

## ONAGRACEAE

柳叶菜科 liu ye cai ke

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Annual or perennial herbs, or shrubs, rarely trees to 30 m tall, often with epidermal oil cells, usually with internal phloem. Leaves simple, spirally arranged, opposite, or occasionally whorled, entire or toothed to pinnatifid; stipules present and usually caducous, or absent. Flowers perfect and hermaphroditic or occasionally unisexual, actinomorphic or zygomorphic, (2–)4(–7)-merous, axillary, in leafy spikes or racemes or solitary, or occasionally in panicles, all but *Ludwigia* with distinct floral tube, nectariferous within. Sepals green or colored, valvate. Petals as many as sepals or rarely absent, variously colored, imbricate or convolute and occasionally clawed. Stamens as many as sepals in one series or 2 × as many as sepals in 2 series [in *Lopezia* Cavanilles reduced to 2 or 1 plus 1 sterile staminode]; anthers versatile or basifixed, dithecal, sometimes cross-partitioned, opening by longitudinal slits; pollen grains almost always united by viscin threads, shed as monads, tetrads, or polyads. Ovary inferior, with as many carpels and locules as sepals, septa sometimes thin or absent at maturity; placentation axile or parietal, ovules 1 to many per locule, in 1 or several rows or clustered, anatropous, bitegmic; style 1; stigma with as many lobes as sepals or clavate to globose. Fruit a loculicidal capsule or indehiscent nut or berry. Seeds small, smooth or variously sculptured, sometimes with a coma [or wing], with straight oily embryo, endosperm lacking.

Seventeen genera and ca. 650 species: widespread in temperate and subtropical areas, but best represented in W North America; six genera (two introduced), 64 species (11 endemic, 11 introduced), and five natural hybrids (two endemic) in China.

Onagraceae are a well-defined, monophyletic family in the order Myrtales, with a sister relationship to Lythraceae. Within the order Myrtales, the Onagraceae are distinguished by a number of features including (1) a distinctive 4-nucleate embryo sac; (2) abundant raphides in vegetative cells; (3) paracrystalline beaded pollen exine; and (4) pollen with viscin threads.

Some species of *Oenothera* are grown for the oil in their seeds, which contains gamma linolenic acid (GLA), used for medicinal purposes. Several species of Onagraceae also are cultivated in China for their horticultural value, including species of *Fuchsia* Linnaeus (generally distinguished by having large, tubular, red or orange flowers and fleshy berries) and *Clarkia* Pursh (distinguished by having stigmas with commissural lobes with dry, unicellular papillae, and dry, elongate capsules similar to those of *Epilobium* but lacking comas on the seeds). The most commonly cultivated *Fuchsia* is *F. ×hybrida* Hort. and the related *F. magellanica* Lamarck in *F. sect. Quelusia* (Vandelli) Candolle from South America; *F. triphylla* Linnaeus, in *F. sect. Fuchsia*, from Hispaniola, is known from only one gathering in Fujian. Similarly, *Clarkia amoena* (Lehmann) A. Nelson & J. F. Macbride is widely cultivated in China, whereas *C. pulchella* Pursh is known from only one gathering in Xizang; both species are native to W North America. There are no naturalized species of either *Clarkia* or *Fuchsia* in China.

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- 1a. Sepals 2; fruit bristly with hooked hairs, indehiscent ..... 2. *Circaea*  
1b. Sepals (3 or)4 or 5(–7); fruit not bristly with hooked hairs, dehiscent in most species.  
2a. Seeds with a coma of hairs; petals mostly rose-purple to white, never yellow.  
3a. Leaves spirally arranged or alternate; floral tube absent; flowers slightly zygomorphic; petals entire;  
stamens subequal in a single whorl; stigma deeply 4-lobed ..... 3. *Chamerion*  
3b. Leaves opposite at least below inflorescence; floral tube present; flowers actinomorphic; petals cleft or  
emarginate; stamens in two unequal whorls; stigma entire or 4-lobed ..... 4. *Epilobium*  
2b. Seeds lacking a coma of hairs; petals mostly yellow, rarely rose-purple to white.  
4a. Sepals persistent after anthesis; floral tube not prolonged beyond ovary; flowers (3 or)4 or 5(–7)-merous ..... 1. *Ludwigia*  
4b. Sepals deciduous after anthesis (often with floral tube); floral tube prolonged, often well beyond ovary;  
flowers (3 or)4-merous.  
5a. Fruit a dehiscent, many seeded capsule ..... 5. *Oenothera*  
5b. Fruit a nutlike, hard, indehiscent, 1–4-seeded capsule ..... 6. *Gaura*

### 1. LUDWIGIA Linnaeus, Sp. Pl. 1: 118 [“*Ludvigia*”]; 2: [1204]. 1753.

丁香蓼属 ding xiang liao shu

Chen Jiarui (陈家瑞 Chen Chia-jui); Peter C. Hoch, Peter H. Raven

*Isnardia* Linnaeus; *Jussiaea* Linnaeus; *Oocarpon* Micheli.

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Herbs slender, erect to prostrate and rooting at nodes, or shrubs or rarely small trees; underwater parts often swollen and spongy or with inflated white spongy pneumatophores. Leaves alternate [or opposite], usually entire; stipules present, reduced and/or deciduous; bracteoles 2, at or near base of ovary, or absent. Flowers perfect, actinomorphic, in upper leaf axils or in spikes, racemes, or clusters; floral tube not prolonged beyond ovary. Sepals (3 or)4 or 5(–7), green, persistent after anthesis. Petals as many as sepals or absent, yellow or white, caducous. Stamens as many as or  $2 \times$  as many as sepals; anthers versatile or sometimes basifixed; pollen shed singly or in tetrads or polyads. Ovary with as many locules as sepals, rarely more, apex flat or conic, often with a depressed nectary surrounding base of each epipetalous stamen; stigma capitate or hemispheric, entire or lobed, upper  $1/2$ – $2/3$  receptive. Fruit an obovoid to cylindrical capsule, dehiscent irregularly or by a terminal pore or by flaps separating from valvelike apex. Seeds numerous, in one to several rows per locule, free or embedded in powdery or woody endocarp, raphe small or conspicuous, sometimes equal in size to body of seed.  $2n = 16, 32, 48, 64, 80, 96, 128$ .

Eighty-two species: cosmopolitan, on all continents except Antarctica; nine species (one endemic) in China.

*Ludwigia* is distinctive within the family, and morphological, anatomical, and molecular evidence indicates that it is the sister group to the remainder of the family. Historically, plants of this affinity with stamen number equal to sepal number were *Ludwigia*, and those with stamens twice as many as sepals were *Jussiaea*, but Raven and others demonstrated reticulate variation in this character, and treated the two groups as a single genus. Polyploidy and autogamy are important evolutionary phenomena within the genus.

- 1a. Sepals 5–12 mm; petals 6–18 mm.
- 2a. Sepals 4; stems densely villous-hairy or rarely puberulous; pedicels 1–10 mm; seeds free, with inflated raphe equal in size to body of seed; pollen in tetrads ..... 1. *L. octovalvis*
- 2b. Sepals 5; stems subglabrous or rarely villous-hairy; pedicels 15–65 mm; seeds embedded in endocarp (sterile in *L. ×taiwanensis*), with inconspicuous raphe; pollen in monads.
- 3a. Petals creamy-white with yellow base; plants with erect clusters of short, spindle-shaped pneumatophores at nodes of floating branches ..... 6. *L. adscendens*
- 3b. Petals yellow throughout; plants often lacking pneumatophores at nodes of floating branches or when present mainly long and found on submerged stems.
- 4a. Petals bright yellow; capsules fertile, 10–40 mm ..... 7. *L. peploides*
- 4b. Petals pale yellow; capsules sterile and abortive ..... 8. *L. ×taiwanensis*
- 1b. Sepals 1–4.5 mm; petals 1–3 mm or absent.
- 5a. Plants prostrate or ascending, rooting at nodes; stems 20–45 cm; petals absent; capsules 3–5 mm, elongate-globose; seed raphe enlarged, triangular ..... 9. *L. ovalis*
- 5b. Plants primarily erect, rooting only at stem base; stems 10–300 cm tall; petals present, yellow; capsules (3–)10–30 mm, cylindrical or oblanceolate; seed raphe inconspicuous.
- 6a. Stamens  $2 \times$  as many as sepals; seeds in upper expanded capsule free, in 2+ rows per locule, 0.3–0.5 mm, seeds in lower capsule embedded in endocarp, in one row per locule, 0.7–0.9 mm ..... 5. *L. hyssopifolia*
- 6b. Stamens as many as sepals, rarely more; seeds all free or all embedded throughout capsules, not mixed in arrangement or size.
- 7a. Seeds 0.8–1.4 mm, embedded in endocarp; pollen in monads ..... 4. *L. epilobioides*
- 7b. Seeds 0.3–0.6 mm, free, not embedded in endocarp; pollen in tetrads.
- 8a. Sepals 4 or 5; capsules oblanceolate, 2.5–5 mm thick, terete; seeds 0.3–0.5 mm; in 2+ rows or clusters per locule, not outlined through smooth capsule wall ..... 2. *L. perennis*
- 8b. Sepals 4; capsules narrowly cylindrical, 1–2 mm thick, somewhat 4-angled; seeds 0.5–0.6 mm; in 1 row per locule, clearly outlined through capsule wall ..... 3. *L. prostrata*

**1. *Ludwigia octovalvis*** (Jacquin) P. H. Raven, Kew Bull. 15: 476. 1962.

毛草龙 mao cao long

*Oenothera octovalvis* Jacquin, Enum. Syst. Pl. 19. 1760; *Jussiaea angustifolia* Lamarck; *J. octonervia* Lamarck; *J. octonervia* f. *sessiliflora* Micheli; *J. octovalvis* (Jacquin) Swartz; *J. pubescens* Linnaeus; *J. suffruticosa* Linnaeus; *J. suffruticosa* f. *angustifolia* (Lamarck) Alston; *J. suffruticosa* var. *subglabra* Thwaites ex Trimen; *J. suffruticosa* f. *villosa* (Lamarck) Alston; *J. villosa* Lamarck; *Ludwigia octovalvis* subsp. *sessiliflora* (Micheli) P. H. Raven; *L. pubescens* (Linnaeus) H. Hara.

Herbs robust, erect, perennial, sometimes woody at base or even shrubby. Stems 25–400 cm tall, well-branched, densely spreading pubescent at least on upper stem, or puberulous or

subglabrous. Petiole 1–10 mm; leaf blade linear to subovate, 1–14 × 0.3–4 cm, lateral veins 11–20 per side, submarginal vein prominent, base narrowly or broadly cuneate, apex attenuate. Sepals 4, ovate or lanceolate, 6–15 mm. Petals yellow, broadly obovate, 6–17 × 5–17 mm. Stamens 8; filaments 1–4 mm; anthers 1.2–4 mm; pollen in tetrads. Style 1.5–3.5 mm; stigma subglobose, shallowly 4-lobed. Capsule pale brown with 8 darker ribs, cylindrical, terete, 1.7–4.5 cm, 2–8 mm in diam., thinly walled, readily and irregularly loculicidal; pedicel 1–10 mm. Seeds in 2 or more rows per locule, free, brown, 0.6–0.75 mm, raphe inflated and equal in size to seed body, evenly transversely ridged. Fl. and fr. Jan–Dec.  $2n = 32, 48^*$ .

Moist to wet places along streams, ponds, or lakes, often on disturbed and/or cultivated sites, common and widespread; near sea level to 2200 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Jiangxi, Sichuan, Taiwan, E Xizang, Yunnan, Zhejiang [India, Japan, Malaysia,

Myanmar, Singapore, Thailand, Vietnam; widespread throughout Africa, S, SE, and SW Asia, Australia, Europe, North America, Pacific islands, South America].

The pattern of variation in this cosmopolitan species is extremely complex and needs further careful analysis; in the absence of a more definitive treatment, we have abandoned the subspecies recognized by Raven (Reinwardtia 6: 327–427. 1963). The three other species recognized in *Ludwigia* sect. *Macrocarpon* (Micheli) H. Hara occur only in the Neotropics, as do most species in the presumably related *L.* sect. *Myrtocarpus* (Munz) H. Hara, which suggests that this widespread species may have arisen there and spread worldwide, presumably assisted by human activities.

## 2. *Ludwigia perennis* Linnaeus, Sp. Pl. 1: 119. 1753.

细花丁香蓼 xi hua ding xiang liao

*Jussiaea caryophylla* Lamarck; *J. perennis* (Linnaeus) Brenan; *Ludwigia caryophylla* (Lamarck) Merrill & F. P. Metcalf; *L. parviflora* Roxburgh.

Herbs erect, annual, with taproot. Stems 20–100 cm tall, branched, subglabrous or minutely puberulous on younger parts. Petiole 2–15 mm, winged; leaf blade narrowly elliptic to lanceolate, 1–11 × 0.3–2.7 cm, lateral veins 6–12 per side, submarginal vein inconspicuous, base narrowly cuneate, apex subacute. Sepals 4, rarely 5, deltate, (1.3–)2–3.5 mm, glabrous or minutely puberulous. Petals yellow, elliptic, 1–3 × 0.7–2 mm. Stamens as many as sepals, or rarely more; filaments 0.3–0.7 mm; anthers 0.5–0.7 mm; pollen in tetrads. Style 0.7–1.5 mm; stigma globose. Capsule often nodding, pale brown, oblanceoloid, terete, 3–16(–19) mm, 2.5–5 mm in diam., thinly walled, readily and irregularly loculicidal, glabrous or puberulous, sessile or pedicel to 6 mm. Seeds in 2 or more rows per locule, free, brown with fine brown lines, 0.3–0.5 mm, raphe very narrow and inconspicuous. Fl. and fr. Jul–Nov.  $2n = 16$ .

Wet sites such as flood plains, roadside ditches, muddy wallows, abandoned rice paddies; near sea level to 1200 m. Fujian, Guangdong, Guangxi, Hainan, Jiangxi, Taiwan, Yunnan [Bangladesh, Bhutan, India, Indonesia, Japan, Myanmar, Nepal, Philippines, Sri Lanka; Africa (including Madagascar), SE and SW Asia, Australia, Pacific islands (New Caledonia)].

## 3. *Ludwigia prostrata* Roxburgh, Fl. Ind. 1: 441. 1820.

丁香蓼 ding xiang liao

*Jussiaea prostrata* (Roxburgh) H. Léveillé.

Herbs erect, annual or short-lived perennial. Stems often red tinged, 10–60 cm tall, often branched, subglabrous. Petiole 4–25 mm; leaf blade elliptic to narrowly elliptic, 1–13 × 0.3–2.7 cm, glabrous or with few hairs on veins, lateral veins 8–12 per side, submarginal vein inconspicuous, base narrowly cuneate, apex acute. Sepals 4, deltate, 1.3–2.5 mm, glabrous. Petals yellow, narrowly spatulate, 1.3–2.2 mm. Stamens as many as sepals; filaments 0.4–0.6 mm; anthers 0.3–0.4 mm; pollen in tetrads. Style 0.8–1 mm; stigma globose. Capsule pale brown, subcylindric, slightly 4-angled, 1.2–2.2 cm, glabrous, thinly walled, readily and irregularly dehiscent, seeds clearly visible in outline through walls, sessile or pedicel to 1.5 mm. Seeds in one row per locule, free, pale brown with darker specks or transverse fine stripes, 0.5–0.6 mm, raphe narrow, inconspicuous. Fl. and fr. Jun–Nov.  $2n = 16$ .

Wet sites such as rice paddies, flood plains, streamsides; near sea level to 800 m. Guangxi, Hainan, Yunnan [Bhutan, N India, Indonesia, Nepal, Philippines, Sri Lanka].

## 4. *Ludwigia epilobioides* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9 [Prim. Fl. Amur.]: 104. 1859.

假柳叶菜 jia liu ye cai

*Jussiaea fauriei* H. Léveillé; *J. greatrexi* H. Hara; *J. japonica* H. Léveillé; *J. parmentieri* H. Léveillé; *J. philippiana* H. Léveillé; *J. prostrata* var. *fauriei* (H. Léveillé) H. Léveillé; *J. prostrata* var. *parmentieri* (H. Léveillé) H. Léveillé; *J. prostrata* var. *philippiana* (H. Léveillé) H. Léveillé; *Ludwigia epilobioides* subsp. *greatrexi* (H. Hara) P. H. Raven; *L. greatrexi* (H. Hara) H. Hara; *Nematopyxis japonica* Miquel.

Herbs erect, often stout, annual. Stems 15–130 cm tall, well-branched, subglabrous or finely puberulous. Petiole 3–15 mm; leaf blade narrowly elliptic to narrowly lanceolate, 1–10 × 0.4–2.5 cm, subglabrous or puberulous, lateral veins 8–13 per side, submarginal vein inconspicuous, base narrowly cuneate, apex acuminate. Sepals 4 or 5, rarely 6, deltate, 1.5–4.5 mm, puberulous. Petals yellow, obovate, 1.8–2 × 0.7–1.2 mm. Stamens as many as sepals; filaments 0.5–1.2 mm; anthers 0.4–0.7 mm; pollen in monads. Style 0.5–1.2 mm; stigma globose. Capsule light brown, sublinear and terete, 1–2.8 cm, 1–2 mm in diam., puberulous, relatively thinly walled, wall often detaching at maturity, leaving columns of seeds attached to vascular strands; subsessile. Seeds in 1 or 2 rows per locule, each locule loosely enclosed in a column of spongy, light brown endocarp that disintegrates easily into 1- or 2-seeded units, light brown with dark red-brown stripes, 0.8–1.4 mm, raphe inconspicuous. Fl. May–Aug, fr. Jun–Oct.  $2n = 48^*$ .

Often common in low moist places such as paddy fields, ditches, stream banks; near sea level to 1600 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan, Korea, Russia (Amur region), Vietnam].

The fine distinction found between typical *Ludwigia epilobioides* and subsp. *greatrexi* in Japan is not apparent in other material of this species. The two taxa are therefore not separated in this treatment.

Young shoots of this species are sometimes used to feed farm animals.

## 5. *Ludwigia hyssopifolia* (G. Don) Exell, Garcia de Orta 5: 471. 1957.

草龙 cao long

*Jussiaea hyssopifolia* G. Don, Gen. Hist. 2: 693. 1832; *J. linifolia* Vahl; *J. micrantha* Kunze; *Ludwigia micrantha* (Kunze) H. Hara.

Herbs erect, annual, sometimes woody at base and perennial, often in water and then with elongate pneumatophores on submerged branches. Stems 50–300 cm tall, branched, new growth and inflorescence minutely puberulous. Petiole 3–18 mm; leaf blade lanceolate, 2–9 × 0.5–2 cm, subglabrous or puberulous, lateral veins 7–15 per side, submarginal vein inconspicuous, base narrowly cuneate, apex acuminate. Sepals 4, lanceolate, 2–4 mm, finely puberulous. Petals yellow, fading to orange-yellow, elliptic, 2–3 × 1–2 mm. Stamens 2 × as many as

sepals; anthers 0.4–0.6 mm; pollen in monads. Style 1–1.5 mm; stigma depressed-globose. Capsule cylindrical, subterete, enlarged in upper 1/6–1/3, 1.5–3 cm, finely puberulous, relatively thinly walled; subsessile. Seeds in inflated upper capsule in 2 or more rows per locule, free, pale brown, ovoid, 0.3–0.5 mm, raphe narrow; seeds in lower capsule in one row per locule, embedded in cube of relatively hard endocarp, brown, 0.7–0.9 mm, raphe ca. 1/3 width of seed. Fl. and fr. Jun–Feb.  $2n = 16^*$ .

Scattered to common in open wet often disturbed areas, stream-sides, roadside ditches, clear agricultural land, or openings in moist forests; near sea level to 800 m. Fujian, Guangdong, Guangxi, Hainan, Taiwan, Yunnan [Bangladesh, Bhutan, India, Indonesia, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Thailand, Vietnam; widespread in Africa, SE Asia, Australia, Pacific islands, South America].

**6. *Ludwigia adscendens*** (Linnaeus) H. Hara, J. Jap. Bot. 28: 291. 1953.

水龙 shui long

*Jussiaea adscendens* Linnaeus, Syst. Nat., ed. 12, 2: 297; Mant. Pl. 1: 69. 1767; *J. repens* Linnaeus.

Herbs perennial, with creeping or floating stems, rooting at nodes, with white, erect, short (1–3 cm), spindle-shaped pneumatophores in clusters at nodes of floating stems. Floating stems to 400 cm, terrestrial stems 20–60 cm, much branched, tips ascending, glabrous or densely villous. Petiole 5–20 mm; leaf blade oblong to spatulate-oblong, 0.4–7 × 0.7–3 cm, glabrous, lateral veins 6–13 per side, submarginal vein not prominent, base narrowly cuneate or attenuate, margin entire, apex obtuse to subacute. Sepals 5, deltoid-acuminate, 5–11 mm, glabrous or villous. Petals creamy-white with yellow base, obovate, 9–18 × 6–10 mm. Stamens 10; filaments white, 2.5–4 mm; anthers 0.7–1.8 mm; pollen in monads. Style white, 4–10 mm, glabrous; stigma discoid. Capsule light brown with dark brown ribs, cylindrical, terete, 1.2–2.7 cm, 3–4 mm in diam., glabrous or villous, thickly walled, tardily and irregularly dehiscent; pedicel 1.5–5.5 cm. Seeds in one row per locule, firmly embedded in coherent cubes of woody endocarp fused to capsule wall, pale brown, oblong or elliptic, 1.1–1.3 mm, raphe inconspicuous. Fl. Apr–Nov, fr. May–Nov.  $2n = 32^*$ .

Wet swampy places, flooded rice paddies, often floating in water at edges of ponds, tanks, ditches; near sea level to 1600 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Taiwan, Yunnan, Zhejiang [India, Indonesia, Japan, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand; widespread in Africa, S and SE Asia, Australia].

The plant is used medicinally for its febrifugal and antismelling properties.

**7. *Ludwigia peploides*** (Kunth) P. H. Raven subsp. ***stipulacea*** (Ohwi) P. H. Raven, Reinwardtia 6: 397. 1963.

黄花水龙 huang hua shui long

*Jussiaea stipulacea* Ohwi, J. Jap. Bot. 26: 232. 1951; *Ludwigia adscendens* (Linnaeus) H. Hara var. *stipulacea* (Ohwi) H. Hara; *L. stipulacea* (Ohwi) Ohwi.

