

136. LOTUS Linnaeus, Sp. Pl. 2: 773. 1753.

百脉根属 bai mai gen shu

Bonjeanea Reichenbach; *Dorycnium* Miller; *Miediega* Bubani; *Mullaghera* Bubani; *Scandalida* Adanson; *Tetragonolobus* Scopoli.

Herbs, annual or perennial, subshrubs, or rarely shrubs. Leaves pinnate or palmate, usually sessile, 3–9-foliolate; stipules absent, or reduced to small dark glands; leaflets sessile or on very short petiolules, most species with 5 leaflets, 3 crowded at apex of leaf rachis, 2 at base; basal pair similar to apical ones or often differing in shape and stipulelike. Inflorescence an axillary, pedunculate, 1- to many-flowered umbel; peduncle with a sterile bract usually represented by a conspicuous leaf with 1–3(–5) leaflets; flower-subtending bracts reduced to small dark glands (rarely with a herbaceous blade) or absent; bracteoles usually absent, when rarely present then glandular. Calyx campanulate or trumpet-shaped; teeth 5, subequal or distal longer, sometimes connate into 2 lips. Corolla yellow (often turning green in herbarium), pink, violet, brown, or white. Vexillary stamen free. Ovules numerous or several; style entire [or with a small toothlike appendage]; stigma terminal. Legume linear to ovoid, straight or incurved, terete or flattened, longitudinally dehiscent [indehiscent in 1 species outside China]. Seeds subglobose or lenticular, smooth, rarely verrucose.

About 125 species: temperate and subtropical Africa, Asia, N Atlantic islands, Australia, Europe, W Pacific islands; introduced in the Americas, New Zealand, and some other islands; eight species (one to three introduced) in China.

Sectional subdivisions are given after Kramina and Sokoloff (Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 108(5): 59–63. 2003) and Sokoloff (Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 108(3): 35–48. 2003); these are based on morphology and chromosome numbers. Molecular phylogenetic data (Degtjareva et al., Canad. J. Bot. 84: 813–830. 2006; and Wulfenia 15: 35–49. 2008) are not always consistent with this classification (e.g., *Lotus* sect. *Heinekenia* is paraphyletic), but further research is needed to see if putatively monophyletic groups can be morphologically characterized.

Species nos. 4–7 represent the *Lotus corniculatus* complex, a polyploid complex including both diploid and tetraploid taxa, which are not clearly distinguishable by morphological characters. Introduced in North and South America, Australia, and New Zealand, the taxa are native to E and N Africa, Asia, and Europe.

Lotus pedunculatus Cavanilles (Icon. Descr. 2: 52. 1793; *L. uliginosus* Schkuhr) is a widespread species of swamps, wet meadows, and other wetlands native to N Africa, SW Asia, and Europe, and introduced in S Africa, Australia, North and South America, and the Pacific islands. In view of this broad non-native distribution, it may also be introduced in China, although no confirmed records are known to the present authors. A short description is provided here. Herbs, perennial, 30–100 cm, glabrescent or sparsely pilose, with underground off-shoots. Stem erect or ascending, subglabrous to villous, hollow. Leaflets obovate, 8–25 × 3–15 mm, often glaucous abaxially, with prominent midrib. Heads (1–)6–12(–18)-flowered; peduncle long. Calyx teeth ca. as long as tube, spreading in bud, pilose. Corolla yellow, 10–18 mm. Legume 15–35 × 1.8–2.5 mm. Seeds olive or yellowish to light brown, usually unspotted, small, ovoid, 1–1.2 mm.

