

## 2. MORUS Linnaeus, Sp. Pl. 2: 986. 1753.

桑属 sang shu

Trees or shrubs, deciduous, with latex; monoecious or dioecious. Winter buds with 3–6 bud scales; scales imbricate. Stipules free, sublateral, caducous. Leaves alternate; leaf blade simple to deeply palmately lobed, margin toothed; primary veins 3–5 from base, secondary veins pinnate. Male inflorescences axillary, spicate, many-flowered, shortly pedunculate. Female inflorescences shortly spicate to capitate. Male flowers: calyx lobes 4, imbricate; stamens inflexed in bud; pistillode top-shaped. Female flowers: sessile; calyx lobes 4, imbricate, fleshy in fruit; ovary 1-loculed; style present or not; stigma 2-branched, abaxially pubescent or papillose. Fruit with enlarged, succulent calyx usually aggregated into juicy syncarp. Syncarp with achenes enclosed by enlarged and succulent calyx; endocarp shell-like; exocarp fleshy. Seed ± globose; endosperm fleshy; embryo incurved; cotyledon elliptic.

About 16 species: widespread in all temperate areas, also in the mountains of tropical Africa, Indonesia, and South America; 11 species (five endemic, one introduced) in China.

*Morus* species are cultivated in many temperate and tropical countries. The leaves are used as food for silkworms and the fruit for human consumption. Male material is often very difficult to name.

*Morus calva* H. Léveillé is *Coriaria sinica* Maximowicz (Coriariaceae) and *M. mairei* H. Léveillé is *Acalypha mairei* (H. Léveillé) Schneider (Euphorbiaceae).

- 1a. Female flowers with style long and conspicuous.
  - 2a. Leaf blade marginal teeth each with subulate apiculum or seta; stigmas with a nipple-like protuberance ..... 10. *M. mongolica*
  - 2b. Leaf blade marginal teeth without subulate apiculum or seta; stigmas without a nipple-like protuberance.
    - 3a. Syncarp less than 2.5 cm ..... 11. *M. australis*
    - 3b. Syncarp 3–6 cm.
      - 4a. Leaf blade not lobed, veins abaxially prominent; stigmas glabrous ..... 8. *M. notabilis*
      - 4b. Leaf blade deeply 3–5-lobed, veins abaxially not prominent; stigmas abaxially pubescent ..... 9. *M. trilobata*
- 1b. Female flowers with style very short or absent.
  - 5a. Infructescences longer than 2.5 cm.
    - 6a. Infructescences with fruit joined into a syncarp, 2.5–3.7 cm; leaf blades elliptic to narrowly elliptic ..... 5. *M. liboensis*
    - 6b. Infructescences with fruit ± free, 6–16 cm; leaf blade ovate, broadly ovate, oblong, or broadly elliptic.
      - 7a. Leaf blade oblong to broadly elliptic, margin subentire or toothed toward apex only; infructescences 10–16 cm, apparently not fleshy ..... 6. *M. wittiorum*
      - 7b. Leaf blade ovate to broadly ovate, margin minutely and densely serrate; infructescences 6–12 cm, fleshy ..... 7. *M. macroura*
  - 5b. Infructescences usually shorter than 2.5 cm.
    - 8a. Leaf blade sparsely pubescent along midvein or in tufts in axil of midvein and primary lateral veins; stigmas with mastoidlike protuberance ..... 1. *M. alba*
    - 8b. Leaf blade pubescence not as above; stigmas without mastoidlike protuberance.
      - 9a. Leaves irregularly toothed ..... 2. *M. serrata*
      - 9b. Leaves regularly toothed.
        - 10a. Syncarp 1.5–2.5 cm in diam.; stigma long pubescent ..... 3. *M. nigra*
        - 10b. Syncarp less than 1 cm in diam.; stigma shortly pubescent ..... 4. *M. cathayana*