Herbs perennial, sprawling and rooting at nodes or floating, pneumatophores usually absent on floating stems but sometimes present on stems under water. Floating stems to 300 cm,

terrestrial stems 10–60 cm, branched, ascending, glabrous. Petiole 2–35 mm; leaf blade oblong, 2.5–10 × 1–3.2 cm, lateral veins 7–11 per side, submarginal vein not prominent, base narrowly cuneate, apex acute or acuminate. Sepals 5, deltoid-acuminate, 6–12 mm, glabrous or villous. Petals bright golden-yellow with a darker spot at base, obovate, 9–17 × 5–11 mm. Stamens 10; filaments bright yellow, 2.5–5 mm; anthers pale yellow, 1–1.8 mm; pollen in monads. Style yellow, 2.5–5 mm, lower half densely long hairy; stigma depressed-globose, deeply 5-lobed. Capsule light brown, cylindrical, somewhat 5-angled, abruptly narrowed at base, scarcely narrowed at apex, 1.2–4 cm, 2–5 mm in diam., glabrous, thickly walled, tardily and irregularly dehiscent; pedicels 2–6.5 cm. Seeds in one row per locule, firmly embedded in coherent cubes of woody endocarp fused to capsule wall, pale brown, 1.1–1.3 mm, raphe inconspicuous. Fl. May–Oct, fr. Jul–Nov.  $2n = 16^*$ .

Wet swampy areas, especially along rivers, ditches, and lakes, often in disturbed and/or cultivated areas; near sea level to 300 m. Anhui, Fujian, Guangdong, Zhejiang [Japan].

*Ludwigia peploides* subsp. *peploides* is native to the S United States through W and C South America to Argentina, and is introduced on some Pacific islands. *Ludwigia peploides* subsp. *montevideensis* (Sprengel) P. H. Raven is native to S Brazil, Uruguay, Argentina, and Chile, and is introduced in the United States (California), as well as in France, Australia, and New Zealand.

**8. *Ludwigia ×taiwanensis*** C. I. Peng, Bot. Bull. Acad. Sin. 31: 344. 1990.

台湾水龙 tai wan shui long

Herbs perennial, with creeping or floating stems rooting at nodes, sometimes with white, erect, spindle-shaped pneumatophores in clusters at nodes of floating stems. Floating stems to 100 cm, terrestrial stems 20–60 cm, branched, ascending, glabrous. Petiole 5–30 mm; leaf blade narrowly elliptic to spatulate-oblong, 0.7–9.5 × 0.4–2.7 cm, glabrous, submarginal vein inconspicuous, base narrowly cuneate or attenuate, margin entire, apex rounded or obtuse. Sepals 5, narrowly triangular-lanceolate, 8–12 mm, glabrous to hirtellous. Petals pale yellow, broadly obovate, 1.3–1.8 cm × 9–12 mm. Stamens 10; filaments 2–3.5 mm; anthers shriveled, indehiscent; pollen in monads, abortive. Style 5–7 mm; stigma discoid; pedicels 1.5–6 cm. Capsules not maturing, falling soon after flowering. Seeds absent (sterile). Fl. May–Dec, fr. absent.  $2n = 24^*$ .

• Wet disturbed areas in drainage ditches, fallow and wet paddies, along river banks, swampy waste grounds, borders of ponds or reservoirs; near sea level to 500 m. Fujian, Guangdong, Guangxi, Hainan, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan.

This is the hybrid *Ludwigia adscendens* × *L. peploides* subsp. *stipulacea*.

These triploid ( $2n = 24$ ) populations of natural hybrids between *Ludwigia adscendens* ( $n = 16$ ) and *L. peploides* subsp. *stipulacea* ( $n = 8$ ) are widespread in S China (Peng, Bot. Bull. Acad. Sin. 31: 343–349. 1990; Gu et al., Cathaya 3: 37–44. 1991). Plants of this complex are very plastic vegetatively and are best distinguished by reproductive features. The color of the petals is bright yellow in *L. peploides* subsp. *stipulacea*, white with a yellow base in *L. adscendens*, and pale yellow in the hybrid. *Ludwigia ×taiwanensis*, which in the past was usually misidentified as *L. peploides* subsp. *stipulacea*, flowers profusely, but the ovary aborts and never matures as a ripe fruit. Although *L. ×taiwanensis*

is highly sterile, it readily regenerates and establishes large colonies from fragments.

**9. *Ludwigia ovalis*** Miquel, Ann. Mus. Bot. Lugduno-Batavi 3: 95. 1867.

卵叶丁香蓼 luan ye ding xiang liao

*Ludwigia palustris* (Linnaeus) Elliott var. *ovalis* (Miquel) H. Lévillé.

Herbs delicate, perennial, creeping and rooting at nodes. Stems ascending, 20–45 cm tall, branched basally, subglabrous or finely puberulous. Petiole winged, to 7 mm; leaf blade ovate, 0.5–2.5 × 0.4–2 cm, glabrous, lateral veins 4–7 per side, submarginal vein absent, base abruptly attenuate, apex acute. Se-

pals 4, deltoid-acute, 1–3 mm, very finely puberulous along margin. Petals absent. Stamens 4; filaments translucent, 0.5–0.8 mm, dilated below; anthers 0.6–0.9 mm, nearly basifixed; pollen in monads. Style green, 0.6–1 mm; stigma dark green, globose. Capsules elongate-globose, subterete, 3–5 mm, 2.5–3.5 mm in diam., finely puberulous, thinly walled, readily and irregularly loculicidal; subsessile or pedicel to 6 mm. Seeds in 2 or more rows per locule, free, reddish brown, apiculate, 0.7–0.9 mm, raphe inflated and triangular, 0.2–0.5 mm across, coarsely reticulate. Fl. Jul–Sep, fr. Jul–Oct.  $2n = 32$ .

Moist places, especially on beds of lakes and ponds; 100–500 m. Anhui, Hunan, Fujian, Guangdong, Jiangsu, Taiwan, Zhejiang [Japan, Korea].

## 2. CIRCAEA Linnaeus, Sp. Pl. 1: 9. 1753.

露珠草属 lu zhu cao shu

Chen Jiarui (陈家瑞 Chen Chia-jui); David E. Boufford

Herbs, perennial, rhizomatous, often forming large colonies. Leaves petiolate, opposite, becoming alternate and bractlike in inflorescence. Inflorescences simple or branched racemes, terminal on main stem and at apices of short axillary branches. Flowers 2-merous, with a floral tube. Sepals and petals alternate. Petals obcordate or obovate, notched at apex, white or pink. Stamens opposite sepals; nectary wholly within floral tube or elongated and projecting above opening of floral tube as a fleshy cylindrical or ringlike disk. Ovary locules 1 or 2; ovules 1 per locule; style equaling or longer than stamens, stigma 2-lobed. Fruit an indehiscent capsule, with stiff uncinuate hairs, with or without conspicuous rows of corky tissue. Seeds smooth, fusiform or broadly clavoid to narrowly ovoid, adhering ± firmly to inner ovary.  $2n = 22$ .

Eight species: temperate and boreal forests of the N hemisphere, from near sea level to 5000 m and from 10°–70° N; seven species (one endemic) and five natural hybrids (two endemic) in China.

Hybrids are common and often abundant in naturally disturbed habitats in Europe, Japan, and North America, but few gatherings of hybrids are known from China.

Ascherson and Magnus (Bot. Zeitung (Berlin) 28: 47–49, 745–787. 1870) divided *Circaea* into two groups, which they called “divisions,” based on the number of locules in the ovary. Included in their “*Uniloculares*” are *C. alpina* and *C. repens*, with all of the other species placed in “*Biloculares*.” These groups were later given sectional status by Steinberg (in Schischkin & Bobrov, Fl. URSS 15: 634. 1949). The single line of specialization, leading from the 2-loculed, outcrossing species to the 1-loculed, self-pollinating *C. alpina*, through the intermediate *C. repens*, represents a continuum that makes formal recognition of two infrageneric groups unwarranted.

Flowers, mature fruits, and carefully collected rhizomes are highly desirable to facilitate identification. The nature of the nectary is most easily determined in living plants.

1a. Locule of ovary and fruit 1; rhizomes terminated by a tuber.

2a. Petals notched to more than 1/2 their length, V-shaped; pedicels glandular pubescent; leaves with 9–15 secondary veins; combined length of mature fruit and pedicel 7.5–15 mm ..... 6. *C. repens*

2b. Petals notched to 1/2 or less their length, obovate to obtriangular, ± cordate; pedicels glabrous; leaves with 4–10 secondary veins; combined length of mature fruit and pedicel 3.5–7.8 mm ..... 7. *C. alpina*

1b. Locules of ovary and fruit 2; rhizomes without tubers.

3a. Nectary wholly included within floral tube, not projecting as a cylindrical or ringlike disk beyond opening of floral tube.

4a. Axis of inflorescence with glandular and nonglandular hairs; fruit obliquely thickly lenticular to flattened-pyriform, obliquely rounded to pedicel ..... 1. *C. cordata*

4b. Axis of inflorescence glabrous or with only glandular hairs; fruit obovoid to pyriform, not at all or only slightly flattened, tapering smoothly to pedicel ..... 2. *C. glabrescens*

3b. Nectary exerted beyond opening of floral tube, projecting as a ringlike or cylindrical fleshy disk above opening of floral tube.

5a. Petals obovate, notched to 1/5 or less their length; axis of inflorescence and pedicels glabrous ..... 5. *C. erubescens*

5b. Petals obovate to depressed broadly obovate, notched to 1/4 or more their length; axis of inflorescence and pedicels commonly pubescent; fruit with prominently thickened ribs, ribs separated by deep grooves (sulci).

6a. Stem pubescent, often densely so; leaves basally cuneate, rarely rounded; inflorescence with both glandular and falcate hairs ..... 3. *C. mollis*

- 6b. Stem glabrous or with sparse falcate hairs; leaves basally rounded to subcordate; inflorescence densely glandular pubescent, without falcate hairs ..... 4. *C. canadensis*

**1. *Circaea cordata*** Royle, Ill. Bot. Himal. Mts. 211. 1835.

露珠草 lu zhu cao

*Circaea cardiophylla* Makino; *C. ×hybrida* Handel-Mazzetti; *C. kitagawae* H. Hara.

Plants 20–150 cm tall, pubescent, usually densely so, with long, soft, spreading hairs, soft, falcately recurved hairs, and capitate and clavately tipped glandular hairs. Rhizomes not tuberous. Leaves narrowly to broadly ovate, 4–13 × 2.3–11 cm, base broadly cuneate to broadly rounded or truncate or more commonly cordate, margin denticulate to subentire, apex shortly acuminate. Racemes simple or branched near base, 2–20 cm; flowering pedicels ± clustered and perpendicular to axis of raceme, pubescent, with a minute setaceous bracteole at base. Buds with few to many, long, straight or slightly curved, rarely hooked, hairs. Floral tube 0.6–1 mm. Sepals reflexed in flower, white or pale green, ovate to broadly so, 2–3.7 × 1.4–2 mm, apex broadly to narrowly rounded to obtuse. Petals reflexed, white, ovate to broadly so, or depressed-obovate to broadly obovate, 1–2.4 × 1.2–3.1 mm, apex obcordate, apical notch 1/2–2/3 length of petal, petal lobes broadly rounded. Stamens spreading, shorter than to ca. as long as style; nectary wholly within floral tube and inconspicuous. Fruiting pedicel and mature fruit 4.4–7 mm. Fruit 3–3.9 × 1.8–3.3 mm, locules 2, obliquely obovoid to lenticular, abaxially flattened, base obliquely rounded or truncate to pedicel, with low, corky thickenings along margins and between locules, without prominent sulci. Seed 1 per locule. Fl. Jun–Aug, fr. Jul–Sep.  $2n = 22$ .

Well-drained soils in mixed deciduous, rarely boreal, forests; near sea level to 3500 m. Anhui, Gansu, Guizhou, Hebei, Henan, Heilongjiang, Hubei, Hunan, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [N India, Japan, Kashmir, Korea, Nepal, Pakistan, Russia (Far East)].

“*Circaea bodinieri*” (H. Léveillé, Bull. Acad. Int. Geogr. Bot. 22: 224. 1912) belongs here but was a provisional name and was therefore not validly published (*Vienna Code*, Art. 34.1(b)).

**2. *Circaea glabrescens*** (Pampanini) Handel-Mazzetti, Symb. Sin. 7: 604. 1933.

秃梗露珠草 tu geng lu zhu cao

*Circaea cordata* Royle var. *glabrescens* Pampanini, Nuovo Giorn. Bot. Ital. 17: 677. 1910.

Plants 12–80 cm tall, pubescent with short, soft, falcately recurved hairs, rarely glabrous. Rhizomes not tuberous. Leaves narrowly to broadly ovate, 3.7–11 × 1.8–5 cm, base rounded or rarely subcordate, margin denticulate, apex acuminate to shortly acuminate. Racemes simple or branched at base, 2–18 cm; flowering pedicel perpendicular to axis of raceme, glabrous, subtended by a setaceous bracteole. Buds commonly pubescent with a few, long, straight to slightly bent hairs, occasionally also with short uncinuate hairs. Floral tube 0.9–1.3 mm. Sepals reflexed in flower, pink or greenish white, oblong to nearly ovate, 1.8–3.3 × 1.2–1.7 mm, apex acute or obtuse. Petals pink, obovate to broadly obovate in outline, 1–1.9 × 1.3–2.6 mm, apex obcor-

date, apical notch ca. 1/2 length of petal; petal lobes broadly rounded. Stamens spreading, shorter than style; nectary wholly within floral tube and inconspicuous. Fruiting pedicel and mature fruit 4.5–8.5 mm. Fruit 2.5–3.3 × 1.6–1.8 mm thick, locules 2, 2-seeded, obovoid to pyriform, tapering smoothly to pedicel, without ribs or sulci but with a shallow groove extending from pedicel. Seed 1 per locule. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 22^*$ .

• Deciduous forests; 700–2500 m. SE Gansu, W Hubei, C and S Shaanxi, SW Shanxi, N Sichuan, Taiwan.

**3. *Circaea mollis*** Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4: 134. 1845.

南方露珠草 nan fang lu zhu cao

*Circaea coreana* H. Léveillé; *C. coreana* var. *sinensis* H. Léveillé; *C. lutetiana* Linnaeus var. *taquetii* H. Léveillé.

Plants 25–150 cm tall, pubescent with falcately recurved hairs. Rhizomes not tuberous. Leaves narrowly to broadly lanceolate to narrowly ovate, 3–16 × 2–5.5 cm, base cuneate or occasionally rounded, margin subentire to denticulate, apex attenuate to slightly acuminate. Terminal raceme branched at base, rarely simple, 1.5–4 cm to ca. 20 cm; racemes at apex of axillary branches usually simple; flowering pedicel perpendicular to axis of raceme, without or rarely with a minute setaceous bracteole at base, commonly pubescent. Buds glabrous or pubescent with crisped, straight, capitate and clavately tipped glandular hairs. Floral tube 0.5–1 mm. Sepals spreading or somewhat reflexed in flower, pale green or whitish, 1.6–2.9 × 1–1.5 mm, apex abruptly shortly acuminate to obtuse or minutely mammiform. Petals white, broadly to broadly depressed-obovate, 0.7–1.8 × 1–2.6 mm, apical notch 1/4–1/2 length of petal. Stamens normally spreading at anthesis, shorter than or occasionally equal to, rarely longer than, style; nectary conspicuous, exerted beyond floral tube. Pedicel and mature fruit 5–7 mm. Fruit narrowly to broadly pyriform or globose, 2.6–3.5 × 2–3.2 mm, with prominent ribs and deep sulci, tapering concavely and obliquely to pedicel; fruiting pedicel reflexed, often sharply so. Ovary locules 2. Seeds 2. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 22^*$ .

Deciduous forests; near sea level to ca. 2000 m. Anhui, Fujian, S Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Shandong, Sichuan, Yunnan, Zhejiang [Cambodia, India (Assam), Japan, Korea, N Laos, N Myanmar, SE Russia, N Vietnam].

**4. *Circaea canadensis*** (Linnaeus) Hill subsp. ***quadrisulcata*** (Maximowicz) Boufford, Harvard Pap. Bot. 9: 256. 2005.

水珠草 shui zhu cao

*Circaea lutetiana* Linnaeus f. *quadrisulcata* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9 [Prim. Fl. Amur.]: 106. 1859; *C. lutetiana* subsp. *quadrisulcata* (Maximowicz) Ascherson & Magnus; *C. maximowiczii* (H. Léveillé) H. Hara; *C. maximowiczii* f. *viridicalyx* (H. Hara) Kitagawa; *C. maximowiczii* var. *viridicalyx* H. Hara; *C. mollis*

Siebold & Zuccarini var. *maximowiczii* H. Léveillé; *C. quadrisulcata* (Maximowicz) Franchet & Savatier.

Plants 15–80 cm tall. Rhizomes not tuberous. Stem glabrous or rarely with sparse falcate hairs. Leaves narrowly to broadly ovate to oblong ovate, 4.5–12 × 2–5 cm, base rounded to subcordate, rarely broadly cuneate, margin denticulate, apex shortly to long acuminate. Racemes 2.5–30 cm, simple or branched at base. Flowering pedicels perpendicular to axis of raceme, with stipitate glandular hairs, without a bracteole at base. Floral tube 0.6–1 mm. Sepals reflexed, most commonly purple, 1.3–3.2 × 1–1.7 mm. Petals commonly pink, 1–2 × 1.4–2.5 mm, apical notch 1/3 to slightly more than 1/2 length of petal; nectary conspicuous, exerted beyond floral tube. Fruiting pedicel and mature fruit 5.3–8.5 mm. Fruit pyriform to subglobose, 2.2–3.8 × 1.8–3 mm, rounded, usually obliquely, to pedicel, with prominent ribs and deep sulci. Ovary locules 2. Seeds 2. Fl. Jun–Aug(–Sep), fr. Jul–Sep.  $2n = 22$ .

Cool-temperate deciduous forests and mixed deciduous-boreal forests; near sea level to ca. 1500 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Nongol, Shandong [N Japan, Korea, Russia; E Europe from vicinity of Moscow across Siberia between 50°–60° N].

Molecular and morphological analyses indicate that *Circaea lutetiana* Linnaeus is a distinct species from *C. canadensis*. *Circaea canadensis* subsp. *canadensis* occurs in E North America.

**5. *Circaea erubescens*** Franchet & Savatier, Enum. Pl. Jap. 2: 370. 1879.

谷蓼 gu liao

*Circaea delavayi* H. Léveillé; *C. kawakamii* Hayata; *C. lutetiana* Linnaeus race *erubescens* (Franchet & Savatier) H. Léveillé.

Plants 10–120 cm tall, glabrous. Rhizomes not tuberous. Leaves lanceolate to ovate or occasionally broadly ovate, 2.5–10 × 1–6 cm, base broadly cuneate to rounded or truncate, rarely subcordate, margin denticulate, apex shortly acuminate. Terminal raceme simple or more commonly branched at base, 2–20 cm, flowering pedicel perpendicular to axis of raceme, without, less commonly with, a minute, setaceous bracteole at base, bracteole usually deciduous before maturation of fruit. Buds glabrous; floral tube 0.5–0.8 mm. Sepals reflexed in flower, reddish purple, oblong to lanceolate, 0.6–2.5 × 0.8–1.2 mm, abruptly acuminate. Petals pink, narrowly to broadly obtrullate or obovate, 0.8–1.7 × 0.7–1 mm, apical notch 1/10–1/5 length of petal; petal lobes minutely crenulate or with minute secondary lobes. Stamens shorter than style; nectary exerted beyond opening of floral tube. Fruiting pedicel and mature fruit 6–12 mm. Fruit obovoid to broadly so, 1.7–3.2 × 1.2–2.1 mm, slightly flattened abaxially, tapering smoothly to pedicel, without prominent ribs or sulci, but with a narrow groove representing extension of pedicel. Ovary locules 2. Seeds 2. Fl. Jun–Sep, fr. Jul–Sep.  $2n = 22$ .

Rocky stream beds and seepages, along trails and road banks and in rich alluvial woods in temperate broad-leaved forests; near sea level to 2500 m. Anhui, Fujian, Guangdong, Guizhou, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shanxi, Sichuan, Taiwan, Yunnan, Zhejiang [Japan (except Ryukyu Islands), S Korea].

**6. *Circaea repens*** Wallich ex Ascherson & Magnus, Bot. Zeitung (Berlin) 28: 761. 1870.

匍匐露珠草 pu fu lu zhu cao

*Circaea alpina* Linnaeus var. *himalaica* C. B. Clarke.

Plants 15–100 cm tall, pubescent with falcate hairs, inflorescence with capitate and clavately tipped glandular hairs. Rhizomes with tuberous thickening at apex. Leaves narrowly to broadly ovate, rarely nearly orbicular, 1.8–9 × 1.5–5 cm, base rounded, broadly cuneate, or cordate, margin denticulate, apex acute to shortly acuminate. Inflorescence simple or branched, sometimes also with terminal racemes on upper axillary branches. Flowering pedicels perpendicular to axis of raceme or slightly ascending, with stipitate glandular hairs, with or without a minute bracteole at base. Buds sparsely pubescent, rarely glabrous; floral tube 0.4–0.8 mm. Sepals spreading to reflexed, white, green or reddish tinged, oblong to ovate, 1.8–2.5 × 1.1–1.5 mm, apex gradually rounded to obtuse or acute. Petals white or pink, broadly to narrowly obtriangular in outline, V-shaped, 1.4–2.3 × 1.3–2(–2.9) mm, apical notch 3/4 length of petal. Stamens ca. equal to or shorter than style; nectary inconspicuous, within floral tube. Fruiting pedicel and mature fruit 7.5–15 mm. Fruit narrowly to broadly clavate, 3.5–4.2 × 0.9–1.6 mm, tapering smoothly to pedicel, without prominent ribs and deep sulci, but with a shallow groove representing an extension of pedicel; locule 1, but with trace of a second locule in cross-section. Seed 1. Fl. Jul–Oct, fr. Jul–Nov.  $2n = 22$ .

Moist to wet forests, thickets, and open places; 1500–3300 m. W Hubei, Sichuan, Xizang, Yunnan [Bhutan, N India, Myanmar (one gathering), Nepal, Pakistan (one gathering)].

The fruit of *Circaea repens* often shows a trace of a second locule in cross-section, but bears only a single seed. In many ways this species is intermediate between species with one and two locules.