- 1a. Basal leaflets of 5-foliolate sessile leaves adnate to leaf rachis; legume longitudinally 4-winged; flowers 18–28 mm; corolla deep red, purple, or brown when dry; plants annual; cultivated (*L. sect. Tetragonolobus* (Scopoli) Benth & J. D. Hooker) 8. *L. tetragonolobus*
- 1b. Leaflets never adnate to leaf rachis; legume wingless; corolla yellow, red, or white; plants perennial or annual.
 - 2a. Style smooth (except for inconspicuous papillae surrounding stigma); calyx trumpet-shaped; claw of standard less than half as long as standard; keel somewhat curved; all leaflets similar in shape (*L. sect. Bonjeanea* (Reichenbach) D. D. Sokoloff) 1. *L. strictus*
 - 2b. Style papillose along length (use magnification); calyx campanulate; claw of standard longer than above; keel bent at a 90° angle; basal 2 leaflets different in shape to distal 3.
 - 3a. Wings and standard white (occasionally pale pink or tinged with violet), keel white with reddish or pink tip; all leaflets oblanceolate or obovate, basal leaflets sometimes smaller than apical ones, but of a similar shape, with maximum width at distal or central part of a leaflet (*L. sect. Heinekenia* Webb & Berthelot) 2. *L. taitungensis*
 - 3b. Corolla yellow (then often greenish in herbarium), sometimes reddish or red; basal 2 leaflets differing in shape from apical 3 leaflets and typically having maximum width closer to leaflet base (*L. sect. Lotus*).
 - 4a. Perennials with underground off-shoots, stem hollow *L. pedunculatus* (see note above)
 - 4b. Annuals or perennials with a taproot, without underground off-shoots, sometimes with short rhizomes.
 - 5a. Stems and peduncles and often all parts of a plant with long (1–2.5 mm) spreading hairs; style 2.5–3(–3.5) mm; annual or biennial herbs (rarely short-lived perennials) 3. *L. angustissimus*
 - 5b. Plants without long spreading hairs; style more than 3 mm; perennial herbs (sometimes annuals or biennials) (*L. corniculatus* complex).

- 6a. Leaflets of cauline leaves obovate to obovate-lanceolate, leaflet index (i.e., length to width ratio) ≤ 3.5 ; calyx teeth longer than tube or equaling it.
 7a. Flowers (9-)10-15(-18) mm; corolla yellow; style 4-6 mm; narrow part of 2 upper calyx teeth less than half their length 4. *L. corniculatus*
 7b. Flowers 8-10 mm; corolla yellow, becoming red or purple after pollination; style 3-4 mm; narrow part of 2 upper calyx teeth more than half their length 5. *L. krylovii*
 6b. Leaflets of cauline leaves oblanceolate to linear, leaflet index ≥ 3.5 ; calyx teeth shorter than tube or \pm equaling it.
 8a. Corolla yellow; calyx teeth shorter than tube; terminal leaflet 1.5-3 \times as long as leaf rachis; flower 8-10.5(-11) mm; style 4-5.5 mm 6. *L. tenuis*
 8b. Corolla yellow, usually with reddish or purple parts; calyx teeth \pm equaling tube; terminal leaflet (3-)4-7 \times as long as leaf rachis; flower 6-8 mm; style 3-4 mm 7. *L. schoelleri*

1. *Lotus strictus* Fischer & C. A. Meyer, Index Sem. Hort. Petrop. 1: 32. 1835.

直立百脉根 zhi li bai mai gen

Dorycnium strictum (Fischer & C. A. Meyer) Lassen; *Lotus albus* Janka; *L. thermalis* Boissier.

Herbs, perennial, 40-75 cm, sparsely puberulent with appressed trichomes. Stems erect, robust, branching, subglabrous. Leaf rachis very short; all leaflets similar in shape, oblong-obovate to oblong, 6-30 \times 4-12 mm, sparsely puberulent abaxially. Umbels 2-10-flowered; peduncle longer than leaves. Calyx trumpet-shaped, 7-8 mm, sparsely puberulent; teeth subequal, slightly shorter than tube; upper teeth curved upward. Corolla white or pale yellow, 10-15(-20) mm; claw of standard less than half as long as standard; keel somewhat curved. Style smooth (except for inconspicuous papillae surrounding stigma). Legume cylindric, 25-40 \times 3-4 mm, straight or curved at apex.

