

### 3. OXALIS Linnaeus, Sp. Pl. 1: 433. 1753.

酢浆草属 cu jiang cao shu

Herbs, annual or perennial, usually with tubers, bulbs, or rhizomes. Stems erect, creeping, or absent (rosette). Stipules usually absent or very small. Leaves radical or alternate, 3-foliolate (Chinese taxa). Inflorescences solitary, cymose, or umbellate; peduncle long, with 2 small bracts at apex, bracts appearing to be mid peduncle in solitary-flowered species. Sepals distinct, imbricate. Petals yellow, red, pink, or white, convolute, sometimes basally slightly connate. Stamens all fertile; filaments basally connate or distinct. Ovary locules with 1 to several ovules. Capsule loculicidally dehiscent. Seeds with an outer fleshy coat which bursts elastically.

About 700 species: tropics and subtropics of both hemispheres but extending into temperate regions; eight species (two introduced) in China.

*Oxalis bowiei* Aiton ex G. Don, which is native to South Africa, is cultivated as an ornamental in China and is often persistent as a greenhouse weed.

*Oxalis bulbifera* X. S. Shen & H. Sun was described from a single collection in Anhui (Tiantangzhai), *Shen Xian-sheng 20088* (holotype, KUN). The type specimen could not be traced in KUN, and no further material was available on contacting the authors. Although described as having affinities with *Oxalis acetosella*, it differs in several peculiar characteristics: the flowers are solitary or in pairs and the aerial stem is well developed. Even more unusual is the development at the leafless stem apex of “bracts” with bulbils in the axils. These are probably more accurately termed stipules, but the bulbils are a mystery. It is impossible to interpret this very unusual finding without recourse to herbarium material, and as such it is not included in the main account.

1a. Stemless bulbous perennials.

2a. Petals yellow; leaves glabrous, semisucculent ..... 3. *O. pes-caprae*

2b. Petals pink; leaves hairy above and below, membranous ..... 4. *O. corymbosa*

1b. Bulbs absent, aerial stems well developed or creeping rhizome at or just below soil surface.

3a. Petals yellow; flowers usually not solitary; aerial stems well developed.

4a. Plants creeping to caespitose, without septate hairs on vegetative parts; stolons absent; flowers in an umbellate inflorescence or solitary; fruiting pedicels deflexed to horizontal ..... 1. *O. corniculata*

4b. Plants erect to decumbent, with septate hairs on vegetative parts; stolons present; flowers in a cymose inflorescence; fruiting pedicels erect ..... 2. *O. stricta*

3b. Petals white, purplish pink to purple; flowers solitary; plants with creeping rhizome at or just below soil surface.

5a. Rhizome less than 3 mm thick (with scales), sparsely or densely clothed with pale brown remains of leaf bases; bracts glabrous or apex pubescent.

6a. Rhizome less than 2 mm thick with scales; scales glabrous, widely spaced; bracts rounded-ovate, glabrous ..... 5. *O. leucolepis*

6b. Rhizome ca. 3 mm thick with scales; scales sparsely strigose, congested; bracts lanceolate, apex pubescent ..... 6. *O. acetosella*

5b. Rhizome more than 5 mm thick (with scales), densely clothed with dark brown remains of leaf bases; bracts pubescent along midvein and margins.

7a. Leaflet blade apex broadly emarginate to subtruncate, lobe apices obtuse; bracts near middle of flowering stem; capsule subglobose to oblong, less than 2 cm ..... 7. *O. griffithii*

7b. Leaflet blade apex truncate to subtruncate, lobe apices subacute; bracts near base of flower; capsule long conical, more than 2.5 cm ..... 8. *O. obtriangulata*

1. *Oxalis corniculata* Linnaeus, Sp. Pl. 1: 435. 1753.

酢浆草 cu jiang cao

*Acetosella corniculata* (Linnaeus) Kuntze; *Oxalis corniculata* f. *erecta* Makino; *O. corniculata* subsp. *repens* (Thunberg) Masamune; *O. corniculata* var. *repens* (Thunberg) Zuccarini; *O. corniculata* subsp. *subglabra* (Kuntze) Masamune; *O. corniculata* var. *taiwanensis* Masamune; *O. minima* Steudel; *O. procumbens* Steudel; *O. repens* Thunberg; *O. repens* var. *erecta* (Makino) Masamune; *O. repens* f. *speciosa* Masamune; *O. taiwanensis* (Masamune) Masamune; *Xanthoxalis corniculata* (Linnaeus) Small; *X. corniculata* var. *repens* (Thunberg) Nakai; *X. repens* (Thunberg) Moldenke.

