

## BOMBACACEAE

木棉科 mu mian ke

Tang Ya (唐亚)<sup>1</sup>; Michael G. Gilbert<sup>2</sup>, Laurence J. Dorr<sup>3</sup>

Trees, usually large, often deciduous; trunks sometimes spiny, often buttressed; bark fibrous, with mucilaginous exudates; indumentum usually stellate or tufted. Leaves alternate, spiral; stipules inconspicuous, caducous; petiole pulvinate; leaf blade often palmately compound (simple and lobed in *Ochroma*), margin often entire. Inflorescences axillary, 1(or 2)-flowered, rarely many-flowered. Flowers bisexual, actinomorphic, large and showy. Epicalyx of 3 bracts, inconspicuous and caducous. Calyx shortly cylindrical, truncate, or irregularly 3–5-lobed, sometimes splitting. Petals 5, joined at base with androecium and falling as one unit, imbricate. Stamens usually very many (3–15 in *Ceiba*); filaments usually united in lower half into a filament tube around style, tube sometimes lobed, with stamens in 5 groups with completely united filaments and sessile anthers; anthers usually 1-celled, apparently 2-celled and non-septate in *Ceiba*, sometimes many anthers united into an apparent many-celled “super-anther”; pollen usually spheroidal, ± smooth, reticulate; staminodes absent. Ovary superior, syncarpous, carpels usually 5; ovules 2 to many per locule, axile, anatropous; style 5-lobed. Fruit a 5-valved capsule, or hard and indehiscent (e.g., *Adansonia*), many-seeded with seeds often embedded in endocarp hairs (kapok), less often fruit winged or juicy and few-seeded. Seeds sometimes winged.

About 30 genera and ca. 250 species: found widely in tropics, especially tropical America; three genera (two introduced) and five species (two introduced) in China.

See the comments under the Malvaceae (p. 264) for the relationships of the Bombacaceae.

*Durio* Adanson was at one time associated with this family but has always been regarded as anomalous and molecular data show it to be most closely related to the Helicteroideae (Sterculiaceae) but so distinct morphologically that it might better be placed in its own family or subfamily. Fruits of *Durio zibethinus* Murray (榴莲 liu lian, durian) are often available in S China, but attempts to cultivate it in China have not been successful and all fruits are imported from SE Asia.

*Adansonia digitata* Linnaeus (African baobab tree, 猴面包树 hou mian bao shu) and *Ochroma pyramidale* (Cavanilles ex Lamarck) Urban (*O. lagopus* Swartz, 轻木 qing mu, noteworthy as the source of the extremely lightweight timber, balsa) are only found in botanical gardens and do not merit full treatments.

Li Hen. 1984. Bombacaceae. In: Feng Kuo-mei, ed., Fl. Reipubl. Popularis Sin. 49(2): 102–112.

- 1a. Leaves simple, evergreen.
  - 2a. Leaf blade palmately veined, dentate; capsule without spines; seeds surrounded by dense wool .... *Ochroma* (see note above)
  - 2b. Leaf blade pinnately veined, entire; capsule with robust spines; seeds surrounded by strongly scented edible flesh ..... *Durio* (see note above)
- 1b. Leaves palmately 5–11-foliolate, often deciduous (evergreen in *Pachira*).
  - 3a. Pedicel more than 30 cm; capsule not dehiscent; seeds enclosed in edible pulp ..... *Adansonia* (see note above)
  - 3b. Pedicel less than 10 cm; capsule dehiscent; seeds often enclosed in wool.
    - 4a. Stamens 3–15; calyx persistent after flowering ..... 3. *Ceiba*
    - 4b. Stamens more than 40; calyx deciduous.
      - 5a. Stamens in many fascicles, each fascicle with 7–10 stamens; calyx truncate, adaxially glabrous; seeds 2.2–2.5 cm, not immersed in hairs; trees to 5 m; leaflets subsessile or with petiolule less than 0.4 cm ..... 1. *Pachira*
      - 5b. Stamens not in fascicles or in 5 fascicles, each with more than 10 stamens; calyx toothed, adaxially hairy; seeds to 0.5 cm, immersed in hairs; trees to 25 m; leaflets with petiolule 1–4 cm ..... 2. *Bombax*

### 1. PACHIRA Aublet, Hist. Pl. Guiane 2: 725. 1775.

瓜栗属 gua li shu

*Bombacopsis* Pittier, nom. cons.; *Bombax* subg. *Rhodognaphalon* Ulbrich; *Carolinea* Linnaeus f.; *Pochota* Ramírez Goyena; *Rhodognaphalon* (Ulbrich) Roberty; *Rhodognaphalopsis* A. Robyns.

