

## The Onagraceae of Guizhou, China

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(Received April 19, 1990; Accepted June 4, 1990)

**Abstract.** A taxonomic treatment of the Onagraceae of Guizhou, China, is presented as a model for an English language flora of a province in China. The treatment includes keys, brief descriptions, distribution maps and brief notes on aspects of the biology and taxonomy of each taxon. Illustrations are provided for at least one species in each genus.

**Key Words:** Flora of China; Guizhou province; Onagraceae.

Through the work of Peter H. Raven and collaborators the Onagraceae are among the world's best known families of flowering plants. Detailed monographs or revisions have recently been or soon will be published for three of the four genera in the family occurring in China (Boufford, 1983; Chen, Hoch & Raven, in press; Raven, 1963). The fourth genus, *Oenothera*, is New World in origin, but several species have been widely introduced and are now well established, if not well collected, throughout much of temperate eastern Asia. All of the introduced species of *Oenothera* in Guizhou have been treated in monographic, revisionary or floristic studies in other parts of the world. Additional information on *Epilobium* was obtained from the unpublished manuscript on the genus in China very generously made available by C. J. Chen, P. C. Hoch and P. H. Raven. The extent of knowledge on the family therefore makes it an ideal subject to use as a model for the production of a flora of a province in China, and to test the feasibility of preparing a flora in China in a style similar to that used in several floras recently produced for parts of the United States (for example, Voss, 1972, 1975; Radford *et al.*, 1968; Great Plains Flora Association, 1977; 1986) and Canada (Packer, 1983; Porsild and Cody, 1980) where distribution maps are an important component.

Guizhou occupies an area of about 174,000 km<sup>2</sup> in south central China and is roughly the size of the state

of Washington in the northwestern United States. It reaches from about 24°50' to about 29°10'N and from about 103°46' to 109°30'E. The province is largely mountainous with the largest ranges in the northeast and east central parts. The highest peak, Fanjing Shan in the Wuling Mountains, exceeds 2550 m elevation (Deng, 1982). Extensive areas of flat land are scarce and except for narrow areas along major streams, much of the land in cultivation has resulted from terracing. The province is largely underlain with limestone and large rivers that vanish into the ground and streams that gush from caves on mountainsides are not unusual in Guizhou. The rugged topography and the difficulties associated with farming it has kept the population low in Guizhou, in relation to other provinces in China. The number of people in the province stood at slightly over 27.3 million in 1979 (Anonymous, 1980).

Guizhou has received relatively little attention from both Western and Chinese botanists. French missionaries made concentrated collections in the vicinity of some of the larger cities at about the beginning of the twentieth century. The specimens they sent back to Paris served as the basis for a number of new names, many of which were proposed by Hector Léveillé and treated in his *Flora du Kouy-tcheou* (Léveillé, 1914-1915), the only flora completed for the entire province to date. In the early 1930's A. N. Steward planned extensive botanical exploration in Guizhou, but in the

end spent only part of a single season in the province (Steward and Chiao, 1933). A number of Chinese botanists followed Steward and Chiao, and although detailed studies were undertaken in specific parts of the province, no program to systematically explore the entire province was ever completed. Currently there is a project underway within Guizhou to produce a flora of the province in Chinese. Two volumes have appeared as of this writing (Guizhou Flora Committee, 1982, 1986).

In 1984 the idea of a joint project to prepare a flora of Guizhou was discussed by American and Chinese botanists in Beijing. Toward that goal a two and a half month expedition was organized to northeastern Guizhou in the late summer of 1986. At the conclusion of field work there was also an opportunity to examine herbarium specimens in the Institute of Biology, Guiyang (HGAS), the Institute of Botany, Beijing (PE), and in the Harvard University Herbaria (A and GH). The field and herbarium studies provided an opportunity to determine the adequacy of current resources for the production of a flora of Guizhou. For *Epilobium* and *Circaea*, the two largest genera in the Onagraceae in Guizhou, the specimens in the herbaria mentioned above were supplemented by collections in more than 150 additional herbaria.

To show distribution within the province an outline map of Guizhou showing all 80 *xian* and municipalities was prepared (Fig. 1). A worksheet to accompany the outline maps and to facilitate the gathering of distributional data, the recording of flowering and fruiting periods and for noting additional information was also designed (Fig. 2). Distribution by *xian* was recorded on the data sheets and later transferred to base maps.

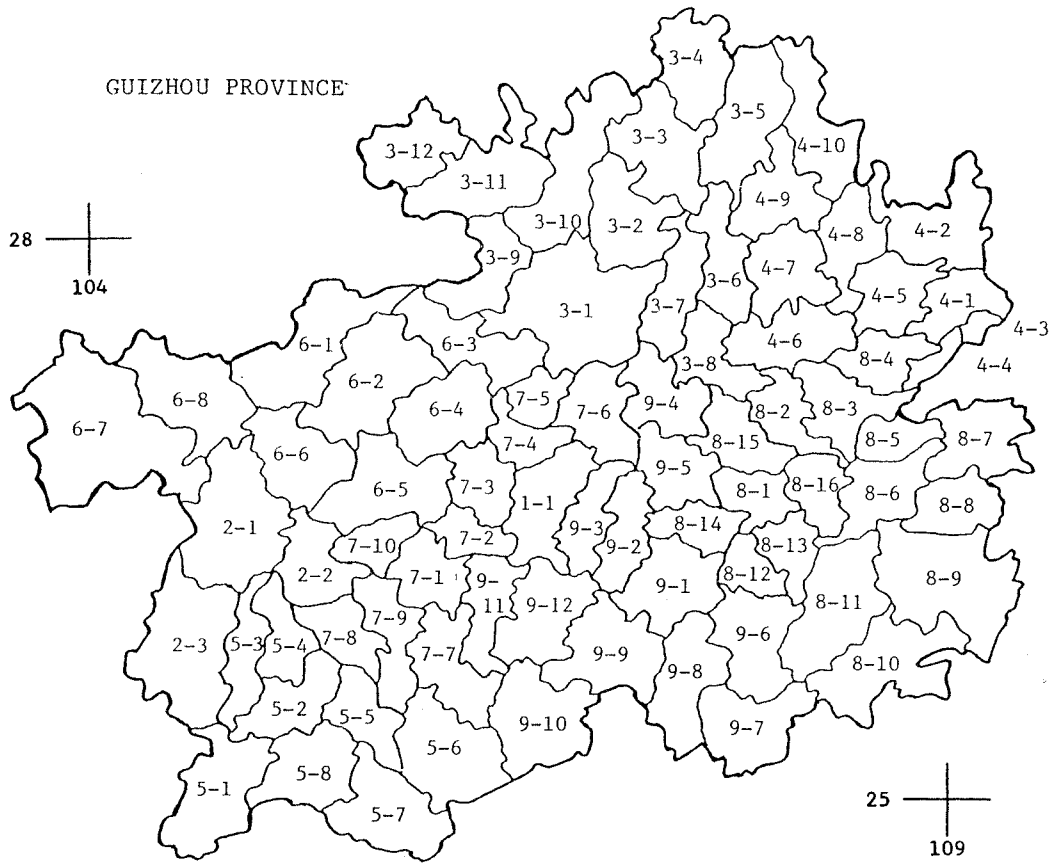
The results of these efforts make it clear that additional collecting is needed for two reasons: to fill in large gaps in distribution of nearly all taxa; and to explore portions of the province that have been mostly or completely neglected by botanical explorers. Overall, the number of collections currently available is marginally sufficient for the production of keys and descriptions of all of the taxa in Guizhou. The descriptions for a number of taxa, and particularly the keys, are greatly enhanced if material from surrounding provinces, or even from throughout the entire range, is used.

When the specimens are mapped it quickly becomes evident that the flora of Guizhou, in general, is

not well known. The few areas where collections reflect a true pattern of distribution are those where unusual geological, vegetational or topographical features have been the focus of intense botanical exploration. Particularly well explored areas are in the mountainous regions of northeastern Guizhou, especially in Yingjiang *Xian*, and in the vicinity of Leigong Shan in the east central part of the province. These two mountainous regions contain the highest peaks in Guizhou, and the forests in the two areas are more extensive than in other parts of the province and still relatively intact. Other comparably well collected areas are around the larger cities where missionaries were based, or which served as major way stations for botanical exploring parties travelling to other parts of the province.

It is also evident that common habitats, such as around villages or near paddy fields, are mostly neglected. Mapping the collections of *Ludwigia epilobioides* Maximowicz subsp. *epilobioides*, a frequent and often abundant plant in paddy fields and most conspicuous after the rice has been harvested, shows this neglect quite well. The documented distribution does not reflect the fact that the species almost surely occurs in every rice paddy in the province. Other taxa in the Onagraceae that are also presumably undercollected are *Oenothera rosea* L'Héritier ex Aiton and *O. biennis* L., both introduced and both exhibiting weedy tendencies. The native *Circaea mollis* Sieb. & Zucc. is also probably more widespread, at least across the northern half of the province, than collections indicate. Plants in difficult genera, such as many of the species of *Epilobium* L., are often intentionally undercollected because they are difficult to identify. Three of the 13 species of *Epilobium* in Guizhou are known from only single collections, although one of them, *E. angustifolium* L., is showy and presents no difficulty in identification. The single collection was made early in the 1900's and probably reflects the rarity of this species in the province.

Suspected major phytogeographical patterns in the flowering plants within Guizhou, at least as reflected by the Onagraceae, are also imperceptible. Whether this is because of the nature of the species in this family, an insufficient number of collections on which the maps are based, or the absence of clear phytogeographic patterns, is impossible to determine without mapping the distribution of species in other families.