Annuals or short-lived perennials. Stems to 50 cm but often shorter, creeping, ascending to semierect, variably pubescent with adpressed simple hairs. Rootstock a slender

taproot, sometimes woody; stems several, freely rooting at nodes in contact with soil; stolons absent. Stipules small, rectangular to auriculate. Leaves alternate or pseudovercillate; petiole 1–8(–13) cm; leaflet blades obcordate, 0.3–1.8 × 0.4–2.3 cm, green or suffused purplish red, variably adaxially and abaxially pubescent, apex deeply emarginate. Inflorescences umbellate, (2–)1–5(–7)-flowered; peduncle usually slightly longer than petioles; bracts linear-lanceolate, 2–4 × ca. 1 mm. Pedicel 4–15(–20) mm, deflexed or horizontal in fruit, densely strigose. Sepals oblong-lanceolate, 3.5–5 × 1.2–2 mm, margin ciliate especially at apex. Petals bright yellow, oblong-obovate, 6–8 × 3–4 mm. Capsule long cylindrical, 8–25 × 2–3 mm, 5-sided, strigose with abundant simple hairs and a few septate hairs on dehiscence sutures. Seeds brown to brownish red, 5–14 per locule, ovoid-oblong, 1–1.5 × 0.8–1 mm, transversely ridged. Fl. and fr. Feb–Oct. *2n* = 24.

Mountain slopes, forests, grasslands, riversides, roadsides, fields, wastelands; sea level to 3400 m. Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Henan, Hubei, Hunan, Nei Mongol, Jiangsu, Jiangxi, Liaoning, E Qinghai, Shaanxi, Shandong, Shanxi, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Korea, Malaysia, Myanmar, Nepal, Pakistan, Russia, Thailand; almost cosmopolitan].

This species is used medicinally.

This highly successful weedy species is so widespread, particularly in areas disturbed by humans, that its origin is unknown. It has been reported from China in additional provinces, such as Heilongjiang, Jilin, Ningxia, and Xinjiang, where it is likely a weed in protected locations, such as in greenhouses. The most frequently encountered variety in China is *Oxalis corniculata* var. *villosa* (M. Bieberstein) Hohenacker, but this variety is often under-recorded due to the glabrescent nature of the adaxial surface of the leaves. *Oxalis corniculata* var. *villosa* has leaflet blades covered with trichomes all over the abaxial surface, whereas for var. *corniculata* the abaxial surface has trichomes only on the midrib of the terminal leaflet and the basal half of the lateral leaflets. Plants with leaves, and to a lesser extent all vegetative parts, suffused purplish red are *Oxalis corniculata* var. *atropurpurea* Planchon. The purple coloration is conspicuous in plants from exposed sunny habitats but is much less prominent in shaded plants and fades on drying, making confident determination of old herbarium specimens difficult. Determination of the exact distribution of these varieties in China needs additional study.

Synonyms of *Oxalis corniculata* var. *villosa* include: *Oxalis villosa* M. Bieberstein, Fl. Taur.-Caucas. 1: 355. 1808; *Acetosella corniculata* var. *villosa* (M. Bieberstein) Kuntze; ?*O. corniculata* f. *maritima* Masamune; *O. corniculata* var. *sericea* Knuth; *O. corniculata* var. *trichocaulon* H. Léveillé; *O. corniculata* f. *villosa* (M. Bieberstein) Goiran; ?*O. corniculata* var. *viscidula* Wiegand; *O. langloisii* (Small) Fedde; *O. thunbergiana* Montrouzier; *Xanthoxalis langloisii* Small. Synonyms of *Oxalis corniculata* var. *atropurpurea* include: *Oxalis corniculata* f. *purpurea* (Parlatore) Knuth; *O. corniculata* var. *purpurea* Parlatore; *O. tropaeoloides* Schlachter ex Planchon; *Xanthoxalis corniculata* f. *atropurpurea* (Planchon) Nakai; *X. corniculata* var. *atropurpurea* (Planchon) Moldenke; *X. corniculata* f. *purpurea* (Parlatore) Nakai.

## 2. *Oxalis stricta* Linnaeus, Sp. Pl. 1: 435. 1753.

直酢浆草 zhi cu jiang cao

*Acetosella chinensis* (Haworth ex G. Don) Kuntze; *A. fontana* (Bunge) Kuntze; *Oxalis chinensis* Haworth ex G. Don; *O. corniculata* var. *stricta* (Linnaeus) C. C. Huang & L. R. Xu; *O. cymosa* Small; *O. diffusa* Boreau; *O. europaea* Jordan; *O. fontana* Bunge; *O. repens* Thunberg var. *stricta* Hatusima; *O. shinanoensis* T. Itô; *Xanthoxalis cymosa* (Small) Small; *X. europaea* (Jordan) Moldenke; *X. stricta* (Linnaeus) Small.