**7. *Circaea alpina*** Linnaeus, Sp. Pl. 1: 9. 1753.

高山露珠草 gao shan lu zhu cao

Plants 3–50 cm tall, glabrous or pubescent with short falcate hairs on stem and short glandular hairs in inflorescence. Rhizomes with tuberous thickening at apex. Leaves highly variably shaped from narrowly trullate or elliptic to nearly circular, 1–11 × 0.7–5.5(–8) cm, base narrowly cuneate to cordate, margin subentire to sharply serrate, apex acute to shortly acuminate. Terminal raceme 0.7–2 to 12(–17) cm. Flowering pedicels perpendicular to axis of raceme (in *C. alpina* subsp. *caulescens* and some plants of subsp. *angustifolia*) to ascending or erect, with or without a minute setaceous bracteole at base. Buds glabrous, rarely glabrescent; floral tube ranging from nearly absent to 0.6 mm. Sepals, spreading or slightly reflexed, white or pink, occasionally purple tinged at apex, rarely purple throughout, oblong, ovate to broadly so, or triangular-ovate, 0.8–2 × 0.6–1.3 mm, glabrous, apex rounded to obtuse or minutely mammiform. Petals white, narrowly obtriangular, obovate to broadly so to depressed-obovate, 0.5–2 × 0.6–1.9 mm, apical notch essentially lacking or to 1/2 length of petal; petal lobes rounded to truncate, rarely somewhat crenulate (in *C. alpina* subsp. *angustifolia*). Stamens erect or ascending, less commonly spreading, equaling or slightly longer than style; nectary wholly with-

in floral tube and inconspicuous. Fruiting pedicel and mature fruit 3.5–7.8 mm. Fruit clavate or obovoid, 1.6–2.7 × 0.5–1.2 mm, tapering smoothly to pedicel, locule 1, seed 1, without ribs or sulci, but pedicel extending as a shallow groove along upper surface.  $2n = 22$  (unknown in *C. alpina* subsp. *micrantha*).

Forests, thickets, grassy alpine areas, cool, moist, and wet places, on moss-covered rocks and logs; near sea level to 5000 m. Anhui, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Jiangxi, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [NE Afghanistan, Bhutan, India, Japan, Kazakhstan, Korea, Mongolia, N Myanmar, Nepal, Russia, Thailand, NW Vietnam; circumboreal in forests between 30°–65° N, but restricted to high elevations at lower latitudes].

*Circaea alpina* is a facultatively inbreeding complex of six subspecies, each exhibiting different geographic or ecological preferences but with areas of overlap between two or more subspecies in parts of their range. The subspecies form a reticulate pattern of morphologically intergrading populations, some of which are separated only by seemingly minute differences. Other subspecies, were it not for the numerous intermediate plants, appear so dissimilar that some might recognize them as separate species, as has often been done in the past. Five subspecies are in China.

- 1a. Inflorescences elongating as or before flowers open; flowers ± loosely spaced; lower flower-bearing pedicels perpendicular to raceme axis at anthesis.
  - 2a. Pedicels without a minute bracteole at base, or bracteole represented by a darkened gland; leaves ovate to broadly so, base rounded, truncate, or subcordate; hairs on fruit translucent ..... 7a. subsp. *caulescens*
  - 2b. Pedicels with a minute bracteole at base; leaves elliptic to trullate or ovate, base narrowly to broadly cuneate; hairs on fruit containing purple pigment ..... 7b. subsp. *angustifolia*
- 1b. Inflorescences elongating after flowers open; flowers clustered and corymbose at summit of raceme; pedicels erect or ascending at anthesis.
  - 3a. Stem glabrous.
    - 4a. Ovary minutely pubescent at anthesis; petals conspicuously notched, notch 1/4–1/2 length of petal ..... 7d. subsp. *alpina*
    - 4b. Ovary glabrous at anthesis; petals emarginate or barely notched, notch less than 1/5 length of petal ..... 7e. subsp. *micrantha*
  - 3b. Stem pubescent, with at least a few, soft, falcate hairs.
    - 5a. Leaves thin, pale green, translucent; ovary glabrous at anthesis; petals emarginate or barely notched ..... 7e. subsp. *micrantha*
    - 5b. Leaves thick, deep green or reddish, opaque; ovary pubescent with hooked hairs at anthesis; petals clearly notched to ca. 1/2 their length.

- 6a. Leaves elliptic to trullate, base narrowly to broadly cuneate ..... 7b. subsp. *angustifolia*
- 6b. Leaves ovate, base rounded to subcordate, rarely broadly cuneate ..... 7c. subsp. *imaicola*

**7a. *Circaea alpina* subsp. *caulescens*** (Komarov) Tatewaki, Veg. Shikotan Is. 44. 1940.

深山露珠草 shen shan lu zhu cao

*Circaea alpina* var. *caulescens* Komarov, Fl. Manshur. 3: 99. 1905; *C. alpina* var. *pilosula* (H. Hara) H. Hara; *C. caucasica* A. K. Skvortsov; *C. caulescens* (Komarov) Nakai ex H. Hara; *C. caulescens* var. *pilosula* H. Hara; *C. caulescens* var. *robusta* Nakai ex H. Hara; *C. ×dubia* H. Hara var. *makinoi* H. Hara.

Plants 5–35 cm tall. Stem pubescent. Leaves opaque, ovate to broadly ovate to nearly deltoid, 1.2–4.5 × 0.6–3.5 cm, base rounded to truncate or cordate, margin shallowly to prominently dentate, apex acute to shortly acuminate. Inflorescence glabrous or rarely with sparse glandular hairs; pedicels ascending or diverging perpendicular to axis of raceme at anthesis, glabrous, with a minute bracteole at base or more commonly bracteole absent and represented by a short glandular process; flowers opening during or after elongation of raceme and ± widely spaced. Buds glabrous; ovary with uncinata hairs at anthesis; floral tube 0.2–0.4 mm. Sepals narrowly to broadly ovate or oblong-ovate, apex rounded to obtuse or rarely minutely mammiform. Petals white or pink, obovate to depressed-obovate or obdeltoid, apical notch 1/3–1/2 length of petal; petal lobes rounded. Uncinate hairs of fruit unpigmented. Fl. Jun–Sep, fr. Jul–Sep.  $2n = 22$ .

Moist places, on moss-covered rocks and logs and in drier soils in cool-temperate deciduous and mixed forests and lower part of boreal forests; near sea level to 1500 m. Anhui, Hebei, Heilongjiang, Jilin, Liaoning, Shandong, Shanxi [Japan, Korea, Mongolia, Russia (Far East, also disjunct on S shore of Lake Baikal and in Altai mountains); SW Asia (Caucasus)].

**7b. *Circaea alpina* subsp. *angustifolia*** (Handel-Mazzetti) Boufford, Ann. Missouri Bot. Gard. 69: 910. 1983 [“1982”].

狭叶露珠草 xia ye lu zhu cao

*Circaea imaicola* (Ascherson & Magnus) Handel-Mazzetti var. *angustifolia* Handel-Mazzetti, Symb. Sin. 7: 603. 1933; *C. imaicola* var. *mairei* (H. Léveillé) Handel-Mazzetti; *C. lutetiana* Linnaeus var. *mairei* H. Léveillé; *C. pricei* Hayata var. *mairei* (H. Léveillé) Handel-Mazzetti.

Plants 7–35 cm tall. Stem pubescent. Leaves opaque, elliptic, trullate, broadly trullate, or ovate, rarely broadly ovate, 1.4–4.5 × 0.6–3 cm, base narrowly to broadly cuneate, margin shallowly denticulate, apex acute. Inflorescence simple or with lateral racemes at base, glabrous or pubescent, with short glandular hairs; pedicels ascending or diverging perpendicular to axis of raceme at anthesis, glabrous or, rarely, sparsely pubescent with short glandular hairs; flowers opening during or after elongation of raceme and ± widely spaced, with a setaceous bracteole at base. Buds glabrous; ovary with uncinata hairs at anthesis.

sis; floral tube 0.2–0.3 mm. Sepals broadly to broadly ovate or oblong-ovate, apex rounded to obtuse. Petals white or pink, narrowly to broadly obovate, apical notch 1/5–1/3 length of petal; petal lobes rounded, truncate, or minutely crenulate. Uncinate hairs of fruit containing purple pigment. Fl. Jul–Sep(–Oct), fr. Aug–Nov.  $2n = 22^*$ .

• Moist open areas, thickets and forests in mountains; 2000–3600 m. Sichuan, Xizang, Yunnan.

**7c. *Circaea alpina* subsp. *imaicola*** (Ascherson & Magnus) Kitamura, Fl. Afghanistan 279. 1960.

高原露珠草 gao yuan lu zhu cao

*Circaea alpina* var. *imaicola* Ascherson & Magnus, Bot. Zeitung (Berlin) 28: 749. 1870; *C. hohuanensis* S. S. Ying; *C. imaicola* (Ascherson & Magnus) Handel-Mazzetti; *C. minutula* Ohwi; *C. pricei* Hayata; *C. taiwaniana* S. S. Ying.

Plants 3.5–45 cm tall. Stem densely to sparsely pubescent. Leaves ovate to broadly ovate, less commonly orbicular-ovate, 2–7 × 1.4–4.5 cm, base truncate or rounded, less often broadly cuneate to subcordate, margin subentire to occasionally prominently dentate, apex acute to shortly acuminate. Inflorescence simple or branched, pubescent with short glandular hairs, less commonly glabrous; flowering pedicel erect or ascending, glabrous; flowers clustered at apex of raceme and opening before elongation of raceme axis, with a minute setaceous bracteole at base. Buds glabrous, rarely glabrescent; ovary with uncinat hairs at anthesis; floral tube nearly absent to 0.3 mm. Sepals oblong to ovate, apex rounded to obtuse. Petals white or pink, narrowly to broadly obovate in outline, apical notch 1/4–1/2 length of petal; petal lobes rounded. Uncinate hairs of fruit unpigmented. Fl. Jul–Sep(–Oct), fr. Aug–Nov.  $2n = 22^*$ .

Cool moist places along streams, thickets, deciduous and coniferous forests in mountains; (1500–)2000–4000 m. Anhui, Gansu, Guizhou, Henan, Hubei, Jiangxi, Qinghai, Shaanxi, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [NE Afghanistan, Bhutan, India, N Myanmar, Nepal, Thailand, NW Vietnam].

**7d. *Circaea alpina* subsp. *alpina***

露珠草(原亚种) lu zhu cao (yuan ya zhong)

*Circaea caulescens* (Komarov) Nakai ex H. Hara var. *glabra* H. Hara; *C. caulescens* f. *ramosissima* H. Hara; *C. caulescens* var. *rosulata* H. Hara; *C. lutetiana* race *alpina* (Linnaeus) H. Léveillé; *C. lutetiana* subsp. *alpina* (Linnaeus) H. Léveillé.

Plants 3–30 cm tall. Stem glabrous, sometimes with glan-

dular hairs in inflorescence. Leaves translucent, ovate to broadly so, rarely nearly circular in outline, base cordate to subcordate, less commonly truncate or rounded, margin conspicuously dentate, apex shortly acuminate to acute. Inflorescence simple or with lateral racemes from base, glabrous to densely pubescent with short glandular hairs; flowering pedicel ascending or erect, glabrous, with a setaceous bracteole at base; flowers opening before elongation of raceme and clustered at its apex. Buds glabrous; floral tube nearly absent to 0.5 mm. Sepals oblong to ovate, sometimes broadly so, apex rounded to obtuse or minutely mammiform. Petals white, obtriangular to obovate, apical notch, 1/4–1/2 length of petal; petal lobes rounded. Uncinate hairs of fruit unpigmented. Fl. Jun–Aug(–Sep), fr. Jul–Sep.  $2n = 22$ .

Moist to wet places, on moss-covered rocks and logs; near sea level to 2500 m. Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Shanxi [Japan, Kazakhstan, Korea, Mongolia, Russia; circumboreal in forests between 30°–65° N, but restricted to high elevations at lower latitudes].

**7e. *Circaea alpina* subsp. *micrantha*** (A. K. Skvortsov) Boufford, Ann. Missouri Bot. Gard. 69: 959. 1983 ["1982"].

高寒露珠草 gao han lu zhu cao

*Circaea micrantha* A. K. Skvortsov, Byull. Glavn. Bot. Sada (Moscow) 103: 36. 1977.

Plants 4–25 cm tall. Stem glabrous or minutely pubescent, rarely densely pubescent. Leaves translucent, narrowly ovate to broadly triangular, (1–)2–6.5 × 0.8–4 cm, base cordate, less often truncate, margin sharply dentate to serrate, apex acute or shortly acuminate. Inflorescence a simple raceme or with 1 or 2, rarely more, lateral racemes arising from base, densely to sparsely pubescent with glandular hairs; flowering pedicel ascending or erect, glabrous or glandular pubescent, basally with a setaceous bracteole; flowers opening before elongation of raceme and clustered at its tip. Buds glabrous; ovary glabrous or rarely with minute uncinat hairs at anthesis; floral tube nearly absent to 0.4 mm. Sepals ovate to broadly ovate to oblong ovate, apex rounded or minutely mammiform. Petals white or pink, obtriangular to obovate, apical notch absent or to 1/5 length of petal; petal lobes, when present, truncate to rounded. Uncinate hairs of fruit unpigmented or occasionally with purple pigment. Fl. Jun–Sep(–Oct), fr. Jul–Nov. Chromosome number unknown.

Moist thickets and coniferous forests, grassy alpine areas; 3100–5000 m. Gansu, Sichuan, Xizang, Yunnan [Bhutan, N India, N Myanmar, Nepal].

### Hybrids

Hybrids in *Circaea* are common and abundant in Europe, North America, and Japan, but remarkably uncommon on the Asian mainland, even though the greatest number of taxa in the genus occurs in China, and many of them have sympatric ranges. The hybrids are usually intermediate between their parents. They occur most frequently in naturally disturbed places, such as the floodplains of rivers and streams. The ease with which they form colonies from rhizomes no doubt explains their abundance outside of China, despite their almost total sexual sterility. Hybrids that do occur in China are the following.

***Circaea* × *dubia*** H. Hara, Bot. Mag. (Tokyo) 50: 306. 1936.

可疑露珠草 ke yi lu zhu cao

This is the hybrid *Circaea cordata* × *C. erubescens* and is

intermediate between the parents. The flowers have the exerted nectary of *C. erubescens* and usually at least a few of the long, spreading hairs of *C. cordata*. They also resemble *C. cordata* in being more robust, in leaf shape and in having more closely

spaced flowers at anthesis. Although the petals are more like those of *C. cordata* in shape, they are often pink as in *C. erubescens*.

Disturbed areas, commonly along streams, in broad-leaved deciduous forests. Near sea level to 1500 m. NE China ("Manchuria, 1941" without further data) [Japan].

***Circaea* × *skvortsovii*** Boufford, Ann. Missouri Bot. Gard. 69: 965. 1983 ["1982"].

北方露珠草 bei fang lu zhu cao

This is the hybrid *Circaea canadensis* subsp. *quadrisulcata* × *C. cordata* and is most obviously intermediate between the parents in degree and the nature of pubescence and in the morphology of the flower parts. It is similar to *C. cordata* in having sporadic, long, sharply pointed, straight or slightly curved spreading hairs on various parts of the plant and in having a pubescent stem. It is similar to *C. canadensis* subsp. *quadrisulcata* in the color of the buds, sepals, and petals and in the presence of a low, exserted nectary projecting beyond the opening of the floral tube. It also has the densely glandular inflorescence of *C. canadensis* subsp. *quadrisulcata*, but the closely spaced flowers and petal shape of *C. cordata*.

Disturbed habitats; near sea level (upper elevation unknown). Hebei, also "Manchuria, Kori-mon" [Japan].

***Circaea* × *ovata*** (Honda) Boufford, Ann. Missouri Bot. Gard. 69: 968. 1983 ["1982"].

卵叶露珠草 luan ye lu zhu cao

*Circaea quadrisulcata* (Maximowicz) Franchet & Savatier var. *ovata* Honda, Bot. Mag. (Tokyo) 46: 3. 1932.

This is the hybrid *Circaea cordata* × *C. mollis* and is morphologically intermediate between the parents. It resembles *C.*

*cordata* in the long, recurved and straight, sharply pointed hairs on some parts of the plant, but is similar to *C. mollis* in having an exserted, ringlike nectary and darkened stem nodes.

Disturbed areas in broad-leaved deciduous forests; below 100–1500 m. Sichuan, Yunnan [Japan, S Korea].

***Circaea* × *taronensis*** H. Li, Fl. Yunnan. 4: 157. 1986.

贡山露珠草 gong shan lu zhu cao

Known only from the type, this is the hybrid *Circaea alpina* subsp. *imaicola* × *C. cordata* and is intermediate between the two parents in overall appearance. Some leaves with the base rounded to cordate are like those in *C. alpina* subsp. *imaicola*, but some leaves on the upper portion of the stem have the base cordate as in *C. cordata*. The pubescence is more dense than in *C. alpina* subsp. *imaicola* but with fewer of the long, straight trichomes of *C. cordata*.

- Moist forests; ca. 1800 m. NW Yunnan (Gongshan).

***Circaea alpina*** Linnaeus subsp. ***imaicola*** (Ascherson & Magnus) Kitamura × ***C. repens*** Wallich ex Ascherson & Magnus

西南露珠草 xi nan lu zhu cao

Plants that appear to be hybrids between *Circaea alpina* subsp. *imaicola* and *C. repens* are like *C. repens* in stature. The flowers are smaller and more closely spaced than in *C. repens* and are borne on ascending, minutely glandular pubescent pedicels. In *C. repens*, the petioles are glandular pubescent and most commonly spread at right angles to the raceme axis at anthesis. The hybrids have deeply notched petals, as in *C. repens*, but which are often broader, as in some plants of *C. alpina* subsp. *imaicola*.

- Habitat unknown, but presumably in disturbed shaded places; 1800–3200 m. Sichuan, Yunnan.

### 3. CHAMERION (Rafinesque) Rafinesque ex Holub, Folia Geobot. Phytotax. 7: 85. 1972.

柳兰属 liu lan shu

Chen Jiarui (陈家瑞 Chen Chia-jui); Peter C. Hoch, Peter H. Raven

*Epilobium* subg. *Chamerion* Rafinesque, Amer. Monthly Mag. & Crit. Rev. 2: 266. 1818.

Herbs perennial, erect, usually clumped, with shoots from woody caudex or spreading lateral roots. Stems simple or rarely branched, pubescent to subglabrous, hairs always eglandular. Leaves spirally arranged, rarely subopposite or subverticillate, subleathery, basal ones sessile, upper ones usually petiolate; stipules absent; bracteoles absent. Inflorescence a simple raceme or spike, rarely branched. Flowers 4-merous, slightly zygomorphic, strongly protandrous, lacking a floral tube, producing nectar from raised disk at base of style and stamens. Petals pink to rose-purple, rarely white, obcordate or obovate, entire. Stamens 8, subequal in single whorl, erect at onset of anthesis, later reflexed; pollen blue or yellow, shed in monads. Style initially deflexed, becoming erect as stigma deflexes; stigma deeply 4-lobed and revolute, receptive on inner surfaces. Fruit an elongate capsule, slender, 4-loculed, loculidical. Seeds many, with terminal coma of silky hairs.  $2n = 36, 72, 108$ .

Eight species: montane to arctic N hemisphere, widespread in Asia and Europe, barely reaching N Africa, and in North America south to the high mountains of C Mexico; four species in China.

The species occur primarily in moist, rocky areas in high-montane regions, with one species (*Chamerion angustifolium*) more widespread in disturbed, temperate habitats.

Raven (Ann. Missouri Bot. Gard. 63: 326–340. 1977 ["1976"]) divided this group into two subsections under *Epilobium* sect. *Chamaenerion* Tausch, elevated to sections by Holub (Folia Geobot. Phytotax. 7: 81–90. 1972), with *Chamerion* sect. *Rosmarinifolium* (Taciik) Holub occurring in SW Asia and Europe, and *C.* sect. *Chamerion*, the only section found in China, widespread in the N hemisphere. Although sometimes included within *Epilobium*, *Chamerion* forms a well-differentiated sister group to that genus, based on both morphological and molecular evidence.

- 1a. Bracts much smaller than cauline leaves, leathery, sublinear; leaves linear to lanceolate, with distinct submarginal vein; seeds with inconspicuous chalazal collar (less than 0.05 mm) ..... 4. *C. angustifolium*
- 1b. Bracts ca. as long as cauline leaves, foliaceous, lanceolate to elliptic; leaves narrowly ovate or elliptic to lanceolate-elliptic, lacking submarginal vein; seeds with distinct chalazal collar (more than 0.08 mm).
- 2a. Style glabrous; stems subglabrous to sparsely strigillose, only rarely densely strigillose; seeds 1.2–2.1 mm; primary leaf veins obscure ..... 1. *C. latifolium*
- 2b. Style pubescent on lower half; stems densely strigillose; seeds 1–1.3 mm; primary leaf veins distinct.
- 3a. Secondary leaf veins conspicuously reticulate or anastomosing; plants 30–120 cm tall; sepals 11–15 mm; petals 8–14 mm; fruiting pedicels 1.5–5 cm ..... 3. *C. conspersum*
- 3b. Secondary leaf veins obscure, not conspicuously anastomosing; plants 20–45 cm tall; sepals 15–20 mm; petals 17–25 mm; fruiting pedicels 1–3 cm ..... 2. *C. speciosum*

**1. *Chamerion latifolium*** (Linnaeus) Holub, *Folia Geobot. Phytotax.* 7: 86. 1972.

宽叶柳兰 kuan ye liu lan

*Epilobium latifolium* Linnaeus, *Sp. Pl.* 1: 347. 1753; *Chamaenerion latifolium* (Linnaeus) Franchet & Lange; *E. changaicum* Grubov; *E. kesamitsui* Yamazaki.

Herbs perennial, erect, clumped, with a thick woody rhizome and wiry mass of roots. Stems 12–35 cm tall, glabrous below to sparsely or rarely densely strigillose on upper stem and inflorescence. Leaves sessile or petioles to 2 mm; basal leaf blade brown, triangular-ovate, 5–10 mm, submembranous; cauline blade green or pale green, elliptic or ovate to lanceolate-elliptic, 2–5(–8) × 0.6–1.7(–2.6) cm, subglabrous or strigillose, especially on veins, lateral veins obscure, 3 or 4 per side, base cuneate or sometimes subobtusate, margin subentire to remotely punctate-denticulate with 4–7 teeth, apex obtuse or acuminate. Bracts ca. 1/2 as long as cauline leaves, foliaceous. Inflorescence sparsely to moderately strigillose. Flowers erect in bud, nodding at early anthesis. Sepals 1–1.6 cm × 1.5–3.5 mm. Petals rose-purple or pink, 1–2.4(–3.2) cm × 7–15(–23) mm. Ovary purplish green, 1–2 cm, densely canescent; style 3.5–8 mm, glabrous. Capsules 2.5–8 cm, strigillose; pedicels 1.2–2.5 cm. Seeds 1.2–2.1 × 0.4–0.6 mm, irregularly low-reticulate, with distinct chalazal collar 0.1–0.12 mm; coma tawny or dingy, 9–15 mm, not readily deciduous. Fl. Jun–Aug, fr. Aug–Oct.  $2n = 36, 72$ .

Moist gravelly areas along rivers and in mountains; 1600–5200 m. Qinghai, Xinjiang, Xizang, NW Yunnan [Afghanistan, Bhutan, India, Japan, Mongolia, Nepal, Pakistan, Russia (Amur region, Siberia), Tajikistan; C and SW Asia, Europe, North America (including Greenland)].