### 1. *Morus alba* Linnaeus, Sp. Pl. 2: 986. 1753.

桑 sang

Shrubs or trees, 3–10 m tall. Bark gray, shallowly furrowed. Branches finely hairy. Winter buds reddish brown, ovoid, finely hairy. Stipules lanceolate, 2–3.5 cm, densely covered with short pubescence. Petiole 1.5–5.5 cm, pubescent; leaf blade ovate to broadly ovate, irregularly lobed, 5–30 × 5–12 cm, abaxially sparsely pubescent along midvein or in tufts in axil of midvein and primary lateral veins, adaxially bright green and glabrous, base rounded to ± cordate, margin coarsely serrate to crenate, apex acute, acuminate, or obtuse. Male catkins pendulous, 2–3.5 cm, densely white hairy. Female catkins 1–2 cm, pubescent; peduncle 5–10 mm, pubescent. Male flowers: calyx lobes pale green, broadly elliptic; filaments inflexed in bud; anthers 2-loculed, globose to reniform. Female flowers: sessile; calyx lobes ovoid, ± compressed, with marginal hairs;

ovary sessile, ovoid; style absent; stigmas with mastoidlike protuberance, branches divergent, papillose. Syncarp red when immature, blackish purple, purple, or greenish white when mature, ovoid, ellipsoid, or cylindrical, 1–2.5 cm. Fl. Apr–May, fr. May–Aug.

• Originally endemic to C and N China, now cultivated throughout China [widely cultivated throughout the world].

The leaves provide food for silkworms, the bark fiber is used for textiles and paper, and the bark is also used for medicine.

- 1a. Leaf blade thin, 5–15 cm; syncarp blackish purple when mature, ovoid to ellipsoid ..... 1a. var. *alba*
- 1b. Leaf blade thick, to 30 cm; syncarp greenish white to purple when mature, cylindrical ..... 1b. var. *multicaulis*

### 1a. *Morus alba* var. *alba*

桑(原变种) sang (yuan bian zhong)

*Morus alba* var. *atropurpurea* (Roxburgh) Bureau; *M. alba* var. *bungeana* Bureau; *M. atropurpurea* Roxburgh.

Leaf blade 5–15 cm, thin, flat. Syncarp blackish purple when mature, ovoid to ellipsoid, 1–2.5 cm.

• Originally endemic to C and N China, now cultivated throughout China [widely cultivated throughout the world].

**1b. *Morus alba* var. *multicaulis* (Perrottet) Loudon, Arbor. Frutic. Brit. 3: 1348. 1838.**

鲁桑 lu sang

*Morus multicaulis* Perrottet, Mém. Soc. Linn. Paris 3: 129. 1823–1824 [“1825”]; *M. alba* var. *latifolia* (Poiret) Bureau; *M. chinensis* Loddiges ex Loudon; *M. latifolia* Poiret.

Leaf blade ca. 30 cm, thick, wrinkled. Syncarp greenish white to purple when mature.

• Cultivated. Jiangsu, Shaanxi, Sichuan, Zhejiang.

**2. *Morus serrata* Roxburgh, Fl. Ind., ed. 1832, 3: 596. 1832.**

吉隆桑 ji long sang

*Morus alba* Linnaeus var. *serrata* (Roxburgh) Bureau; *M. gyirongensis* S. S. Chang; *M. pabularia* Decaisne.

Trees to 15 m tall. Branchlets densely pubescent. Stipules lanceolate-ovate, 1.5–2 cm. Petiole 4–6 cm, densely white pubescent; leaf blade broadly ovate, unlobed, 10–14 × 6–10 cm, abaxially densely white pubescent along midvein and basal lateral veins, adaxially glabrous, base cordate, margin toothed with teeth triangular and apically shortly acuminate, apex acuminate to caudate; basal lateral veins 2, extending to basal half. Female inflorescences axillary, single; peduncle 0.5–1.5 cm. Female flowers: calyx lobes ovate-orbicular, adaxially pubescent; style absent; stigmas without mastoidlike protuberance, 2-branched, pubescent. Syncarp red when mature, shortly cylindrical. Achenes ovoid, ± compressed, glabrous. Fl. and fr. May–Jun.

Mountain forests; ca. 2300 m. S Xizang (Gyirong) [NW India, Nepal].

