

### 15. GLEDITSIA Linnaeus, Sp. Pl. 2: 1056. 1753.

皂荚属 zao jia shu

Chen Dezhaoh (陈德昭 Chen Te-chao), Zhang Dianxiang (张奠湘); Kai Larsen

Trees or shrubs, deciduous. Trunk and branches usually with stout, simple or branched spines. Leaves alternate, often clustered, simply paripinnate and bipinnate often on same plant; stipules caducous, small; rachis of leaves and pinnae sulcate; leaflets numerous, subopposite or alternate, base oblique or subsymmetrical, margin serrulate or crenate, rarely entire. Inflorescences axillary, rarely terminal, spikes or racemes, rarely panicles. Flowers polygamous or plants dioecious, light green or greenish white. Receptacle campanulate, outside pubescent. Calyx 3–5-lobed; lobes subequal. Petals 3–5, slightly unequal, ca. as long as or slightly longer than calyx lobes. Stamens 6–10, exerted, slightly flat, broad, with crisped hairs from middle downward; anthers dorsifixed. Ovary sessile or shortly stalked; ovules 1 to numerous; style short; stigma terminal. Legume ovoid or elliptic, flat or subterete.

About 16 species: C and SE Asia, North and South America; six species (three endemic, one introduced) in China.

*Gleditsia medogensis* C. C. Ni (Acta Phytotax. Sin. 25: 231. 1987), described from SE Xizang (Médog), could not be treated here because no material was seen by the present authors. Judging from the protologue, it may be conspecific with the variable *G. japonica*.

- 1a. Leaflets 6–24 mm, margin entire, upper leaflets smaller than those in lower part; legume 3–6 cm, with 1–3 seeds ..... 1. *G. microphylla*
- 1b. Leaflets more than 25 mm, margin irregularly serrate; legume more than 6 cm, with numerous seeds.
  - 2a. Legume densely yellowish green velutinous ..... 6. *G. japonica*
  - 2b. Legume glabrous or puberulent.
    - 3a. Leaflets obliquely oblong or rhombic-lanceolate, midvein conspicuous at base; calyx lobes and petals 5; stamens 10; ovary densely silky.
      - 4a. Leaves pinnate or bipinnate; leaflets with reticulate veinlets adaxially obscure; racemes often comprising panicles; legume 6–12 cm, swollen opposite seeds ..... 2. *G. australis*
      - 4b. Leaves pinnate; leaflets with reticulate veinlets conspicuously raised; racemes simple; legume 13.5–26 cm, not swollen opposite seeds ..... 3. *G. fera*
    - 3b. Leaflets ovate, ovate-lanceolate, or oblong, midvein at middle or slightly oblique; calyx lobes and petals 3 or 4; stamens 6–8(or 9); ovary not silky.
      - 5a. Leaflets 11–18 pairs, elliptic-lanceolate, apex acute; ovary hoary ..... 4. *G. triacanthos*
      - 5b. Leaflets 3–10 pairs, ovate or elliptic, apex obtuse or emarginate; ovary glabrous or only sutures and base pubescent.
        - 6a. Spines terete; leaflets with reticulate veinlets adaxially conspicuously raised, margin densely finely serrate; ovary pubescent at base and along sutures; legume thick, not twisted, straight, or curved ..... 5. *G. sinensis*
        - 6b. Spines flat at least at base; leaflets with reticulate veinlets obscure, margin entire or sparsely shallowly crenate; ovary glabrous; legume flat, irregularly twisted or curved, falcate ..... 6. *G. japonica*

