

10. Tribe THERMOPSIDEAE

野决明族 ye jue ming zu

Wei Zhi (韦直); J. Michael Lock

Shrubs or perennial herbs, latter often with a woody rootstock. Leaves usually 3-foliolate, rarely 1-foliolate; stipulate; stipels absent. Flowers in terminal racemes, strongly papilionaceous. Calyx imbricate in bud. Petals 5. Stamens (9 or)10, free (occasionally 2 or 3 fused to near apex); anthers all similar. Ovary 1- to many ovuled; upper part of style usually glabrous and upturned. Legumes elongated, flattened or globose. Seeds oblong-reniform, ellipsoid to discoid; hilum small.

Six genera and 40–50 species: scattered throughout temperate areas of North America, the Mediterranean basin, and C and NE Asia; three genera and 15 species (five endemic) in China.

This tribe, with the exception of the North American *Pickeringia*, appears to be monophyletic, and it lies closest to Euchrestae and to a Podalyriae-Crotalariae-Genisteae clade (see discussion in Lewis et al., *Legumes World*, 263. 2005).

- 1a. Aerial portions of plant herbaceous, dying back to rootstock in winter 49. *Thermopsis*
1b. Aerial portions of plant woody, persistent.
2a. Stipules small, subulate, not united; bracteoles 2, positioned just below calyx 47. *Ammopiptanthus*
2b. Stipules prominent, united, soon falling, leaving a prominent scar; bracteoles absent 48. *Piptanthus*

47. AMMOPIPTANTHUS S. H. Cheng, Bot. Zhurn. (Moscow & Leningrad) 44: 1381. 1959.

沙冬青属 sha dong qing shu

Evergreen shrubs. Leaves digitately 1- or 3-foliolate; stipules subulate, mostly adnate to petiole; leaflets entire, silvery tomentose. Flowers in short racemes terminating branchlets; bracts small, deciduous. Calyx campanulate, 5-toothed, subglabrous. Corolla yellow; petals subequal, clawed. Stamens 10; filaments free; anthers uniform. Ovary stipitate, with several ovules; style glabrous. Legume linear to oblong, flat, dehiscent. Seeds reniform, compressed, strophiolate.

One species: China, Kazakhstan, Kyrgyzstan, Mongolia.

1. *Ammopiptanthus mongolicus* (Maximowicz ex Komarov) S. H. Cheng, Bot. Zhurn. (Moscow & Leningrad) 44: 1381. 1959.

沙冬青 sha dong qing

Piptanthus mongolicus Maximowicz ex Komarov, Trudy Glavn. Bot. Sada 34: 33. 1920; *Ammopiptanthus nanus* (Popov) S. H. Cheng; *P. nanus* Popov.

Evergreen shrubs, 1.5–2 m tall; bark yellowish brown. Stems terete, weakly ridged, gray puberulent at first, glabrescent. Leaves 1- or 3-foliolate; stipules small, triangular, adnate to petiole, silvery tomentose; petiole 4–15 mm; leaflets rhombic-elliptic or broadly elliptic to broadly ovate, 1.5–4 × 0.6–2.4 cm, densely silvery tomentose on both surfaces, lateral veins inconspicuous, base broadly cuneate to rounded, apex obtuse,

often mucronate. Flowers 4–15, in short dense terminal racemes; bracts ovate, 5–6 mm, deciduous; pedicels ca. 1 cm, subglabrous, with 2 bracteoles at midpoint. Calyx 5–7 mm. Corolla yellow, ca. 2 cm, petals long clawed. Ovary stipitate, glabrous. Legume linear-oblong, 3–8 × 1–2 cm, flat, apex acute to obtuse; stipe 8–10 mm. Seeds 2–5, orbicular-reniform, ca. 6 mm in diam. Fl. Apr–Jun, fr. May–Aug.

Sand dunes, gravel slopes, terraces beside ravines. Gansu, Nei Mongol, Ningxia, W Xinjiang (Kashi) [Kazakhstan, Kyrgyzstan, S Mongolia].