**3. *Morus nigra* Linnaeus, Sp. Pl. 2: 986. 1753.**

黑桑 hei sang

Trees to 10 m tall; monoecious or dioecious. Bark dark brown. Branchlets pale brown pubescent. Stipules lanceolate, membranous, brown pubescent. Petiole 1.5–2.5 cm, pubescent; leaf blade broadly ovate, unlobed, 6–12(–20) × 7–11 cm, thick, abaxially pale green, shortly pubescent, and tomentose, adaxially dark green and coarse, base cordate, margin regularly and coarsely serrate, apex acute to shortly acuminate. Male catkins cylindrical, 2–4 cm, pubescent. Female catkins ellipsoid, 2–2.5 cm; peduncle short. Female flowers: style inconspicuous; stigmas without mastoidlike protuberance, 2-branched and pubescent. Syncarp blackish purple when mature, elliptic, 2–2.5 × 1.5–2.5 cm.

Cultivated. Hebei, Shandong, Xinjiang (mainly) [native to W Iran; widely cultivated elsewhere].

This species is a valuable fruit tree in some countries.

**4. *Morus cathayana* Hemsley, J. Linn. Soc., Bot. 26: 456. 1894.**

华桑 hua sang

Small trees or shrubs; monoecious. Bark grayish white, smooth. Branchlets pubescent when young, glabrescent, conspicuously lenticellate. Stipules lanceolate. Petiole 2–5 cm, pubescent; leaf blade broadly ovate to ± orbicular, sometimes lobed, 8–20 × 6–13 cm, thick papery, abaxially densely white or yellowish gray pubescent, adaxially scabrous, sparsely covered with short hairs, and basally pubescent along veins, base cordate to truncate and ± oblique, margin shallowly to coarsely serrate or basally entire and apically shallowly serrate, apex acute to shortly acuminate. Male catkins 3–5 cm. Female catkins 1–3 cm. Male flowers: calyx lobes yellowish green, narrowly ovate, adaxially pubescent; stamens 4; pistillode small. Female flowers: calyx lobes obovate, apically pubescent; styles short; stigmas without mastoidlike protuberance, 2-branched, abaxially pubescent. Syncarp white, red, or dark purple when mature, cylindrical, 2–3 cm. Fl. Apr–May, fr. May–Jun.

Sunny slopes or valleys, high mountains; 900–1300 m. Anhui, N Fujian, N Guangdong, Hebei, Henan, Hubei, Hunan, S Jiangsu, S Shaanxi, Sichuan, NW Yunnan, Zhejiang [Japan, Korea].

1a. Leaf blade abaxially white pubescent, margin shallowly to coarsely serrate

..... 4a. var. *cathayana*

1b. Leaf blade abaxially yellowish gray pubescent, margin basally entire and

apically shallowly serrate ..... 4b. var. *gongshanensis*

**4a. *Morus cathayana* var. *cathayana***

华桑(原变种) hua sang (yuan bian zhong)

*Morus cathayana* var. *japonica* (Makino) Koidzumi; *M. chinlingensis* C. L. Min; *M. rubra* Linnaeus var. *japonica* Makino; *M. tiliifolia* Makino.

Branchlets pubescent. Leaf blade abaxially white pubescent, margin shallowly to coarsely serrate.

Sunny slopes or valleys; 900–1300 m. Anhui, N Fujian, N Guangdong, Hebei, Henan, Hubei, Hunan, S Jiangsu, S Shaanxi, Sichuan, Zhejiang [Japan, Korea].

**4b. *Morus cathayana* var. *gongshanensis* (Z. Y. Cao) Z. Y. Cao, Acta Bot. Yunnan. 17: 154. 1995.**

贡山桑 gong shan sang

*Morus gongshanensis* Z. Y. Cao, Acta Phytotax. Sin. 29: 264. 1991.

Branchlets glabrous when young. Leaf blade whitish green when dry, abaxially yellowish gray pubescent, margin basally entire and apically shallowly serrate.

• High mountains. NW Yunnan.