Anlong 5-8	Huangping 8-15	Pu'an 5-3	Wanshan 4-3
Anshun 7-1	Huishui 9-12	Puding 7-10	Weining 6-7
Bijie 6-1	Jiangkou 4-5	Qianxi 6-4	Weng'an 9-4
Ceheng 5-7	Jianhe 8-6	Qinglong 5-4	Wuchuan 3-5
Cengong 8-4	Jinping 8-8	Qingzhen 7-3	Xifeng 7-5
Changshun 9-11	Jinsha 6-3	Renhuai 3-9	Xingren 5-2
Chishui 3-12	Kaili 8-1	Rongjiang 8-11	Xingyi 5-1
Congjiang 8-10	Kaiyang 7-6	Sandu 9-6	Xishui 3-11
Dafang 6-2	Leishan 8-13	Sansui 8-5	Xiuwen 7-4
Danzhai 8-12	Libo 9-7	Shibing 8-2	Yanhe 4-10
Daozhen 3-4	Liping 8-9	Shiqian 4-6	Yinjiang 4-8
Dejiang 4-9	Longli 9-3	Shuicheng 2-1	Yuping 4-4
Dushan 9-8	Luodian 9-10	Sinan 4-7	Yuqing 3-8
Duyun 9-1	Luzhi 2-2	Songtao 4-2	Zhenfeng 5-5
Fenggang 3-6	Majiang 8-14	Suiyang 3-2	Zheng'an 3-3
Fuquan 9-5	Meitan 3-7	Taijiang 8-16	Zhenning 7-9
Guanling 7-8	Nayong 6-6	Tianzhu 8-7	Zhenyuan 8-3
Guiding 9-2	Panxian 2-3	Tongren 4-1	Zhijin 6-5
Guiyang 1-1	Pingba 7-2	Tongzi 3-10	Ziyun 7-7
Hezhang 6-8	Pingtang 9-9	Wangmo 5-6	Zunyi 3-1

Fig. 1. Outline map of Guizhou Province, China, showing boundaries of *xian*. First number indicates prefecture, autonomous prefecture, municipality or other administrative unit (1, Guiyang City; 2, Shuicheng Special District; 3, Zunyi Prefecture; 4, Tongren Prefecture; 5, Xingyi Prefecture; 6, Bijie Prefecture; 7, Anshun Prefecture; 8, Qiandongnan Miao-Dong Autonomous Prefecture; 9, Qiannan Bouyei-Miao Autonomous Prefecture); the second number indicates the *xian*.

Taxon: Circaea mollis Siebold & Zuccarini

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<input type="checkbox"/> Anshun 7-1	<input type="checkbox"/> Huishui 9-12	<input type="checkbox"/> Puding 7-10	<input type="checkbox"/> Weining 6-7
<input type="checkbox"/> Bijie 6-1	<input checked="" type="checkbox"/> Jiangkou 4-5	<input type="checkbox"/> Qianxi 6-4	<input type="checkbox"/> Weng'an 9-4
<input type="checkbox"/> Ceheng 5-7	<input type="checkbox"/> Jianhe 8-6	<input type="checkbox"/> Qinglong 5-4	<input type="checkbox"/> Wuchuan 3-5
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<input type="checkbox"/> Duyun 9-1	<input type="checkbox"/> Luzhi 2-2	<input checked="" type="checkbox"/> Songtao 4-2	<input type="checkbox"/> Zhenfeng 5-5
<input type="checkbox"/> Fenggang 3-6	<input type="checkbox"/> Majiang 8-14	<input type="checkbox"/> Suiyang 3-2	<input type="checkbox"/> Zheng'an 3-3
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<input type="checkbox"/> Guiding 9-2	<input type="checkbox"/> Panxian 2-3	<input type="checkbox"/> Tongren 4-1	<input type="checkbox"/> Zhijin 6-5
<input checked="" type="checkbox"/> Guiyang 1-1	<input type="checkbox"/> Pingba 7-2	<input type="checkbox"/> Tongzi 3-10	<input type="checkbox"/> Ziyun 7-7
<input type="checkbox"/> Hezhang 6-8	<input type="checkbox"/> Pingtang 9-9	<input type="checkbox"/> Wangmo 5-6	<input type="checkbox"/> Zunyi 3-1

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Flowers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Notes:

Fig. 2. Worksheet for recording data from herbarium specimens.

The keys are intended to be diagnostic, and an attempt was made to use at least two different characters in each contrasting couplet to facilitate identification of plants in flowering or fruiting condition. The descriptions focus primarily on features that separate

taxa and are not exhaustive. Besides keys and descriptions to all of the taxa, synonymy is given for each of the accepted names. For names based on plants collected in Guizhou the type specimen and its location are cited.

**Taxonomic Treatment**

**Onagraceae**

Annual, biennial or perennial herbs [in Guizhou]. Leaves alternate, opposite or rarely whorled, entire or toothed to sinuate-pinnatifid, sessile or petiolate, stipules minute or absent. Flowers actinomorphic or zygomorphic, axillary or in terminal inflorescences, hermaphroditic [in plants from Guizhou], 2 or 4-6-merous; floral tube present or absent; stamens as many, or twice as many, as the sepals; anthers versa-

tile; pollen shed singly or in tetrads, held together by viscine threads; ovary inferior; style single; stigma shallowly or deeply lobed, clavate or globose; fruit a dehiscent or indehiscent capsule; seeds anatropous, lacking endosperm, with or without a terminal tuft of silky hairs [coma].

The family contains 18 genera and about 650 species worldwide with the greatest representation in western North and South America. All three genera native in the Old World occur in Guizhou.

**Key to Genera**

- 1. Flowers 2-merous; ovaries and indehiscent fruits with stiff hooked hairs; ovules and seeds 1 per locule . . . . . 1. *Circaea*
- 1. Flowers 4-(6-)merous; ovaries and dehiscent fruits glabrous or with curved or straight soft hairs; ovules and seeds numerous in each locule.
  - 2. Seeds with a coma; petals pink, rose purple or white; leaves opposite (less often alternate or rarely whorled in ours) . . . . . 2. *Epilobium*
  - 2. Seeds without a coma; petals yellow, white, rose purple or pink; leaves alternate.
    - 3. Floral tube present; flowers yellow, white, pink or rose purple; capsules clavate, obovoid or cylindrical . . . . . 3. *Oenothera*
    - 3. Floral tube absent; flowers yellow; capsules cylindrical . . . . . 4. *Ludwigia*

**1. *Circaea* L.**

Perennial rhizomatous herbs, often forming large colonies. Leaves petiolate, opposite, becoming alternate and bract-like above. Inflorescence terminal on the main stem and also at the tips of short axillary branches, a simple or branched raceme. Flowers white or pink, 2-merous, with a floral tube; ovary uni- or bilocular, covered with stiff uncinuate hairs; ovules 1 per locule; sepals and petals alternate; petals obcordate or obtrullate, notched at the apex; anthers opposite the sepals; nectary surrounding the base of the style, in-

cluded within or projecting beyond the opening of the floral tube; style equalling or longer than the stamens, stigma 2-lobed.

A genus of 7 species and an additional 7 subspecies occurring in temperate and boreal forests of the northern hemisphere and with all 7 species and 11 of the 14 taxa in China. Hybrids are common and often abundant in naturally disturbed habitats in North America, Europe and Japan, but few collections of hybrids are known from China (Boufford, 1983; Averett and Boufford, 1985; Seavey and Boufford, 1983).

- 1. Ovaries and fruits bilocular; rhizomes not terminated by tubers; flowers opening on spreading pedicels.
  - 2. Nectary wholly included, not projecting beyond the opening of the floral tube; plants with some long spreading hairs . . . . . 1. *C. cordata*
  - 2. Nectary projecting beyond the opening of the floral tube; plants glabrous or with short falcately recurved hairs.
    - 3. Stems with short falcately recurved hairs; petals obovate to depressed broadly obovate, with the apical notch one fourth or more the length of the petal; fruits strongly ribbed and deeply grooved . . . . . 2. *C. mollis*
    - 3. Stems glabrous; petals obtrullate, with the apical notch one fifth or less the length of the petal; fruits without strong ribs and deep grooves . . . . . 3. *C. erubescens*
- 1. Ovaries and fruits unilocular; rhizomes terminated by fleshy tubers; flowers opening on erect or ascending pedicels . . . . . 4. *C. alpina* subsp. *imaicola*

1. ***Circaea cordata*** Royle, Illustr. Bot. Himal. 211. 1834. (Figs. 3a-c, 7b). [*C. bodinieri* H. Léveillé, nom. provis. Bull. Acad. Int. Geogr. Bot. 22: 224. 1912. *C. × hybrida* Hand.-Mazz., Symb. Sin. 7: 605. 1933. *C. kitagawae* Hara, J. Jap. Bot. 10: 595. 1935.].

Plants 2-15 dm tall, with non-tuberous rhizomes, pubescent, usually densely so, with long straight hairs, straight gland tipped hairs and short falcately recurved hairs. Leaves narrowly to very broadly ovate, base cordate or rounded to very broadly cuneate, apex acuminate. Buds pubescent, rarely subglabrous, with few to many long straight or slightly curved hairs intermixed with shorter, often gland tipped, hairs. Flowers closely spaced on spreading pedicels; sepals 2-3.7 mm long, 1.4-2 mm wide; petals 1-2.4 mm long, 1.2-3.1 mm wide, white, depressed obovate, apex obcordate, apical notch 0.5-1.9 mm long and 1/2-2/3 the length of the petal; nectary inconspicuous at the base of the floral tube. Fruit 3-3.9 mm long, 1.8-3.3 mm broad, bilocular and 2-seeded, obliquely obovoid to lenticular, flattened, truncate to obliquely rounded to the pedicel, with low corky thickenings along the margins and between the locules, without prominent grooves.  $n=11$ .

Well drained soils in mixed deciduous forests, forest margins and thickets; southern Sakhalin and the Kurile Islands through Japan, Korea, the Soviet Far East and Taiwan to southwestern China and northeastern India; Nepal, Kashmir and Pakistan; to ca. 1500 m. Fl. Jul-Sep; fr. Aug-Oct.

2. ***Circaea mollis*** Siebold & Zuccarini, Abh. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. 4: 134. 1843. (Figs. 3e, 7d). [*C. coreana* H. Léveillé, Repert. Spec. Nov. Regni Veg. 4: 226. 1907. *C. coreana* H. Léveillé var. *sinensis* H. Léveillé, Repert. Spec. Nov. Regni Veg. 4: 226. 1907. Type: Guizhou, *J. Esquirol* 647, specimen not seen.].

Plants 2.5-15 dm tall, with non-tuberous rhizomes, pubescent, usually densely so, with short falcately recurved hairs, the inflorescence also with gland tipped hairs or glabrous. Leaves narrowly to broadly lanceolate to narrowly ovate, base narrowly to broadly cuneate or occasionally rounded to very broadly cuneate, apex acute to acuminate. Buds glabrous or pubescent with short, often gland tipped, hairs. Flowers distantly spaced on spreading pedicels; sepals 1.6-2.4

mm long, 1-1.5 mm wide; petals 0.7-1.8 mm long, 1-2.6 mm wide, white, broadly to very broadly depressed obovate, apex obcordate, apical notch 0.2-0.5 mm long, 1/4-1/2 the length of the petal; nectary exerted beyond the opening of the floral tube. Fruit 2.6-3.5 mm long, 2-3.2 mm, bilocular and 2-seeded, very broadly pyriform to globose, concavely and obliquely tapering to the pedicel, with prominent corky thickenings and deep, prominent grooves.  $n=11$ .

