

49. THERMOPSIS R. Brown in W. T. Aiton, Hort. Kew., ed. 2, 3: 3. 1811.

野决明属 *ye jue ming shu*

Perennial herbs. Rhizome creeping, producing annual erect stems, basal stipules joined to form a sheath, thin and scarious, 3-fid. Leaves digitately 3-foliolate, pedicellate; stipules large, leaflike, free. Racemes leaf-opposed or terminal; bracts connate with lateral stipules, becoming 3(or 6)-fid, persistent; bracteoles absent. Calyx campanulate, or gibbous and baglike on proximal side, 5-toothed. Corolla yellow, rarely purple, petals clawed. Stamens 10, free. Ovules 4–22. Legume linear-oblong or ovate, straight or curved, leathery. Seed reniform or orbicular; hilum small, white.

About 25 species: C and E Asia and North America; 12 species (four endemic) in China.

The genus in China appears to be divisible into three groups. *Thermopsis lupinoides* and *T. chinensis* are upright plants with terminal inflorescences, apparently from a single rootstock. *Thermopsis lanceolata* is an upright plant with terminal inflorescences; there are numerous aerial shoots arising from a spreading rhizome. *Thermopsis barbata*, *T. inflata*, *T. smithiana*, and *T. alpina* are all precociously flowering species, in which the inflorescences arise early from the rootstock, before the main leafy shoots appear. Then, basal buds on the flowering shoot, below the inflorescence, develop into long leafy shoots completely different in appearance from the precociously flowering material.

- 1a. Flowers alternate; petioles subequal to stipules; stems more than 50 cm.
 - 2a. Leaflets 3.5–8 cm; stipules broadly ovate, obtuse or mucronate; legume inclined extrorsely, valves papery, sparsely villous 1. *T. lupinoides*
 - 2b. Leaflets 2–4.5 cm; stipules lanceolate, acuminate; legumes appressed to stem, valves thinly woody, appressed hirsute 2. *T. chinensis*
- 1b. Flowers opposite or verticillate; petioles shorter than stipules; stems less than 30 cm.
 - 3a. Calyx not gibbous, base tapering, distal tooth ca. 2 × length of tube; corolla yellow or purple.
 - 4a. Corolla purple 11. *T. barbata*
 - 4b. Corolla yellow 12. *T. gyirongensis*
 - 3b. Calyx gibbous proximally, distal tooth subequal to tube; corolla yellow.
 - 5a. Legume elliptic or narrowly elliptic, inflated; leaflets obovate or broadly obovate; plant usually 7–15(–18) cm.
 - 6a. Legume stipitate, equal to calyx tube, beak exerted from dorsal suture, downcurved; ovules 12–17; seeds reniform; wings narrower than keel; leaflets broadly obovate, apex acute, both sides asymmetric 9. *T. inflata*
 - 6b. Legume without stipe, base tapering, apex rounded, mucronate; ovules 3–5; seeds ellipsoid; wings ca. as broad as keel; leaflets obovate to narrowly elliptic, apex rounded 10. *T. smithiana*
 - 5b. Legume linear to oblong, compressed; leaflets oblanceolate, oblong, to ovate; plant usually 15–30 cm.
 - 7a. Leaflets narrowly elliptic or linear, length more than 5 × width; wings much narrower than keel.
 - 8a. Leaflets glabrous adaxially, appressed pubescent abaxially; legume flat, 8–13 mm wide, seeds close to dorsal suture 5. *T. turkestanica*
 - 8b. Leaflets appressed pubescent adaxially, rather densely so abaxially; legume 7–9(–11) mm wide, seeds prominent in legume, at central line of valve 8. *T. mongolica*
 - 7b. Leaflets oblanceolate to ovate, length less than 4.5 × width; wings as wide as keel or slightly narrower.
 - 9a. Leaflets plane, 1.5–2.5 × as long as broad; wings and keel subequal in width; ovules 4–8; legume flat 3. *T. alpina*
 - 9b. Leaflets involute along margins, 2.5–4.5 × as long as broad; wings slightly narrower than keel; ovules 10–20; legume prominent with seeds.
 - 10a. Leaflets to 7.5 cm; legumes with straight sutures 4. *T. lanceolata*
 - 10b. Leaflets less than 4 cm; legume contracted between seeds.
 - 11a. Plant appressed puberulent or tomentose; leaflets narrowly obovate, rounded at apex; seeds dark green 6. *T. przewalskii*
 - 11b. Plant villous; leaflets narrowly oblong, apex acute; seeds black 7. *T. yushuensis*