**5. *Morus liboensis* S. S. Chang, Acta Phytotax. Sin. 22: 66. 1984.**

荔波桑 li bo sang

Trees 6–15 m tall, d.b.h. 16–20 cm. Branches gray-brown, cylindrical. Winter buds ovoid, ca. 3 mm, sparsely pubescent. Stipules pubescent. Petiole 2–3 cm, sparsely pubescent; leaf blade elliptic to narrowly elliptic, 6–12 × 4–8 cm, papery, abaxially whitish green and basally sparsely white pubescent, adaxially dark green, densely white pubescent, and with pointed cystoliths, base cordate to rounded, margin crenate on apical 1/3, apex acute to shortly acuminate with a 7–10 mm acumen; midvein abaxially prominent and adaxially impressed, basal lateral veins extending to 2/3 of leaf blade length, secondary veins 3 or 4 on each side of midvein. Peduncle ca. 1 cm, pubescent. Female flowers: calyx lobes broadly ovate, margin pubescent; stigma 2-branched, abaxially papillose. Syncarp red when mature, cylindrical, 2.5–3.7 cm × 4–5 mm; achenes dense.

- Limestone areas; ca. 700 m. Guizhou (Libo).

**6. *Morus wittiorum*** Handel-Mazzetti, Anz. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 58: 88. 1921.

长穗桑 chang sui sang

*Morus jinpingensis* S. S. Chang.

Trees or shrubs, 4–12 m tall, deciduous; dioecious. Bark grayish white, smooth. Branchlets pale brown, conspicuously lenticellate. Winter buds ovoid. Stipules narrowly ovate, ca. 4 mm. Petiole 1.5–3.5 cm, shallowly grooved; leaf blade oblong to broadly elliptic, 8–12 × 5–9 cm, papery, glabrous or young leaves abaxially with short soft hairs along midvein and lateral veins, abaxially pale green, adaxially green, base rounded to broadly truncate, margin subentire or toothed toward apex only, apex acuminate; basal lateral veins 3 pairs, extending to 1/2 of leaf blade length, secondary veins 3 or 4 on each side of midvein. Male catkins axillary; peduncle short. Female catkins 9–15 cm; peduncle 2–3 cm. Male flowers: calyx lobes green, ± orbicular. Female flowers: sessile; calyx lobes yellowish green, imbricate; ovary 1-loculed; style very short; stigma 2-branched. Syncarp cylindrical, 10–16 cm; achenes ovoid. Fl. Apr–May, fr. May–Jun.

- Forested slopes, beside streams; 900–1400 m. Guangdong, Guangxi, Guizhou, Hubei, Hunan.

The leaves provide food for silkworms and the bark fibers are used for making textiles and paper.

**7. *Morus macroura*** Miquel, Pl. Jungh. 1: 42. 1851.

奶桑 nai sang

*Morus alba* Linnaeus var. *laevigata* Wallich ex Bureau; *M. laevigata* Wallich ex Brandis; *M. macroura* var. *mawu* (Koidzumi) C. Y. Wu & Z. Y. Cao; *M. wallichiana* Koidzumi; *M. wittiorum* Handel-Mazzetti var. *mawu* Koidzumi.

Trees 7–12 m tall, d.b.h. 10–20 cm; dioecious. Branchlets pubescent when young. Winter buds ovoid-ellipsoid to ovoid, white pubescent. Stipules small. Petiole 2–4 cm; leaf blade ovate to broadly ovate, 5–15 × 5–9 cm, membranous, abaxially pale green and with short soft hairs along midvein and lateral veins when young, adaxially dark green and with soft hairs along veins, base rounded, ± cordate, or truncate, margin minutely and densely serrate, apex acuminate to shortly acuminate; secondary veins 4–6 on each side of midvein. Male catkins axillary, paired, 4–8 cm; peduncle 1–1.5 cm. Female

inflorescences cylindrical, 6–12 cm; peduncle 1–1.5 cm. Male flowers: calyx lobes ovate, adaxially pubescent; filament ca. 2.5 mm; anther globose. Female flowers: calyx lobes pubescent; ovary ovoid, declinate, ± compressed, pubescent; style absent; stigma 2-branched, papillate. Syncarp yellowish white when mature, 6–12 cm; achenes ovoid. Fl. Mar–Apr, fr. Apr–May.