Annuals or short-lived perennials, all vegetative parts (except petioles) variably pubescent with simple and multi-septate hairs. Stems to 30 cm, usually single when young, erect, branching and finally decumbent with age but not rooting at nodes; underground stolons usually present. Stipules absent or rounded and inconspicuous. Leaves alternate or sometimes almost opposite or whorled; petiole (2–)3–8(–12) cm, pubescent with simple and at least some septate trichomes at base; leaflet blades obcordate, (0.3–)0.8–1.8(–2.5) × (0.3–)1.2–3(–3.5) cm, green, abaxially sparsely pubescent, adaxially glabrous, apex deeply emarginate. Inflorescences dichotomous cymes, some-

times umbellate, 2–5(–7)-flowered; peduncle ca. 2 × as long as petioles or longer, base with a swollen articulation; bracts linear, 1.5–2 × ca. 1 mm, glabrous or with very sparse trichomes. Pedicels (3–)5–10 mm, erect in fruit, pubescent with simple and septate hairs. Sepals linear to narrowly elliptic, 4–7 × 1–2 mm, margin ciliate. Petals pale yellow, oblong-obovate, 5–10 × 2–3 mm. Capsule cylindrical, 8–15 × 2–3.5 mm, 5-sided, glabrous or pubescent with only septate trichomes. Seeds 4–10 per locule, brown to brownish red, ovoid-oblong, 1–1.5 × 0.8–1 mm, transversely ridged. Fl. and fr. Feb–Oct.  $2n = 24$ .

Forests, ravines; 400–1500 m. Guangxi, Hebei, Henan, Hubei, Jiangxi, Jilin, Liaoning, Shanxi, Zhejiang [Japan, Korea, SE Russia; E North America, introduced in Europe].

*Oxalis stricta* is similar in appearance to *O. corniculata*, and some recorded occurrence of *O. stricta* in China beyond those reported here represent misidentification.

## 3. *Oxalis pes-caprae* Linnaeus, Sp. Pl. 1: 434. 1753.

黄花酢浆草 huang hua cu jiang cao

*Oxalis cernua* Thunberg.

Perennials, 5–15(–40) cm tall, acaulescent, sparsely pubescent; bulb with white fleshy contractile root and a slender vertical stem rising to soil surface; underground stem and soil surface crown bearing numerous small bulbils and scales. Petiole 3–10 cm, erect to spreading; leaflet blades obcordate, 0.8–2 × 1.2–3.2 cm, slightly succulent, bright green often with dark purple spots, glabrous, apex deeply emarginate. Umbellate cymes with 3–20 flowers; peduncle 2 × as long as petioles. Flowers 2–3 cm across, nodding. Sepals lanceolate, 2.5–4 × ca. 1 mm, apex with a pair of orange calli. Petals deep golden yellow, obovate. Capsule long terete, pubescent, very rarely formed. Fl. Apr–Sep.

Cultivated grounds, open habitats; low elevations. Naturalized at least in Fujian but cultivated elsewhere in S China and very likely to escape and spread vegetatively [native to South Africa].

This species is cultivated as an ornamental in at least Hubei, Shaanxi, and Xinjiang. It is widely introduced and a problem weed in the Mediterranean and warm temperate and subtropical areas.

## 4. *Oxalis corymbosa* Candolle, Prodr. 1: 696. 1824.

红花酢浆草 hong hua cu jiang cao

*Oxalis debilis* Kunth var. *corymbosa* (Candolle) Lourtie; *O. martiana* Zuccarini.

Perennials, (6–)10–25(–40) cm tall, stemless, pubescent. Subterranean bulb 1.5–3 cm; scales loose, papery, 3-veined; sessile bulbils 3–6 mm, numerous. Leaves basal; petiole 5–30 cm, with long sparse to moderately dense spreading white trichomes; leaflet blades obcordate, 1–4.5 × 1.5–6 cm, both surfaces covered with trichomes, adaxial surface punctate with dark calli especially near margin, apex deeply emarginate. Inflorescences corymbose cymes, irregularly branched, 8–15-flowered; peduncle 10–40 cm or longer; bracts lanceolate, membranous. Pedicels, bracts, and sepals pubescent. Pedicel 0.5–2.5 cm. Sepals lanceolate, 4–7 mm, apex with 2 reddish brown calli. Petals purplish pink with darker veins, obcordate,

1.5–2 cm. Ovary pubescent. Capsule rarely formed. Fl. Mar–Dec.