Broad-leaved deciduous or mixed broad-leaved deciduous and evergreen forests, thickets; Japan, South Korea, locally in northeastern China and the southeastern U.S.S.R., to northern Vietnam, Cambodia, Laos, Burma and easternmost Assam, India; below 1700 m. Fl. Jun-Aug; fr. Jul-Sep.

3. ***Circaea erubescens*** Franchet & Savatier, Enum. Pl. Jap. 2: 370. 1879. (Fig. 7c). [*C. delavayi* H. Léveillé, Repert. Spec. Nov. Regni Veg. 8: 138. 1908. *C. lutetiana* L. race *erubescens* (Franchet & Savatier) H. Léveillé, Bull. Acad. Int. Geogr. Bot. 21: 219. 1912.].

Plants 1-12 dm tall, with non-tuberous rhizomes, glabrous. Leaves lanceolate to ovate or occasionally broadly ovate, base very broadly cuneate to rounded or truncate, apex short acuminate. Buds glabrous, reddish purple. Flowers distantly spaced on spreading pedicels; sepals 0.6-2.5 mm long, 0.8-1.2 mm wide; petals 0.8-1.7 mm long, 0.7-1 mm wide, pink, narrowly to broadly obtrullate or obovate, apex crenulate or with minute secondary lobes, apical notch 0.1-0.3 mm long, 1/10-1/5 the length of the petal; nectary exerted beyond the opening of the floral tube. Fruit 1.7-3.2 mm long, 1.2-2.1 mm broad, bilocular and 2-seeded, obovoid to broadly so, very slightly flattened dorsally, tapering smoothly to the pedicel, without prominent corky thickenings and grooves.  $n=11$ .

Rocky streambeds and trailsides, thickets broad-leaved deciduous or mixed broad-leaved forests; Japan, South Korea, and Taiwan westward along the Changjiang River and its tributaries to southern Sichuan, Yunnan and Guizhou; below 2500 m. Fl. Jul-Sep; fr. Aug-Oct.

4. ***Circaea alpina*** L. subsp. ***imaicola*** (Ascherson & Magnus) Kitamura, Fl. Afghanistan 279. 1960. (Figs. 3d, 7a). [*C. alpina* L. var. *imaicola* Asch. & Mag.,

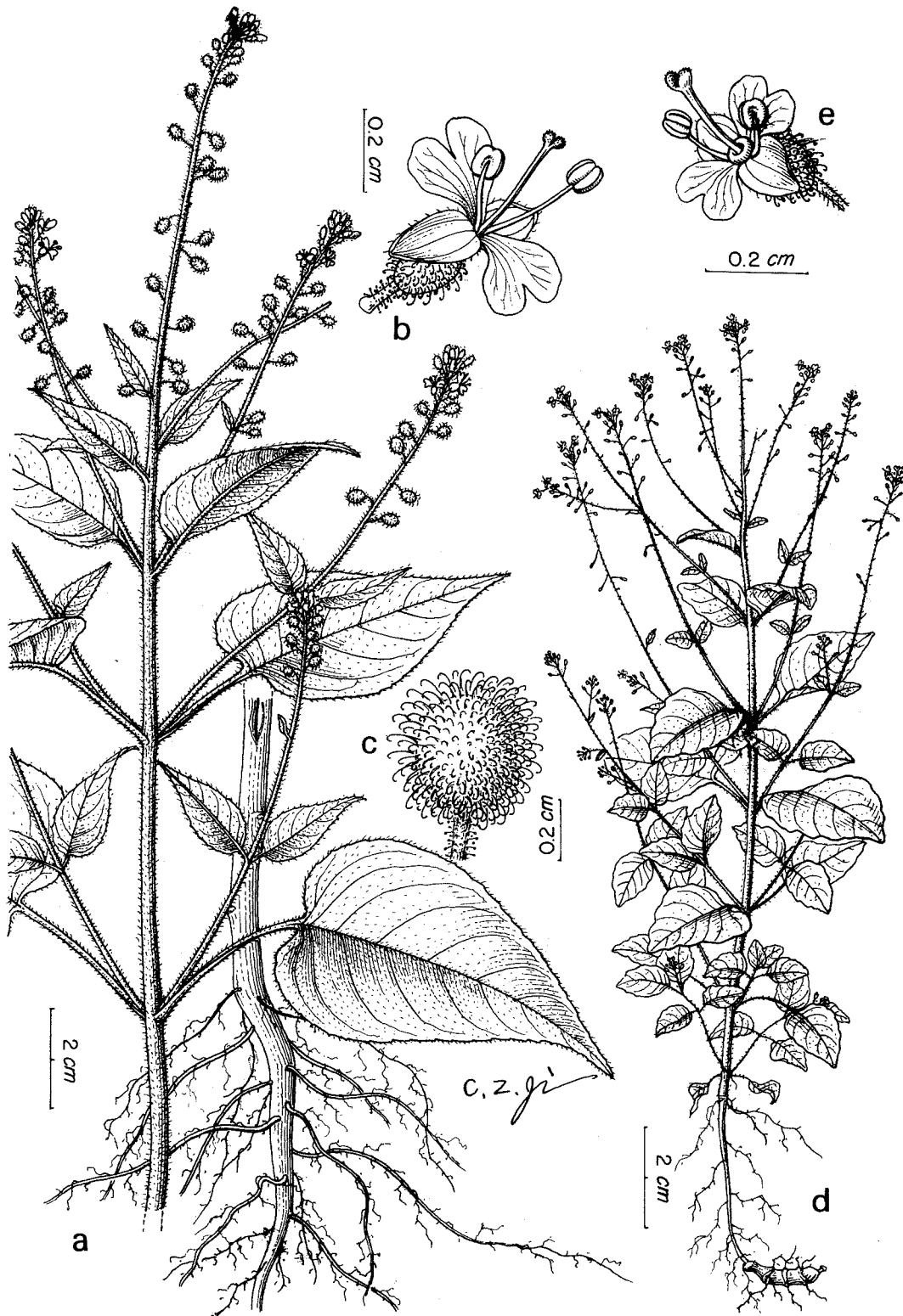


Fig. 3. *Circaea*. a-c, *C. cordata*: a, habit; b, flower (nectary within floral tube); c, fruit. d, *C. alpina* subsp. *imaicola*: habit (note stem arising from tuber). e, *C. mollis*: flower (note ring-like nectary projecting beyond floral tube).

Bot. Zeit. (Berlin) 28: 749. 1870. *C. pricei* Hayata, Ic. Pl. Formosa 5: 72. 1915. *C. imaicola* (Asch. & Mag.) Hand.-Maz., Symb. Sin. 7: 603. 1933. *C. minutula* Ohwi, Acta Phytotax. Geobot. 2: 151. 1933. *C. taiwaniana* S. S. Ying, Alpine Pl. Taiwan in Color 2: 199. 1978.]

Plants 0.35-3 dm tall, rhizomes terminated by tubers, pubescent, the stem with falcately recurved hairs, the inflorescence with glandular hairs. Leaves ovate to broadly ovate, base truncate to rounded, rarely broadly cuneate or subcordate apex acute to short acuminate. Buds glabrous or glabrescent, white or pink. Flowers closely spaced on erect or ascending pedicels; sepals 0.7-1.6 mm long, 0.8-1.1 mm wide; petals 0.5-1.8 mm long, 0.7-1.5 mm wide, white or pink, narrowly to broadly obovate, apex obcordate, apex crenulate or with minute secondary lobes, apical notch 0.2-0.7 mm long, 1/4-1/2 the length of the petal; nectary wholly within the floral tube. Fruit 2.1-2.5 mm long, 0.5-1.1 mm broad, unilocular and 1-seeded, clavate, without corky thickenings and grooves.  $n=11$ .

Cool, moist places along streams or in thickets, broad-leaved deciduous or mixed broad-leaved-coniferous forests; central and southwestern China, north-

western Vietnam, northern Thailand and Burma, and Assam, India, westward along the Himalayas to Afghanistan; disjunct in the mountains of Taiwan and ern India; 2500-2750 m. Fl. Jun-Aug; fr. Jul-Sep.

## 2. *Epilobium* L.

Erect perennial herbs reproducing vegetatively by basal leafy rosettes, basal shoots [stolons or soboles], subterranean globose or ovoid winter buds with fleshy overwintering scales [turions], or rhizomes. Leaves opposite, alternate, or rarely whorled. Flowers borne singly in the leaf axils, but clustered upward and forming a  $\pm$  definite inflorescence. Flowers 4-merous, the petals purplish, pink or white; stamens 8. Capsule elongate, slender, 4-loculed, loculicidally dehiscent, many seeded; seeds [in ours] with a terminal tuft of silky hairs (coma).  $n=12, 13, 15, 16$ , or [in taxa in Guizhou] 18 or multiples of 18. Chen, C. J., P. C. Hoch & P. H. Raven. (in press). *Epilobium* (Onagraceae) in China. (unpublished manuscript, from which the following treatment was largely extracted). Keating, R. C., P. C. Hoch & P. H. Raven. 1982. Perennation in *Epilobium* (Onagraceae) and its relation to classification and ecology. Syst. Bot. 7: 379-404.