Populations of this species occur mainly in two disjunct areas in China: the Tian Shan–Altay–Pamir region of Xinjiang, and the E Himalayan region of Xizang and Yunnan (with one outlier in Qinghai). There are some morphological differences in pubescence, leaf margin and veins, and pollen size and number of pores between populations from the two regions, which may be correlated with ploidy levels, those from Xinjiang apparently being diploid and those from SW China being tetraploid. However, more chromosome counts and further careful analyses of populations are needed to clarify this situation.

**2. *Chamerion speciosum*** (Decaisne) Holub, *Folia Geobot. Phytotax.* 7: 86. 1972.

喜马拉雅柳兰 xi ma la ya liu lan

*Epilobium speciosum* Decaisne in Jacquemont, *Voy. Inde* 4(Bot.): 57. 1844; *E. latifolium* Linnaeus subsp. *speciosum* (Decaisne) P. H. Raven.

Herbs perennial, erect, clumped, with a thick, woody rhizome. Stems 20–45 cm tall, densely strigillose throughout, especially on inflorescence. Leaves sessile, or petioles to 2 mm; basal leaf blade brownish green, triangular-ovate to lanceolate, 1–2 cm, submembranous; cauline blade pale green or brown when dry, narrowly ovate to lanceolate-elliptic, 3.5–7.5 × 0.7–1.8(–3) cm, both surfaces strigillose, lateral veins distinct, 3–5 per side, base cuneate, margin remotely punctate-denticulate with 7–15 teeth per side, apex acute, acuminate, or sometimes subobtusate. Bracts ca. 1/2 as long as cauline leaves. Inflorescence densely strigillose. Flowers erect in bud, nodding at early anthesis. Sepals 1.5–2 cm × 3–5 mm. Petals purplish red or rose, 1.7–2.5 × 1.2–2.2 cm. Ovary purplish green, 1.7–2.5 cm, densely canescent; style 5–7 mm, lower half villous. Capsules 5–9 cm, strigillose; pedicels 1–3 cm. Seeds 1.2–1.3 × 0.4–0.6 mm, irregularly low-reticulate; coma tawny, 1–1.3 cm, not readily deciduous. Fl. Aug–Sep, fr. Sep–Oct. Chromosome number unknown.

Moist gravelly or sandy soils, scree slopes in mountains; 3900–4500 m. Xizang [India, Nepal, Pakistan; endemic to Himalayan region].

**3. *Chamerion conspersum*** (Haussknecht) Holub, *Folia Geobot. Phytotax.* 7: 86. 1972.

网脉柳兰 wang mai liu lan

*Epilobium conspersum* Haussknecht, *Oesterr. Bot. Z.* 29: 51. 1879; *Chamaenerion conspersum* (Haussknecht) Kitamura; *C. reticulatum* (C. B. Clarke) Kitamura; *E. reticulatum* C. B. Clarke.

Herbs perennial, robust, with a somewhat woody rhizome. Stems 30–120 cm tall, densely strigillose throughout. Leaves sessile or petioles to 3 mm; basal leaf blade narrowly triangular to narrowly lanceolate, 8–10 mm; cauline blade pale green abaxially, dark green adaxially, narrowly oblong or elliptic-lanceolate, 4.5–11 × 0.7–1.4 cm, both surfaces strigillose, lateral veins distinct, 4 or 5 per side, secondary veins conspicuous, anastomosing, base cuneate, margin often revolute, denticulate with 15–35 teeth per side, apex acuminate. Bracts somewhat less than 1/2 as long as cauline leaves. Inflorescence densely strigillose. Flowers suberect in bud, nodding at early anthesis. Sepals 1.1–1.5 cm × 3–5 mm. Petals rose-purple, 8–14 × 6–13 mm. Ovary purplish green, 1–2 cm, densely canescent; style 5–8 mm, lower half densely villous. Capsules 2.5–7.5 cm, strigillose; pedicels 1.5–5 cm. Seeds 1–1.2 × 0.4–0.5 mm, low papillose to reticulate, with distinct chalazal collar 0.08–0.1 mm; coma tawny, 1–1.2 cm, not readily deciduous. Fl. Jul–Sep, fr. Sep–Oct.  $2n = 36$ .

Open, moist gravel beds, sandy streambeds, talus ridges; 2300–4700 m. Qinghai, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, NE India (Sikkim), Myanmar, Nepal].

Some morphologically intermediate populations appear to be hybrids between this species and *Chamerion angustifolium* or *C. speciosum* in areas where these species overlap. More analyses are needed to verify these observations.

**4. *Chamerion angustifolium*** (Linnaeus) Holub, Folia Geobot. Phytotax. 7: 86. 1972.

柳兰 liu lan

Herbs perennial, erect, forming large clones by vigorous soboles from a woody caudex or by long lateral roots. Stems 20–200 cm tall, glabrous to densely strigillose especially on inflorescence. Leaves sessile or petioles to 7 mm; basal leaf blade scalelike below ground, lanceolate-oblong to obovate, 0.5–2 cm; cauline blade green, linear to lanceolate, 3–23 × 0.3–3.4 cm, glabrous throughout or abaxially strigillose on midvein, lateral veins 10–25 per side, confluent to submarginal vein, base obtuse or cuneate to attenuate, margin entire or scarcely denticulate, apex attenuate-acute. Bracts much smaller than cauline leaves. Inflorescence glabrous or strigillose. Flowers nodding in bud, suberect at anthesis. Sepals 6–19 × 1.5–3 mm. Petals pale pink to purple or rarely white, 9–25 × 3–15 mm. Ovary 0.6–2.5 cm, densely canescent; style 8–16 mm, lower part villous. Capsules 4–9.5 cm, densely appressed-canescenscent; pedicels 0.5–3 cm. Seeds 0.9–1.3 × 0.3–0.45 mm, irregularly reticulate, with indistinct chalazal collar; coma dingy or white, 1–1.7 cm, not easily detaching.

Moist often disturbed places; near sea level to 4700 m. Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, Bhutan, India, Japan, Korea, Mongolia, Myanmar, Nepal, Pakistan, Russia; N Africa, C, N, and SW Asia, Europe, North America].

- 1a. Leaves abaxially glabrous on midvein, (3–)7–14(–18.5) × (0.3–)0.7–1.3(–2.5) cm, base obtuse or subrounded, margin subentire, subsessile; stems subglabrous, petals 9–15(–19) × 3–9(–11) mm ..... 4a. subsp. *angustifolium*
- 1b. Leaves abaxially usually pubescent on midvein, (6–)9–23 × (0.7–)1.5–3.4 cm, base cuneate, margin denticulate, petioles 2–7 mm; stems strigillose at least above; petals 14–25 × 7–15 mm ..... 4b. subsp. *circumvagum*

**4a. *Chamerion angustifolium* subsp. *angustifolium***

柳兰(原亚种) liu lan (yuan ya zhong)

*Epilobium angustifolium* Linnaeus, Sp. Pl. 1: 347. 1753; *Chamaenerion angustifolium* (Linnaeus) Scopoli; *C. angustifolium* var. *album* Yue Zhang & J. Y. Ma; *E. neriifolium* H. Léveillé; *E. spicatum* Lamarck.

Stems 20–130 cm tall, subglabrous. Leaves subsessile; cauline blade linear-lanceolate or narrowly lanceolate, (3–)7–14(–18.5) × (0.3–)0.7–1.3(–2.5) cm, glabrous throughout, lateral veins often indistinct but submarginal vein distinct, base obtuse to cuneate, margin subentire to obscurely denticulate, somewhat revolute. Inflorescence subglabrous. Sepals 6–15 mm. Petals 9–15(–19) × 3–9(–11) mm. Capsules 4–8 cm; pedicels 0.5–1.9 cm. Seeds 0.9–1 mm. Fl. Jul–Sep, fr. Aug–Oct. *2n* = 36\*.

Moist often disturbed places in mountains, 500–4700 m. Gansu, Hebei, Heilongjiang, Jilin, Nei Mongol, Ningxia, Qinghai, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, Bhutan, India, Japan, Korea, Myanmar, Nepal, Pakistan, Russia; C, N, and SW Asia, Europe, North America].

**4b. *Chamerion angustifolium* subsp. *circumvagum*** (Mosquin) Hoch, Fl. Japan 2c: 241. 1999.

毛脉柳兰 mao mai liu lan

*Epilobium angustifolium* subsp. *circumvagum* Mosquin, Brittonia 18: 167. 1966; *Chamaenerion angustifolium* subsp. *circumvagum* (Mosquin) Moldenke; *C. angustifolium* var. *platyphyllum* Daniels.

Stems 30–200 cm tall, glabrous below, sparsely strigillose throughout upper stem and inflorescence. Leaves with petioles 2–7 mm; cauline blade oblong- or elliptic-lanceolate, (6–)9–23 × (0.7–)1.5–3.4 cm, sparsely strigillose adaxially, with strigillose leaf midvein especially abaxially, lateral and submarginal veins distinct, base subcuneate to attenuate, margin ± denticulate, flat or scarcely revolute. Inflorescence strigillose. Sepals 9–19 mm. Petals 14–25 × 7–15 mm. Capsules 5–9.5 cm; pedicels 1–3 cm. Seeds 1–1.3 mm. Fl. Jul–Sep, fr. Aug–Oct. *2n* = 72, 108\*.

Moist often disturbed places in mountains; near sea level to 3600(–4400) m. Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Xizang, Yunnan [Afghanistan, Bhutan, India, Japan, Korea, Myanmar, Nepal, Pakistan, Russia; N Africa, C, N, and SW Asia, Europe, North America].

**4. EPILOBIUM** Linnaeus, Sp. Pl. 1: 347. 1753.

柳叶菜属 liu ye cai shu

Chen Jiarui (陈家瑞 Chen Chia-jui); Peter C. Hoch, Peter H. Raven

*Boisduvalia* Spach; *Chamaenerion* Séguier; *Zauschneria* Presl.

Herbs perennial [or annual, sometimes suffrutescent], with leafy rosettes, stolons, soboles (shoots), or turions (subterranean globose buds with fleshy scales). Stems glabrous to pubescent, often with lines of hairs decurrent from margins of petioles. Leaves

opposite, becoming alternate and bractlike in inflorescence; petiolate or sessile; stipules absent; bracteoles absent. Inflorescences simple or branched racemes, panicles, spikes, or corymbs. Flowers 4-merous, often protandrous, with floral tube, producing nectar at base of style. Petals pink to rose-purple or white [or rarely cream-colored or orange-red], obovate or obtrullate, notched at apex. Stamens 8, in two unequal whorls; pollen yellow, shed in tetrads. Style erect; stigma entire or 4-lobed. Fruit an elongate, slender capsule, 4-loculed, loculicidal. Seeds many [or rarely only 4], generally with terminal coma of silky hairs [or coma rarely lacking].  $2n = [18, 20, 24, 26, 28, 30, 32,] 36, [38, 60]$ .

About 165 species: montane, boreal, and/or arctic regions of Africa, Asia, Australasia, Europe, and North and South America, from sea level to 5000 m, often in moist, disturbed places: 33 species (nine endemic) in China.

The genus is divided into seven sections, all present in North America but only one, *Epilobium* sect. *Epilobium*, in China, where the species occur in most temperate to montane habitats except extreme deserts or warm, subtropical forests.

Careful gathering of ripe seeds and perennating structures, usually at or just below the ground surface, facilitate identification. The pattern of vestiture on stems, also extremely valuable for identification, is sometimes obscure on specimens collected very late in the growing season.

- 1a. Stigma deeply 4-lobed (rarely shallowly so in *E. blinii*).
- 2a. Stems (18–)30–120(–250) cm tall, with long spreading and short erect glandular hairs; leaves 3–12 cm, subacute to acuminate, with (15–)20–60 teeth per side; seeds 0.8–1.2 mm, coarsely papillose.
- 3a. Leaves clasping; petals (7–)10–20 mm; stigma exerted beyond anthers at anthesis ..... 1. *E. hirsutum*
- 3b. Leaves subsessile but not clasping; petals 5–8 mm; stigma surrounded by anthers of longer stamens at anthesis ..... 2. *E. parviflorum*
- 2b. Stems 3–25(–45) cm tall, strigillose; leaves 0.8–3 cm, obtuse, with 3–7 indistinct teeth per side; seeds 1.2–1.8 mm, finely papillose or reticulate.
- 4a. Loosely matted herb, stems 3–18 cm tall, branched; leaf petioles 1–3 mm; petals 1.6–3.1 cm; fruiting pedicels 4–7 mm; seeds reticulate; Taiwan ..... 4. *E. nankotaizanense*
- 4b. Ascending or erect herb, stems 10–25(–45) cm tall, usually simple; leaves subsessile; petals 1–1.5 cm; fruiting pedicels 15–35 mm; seeds finely papillose; SW China ..... 3. *E. blinii*
- 1b. Stigma entire or shallowly emarginate.
- 5a. Stems pubescent throughout, either lacking raised pubescent lines decurrent from margins of petioles, or lines inconspicuous.
- 6a. Plants forming short basal shoots (soboles), often clumped; stems occasionally with persistent basal scales.
- 7a. Inflorescence variously pubescent, but without glandular hairs.
- 8a. Ovary white canescent; seeds with conspicuous chalazal collar; leaves oblong-lanceolate to narrowly ovate, 2–7 cm ..... 29. *E. minutiflorum*
- 8b. Ovary strigillose, not white canescent; seeds with inconspicuous chalazal collar; leaves sublinear to elliptic or lanceolate, 1–4.5 cm.
- 9a. Plants erect, loosely clumped or not clumped; stems mostly well-branched throughout; leaves 1–4.5 cm, linear to narrowly lanceolate ..... 10. *E. platystigmatosum*
- 9b. Plants ascending, forming distinct clumps or mats; stems simple or branched only from base; leaves 1–2 cm, elliptic to lanceolate ..... 11. *E. hohuanense*
- 7b. Inflorescence variously pubescent, but always with glandular hairs, especially on inflorescence.
- 10a. Mid-cauline and upper leaves with distinct petioles 2–7 mm, and with narrowly cuneate bases ..... 13. *E. royleanum*
- 10b. Mid-cauline and upper leaves subsessile or with petioles to 2 mm, and with subcordate, rounded, or broadly cuneate bases.
- 11a. Leaves subentire, lanceolate-elliptic, seed coma tawny ..... 28. *E. fastigiatoramosum*
- 11b. Leaves denticulate, ovate to lanceolate or oblong-lanceolate; seed coma white or dingy.
- 12a. Petals 3–4.3(–5) mm; ovary white canescent; seeds with conspicuous chalazal collar ..... 29. *E. minutiflorum*
- 12b. Petals 7–11 mm; ovary pubescent but not white canescent; seeds with inconspicuous chalazal collar ..... 16. *E. brevifolium*
- 6b. Plants with basal rosettes, turions, or stolons, not basal shoots, rarely clumped; stems often with persistent basal scales.
- 13a. Plants throughout densely appressed tomentose; plants with leafy rosettes; petals 8–16 mm ..... 15. *E. pannosum*
- 13b. Plants strigillose, villous, and/or glandular pubescent, but not tomentose; plants forming stolons or turions, not leafy rosettes; petals 4–8 mm (except to 15 mm in *E. kermodei*).
- 14a. Plants forming fleshy turions, leaving dense leathery basal scales; fruiting pedicels 5–10 mm; plants 7–25 cm tall; Taiwan ..... 12. *E. taiwanianum*
- 14b. Plants forming stolons, usually with few or no basal scales; fruiting pedicels 7–50 mm; plants 25–120 cm tall (except *E. palustre*, (5–)15–70 cm tall); widespread, but not in Taiwan.
- 15a. Plants forming thick, ropelike stolons with fleshy terminal buds; capsules 7–11 cm; seeds 0.8–1.2 mm ..... 14. *E. kermodei*

- 15b. Plants forming filiform, threadlike stolons, sometimes with terminal buds; capsules 3–9 cm; seeds 1.3–2.2 mm.
- 16a. Leaves sublinear to narrowly lanceolate, subentire to obscurely denticulate; stolons with fleshy terminal turions; fruiting pedicels 1–5 cm; seed comas dingy white ..... 27. *E. palustre*
- 16b. Leaves ovate or broadly oblong to lanceolate, sharply serrulate; stolons without terminal turions; fruiting pedicels 0.7–1.5 cm; seed comas reddish ..... 17. *E. pyrriholophum*
- 5b. Stems subglabrous below inflorescence except for 2 or 4 raised strigillose lines decurrent from margins of petiole.
- 17a. Inflorescence glabrous or rarely with scattered hairs on ovary and sepals.
- 18a. Plants low, mat-forming; stems 3–20 cm tall; leaves 0.8–2.5 cm; petals 2.5–6.5 mm; capsules 1.7–3.6 cm ..... 33. *E. anagallidifolium*
- 18b. Plants erect, clumped; stems (5–)10–25(–60) cm tall; leaves (0.8–)1.5–7.5 cm; petals 7–14 mm; capsules 5–9 cm ..... 22. *E. sikkimense*
- 17b. Inflorescence moderately to densely pubescent.
- 19a. Inflorescence strigillose and/or villous, but lacking short, erect glandular hairs.
- 20a. Leaves sessile (lower ones often with petioles to 2 mm).
- 21a. Stems 10–50 cm tall, erect; leaves 3.4–6 cm; seeds papillose ..... 5. *E. roseum*
- 21b. Stems 7–25 cm tall, ascending; leaves 1–2.5 cm; seeds reticulate.
- 22a. Leaves 1.1–1.6 cm; capsules 3.5–4 cm, pedicels 6–7 mm; seeds 0.8–0.9 mm; SW China ..... 31. *E. clarkeanum*
- 22b. Leaves 1.5–2.5 cm; capsules 4.5–5 cm, pedicels 15–20 mm; seeds 1–1.1 cm; Taiwan ..... 32. *E. pengii*
- 20b. Leaves with distinct petioles 2–11 mm.
- 23a. Leaves narrowly spatulate to rarely broader, with prominent pale abaxial midvein, often crowded and spirally arranged on mid-stem; petioles 2–11 mm; fruiting pedicels 1.3–4 cm ..... 9. *E. sinense*
- 23b. Leaves sublinear to narrowly ovate, without pale midvein, always opposite below inflorescence; petioles 2–7(–10) mm; fruiting pedicels 0.5–3 cm.
- 24a. Leaves narrowly lanceolate to sublinear; petioles 3–7(–10) mm; seeds 0.8–1 mm, papillose ..... 7. *E. cylindricum*
- 24b. Leaves lanceolate to narrowly ovate; petioles 2–5 mm; seeds 1–1.3 mm, reticulate or papillose.
- 25a. Plants well-branched, not much clumped; petals 5–8 mm; stigma capitate to broadly clavate; seeds reticulate; Himalayas and SW China ..... 8. *E. tibetanum*
- 25b. Plants mostly simple, forming clumps; petals 5.5–6.5 mm; stigma clavate or rarely subcapitate; seeds coarsely papillose; W China (Tian Shan) ..... 6. *E. tianschanicum*
- 19b. Inflorescence variously pubescent, always with some short, erect glandular hairs.
- 26a. Plants forming fleshy turions at or below ground level; stem bases with thick, brown, leathery scales.
- 27a. Leaves elliptic or oblong to elliptic-lanceolate, with mostly cuneate bases and distinct petioles (1–)2–15 mm.
- 28a. Petioles 3–10(–15) mm; stigma broadly clavate to subcapitate; seeds 1–1.2 × 0.45–0.55 mm, obovoid; Xinjiang ..... 5. *E. roseum*
- 28b. Petioles 1–4(–6) mm; stigma capitate; seeds 1.1–1.4 × 0.3–0.45 mm, narrowly obovoid; SW China ... 26. *E. fangii*
- 27b. Leaves ovate to lanceolate, with ± rounded bases and obscure petioles to 3 mm (except in *E. laxum* with petioles 2–8 mm on lower leaves).
- 29a. Petals 4.5–5.5 mm; stigma clavate to subcapitate; seeds 0.9–1 mm ..... 25. *E. gouldii*
- 29b. Petals 5.5–16 mm; stigma capitate or nearly so; seeds 1.1–1.5 mm.
- 30a. Leaves 2–7 × 1.2–2.6 cm, ovate to narrowly ovate, crowded, usually longer than internodes; petals (7–)10–16 mm; fruiting pedicels 1–7(–10) mm; W Himalayas and Tian Shan ..... 21. *E. laxum*
- 30b. Leaves 1.5–5.5 × 0.5–1.5 cm, narrowly ovate to lanceolate, not crowded, usually shorter than internodes; petals 5.5–11 mm; fruiting pedicels 4–12 mm; SW China ..... 24. *E. subcoriaceum*
- 26b. Plants forming soboles, stolons, or rosettes, but not fleshy turions; stem bases with rather loose, ± herbaceous scales, or scales absent.
- 31a. Plants forming leafy rosettes; seed surface with conspicuous longitudinal ridges of flattened fused papillae; NE China ..... 30. *E. ciliatum*
- 31b. Plants forming soboles or stolons; seed surface papillose or reticulate, without longitudinal ridges.
- 32a. Stems ascending, forming clumps or mats; leaves subentire to scarcely denticulate; capsules 1.7–3.6 cm; pedicels 1–3.5(–5) cm; seeds reticulate ..... 33. *E. anagallidifolium*
- 32b. Stems mostly erect, loosely or not clumped; leaves denticulate or serrulate; capsules (1.5–)3.5–11 cm; pedicels 0.3–2.5 cm; seeds papillose.
- 33a. Plants forming thick ropelike stolons 1–12 cm with fleshy terminal bud; robust stems 40–120(–200) cm tall; capsules 7–11 cm ..... 14. *E. kermodi*
- 33b. Plants forming soboles, not stolons; stems 4–80(–150) cm, mostly less than 50 cm; capsules 1.5–7.5 cm (rarely to 9 cm in *E. sikkimense*).

- 34a. Stem bases with crowded brown scales; stems 5–25(–60) cm tall.  
 35a. Stems mostly erect; leaves (0.8–)1.5–7.5 cm; petals 7–14 mm; capsules 5–9 cm; pedicels 0.6–2(–2.5) cm ..... 22. *E. sikkimense*  
 35b. Stems mostly ascending; leaves 0.7–2.2 cm; petals 5–6.5 mm; capsules 3.5–5(–6) cm; pedicels 0.4–1 cm ..... 23. *E. williamsii*
- 34b. Stem bases without scales; stems (10–)20–150 cm tall, mostly more than 25 cm tall (except *E. kingdonii*, with stems 8–25 cm tall).  
 36a. Plants 8–25 cm tall, ascending; floral tube with sparse, even pubescence; seeds 1.4–1.6 mm, very finely papillose ..... 19. *E. kingdonii*  
 36b. Plants (10–)20–150 cm tall, erect; floral tube usually with tufts of hairs on costae and at insertion of sepals at mouth of floral tube; seeds 0.8–1 mm, coarsely papillose.  
 37a. Stems 15–80 cm tall, somewhat 4-angled, with (2 or)4 raised strigillose lines on internodes; leaves oblong, oblong-ovate, or elliptic, apex obtuse or rarely acute; petals 5.5–13 mm; fruiting pedicels 1–2.5 cm ..... 20. *E. wallichianum*  
 37b. Stems (10–)20–150 cm tall, subterete, with 2 raised strigillose lines on internodes; leaves ovate to oblong-lanceolate, apex acute or acuminate; petals 4.5–8 mm; fruiting pedicels 0.3–1.3 cm ..... 18. *E. amurense*

### 1. *Epilobium hirsutum* Linnaeus, Sp. Pl. 1: 347. 1753.

柳叶菜 liu ye cai

*Chamaenerion hirsutum* (Linnaeus) Scopoli; *Epilobium hirsutum* var. *laetum* Wallich ex C. B. Clarke; *E. hirsutum* var. *sericeum* Benth. ex C. B. Clarke; *E. hirsutum* var. *tomentosum* (Ventenat) Boissier; *E. hirsutum* var. *villosum* (Thunberg) H. Hara; *E. tomentosum* Ventenat; *E. velutinum* Nevski (1937), nom. illeg. superfl., not H. Léveillé (1916); *E. villosum* Thunberg.