Xinjiang [E Kazakhstan, Russia (Altai); SW Asia (Armenia, Turkey), SE Europe (Bulgaria, Greece)].

Lotus strictus was reported from Xinjiang by Chang Y. Yang (Claves Pl. Xinjiang. 3: 20. 1985). The species has a highly disjunct distribution; the localities in China, Kazakhstan, and Russia are close to each other but far away from the next-closest localities in Armenia.

2. *Lotus taitungensis* S. S. Ying, Coloured Ill. Fl. Taiwan 5: 596. 1995.

兰屿百脉根 lan yu bai mai gen

Lotus pacificus Kramina & D. D. Sokoloff.

Herbs, perennial, 50-80 cm, puberulent. Rootstock woody. Stem terete, strong, fleshy, decumbent with end ascending. Leaves sessile; stipules absent or present as inconspicuous dark glands; rachis 4-12 mm; leaflets 5(-7), all similar in shape, oblanceolate to narrowly obovate, 1-2(-4) cm, base cuneate, apex acute to almost rounded with a cusp. Heads (1 or)2-6(-8)-flowered; peduncle (0.6-)2-3 cm; sterile bract with 1-3 leaflets; subtending floral bracts present, wholly glandular or rarely with a minute blade and a pair of glands; pedicels short, pubescent. Flowers (8.5-)10-14.5(-20) mm. Calyx 7-11 mm; teeth subulate, as long as or longer than tube. Corolla white, occasionally pale pink or tinged with violet, keel dark spotted with reddish or pink tip; keel incurved by acute angle, shortly rostrate. Ovary linear, glabrous; style (3-)4.5-6.5 mm. Legume cylindric, 3-5 cm \times 2.7-4.4 mm, straight, valves twisted. Seeds numerous, globose, smooth. Fl. Sep-Mar.

Sandy places on seashores. Taiwan (Lan Yu and along E coast of main island) [Japan (Ryukyu Islands)].

The Chinese records of *Lotus australis* Andrews are referable to this species, which was named *L. pacificus* (Kramina & Sokoloff, Adanson, n.s., 26: 183. 2004) although *L. taitungensis* had been previously described for the same taxon. True *L. australis* is restricted to Australia. Other relatives of *L. taitungensis* are *L. anfractuosus* (E. G. Baker) Kramina & D. D. Sokoloff from New Caledonia and Vanuatu and *L. cruentus* Court from Australia.

3. *Lotus angustissimus* Linnaeus, Sp. Pl. 2: 774. 1753.

尖齿百脉根 jian chi bai mai gen

Lotus praetermissus Kuprianova.

Herbs, annual or biennial, rarely short-lived perennial, (5-)10-30(-50) cm, glabrescent or sparsely pilose, stems and peduncles and often other parts of plant with long (1-2.5 mm) spreading hairs, stems also with short (0.1-0.6 mm) semi-appressed trichomes. Stems erect, prostrate or ascending, branched, slender. Leaflets 5, acute, apical 3 elliptic to narrowly elliptic or rhombic, 7-17 \times 2-6 mm, basal 2 obliquely ovate, shorter than apical ones. Umbels 1- or 2(or 3)-flowered; peduncle 0.5-4 cm; sterile bract with 1-3 leaflets. Flowers 5-8(-8.5) mm. Calyx 4-5 mm; teeth filiform, longer or shorter than tube. Corolla yellow or orange. Style 2.5-3(-3.5) mm. Legume light to dark brown, straight, cylindric, 5-28 \times 1-1.5 mm, 12-28-seeded. Seeds yellow or brown, 1-colored or spotted, globose, 0.9-1.2 mm. Fl. Jun-Oct, fr. Jul-Nov.