**1. *Gleditsia microphylla*** D. A. Gordon ex Isely, Mem. New York Bot. Gard. 25: 214. 1975.

野皂荚 ye zao jia

Shrubs or small trees, 2–4 m tall. Branches grayish white to light brown; young branchlets puberulent, glabrescent when old. Spines not robust, long needlelike, 1.5–6.5 cm, with few, short branches. Leaves pinnate or bipinnate (pinnae 2–4 pairs), 7–16 cm; petiolules short, ca. 1 mm, puberulent; leaflets 5–12 pairs, obliquely ovate to oblong, 6–24 × 3–10 mm, thinly leathery, upper leaflets much smaller than lower ones, abaxially puberulent, adaxially glabrous, veins obscure on both surfaces, base oblique, broadly cuneate, margin entire, apex rounded. Flowers polygamous, greenish white, subsessile, fascicled, in spikes or terminal panicles. Inflorescence 5–12 cm, puberulent; bracts 3, lowest lanceolate, ca. 1.5 mm, upper 2 ovate, ca. 1 mm, pubescent. Male flowers: ca. 5 mm in diam.; receptacle ca. 1.5 mm.; sepals 3 or 4, lanceolate, 2.5–3 mm; petals 3 or 4, ovate-oblong, ca. 3 mm, as calyx lobes puberulent outside, villous

inside; stamens 6–8. Bisexual flowers: ca. 4 mm in diam.; calyx lobes 4, triangular-lanceolate, 1.5–2 mm, both sides puberulent; petals 4, ovate-oblong, ca. 2 mm, outside puberulent, inside villous; stamens 4, opposite to sepals; ovary long stalked, glabrous, 1–3-ovuled. Legume reddish brown to deep brown, obliquely elliptic or obliquely oblong, flat, thin, 3–6 × 1–2 cm, glabrous, with slender beak at apex; stipe 1–2 cm. Seeds 1–3, brownish, compressed, ovoid or oblong, 7–10 × 6–7 mm, smooth. Fl. Jun–Jul, fr. Jul–Oct.

• Sunny slopes, roadsides; 100–1300 m. Anhui, ?Guizhou, Hebei, Henan, Jiangsu, Shaanxi, Shandong, Shanxi.

**2. *Gleditsia australis*** Hemsley, J. Linn. Soc., Bot. 23: 208. 1887.

小果皂荚 xiao guo zao jia

*Gleditsia microcarpa* F. P. Metcalf.

Trees, 3–20 m tall. Branches brownish gray, with robust

spines. Spines brownish purple, conical, 3–5 cm, branched. Leaves pinnate or bipinnate (pinnae 2–6 pairs), 10–18 cm; petiolules ca. 1 mm; leaflets 5–9 pairs, adaxially shiny, obliquely elliptic to rhombic-oblong, 2.5–4 × 1–2 cm, papery to thinly leathery, abaxially glabrous, adaxially slightly puberulent on veins, reticulate veinlets slightly lax, obscure, base obliquely acute or obliquely cuneate, margin obtusely serrate or subentire, apex rounded, often emarginate. Flowers polygamous, pale green or greenish white; pedicels 1–2.5 mm. Male flowers: 4–5 mm in diam., several fascicled or in cymules, cymules in dense racemes again, several racemes comprising a panicle to 28 cm, puberulent, axillary or terminal; sepals 5, lanceolate, ca. as long as receptacle, outside densely puberulent; petals 5, elliptic, ca. 2 mm, outside densely puberulent, inside pubescent. Bisexual flowers: 7–9 mm in diam.; inflorescence as male inflorescence, with scattered flowers; calyx tube ca. 2 mm, glabrous; calyx lobes 5 or 6, lanceolate, ca. 3 mm, outside puberulent, inside as petals densely light brown crisped pubescent; petals 5 or 6, elliptic, outside velutinous. Stamens 5, not exerted. Ovary sessile, densely light brown silky. Legume subsessile, brownish black when dry, compressed, strap-shaped, (4–)6–12 × 1–2.5 cm, straight or slightly curved, valve leathery, conspicuously swollen opposite seeds, apex mucronate. Seeds 5–12, deep brown to brownish black, slightly compressed, elliptic to oblong, 7–11 × 4–5 mm, smooth. Fl. Jun–Oct, fr. Nov–Apr.