1. *Thermopsis lupinoides* (Linnaeus) Link, Enum. Hort. Berol. Alt. 1: 401. 1821.

野决明 *ye jue ming*

Sophora lupinoides Linnaeus, Sp. Pl. 1: 374. 1753; *Podalyria lupinoides* (Linnaeus) Willdenow; *S. fabacea* Pallas; *Thermopsis fabacea* (Pallas) Candolle.

Perennial herbs, 50–80 cm tall. Stems erect, vertically ridged, apical part white puberulent, basal part glabrescent. Stipules elliptic or ovate, 2–5 × 1.5–3 cm, equaling petiole; leaflets broadly elliptic, 3.5–8 × (2–)2.5–3.5(–4.7) cm, base cuneate, apex obtuse or acute, terminal one rather longer, broadly lanceolate, white pubescent abaxially, glabrous adaxially. Racemes terminal, 5–18(–25) cm, densely pubescent; flowers al-

ternate, numerous and scattered; bracts lanceolate, 8–15 mm; pedicels 5–10 mm. Calyx ca. 10 mm, densely appressed pubescent. Corolla 2–2.5 cm, petals subequal. Ovary densely silky; ovules 10–14. Legume linear, 3–9(–12) × 0.5–0.8 cm, straight and tapering upward, spreading, sparsely brown hairy. Seed dark brown, reniform, compressed, 3–4 × 2–3 mm. Fl. May–Aug.

Sandy beaches and flood lands of ravines or marine areas. Heilongjiang, Jilin [Japan, Korea, Russia (Kamchatka, Sakhalin)].

The name *Sophora lupinoides*, applied in this sense, was proposed for conservation with a conserved type by Zhu and Kirkbride (Taxon 55: 1047–1049. 2006).

2. *Thermopsis chinensis* Benth. ex S. Moore, J. Bot. 16: 131. 1878.

霍州油菜 huozhou youcai

Perennial herbs, ca. 50 cm tall. Stems erect, ridged, spreading villous when young, glabrescent, branched, branchlets ascending. Stipules on main stem linear-ovate, longer than petiole, on branches lanceolate, shorter than petiole; leaflets obovate or narrowly obovate, 2–4.5 × 0.8–2 cm, sparsely villous abaxially, glabrous adaxially, base cuneate, apex rounded, mucronate. Racemes 10–30 cm; flowers alternate; bracts ovate, 1.2–1.9 cm. Calyx 8–13 mm, sparsely puberulent. Corolla yellow, 2.4–2.8 cm, petals long clawed. Ovary densely silky; ovules 16–22. Legume linear-lanceolate, 5–7 × 0.7–0.8 cm, held almost erect and close to stem, thinly woody, beaked, sparsely appressed yellowish hirsute. Seeds 15–20, reddish brown, reniform, ca. 2.5 × 2 mm, densely glandular. Fl. Apr–May, fr. Jun–Jul.

Stream banks, wastelands, roadsides. Anhui, Fujian, Hebei, Hubei, Jiangsu, Shaanxi, Zhejiang [Japan].

3. *Thermopsis alpina* (Pallas) Ledebour, Fl. Altaic. 2: 112. 1830.