Moist grasslands, sandy soils by margins of swamps and ravines; 500-1200 m. Xinjiang [Kazakhstan, Russia (European part, Siberia); N Africa, SW Asia, N Atlantic islands, Europe; introduced in S Africa, Australia, W North America, and Pacific islands (New Zealand)].

This is probably an introduced species in China.

4. *Lotus corniculatus* Linnaeus, Sp. Pl. 2: 775. 1753.

百脉根 bai mai gen

Herbs, perennial, 15-80 cm, with a taproot, scattered sparsely white puberulent or glabrescent. Stem cylindric to angular, solid, decumbent or ascending. Leaflets 5, apical 3 obovate to oblanceolate-obovate (lateral 2 oblique), 5-20 \times 4-10 mm, papery, basal 2 stipulelike, midrib obscure. Umbels rarely more than 7-flowered; peduncle 3-10 cm; sterile bract with 1-3 leaflets, \pm equal to calyx, 5-7 mm. Flowers (9-)10-18 mm. Calyx teeth almost equal in length, narrowly triangular, \pm equaling, longer than, or shorter than tube. Corolla yellow or partly or

wholly orange-red, often bluish black when dry. Ovary glabrous; ovules 35–40; style 4–6 mm. Legume brown, linear-cylindric, 20–25 × 2–4 mm. Seeds light to dark brown, 1-colored or spotted with violet-black spots or dots, small, ovoid, 1–1.7 mm. Fl. (Jan–)Feb–Oct, fr. (Mar–)Apr–Oct.

Pinus plantations, thickets, scrub, damp meadows, alpine meadows, dry hill pastures, grassy places, rocky slopes, ravines, river valleys, banks, roadsides, abandoned fields, cultivated ground; 400–3400 m. Guizhou, Hubei, Hunan, Sichuan, Taiwan, Tianjin, Xizang, Yunnan [Afghanistan, Bhutan, India, Japan, Kashmir, Kazakhstan, Korea, Mongolia, Myanmar, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan; E and N Africa, SW Asia, Europe; introduced in Australia (including Tasmania), North, Central, and South America, and Pacific islands (New Zealand)].

- 1a. Umbels 3–7-flowered; calyx teeth equaling, shorter than, or longer than calyx tube, narrow part of 2 upper calyx teeth more than half their length 4a. var. *corniculatus*
- 1b. Umbels 1–3(or 4)-flowered; calyx teeth slightly longer than calyx tube, narrow part of 2 upper calyx teeth less than half their length 4b. var. *japonicus*

4a. *Lotus corniculatus* var. *corniculatus*

百脉根(原变种) bai mai gen (yuan bian zhong)

Plants subglabrous or scattered sparsely white puberulent on vegetative parts and calyces. Umbels 3–7-flowered. Flowers 11–18 mm. Corolla yellow or yellow with orange parts or stripes. Calyx teeth equaling, shorter than, or longer than calyx tube, narrow part of 2 upper calyx teeth more than half their length. $2n = 24$.

Moist and weak alkaline soil of fields, grasslands, and ravines. Provinces of upper and middle Chang Jiang, NW and SW China [N Africa, SW Asia, Europe; introduced in Australia and North America].

The occurrence this variety in China needs to be confirmed, because previously only diploid races of the *Lotus corniculatus* complex were reported to occur as native in E Asia (Larsen, Bot. Tidsskr. 54: 44–56. 1958; Grant, Canad. J. Bot. 73: 1787–1809. 1995). However, this variety may occur as an introduced taxon in China.

4b. *Lotus corniculatus* var. *japonicus* Regel, Index Sem. Hort. Petrop. 23. 1864.

光叶百脉根 guang ye bai mai gen

Lotus japonicus (Regel) Larsen.

Plants glabrescent or sparsely puberulent on rachis, petioles, midrib, calyces (especially on teeth margins and abaxial part of tube), and sometimes stems. Umbels 1–3(or 4)-flowered. Flowers 10–12.5(–14) mm. Corolla yellow. Calyx teeth slightly longer than tube, sometimes equaling it, narrow part of 2 upper calyx teeth less than half their length. $2n = 12$.