Cultivated and also escaped as a common weed of cultivated grounds and open habitats; near sea level to 2300 m. Naturalized in Anhui, Fujian, Gansu (cultivated), Guangdong, Guangxi, Guizhou, Hainan, Hebei (cultivated), Henan (cultivated), Hubei (cultivated), Hunan, Jiangsu, Jiangxi, Shandong (cultivated), Shanxi (cultivated), Sichuan, Taiwan, Xinjiang (cultivated), Yunnan, Zhejiang [native to tropical South America, cultivated as an ornamental and naturalized in warm temperate areas in many parts of the world].

Some rounded-leaved forms of *Oxalis latifolia* Humboldt, Bonpland & Kunth can be confused with *O. corymbosa* and are most clearly distinguished by the bulb scales with 5–11 veins. Both species are recorded as introduced weeds in other Asian countries. The superficially similar *O. articulata* Savigny is cultivated in China but is readily recognized by its woody tuberous rhizome. Specimens of *O. articulata* without basal parts can be distinguished by the lack of spreading hairs on the petioles and peduncles.

**5. *Oxalis leucolepis*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 223. 1912.

白鳞酢浆草 bai lin cu jiang cao

*Oxalis acetosella* Linnaeus subsp. *leucolepis* (Diels) C. C. Huang & L. R. Xu.

Perennials to 12(–15) cm tall, slender. Rhizome creeping underground, very slender, very sparsely covered with fleshy pale brown scalelike remains of leaf bases, ca. 0.5 mm thick not including scales, 1.5–2 mm thick including scales; scales pale brown, usually widely spaced, glabrous. Petiole 6–11 cm; leaflet blades rounded-obcordate, 1–1.8 × 1.1–2 cm, abaxially pubescent and often purplish, adaxially glabrous, apex deeply emarginate; lobe apices rounded. Flowers solitary, nodding; peduncle as long as or longer than leaves; bracts 2 at middle of flowering stalk, rounded-ovate to ovate, ca. 2 mm, translucent, glabrous. Sepals ovate-lanceolate, ca. 5 mm, persistent. Petals white, purplish veined, spotted dark purple at base, 0.9–1.4 cm. Fl. Jul–Aug.

Shaded *Abies*, *Pinus*, and mixed forests, among moss and boulders; 2800–4000 m. SE Xizang, Yunnan [Bhutan, India (Sikkim), Myanmar, Nepal].

The taxonomy of this and the following three species is not clearly resolved, with some preferring to recognize just one species with several infraspecific taxa.

**6. *Oxalis acetosella*** Linnaeus, Sp. Pl. 1: 433. 1753.

白花酢浆草 bai hua cu jiang cao

Perennials 8–15 cm tall, stemless. Rhizome creeping underground, slender, mostly covered with fleshy pale brown scalelike remains of leaf bases, ca. 1 mm thick not including scales, ca. 3 mm thick including scales; scales pale brown, sparsely strigose. Petiole 3–15 cm; leaflet blades obcordate, 0.5–2 × 0.8–3 cm, apex deeply emarginate; lobe apices rounded. Flowers solitary, nodding; peduncle as long as or longer than leaves; bracts at middle of flowering stalk, lanceolate, ca. 3 mm, with trichomes around apex. Sepals ovate-lanceolate, persistent. Petals white, lilac to pinkish veined, obovate, (1.2–)1.5–2.2 cm,

apex retuse to deeply emarginate. Capsule angular-ovoid, 3–4 mm. Seeds light brown, ovoid, longitudinally ridged. Fl. Jul–Aug, fr. Aug–Sep.  $2n = 22$ .

Forests, shady places; 800–3700 m. Heilongjiang, Jilin, Liaoning, Ningxia (Liupan Shan), Xinjiang [Japan, Korea, Mongolia, Nepal, Pakistan, Russia; Europe].

This species is often misidentified, with robust forms attributable to *Oxalis griffithii* (which has a much thicker rhizome with dark brown scales and densely pubescent bracts) and slender forms attributable to *O. leucolepis* (which has thin rhizomes with widely spaced scales and glabrous, often rotund bracts). See Veldkamp (Fl. Males., Ser. 1, Spermat. 7(1). 1971) for discussions on *O. acetosella* sensu lato. Records from Zhongdian Xian and Lijiang Xian in Yunnan (X. Chuang, Fl. Yunnan. 5: 106. 1991) require confirmation.