高山野决明 gao shan ye jue ming

Sophora alpina Pallas, Sp. Astragal. 121. 1803; *Thermopsis alpestris* Czefranov. & T. *alpina* var. *licentiana* (E. Peter) Z. X. Peng & Y. M. Yuan; *T. alpina* var. *yunnanensis* Franchet; *T. licentiana* E. Peter; *T. yunnanensis* (Franchet) P. C. Li.

Perennial herbs, 12–30 cm tall, from a substantial woody rootstock. Stems erect, simple or few branched, white spreading villous at least on nodes. Stipules ovate or broadly lanceolate, 2–3.5 cm, base cuneate or rounded, apex acute; leaflets linear-obovate to ovate, 2–5.5 × 0.8–2.5 cm, usually densely villous abaxially, glabrous or villous along midrib and margins adaxially, apex acute. Racemes terminal, 5–15 cm; flowers 2 or 3 verticillate in 2 or 3 whorls; bracts 10–18 mm, villous. Calyx 10–17 mm, slightly gibbous. Corolla yellow, 2–2.8 cm, petals long clawed. Ovary 4–8-ovuled; stipe 2–5 mm. Legume clear shiny brown, ovate-oblong, 2–5(–6) × 1–2 cm, flat, usually curved downward, sparsely white villous, long cuspidate. Seeds 3 or 4, prominent, brown, reniform, 5–6 × 3–4 mm, compressed; hilum gray. Fl. May–Jul, fr. Jul–Aug.

Sandy river beaches, alpine tundra, gravel deserts; 2400–4800 m. SW Gansu, Hebei, Qinghai, Sichuan, Xinjiang, Xizang, Yunnan [Kazakhstan, Mongolia, Russia].

4. *Thermopsis lanceolata* R. Brown in W. T. Aiton, Hort. Kew.,

ed. 2, 3: 3. 1811.

披针叶野决明 pi zhen ye ye jue ming

Thermopsis dahurica Czefranov. & T. *glabra* Czefranov. & T. *lanceolata* subsp. *glabra* (Czefranov.) Kurbatski; *T. lanceolata* var. *glabra* (Czefranov.) Yakovlev; *T. lanceolata* subsp. *sibirica* (Czefranov.) Kurbatski; *T. orientalis* Czefranov. & T. *sibirica* Czefranov.

Perennial herbs. Stems erect, 12–40 cm, ridged, creamy pubescent. Stipules ovate-lanceolate, 1.5–3 cm, acuminate; petiole 3–8 mm; leaflets linear-oblong or oblanceolate to linear, 2.5–7.5 × 0.5–1.6 cm, appressed puberulent abaxially, glabrous adaxially. Racemes terminal, 6–17 cm; flowers 2 or 3 verticillate in 2–6 whorls; bracts 8–20 mm, persistent. Calyx 1.5–2.2 cm, gibbous, densely hairy. Corolla yellow, 2.5–2.8 cm, petals with long claw. Ovary densely hairy, with 2–3 mm stipe; ovules 12–20. Legume brown, linear, 5–9 × 0.7–1.2 cm, puberulent, beaked. Seeds 6–14, at central line of valve, black with grayish waxy coating, reniform, 3–5 × 2.5–3.5 mm, smooth. Fl. May–Jul, fr. Jun–Oct.

Grasslands, ravines, waste fields. Gansu, ?Hebei, Nei Mongol, Shaanxi, Shanxi, Xinjiang, Xizang [Kyrgyzstan, Mongolia, Russia].

The name *Thermopsis lanceolata*, applied in this sense, was proposed for conservation with a conserved type by Zhu and Kirkbride (Taxon 55: 1047–1049. 2006). Conservation as proposed was recommended (see Brummitt, Taxon 58: 282–283. 2009).

5. *Thermopsis turkestanica* Gandoger, Bull. Soc. Bot. France 60: 462. 1913.