Grasslands, ravine slopes, mountain meadows, alongside irrigation channels and streams, rice fields, river valleys, lake banks, roadsides, rocky slopes; below 3100 m. Provinces of upper and middle Chang Jiang, C, NW, and SW China, Taiwan [Japan, Kashmir, Korea, C and W Nepal].

In FRPS (42(2): 224, 226. 1998), *Lotus alpinus* (Seringe) Schleicher ex Ramond (Mem. Mus. Hist. Nat. (Paris) 13: 275. 1825; *L. corniculatus* var. *alpinus* Seringe in Candolle, Prodr. 2: 214. 1825) was recorded from alpine rocky slopes at 3000–3500 m in Qinghai and Xizang. One of us (Kramina) has seen no specimens similar to *L. alpinus* among the material studied from China. Probably some mountain forms or varieties of *L. corniculatus* sensu lato exist in China, but these do not seem close to those from C Europe or even Turkey, where *L. alpinus* is otherwise distributed. This problem needs additional study using both morphological and molecular-genetic methods.

5. *Lotus krylovii* Schischkin & Sergievskaya, Sist. Zametki Mater. Gerb. Krylova Tomsk. Gosud. Univ. Kuybysheva 1932 (7–8): 5. 1932.

中亚百脉根 zhong ya bai mai gen

Lotus confusus Sergievskaya; *L. corniculatus* Linnaeus var. *versicolor* Bongard & C. A. Meyer.

Herbs, perennial, sometimes annual, 10–45 cm, glabrous or puberulent on cauline leaves and calyces. Stem branched from base, erect or ascending. Leaflets 5, apical 3 obovate to obovate-elliptic and obovate-lanceolate, 7–13 × 4–6 mm, base cuneate, apex rounded, basal 2 obliquely ovate, acute, subglabrous on both surfaces. Umbels 1- or 2(or 3)-flowered; peduncle 2–6 cm; sterile bract with 1–3 leaflets. Flowers 8–10 mm. Calyx 5–6 mm; teeth filiform, longer than tube, narrow part of upper calyx teeth more than half their length. Corolla light yellow, then becoming purple or red. Ovary linear; ovules 30–35; style 3–4 mm. Legume cylindric, 20–30 × 2–3 mm. Fl. May–Aug, fr. Jul–Oct.

Alkaline or saline swamps and lakeshores. Xinjiang (Junggar Pendi, Kashi Diqu), Xizang [Afghanistan, India, Kazakhstan, Kyrgyzstan, W Mongolia, Pakistan, Russia (European part, Siberia), Tajikistan, Turkmenistan, Uzbekistan; SW Asia (Iran), E Europe (SE Ukraine); introduced in North America (Canada)].

The Chinese record of *Lotus frondosus* (Frey) Kuprianova from Xinjiang (FRPS 42(2): 224, 226. 1998) is based on a misidentification of *L. krylovii*, as were the records from the former Soviet Union by Kuprianova (Fl. URSS 11: 295. 1945). *Lotus corniculatus* var. *frondosus* Frey was described from Turkmenistan and is distributed also in Afghanistan, Pakistan, Uzbekistan, and SW Asia (Iran and Iraq).

6. *Lotus tenuis* Waldstein & Kitaibel ex Willdenow, Enum. Pl. 2: 797. 1809.

细叶百脉根 xi ye bai mai gen

Lotus corniculatus Linnaeus var. *tenuifolius* Linnaeus; *L. corniculatus* subsp. *tenuis* (Waldstein & Kitaibel ex Willdenow) Briquet; *L. glaber* Miller, nom. utique rej.; *L. tenuifolius* (Linnaeus) Reichenbach.