Two species have been recognized, but the differences between them are of degree only and do not appear to merit recognition of more than one rather variable species. Many species of arid areas vary considerably in their morphology according to water availability, grazing, and season, and this species appears to be no exception.

48. PIPTANTHUS Sweet, Brit. Fl. Gard. 3: t. 264. 1828.

黄花木属 huang hua mu shu

Shrubs, 1–4 m tall. Leaves digitately 3-foliolate, entire; stipules large, opposite to petiole, basal 2/3 fused and surrounding stem, leaving a prominent scar when fallen, free apical portion acute. Racemes terminal, with 2 or 3 flowers at nodes, in whorls; bracts stipulelike, connected at base into a sheath, deciduous; bracteoles absent. Calyx 5-toothed, proximal 2 lobes mainly fused with a bifid tip, falling after flowering at articulation surrounding perigynous line. Corolla yellow, petals subequal. Stamens free; anthers uniform. Ovary stipitate; ovules 2–10. Legume broadly linear, stipitate, thinly leathery, compressed, continuous inside. Seeds reniform, with a minute strophiole.

Two species: Bhutan, China, India, Kashmir, Nepal; two species (one endemic) in China.

- 1a. Keel equaling or slightly longer than standard; stems and calyces white woolly; leaflets yellow silky abaxially when young, then glabrescent; legume glabrous 1. *P. nepalensis*

- 1b. Keel slightly shorter than standard; leaflets densely tomentose abaxially, even when mature; legume rusty tomentose 2. *P. tomentosus*

1. *Piptanthus nepalensis* (Hooker) Sweet, Brit. Fl. Gard. 3: t. 264. 1828.

黄花木 huang hua mu

Baptisia nepalensis Hooker, Exot. Fl. 2: 131. 1824; *Piptanthus bicolor* Craib; *P. bombycinus* C. Marquand; *P. concolor* Harrow ex Craib; *P. concolor* subsp. *harrovi* Stapf; *P. concolor* subsp. *yunnanensis* Stapf; *P. forrestii* Craib; *P. laburnifolius* (D. Don) Stapf; *P. laburnifolius* f. *nepalensis* Stapf; *P. laburnifolius* f. *sikkimensis* Stapf; *P. leiocarpus* Stapf; *P. leiocarpus* var. *sericopetalus* P. C. Li; *P. nepalensis* f. *leiocarpus* (Stapf) S. Q. Wei; *P. nepalensis* var. *leiocarpus* (Stapf) X. Y. Zhu; *P. nepalensis* f. *sericopetalus* (P. C. Li) S. Q. Wei; *P. nepalensis* var. *sericopetalus* (P. C. Li) X. Y. Zhu; *Thermopsis laburnifolia* D. Don.

Shrubs, 1.5–3 m tall. Stems terete, ridged, white woolly to appressed pubescent, glabrescent. Stipules lanceolate to ovate, 7–14 mm; petiole 1–3 cm, with a wide groove adaxially; leaflets elliptic, oblong-elliptic, or linear-ovate, 4–14 × 1.5–4 cm, flat on both surfaces, papery, dark green, yellow silky and white appressed pubescent abaxially, gradually glabrescent, becoming glaucous, glabrous or sparsely hairy along midrib adaxially, lateral veins 6–8 pairs, base cuneate, margins sometimes ciliate, apex acute or acuminate. Racemes terminal, 5–8 cm, with flowers in 2–7 whorls, axis densely white woolly, elongating at anthesis; bracts broadly ovate to obovate, 7–12 mm, acute; pedicels 1.5–2.5 cm. Calyx campanulate, 1–1.6 cm, white woolly. Corolla bright yellow, 1.8–2.6 cm; standard orbicular to broadly cordate, with 4–6 mm claw; wings shorter; keel equal to or slightly longer than standard, to 2.2 cm. Ovary stipitate, densely sericeous to almost glabrous, 4–10-ovuled. Legume broadly linear, flat, 7–15 × 0.9–1.5 cm, stipitate, apex sharply pointed; valves membranous, reticulate, glabrous to very sparsely pubescent. Seed brown, reniform, 4–5 × 3–3.5 mm, compressed. Fl. Apr–Jul, fr. Jun–Sep.