**7. *Oxalis griffithii*** Edgeworth & J. D. Hooker in J. D. Hooker, Fl. Brit. India 1: 436. 1874.

山酢浆草 shan cu jiang cao

*Oxalis acetosella* Linnaeus subsp. *formosana* Terao; *O. acetosella* subsp. *griffithii* (Edgeworth & J. D. Hooker) H. Hara; *O. acetosella* subsp. *japonica* (Franchet & Savatier) H. Hara; *O. acetosella* var. *japonica* (Franchet & Savatier) Makino; *O. hupehensis* R. Knuth; *O. japonica* Franchet & Savatier; *O. leucolepis* Diels var. *griffithii* (Edgeworth & J. D. Hooker) R. C. Srivastava.

Perennials 7–25 cm tall, stemless, pubescent. Rhizome creeping underground, entirely densely covered by dark brown scalelike remains of leaf bases, 6–12 mm thick including scales; scales strigose. Leaves basal; petiole 6–20 cm, pubescent, trichomes brown and curled; leaflet blades obtriangular, 1–2.5(–4.5) × 1.5–3.5(–5.5) cm, abaxially pubescent, adaxially glabrous, apex broadly emarginate to subtruncate; lobe apices obtuse. Flowers solitary, nodding; peduncle 4–15 cm, equal to or longer than leaves; bracts at middle of flowering stalk, lanceolate, 2.5–4 mm, with dense trichomes along midvein and margins. Sepals lanceolate, 5–7 mm, persistent. Petals white with lilac veins, rarely pink (Hubei), narrowly obovate, 1.2–1.6 (–2) cm, apex retuse to deeply emarginate. Capsule oblong-conic, 5–13 × 5–6 mm. Seeds ovoid, 2.5–3.5 mm, longitudinally ridged. Fl. Mar–Sep, fr. May–Oct.

Mixed deciduous or coniferous forests, thickets, moist and dry shady places; 800–3400 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Shandong, Sichuan, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Japan, Kashmir, Korea, N Myanmar, Nepal, Philippines].

*E. H. Wilson 264* (type of *Oxalis hupehensis*) is a pink-flowered robust form of *O. griffithii*. *Oxalis taimonii* Yamamoto (*O. acetosella* subsp. *taimonii* (Yamamoto) S. F. Huang & T. C. Huang; *O. martiana* var. *taimonii* (Yamamoto) S. S. Ying) is probably referable to *O. griffithii* but needs further study. The report of *O. griffithii* from Ningxia (D. Z. Ma & H. L. Liu, eds., Fl. Ningxia. 1: 405. 1986) is *O. acetosella*.

**8. *Oxalis obtriangulata*** Maximowicz, Mélanges Biol. Bull. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 6: 260. 1867.

三角叶酢浆草 san jiao ye cu jiang cao

*Acetosella obtriangulata* (Maximowicz) Kuntze.

Perennials 5–12 cm tall, to 28 cm tall in fruit, stemless, sparsely pubescent. Rhizome creeping underground, 5–8 mm in diam., covered densely by glabrous fleshy brown scalelike remains of leaf bases. Leaves basal; petiole 4–9 cm, to 25 cm in fruit, rubiginously pubescent; leaflet blades broadly obtriangular, 1–1.8 × 1.4–2.2 cm, to 4.5 × 6 cm in fruit, abaxially pubescent or glabrous, adaxially glabrous, apex truncate to subtruncate; lobe apices subacute. Flowers solitary, nodding; bracts 3–4 mm, almost at base of flowers (1–2.5 cm from fruit due to pedicel extension). Sepals oblong, 7–8 mm, persistent. Petals

white, oblong-obovate, ca. 1.6 × 0.8 cm, apex emarginate. Capsule long conical, 3–4 × 0.6–0.8 cm. Seeds ovoid, 1.8–2 × 1–1.5 mm, longitudinally ridged. Fl. and fr. May–Jun.

Forests, thickets, shady places; 700–1500 m. Jilin, Liaoning [N Japan, Korea, Russia].

Specimens of *Oxalis griffithii* are often misidentified as this species. Reports of *O. obtriangulata* from Anhui (S. H. Huang et al., Anhui Zhiwuzhi (Fl. Anhui) 3: 218. 1990) and Henan (B. Z. Ding & S. Y. Wang, eds., Henan Zhiwuzhi (Fl. Henan) 2: 404. 1988) are almost certainly *O. griffithii*.