Herbs robust, perennial, sometimes woody near base with long, thick, ropelike hypogean stolons often terminating in a rosette of leaves. Stems 25–120(–250) cm tall, much branched in upper half, densely villous pubescent, with short glandular hairs especially on inflorescence, rarely sparsely pubescent, or rarely densely white tomentose. Leaves sessile and clasping stem; cauline blade lanceolate-elliptic to narrowly obovate or elliptic, rarely very narrowly lanceolate, 4–12(–23) × 0.3–4(–5) cm, both surfaces villous, very rarely glabrescent, base subcuneate and clasping, margin serrulate with 20–50 teeth per side, apex acute to acuminate. Inflorescence and flowers erect. Sepals 6–12 mm, often keeled. Petals bright pink to dark purple, 8–20 mm. Stigma deeply 4-lobed. Capsules 2.5–9 cm, pubescent or rarely glabrescent; pedicels 0.5–2 cm. Seeds dark brown, 0.8–1.2 mm, coarsely papillose, with inconspicuous chalazal collar; coma tawny or dull white, detaching easily. Fl. Jun–Aug, fr. Jul–Sep.  $2n = 36$ .

Wet places near streams, ditches, marshes, gravel or sandy beds of rivers, roadsides; (200–)500–2000 m in N China, (100–)500–2800(–3500) m in SW China. Anhui, Gansu, Guangdong, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan, Zhejiang [Afghanistan, India, Japan, Korea, Mongolia, Nepal, Pakistan, Russia; widespread in Africa, SW Asia, Europe, and naturalized in North America].

This is an extremely widespread and variable species that spreads aggressively by vegetative growth in wet habitats.

Populations from Xinjiang tend to have strikingly tomentose pubescence, unlike plants from other regions, but the pattern of variability for entire species obscures these differences, so no subdivision is recognized.

### 2. *Epilobium parviflorum* Schreber, Spicil. Fl. Lips. 146. 1771.

小花柳叶菜 xiao hua liu ye cai

*Epilobium parviflorum* var. *vestitum* Benth. ex C. B. Clarke.

Herbs robust, perennial, with short-stalked leafy basal rosettes. Stems 18–100(–160) cm tall, well-branched above, densely gray villous on lower part, mixed above with short glandular hairs, often with raised lines decurrent from margins of petioles. Leaves subsessile or lower ones with petioles 1–3 mm; cauline blade lanceolate-elliptic to narrowly lanceolate or oblong-lanceolate, 3–12 × 0.5–2.5 cm, both surfaces villous, base usually rounded, margin denticulate with 15–60 teeth per side, apex subacute. Inflorescence and flowers erect. Sepals 2.5–6 mm, keeled. Petals bright pink to dark purple, 4–8.5 mm. Stigma deeply 4-lobed. Capsules 3–7 cm, pubescent or rarely glabrescent; pedicels 0.5–1.8 cm. Seeds dark brown, 0.8–1.1 mm, coarsely papillose, with inconspicuous chalazal collar; coma tawny or dull white, detaching easily. Fl. Jun–Sep, fr. Jul–Oct.  $2n = 36$ .

Usually in disturbed wet places near streams, bogs, and rivers, open waste slopes and meadows in mountains; (300–)500–1800(–2500) m. Gansu, Guizhou, Hebei, Henan, Hubei, Hunan, Nei Mongol, Shaanxi, Shandong, Shanxi, Sichuan, Xinjiang, Yunnan [Afghanistan, India, Japan, Korea, Nepal, Pakistan, Russia; Africa, SW Asia, naturalized in New Zealand, North America].

### 3. *Epilobium blinii* H. Léveillé, Repert. Spec. Nov. Regni Veg. 7: 338. 1909.

长柱柳叶菜 chang zhu liu ye cai

*Epilobium forrestii* Diels.

Herbs perennial, with short-stalked leafy basal rosettes. Stems 10–45 cm tall, simple or with few branches, strigillose throughout, mixed with glandular hairs on inflorescence or rarely subglabrous, with raised strigillose lines decurrent from margins of petioles. Leaves subsessile or lower ones with petioles 1–5 mm; cauline blade narrowly elliptic to lanceolate-elliptic, 1–3 × 0.4–0.9 cm, both surfaces sparsely strigillose, base subcuneate to rarely rounded, margin remotely denticulate with 3–7 teeth per side, apex obtuse. Inflorescence suberect or nodding;

flowers erect. Sepals 5–7.5 mm. Petals pink to rose-purple, 1–1.5 cm. Stigma deeply to shallowly 4-lobed. Capsules 3–5.5 cm, strigillose, sometimes glandular; pedicels 1.5–3.5 cm. Seeds brown, 1.2–1.5 mm, minutely papillose, with short chalazal collar; coma tawny, detaching easily. Fl. Apr–Aug(–Sep), fr. May–Aug(–Oct).  $2n = 36^*$ .

• Uncommon in permanently wet places, including sphagnum bogs; 1500–2700(–3300) m. Sichuan, Yunnan.

This highly distinctive, Chinese endemic species is quite rare and possibly endangered due to habitat loss.

**4. *Epilobium nankotaizanense*** Yamamoto, Icon. Pl. Formosan., Suppl. 2: 29. 1926.

南湖柳叶菜 nan hu liu ye cai

Herbs perennial, loosely matted with wiry spreading roots and fleshy soboles that creep and root at nodes, with dense basal scales. Stems 3–18 cm tall, usually branched above, strigillose throughout, mixed with glandular hairs on inflorescence. Leaves crowded on upper stems, leathery, rather fleshy; petiole 1–3 mm; cauline blade broadly elliptic to obovate or ovate, rarely to suborbicular, 0.8–2.1 × 0.5–1.2 cm, sparsely strigillose on margin and veins, otherwise glabrous, base attenuate or rarely subtruncate, margin weakly denticulate with 3–7 teeth per side, apex obtuse. Inflorescence ascending; flowers slightly nodding in bud. Sepals 1.1–1.7 cm. Petals rose-purple, 1.6–3.3 cm. Stigma subglobose, shallowly 4-lobed. Capsules 2–4.5 cm, sparsely strigillose and glandular; pedicels 0.4–0.7 cm. Seeds brown, 1.6–1.8 mm, finely reticulate, with short chalazal collar; coma tawny, persistent. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 36^*$ .

• Local on moist open scree slopes in high mountains; 2600–3800 m. Taiwan.

**5. *Epilobium roseum*** Schreber, Spicil. Fl. Lips. 147. 1771.

长柄柳叶菜 chang bing liu ye cai

Herbs erect, perennial, with fleshy elongated turions that leave leathery, obovate scales, rarely forming thin stolons. Stems 10–50 cm tall, simple or branched, strigillose usually mixed with glandular hairs throughout upper stem, glabrescent below, with 2 or 4 raised strigillose lines decurrent from margins of petioles. Leaves sessile or petioles 2–10(–15) mm; cauline blade elliptic to oblong or lanceolate to narrowly ovate, 2.2–6 × 0.8–2.5 cm, subglabrous with strigillose margin and veins adaxially, base cuneate to rounded or subcordate, margin denticulate with 9–45 teeth per side, apex subobtusely to acute. Inflorescence and flowers erect. Sepals 3.5–5 mm. Petals pink to rose-purple, 5–8 mm. Stigma clavate to subcapitate, entire. Capsules 3–6 cm, strigillose and glandular pubescent; pedicels 0.6–1.5 cm. Seeds dark brown, 1–1.2 mm, papillose, with inconspicuous chalazal collar; coma white, detaching easily.  $2n = 36$ .

Damp areas near streams, roadsides, ditches in mountains; 1500–2200 m. Xinjiang [Kazakhstan, Russia; C and SW Asia, Europe].

- 1a. Plants with fleshy elongated basal turions; leaf petioles 3–10(–15) mm; stigma broadly clavate to subcapitate; capsules 4–6 cm

..... 5a. subsp. *roseum*

- 1b. Plants with filiform epigeous stolons or shorter, fleshy soboles; leaves sessile (lower ones with petioles to 2 mm); stigma clavate; capsules 3–6 cm ..... 5b. subsp. *sessile*

**5a. *Epilobium roseum* subsp. *roseum***

长柄柳叶菜(原亚种) chang bing liu ye cai (yuan ya zhong)

Herbs perennial, variable, with fleshy elongated basal turions that leave leathery, ovate scales 6–8 × 4–6 mm. Leaves with petioles 3–10(–15) mm; cauline blade elliptic to oblong or lanceolate, 2.2–5 × 0.8–1.8 cm, base cuneate to broadly so, margin weakly denticulate with 9–25 teeth per side, apex subobtusely. Inflorescence strigillose, sometimes with glandular hairs. Stigma broadly clavate to subcapitate. Capsules 4–6 cm, sparsely strigillose. Fl. Jul–Sep, fr. Aug–Sep.  $2n = 36$ .

Damp areas near streams, roadsides, ditches in mountains; 1800–2200 m. Xinjiang [Kazakhstan, Russia; SW Asia, Europe].

**5b. *Epilobium roseum* subsp. *sessile*** (Boissier) P.H. Raven, Notes Roy. Bot. Gard. Edinburgh 24: 194. 1962.

多脉柳叶菜 duo mai liu ye cai

*Epilobium roseum* var. *sessile* Boissier, Fl. Orient. 2: 749. 1872; *E. almaatense* Steinberg; *E. nervosum* Boissier & Buhse; *E. smyrnaeum* Boissier & Balansa.

Herbs perennial, with filiform epigeous stolons with widely spaced small leaves, or shorter fleshy basal soboles. Leaves sessile or lower ones with petioles to 2 mm; cauline blade 3.4–6 × 0.9–2.5 cm, lower ones oblong-lanceolate with base broadly cuneate and apex subobtusely, upper ones narrowly ovate to lanceolate with base rounded or subcordate and apex acute to acuminate, margin remotely denticulate with 23–45 teeth per side. Inflorescence strigillose. Stigma clavate. Capsules 3–6 cm, strigillose. Fl. Jun–Aug, fr. Jul–Sep.  $2n = 36$ .

Damp areas near streams, ditches in mountains; 1500–2100 m. Xinjiang [Kazakhstan, Russia; C and SW Asia].

**6. *Epilobium tianschanicum*** Pavlov, Uchen. Zap. Moskovsk. Gosud. Univ. 2: 327. 1934.

天山柳叶菜 tian shan liu ye cai

Herbs perennial, clumped, with fleshy basal soboles or leafy rosettes that leave brown scales or leaves around caudex. Stems 30–50 cm tall, simple, often basally decumbent, strigillose throughout upper stem, subglabrous below, with 2 or 4 raised strigillose lines decurrent from margins of petioles. Leaves with petioles 2–4 mm; cauline blade 3–5 × 0.9–1.4 cm, narrowly ovate to lanceolate, subglabrous with strigillose margin and veins, base subrounded or broadly cuneate, margin serrulate with 14–25 teeth per side, apex acute. Inflorescence slightly nodding; flowers erect. Sepals 4–5.5 mm, keeled. Petals rose-purple, 5.5–6.5 mm. Stigma clavate to subcapitate, entire. Capsules 4–6 cm, sparsely strigillose; pedicels 1.5–2.9 cm. Seeds brown, 1–1.3 mm, coarsely papillose, with inconspicuous chalazal collar; coma dingy white, detaching easily. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 36$ .

Along rivers, streams, and ditches in mountains; 1000–1700 m. Xinjiang [Kazakhstan, Kyrgyzstan, Russia, Tajikistan; endemic to Tian Shan region].

**7. *Epilobium cylindricum*** D. Don, Prodr. Fl. Nepal. 222. 1825.

圆柱柳叶菜 *yuan zhu liu ye cai*

*Epilobium beauverdianum* H. Léveillé; *E. christii* H. Léveillé; *E. roseum* Schreber var. *cylindricum* (D. Don) C. B. Clarke.

Herbs perennial, robust, with thick caudex and leafy basal soboles or loose rosettes. Stems 10–110 cm tall, well-branched above, strigillose or rarely subglabrous on upper stem, glabrescent below with indistinct, sparsely strigillose lines decurrent from margins of petioles. Leaves subleathery; petiole 3–7(–10) mm; cauline blade narrowly lanceolate to sublinear, 3–12 × 0.4–2 cm, glabrous with sparsely strigillose margin and veins, base cuneate, margin densely serrulate with (20–)30–50 teeth per side, apex acute. Inflorescence erect, strigillose, rarely with a few glandular hairs; flowers suberect. Sepals 3–5 mm, keeled. Petals pink or rose-purple, rarely white, 3.6–7 mm. Stigma capitate or broadly clavate, entire. Capsules 4–8.5 cm, sparsely strigillose; pedicels (0.5–)1–2.5 cm. Seeds brown, 0.8–1 mm, papillose, with inconspicuous chalazal collar; coma dingy white, detaching easily. Fl. Jun–Sep, fr. Jul–Sep.  $2n = 36$ .

Disturbed wet places along rivers, streams, and lakes, often along roadside ditches in mountains; (400–)1300–3200 m. Gansu, Guizhou, Hubei, Sichuan, Xizang, Yunnan [Afghanistan, Bhutan, India, Kashmir, Kyrgyzstan, Nepal, Pakistan, Russia; SW Asia].

**8. *Epilobium tibetanum*** Haussknecht, Oesterr. Bot. Z. 29: 53. 1879.

光籽柳叶菜 *guang zi liu ye cai*

*Epilobium leiospermum* Haussknecht; *E. nuristanicum* K. H. Rechinger; *E. pseudobscurum* Haussknecht; *E. roseum* Schreber var. *anagallidifolium* C. B. Clarke, p.p.

Herbs erect, perennial, with short leafy soboles and rhizome with dense, fibrous rootlets. Stems 13–100 cm tall, well-branched, sparsely strigillose throughout upper stem, glabrescent below with indistinct raised lines decurrent from margins of petioles. Leaves subleathery; petiole 2–5 mm; cauline blade lanceolate to narrowly ovate, 1.2–6.5 × 0.5–1.5 cm, glabrous with sparsely strigillose margin and veins, base cuneate or subrounded, margin serrulate with 15–35 teeth per side, apex acute or acuminate. Inflorescence and flowers suberect. Sepals 3.5–5 mm, keeled. Petals pink or rose-purple, rarely white, 5–8 mm. Stigma capitate or broadly clavate, entire. Capsules 4–8.8 cm, sparsely strigillose; pedicels 0.8–2.5 cm. Seeds brown, 1.1–1.3 mm, reticulate, with inconspicuous chalazal collar; coma dingy white, detaching easily. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 36$ .

Scattered but locally common in disturbed moist places along rivers, streams, and ditches in mountains; 2300–4500 m. Sichuan, Xizang, Yunnan [Afghanistan, Bhutan, India, Nepal, Pakistan; SW Asia].

**9. *Epilobium sinense*** H. Léveillé, Bull. Herb. Boissier, sér. 2, 7: 590. 1907.

中华柳叶菜 *zhong hua liu ye cai*

Herbs perennial, robust, clumped with short leafy basal soboles. Stems 10–50 cm tall, simple or few-branched, very densely leafy, glabrescent throughout except for raised strigillose lines decurrent from margins of petioles. Leaves often spirally arranged on upper stem, crowded, subleathery; petiole 2–11 mm; cauline blade narrowly spatulate to oblong or lanceolate-linear, or rarely narrowly obovate, 1.2–7 cm × 3–10 mm, glabrous with sparsely strigillose margin and midvein, midvein conspicuously pale, prominent abaxially, base narrowly cuneate, margin weakly denticulate with 3–12 teeth per side, apex obtuse. Inflorescence and flowers erect. Sepals 4.5–6.5 mm. Petals white or pink, rarely rose-purple, 5.5–8 mm. Stigma capitate or broadly clavate, entire. Capsules 2.5–5.5 cm, glabrescent or sparsely strigillose; pedicels 1.3–4 cm. Seeds brown, 1.2–1.3 mm, finely papillose, with inconspicuous chalazal collar; coma reddish, detaching easily. Fl. Jun–Sep, fr. Aug–Oct(–Dec).  $2n = 36^*$ .

• Moist places along rivers and streams, occasionally in other rocky, exposed places; 500–2400 m. Gansu, Guizhou, Henan, Hubei, Hunan, Sichuan, Yunnan.

**10. *Epilobium platystigmatosum*** C. B. Robinson, Philipp. J. Sci. 3: 210. 1908.

阔柱柳叶菜 *kuo zhu liu ye cai*

*Epilobium cephalostigma* Haussknecht var. *linearifolium* Hisauti; *E. formosanum* Masamune; *E. sohayakiense* Koidzumi.

Herbs perennial, loosely clumped with leafy basal soboles. Stems (9–)15–70 cm tall, usually branched throughout, densely leafy, strigillose throughout, lacking raised lines. Petiole 1–4 mm; cauline leaf blade sublinear to narrowly lanceolate, 1–4.5 cm × 1.5–5 mm, glabrous with strigillose margin and midvein, base attenuate to narrowly cuneate, margin weakly denticulate with 3–8 teeth per side, apex acute or obtuse. Inflorescence slightly nodding before anthesis; flowers erect. Sepals 2.5–3.2 mm. Petals white or pink, rarely rose-purple, 3–5 mm. Stigma capitate to broadly clavate, entire. Capsules 2.3–5 cm, glabrescent or sparsely strigillose; pedicels 0.8–2.2 cm. Seeds brown, 0.8–0.9 mm, coarsely papillose, with inconspicuous chalazal collar; coma dingy white, easily detaching. Fl. Aug–Oct, fr. Sep–Nov.  $2n = 36^*$ .

Moist, often disturbed places along streams and rivers in mountains; (400–)1000–2000(–3500) m. Gansu, Guangxi, Hebei, Henan, Hubei, Qinghai, Shaanxi, Sichuan, Taiwan, Yunnan [Japan, Philippines].

**11. *Epilobium hohuanense*** S. S. Ying, Quart. J. Chin. Forest. 8: 121. 1975.

合欢柳叶菜 *he huan liu ye cai*

Herbs perennial, caespitose or clumped, with thin, fleshy soboles that leave small scattered basal scales. Stems 5–20(–30) cm tall, ascending, simple or rarely branched, strigillose throughout, sometimes with broad indefinite lines decurrent from margins of petioles. Leaves sessile or lower ones with petioles 1–3 mm; cauline blade elliptic or oblong to lanceolate, often narrowly so, spatulate near base, (0.5–)1–2 × 0.15–0.7 cm, sub-

glabrous with faintly strigillose margin and midvein, base attenuate to narrowly cuneate, margin denticulate with 4–10 teeth per side, apex subacute to obtuse. Inflorescence erect; flowers suberect. Sepals 2–3.5 mm. Petals white, later turning pink or rose, 3.5–6.5 mm. Stigma capitate to broadly clavate, entire. Capsules 2.6–5.5 cm, glabrescent or sparsely strigillose; pedicels 0.9–2.2 cm. Seeds light brown, 1–1.3 mm, papillose, with inconspicuous chalazal collar; coma white, persistent. Fl. Jul–Sep, fr. Aug–Nov.  $2n = 36^*$ .

• Loose scree or gravel in open moist (rarely shaded) places in mountains; 2600–3600 m. Taiwan.

**12. *Epilobium taiwanianum*** C. J. Chen et al., Syst. Bot. Monogr. 34: 95. 1992.

台湾柳叶菜 tai wan liu ye cai

Herbs perennial, suberect, often clumped, with fleshy turions that leave brown leathery basal scales. Stems 7–25 cm tall, simple or sparsely branched, strigillose throughout, lacking raised decurrent lines. Leaves sessile or lower ones with petioles 1–2 mm; cauline blade ovate to lanceolate to lanceolate-elliptic, spatulate near base, 1–2.5 × 0.5–1 cm, subglabrous with faintly strigillose margin and midvein, base cuneate to broadly so, margin denticulate with 3–9 teeth per side, apex acute to obtuse. Inflorescence nodding before anthesis; flowers erect. Sepals 3–5 mm, keeled. Petals rose-purple, 4–6.5 mm. Stigma capitate to broadly clavate, entire. Capsules 2.5–5 cm, strigillose; pedicels 0.5–1 cm. Seeds light brown, 1.1–1.5 mm, low papillose, with inconspicuous chalazal collar; coma white, detaching easily. Fl. Jul–Sep, fr. Aug–Oct(–Dec). Chromosome number unknown.

• Subalpine scree or gravel slopes where moisture is sufficient, rarely in shaded places; 3000–3900 m. Taiwan.

**13. *Epilobium royleanum*** Haussknecht, Oesterr. Bot. Z. 29: 55. 1879.

短梗柳叶菜 duan geng liu ye cai

*Epilobium himalayense* Haussknecht; *E. lividum* Haussknecht; *E. roseum* Schreber var. *dalhousieanum* C. B. Clarke; *E. roseum* var. *indicum* C. B. Clarke; *E. royleanum* f. *glabrum* P. H. Raven; *E. royleanum* f. *glandulosum* P. H. Raven.

Herbs perennial, erect or ascending, with fleshy soboles that leave brown basal scales. Stems 10–60 cm tall, well-branched or simple, strigillose and usually glandular pubescent throughout, lacking raised decurrent lines. Petiole 2–7 mm; cauline leaf blade narrowly ovate to lanceolate, sometimes elliptic or oblong-lanceolate, 1.5–5.5(–7) × 0.5–2.5(–3.3) cm, subglabrous with faintly strigillose margin and midvein, base cuneate (subrounded), margin densely serrulate with 10–24 teeth per side, apex acute or subacuminate. Inflorescence and flowers erect. Sepals 3.8–6 mm. Petals pink to rose-purple, 5–7.2 mm. Stigma capitate to broadly clavate, entire. Capsules 3.5–7 cm, strigillose, glandular; pedicels 0.4–1 cm. Seeds light brown, 0.9–1.2 mm, papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 36$ .