Coniferous forests, woodland margins, thickets, meadows; 1600–4000 m. Gansu, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, India, Kashmir, Nepal].

This is a very variable species, and several taxa have been distinguished on the basis of variation in the indumentum of the ovary, legume, and leaves. Turner (Brittonia 32: 281–285. 1980) revised the genus and concluded that variation in these characters was continuous and that only two taxa should be recognized, and we agree. Even *Piptanthus tomentosus* could be considered to be a very hairy higher-elevation ecotype, but it is here retained as distinct.

2. *Piptanthus tomentosus* Franchet, Rev. Hort. [Paris] 59: 474. 1887.

绒叶黄花木 rong ye huang hua mu

Shrubs, 1–3 m tall; bark dark brown. Stems terete, ridged, young branchlets tomentose, glabrescent. Stipules broadly ovate, 5–15 mm, tomentose; petiole 1–2 cm, furrowed adaxially; leaflets ovate-elliptic or lanceolate to obovate-lanceolate, 2.5–8 × 1–3 cm, rusty and gray mixed tomentose-sericeous abaxially, densely white silky at first adaxially, indumentum thinning with age but never completely absent, base cuneate, apex acute or obtuse. Racemes terminal, elongated, 5–15 cm; internodes 1.5–2 cm, usually 3-whorled; bracts broadly ovate, 1–1.5 cm, acute; pedicels ca. 1.5 cm. Calyx 1–1.2 cm, rusty tomentose. Corolla lemon-yellow, 1.8–2.2 cm; standard orbicular or broadly cordate, with ca. 6 mm claw; wings short; keel slightly shorter than standard. Ovary densely rusty tomentose, with ca. 5 mm stipe; ovules 4–8. Legume linear, 45–90 × 9–10 mm, compressed, rusty tomentose, apex acute. Seeds 2–6, brown, reniform, 5–6 × 4–5 mm. Fl. Apr–Jul, fr. Aug–Sep.

• Thickets by woodlands, meadows on slopes; 3000–3800 m. SW Sichuan, W Yunnan.

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. $2 \times$ 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 $5 \times$ 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 $4.5 \times$ width; wings as wide as keel or slightly narrower.
- 9a. Leaflets plane, $1.5\text{--}2.5 \times$ as long as broad; wings and keel subequal in width; ovules 4–8; legume flat 3. *T. alpina*
- 9b. Leaflets involute along margins, $2.5\text{--}4.5 \times$ 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, $2\text{--}5 \times 1.5\text{--}3$ cm, equaling petiole; leaflets broadly elliptic, $3.5\text{--}8 \times (2\text{--})2.5\text{--}3.5(4.7)$ 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 alternate, 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, $3\text{--}9(12) \times 0.5\text{--}0.8$ cm, straight and tapering upward, spreading, sparsely brown hairy. Seed dark brown, reniform, compressed, $3\text{--}4 \times 2\text{--}3$ 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* Bentham ex S. Moore, J. Bot. 16: 131. 1878.

霍州油菜 *huo zhou you cai*

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, $2\text{--}4.5 \times 0.8\text{--}2$ 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, $5\text{--}7 \times 0.7\text{--}0.8$ 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* Czefranova; *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, $2\text{--}5.5 \times 0.8\text{--}2.5$ 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 Czefranova; *T. glabra* Czefranova; *T. lanceolata* subsp. *glabra* (Czefranova) Kurbatski; *T. lanceolata* var. *glabra* (Czefranova) Yakovlev; *T. lanceolata* subsp. *sibirica* (Czefranova) Kurbatski; *T. orientalis* Czefranova; *T. sibirica* Czefranova.

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 xin jiang ye 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* Czefranova, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 16: 210. 1954.

青海野决明 qing hai ye ye jue ming

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

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 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 ye jue ming

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

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* Czefranová.

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 jue ming

Thermopsis atrata Czefranová.

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*.