Gentle slopes, mountain valleys, forests, near roads, by streams, sunny places. Guangdong, Guangxi [Vietnam].

**3. *Gleditsia fera*** (Loureiro) Merrill, Philipp. J. Sci., C, 13: 141. 1918.

华南皂荚 hua nan zao jia

*Mimosa fera* Loureiro, Fl. Cochinch. 2: 652. 1790; *Gleditsia formosana* Hayata; *G. thorelii* Gagnepain.

Trees, 3–24 m tall. Branches grayish brown. Spines robust, branched, terete at base, to 13 cm. Leaves pinnate, 11–18 cm; rachis sulcate, glabrous or pilose; petiolules ca. 1 mm; leaflets 5–9 pairs, adaxially deep brown, shiny, obliquely elliptic to rhombic-oblong, 2–7(–12) × 1–3(–5) cm, papery to thinly leathery, abaxially glabrous, adaxially glabrous or sometimes pubescent on midvein, midvein inclined to one side at base of blade, reticulate veinlets crowded, slender, conspicuously raised, base obliquely cuneate or rounded and oblique, margin crenate, sometimes shallowly, obtusely serrate, apex rounded and emarginate. Flowers several in cymules, polygamous, greenish white, cymules in axillary or terminal racemes 7–16 cm. Male flowers: 6–7 mm in diam.; receptacle ca. 2.5 mm; sepals 5, triangular-lanceolate, 2.5–3 mm, outside densely puberulent; petals 5, oblong, both sides puberulent; stamens 10; rudimentary pistil linear-terete, 4–5 mm, villous. Bisexual flowers: 8–10 mm in diam.; calyx and petals similar to those of male flowers, but calyx with a villous ring inside at base; stamens 5 or 6; anthers acute at apex; ovary densely brownish yellow silky, many ovuled. Legume compressed, 13.5–26(–41) × 2.5–3(–6.5) cm, straight or slightly curved, occasionally twisted, valves leathery, densely brownish yellow puberulent when young, glabrescent and becoming deep brown to blackish brown when old, apex

with beak 2–5 mm; stipe 5–10 mm. Seeds numerous, brown to blackish brown, compressed or lenticular, ovoid to oblong, 8–11(–14) × 5–6(–11) mm, smooth. Fl. Apr–May, fr. Jun–Dec.

• Gentle slopes, mountain valleys, forests, beside villages, near roads, sunny places, occasionally cultivated; 300–1000 m. Fujian, Guangdong, Guangxi, ?Guizhou, ?Hainan, Hunan, Jiangxi, Taiwan, ?Yunnan.

The records of *Gleditsia rolfei* S. Vidal from Taiwan (Fl. Taiwan 3: 293. 1977; ed. 2, 3: 182. 1993) are referable to *G. fera*.

The fruit contains saponin that can be used as soap and as an insecticide.

**4. *Gleditsia triacanthos*** Linnaeus, Sp. Pl. 2: 1056. 1753.

美国皂荚 mei guo zao jia

Trees or small trees, to 45 m tall. Bark grayish black, 1–2 cm thick, with deep cracks and narrow, long ridges. Branchlets deep brown, rough, slightly sulcate, with small, orbicular lenticels. Spines deep brown, slightly flat, robust, often branched, 2.5–10 cm, rarely branchlets unarmed. Leaves pinnate or bipinnate (pinnae 4–14 pairs), 11–22 cm; petiolules ca. 1 mm, pubescent; leaflets 11–18 pairs, abaxially yellowish green, adaxially dark green, shiny, elliptic-lanceolate, 1.5–3.5 cm × 4–8 mm, papery, abaxially puberulent on midvein, adaxially glabrous, base cuneate or slightly rounded and oblique, margin sparsely undulate-dentate, apex acute, sometimes slightly obtuse. Flowers yellowish green. Pedicels 1–2 mm. Male flowers: 6–7 mm in diam., solitary or several clustered in racemes; inflorescences terminal or often several fascicled in axils of leaves, 5–13 cm, puberulent; receptacle ca. 2 mm; sepals 2 or 3, lanceolate, 2–2.5 mm; petals 3 or 4, ovate or ovate-lanceolate, ca. 2.5 mm, as sepals puberulent on both surfaces; stamens 6–9. Female flowers: in slender, few-flowered racemes, racemes solitary and ca. as long as male inflorescence; ovary hoary. Legume compressed, strap-shaped, 30–50 cm, falcately curved or irregularly twisted, valves thin and rough, dark brown, pilose. Seeds numerous, compressed, ovoid or elliptic, ca. 8 mm, divided by thick pulp. Fl. Apr–Jun, fr. Oct–Dec.  $2n = 28$ .