### Key to the Species of *Epilobium* in Guizhou

1. Stem leaves alternate, very rarely opposite or verticillate near the base; floral tube absent; sepals 9-19 mm long; style deflexed . . . . . 1. *E. angustifolium* subsp. *circumvagum*
1. Stem leaves opposite at least below the inflorescence; floral tube present; sepals 8 mm or less long (if longer than the stems and ovaries densely villous); style erect.
  2. Stigma deeply 4-lobed.
    3. Leaves distinctly clasping; flowers 9-20 mm long; stigma elevated far above the anthers at anthesis . . . . . 2. *E. hirsutum*
    3. Leaves sessile, but not clasping; flowers 5-7.5 mm long; stigma surrounded by anthers of longer stamens at anthesis . . . . . 3. *E. parviflorum*
  2. Stigma entire or shallowly emarginate.
    4. Stems more or less tetragonal or diagonal in cross section with hairy elevated lines decurrent from the margins of the petioles, the remainder of the stem otherwise subglabrous, at least on the lower half.
      5. Leaves spatulate, with a remarkably pale prominent midrib beneath; petioles 2-11 mm long; mature pedicels 1.3-4 cm long . . . . . 5. *E. sinense*
      5. Leaves ovate, oblong-ovate or elliptic with slightly prominent midrib beneath; petioles 0-6 mm long; mature pedicels 0.4-2 cm long.
    6. Stems tetragonal in cross section, with 4 or 2 hairy lines decurrent from the petioles; leaves oblong, oblong-ovate or elliptic with obtuse, rarely acute, apex, stigma clavate, usually elevated above the anthers at anthesis . . . . . 13. *E. wallichianum*
    6. Stems subterete or diagonal in cross section, usually with 2 hairy lines decurrent from the petioles;



leaves ovate to oblong-lanceolate with acute or acuminate apex; stigma capitate to subcapitate, surrounded by the anthers at anthesis.

- 7. Decurrent lines on stem more conspicuously strigillose than stem; pubescence in inflorescence an admixture of strigillose and glandular hairs; hairs on the floral tube between the bases of the sepals tufted . . . . . 11. *E. amurense*
- 7. Decurrent lines and stem uniformly strigillose; hairs in inflorescence strigillose; hairs on the floral tube between the bases of the sepals uniformly scattered . . . . . 12. *E. cephalostigma*
- 4. Stem usually terete, pubescent all around, lacking raised decurrent lines from margins of petioles, or with inconspicuous sparsely pubescent lines.
- 8. Stems pubescent all around at least on the upper stem, but with faint pubescent lines decurrent from margins of petioles.
- 9. Plants forming stolons that terminate in leafy rosettes; stems usually simple, with predominantly glandular hairs; flowers 7-18 mm long; capsules 7-11 cm long . . . . . 7. *E. kermodei*
- 9. Plants forming soboles; stems usually well-branched with an admixture of strigillose and glandular hairs, flowers 3.5-7 mm long; mature capsules 4-8.5 cm long . . . . . 4. *E. cylindricum*
- 8. Stems uniformly pubescent all around, without raised decurrent lines from margins of petioles.
- 10. Stigma clavate, or sometimes subcapitate; leaves sessile.
- 11. Stems with appressed velvety tomentum, forming basal rosettes; flowers 11-17 mm long; pedicels of mature capsules 1.2-2.8 cm long . . . . . 8. *E. pannosum*
- 11. Stems covered with strigillose or glandular hairs, or a mixture of the two, forming soboles or stolons; flowers 6-11 mm long; pedicels of mature capsules 0.4-1.5 mm long.
- 12. Stems covered with strigillose hairs, sometimes mixed with glandular hairs above, forming fleshy soboles; coma dull white; flowers 7-11 mm long . . . . . 9. *E. brevifolium* subsp. *trichoneurum*
- 12. Stems covered with predominantly glandular hairs, forming thick leafy stolons; coma reddish brown; flowers 6-8 mm long . . . . . 10. *E. pyrriholophum*
- 10. Stigma capitate or sometimes subcapitate or clavate-capitate; petioles 1-7 mm long.
- 13. Petals 5-7.2 mm long; stigma capitate or sometimes clavate-capitate; petioles 1-7 mm long . . . . . 6. *E. royleanum*
- 13. Petals 7-10 mm long; stigma usually clavate, but sometimes subcapitate; petioles usually lacking, rarely 1-4 mm long . . . . . 9. *E. brevifolium* subsp. *trichoneurum*

1. ***Epilobium angustifolium* L. subsp. *circumvagum*** Mosquin, Brittonia 18: 167. 1966. (Fig. 7f). [*Chamaenerion angustifolium* (L.) Scopoli subsp. *circumvagum* (Mosquin) Moldenke, Phytologia 27: 289. 1973.].

Perennial herb 0.3-2 m tall, colonial from vigorous rhizomes; stems simple or rarely branched above, glabrous below, sparsely strigillose above. Leaves alternate, very rarely opposite or verticillate, oblong to elliptic-lanceolate, 6-23 cm long, (0.7-)1.5-3.4 cm wide, ± evidently denticulate, petiole 2-7 mm long, base obtuse to cuneate, apex attenuate. Inflorescence a simple, lax raceme; flowers nodding in bud suberect at anthesis; ovaries densely appressed canescent; floral tube lacking, instead with a slightly raised disk; sepals

oblong lanceolate or upper two oblanceolate, 9-19 mm long, 1.5-3 mm wide, clawed; corolla zygomorphic, the upper petals larger, petals pale pink to purple or rarely white, obovate to suborbicular, 14-25 mm long, 7-15 mm wide, usually entire to shallowly emarginate; style erect in bud, sharply deflexed at initiation of anthesis, becoming erect again after anthers dehisce and filaments recurve, stigma deeply 4-lobed, the lobes 3-6 mm long. Capsule indumentum similar to that of the ovaries. *n*=36.

In open and semi-open areas in the mountains, especially in cleared or burned areas, along roads, scree slopes and along streams; across the northern United States and southern Canada and along the Pacific coast to the Pribiloff Islands; in Asia from Kamchatka, Sakhalin and the Ussuri region to Japan

and Korea, northeastern and southwestern China and across the Himalayas and Caucasus Mts. to Turkey; 1100-3600 m in southwestern China, but elevation in Guizhou not known. Fl. Jun-Sep; fr. Jul-Oct.

*Epilobium angustifolium* subsp. *circumvagum*, very distinct in the genus in Guizhou, has been collected only once in the northwestern part of the province (*E. Bodinier* s. n., s. d. (P)), but the exact place of collection is unknown.

2. ***Epilobium hirsutum*** L., Sp. Pl. 1: 347. 1753. (Figs. 4a-b, 7j).

Perennial herb 0.25-1.2(-2.5) m tall, producing long, rope-like hypogean stolons to 1 m in length with scattered cataphylls and often terminating in leafy rosettes; stems freely branched, especially above, covered throughout with dense villous hairs with an admixture of short glandular hairs, especially in the inflorescence, rarely white tomentose. Leaves mostly opposite, alternate in the inflorescence, lance-elliptic to narrowly obovate or elliptic, rarely very narrowly lanceolate, serrulate, sessile and  $\pm$  clasping, base subcuneate, apex acute to acuminate. Inflorescence and flowers erect; ovaries densely long villous and short glandular pubescent, sometimes predominantly glandular; floral tube 1.3-2 mm long; sepals oblong linear, 6-12 mm long, 1-2 mm wide; petals bright pink to dark purple, broadly obcordate, 9-20 mm long, 7-15 mm wide, the notch 1-2 mm deep; stigma 4-lobed, the lobes 2-3.5 mm long, elevated above the anthers at anthesis. Capsule indumentum similar to that of the ovaries or sometimes glabrescent.  $n=18$ .

In wet places near streams, abandoned but flooded paddy fields, marshes, river beds, roadsides; temperate and montane Europe and Africa, introduced in North America; temperate and subtropical China; 1800-2500 m. Fl. Jun-Sep; fr. Aug-Oct.

3. ***Epilobium parviflorum*** Schreber, Spicil. Fl. Lips. 146, 155. 1771. (Fig. 8b). [*E. parviflorum* Schreber var. *vestitum* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 584. 1879.].

Perennial herb 0.18-1 (-1.6) m tall, producing short stalked epigeous basal rosettes; stems freely branched above, densely covered with gray villous hairs below and grading into short glandular hairs above, often

with pubescent or subglabrous decurrent lines from the margins of the petioles. Leaves opposite below, alternate above, narrowly lanceolate to oblong lanceolate, 3-12 cm long, 0.5-2.5 cm wide, denticulate, petiolate, base usually rounded, apex subacute. Inflorescence and flowers erect; ovaries with dense short erect glandular hairs, sometimes with an admixture of scattered villous hairs; floral tube 1-1.9 mm long; sepals narrowly lanceolate, 2.5-6 mm long, 1-1.5 mm wide; petals bright pink to bright rose purple, broadly obovate, 4-8.5 mm long, 3-4.5 mm wide, the notch 1-3.5 mm deep; stigma deeply 4-lobed, the lobes 1-1.8 mm long, surrounded by or barely elevated above the anthers at anthesis. Capsule indumentum similar to that of the ovaries, rarely glabrescent.  $n=18$ .

In disturbed wet places near streams, bogs and rivers, also on open slopes and meadows in mountains; Eurasia, from northcentral China and the Himalayas to Europe; northern Africa; 350-2500 m. Fl. Jun-Sep; fr. Jul-Oct.

*Epilobium parviflorum* resembles *E. hirsutum*, but differs in having short, distinct petioles, the stigma surrounded by the anthers at anthesis and perennation by rosettes rather than by long, rope-like stolons.

4. ***Epilobium cylindricum*** D. Don, Prodr. Fl. Nepal 222. 1825. (Fig. 7i). [*E. beauverdianum* H. Léveillé, Repert. Spec. Nov. Regni Veg. 8: 138. 1910; Icon. Gen. Epil. t. 82. 1910. *E. christii* H. Léveillé, Repert. Spec. Nov. Regni Veg. 9: 19. 1910; Icon. Gen. Epil. t. 72. 1910.].

Perennial herb 0.1-1.1 m tall, producing leafy basal soboles or loose rosettes; stems freely branched above, strigillose, glabrescent below, and sometimes also above, usually with strigillose or glabrous indistinct raised lines decurrent from the margins of the petioles. Leaves opposite or subopposite below, alternate above, narrowly lanceolate to sublinear, 3-12 cm long, 0.4-2 cm wide, densely sharp serrulate, petiolate, base cuneate, apex acute. Inflorescence and flowers erect; ovaries densely white strigillose and usually eglandular; floral tube 1-1.5 mm long; sepals lanceolate, 3-5 mm long, 1-1.3 mm wide; petals pink or rose purple, rarely white, obcordate, 3.6-7 mm long, 1.8-4 mm wide, the notch 0.8-1 mm deep; stigma capitate to broadly clavate, 0.8-2.2 mm long, surrounded by anthers at anthesis. Capsule strigillose or sparsely strigillose.  $n=$



Fig. 4. *Epilobium*. a-b, *E. hirsutum*: a, habit; b, flower showing stigma. c-e, *E. brevifolium* subsp. *trichoneurum*: c, base of plant; d, portion of inflorescence; e, flower showing stigma.