Herbs, perennial, 20–100 cm, with a taproot, glabrescent or sparsely puberulent with short appressed hairs. Stem slender, erect or ascending. Leaflets 5, obovate-oblongate or oblongate to linear, 4–18 × 1–4 mm, basal 2 shorter; terminal leaflet of a leaf 1.5–3 × as long as leaf rachis. Umbels (1 or) 2–5-flowered; peduncle 3–12 cm, slender; bracts 1–3, 1.5–2 × as long as calyx. Flowers 8–10.5(–11) mm. Calyx 4–6 mm; teeth shorter than tube, narrow part of 2 upper calyx teeth less than half their length. Corolla yellow. Ovary linear; ovules numer-

ous; style 4–5.5 mm. Legume straight, cylindric, 9–25 × 1.2–2.5 mm. Seeds light brown, globose, 1.4–1.6 mm, smooth. Fl. May–Aug, fr. Jul–Sep.

Saline, poorly drained grasslands of lake or swamp shores. NW China, Tianjin [Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia (European part, Siberia), Tajikistan, Turkmenistan, Uzbekistan; N Africa, SW Asia, Europe; introduced in North America, Pacific islands (New Zealand), and South America (Argentina)].

Whether this is a native or introduced species in China needs verification.

7. *Lotus schoelleri* Schweinfurth, Bull. Herb. Boissier 4(App. 2): 231. 1896.

直根百脉根 zhi gen bai mai gen

Lotus corniculatus Linnaeus var. *eremanthus* Chiovenda; *L. elisabethae* Opperman ex Wissjulina; *L. mearnsii* De Wilde-man (1925), not (Britton) Greene (1890).

Herbs, perennial or annual, with a taproot, almost glabrous or rarely with spreading trichomes. Stem erect or ascending. Leaflets: apical 3 oblanceolate to linear, basal 2 obliquely ovate to lanceolate; terminal leaflet (3–)4–7 × as long as leaf rachis. Umbels 1–3-flowered; peduncle 1–6(–10) cm. Flower 6–8 mm. Calyx 4.5–5.8 mm; teeth ± equaling tube, narrow part of 2 upper calyx teeth less than half their length. Corolla yellow, usually with rose, red, or purple parts. Style 3–4 mm. Legume straight, almost cylindric or slightly compressed, 15–30 × 1.5–4 mm.

Wet meadows, often on saline soils, banks of rivers, lakes, and irrigation channels. Gansu, Liaoning, Nei Mongol, Xinjiang [Afghanistan, Mongolia, Russia (Lower Volga region, S Siberia), Turkmenistan; E and N Africa, SW Asia, E Europe (E Ukraine)].

8. *Lotus tetragonolobus* Linnaeus, Sp. Pl. 2: 773. 1753.

苜蓿百脉根 chi jia bai mai gen

Tetragonolobus purpureus Moench.

Herbs, annual, 15–40 cm. Stem fleshy, prostrate, ascending, or erect, branchy, ridged, usually spreading sparsely villous. Leaflets 5, sessile, apical 3 ovate-rhombic, 2–5 × ca. 3 cm, base cuneate, apex acuminate, basal 2 stipulelike, adnate to rachis, ovate, less than 1 cm, puberulent on both surfaces. Umbels 1- or 2-flowered; peduncle short; bracts 3. Flowers 18–28 mm. Calyx ca. 15 mm, pubescent, often with dark purple spots; teeth longer than tube. Corolla scarlet, mauve when dry. Ovary glabrous; ovules numerous. Legume cylindric, (20–)30–60(–70) × 5–8 mm, tapering at both ends, margins thickened, with 4 wings by sides of both sutures, undulate, 2–4 mm in width. Seeds brown, subglobose, 3.5–4.5 mm, smooth.

Cultivated in China [native to the Mediterranean region, extending to S Ukraine and Caucasus; introduced in Australia and Pacific islands (New Zealand)].

The young tender legumes are eaten as a vegetable.

LOTEAE