Trees, sometimes deciduous, spiny and/or buttressed. Leaves palmately compound; leaflets 3–11, with basal joint, sometimes petiolulate, margin entire or serrate. Flowers bisexual, solitary or 2- or 3-fascicled, axillary, pedicellate; pedicel shorter than 10 cm; bracteoles 2 or 3. Calyx cup-shaped to tubular, adaxially glabrous, truncate to lobed, often with glands abaxially, persistent, sometimes accrescent. Petals spatulate to linear, yellowish green, white, or reddish, abaxially tomentose. Stamens 90–1000 in fascicles of 7–10, connate into tube at base; anthers reniform. Ovary 5-locular; ovules many; style exserted; stigma 5-lobed. Fruit nearly oblong

<sup>1</sup> Department of Environmental Sciences, Sichuan University, Chengdu, Sichuan 610065, People's Republic of China.

<sup>2</sup> Missouri Botanical Garden c/o Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE, United Kingdom.

<sup>3</sup> United States National Herbarium, Department of Botany, National Museum of Natural History, MRC-166, Smithsonian Institution, P.O. Box 37012, Washington, DC 20013-7012, U.S.A.

or nearly pyriform, woody or leathery, loculicidally dehiscent into 5 valves, inner surface long woolly. Seeds irregularly scariform-cuneate, large, to 2.5 cm, glabrous, seed coat fragile, smooth.

About 50 species: tropical America; one species (introduced) in China.

**1. *Pachira aquatica*** Aublet, Hist. Pl. Guiane 2: 726. 1775.

瓜栗 *gua li*

*Bombax aquaticum* (Aublet) K. Schumann; *B. macrocarpum* (Schlechtendal & Chamisso) K. Schumann; *Carolinea macrocarpa* Schlechtendal & Chamisso; *C. princeps* Linnaeus f., nom. illeg. superfl.; *Pachira macrocarpa* (Schlechtendal & Chamisso) Walpers.

Small trees 4–5(–18) m tall; young branchlets brown, glabrous. Petiole 11–15 cm, ferruginous stellate tomentose; leaflets 5–11, slightly petiolulate or subsessile, leaflet blade oblong to obovate-oblong, abaxially ferruginous stellate tomentose, adaxially glabrous, base cuneate, margin entire, apex acuminate; central leaflet 13–24 × 4.5–8 cm, size decreasing outward; midrib abaxially prominently raised, adaxially flat, lateral veins 16–20 per side of midrib, straight, connected near margin, veinlets thin and dense, prominently raised abaxially. Flowers solitary,

axillary near twig tips. Pedicel robust, ca. 2 cm, yellow stellate tomentose, glabrescent. Calyx cup-shaped, nearly leathery, ca. 1.5 × 1.3 cm in diam., abaxially sparsely stellate pilose, adaxially glabrous, truncate or obscurely 3–6-toothed, persistent, with 2–3 globose glands at base. Petals yellowish green, narrowly lanceolate or filiform, up to 15 cm, distal half reflexed. Staminal tube short, proximally yellow, distally red, 13–15 cm including filaments; anthers 2–3 mm. Style dark red, longer than stamens; stigma minute. Capsule nearly pyriform, 9–10 × 4–6 cm, endocarp yellow-brown, thick, woody, abaxially glabrous, adaxially densely long woolly. Seeds many per cell, dark brown with white spirals, 2–2.5 × 1–1.5 cm. Fl. May–Nov.

Cultivated. Guangdong, Taiwan, S Yunnan [native to tropical America, now cultivated and naturalized throughout the tropics].

The seeds are edible raw or roasted. Bonsai plants of this species are very tolerant of drought and shade and are sold in many countries as houseplants. Such plants usually have braided stems.

**2. BOMBAX** Linnaeus, Sp. Pl. 1: 511. 1753, nom. cons.

木棉属 *mu mian shu*

Deciduous big trees; young trunk usually spiny. Leaf blade palmately compound; leaflets 5–9, sometimes petiolulate, with basal joint, margin entire. Flowers bisexual, solitary or fascicled, axillary or terminal. Flowers large, produced before leaf flush. Pedicel shorter than 10 cm. Bracteoles absent. Calyx tubular, campanulate, or cup-shaped, apex truncate to deeply lobed, sometimes with abaxial glands, leathery, falling with petals and stamens. Petals 5, usually red, sometimes yellow, orange, or white, obovate or obovate-lanceolate, asymmetrical, sometimes reflexed. Stamens 70–900, bases connate into short tube; filaments connate into 5–10 distinct phalanges, alternating with petals; anthers reniform. Ovary syncarpous, 5-locular; ovules many per locule; style filiform, longer than stamens; stigma stellately lobed. Capsule loculicidally dehiscent into 5 valves, valves woody or leathery, with silky wool inside. Seeds small, black, enclosed by wool.