18.

Wet, disturbed places, stream margins and shores; southcentral China (Gansu, Guizhou and Yunnan) through the Himalayas to Afghanistan, northward into the Tian Shan region of the Soviet Union; 400-2700 m. Fl. Jun-Aug(-Oct); fr. Jul-Sep(-Dec).

5. **Epilobium sinense** H. Lévillé, Bull. Herb. Boiss. ser. 2, 7: 590. 1907. (Fig. 8e). (Guizhou, Guiding Xian, Pingfa [Yunwu], 29 Jul 1905, *J. Cavalerie s. n.* (Lectotype: P; isolectotypes: P, 3 sheets).

Clumped perennial herb 10-50 cm tall, producing short, densely leafy basal soboles; stems simple or few branched, glabrescent except for strigillose hairs on raised lines decurrent from the margins of the petioles. Leaves opposite below, alternate above, narrowly spatulate to oblong or lance-linear, or rarely narrowly obovate, 1.2-7 cm long, 0.3-1 cm wide, weakly and remotely denticulate, base narrowly cuneate, apex obtuse, petioles 2-11 mm long. Inflorescence and flowers erect; ovaries sparsely strigillose and eglandular; floral tube 1-1.2 mm long; sepals oblong-lanceolate, 4.5-6.5 mm long, 1-1.2 mm wide; petals white, pink, or sometimes rose purple, obovate, 5.5-8 mm long, 3-4.5 mm wide, the notch 1-1.7 mm deep; stigma capitate or sometimes broadly clavate, 0.8-1.7 mm long, surrounded by the anthers of at least the longer stamens at anthesis. Capsule glabrescent or sparsely strigillose.  $n=18$ .

Wet places along streams and rivers, occasionally in other exposed rocky places; 550-2400 m; endemic to China. Fl. Jun-Sep; fr. Aug-Dec.

6. **Epilobium royleanum** Haussknecht, Oesterr. Bot. Zeitschr. 29: 55. 1879. (Fig. 8d). [*E. roseum* Schreber var. *indicum* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 584. 1879; *E. roseum* Schreber var. *dalhousieanum* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 584. 1879; *E. lividum* Haussknecht, Monogr. Epil. 201. 1884; *E. royleanum* Haussknecht forma *glandulosum* Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 360. 1962; *E. royleanum* Haussknecht forma *glabrum* Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 361. 1962.].

Perennial herb (8-)15-60 cm tall, producing fleshy soboles at or below ground level, which leave dark

brown scales at the base of the stem; stems usually freely branched or sometimes simple, strigillose and  $\pm$  glandular pubescent, especially above, rarely glandular throughout, or rarely subglabrous, without raised lines from the margins of the petioles. Leaves opposite, alternate in the inflorescence, narrowly ovate to lanceolate, sometimes elliptic or oblong lanceolate, 1.5-7 cm long, 0.35-2.2 cm wide, densely serrulate, base cuneate or rarely rounded, apex acute or subacuminate, petioles 2-7 mm long, slightly clasping, but not decurrent. Inflorescence and flowers erect; ovaries densely strigillose, often with an admixture of glandular hairs; floral tube 0.6-1 mm long; sepals oblong-lanceolate, 3.8-6 mm long, 0.8-1.6 mm wide; petals pink to rose purple, obovate, 5-7.2 mm long, 2.5-3.2 mm wide, the notch 0.6-1 mm deep; stigma capitate or sometimes clavate-capitate, 1.6-2 mm long, surrounded by the anthers of at least the longer stamens at anthesis. Capsule with strigillose and scattered glandular hairs.  $n=18$ .

Wet, weedy places in valleys, along trails and in seasonally flooded grasslands in mountainous regions; 1400-2500 m; central and western China through the Himalayas to northeastern Afghanistan. Fl. Jul-Aug; fr. Aug-Oct.

The single specimen from Guizhou was collected in the Fanjing Shan mountain range (Steward *et al.* 396 (F, S). *Epilobium brevifolium* subsp. *trichoneurum* is similar to *E. royleanum*, but the latter has broader and shorter subsessile leaves with more rounded bases, larger flowers and a less branched stem.

7. **Epilobium kermodei** Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 364. 1962. (Fig. 7k).

Perennial herb 0.4-1.2(-2) m tall, producing fleshy basal stolons 1-6 cm long that terminate in thick fleshy buds; stems simple or sparsely branched, covered with glandular and some strigillose hairs, especially in the inflorescence, and also with indistinct hairy decurrent lines from the margins of the petioles, especially below. Leaves opposite below, alternate in the inflorescence, narrowly ovate to lanceolate, 3.5-8(-11) cm long, 1.5-4.5 cm wide, sharply serrulate, base broadly cuneate to subrounded, apex acute, subsessile or on petioles 1-6 mm long. Inflorescence and flowers erect; ovaries strigillose with an admixture of glandular hairs; floral tube 1.2-2 mm long; sepals lanceolate, 5-8 mm long, 1.5

-2 mm wide; petals rose or rose purple, often broadly obcordate, 7-15(-18) mm long, 4-11 (-15) mm wide, the notch 1-2 mm deep; stigma capitate to broadly clavate, 1.7-2 mm long, surrounded by the mature anthers at anthesis. Capsule indumentum similar to that of the ovaries.  $n=18$ .

Open weedy meadows, woodland margins, gravelly streambeds, boggy areas; 400-2500 m; central to southwestern China and northeastern Burma. Fl. (Feb-)May-July; fr. Jun-Aug(-Oct).

8. ***Epilobium pannosum*** Haussknecht, Oesterr. Bot. Zeitschr. 29: 54. 1879. (Fig. 8a). [*E. brevifolium* D. Don subsp. *pannosum* (Haussknecht) Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 363. 1962; *E. khasianum* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 585. 1879.].

Perennial herb 0.2-1.2 m tall, sprouting from the base or forming leafy basal rosettes; stems simple below, sparsely branched above, covered with dense appressed tomentose pubescence, sometimes with an admixture of glandular hairs, especially in the inflorescence, and also with indistinct hairy decurrent lines from the margins of the petioles, especially below. Leaves opposite throughout or alternate in the inflorescence, elliptic to lanceolate or ovate, 1-4.8 cm long, 0.5-1.7 cm wide, remotely denticulate and sometimes revolute, base subrounded, apex acuminate, acute, or subobtuse, sessile and sometimes clasping. Inflorescence nodding in bud, later erect, and flowers nodding to suberect; ovaries very densely covered with velvety tomentum mixed with glandular hairs; floral tube 0.8-1.2 mm long; sepals oblong-lanceolate, 5.5-8 mm long, 1.5-2.5 mm wide; petals pink or rose purple, broadly obcordate, 8-16 mm long, 6.4-10 mm wide, the notch 1-2 mm deep; stigma cylindrical to broadly clavate, 1.5-3.5 mm long, elevated above the anthers at anthesis. Capsule indumentum similar to that of the ovaries.  $n=18$ .

Moist pastures, shaded wet weedy places by streams, and in valleys in broad-leaved evergreen forests; 760-2100 m; southwestern China, northern Vietnam, northeastern Burma, and Assam, India. Fl. Jul-Oct; fr. Sep-Nov.

*Epilobium pannosum* differs from *E. brevifolium* in its tomentose indumentum, in having rosettes instead of soboles and a stigma elevated above the anthers at anthesis. The only specimen from Guizhou was col-

lected in Jiangdi (*J. Cavalerie* 4123 (P)). This collection has 4 elevated lines decurrent from the margins of the leaf bases and sparse, but predominantly glandular hairs all around. The pollen fertility of this specimen is reduced (11%) and Chen *et al.* (in press) consider that it might possibly be a hybrid between *E. pannosum* and *E. wallichianum*.

9. ***Epilobium brevifolium*** D. Don subsp. ***trichoneurum*** (Haussknecht) Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 362. 1962. (Figs. 4c-e, 7g). [*E. trichoneurum* Haussknecht, Oesterr. Bot. Zeitschr. 29: 54. 1879; *E. hookeri* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 585. 1879; *E. esquirolii* H. Lévillé, Bull. Herb. Boiss. ser. 2. 7: 590. 1907, type: Guizhou, *J. Esquirol* 607 (G, holotype); *E. cavaleriei* H. Lévillé, Bull. Herb. Boiss. Ser. 2. 7: 590. 1907, type: Guizhou, Pin-fa, *J. Cavalerie* 352 (G, lectotype designated by Chen *et al.* (in press), E, K, isolectotypes); *E. cordouei* H. Lévillé, Repert. Spec. Nov. Regni Veg. 6: 110. 1908, type: Guizhou, "Kouy-Tcheou, Majo," *J. Cavalerie* 3151 (not seen); *E. philippinense* C. B. Robinson, Philipp. J. Sci., Sect. C, 3: 209. 1908.].

Perennial herb 1.5-9 dm tall, producing fleshy basal soboles, often leaving scales at the base of the stem; stems simple or branched above, strigillose, sometimes with an admixture of glandular hairs especially in the inflorescence, without decurrent raised lines from the margins of the petioles. Leaves mostly opposite below, alternate in the inflorescence, narrowly ovate to elliptic-lanceolate, rarely broadly ovate, 1.5-5(-8) cm long, 0.5-2(-3) cm wide, weakly and remotely denticulate, base rounded to cuneate, apex subobtuse to acute, petioles 1-4 mm long, rarely sessile. Inflorescence and flowers erect; ovaries strigillose sometimes with an admixture of glandular hairs; floral tube 1-1.4 mm long; sepals lance-oblong, 4.5-6.5 mm long, 1-1.2 mm wide; petals dark pink to rose purple, obcordate, 7-10 mm long, 3-4 mm wide, the notch 1-1.5 mm deep; stigma clavate, 1.5-3.5 mm long; often held above the anthers, or the stamens subequal and shedding pollen on the stigma at anthesis. Capsule indumentum similar to that of the ovaries.  $n=18$ .

Open grassy places, wet areas in valleys and disturbed areas in the mountains; 600-2500 m; from Bhutan to Assam, India, and Burma through southern China

and northern Vietnam to northern Luzon, the Philippines; Fl. Jul-Oct; fr. Sep-Oct.