Moist weedy places in valleys, along roads and streams, some-

times in high mountain meadows; 1400–3300(–4300) m. Gansu, Guizhou, Henan, Hubei, Qinghai, Shaanxi, Sichuan, Xinjiang, Xizang, Yunnan [Afghanistan, Bhutan, India, Kashmir, Nepal, Pakistan; SW Asia].

**14. *Epilobium kermodei*** P. H. Raven, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 364. 1962.

锐齿柳叶菜 rui chi liu ye cai

Herbs perennial, robust, erect, with fleshy stolons 1–12 cm, extending underground and terminating in thickened buds. Stems 40–120(–200) cm tall, simple or sparsely branched, densely glandular and strigillose throughout, with faint raised strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles 1–6 mm; cauline blade narrowly ovate to lanceolate, 3.5–8(–11) × 1.5–4(–4.5) cm, subglabrous with densely strigillose margin and midvein, base broadly cuneate to subrounded, margin sharply serrulate with 28–42(–60) teeth per side, apex acute. Inflorescence erect, congested; flowers erect. Sepals 5–8 mm. Petals rose-purple, 7–15(–18) mm. Stigma capitate to broadly clavate, entire. Capsules 7–11 cm, strigillose, glandular; pedicels 0.7–1.5 cm. Seeds dark brown, 0.8–1.2 mm, coarsely papillose, with short chalazal collar; coma white, detaching easily. Fl. May–Aug, fr. (May–)Jul–Sep.  $2n = 36^*$ .

Moist disturbed places along roads and streams, boggy areas, meadows, forest margins; 400–1400 m in C China to 1800–2800(–3800) m in SW China. Guangxi, Guizhou, Hubei, Hunan, Sichuan, Yunnan [Myanmar].

Most populations of this species were earlier determined as *Epilobium tanguticum* (*E. wallichianum* in this treatment), prior to Raven's study of the genus in the Himalayan region.

**15. *Epilobium pannosum*** Haussknecht, Oesterr. Bot. Z. 29: 54. 1879.

硬毛柳叶菜 ying mao liu ye cai

*Epilobium brevifolium* D. Don subsp. *pannosum* (Haussknecht) P. H. Raven; *E. khasianum* C. B. Clarke.

Herbs perennial, robust, erect, sprouting from caudex or with leafy basal rosettes. Stems 20–120 cm tall, sparsely branched above, densely appressed-tomentose, sometimes mixed with glandular hairs on inflorescence, lacking obvious raised decurrent lines. Leaves crowded, subleathery, sessile and often clasping; cauline blade elliptic to lanceolate or ovate, 1–4.8 × 0.5–1.7 cm, both surfaces densely appressed-tomentose, base subrounded, margin remotely denticulate with 3–15 teeth per side, apex acuminate to acute or subobtusate. Inflorescence nodding initially, later erect; flowers nodding to suberect. Sepals 5.5–8 mm. Petals pink to rose-purple, 8–16 mm. Stigma cylindrical to broadly clavate, entire. Capsules 3.5–6.5 cm, tomentose, glandular; pedicels 1.2–2.8 cm. Seeds dark brown, 0.9–1 mm, finely papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Oct, fr. Sep–Nov.  $2n = 36^*$ .

Moist semishaded disturbed places by streams, or in valleys in evergreen broad-leaved forests; (700–)1500–2200 m. Guizhou, Sichuan, Yunnan [India, Myanmar, Vietnam].

**16. *Epilobium brevifolium*** D. Don, Prodr. Fl. Nepal. 222. 1825.

短叶柳叶菜 duan ye liu ye cai

Herbs perennial, erect or ascending, with fleshy soboles that leave loose brown basal scales. Stems 15–90 cm tall, simple or branched, strigillose throughout, sometimes mixed with glandular hairs on inflorescence, lacking raised decurrent lines. Leaves subsessile or petioles to 4 mm; cauline blade broadly ovate to broadly lanceolate-elliptic, 1.5–5(–8) × 0.5–2.2(–3) cm, subglabrous with strigillose margin and midvein, base subcordate to cuneate, margin sharply denticulate with 7–22 teeth per side, apex subobtuse to acute. Inflorescence and flowers erect to slightly nodding. Sepals 4.5–6.5 mm, keeled. Petals pink to rose-purple, 7–11 mm. Stigma clavate or broadly so, entire. Capsules 3.5–7 cm, strigillose, often glandular; pedicels 0.4–1.5 cm. Seeds dark brown, 0.9–1.1 mm, coarsely papillose, with short chalazal collar; coma white, detaching easily.  $2n = 36$ .

Moist or open disturbed places by streams in valleys and mountains; 600–2500(–3600) m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Myanmar, Nepal, Philippines, Vietnam].

- 1a. Leaves broadly ovate to ovate, base subcordate, usually herbaceous, petiole to 2 mm; petals 9–11 mm; stigma broadly clavate to clavate; capsules 5–7 cm ..... 16a. subsp. *brevifolium*
- 1b. Leaves lanceolate or elliptic to narrowly ovate, base rounded or cuneate, subleathery, petiole 1–4 mm; petals 7–10 mm; stigma clavate; capsules 3.5–7 cm ..... 16b. subsp. *trichoneurum*

**16a. *Epilobium brevifolium* subsp. *brevifolium***

短叶柳叶菜(原亚种) duan ye liu ye cai (yuan ya zhong)

*Epilobium trichoneurum* Haussknecht var. *brachyphyllum* Haussknecht.

Stems 25–60 cm tall, simple or branched. Leaves herbaceous, subsessile or petiole to 2 mm; cauline blade broadly ovate or ovate, 2.5–4.5 × 1.5–2.2 cm, base subcordate, margin sharply denticulate with 15–22 teeth per side, apex acute or subobtuse. Petals 9–11 mm. Stigma broadly clavate or clavate. Capsules 5–7 cm. Seeds 0.9–1.1 mm. Fl. Jun–Jul, fr. Aug–Sep.  $2n = 36$ .

Rare in moist disturbed places by streams in mountains; 1700–2100 m. Xizang, Yunnan [India, Nepal].

**16b. *Epilobium brevifolium* subsp. *trichoneurum*** (Haussknecht) P. H. Raven, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 362. 1962.

腺茎柳叶菜 xian jing liu ye cai

*Epilobium trichoneurum* Haussknecht, Oesterr. Bot. Z. 29: 54. 1879; *E. cavaleri* H. Léveillé; *E. cordouei* H. Léveillé; *E. esquirolii* H. Léveillé; *E. hookeri* C. B. Clarke; *E. philippinense* C. B. Robinson.

Stems 15–90 cm tall, simple to well-branched above. Leaves subleathery; petiole to 4 mm; cauline blade lanceolate or elliptic to narrowly ovate, 1.5–5(–8) × 0.5–2(–3) cm, base rounded or cuneate, margin sharply denticulate with 7–17 teeth per side, apex subobtuse to acute. Petals 7–10 mm. Stigma clavate. Capsules 3.5–7 cm. Seeds 1–1.1 mm. Fl. Jul–Sep(–Oct), fr. Sep–Oct.  $2n = 36^*$ .

Open disturbed places along streams in valleys and mountains; 600–2500(–3600) m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, NE India (Assam), Myanmar, Nepal, Philippines (Luzon), Vietnam].

**17. *Epilobium pyrriholophum*** Franchet & Savatier, Enum. Pl. Jap. 2: 370. 1879.

长籽柳叶菜 chang zi liu ye cai

*Epilobium arcuatum* H. Léveillé; *E. axillare* Franchet ex Koidzumi; *E. chrysocoma* H. Léveillé; *E. hakkodense* H. Léveillé; *E. japonicum* (Miquel) Haussknecht; *E. japonicum* var. *glandulosopubescens* Haussknecht; *E. kiusianum* Nakai; *E. makinoense* H. Léveillé; *E. myokense* Koidzumi; *E. nakaianum* H. Léveillé; *E. oligodontum* Haussknecht; *E. prostratum* H. Léveillé (1907), not Warburg (1893); *E. pyrriholophum* var. *anuoleucholophum* H. Léveillé; *E. pyrriholophum* var. *curvatopilosum* H. Hara; *E. pyrriholophum* var. *japonicum* (Miquel) H. Hara; *E. pyrriholophum* f. *kiusianum* (Nakai) Nakai; *E. quadrangulum* H. Léveillé; *E. rouyanum* H. Léveillé; *E. tetragonum* Linnaeus var. *japonicum* Miquel.

Herbs perennial, erect, with basal filiform stolons with small widely spaced leaves. Stems 25–80 cm tall, usually well-branched or simple, strigillose and glandular pubescent throughout, especially dense on inflorescence. Leaves crowded, subsessile; cauline blade ovate to broadly oblong, upper ones narrowly ovate to lanceolate, 2–6 × 0.5–2 cm, both surfaces strigillose especially on margin and veins, base obtuse to subcordate, margin usually sharply serrulate with 7–15 teeth per side, apex acute or subobtuse. Inflorescence and flowers erect. Sepals 4–7 mm. Petals pink to purple, 6–8 mm. Stigma clavate to subcapitate, entire. Capsules 3.5–7.5 cm, strigillose, glandular; pedicels 0.7–1.5 cm. Seeds brown, 1.5–1.8 mm, finely papillose, with conspicuous chalazal collar 0.08–0.1 mm; coma reddish brown, rather persistent. Fl. Jul–Sep, fr. Aug–Nov.  $2n = 36$ .

Wet places along streams and low areas, disturbed moist hillsides in mountains; (100–)300–1800 m. Anhui, Fujian, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, E Sichuan, Zhejiang [Japan, Russia (Far East)].

**18. *Epilobium amurense*** Haussknecht, Oesterr. Bot. Z. 29: 55. 1879.

毛脉柳叶菜 mao mai liu ye cai

Herbs perennial, erect, with leafy basal soboles, elongated rosettes, or rarely fleshy stolons. Stems (10–)20–150 cm tall, simple or branched, densely strigillose, often mixed with glandular hairs on upper parts, with 2(or 4) ± distinct raised strigillose lines decurrent from margins of petioles, or rarely subglabrous throughout. Leaves subsessile or petioles 1–6 mm; cau-

line blade ovate to narrowly so, or rarely lanceolate-oblong, 2–9.5 × 0.5–2.5 cm, subglabrous with strigillose margin and veins, base rounded or cuneate, margin serrulate or denticulate with 6–35 teeth per side, apex acute or acuminate. Inflorescence and flowers erect to slightly nodding. Sepals 3.5–6 mm, often keeled. Petals white, pink or rose-purple, 4.5–8(–10) mm. Stigma capitate or broadly capitate, entire. Capsules 1.5–7 cm, sparsely strigillose or rarely glabrous; pedicels 0.3–1.3 cm. Seeds brown, 0.8–1 mm, coarsely papillose, with short chalazal collar; coma dull white, readily detached.  $2n = 36$ .

Moist stream banks, wet areas along streams, roadside ditches, disturbed grassy slopes and moist areas in mountains; 600–4200 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangxi, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Korea, Myanmar, Nepal, Pakistan, Russia (Far East, Kamchatka)].

- 1a. Stems with prominent raised strigillose lines decurrent from margins of petioles; inflorescence strigillose with scattered glandular hairs; floral tube with tufts of hairs at insertion of sepals; leaves mostly ovate ..... 18a. subsp. *amurense*
- 1b. Stems with weak, barely raised strigillose lines, often incomplete through internodes; inflorescence strigillose but eglandular; floral tube evenly strigillose, without tufts; leaves oblong-lanceolate to narrowly ovate ..... 18b. subsp. *cephalostigma*

### 18a. *Epilobium amurense* subsp. *amurense*

毛脉柳叶菜(原亚种) *mao mai liu ye cai* (*yuan ya zhong*)

*Epilobium amurense* subsp. *laetum* (Wallich ex Haussknecht) P. H. Raven; *E. gansuense* H. Léveillé; *E. laetum* Wallich ex Haussknecht; *E. miyabei* H. Léveillé; *E. nepalense* Haussknecht; *E. origanifolium* Lamarck var. *pubescens* Maximowicz; *E. ovale* Takeda; *E. tenue* Komarov; *E. yabei* H. Léveillé.

Herbs perennial, erect, with short leafy soboles, rosettes, or rarely fleshy stolons. Stems (10–)20–50(–80) cm tall, strigillose and glandular on upper part, sparsely strigillose below with two raised densely strigillose lines decurrent from margins of petiole, or rarely stem subglabrous. Leaves subsessile or lower ones with petioles 1–4 mm; cauline blade ovate, oblong, or lanceolate, to obovate below, 2–7 × 0.5–2.5 cm, margin sharply serrulate with 6–25 teeth per side. Inflorescence strigillose with scattered glandular hairs. Sepals 3.5–5 mm, sparsely strigillose, with tufts of hairs at junctures of sepal bases. Petals 5–8(–10) mm. Fl. (May–)Jul–Aug, fr. (Jun–)Aug–Oct.  $2n = 36^*$ .

Moist stream banks, roadside ditches, disturbed grassy slopes in mountains; 1300–4200 m. Gansu, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan [Bhutan, India, Japan, Korea, Myanmar, Nepal, Pakistan, Russia (Far East, Kamchatka)].

**18b. *Epilobium amurense* subsp. *cephalostigma*** (Haussknecht) C. J. Chen et al., Syst. Bot. Monogr. 34: 127. 1992.

光滑柳叶菜 *guang hua liu ye cai*

*Epilobium cephalostigma* Haussknecht, Oesterr. Bot. Z. 29: 57. 1879; *E. angulatum* Komarov; *E. calycinum* Haussknecht; *E. cephalostigma* Haussknecht var. *nudicarpum* (Komarov) H. Hara; *E. consimile* Haussknecht var. *japonicum* Nakai; *E. coreanum* H. Léveillé; *E. cylindrostigma* Komarov; *E. nudicarpum* Komarov; *E. sugaharae* Koidzumi.

Herbs perennial, erect, with leafy basal soboles. Stems 25–150 cm tall, usually well-branched, strigillose on upper part, lacking any glandular hairs, with two faint strigillose lines decurrent from margins of petioles, or rarely subglabrous. Leaves subsessile or lower ones with petioles 1–6 mm; cauline blade oblong-lanceolate to narrowly ovate or rarely narrowly rhombic, 3–9.5 × 0.8–2.5 cm, margin sharply denticulate with 13–35 teeth per side. Inflorescence strigillose or very rarely subglabrous. Sepals 3.8–6 mm, sparsely and evenly strigillose or rarely subglabrous. Petals 4.5–7 mm. Fl. Jun–Sep, fr. Aug–Oct.  $2n = 36$ .

Wet areas along streams, roadside ditches at low elevations or in mountains in south; 600–2100 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangxi, Jilin, Liaoning, Shaanxi, Shandong, Sichuan, Yunnan, Zhejiang [Japan, Korea, Russia (Far East)].

**19. *Epilobium kingdonii*** P. H. Raven, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 377. 1962.

矮生柳叶菜 *ai sheng liu ye cai*

Herbs perennial, loosely clumped or matted with fleshy soboles 2–6 cm below ground, caudex with scales. Stems 8–25 cm tall, simple or rarely branched, strigillose and scarcely glandular above, subglabrous below with 2 raised strigillose lines decurrent from margins of petioles. Leaves crowded, subsessile above, lower ones with petioles to 2 mm; cauline blade ovate, 0.8–2(–2.7) × 0.4–1(–1.6) cm, glabrous except for sparsely strigillose margin and midvein, base cuneate to obtuse, margin obscurely serrulate with 8–15 teeth per side, apex acute. Inflorescence slightly nodding in bud; flowers suberect. Sepals 4–5 mm. Petals rose-purple, 7–8 mm. Stigma capitate, entire. Capsules 3.5–5.5 cm, subglabrous; pedicels 0.4–1.2 cm. Seeds dark brown, 1.4–1.6 mm, finely papillose, with short chalazal collar; coma white, detaching easily. Fl. Aug–Sep, fr. Aug–Oct. Chromosome number unknown.

• Shaded moist slopes along rivers and streams; 3300–3700 m. W Sichuan, SE Xizang, NW Yunnan.

**20. *Epilobium wallichianum*** Haussknecht, Oesterr. Bot. Z. 29: 54. 1879.

滇藏柳叶菜 *dian zang liu ye cai*

*Epilobium duclouxii* H. Léveillé; *E. mairei* H. Léveillé; *E. souliei* H. Léveillé; *E. sykesii* P. H. Raven; *E. tanguticum* Haussknecht; *E. wallichianum* subsp. *souliei* (H. Léveillé) P. H. Raven.

Herbs perennial, erect or ascending, with leafy basal soboles. Stems 15–80 cm tall, simple to well-branched, sparsely strigillose and glandular above, subglabrous below with 4 or

rarely 2 raised strigillose lines decurrent from margins of petioles, usually 4-angled. Leaves subleathery, subsessile; cauline blade oblong or elliptic to subovate,  $2-6 \times 0.6-2.5$  cm, subglabrous except for sparsely strigillose margin and midvein, base subrounded or subcordate to broadly cuneate, margin serrulate with 10–25 teeth per side, apex obtuse or acute. Inflorescence and flowers often nodding. Sepals 4–8 mm. Petals pink to rose-purple, 5.5–13 mm. Stigma capitate to broadly clavate, entire. Capsules 3.8–7.5 cm, sparsely strigillose and glandular; pedicels 1–2.5 cm. Seeds brown, 0.9–1 mm, low papillose, with short chalazal collar; coma dull white, detaching easily. Fl. (May–)Jul–Aug, fr. Aug–Sep.  $2n = 36$ .

Moist places along rivers, streams, and bogs, and along forest margins in mountains; (1300–)1800–4100 m. Gansu, Guizhou, Hubei, Sichuan, Xizang, Yunnan [Bhutan, NE India (Assam, W Bengal, Sikkim), Myanmar, Nepal].

**21. *Epilobium laxum*** Royle, Ill. Bot. Himal. Mts. 211. 1835.

大花柳叶菜 da hua liu ye cai

*Epilobium amplexens* (Benth. ex C. B. Clarke) Haussknecht; *E. duthiei* Haussknecht; *E. sadae* H. Léveillé; *E. subnivale* Popov ex Pavlov; *E. tetragonum* Linnaeus var. *amplexens* Benth. ex C. B. Clarke.

Herbs perennial, erect, often clumped, with fleshy turions just below ground that leave brown basal scales. Stems 10–70 cm tall, branched or simple, strigillose and sparsely glandular above, glabrous below with raised strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles 2–8 mm; cauline blade ovate to broadly lanceolate above to obovate below,  $2-7 \times 1.2-2.6$  cm, subglabrous except for sparsely strigillose margin and midvein, base rounded, margin sharply denticulate with 15–20 teeth per side or subentire below, apex subacuminate. Inflorescence and flowers nodding to suberect. Sepals 4–7.5 mm. Petals bright rose-purple, (7–)10–16 mm. Stigma subcapitate, entire. Capsules 3.5–7.5 cm, sparsely strigillose, erect and appressed to stem; pedicels 0.1–1 cm. Seeds brown, 1.2–1.5 mm, finely papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Sep, fr. Jul–Sep.  $2n = 36$ .

Along rocky streams in mountains; 2500–4300 m. Xinjiang [India, Pakistan; SW Asia].

**22. *Epilobium sikkimense*** Haussknecht, Oesterr. Bot. Z. 29: 52. 1879.

鳞片柳叶菜 lin pian liu ye cai

*Epilobium sikkimense* subsp. *ludlowianum* P. H. Raven; *E. soboliferum* P. H. Raven; *E. squamosum* P. H. Raven; *E. trilicetorum* P. H. Raven.

Herbs perennial, erect, often clumped, with thick fleshy soboles just at or below ground level that leave brown basal scales. Stems (5–)10–25(–60) cm tall, simple or sometimes branched, glabrous except for 2(or 4) raised strigillose lines decurrent from margins of petioles, or sometimes strigillose and glandular on inflorescence. Leaves sessile and slightly clasping above, lower ones with petioles to 3 mm; cauline blade ovate to elliptic or oblong-lanceolate, narrower below, (0.8–)1.5–7.5 ×

(0.6–)1–3.7 cm, glabrous except for sparsely strigillose margin and midvein, base broadly cuneate or rounded, margin serrulate with 10–35 teeth per side, apex subobtusate to acute. Inflorescence and flowers nodding to suberect. Sepals 5.5–8 mm. Petals pink to rose-purple, 7–14 mm. Stigma capitate, entire. Capsules 5–9 cm, sparsely strigillose and glandular; pedicels 0.6–2(–2.5) cm. Seeds gray-brown, 1–1.3 mm, coarsely papillose, with short chalazal collar; coma white, detaching easily. Fl. (Jun–)Jul–Aug, fr. Aug–Sep.  $2n = 36^*$ .

High montane and alpine meadows, moist rocky slopes along streams, rocky glacial outwashes and gravel bars; (2400–)3200–4700 m. Gansu, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan [Bhutan, N India (Darjeeling, Sikkim, Uttar Pradesh), Myanmar, Nepal; Himalayan region].

**23. *Epilobium williamsii*** P. H. Raven, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 378. 1962.

埋鳞柳叶菜 mai lin liu ye cai

Herbs perennial, clumped or matted, with fleshy, elongated soboles 1.5–7 cm that leave brown basal scales. Stems 4–17(–25) cm tall, usually branched from base or simple, strigillose and glandular above, subglabrous or sparsely strigillose below with faint raised strigillose lines decurrent from margins of petioles. Leaves crowded, subleathery, sessile or petioles to 2 mm; cauline blade ovate to elliptic-ovate,  $0.7-2.2 \times 0.3-1$  cm, subglabrous except for sparsely strigillose margin and midvein, base subrounded to broadly cuneate or subcordate, margin serrulate with 6–18(–26) teeth per side, apex acute to subacuminate. Inflorescence and flowers nodding to suberect. Sepals 3–4.5 mm. Petals rose-purple, 5–6.5 mm. Stigma capitate, entire. Capsules 3.5–5(–6) cm, sparsely strigillose; pedicels 4–10 mm. Seeds gray-brown, 0.9–1(–1.2) mm, finely papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Aug, fr. Aug–Sep. Chromosome number unknown.

Open alpine meadows, moist places by streams, or on gravel banks of glacial lakes in high mountains; (2900–)3400–4900 m. Qinghai, Sichuan, Xizang, Yunnan [India, Myanmar, Nepal].