Along streams on moist sites, fertile soils. Cultivated in Hong Kong and Shanghai [native to the Americas].

This species is cultivated in temperate regions as an ornamental and used as a wayside tree and hedge. The wood is durable and used for buildings and for props.

**5. *Gleditsia sinensis*** Lamarck, Encycl. 2: 465. 1788.

皂荚 zao jia

*Gleditsia horrida* Willdenow; *G. macracantha* Desfontaines; *G. officinalis* Hemsley.

Trees or small trees, to 30 m tall. Branches grayish to deep brown. Spines robust, terete, conical, to 16 cm, often branched. Leaves pinnate, 10–18(–26) cm; petiolules 1–2(–5) mm, puberulent; leaflets (2 or)3–9 pairs, ovate-lanceolate to oblong, 2–8.5(–12.5) × 1–4(–6) cm, papery, abaxially slightly pubescent on midvein, adaxially puberulent, reticulate veinlets conspicuously raised on both surfaces, base rounded or cuneate, sometimes slightly oblique, margin serrate, apex acute or acuminate,

tip rounded, mucronate. Flowers polygamous, yellowish white, in axillary or terminal, puberulent racemes 5–14 cm. Male flowers: 9–10 mm in diam.; pedicels 2–8(–10) mm; receptacle deep brown, 2.5–3 mm, outside pubescent; sepals 4, triangular-lanceolate, ca. 3 mm, both sides pubescent; petals 4, oblong, 4–5 mm, puberulent; stamens (6–)8; rudimentary pistil ca. 2.5 mm. Bisexual flowers: 10–12 mm in diam.; pedicels 2–5 mm; sepals and petals similar to those of male flowers but longer; stamens 8; ovary hairy at base and on sutures; ovules numerous; stigma 2-lobed. Legume brown or reddish brown, curved, strap-shaped, 12–37 × 2–4 cm, straight or twisted, with slightly thick pulp, swollen on both surfaces, some legumes shorter and smaller, ± terete, 5–13 × 1–1.5 cm, without seeds; stipe 1–3.5 cm; valves leathery, often farinose. Seeds numerous, brown, shiny, oblong or elliptic, 11–13 × 8–9 mm. Fl. Mar–May, fr. May–Dec.  $2n = 28^*$ .

• Mountain slopes, forests, valleys, near roads; 200–2500 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Qinghai, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang.

Specimens from Sichuan called “zhu ya zao,” named as *Gleditsia officinalis*, with curved, small fruit without seeds, are an abnormal type and are referable to this species.