10. **Epilobium pyrricholophum** Franchet & Savatier, Enum. Pl. Jap. 1: 168. 1875, nom. subnud.; 2: 370. 1877. (Fig. 8c). [*E. japonicum* Haussknecht, Oesterr. Bot. Zeitschr. 29: 56. 1879; *E. japonicum* Haussknecht var. *glanduloso-pubescentis* Haussknecht, Oesterr. Bot. Zeitschr. 29: 56. 1879; *E. oligodontum* Haussknecht, Oesterr. Bot. Zeitschr. 29: 58. 1879; *E. quadrangulum* H. Léveillé, Bull. Soc. Agric. Sarthe 60: 72. 1905; *E. chrysocoma* H. Léveillé, Bull. Herb. Boiss. ser. 2, 17: 589. 1907; *E. arcuatum* H. Léveillé, Bull. Herb. Boiss. ser. 2, 17: 589. 1907.].

Perennial herb 2.5-8 dm tall, producing basal filiform stolons with small, widely spaced, subentire suborbicular, obtuse leaves; stems usually well branched or sometimes simple, strigillose with an admixture of glandular hairs, especially in the upper part, without indistinct hairy decurrent lines from the margins of the petioles. Leaves opposite below, alternate in the inflorescence, ovate to broadly oblong, the upper ones narrowly ovate to lanceolate, 2-5 cm long, 0.5-2 cm wide, usually sharply serrulate, base obtuse, rounded or subcordate, apex acute or subobtuse, subsessile. Inflorescence and flowers erect; ovaries predominantly glandular pubescent; floral tube 1-1.2 mm long; sepals lance-oblong, 4-7 mm long, 1-1.2 mm wide; petals pink or purple, obovate, 6-8 mm long, 3-4.5 mm wide, the notch 1-1.4 mm deep; stigma clavate or subcapitate, 2-3 mm long, often elevated above the mature anthers at anthesis. Capsule indumentum similar to that of the ovaries.  $n=18$ .

Wet places along streams and valley bottoms, moist weedy places on hillsides in mountainous regions; 150-1770 m; Japan and Ussuri region of the Soviet Union to eastern and southern China. Fl. Jun-Sep; fr. Jul-Nov.

Differs from other species, particularly *E. brevifolium* subsp. *trichoneurum*, in the basal stolons and the strong admixture of glandular hairs on the stems and in the inflorescences.

11. **Epilobium amurense** Haussknecht, Oesterr. Bot. Zeitschr. 29: 55. 1879. Based on *E. organifolium* Lamarck var. *pubescens* Maximowicz, Prim. Fl. Amur. 105. 1859. (Fig. 7e) [*E. laetum* Wallich ex

Haussknecht, Monogr. Epil. 218. 1884; *E. amurense* Haussknecht subsp. *laetum* (Wallich ex Haussknecht) Raven, Bull. Brit. Mus. (Nat. Hist.) 2: 367. 1962; *E. nepalense* Haussknecht, Oesterr. Bot. Zeitschr. 29: 53. 1879, *pro parte, non L.*; *E. tetragonum* sensu C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 586. 1879; *E. tenue* Komarov, Acta Horti Petrop. 25: 95. 1905; *E. gansuense* H. Léveillé, Bull. Herb. Boiss. ser. 2, 7: 590. 1907.].

Perennial herb 1-8 dm tall, producing short leafy soboles or elongated rosettes, or rarely fleshy stolons, from the base; stems simple or branched, sparsely to moderately strigillose, often with an admixture of glandular hairs in the inflorescence, and also with 2, raised, densely strigillose decurrent lines from the margins of the petioles, or occasionally the stem subglabrous. Leaves opposite below, alternate in the inflorescence, ovate to oblong or lanceolate, rarely obovate below, 2-7 cm long, 0.5-2.5 cm wide, usually sharply serrulate, base rounded to broadly cuneate, apex acute, sometimes subacuminate or subobtuse, subsessile or the lower cauline leaves with petioles 1-4 mm long. Inflorescence somewhat nodding; flowers suberect; ovaries strigillose with an admixture of scattered glandular hairs; floral tube 0.6-0.9 mm long, with tufts of hairs between the bases of the sepals; sepals lance-oblong, 3.5-5 mm long, 0.8-1.2 mm wide; petals white, rose or purple, obovate, 5-8(-10) mm long, 2.4-4.5 mm wide, the notch 0.8-1.5 mm deep; stigma capitate to subcapitate, very rarely broadly clavate, 1-1.5 mm long, surrounded by the mature anthers at anthesis. Capsule sparsely pubescent to glabrescent.  $n=18$ .

Wet places by streams and springs, moist grassy slopes, and disturbed places in the mountains; 1800-2500 m; Kamchatka and eastern Siberia, Japan and northern Korea to southwestern China and westward through the Himalayas to Kashmir and Hunza. Fl. (May-)Jul-Aug; fr. (Jun-)Aug-Oct(-Dec).

12. **Epilobium cephalostigma** Haussknecht, Oesterr. Bot. Zeitschr. 29: 57. 1879. (Fig. 7h). [*E. calycinum* Haussknecht, Monogr. Epil. 196. 1884; *E. nudicarpum* Komarov, Acta Horti Petrop. 18: 432. 1901; *E. cephalostigma* Haussknecht var. *nudicarpum* (Komarov) Hara in Ohwi, Fl. Japan 658. 1953; *E. angulatum* Komarov, Acta Horti Petrop. 18: 432. 1901; *E. cylindrostigma* Komarov, Act Horti

Petrop. 25: 95. 1905; *E. coreanum* H. Léveillé, Bull. Herb. Boiss. ser., 2, 7: 590. 1907; *E. consimile* Haussknecht var. *japonicum* Nakai, Bot. Mag. Tokyo 25: 148. 1911; *E. sugaharai* Koidzumi, Acta Phytotax. Geobot. 5: 121. 1936. ]

Perennial herb 1-10 dm tall, producing short leafy soboles from the base; stems often many branched, usually strigose all around on upper part, occasionally with an admixture of glandular hairs in the inflorescence, with 2, conspicuous, densely strigillose, decurrent lines from the margins of the petioles (rarely the stem subglabrous with raised but glabrous lines in some populations from northeastern China, Korea, Japan and the Soviet Far East). Leaves opposite below, alternate in the inflorescence, lance-oblong to ovate or occasionally rhombic lanceolate, 3-9 cm long, 0.8-2.5 cm wide, sharply denticulate, base cuneate to broadly cuneate, apex acute or acuminate, sessile or the lower cauline leaves with petioles 1-6 mm long. Inflorescence and flowers erect; ovaries scattered strigillose and glandular, rarely glabrous; floral tube 0.7-1 mm long, with scattered uniform hairs between the bases of the sepals; sepals lance-oblong, 3.8-6 mm long, 0.8-1.2 mm wide; petals white, pink, rarely rose purple, obovate, 4.5-7 mm long, 2.5-4 mm wide, the notch 0.8-1.5 mm deep; stigma capitate to subcapitate, very rarely broadly clavate, 1-1.3 mm long, surrounded by the mature anthers at anthesis. Capsule scattered strigillose or glabrescent, rarely glabrous.  $n=18$ .

Wet areas and along streams; 600-2100 m; Soviet Far East, Japan, Korea and northeastern and eastern China westward to eastern Sichuan, Guizhou and eastern Yunnan. Fl. Jun-Sep; fr. Aug-Sep.

Chen *et al.* (in press) consider *Epilobium cephalostigma* to be a subspecies of *E. amurense*, but the combination has not been published and it seems best not to use that combination here.

13. ***Epilobium wallichianum*** Haussknecht, Oesterr. Bot. Zeitschr. 29: 54. 1879. (Fig. 8f). [*E. nepalense* Haussknecht, Oesterr. Bot. Zeitschr. 29: 53. 1879, *pro parte*; *E. tetragonum sensu* C. B. Clarke in J. D. Hooker, Fl. Brit. Ind. 2: 586. 1879, *pro parte, non* L.; *E. souliei* H. Léveillé, Bull. Herb. Boiss., ser. 2, 7: 588. 1907; *E. wallichianum* Haussknecht subsp. *souliei* (H. Léveillé) Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 366. 1962; *E. duclouxii* H. Léveillé,

Repert. Spec. Nov. Regni Veg. 12: 283. 1913; *E. sykesii* Raven, Bull. Brit. Mus. (Nat. Hist.) Bot. 2: 366. 1962; *E. tanguticum* Haussknecht, Oesterr. Bot. Zeitschr. 29: 56. 1879; *E. himalayense sensu* Hand.-Mazz., Symb. Sin. 7: 601. 1933, *non* Haussknecht.].

Perennial herb 1.5-8 dm tall, producing leafy basal soboles; stems simple or freely branched, mostly subglabrous below, with scattered strigillose and glandular hairs in the inflorescence, and with (2 or) 4 strigillose or subglabrous raised decurrent lines from the margins of the petioles. Leaves opposite below, alternate in the inflorescence, oblong, subovate to elliptic, 2-6 cm long, 0.6-2.5 cm wide, serrulate, base subrounded, subcordate, or broadly cuneate, apex obtuse or occasionally acute, subsessile. Inflorescence nodding; flowers usually nodding; ovaries strigillose, sometimes densely so, with an admixture of glandular hairs; floral tube 0.8-2 mm long; sepals lance-oblong, 4-8 mm long, 1-2 mm wide; petals pink or rose purple, obcordate, 5.5-13 mm long, 3-6.5 mm wide, the notch 0.7-1.2 mm deep; stigma capitate to broadly clavate, 0.8-2 mm long, usually held above the mature anthers at anthesis. Capsule sparsely strigillose and with a few glandular hairs.  $n=18$ .

Wet places by streams and bogs, and on grassy slopes and forest margins in mountainous regions; 1380-2750 m; central and southwestern China through the Himalayas to Nepal and West Bengal. Fl. (May)Jul-Aug; fr. Aug-Sep.

### 3. *Oenothera* L.

Erect, annual, biennial or perennial, taprooted or rhizomatous herbs. Leaves alternate, denticulate, subserrate or sinuate-pinnatifid; stipules absent. Flowers 4-merous, in axils of reduced leaves or leaf-like bracts; floral tube present; sepals 4; petals 4, yellow, white, pink or rose purple; stamens 8; pollen shed singly; ovary 4-locular, the seeds numerous in each locule; capsules dehiscent, cylindrical, obovoid or clavate; seeds without a coma.