新疆野决明 xinjiang ye jue ming

Thermopsis kaxgarica Chang Y. Yang; *T. lanceolata* R. Brown subsp. *turkestanica* (Gandoger) Gubanov; *T. lanceolata* var. *turkestanica* (Gandoger) Gubanov.

Perennial herbs, 30–50 cm tall. Stems erect, ridged, branched, appressed puberulent toward apex, glabrescent toward base. Stipules lanceolate, 1.8–3.2(–4) cm; petiole short or sessile; leaflets narrowly lanceolate, (2–)3.5–8 × 0.5–1 cm, tapering at both ends, densely puberulent abaxially, glabrous adaxially. Racemes terminal, 4.5–15(–20) cm; flowers in 5 or 6 whorls; bracts lanceolate. Calyx 15–20 mm, slightly gibbous. Corolla yellow, 2.3–2.5(–2.8) cm, petals long clawed. Ovary with 2–5 mm stipe; ovules 12–18. Legume linear, 4.5–7 × 0.8–1.3 cm, flat, densely white pubescent, cuspidate, undulate along ventral suture. Seeds close to dorsal suture, prominent, dark green, opaque, ellipsoid, 3.5–4.5 × 3–3.5 mm; hilum gray. Fl. May–Jul, fr. Jul–Aug.

Slopes, sandy river beaches; 1200–1800 m. Xinjiang (Tian Shan) [Kazakhstan, Kyrgyzstan, Mongolia (Altai), Russia (Siberia), Tajikistan, Turkmenistan, Uzbekistan].

The illustration in FRPS (42(2): 404, t. 104: 1–7. 1998) suggests that this is probably a synonym of *Thermopsis lanceolata*.

6. *Thermopsis przewalskii* Czefranov. & T. Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 16: 210. 1954.

青海野决明 qinghai ye jue ming

Thermopsis kuenlunica Czefranova; *T. ladyginii* Czefranova; *T. tibetica* Czefranova.

Perennial herbs, 10–18(–35) cm tall. Stems erect, branched, ridged, densely pale yellow appressed pubescent or tomentose. Stipules lanceolate, 1.7–2.4(–3.2) cm; petiole 3–7 mm; leaflets narrowly obovate, 1.7–3.8(–4.2) × 0.7–1.2 cm, 2.5–3 × as long as broad, appressed pubescent abaxially, glabrous adaxially, base cuneate, apex rounded. Racemes terminal, lax, 5–11(–20) cm, basal racemes shorter; flowers in 3–6 whorls; bracts ovate, acute, 1.5–2.2 cm. Calyx 1.8–2.1 mm. Corolla yellow, 2.2–2.7 cm. Ovary 10–18-ovuled, densely hairy; stipe 4–8 mm. Legume straight, linear, 3.5–5 × 0.8–1.5 cm, abruptly contracted into long beak, thinly tomentose, spreading, contracted between seeds. Seeds 6–12, prominent, dark green, orbicular or suborbicular, 3.5–4.5 × 3–4 mm; hilum gray. Fl. May–Jul.

• Thickets or grasslands by ravines, valleys, and lakes, often with *Thermopsis alpina*; 1500–2000(–4600) m. Gansu, Nei Mongol, Qinghai, Shaanxi, Xizang.

This is probably a synonym of *Thermopsis alpina*.

7. *Thermopsis yushuensis* S. Q. Wei, Bull. Bot. Res., Harbin 4(2): 136. 1984.

玉树野决明 yu shu ye jue ming

Perennial herbs, 5–12 cm tall. Stems erect, branched, ridged, densely pale yellow villous. Stipules narrowly ovate, 7–12 mm, acute; petiole 3–4 mm; leaflets narrowly oblong, 14–20 × 3–5 mm, densely pale yellow-villous abaxially, especially dense on midrib and margins, glabrous adaxially, base cuneate, apex acute. Racemes lax, terminal, 4–5 cm; flowers in 2–4 whorls; bracts persistent, ovate, 10–12 mm, acute. Calyx 10–13 mm, gibbous. Corolla yellow, 2–2.4 cm, petals subequal. Ovary white villous; stipe ca. 3 mm; ovules 14–16. Legume linear, slightly curved, 5–6.2 × 0.7–0.9 cm, ascending, acute with long beak, undulate along ventral suture. Seeds close to dorsal suture, prominent, black, suborbicular, 4–4.5 × 3–3.5 mm; hilum white.

