂滇池海棠 chuan e dian chi hai tang

Pyrus yunnanensis var. *veitchii* Osborn, Gard. Chron., ser. 3, 78: 227. 1925.

Leaf blade ovate, abaxially subglabrous, base usually cordate, lobes acute at apex.

• Guizhou, Hubei, Shaanxi, Sichuan, Xizang.

25. *Malus doumeri* (Bois) A. Chevalier, Compt. Rend. Acad. Sci. (Paris) 170: 1129. 1920.

台湾海棠 tai wan hai tang

Pyrus doumeri Bois, Bull. Soc. Bot. France 51: 113. 1904; *Docynia doumeri* (Bois) C. K. Schneider; *D. indica* (Wallich) Decaisne var. *doumeri* (Bois) A. Chevalier; *D. indica* var. *laosensis* (Cardot) A. Chevalier; *Eriolobus doumeri* (Bois) C. K. Schneider; *Malus asiatica* Nakai var. *argutiserrata* Hu & Chen; *M. doumeri* var. *formosana* (Kawakami & Koidzumi ex Hayata) S. S. Ying; *M. formosana* (Kawakami & Koidzumi ex Hayata) Kawakami & Koidzumi; *M. laosensis* (Cardot) A. Chevalier; *M. melliana* (Handel-Mazzetti) Rehder; *Pyrus formosana* Kawakami & Koidzumi ex Hayata; *P. laosensis* Cardot; *P. melliana* Handel-Mazzetti.

Trees to 15 m tall. Branchlets grayish brown or purplish brown when old, terete, villous when young, glabrous when old; buds reddish purple, ovoid, pubescent or only pubescent along margin of scales. Stipules caducous, linear-lanceolate, membranous, glabrous, margin entire, apex acuminate; petiole 1.5–3 cm, tomentose when young, glabrescent; leaf blade narrowly elliptic-ovate or obovate-lanceolate, 9–15 × 4–6.5 cm, both surfaces white tomentose when young, glabrescent, base rounded or cuneate, margin irregularly serrate, apex acuminate, Corymb umbel-like, 3–5 cm in diam., 4- or 5-flowered; bracts caducous, linear-lanceolate, membranous, glabrous, margin entire, apex obtuse. Pedicel 1.5–3 cm, white tomentose. Flowers 2.5–3 cm in diam. Hypanthium campanulate, abaxially tomentose, prolonged into short tube at apex. Sepals ovate or lanceolate, ca. 8 mm, ca. as long as or slightly longer than hypanthium, abaxially tomentose, adaxially densely tomentose, margin obtusely serrate, apex acute or acuminate. Corymb umbel-like, 4–5.5 cm in diam., 5–7-flowered; bracts caducous, lanceolate, membranous, glabrous, margin entire, apex acuminate. Pedicel 3–5 cm, glabrous. Flowers ca. 2.5 cm in diam. Hypanthium obcampanulate, glabrous, prolonged into short tube at apex. Sepals triangular-lanceolate, ca. 8 mm, ca. as long as or slightly longer than hypanthium, abaxially glabrous, adaxially tomentose, margin entire, apex acuminate. Petals purplish white, obovate, 1–2 cm, base shortly clawed, apex rounded. Stamens ca. 30, unequal, slightly shorter than petals. Ovary 5-loculed, with 2 ovules per locule; styles 5, slightly longer than stamens, white tomentose basally. Pome yellowish red, glo-

margin entire, apex acuminate. Petals yellowish white; obovate, 1–2 cm, base shortly clawed, apex rounded. Stamens unequal, slightly shorter than petals. Ovary 4- or 5-loculed, with 2 ovules per locule; styles 4 or 5, longer than stamens, long tomentose basally. Pome yellowish red, globose, 2.5–5.5 cm in diam.; distal part of hypanthium tubular, 5–8 mm, core free; fruiting pedicel 1–3 cm, glabrous; sepals persistent. Fl. May, fr. Aug–Sep.

Forests; 1000–2000 m. Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Taiwan, Yunnan, Zhejiang [Laos, Vietnam].

This species can be used as stock for grafting apple trees in subtropical regions. The fruit are edible.

In floral structure, this species is similar to *Docynia*, and some authors have placed it in that genus. However, in *Malus*, there are two ovules per locule, not many, as in *Docynia*. Consequently, it should be retained in the genus *Malus*.

26. *Malus leiocalyca* S. Z. Huang, Guihaia 9: 305. 1989.

光萼海棠 guang e hai tang

Shrubs or small trees, 4–10 m tall. Branchlets dark gray when old, slightly curved, terete, sparsely pubescent when young, glabrous when old; buds reddish purple, ovoid, glabrous, rarely scales sparsely pubescent at margin. Stipules caducous, linear-lanceolate, membranous, adaxially sparsely pubescent, margin entire, apex acuminate; petiole 1.5–2.5 cm; leaf blade elliptic or ovate-elliptic, 5–10 × 2.5–4 cm, sparsely pubescent when young, glabrescent, base rounded or broadly cune-

bose, 1.5–2.5 cm in diam., core free; fruiting pedicel 1–3 cm, glabrous; distal part of hypanthium tubular, 5–8 mm; sepals persistent. Fl. May, fr. Aug–Sep.

• Mixed mountain forests, stream sides in valleys; 700–2400 m. Anhui, Fujian, Guangdong, Guangxi, Hunan, Jiangxi, Yunnan, Zhejiang.

The protologue appears to indicate two types. However, rather than regard the name as invalid, we consider the first-cited, flowering type (*Exped. Wuyi 2414*, IBSC, as “*Typus fl*”) to be the holotype because it is immediately followed by an explicit citation of two isotypes (IBK, PE, as “*Isotypus*”). We consider the second-cited, fruiting type (*Exped. Wuyi 00585*, IBSC, as “*Typus fr*”) to be a paratype.