Mountain forests, tropical forests; (300–)1000–1300(–2200) m. E Xizang, S Yunnan [Bhutan, Indochina, Malaysia, Myanmar, Sikkim, Thailand].

This species is used for paper making and the wood and leaves are used in dyeing.

**8. *Morus notabilis*** C. K. Schneider in Sargent, Pl. Wilson. 3: 293. 1916.

川桑 chuan sang

Trees 9–15 m tall; dioecious. Bark grayish brown. Branches spreading, subglabrous. Winter buds ovoid, ca. 8 mm, subglabrous. Petiole 2–3 cm, glabrous; leaf blade ± orbicular, 7–15 × 6–12 cm, abaxially pale green and glabrous or pubescent along midvein and lateral veins, adaxially dark green, glabrous, and slightly coarse, base ± cordate, margin narrowly triangular serrate and without subulate apiculum or seta, apex shortly acuminate to obtuse; basal lateral veins 2 and extending to 2/3 of leaf blade length, secondary veins 4–6 on each side of midvein and joined together near margin. Inflorescences axillary. Male catkins green, paired, 4–5 cm. Female inflorescences cylindrical, 3–4 cm, densely flowered; peduncle 3–4.5 cm. Female flowers: calyx lobes glabrous or adaxially sparsely pubescent, margin membranous; ovary ovoid, declinate, ± compressed, pubescent; style long; stigma abaxially papillate. Syncarp white when mature, 3.5–4 cm. Fl. Apr–May, fr. May–Jun.

- Evergreen broad-leaved forests. Sichuan, Yunnan.

**9. *Morus trilobata*** (S. S. Chang) Z. Y. Cao, Acta Phytotax. Sin. 29: 265. 1991.

裂叶桑 lie ye sang

*Morus australis* Poiret var. *trilobata* S. S. Chang, Acta Phytotax. Sin. 22: 66. 1984.

Trees to 3.5 m tall. Branchlets reddish brown, glabrous or subglabrous. Petiole 2–2.5 cm, sparsely hairy; leaf blade deeply 3–5-lobed, 10–13 × 7–10 cm, papery, glabrous or abaxially sparsely pubescent along midvein and lateral veins, base rounded to truncate, margin entire or apically coarsely toothed, teeth apically acute to acuminate and without subulate apiculum or seta; middle lobe narrowly lanceolate, 6–8 × 1–1.5 cm; lateral lobes shorter, lanceolate. Female inflorescences cylindrical, 2–4 × ca. 0.5 cm, pubescent; peduncle 8–10 mm, sparsely pubescent. Female flowers: calyx lobes ovate, ca. 2 mm, margins hairy; pistil 4–5 mm; ovary ca. 2 mm; style ca. 1 mm; stigma 2-branched, ca. 2 mm, abaxially pubescent. Achenes ± compressed. Fl. May–Jun.

- Slopes; ca. 800 m. Guizhou (Kaili).

**10. *Morus mongolica*** (Bureau) C. K. Schneider in Sargent, Pl. Wilson. 3: 296. 1916.

蒙桑 meng sang

*Morus alba* Linnaeus var. *mongolica* Bureau in Candolle, Prodr. 17: 241. 1873; *M. barkamensis* S. S. Chang; *M. deqinensis* S. S. Chang; *M. mongolica* var. *barkamensis* (S. S. Chang) C. Y. Wu & Z. Y. Cao; *M. mongolica* var. *diabolica* Koidzumi; *M. mongolica* var. *hopeiensis* S. S. Chang & Y. P. Wu; *M. mongolica* var. *longicaudata* Z. Y. Cao; *M. mongolica* var. *rotundifolia* Y. B. Wu; *M. mongolica* var. *vestita* Rehder; *M. mongolica* var. *yunnanensis* (Koidzumi) C. Y. Wu & Z. Y. Cao; *M. yunnanensis* Koidzumi.