**24. *Epilobium subcoriaceum*** Haussknecht, Oesterr. Bot. Z. 29: 56. 1879.

亚革质柳叶菜 ya ge zhi liu ye cai

Herbs perennial, erect, with fleshy turions that leave brown basal scales. Stems often reddish green, 15–45 cm tall, simple or branched, sparsely strigillose and glandular on inflorescence, otherwise subglabrous with distinct raised strigillose lines decurrent from margins of petioles. Leaves subleathery, subsessile or petioles to 3 mm; cauline blade narrowly ovate to lanceolate,  $1.5-5.5 \times 0.5-1.5$  cm, subglabrous except for sparsely strigillose margin and midvein, base broadly cuneate, margin serrulate with 13–22 teeth per side, apex acute. Inflorescence and flowers slightly nodding. Sepals 3.5–6 mm. Petals pink to rose-purple, 5.5–11 mm. Stigma capitate, entire. Capsules 3–7 cm, sparsely strigillose and glandular; pedicels 0.4–1.2 cm. Seeds brown, 1.1–1.5 mm, coarsely papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Aug, fr. Aug–Sep. Chromosome number unknown.

• Moist places in mountains, along streams, boggy areas, and disturbed places; 2400–3700 m. Gansu, Qinghai, Shaanxi, Sichuan, Xizang, Yunnan.

**25. *Epilobium gouldii*** P.H. Raven, Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 371. 1962.

鳞根柳叶菜 lin gen liu ye cai

Herbs perennial, erect, with rounded, fleshy turions that leave brown leathery basal scales. Stems often reddish green, 23–30 cm tall, strict, simple or scarcely branched, sparsely strigillose and glandular on inflorescence, otherwise glabrous except for raised strigillose lines decurrent from margins of petioles. Leaves herbaceous, sessile; cauline blade ovate, 2–3 × 1–1.4 cm, subglabrous except for sparsely strigillose margin and midvein, base broadly rounded, margin acutely serrulate with 16–28 teeth per side, apex acute to shortly acuminate. Inflorescence and flowers slightly nodding. Sepals 3.5–4.5 mm, sparsely strigillose with tufts of long spreading hairs at junctures of sepal bases. Petals rose-purple, 4.5–5.5 mm. Stigma clavate to subcapitate, entire. Capsules 4.5–6 cm, sparsely strigillose and glandular; pedicels 0.6–1.5 cm. Seeds light brown, 0.9–1 mm, papillose, with short chalazal collar; coma white, detaching easily. Fl. Jul–Aug, fr. Aug–Sep. Chromosome number unknown.

Moist alpine meadows; 3600–4400 m. Xizang [NE India (Sikkim)].

**26. *Epilobium fangii*** C. J. Chen et al., Syst. Bot. Monogr. 34: 151. 1992.

川西柳叶菜 chuan xi liu ye cai

Herbs perennial, erect, with fleshy, elongated turions 2–3.5 cm underground that leave brown leathery basal scales. Stems 25–40 cm tall, simple or branched, strigillose throughout with scattered glandular hairs above and faint raised strigillose lines decurrent from margins of petioles. Petiole 1–4(–6) mm; cauline leaf blade elliptic to elliptic-oblong, 1.5–4 × 0.5–1.5 cm, subglabrous except for strigillose veins and margin, subleathery, base cuneate to broadly so, margin obscurely serrulate with 5–18 teeth per side, apex subobtuse or acute. Inflorescence and flowers erect. Sepals 4–5 mm, keeled. Petals pink to rose-purple, 6–7.5 mm. Stigma capitate, entire. Capsule 3–7 cm, sparsely strigillose; pedicels 0.5–1.5 cm. Seeds brown, 1.1–1.4 mm, finely papillose, with short chalazal collar; coma dingy white, detaching easily. Fl. May–Jul(–Aug), fr. Jun–Aug(–Oct).  $2n = 36^*$ .

• Open places along streams, bases of rock walls or scree slopes; (1100–)1700–3500 m. W Sichuan, N Yunnan.

**27. *Epilobium palustre*** Linnaeus, Sp. Pl. 1: 348. 1753.

沼生柳叶菜 zhao sheng liu ye cai

*Epilobium fischerianum* Pavlov; *E. palustre* var. *lavandulifolium* Lecoq & Lamotte ex Haussknecht; *E. palustre* var. *majus* C. B. Clarke; *E. palustre* var. *minimum* C. B. Clarke; *E. rhynchocarpum* Boissier.

Herbs perennial, erect, with filiform stolons terminating in small fleshy turions that leave brown basal scales. Stems

(5–)15–70 cm tall, simple or well-branched, strigillose throughout or subglabrous on lower part, rarely with lines decurrent from margins of petioles. Leaves sessile or petioles to 3 mm; cauline blade sublinear to narrowly lanceolate or elliptic, 1.2–7 × 0.3–1.2(–1.9) cm, sparsely strigillose adaxially and on abaxial veins or rarely glabrescent, base rounded or cuneate, margin entire to obscurely denticulate with 5–9 teeth per side, occasionally revolute, apex acute or obtuse. Inflorescence erect or slightly nodding in bud, densely strigillose, sometimes with glandular hairs; flowers erect. Sepals 2.5–4.5 mm. Petals white to pink, 3–7(–9) mm. Stigma clavate to subcylindric, entire. Capsules 3–9 cm, strigillose; pedicels 1–5 cm. Seeds brown, (1.1–)1.3–2.2 mm, finely papillose, with prominent chalazal collar 0.08–0.3 mm; coma dull white or rarely tawny, not easily detaching. Fl. Jun–Aug, fr. Aug–Sep.  $2n = 36$ .

Wet places along streams, rivers, bogs, and marshes, often disturbed, and in subalpine meadows, widespread; 200–4500(–5000) m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Xizang, Yunnan [India, Japan, Kazakhstan, Korea, Mongolia, Nepal, Pakistan, Russia; widespread in C, N, and SW Asia, Europe, and North America (including Greenland)].

**28. *Epilobium fastigiatoramosum*** Nakai, Bot. Mag. (Tokyo) 33: 9. 1919 [*“fastigiato-ramosum”*].

多枝柳叶菜 duo zhi liu ye cai

*Epilobium baicalense* Popov.

Herbs perennial, erect, with short leafy soboles or rarely short filiform stolons with scattered cataphylls. Stems 7–50(–80) cm tall, simple to densely branched, densely strigillose throughout, mixed with glandular hairs on inflorescence, often subglabrous below, lacking raised lines. Leaves sessile or lower ones with petioles to 2 mm; cauline blade lanceolate-elliptic to lanceolate-oblong, 2–7 × 0.3–1.7 cm, sparsely strigillose adaxially and on abaxial veins, base cuneate or subrounded, margin subentire, apex acute or obtuse. Inflorescence and flowers erect. Sepals 2.5–3.3 mm, slightly keeled. Petals white, 3–4(–4.7) mm. Stigma subcapitate to clavate, entire. Capsules 1.7–7 cm, strigillose, sparsely glandular; pedicels 0.9–2.1 cm. Seeds brown, 0.9–1.3 mm, minutely papillose, with inconspicuous chalazal collar; coma tawny, persistent. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 36^*$ .

Wet areas along streams, lakes, bogs, grassy meadows; 400–2000(–3300) m. Gansu, Hebei, Heilongjiang, Jilin, Liaoning, Nei Mongol, Ningxia, Qinghai, Shaanxi, Shandong, Shanxi, Sichuan [Japan, Korea, Mongolia, Russia (Dauria to Ussuri regions)].

**29. *Epilobium minutiflorum*** Haussknecht, Oesterr. Bot. Z. 29: 55. 1879.

细籽柳叶菜 xi zi liu ye cai

*Epilobium decipiens* Haussknecht (1879), not F. Schultz (1861); *E. modestum* Haussknecht; *E. propinquum* Haussknecht; *E. tetragonum* Linnaeus var. *minutiflorum* (Haussknecht) Boissier.

Herbs perennial, erect, with short, fleshy basal soboles or leafy rosettes. Stems 15–100 cm tall, well-branched or rarely simple, densely strigillose throughout, with scattered glandular

hairs on inflorescence, often subglabrous below, with inconspicuous lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles 1–6 mm; cauline blade oblong-lanceolate to narrowly ovate, 2–7 × 0.4–1.7 cm, glabrous except for strigillose margin and veins, base cuneate or subrounded, margin serrulate with 20–41 teeth per side, apex subobtuse or acute. Inflorescence suberect before anthesis; flowers erect. Sepals 2.4–4 mm, sometimes keeled. Petals white, rarely pink or rose, 3–4.3(–5) mm. Stigma clavate to subcapitate, entire. Capsules 3–8 cm, strigillose or rarely glabrescent; pedicels 0.5–2 cm. Seeds brown, 0.8–1.2 mm, minutely papillose, with conspicuous chalazal collar 0.08–0.12 mm; coma white, detaching readily. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 36$ .

Frequent in moist places by streams, bogs, roadside ditches in otherwise low, warm areas; 500–1800 m. Gansu, Hebei, Jilin, Liaoning, Nei Mongol, Ningxia, Shaanxi, Shanxi, Xinjiang, Xizang [Afghanistan, Kazakhstan, Korea, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Uzbekistan; SW Asia].

**30. *Epilobium ciliatum*** Rafinesque, Med. Repos., ser. 2, 5: 361. 1808.

东北柳叶菜 *dong bei liu ye cai*

*Epilobium glandulosum* Lehmann var. *asiaticum* H. Hara; *E. glandulosum* var. *kurilense* (Nakai) H. Hara; *E. kurilense* Nakai; *E. maximowiczii* Haussknecht; *E. punctatum* H. Léveillé.

Herbs perennial, erect, with compact leafy rosettes or rarely fleshy turions that leave brown basal scales. Stems (10–)25–90(–150) cm tall, well-branched or rarely simple, strigillose and glandular pubescent, sparsely pubescent or glabrescent below, with raised strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles 1–3 mm; cauline blade lanceolate to narrowly ovate, 2.5–6(–7) × 0.6–1.5(–2) cm, subglabrous except for strigillose margin and veins, base rounded or rarely subcordate, margin serrulate with 10–30 teeth per side, apex acute to subacuminate. Inflorescence and flowers erect. Sepals 2.4–3.5 mm, keeled. Petals pink or white, rarely rose-purple, 3.5–5(–7) mm. Stigma clavate to cylindrical, entire. Capsules 4.5–7 cm, sparsely strigillose and glandular; pedicels 0.5–0.8(–1.4) cm. Seeds brown, 0.8–1.2 mm, with conspicuous longitudinal ridges of flattened, fused papillae, with chalazal collar 0.08–0.1 mm; coma dull white, readily detaching. Fl. Jul–Aug(–Sep), fr. Aug–Oct.  $2n = 36$ .

Moist disturbed places along streams, rivers, roadside ditches, slopes, and seeps; (700–)1200–2100 m. Heilongjiang, Jilin [Japan, Korea, Russia (Far East); extremely widespread in North and South America; naturalized in Asia, Australia, Europe, and New Zealand].

This variable taxon, which probably originated in North America, has become the most widespread and abundant species of *Epilobium* worldwide. *Epilobium ciliatum* subsp. *glandulosum* (Lehmann) Hoch & P. H. Raven occurs throughout montane and boreal North America; *E. ciliatum* subsp. *watsonii* (Barbey) Hoch & P. H. Raven occurs along the North American Pacific shoreline from California to British Columbia.

**31. *Epilobium clarkeanum*** Haussknecht, Monogr. Epilob. 220. 1884.

雅致柳叶菜 *ya zhi liu ye cai*

Herbs perennial, loosely clumped, with short soboles that leave brown leathery basal scales. Stems 10–20 cm tall, ascending, simple or branched basally, sparsely strigillose on upper stem, glabrescent below with inconspicuous strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles to 2 mm; cauline blade ovate-elliptic to subovate below, 1.1–1.6 × 0.5–0.8 cm, glabrous except for sparsely strigillose margin and midvein, base broadly cuneate or subrounded, margin denticulate with 3–8 teeth per side, apex obtuse to subacute. Inflorescence and flowers nodding. Sepals 2.5–3 mm, keeled. Petals white, 5–6 mm. Stigma capitate, entire. Capsules 3.5–4 cm, sparsely strigillose; pedicels 0.6–0.7 cm. Seeds light brown, 0.8–0.9 mm, reticulate, with short chalazal collar; coma white, readily detaching. Fl. May–Jul, fr. Jul–Aug. Chromosome number unknown.

Wet, boggy places in mountains; 3600–4500 m. Yunnan [NE India (Sikkim), Myanmar].

**32. *Epilobium pengii*** C. J. Chen et al., Syst. Bot. Monogr. 34: 169. 1992.

网籽柳叶菜 *wang zi liu ye cai*

Herbs perennial, loosely clumped, with short leafy or fleshy soboles that leave brown basal scales. Stems ascending, 7–25 cm tall, simple or sparsely branched, strigillose on upper stem, subglabrous below with raised strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles to 2 mm; cauline blade ovate to lanceolate above to broadly elliptic below, 1.5–2.5 × 0.8–1.2 cm, subglabrous except for strigillose margin and veins, base rounded above to cuneate below, margin denticulate with 7–12 teeth per side, apex acute above to obtuse below. Inflorescence nodding; flowers erect. Sepals 4.5–5.5 mm. Petals white, fading to pink, 5–6.5 mm. Stigma capitate, entire. Capsules 4.5–5 cm, strigillose; pedicels 1.5–2 cm. Seeds light brown, 1–1.1 mm, reticulate, with short chalazal collar; coma dingy white, persistent. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 36^*$ .

• Moist, sheltered places along streams and seeps in alpine areas; 3100–3700 m. Taiwan.

**33. *Epilobium anagallidifolium*** Lamarck, Encycl. 2: 376. 1786.

新疆柳叶菜 *xin jiang liu ye cai*

*Epilobium alpinum* Linnaeus, nom. utique rej.; *E. dielsii* H. Léveillé; *E. nakaharanum* Nakai.

Herbs perennial, forming low mats, with thin, leafy epigeous soboles. Stems many, ascending or sigmoidally bent, 3–20 cm tall, simple, subglabrous throughout or strigillose on upper stem with scattered glandular hairs, with sparsely strigillose lines decurrent from margins of petioles. Leaves sessile above, lower ones with petioles 1–6 mm; cauline blade spatulate to oblong basally, elliptic at mid-stem, lanceolate in upper pairs, 0.8–2.5 × 0.25–1 cm, subglabrous except for sparsely strigillose margin and midvein, base attenuate to cuneate, margin subentire to barely denticulate on upper leaves, apex obtuse below to

subacute above. Inflorescence nodding in bud, suberect later; flowers suberect. Sepals 1.5–5 mm. Petals pink to rose-purple, rarely white, 2.5–6.5 mm. Stigma broadly clavate or subcapitate, entire. Capsules 1.7–3.6 cm, subglabrous or with scattered short hairs; pedicels 1–3.5(–5) cm. Seeds light brown, 0.7–1.4 mm, reticulate or rarely low papillose, with short chalazal col-

lar; coma dull white, persistent. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 36$ .

Moist rockslides, talus slopes, and gravelly areas near streams or seeps in high montane and alpine regions; 1300–1500[–4000] m. Xinjiang [Japan, Russia; widespread across N Asia, Europe, and North America].

## 5. OENOTHERA Linnaeus, Sp. Pl. 1: 346. 1753.

月见草属 yue jian cao shu

Chen Jiarui (陈家瑞 Chen Chia-ji); Peter C. Hoch, Warren L. Wagner

Annual, biennial or perennial herbs, caulescent or acaulescent, with a taproot or fibrous roots, occasionally with rhizomes or shoots arising from spreading lateral roots. Leaves alternate or in a basal rosette that often is absent in mature plants, entire, toothed to pinnatifid; stipules absent. Flowers perfect, actinomorphic, in axils of upper leaves, when numerous forming terminal leafy spikes, racemes, or corymbs, opening near sunset or near sunrise. Floral tube usually well developed, cylindric and somewhat flared near mouth, deciduous soon after anthesis. Sepals 4, green or yellowish, often tinged or striped red or purple. Petals 4, yellow, purple, pink, or white. Stamens 8; anthers versatile; pollen shed singly. Ovary with 4 locules; ovules numerous; stigma divided into 4 linear lobes, receptive all around, and subtended by a  $\pm$  conspicuous ringlike indusium in early development, but often obscured when receptive. Fruit a dehiscent capsule [rarely indehiscent outside of China], straight or curved, terete to 4-angled or winged, sessile, occasionally pedicellate, or basal portion sterile and stipelike. Seeds numerous, in 1 or 2(or 3) rows or in clusters in each of 4 locules.  $2n = 14, 28, 42, 56$ .

One hundred and twenty-one species: open, often disturbed habitats in temperate to subtropical areas of North, Central, and South America, with the center of diversity in SW North America; ten species (all naturalized within the past 200 years) in China.

*Oenothera* is currently divided into 15 sections, only three of which are represented in China. An evolutionary phenomenon that has occurred repeatedly in *Oenothera* (52 species) and several other genera of tribe Onagreae is permanent translocation heterozygosity, a peculiar, specialized genetic system based on heterozygosity for successive chromosomal translocations and manifested by autogamy and formation of a ring of 14 chromosomes at meiotic metaphase I (for reviews see Cleland, *Oenothera* Cytogenetics and Evolution. 1972; Holsinger and Ellstrand, *Amer. Naturalist* 124: 48–71. 1984). Permanent translocation heterozygote individuals breed true for their series of reciprocal translocations and are maintained by either balanced lethals or selective fertilization. These plants are essentially clonal. Many species of *Oenothera* that have become naturalized outside their natural range are permanent translocation heterozygotes, as noted in their descriptions.

Several ornamental species of *Oenothera* are known only from cultivation in China, often in Beijing, Kunming, or other botanical gardens. For example, *O. macrocarpa* Nuttall subsp. *macrocarpa* (*O. sect. Megapterium* (Spach) Endlicher) is native to the Great Plains region of C North America but has never become naturalized outside of its indigenous distribution because it is a self-incompatible outcrosser with rather specific habitat requirements. It can be distinguished by its large, yellow corollas (up to 14 cm in diam. at anthesis), 4-winged capsules (wings up to 3.4 cm wide), floral tube (7.8–)9.5–11.5(–14) cm, and coarsely rugose, distally winged seeds. A second species, *O. acaulis* Cavanilles (*O. sect. Lavauxia* (Spach) Endlicher, *O. subsect. Australis* W. L. Wagner & Dietrich), likewise known only from cultivation in China, is native to S South America and is characterized by white petals and capsules winged in the distal half.

- 1a. Petals white, pink, or purple; capsules clavate or obovoid, valves sharply angled, winged or ridged, proximally narrowed into a tapering, sterile stipe; seeds in indistinct rows or clusters in each locule.
- 2a. Petals 16–38 mm, white, fading to rose-purple; sepals 16–32 mm; leaf margin weakly serrate to sinuate-pinnatifid, often with large terminal lobe; pollen ca. 90+% fertile ..... 9. *O. tetraptera*
- 2b. Petals 5–12 mm, pink to rose purple; sepals 5–10 mm; leaf margin subentire to coarsely dentate, sometimes sinuate-pinnatifid at leaf base; pollen ca. 50% fertile ..... 10. *O. rosea*
- 1b. Petals yellow, at least before fading; capsules lanceoloid or cylindric, sometimes slightly enlarged toward apex, valves acute or obtuse to rounded, not narrowed toward base into a sterile stipe; seeds in two rows in each locule.
- 3a. Capsules cylindric and  $\pm$  slightly enlarged toward apex; erect to procumbent annual or short-lived perennial herbs, 5–80(–100) cm tall, rarely biennial; flowers few in upper axils; seeds ellipsoid, brown to dark brown.
- 4a. Floral tube 25–50 mm; sepals 13–33 mm; petals 20–45 mm; stigma exerted beyond anthers at anthesis; pollen ca. 90+% fertile; flowers primarily outcrossing ..... 7. *O. drummondii*
- 4b. Floral tube 12–35 mm; sepals 5–25 mm; petals 5–25(–35) mm; stigma surrounded by anthers at anthesis; pollen ca. 50% fertile; flowers primarily self-pollinating.
- 5a. Leaf margin deeply lobed to dentate; sepals 5–15 mm; petals 5–22 mm, yellow to pale yellow; capsule cylindric throughout ..... 6. *O. laciniata*
- 5b. Leaf margin serrate and usually somewhat undulate; sepals 12–25 mm; petals 15–25(–35) mm, yellow, often with basal red spot; capsule cylindric, enlarged toward apex ..... 8. *O. stricta*
- 3b. Capsules lanceoloid; coarse erect biennial herbs (10–)30–200 cm tall; flowers numerous in generally dense spikes; seeds irregularly angled, dark brown to black.

- 6a. Floral tube 35–50 mm; stigma elevated above anthers at anthesis, flowers mostly outcrossed; petals 35–50 mm; leaf surface often crinkled ..... 3. *O. glazioviana*
- 6b. Floral tube 15–40 mm; stigma surrounded by anthers at anthesis, flowers mostly self-pollinating; petals 7–25(–30) mm; leaf surface smooth.
- 7a. Free sepal tips 0.5–3 mm, apical; dry capsules grayish green or dull green; apex of inflorescence erect.
- 8a. Leaves grayish green, with prominent pale green veins; sepals 9–18 mm; stems ± exclusively densely strigillose; inflorescence dense, apex truncate from widely spreading bracts ..... 1. *O. villosa*
- 8b. Leaves pale green, with inconspicuous veins; sepals 12–22(–28) mm; stems densely or sparsely strigillose and villous; inflorescence relatively open, apex obtuse from erect to slightly spreading bracts ..... 2. *O. biennis*
- 7b. Free sepal tips 0.5–5 mm, distinctly subapical; dry capsules rusty brown to black; apex of inflorescence usually curved or sigmoid.
- 9a. Stems 10–60 cm tall, erect or procumbent, lower portions conspicuously pubescent; leaves grayish green, with inconspicuous veins; capsules dark to dull green, sometimes reddish, drying rusty brown ..... 4. *O. oakesiana*
- 9b. Stems 30–150 mm tall, erect, lower portions inconspicuously pubescent; leaves bright green, with white or red veins; capsules dark green, often drying black ..... 5. *O. parviflora*

**1. *Oenothera villosa*** Thunberg, Prodr. Fl. Cap. 75. 1794.

长毛月见草 chang mao yue jian cao

Herbs erect, biennial, with taproot and basal rosette. Stems 50–200 cm tall, simple or sparsely branched, exclusively densely strigillose, or sometimes with few subappressed or spreading pustulate-based hairs or few glandular hairs on floral tube. Leaves gray-green, with prominent pale or red veins, especially abaxially, sessile; rosette blade 10–30 × 1.2–4(–5) cm; cauline blade narrowly lanceolate or oblanceolate to elliptic, 5–20 × 1–2.5(–4) cm, base obtuse to attenuate, margin conspicuously dentate, apex acute. Inflorescence a dense unbranched spike. Flowers open near sunset; floral tube 2.3–4.4 cm. Sepals 9–18 mm, with free tips 0.5–3 mm, apical, erect. Petals yellow to pale yellow, 7–20 mm. Anthers 4–10 mm; pollen ca. 50% fertile. Ovary densely strigillose; stigma surrounded by anthers. Capsules grayish green, lanceoloid, 2–4.3 cm, sessile. Seeds in two rows per locule, brown to nearly black, 1–2 mm, angled, irregularly pitted. Fl. Jul–Sep, fr. Aug–Oct.  $2n = 14$ , permanent translocation heterozygote; self-compatible, autogamous, often cleistogamous.