About 100 species native to North and South America, but with many species introduced and naturalized elsewhere. Three species occur outside of cultivation in Guizhou; all are probably more common than the few collections indicate.

1. Flowers white, pink or rose purple; capsule clavate



Fig. 5. *Oenothera*. a-c, *O. rosea*: a, habit; b, flower; c, fruit. d-e, *O. biennis*: d, portion of inflorescence showing flower; e, fruit.



or obovoid, widest near apex, pedicellate; plants less than 4 dm tall.

2. Petals 2-3.5 cm long, white, fading to pink, opening near sunset; capsule 1-2 cm long, on a pedicel (0.4-)1-4.5 cm long . . . . . 1. *O. tetraptera*

2. Petals 0.4-1.2 cm long, rose purple, opening near sunrise; capsule 0.5-1 cm long, on a pedicel 4-8 mm long . . . . . 2. *O. rosea*

1. Flowers yellow; capsule cylindric, broadest near base, sessile; plants to 2 m tall . . . . . 3. *O. biennis*

1. **Oenothera tetraptera** Cavanilles, *Icones* 3: 40. 1796. (Fig. 8k).

Simple to freely branched annual to ca. 4 dm tall, stigmatose to hirsute. Leaves lanceolate to oblanceolate or occasionally elliptic, sinuate to sinuate pinnatifid below, becoming subentire above, 1-9 cm long, 0.2-2.5 cm wide; petioles 2-20 mm long. Flowers opening near sunset; floral tube 1-3 cm long; sepals 1.7-4 cm long; petals white, fading pink, 1.6-3.8 cm long. Pollen fertile. Capsule obovoid to clavate, 1-2 cm long, on a pedicel (0.4-)1-4.5 cm long.  $n=7$  (forming bivalents at meiosis).

Disturbed areas, roadsides, in open or partially shaded areas; native to Mexico and adjacent Texas, but widely naturalized elsewhere, scattered from southwestern China to Taiwan; the single specimen from Guizhou was collected at 1420 m. Fl. Jun-?; fr. Jul-?.

2. **Oenothera rosea** L'Héritier ex Aiton, *Hort. Kew.* ed. 1, 2: 3. 1789. (Figs. 5a-c, 8j).

Freely branched perennial to ca. 4 dm tall, strigillose or rarely hirsute. Leaves elliptic or rarely narrowly ovate, subentire, denticulate to sinuate-pinnatifid, 2-9 cm long, 1-3 cm wide; petioles 2-25 mm long. Flowers opening near sunrise; floral tube 4-8 mm long; sepals 7-12 mm long; petals rose purple, 4-12 mm long. Pollen ca. 50% sterile. Capsule obovoid to clavate, 5-10 mm long, on a pedicel 4-8 mm long.  $n = 7$  (forming a ring of 14 at meiosis).

Disturbed grassy areas, margins of thickets, roadsides, around dwellings; in the New World from Texas to Argentina, now a pantropical and subtropical weed, scattered in southern mainland China; 1000-1300 m. Fl. Apr-Jun; fr. Jun-?.

3. **Oenothera biennis** L., *Sp. Pl.* 346. 1753. (Figs. 5d-e,

8i).

Simple or branched biennial to ca. 2 m tall, pubescent woody at the base or even shrubby, up to 4 m tall, subglabrous to densely villous. Leaves linear to lanceolate or narrowly ovate, 3-14.5 cm long, 0.8-4 cm wide; petioles absent or to 15 mm long. Flowers opening near sunset; floral tube 1.5-4 cm long; sepals 1-3 cm long; petals yellow, 1.5-3 cm long. Pollen ca. 50% sterile. Capsules cylindric, 1.5-4 cm long, sessile.  $n=7$  (forming a ring of 14 at meiosis).

Disturbed open areas, roadsides, around dwellings; native of eastern North America, now widely dispersed worldwide, perhaps throughout all of eastern and northeastern China; the single specimen from Guizhou was collected at 840 m. Fl. Jun-?; fr. Jul-?.

**4. Ludwigia L.**

Erect or creeping herbs. Stems often swollen and spongy at the base. Leaves [in plants in Guizhou] alternate, entire; stipules present, caducous. Flowers 4-6 merous, in leaf axils or in axils of leaf-like bracts; floral tube absent; sepals 4-6; petals as many as the sepals, yellow; stamens as many as or twice as many as the sepals; pollen shed singly or in tetrads; ovary with as many locules as the sepals, seeds numerous in each locule; capsules [in plants in Guizhou] dehiscent, cylindrical; seeds without a coma.

About 80 species worldwide. Additional species from further south or east in China to be expected in Guizhou are *L. adscendens* (L.) Hara, *L. peploides* (Kunth) Raven subsp. *stipulacea* (Ohwi) Raven, *L. perennis* L. and *L. prostrata* Roxburgh.

1. Sepals 6-13 mm long; stamens 8; pollen shed in tetrads; capsule without spongy tissue surrounding the seeds . . . . . 1. *L. octovalvis*

1. Sepals less than 5 mm long; stamens 4-6; pollen grains shed singly; capsule with spongy tissue surrounding the seeds . . . . . 2. *L. epilobioides*

1. **Ludwigia octovalvis** (Jacquin) Raven, *Kew Bull.* 15: 476. 1962. (Figs. 6d-e, 8h). [*Jussiaea octovalvis* (Jacquin) Swartz, *Obs. Bot.* 142. 1791; *Jussiaea suffruticosa* L., *Sp. Pl.* 1: 388. 1753, not *Ludwigia suffruticosa* Walter, 1788; *Oenothera octovalvis* Jac-

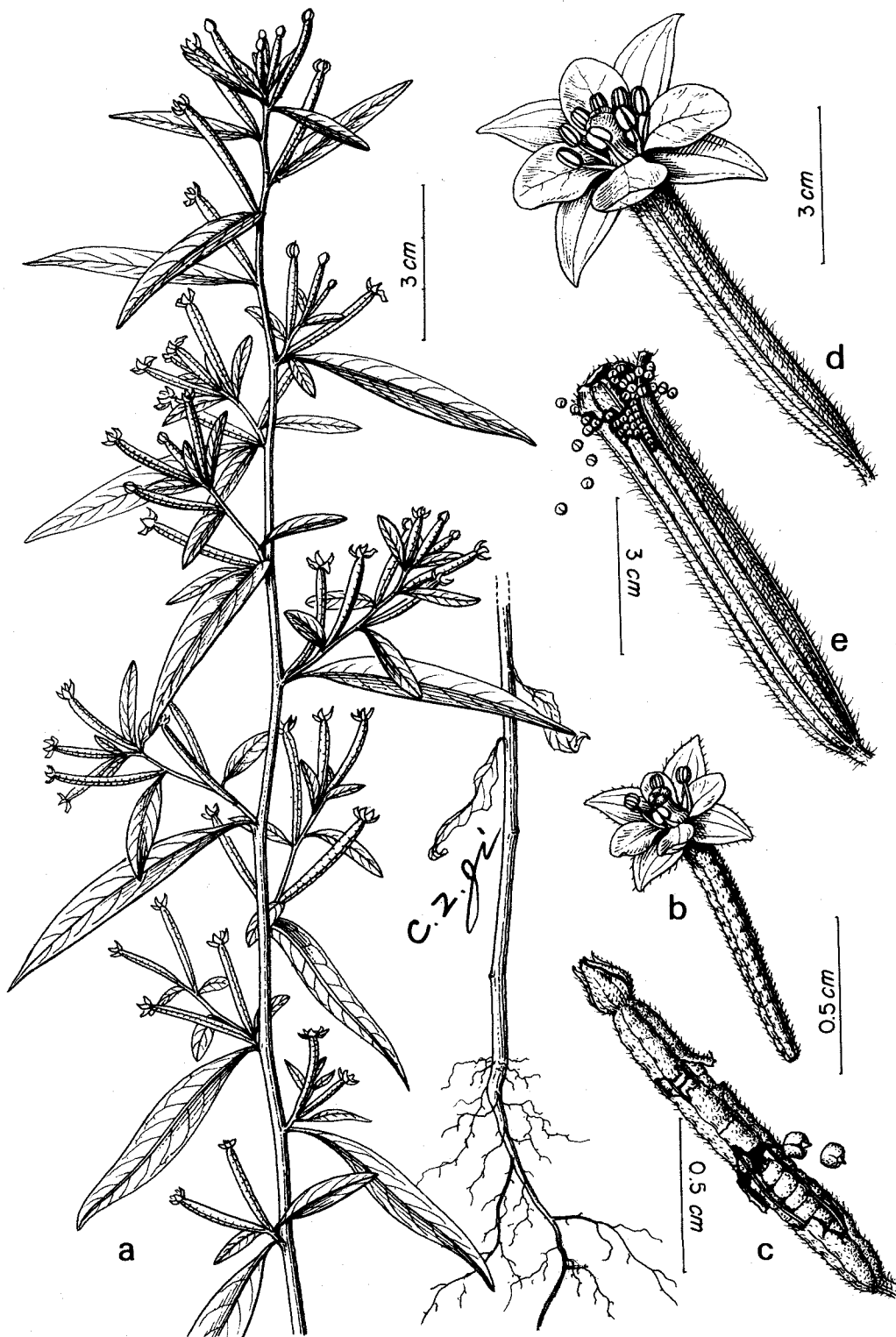


Fig. 6. *Ludwigia*. a-c, *L. epilobioides* subsp. *epilobioides*: a, habit; b, flower; c, fruit and seeds (note spongy covering over seeds). d-e, *L. octovalvis*: d, flower; e, fruit and seeds (note: absence of spongy tissue covering seeds).