• Riverbanks, ravine beaches; ca. 4200 m. Qinghai.

This is probably a synonym of *Thermopsis lanceolata*.

8. *Thermopsis mongolica* Czefranova, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 16: 213. 1954.

蒙古野决明 meng gu ye jue ming

Thermopsis grubovii Czefranova; *T. hirsutissima* Czefranova; *T. junatovii* Czefranova; *T. lanceolata* R. Brown var. *mongolica* (Czefranova) Q. R. Wang & X. Y. Zhu; *T. mongolica* subsp. *schischkinii* (Czefranova) Yakovlev; *T. saurensis* Chang Y. Yang; *T. schischkinii* Czefranova.

Perennial herbs, 20–30(–40) cm tall. Stems erect, solitary or branched, ridged, white pubescent. Leaflets linear-lanceolate to linear, 3–7 × 0.6–2.2 cm, densely white appressed pubescent on both surfaces, especially dense and also with long hairs abaxially, base cuneate, apex acute. Racemes lax, terminal, 5–18 cm; bracts narrowly ovate, 1.2–2(–3) cm, densely silky, acuminate. Calyx 1.4–2 cm, slightly gibbous. Corolla yellow. Ovary

densely silky, shortly stipitate; ovules 9–14. Legume linear, straight or slightly curved, 4–8 × 0.7–1 cm, white pubescent, spreading horizontally at right angles to axis, acute. Seeds 5–12, at central line of valve, prominent, dark brown, reniform, 3.5–4.5 × 3–3.5 mm, spotted; hilum white. Fl. Jun–Jul, fr. Aug–Sep.

Prairies, gravel deserts, saline beaches. Gansu, Nei Mongol, N Xinjiang [Kazakhstan, Mongolia, Russia (W Siberia)].

This is probably a synonym of *Thermopsis lanceolata*.

9. *Thermopsis inflata* Cambessèdes in Jacquemont, Voy. Inde 4(Bot.): 35. 1835–1844.

轮生叶野决明 lun sheng ye ye jue ming

Perennial herbs, 10–20 cm tall. Stems erect, branched, white. Stipules broadly obovate, acute, 1.5–2.5 cm; petiole 1–3 mm, or leaves sessile; leaflets obovate, 1–2.5 × to 1.6 cm, white spreading villous abaxially, especially when young, glabrous adaxially, base cuneate, asymmetric, apex acute. Racemes lax, 3–10 cm; bracts 1–1.5 cm; peduncle 5–7 mm. Calyx 16–20 mm, slightly gibbous, white villous. Corolla yellow, ca. 2.5 cm, petals subequal. Ovary 12–17-ovuled, linear, with 5–10 mm stipe. Legume pale brown, broadly ovate, 3–5 × 1.8–3 cm, inflated, curved downward, white villous, base with stipe equal to calyx, apex rounded, with a long beak exerted from dorsal suture. Seeds numerous, black, reniform, 6–7 × 4–5 mm, smooth. Fl. Jun–Jul, fr. Jul–Aug.

Gravelly meadows by lakes or streams, slopes, alpine rocky cliffs; 4500–5000 m. S Xinjiang, Xizang [Bhutan, NE India, Kashmir, Nepal, Pakistan].

10. *Thermopsis smithiana* E. Peter, Acta Horti Gothob. 13: 412. 1940.

矮生野决明 ai sheng ye ye jue ming

Thermopsis alpina (Pallas) Ledebour var. *humilis* Czefranova.