About 50 species: mostly in tropical America, also in tropical Africa, Asia, and Australasia; three species in China.

- 1a. Leaflets abaxially densely tomentose; petals white, ca. 4 cm ..... 3. *B. cambodiense*  
 1b. Leaflets abaxially glabrous or hairy only on veins; petals red or orange-red, 10–15 cm.  
 2a. Calyx 3.8–5 cm; petals adaxially glabrous; filaments linear; capsule 25–30 cm ..... 1. *B. insigne*  
 2b. Calyx 2–3(–4.5) cm; petals adaxially stellate pilose; filaments thicker at base than apex; capsule 10–15 cm ..... 2. *B. ceiba*

**1. *Bombax insigne*** Wallich var. ***tenebrosum*** (Dunn) A. Robyns, Bull. Jard. Bot. État. 33: 116. 1963.

长果木棉 *chang guo mu mian*

*Bombax tenebrosum* Dunn, J. Linn. Soc., Bot. 35: 483, 486. 1903.

Trees to 20 m tall; trunk not spiny; branchlets spiny or not. Petiole longer than leaves, pubescent; leaflets 5–9, petiolules 1.2–1.6 cm; blades obovate or oblanceolate, 10–15 × 4–5 cm, nearly leathery, abaxially villous only on midrib and lateral veins, base tapering, apex shortly acuminate. Flowers nearly terminal. Pedicel rod-shaped, ca. 1.9 cm, robust. Calyx urceolate or globose, 3.8–5 cm, abaxially nearly glabrous, adaxially very densely woolly, apex obscurely lobed. Petals red, orange, or yellow, oblong or filiform, boat-shaped, incurved, 10–15 × ca. 3 cm, fleshy, abaxially sericeous, adaxially glabrous, obtuse. Stamens ca. 150; filament tube ca. 1.2 cm, filaments filiform, in

5 fascicles, shorter than petals. Capsule brown, long cylindrical, 5-angular, 25–30 × 3.5–5.5 cm, glabrous. Fl. Mar, fr. Apr.

- Forests on limestone; 500–1000 m. S Yunnan.

*Bombax insigne* var. *insigne* is found in Laos, Myanmar, and Viet-nam. It differs by the glabrous petiole and abaxial leaflet surfaces.

**2. *Bombax ceiba*** Linnaeus, Sp. Pl. 1: 511. 1753, nom. cons.

木棉 *mu mian*

*Bombax malabaricum* Candolle; *Gossampinus malabarica* (Candolle) Merrill; *Salmalia malabarica* (Candolle) Schott & Endlicher.

Trees to 25 m tall; trunk buttressed, usually very spiny on young trees; bark gray-white; branches spreading. Stipules minute; petiole 10–20 cm; leaflets 5–7, petiolules 1.5–4 cm; blades oblong to oblong-lanceolate, 10–16 × 3.5–5.5 cm, glabrous, lateral veins 15–17 on each side of midrib, ascending,

base broad or tapering, apex acuminate. Flowers solitary, terminal, ca. 10 cm in diam. Calyx cup-shaped, 2–3(–4.5) cm, abaxially glabrous, adaxially densely yellowish sericeous, calyx lobes 3–5, semi-orbicular, ca. 1.5 × 2.3 cm. Petals usually red, sometimes orange-red, obovate-oblong, 8–10 × 3–4 cm, fleshy, both surfaces stellate puberulent, but sparser adaxially. Filament tube short, filaments thicker at base than apex, outer series in 5 fascicles, each with more than 10 stamens, inner series bifid, central filaments with 10 stamens shorter, entire. Capsule ellipsoid, 10–15 × 4.5–5 cm, densely gray-white villous and stellate puberulent. Seeds many, obovate, smooth. Fl. Mar–Apr, fr. summer.

Hot dry river valleys, savanna; below 1400 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Sichuan, Taiwan, Yunnan [Bangladesh, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Sri Lanka; introduced elsewhere].

*Bombax ceiba* was formerly cultivated for its seed floss (kapok), which is of lower quality than that from *Ceiba pentandra*. *Bombax ceiba* var. *leiocarpum* A. Robyns, distinguished by the glabrous ovary and fruit, is found in N Australia.

**3. *Bombax cambodiense*** Pierre, Fl. Forest. Cochinch. t. 174. 1888.

澜沧木棉 lan cang mu mian

*Bombax anceps* Pierre var. *cambodiense* (Pierre) A. Robyns; *B. insigne* Wallich var. *cambodiense* (Pierre) Prain; *B. kerrii* Prain; *Gossampinus cambodiensis* (Pierre) Backhuizen.