**6. *Gleditsia japonica*** Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 54. 1867.

山皂荚 shan zao jia

Trees or small trees, to 25 m tall. Branchlets purplish brown or grayish green when bark falls off, slightly ribbed, with scattered whitish lenticels, smooth and glabrous. Spines purplish brown to brownish black, slightly flat, robust, 2–15.5 cm, often branched. Leaves pinnate or bipinnate (pinnae 2–6 pairs), 11–25 cm; petiolules very short; leaflets 3–10 pairs, adaxially sometimes shiny, ovate-oblong or ovate-lanceolate to oblong, 2–7(–9) × 1–3(–4) cm (leaflets of bipinnate leaves obviously smaller), papery to thickly papery, abaxially puberulent on midvein and at base, glabrescent when old, adaxially puberulent or glabrous, slightly scabrous, reticulate veinlets obscure, base broadly cuneate or rounded, slightly oblique, margin entire or repand-crenate, apex rounded, sometimes emarginate. Flowers yellowish green, in axillary or terminal, puberulent spikes. Male inflorescence 8–20 cm; female inflorescence 5–16 cm. Male flowers: 5–6 mm in diam.; receptacle deep brown, ca. 1.5 mm, outside densely brown puberulent; sepals 3 or 4, triangular-lanceolate, ca. 2 mm, both surfaces pubescent; petals 4, elliptic, ca. 2 mm, pubescent; stamens 6–8(or 9). Female flowers: 5–8(–9) mm in diam.; receptacle ca. 2 mm; sepals and petals 4 or 5, similar to those of male flowers in shape, ca. 3 mm, both surfaces densely pubescent; staminodes 4–8; ovary glabrous; ovules numerous; style short, incurved; stigma inflated, 2-lobed. Legume brown or brownish black, compressed, strap-shaped, 20–54 × 2–7 cm, irregularly twisted or falcate, apex with beak 5–15 mm; stipe 1.5–3.5(–5) cm; valves leathery, often bullate, glabrous or velutinous, shiny. Seeds numerous, deep brown, elliptic, 9–10 × 5–7 mm, smooth.  $2n = 28^*$ .

Sunny slopes, valleys, streamsides, near roads, forests; 100–2500 m. Anhui, Guizhou, Hebei, Henan, Hunan, Jiangsu, Jiangxi, Liaoning,

Shandong, Yunnan, Zhejiang [Japan, Korea].

- 1a. Legume densely yellowish green velutinous ..... 6b. var. *velutina*
- 1b. Legume glabrous.
  - 2a. Legume 20–35 × 2–4 cm, female flowers 5–6 mm in diam. .... 6a. var. *japonica*
  - 2b. Legume 30–54 × 4.5–7 cm; female flowers 7–8(–9) in diam. .... 6c. var. *delavayi*

**6a. *Gleditsia japonica* var. *japonica***

山皂荚(原变种) shan zao jia (yuan bian zhong)

*Fagara horrida* Thunberg; *Gleditsia melanacantha* Tang & F. T. Wang.

Female flowers 5–6 mm in diam. Legume 20–35 × 2–4 cm, glabrous.

Sunny slopes, valleys, streamsides, near roads; 100–1000 m. Anhui, Hebei, Henan, Hunan, Jiangsu, Jiangxi, Liaoning, Shandong, Zhejiang [Japan, Korea].

This species is commonly cultivated in China. The heartwood has a beautiful pink color; the wood is durable and can be used for props, carpentry work, and building. The seeds are used medicinally, and the young leaves are edible.

**6b. *Gleditsia japonica* var. *velutina*** L. C. Li, Acta Phytotax. Sin. 20: 228. 1982.

绒毛皂荚 rong mao zao jia

*Gleditsia horrida* Willdenow subsp. *velutina* (L. C. Li) Paclt; *G. vestita* Chun & F. C. How ex B. G. Li.

Legume densely yellowish green velutinous.

• Mountain slopes, open forests, near roads; ca. 1000 m. Hunan (Hengshan).

**6c. *Gleditsia japonica* var. *delavayi*** (Franchet) L. C. Li, Acta Phytotax. Sin. 20: 228. 1982.

滇皂荚 dian zao jia

*Gleditsia delavayi* Franchet, Pl. Delavay. 189. 1890; *G. horrida* subsp. *delavayi* (Franchet) Paclt.

Female flowers 7–8(–9) mm in diam. Legume 30–54 × 4.5–7 cm, glabrous.

• Mountain slopes in forests, beside villages, near roads; 1200–2500 m. Guizhou, Yunnan.

This taxon is occasionally cultivated.