Small trees or shrubs; dioecious. Bark grayish brown, furrowed. Old branches grayish black; branchlets dark red. Winter buds grayish brown, ovoid. Stipules 2.5–3.5 cm. Leaf blade elliptic-ovate, 8–15 × 5–8 cm, papery, glabrous, base cordate, margin triangular serrate with a few teeth double serrate, each tooth with subulate apiculum or seta, and apical serrations with long spines, apex shortly acuminate. Male catkins ca. 3 cm. Female inflorescences shortly cylindrical, 1–1.5 cm; peduncle 1–1.5 cm. Male flowers: calyx lobes dark yellow, margin adaxially hairy; anthers 2-loculed, longitudinally dehiscent. Female flowers: calyx lobes glabrous or adaxially sparsely pubescent; style long; stigma with a nipple-like protuberance, 2-branched, abaxially densely papillate. Syncarp red to purple when mature, ca. 1.5 cm. Fl. Mar–Apr, fr. Apr–May.

Mountain slopes, high mountains, forests; 500–3500 m. N Anhui, NE Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, NW Hunan, Jiangsu, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, SE Xizang, Yunnan [Japan, Korea, Mongolia].

The very distinctive leaf margin makes this species easy to recognize, in contrast to the varieties that have been proposed within it. Formal recognition of these varieties does not seem justified because they are based on features of indumentum and leaf shape, which vary more or less continuously.

**11. *Morus australis*** Poiret in Desrousseaux et al., Encycl. 4: 380. 1797.

鸡桑 ji sang

*Morus acidosa* Griffith; *M. alba* Linnaeus var. *indica* Bureau; *M. alba* var. *nigriformis* Bureau; *M. alba* var. *stylosa* Bureau; *M. australis* var. *hastifolia* (F. T. Wang & T. Tang ex Z. Y. Cao) Z. Y. Cao; *M. australis* var. *incisa* C. Y. Wu; *M. australis* var. *inusitata* (H. Léveillé) C. Y. Wu; *M. australis* var. *linearipartita* Z. Y. Cao; *M. australis* var. *oblongifolia* Z. Y. Cao; *M. bombycis* Koidzumi; *M. bombycis* var. *angustifolia* Koidzumi; *M. bombycis* var. *bifida* Koidzumi; *M. bombycis* var. *longistyla* Koidzumi; *M. bombycis* var. *tilifolia* Koidzumi; *M. cavaleriei* H. Léveillé; *M. formosensis* Hotta; *M. hastifolia* F. T. Wang & T. Tang ex Z. Y. Cao; *M. inusitata* H. Léveillé; *M. longistyla* Diels; *M. nigriformis* (Bureau) Koidzumi; *M. stylosa* Seringe var. *ovalifolia* Seringe.

Small trees or shrubs. Bark grayish brown. Winter buds conic to ovoid, large. Stipules linear-lanceolate. Petiole 1–1.5 cm, pubescent; leaf blade lanceolate to broadly ovate, simple or (2 or) 3–5-lobed, lobes rounded to linear, 5–14 × 1–12 cm, abaxially sparsely covered with thick hairs, adaxially scabrous and densely covered with short hairs, base cuneate to cordate, margin serrate or entire and without subulate apiculum or seta,

apex acute to caudate. Male catkins 1–1.5 cm, pubescent. Female inflorescences globose, ca. 1 cm, densely white pubescent;

peduncle short. Male flowers: calyx lobes green, ovate; anther yellow. Female flowers: calyx lobes dark green, oblong; style long; stigma 2-branched, abaxially pubescent. Syncarp red to dark purple when mature, shortly cylindric, ca. 1 cm in diam. Fl. Mar–Apr, fr. Apr–May.

Limestone areas, forest margins, mountain slopes, fallow land, scrub in valleys; 500–2000 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Hainan, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Liaoning, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, SE Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Korea, Myanmar, Nepal, Sikkim].

This species is closely related to *Morus indica* Linnaeus, and some authors have considered them conspecific. Varieties have been recognized on the basis of differences in leaf form, particularly the degree of division. Deeply divided leaves are characteristic of juvenile growth in a number of genera in the Moraceae and other families, and it does not seem advisable to give such material formal names, at least without more detailed population studies.

The bark fibers are used for making paper and the fruit are edible.