Perennial herbs, 7–12(–15) cm tall. Stems erect, 2–4-branched, quadrangular, white villous, base articulate; leaves at base 3 verticillate and connate into a tawny membranous sheath. Stipules 10–16 mm; leaflets obovate to narrowly elliptic, 1.5–2 × 0.5–0.7 cm, white villous abaxially, glabrous adaxially, base tapering, apex obtuse, rarely mucronate. Racemes short, 3–5 cm; flowers 3 verticillate; bracts broadly ovate, acute. Calyx ca. 1.5 cm, slightly gibbous. Corolla bright yellow, ca. 2 cm, petals long clawed. Ovary subsessile, 3–5-ovuled, densely hairy. Legume elliptic, oblong, or obovate, 3–6 × 1.5–2.5 cm, base tapering, apex obtuse, shortly beaked; valves membranous, tawny when dry, white villous. Seeds 1–4, dark scarlet, ellipsoid, 6–7 × ca. 5 mm. Fl. Jun–Jul, fr. Jul–Aug.

• Mountain slopes; 3500–4500 m. W Sichuan, Xizang, NW Yunnan.

11. *Thermopsis barbata* Benth in Royle, Ill. Bot. Himal. Mts. 196. 1835.

紫花野决明 zi hua ye ye jue ming

Thermopsis atrata Czefranova.

Perennial herbs, 8–30 cm tall, densely white or brown villous, with silky sheen, sparsely so in fruit. Stems erect, branched, ridged; leaves at base 4–7 verticillate and connate into a sheath. Stipules leafy; leaflets oblong or lanceolate to oblanceolate, 1–2(–3) × 0.3–0.5(–1) cm, lateral leaflets unequal, densely white villous on both surfaces, base tapering to narrowly winged petiole, apex acute. Racemes lax, 4–19 cm; bracts ovate, 1–1.5 cm, base connate into a sheath. Calyx 1.4–2(–2.3) cm. Corolla deep purple, sometimes becoming blue when dry, 2.4–2.8 cm, petals subequal. Ovary 4–13-ovuled, with 4–8 mm stipe, villous. Legume brown, narrowly elliptic, acute, 2–4.5 × 1–1.8 cm. Seed yellowish brown, reniform, 7–8 × 4–5 mm, convex; hilum white. Fl. Jun–Jul, fr. Aug–Sep.

Valleys, slopes; 2700–4500 m. Qinghai, W Sichuan, Xinjiang (Tian Shan), Xizang, SW Yunnan [India, Kashmir, Nepal, Pakistan].

12. *Thermopsis gyirongensis* S. Q. Wei, Bull. Bot. Res., Harbin 4(2): 138. 1984.

吉隆野决明 ji long ye jue ming

Thermopsis barbata Benth. f. *chrysantha* P. C. Li; *T. barbata* var. *gyirongensis* (S. Q. Wei) Z. X. Peng & Y. M. Yuan.

Perennial herbs, 20–30 cm tall. Stems branched from woody articulate base; leaves at base 4–9 verticillate and connate into sheath, densely tawny villous. Leaflets oblong-lanceolate, 2–3 × 0.4–0.8 cm, lateral leaflets unequal, tawny villous abaxially, especially on margins, glabrous adaxially, base tapering to narrowly winged petiole, apex acute. Racemes lax, 8–10 cm; flowers in 2 or 3 whorls; bracts lanceolate, 1.2–2 cm, 3–6 connate from base. Calyx 1.5–1.7 cm. Corolla yellow, 2.6–2.8 cm, never becoming blue; keel obviously longer than standard. Ovary with 5–6 mm stipe; ovules 4 or 5. Mature legume not seen. Fl. Jun.

- Alpine meadows; ca. 3400 m. S Xizang (Gyirong).

The illustration in FRPS (42(2): 410, t. 106: 10–17. 1998) suggests that this is probably a synonym of *Thermopsis alpina*.