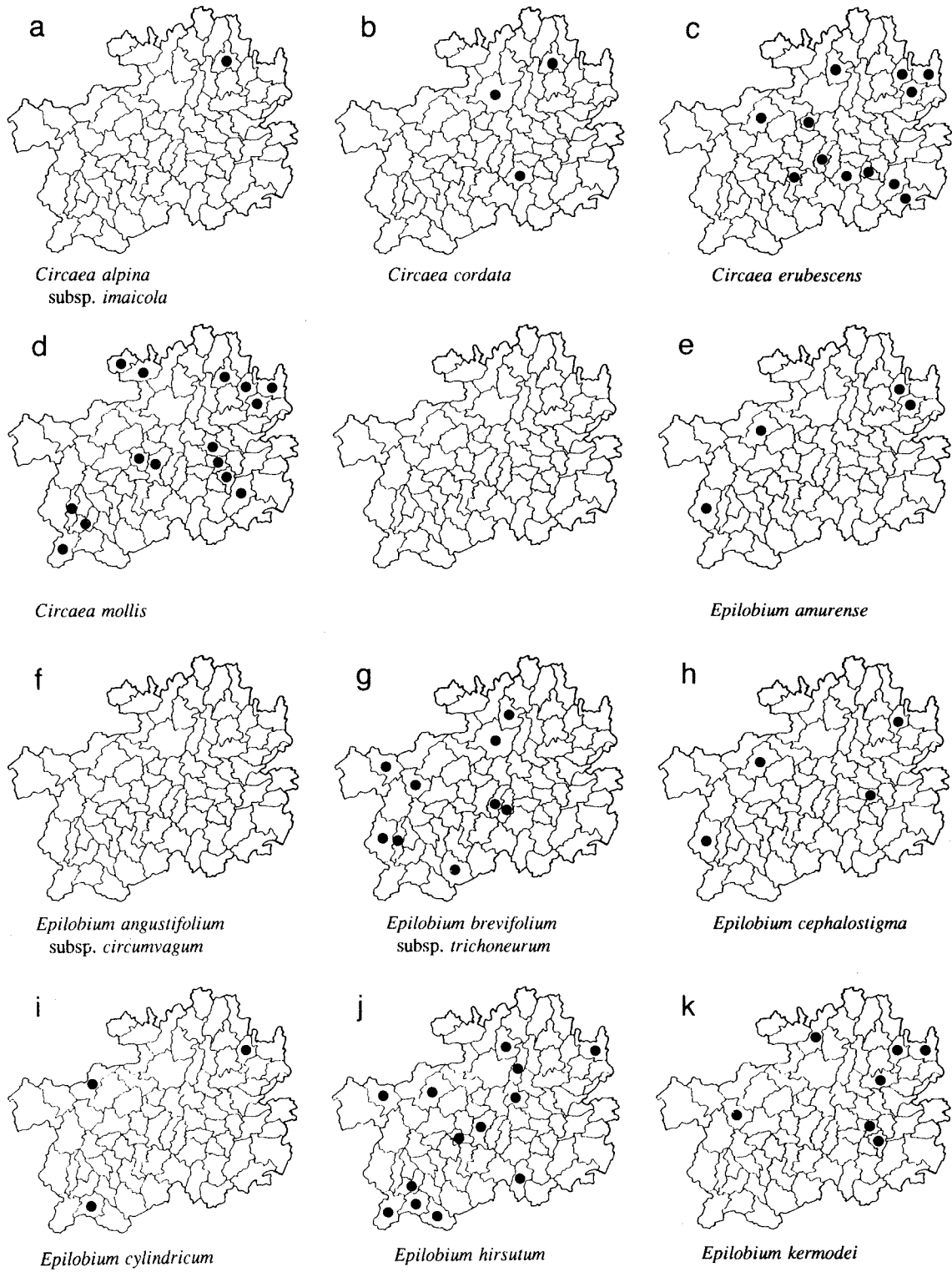


Fig. 7. Distribution of Onagraceae in Guizhou.

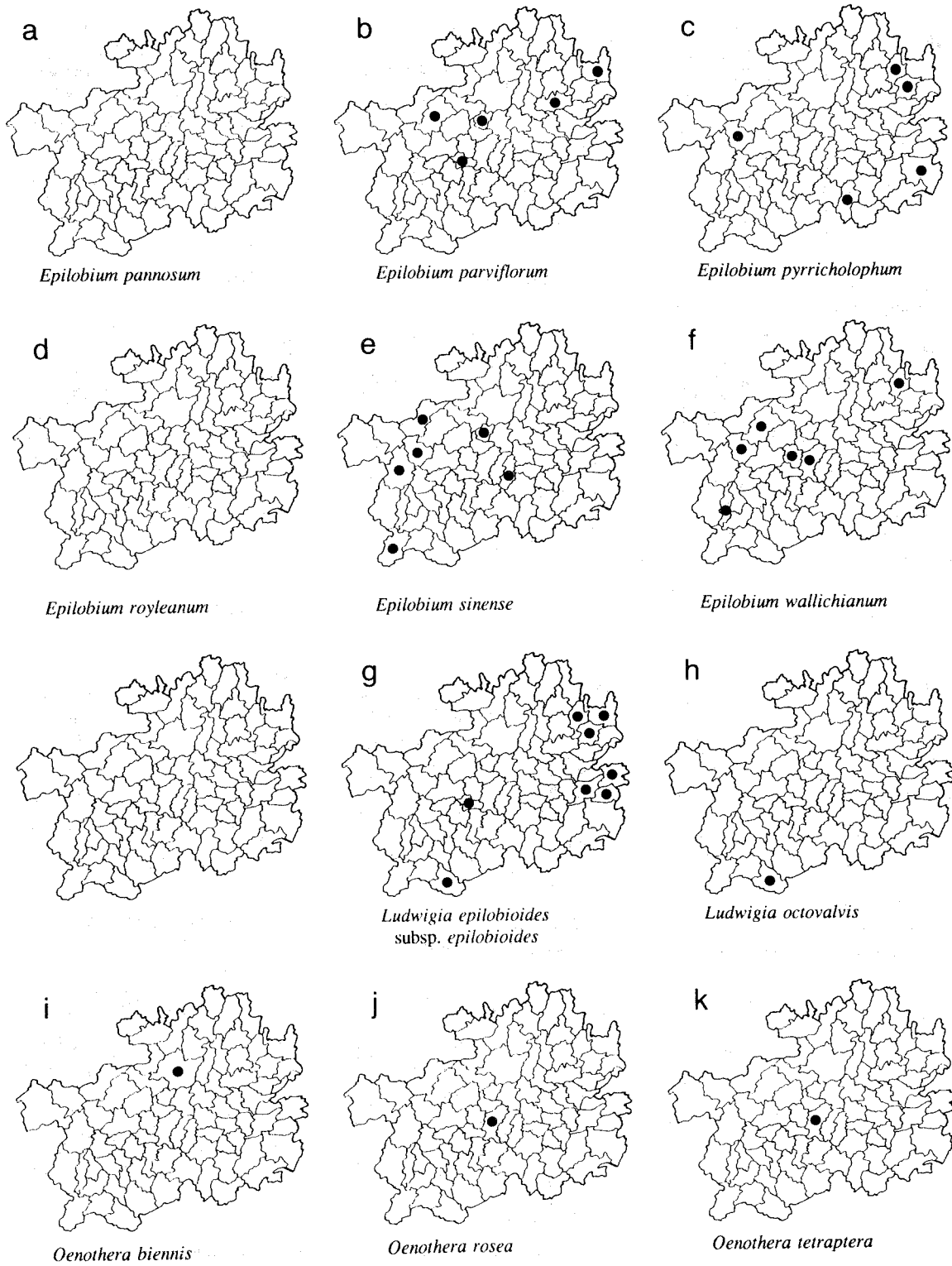


Fig. 8. Distribution of Onagraceae in Guizhou.

quin, Enum. Pl. Carrib. 19. 1760.]

Robust, freely branched (perennial?) herb, somewhat; petioles to 10 mm long. Sepals 4, ovate to lanceolate, 6–13 mm long; petals broadly obovate to cuneate, emarginate, 5–17 mm long, 4–17 mm wide. Stamens 8; pollen shed in tetrads. Capsule thin walled, 1.7–4.5 cm long, terete, seeds not surrounded by corky tissue.  $n=16, 24$ .

Damp to wet places along streams, lakes and marshes; Africa; India, to the foothills of the Himalayas, and through southern China to Taiwan and Japan, south throughout Malesia to Australia; Pacific islands; in the New World from the West Indies to Brazil; occurring from sea level to 1500 m throughout the range, but elevation in Guizhou not known exactly. Fl. Sep–Oct; fr. Sep–Oct.

Raven (1977) has found that differences previously used to separate subspecies in the Asian plants of *L. octoflora* are not of enough significance to warrant taxonomic recognition.

2. **Ludwigia epilobioides** Maximowicz subsp. **epilobioides** Prim. Fl. Amur. 104. 1859. (Figs. 6a–c, 8g).

Usually branched annual herb, 1.5–10 dm tall, subglabrous to finely puberulent. Leaves narrowly elliptic to narrowly lanceolate, 1–10 long, 0.4–2.5 cm wide; petioles 0.3–1.5 cm long. Sepals 4–6, deltoid, 1.5–4.5 mm long; petals obovate, 1.8–2 mm long, 0.7–1.2 mm wide. Stamens as many as the sepals; pollen shed in monads. Capsule relatively thin walled, 1–2.8 cm long, at first 5-angled but terete at maturity, enclosing columns of corky tissue that separate into pieces and loosely surround 1 or 2 seeds.  $n=24$ .

In rice paddies and other low, moist to wet places; northeast China, Korea, Japan and Taiwan to Hainan Island, southwest China and northern Vietnam; sea level to ca. 1500 m. Fl. Sep–Nov; fr. Sep–Nov.

A second subspecies, subsp. *greatrexii* (Hara) Raven, occurs in southern Japan and extends southward to Iriomote Island and Taiwan (Raven, 1963). *Ludwigia epilobioides* is vastly undercollected in Guizhou and probably occurs in every rice paddy within the province.

**Acknowledgements.** I wish to thank the curators and directors

of A, GH, HGAS and PE for access to specimens in their care, C. J. Chen, Peter C. Hoch and Peter H. Raven for making available their unpublished treatment of *Epilobium* in China (from which the treatment of the species in Guizhou was extracted), and my colleagues B. Bartholomew, Q. H. Chen, S. Z. Fang, J. G. Qi, S. A. Spongberg, Z. H. Tsi, Y. L. Tu, P. S. Wang, Y. H. Xiang and T. S. Ying for their help in the field and in the herbarium and C. Z. Ji who prepared the beautiful illustrations. A grant from the National Geographic Society (3384–86) and financial and technical support from the Institute of Botany, Beijing, and the Guizhou Academy of Sciences made our studies in China possible.

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## 中國貴州省的柳葉菜科植物

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本文為中國貴州省柳葉菜科植物之分類處理，旨在為中國各省以英文撰寫之植物誌提供一範例。本文包括簡索表，扼要的性狀描述、分佈圖，以及各類群有關生物學與分類學之札記；各屬植物中至少一種附有插圖。