Open disturbed sites, seasonally moist but often somewhat dryer sites than *O. biennis* and *O. parviflora*; near sea level to 1200 m. Heilongjiang, Jilin, Liaoning [native to EC North America; naturalized in Japan, Russia (Far East), and widely in S Africa, Asia, Europe, and S South America].

**2. *Oenothera biennis*** Linnaeus, Sp. Pl. 1: 346. 1753.

月见草 yue jian cao

*Oenothera muricata* Linnaeus; *O. suaveolens* Desfontaines; *Onagra biennis* (Linnaeus) Scopoli; *O. muricata* (Linnaeus) Moench.

Herbs erect, biennial, with basal rosette. Stems 30–200 cm tall, simple or sparsely branched, densely to very sparsely strigillose and with longer spreading and usually pustulate-based hairs, inflorescence often also glandular puberulous. Leaves green or pale green, with inconspicuous veins, sessile or shortly petiolate; rosette blade 10–30 × 2–5 cm; cauline blade narrowly oblanceolate to elliptic, 5–22 × (1–)1.5–5(–6) cm, base acute to attenuate, margin dentate to subentire, often lobed near base,

apex acute. Inflorescence a dense mostly unbranched spike. Flowers open near sunset; floral tube (2–)2.5–4 cm. Sepals 1.2–2.2(–2.8) cm, with free tips 1.5–3 mm, erect. Petals yellow, fading to orange, 1.2–2.5(–3) cm. Anthers 3–6(–9) mm; pollen ca. 50% fertile. Ovary densely glandular puberulous and sparsely villous or with very sparse pustulate-based hairs, sometimes only densely strigillose; stigma surrounded by anthers. Capsules green, narrowly lanceoloid to lanceoloid, 2–4 cm, sessile. Seeds in two rows per locule, brown to nearly black, 1.1–2 mm, irregularly pitted. Fl. Jul–Oct, fr. Jul–Nov.  $2n = 14$ , permanent translocation heterozygote; self-compatible, autogamous.

Common in open, disturbed areas; near sea level to 1500 m. Anhui, Guangdong, Guangxi, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangsu, Jilin, Liaoning, Nei Mongol, Sichuan, Taiwan, Yunnan [Bhutan, Japan, Kazakhstan, Korea, Kyrgyzstan, Russia; native to E North America; widely naturalized in SW Asia, Europe, Pacific islands (New Zealand), and S South America].

The seeds of this species contain gamma linolenic acid (GLA), an anti-inflammatory compound of potential therapeutic use for cardiovascular disorders, arthritis, and other human diseases. The cultivation of these plants as a source of GLA has increased recently, and the species has become naturalized widely in China.

**3. *Oenothera glazioviana*** Micheli in Martius, Fl. Bras. 13(2): 178. 1875.

黄花月见草 huang hua yue jian cao

*Oenothera erythrosepala* (Borbás) Borbás; *Onagra erythrosepala* Borbás.

Herbs erect, biennial to short-lived perennial, with basal rosette. Stems 50–150 cm tall, usually branched throughout, densely to very sparsely strigillose, with long suberect red pustulate-based hairs, and glandular hairs on inflorescence. Leaves dark to bright green, with inconspicuous veins, surface often crinkled, villous to strigillose, sessile to shortly petiolate; rosette blade 13–30 × 3–5 cm; cauline blade narrowly elliptic to lanceolate or oblanceolate, 5–15 × 2.5–4 cm, base attenuate to narrowly cuneate, margin remotely dentate, usually undulate toward base, apex acute to subobtusate. Inflorescence a dense unbranched spike. Flowers open near sunset; floral tube 3.5–5

cm. Sepals 2.8–4.5 cm, with free tips 5–8 mm, apical, erect or spreading. Petals yellow, fading to reddish orange, 3.5–5 cm. Anthers 1–1.2 cm; pollen ca. 50% fertile. Ovary densely to moderately villous, with long red pustulate-based hairs and dense glandular hairs; stigma elevated above anthers. Capsules green, narrowly lanceoloid, 2–3.5 cm, sessile. Seeds in two rows per locule, brown to dark brown, 1.3–2 mm, irregularly pitted, up to ca. 50% abortive. Fl. Jul–Sep(–Oct), fr. Aug–Oct.  $2n = 14$ , permanent translocation heterozygote; self-compatible, usually outcrossing.

Open disturbed sites such as roadsides, gardens, fallow fields, and along railroad tracks; near sea level to 800 m. Anhui, Guizhou, Hebei, Henan, Hunan, Jiangsu, Jiangxi, Jilin, Shaanxi, Sichuan, Yunnan, Zhejiang [Afghanistan, India, Japan, Pakistan, Russia; Africa, SW Asia, Australia, Europe, North and South America, Pacific islands (New Zealand)].

*Oenothera glazioviana* is not a native plant to any area in the usual sense, having originated via hybridization between two cultivated or naturalized species in a garden in Europe. It was introduced into the horticultural trade as early as 1860, grown for its particularly large, attractive flowers, and has become very widely naturalized.

**4. *Oenothera oakesiana*** (A. Gray) J. W. Robbins ex S. Watson & Coulter, Manual, ed. 6, 190. 1890.

曲序月见草 qu xu yue jian cao

*Oenothera biennis* Linnaeus var. *oakesiana* A. Gray, Manual, ed. 5, 190. 1867.

Herbs erect to procumbent, biennial, with taproot and basal rosette. Stems 10–60 cm tall, simple or branched, densely strigillose throughout, mixed with long erect hairs and/or suberect red pustulate-based hairs, and often glandular hairs on inflorescence. Leaves grayish green, with inconspicuous veins, densely strigillose, sessile or shortly petiolate; rosette blade 8–30 × 0.5–3 cm; cauline blade very narrowly oblanceolate to narrowly elliptic, 3.5–20 × 0.5–2.7 cm, base narrowly cuneate to attenuate, margin remotely dentate to subentire, apex acute to narrowly so. Inflorescence a dense unbranched spike, nodding or sigmoid. Flowers open near sunset; floral tube 1.5–4 cm. Sepals 9–17 mm, with free tips 2.5–4 mm, subapical, erect or spreading. Petals yellow, fading to reddish orange, 7–20 mm. Anthers 3–7 mm; pollen ca. 50% fertile. Ovary densely strigillose, with spreading and glandular hairs mixed; stigma surrounded by anthers. Capsules green, drying rusty brown, narrowly lanceoloid, 1.5–4 cm, sessile. Seeds in (1 or) 2 rows per locule, dark brown to nearly black, 1.1–1.2 mm, irregularly pitted. Fl. Jul–Sep(–Oct), fr. Aug–Oct.  $2n = 14$ , permanent translocation heterozygote; self-compatible, usually autogamous.

Sandy coastal meadows and dunes or on gravelly sites along rivers, also in disturbed sites such as roadsides; near sea level to 500 m. Fujian [native to E North America, naturalized in Europe].

This species is known only from Fujian Province in China, and has not been reported as naturalized elsewhere in Asia.

**5. *Oenothera parviflora*** Linnaeus, Syst. Nat., ed. 10, 2: 998. 1759.

小花月见草 xiao hua yue jian cao

*Oenothera biennis* Linnaeus var. *parviflora* (Linnaeus) Torrey & A. Gray.

Herbs erect, biennial, with taproot and basal rosette. Stems 30–150 cm tall, simple or sparsely branched, sparsely strigillose (sometimes only lower parts) mixed with glandular and long spreading pustulate-based hairs. Leaves bright green, with white or red veins, strigillose to subglabrous, sessile to shortly petiolate; rosette blade 10–30 × 1–4 cm; cauline blade lanceolate to narrowly elliptic or narrowly oblanceolate, 4–18 × 1–3 cm, base attenuate, margin dentate, apex acute. Inflorescence a dense simple or sparsely branched spike, apex often nodding or curved. Flowers open near sunset; floral tube 2.2–4 cm. Sepals 7–17 mm, with free tips 0.5–5 mm, ± subapical. Petals yellow to pale yellow, fading to orange or dull yellow, 8–15(–20) mm. Anthers 3.5–6 mm; pollen ca. 50% fertile. Ovary strigillose, with some spreading, pustulate-based, and/or glandular hairs; stigma surrounded by anthers. Capsules dark green, drying nearly black, narrowly lanceoloid to lanceoloid, 2–4 cm, sessile. Seeds in two rows per locule, brown to dark brown, 1.1–1.8 mm, irregularly pitted. Fl. Jul–Sep(–Oct), fr. Aug–Oct.  $2n = 14$ , permanent translocation heterozygote; self-compatible, autogamous.

Open, usually disturbed sites, roadside ditches; near sea level to 1000 m. Hebei, Liaoning [Japan; native to E North America; widely naturalized in S Africa, Europe, and Pacific islands (New Zealand)].

**6. *Oenothera laciniata*** Hill, Veg. Syst. 12, App.: 64. 1767.

裂叶月见草 lie ye yue jian cao

*Raimannia laciniata* (Hill) Rose ex Britton & A. Brown.

Herbs erect to procumbent, annual or short-lived perennial, usually with basal rosette. Stems 5–50(–100) cm tall, simple or branched, strigillose and often villous, often with glandular hairs on inflorescence. Leaves green, with inconspicuous veins, strigillose and villous, often also glandular puberulous, sessile to shortly petiolate; rosette blade 4–15 × 1–3 cm; cauline blade narrowly oblanceolate to lanceolate or narrowly elliptic, 2–10 × 0.5–3.5 cm, base narrowly cuneate, margin deeply lobed to dentate, apex acute. Inflorescence a lax open spike. Flowers open near sunset, one per stem per day; floral tube 1.2–3.5 cm, upcurved in bud. Sepals 5–15 mm, with free tips 0.3–3 mm, apical, spreading. Petals yellow to pale yellow, fading to orange, 5–22 mm. Anthers 2–6 mm; pollen ca. 50% fertile. Ovary strigillose, with spreading and sometimes a few glandular hairs; stigma surrounded by anthers. Capsules cylindrical, 2–5 cm, sessile. Seeds in two rows per locule, brown to dark brown, ellipsoid to suborbicular, 0.9–1.8 mm, pitted. Fl. Apr–Sep(–Oct), fr. May–Oct.  $2n = 14$ , permanent translocation heterozygote; self-compatible, autogamous.

Open, disturbed, usually sandy sites, often along coastal areas; near sea level to 400 m. Fujian, Taiwan [Japan; native to E North America, naturalized in S Africa, Australia, Central America, Europe, and South America].

**7. *Oenothera drummondii*** Hooker, Bot. Mag. 61: t. 3361. 1834.

海滨月见草 hai bin yue jian cao

*Oenothera littoralis* Schlechtendal.

Herbs erect to procumbent, annual to perennial, usually without rosette, often with decumbent lateral branches terminating in a rosette. Stems 10–50 cm tall, stiff, simple or branched, densely strigillose, sometimes also villous, glandular puberulous on inflorescence. Leaves grayish green, with inconspicuous veins, densely strigillose, sometimes also glandular puberulous, sessile above, petioles 2–12 mm below; basal blade 5–14 × 1–2 cm; cauline blade narrowly oblanceolate or elliptic to broadly obovate, 1–8 × 0.5–2.5 cm, base attenuate, margin shallowly dentate to subentire, rarely lyrate, apex acute to rounded. Inflorescence a lax open spike. Flowers open near sunset, one per stem per day; floral tube 2.5–5 cm, upcurved in bud. Sepals 1.3–3.3 cm, with free tips 1–3 mm, apical, erect and appressed. Petals yellow, 2–4.5 cm. Anthers 4–12 mm; pollen 90%–100% fertile. Ovary densely strigillose to villous, sometimes also glandular puberulous; stigma exerted above anthers. Capsules cylindrical, 2.5–5.5 cm, sessile. Seeds in two rows per locule, brown with darker flecks, ellipsoid to suborbicular, 1.1–1.7 mm, pitted. Fl. May–Nov, fr. Jun–Dec.  $2n = 14$ ; self-compatible, modally outcrossing.

Coastal dunes and other sandy, often disturbed areas; near sea level to 400 m. Fujian, Guangdong [North America: native to coastal areas of SE United States and NE Mexico, naturalized in Africa, SW Asia, Australia, Europe, and South America].

**8. *Oenothera stricta*** Ledebour ex Link, Enum. Pl. Hort. Berol. 1: 377. 1821.

待宵草 dai xiao cao

Herbs erect or rarely decumbent, annual or biennial, often with basal rosette. Stems 25–100 cm tall, simple or barely branched, strigillose, often with spreading and glandular hairs. Leaves green, with inconspicuous veins, strigillose, sessile to shortly petiolate; rosette leaves 10–25 × 0.8–2.5 cm; cauline leaves very narrowly elliptic to lanceolate or oblanceolate, 6–18 × 0.6–2.5 cm, base attenuate, rounded, or cordate, margin serrate and usually somewhat undulate, apex acute. Inflorescence a lax open simple or branched spike. Flowers open near sunset, one or several per day; floral tube 2–3.5 cm, erect in bud. Sepals 1.2–2.5 cm, with free tips 1–3 mm, erect. Petals yellow, often with a red spot at base, fading to reddish orange, 1.5–2.5(–3.5) cm. Anthers 7–11 mm; pollen ca. 50% fertile. Ovary densely strigillose, with some longer spreading or glandular hairs; stigma surrounded by anthers. Capsules cylindrical, somewhat enlarged toward apex, 2–4 cm, sessile. Seeds in two rows per locule, brown, ellipsoid, 1.4–1.8 mm, inconspicuously pitted. Fl. May–Nov, fr. Jun–Nov.  $2n = 14$ , permanent translocation heterozygote; self-compatible, mostly autogamous.

Moist, disturbed habitats near streams, roadside ditches, usually escaped from cultivation; 600–2500 m. Fujian, Guangxi, Guizhou, Hubei, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Yunnan [India, Indonesia, Japan, Pakistan, Russia, Sri Lanka; native to South America (Chile and Argentina); naturalized in Africa, SW Asia, Australia, Europe, North America, and Pacific islands].

This species, sometimes cultivated for its relatively large, attractive flowers, often becomes naturalized in China and elsewhere. Many specimens from China have been determined as *Oenothera odorata*

Jacquin; however, that species, also native to S South America but rarely, if ever, naturalized elsewhere, differs from *O. stricta* by having narrower leaves, larger petals that lack a red spot at the base, shorter floral tubes, and bracts mostly longer than the capsules they subtend.

**9. *Oenothera tetraptera*** Cavanilles, Icon. 3: 40. 1796.

四翅月见草 si chi yue jian cao

Herbs decumbent to ascending, annual or short-lived perennial, clumped to suffrutescent. Stems 15–50 cm tall, simple or branched, strigillose, often also moderately villous. Leaves green, with inconspicuous veins, strigillose, subsessile above, petioles 2–8 mm below; basal blade elliptic to narrowly obovate, 3–10 × 1–3 cm; cauline blade oblanceolate to obovate or elliptic-lanceolate, narrower above, 2–5 × 0.6–2.5 cm, base attenuate, margin weakly serrate to sinuate-pinnatifid, often with a large terminal lobe, apex acute to subobtusate. Inflorescence a lax open simple or branched raceme. Flowers open near sunset; floral tube 1–2.9 cm. Sepals 1.6–3.2 cm, with free tips 0.5–3.5 mm. Petals white, fading to rose-purple, 1.6–3.8 cm. Anthers 4–10 mm; pollen ca. 90+% fertile. Ovary densely strigillose and villous; stigma exerted above anthers. Capsule clavate to obovoid, 7.5–18 mm, valves with wings 2–3 mm wide, attenuate to slender sterile stipe (pedicel) 5–37 mm. Seeds clustered in each locule, light brown, obovoid, 1–1.5 mm, papillose. Fl. May–Aug, fr. Jun–Oct.  $2n = 14$ ; self-compatible, mostly outcrossing.

Moist disturbed places, mostly along roads and near gardens, where it is sometimes cultivated; 300–2200 m. Guizhou, Sichuan, Taiwan, Yunnan [native to S North America (including Mexico); naturalized in Sri Lanka, SW Asia, Australia, Central America, Europe, and N South America].

**10. *Oenothera rosea*** L'Héritier ex Aiton, Hort. Kew. 2: 3. 1789.

粉花月见草 fen hua yue jian cao

Herbs ascending to decumbent, perennial, rhizomatous and sometimes suffrutescent from woody caudex, rarely with basal rosette. Stems 7–65 cm, simple or branched, strigillose, sometimes with longer spreading hairs. Leaves green, with inconspicuous veins, glabrous to sparsely strigillose; petioles 3–20 mm; basal blade 2–5 × 0.5–2 cm; cauline blade elliptic to oblanceolate or oblong-ovate, 1–6 × 0.4–2.5 cm, base attenuate, margin subentire to coarsely dentate, sometimes sinuate-pinnatifid at leaf base, apex acute to obtuse. Inflorescence a lax open simple raceme. Flowers open near sunrise; floral tube 4–10 mm. Sepals 5–10 mm, with free tips 0.4–1 mm. Petals pink to rose-purple, 5–12 mm. Anthers 2–3.5 mm; pollen ca. 50% fertile. Ovary usually densely strigillose; stigma surrounded by anthers. Capsules clavate or narrowly obovoid, 4–12 mm, valves angled or weakly winged, attenuate to slender sterile stipe (pedicel) 5–20 mm. Seeds in several indistinct rows per locule, brown with dark spot at each end, obovoid, 0.5–1.2 mm, finely papillose. Fl. May–Nov, fr. Jun–Dec.  $2n = 14$ , permanent translocation heterozygote; self-compatible, autogamous.

Disturbed habitats along creeks and in low weedy places; 1000–2000 m. Guizhou, Jiangxi, Sichuan, Yunnan, Zhejiang [Japan; native to S North America and N South America, frequently cultivated and naturalized in SW Asia, Australia, Europe, and South America].

## 6. GAURA Linnaeus, Sp. Pl. 1: 347. 1753.

山桃草属 shan tao cao shu

Chen Jiarui (陈家瑞 Chen Chia-jui); Peter C. Hoch, Warren L. Wagner

Annual, biennial or perennial herbs, caulescent, with a taproot or woody branching caudex, occasionally with rhizomes. Stems one to several, simple or much branched. Leaves alternate, basal rosette leaves largest, decreasing in size upward, entire or toothed, often lyrate below, shortly petiolate below to subsessile above; stipules absent. Flowers perfect, zygomorphic to sometimes actinomorphic, forming a spicate raceme, not leafy, opening near sunset or near sunrise. Floral tube distinct, cylindrical, deciduous soon after anthesis. Sepals (3 or)4, reflexed, green or yellowish. Petals (3 or)4, white, fading to reddish, rarely yellow, usually abruptly clawed. Stamens (6 or)8. Anthers versatile; pollen shed singly. Ovary with (3 or)4 locules, with 1(or 2) ovules per locule; stigma divided into (3 or)4 short linear lobes, receptive all around, and subtended by a  $\pm$  conspicuous ringlike indusium. Fruit an indehiscent nutlike capsule with hard walls, broadly fusiform to subcylindric, terete to sharply (3 or)4-angled, sessile or basal portion sterile and stipelike. Seeds (1 or)2–4 per capsule, irregularly ovoid.  $2n = 14, 28, 42, 56$ .

Twenty-one species: C and E North America to C Mexico; one species (naturalized) in China.

Two other species are known from cultivation. *Gaura lindheimeri* Engelm & A. Gray is native to black-soil prairies of SC North America and is distinguished in part by its relatively large flowers (petals 1–1.5 cm), opening near sunrise, and sepals with long, erect hairs. It is commonly cultivated for its attractive flowers but is not known to be naturalized outside of its indigenous distribution; it is found in Hebei, Hong Kong, Jiangxi, and Zhejiang in China. *Gaura biennis* Linnaeus, native to a large area of C North America, has been in cultivation since ca. 1750; it is known from Yunnan in China but does not appear to be naturalized.

Recent molecular data demonstrate that *Gaura*, together with the unispecific genus *Stenosiphon* Spach, although comprising a monophyletic group, is embedded within the diverse genus *Oenothera*, and is best treated as part of that genus. The morphological characters used to delimit the genus—nutlike, indehiscent capsules with 1–4 seeds, flowers mostly zygomorphic, stigma lobes short—still delimit the group but now are viewed as specializations derived within *Oenothera*.

One of the earliest names in Onagraceae based on Chinese material was *Gaura chinensis* Loureiro (Fl. Cochinch. 1: 225. 1790). However, Merrill (Trans. Amer. Phil. Soc., n.s., 24(2): 39, 290. 1935) considered this to be one of Loureiro's "grave errors" and, using Loureiro's description, re-identified this taxon as a species of *Haloragis* J. R. Forster & G. Forster. Orchard (Bull. Auckland Inst. Mus. 10: 1–299. 1975) subsequently revised that group of Haloragaceae, and the species is currently treated as *Gonocarpus chinensis* (Loureiro) Orchard (see the following page).

**1. *Gaura parviflora*** Douglas ex Lehmann, Nov. Stirp. Pug. 2: 15. 1830.

小花山桃草 xiao hua shan tao cao

Herbs annual or short-lived biennial, vigorously growing, with a heavy taproot. Stems erect, 30–200(–300) cm tall, simple below to well-branched on inflorescence, soft villous throughout and usually also glandular pubescent; lower leaves often deciduous by time of flowering and lower stems then naked. Leaves grayish green, with inconspicuous veins, strigillose and sometimes villous; subsessile above to shortly petiolate below; basal blade 5–15  $\times$  1–3 cm; cauline blade narrowly elliptic to broadly lanceolate or oblanceolate, 2–12.5  $\times$  0.5–4 cm, base cuneate to attenuate, margin entire to sinuate-denticulate, apex

acute to acuminate. Inflorescence one to many, slender, dense spicate racemes 5–45 cm, nodding at tips, subglabrous to densely hairy,  $\pm$  ebracteate. Flowers open near sunset; floral tube 1.5–3 mm. Sepals 2–3.5 mm, without free tips. Petals pink to rose, 1.5–3 mm, slightly clawed. Anthers 0.8–1.1 mm; pollen ca. 90+% fertile. Ovary glabrous or puberulous; stigma surrounded by anthers. Capsules indehiscent, reflexed at maturity, fusiform, weakly 4-ridged, 2–4-seeded, 5–11 mm, sessile. Seeds 2–3 mm. Fl. Apr–Sep, fr. May–Oct.  $2n = 14$ ; self-compatible, autogamous.

Weedy areas near cultivation, roadsides; 100–800 m. Anhui, Hebei, Henan, Hubei, Jiangsu, Shandong [native to EC North America (including Mexico); naturalized in Japan and widely in Australia and South America].