Trees 20–25 m tall; bark gray, with many conic spines; branches and branchlets tomentose. Petiole 20–32 cm, distinctively 4-grooved; leaflets 7, petiolules 1–1.2 cm, abaxially hairy; blades 15–28 × 6–12 cm, abaxially tomentose or woolly, lateral veins ca. 25 per side of midrib, abaxially raised, base obtuse, apex acute. Flowers large, solitary or clustered, subapical. Pedicel rough, 25–35 mm; bracteoles 3 or 4. Calyx tube closed, ca. 5 × 3.5 cm wide, abaxially pubescent, adaxially hispid and tomentose, apex 3-toothed. Petals white, obovate, ca. 4 cm, both surfaces hairy. Stamens ca. 400, fascicled; filament tube ca. 15 mm, filaments filiform, glabrous. Ovary conic, pubescent; ovules ca. 80 per locule; style hairy, very short, apex 5-lobed. Fl. and fr. Nov–Dec.

Usually growing as isolated trees along riverbanks, rare; ca. 1400 m. S Yunnan [Cambodia, Myanmar, Thailand].

*Bombax cambodiense* has been treated as a variety of *B. anceps*, which occurs in Cambodia, Laos, Malaysia, and Vietnam and differs by the smaller, glabrous leaflets, 6.5–16 × 2.5–6.5 cm, and by the red, not white, petals.

### 3. **CEIBA** Miller, Gard. Dict. Abr., ed. 4, [287]. 1754.

吉贝属 ji bei shu

*Chorisia* Kunth; *Eriodendron* Candolle.

Trees, deciduous; trunk swollen and/or buttressed, trunk and branches usually spiny. Petiole long; leaf blade palmately compound; leaflets 3–5(–9), shortly petiolulate, both surfaces glabrous, abaxially gray-white, base attenuate, margin serrate or entire. Flowers blooming before or simultaneously with leaf flush, solitary or 2–15-fascicled, pendulous, axillary or subterminal, actinomorphic, rarely zygomorphic. Calyx campanulate, truncate or irregularly 3–5(–12)-lobed, thickly fleshy, persistent. Petals 5, pink or yellow-white, connate at base and coherent to staminal tube, falling with stamens and style. Stamens (3–)5–15; filament tube short, sometimes thickened or with sterile appendages, free parts of filament long to absent, each bearing 2(or 3) straight to strongly twisted thecae. Ovary syncarpous, 5-locular; ovules many per cell; style filiform; stigma capitate to lobulate. Capsule oblong or nearly obovate, pendulous, woody or leathery, loculicidally dehiscent into 5(or 6) valves, inner walls densely woolly. Seeds many, enclosed in wool.

Seventeen species: W Africa (one species) and tropical America (16 species); one species (introduced) in China.

**1. *Ceiba pentandra*** (Linnaeus) Gaertner, Fruct. Sem. Pl. 2: 244. 1791.

吉贝 ji bei

*Bombax pentandrum* Linnaeus, Sp. Pl. 1: 511. 1753; *Eriodendron anfractuosum* Candolle.

Trees to 30 m tall; buttresses small or absent, trunk often sparsely spiny; main branches verticillate, spreading horizontally; young branches spiny. Petiole 7–14(–25) cm, longer than leaflet blade; leaflets 5–9, petiolules 3–4(–10) mm; blades oblong to lanceolate, 5–20 × 1.5–6.5 cm, thinly leathery, glabrous, base acuminate, margin entire or very sparsely and minutely toothed near apex, apex shortly acuminate. Flowers subterminal, solitary or in fascicles of up to 15, produced before or

simultaneous with new leaves. Pedicel (1.8–)2.5–5 cm. Calyx (0.9–)1.2–2 cm, adaxially glabrous. Petals pink or white, obovate-oblong, 2.5–4 × 0.7–1.5 cm, abaxially densely white villous, adaxially glabrous. Filaments on staminal tube varying in length; anthers reniform. Ovary glabrous; style 2.5–3.5 cm; stigma rod-shaped, 5-lobed. Capsule oblong, tapering toward tip, 7.5–15(–26) × 3–5(–11) cm, fruiting pedicel 7–25 cm, endocarp leathery, smooth. Seeds globose, ca. 6 mm in diam. Fl. Mar–Apr.

Cultivated. Guangdong, Guangxi, Yunnan [native to tropical America and possibly West Africa; now pantropical, regarded as invasive on some Pacific islands].

This species is grown as a street tree and for the waterproof fibers surrounding the seeds (kapok).