

ERICACEAE

杜鹃花科 du juan hua ke

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Plants usually woody, or herbs, sometimes lacking chlorophyll. Leaves spiral, sometimes decussate, margin often toothed. Inflorescence racemose; bracteoles paired, basal. Flowers (4 or)5-merous. Calyx imbricate. Corolla connate, imbricate. Stamens 10, sometimes with spurs or awns, dehiscent by pores, pollen in tetrads, rarely single. Ovary superior or inferior, placentation axile, rarely parietal, often many ovules per locule. Style ± as long as corolla, slender. Fruit a capsule or berry, rarely a drupe; calyx persistent.

About 125 genera and 4000 species: widely distributed in temperate and subarctic regions, also at high elevations in tropical regions; 22 genera and 826 species (524 endemic) in China.

The Monotropoideae are here included in the Ericaceae; previously in FRPS (56: 157–216. 1990), they were treated as the Pyrolaceae. *Chio-genes*, recorded from China in FRPS (57(3): 69–71. 1991), is here included in *Gaultheria*. Over the last half century, the Empetraceae have usually been separated from, but closely associated with, the Ericaceae. In their ecology, leaf morphology and insertion, rusts, embryology, stamen anatomy, etc., they largely agree with that family. Molecular data place *Empetrum* and its relatives firmly within the Ericaceae, and in particular within the subfamily Ericoideae, in agreement with phytochemical and palynological data, and there they are best recognized as a separate tribe. There are distinctive features of the Empetraceae that were responsible for their past familial status, e.g., reduced perianth with separate members, low ovule number, enlarged stigmas, etc. However, these are likely to be derived features associated with wind pollination. See Kron et al. (Bot. Rev. 68: 335–423. 2002) and the recent treatment of the Ericaceae by Stevens et al. (in Kubitzki, Fam. Gen. Vasc. Pl. 6: 145–194. 2004).

Several genera and many species are ornamentals. Some fruits of *Vaccinium* in N China are sweet and edible, but of no particular value to humans. Some species of *Chamaedaphne*, *Craibiodendron*, *Leucothoë*, *Lyonia*, *Pieris*, and *Rhododendron* contain more or less toxic diterpenes, which are harmful to humans or domestic animals.

Fang Rhuicheng, Yang Hanbi & Chin Tsenli. 1999. Ericaceae (1). In: Fang Rhuicheng, ed., Fl. Reipubl. Popularis Sin. 57(1): 1–213; Hu Wenkuang, Hu Lincheng, Fang Mingyuan & He Mingyou. 1994. Ericaceae (2). In: Hu Lincheng, Fang Mingyuan, ed., Fl. Reipubl. Popularis Sin. 57(2): 1–438; Hsu Tingzhi, Gao Baochun, Fang Rhuicheng & Huang Shuhua. 1991. Ericaceae (3). In: Fang Rhuicheng, ed., Fl. Reipubl. Popularis Sin. 57(3): 1–207; Chou Yiliang & Zhou Ruichang. 1990. Pyrolaceae. In: Fang Wenpei & Hu Wenkuang, eds., Fl. Reipubl. Popularis Sin. 56: 157–216; Ming Tien lu. 1980. Empetraceae. In: Cheng Mien & Ming Tien lu, eds., Fl. Reipubl. Popularis Sin. 45(1): 60–62.

- 1a. Herbs to subshrubs; petals free.
 - 2a. Achlorophyllous plant without green leaves; anthers without pores.
 - 3a. Fruit a capsule; ovary 5-loculed, with axile placentation 6. *Monotropa*
 - 3b. Fruit a berry; ovary 1-loculed, with parietal placentation 7. *Monotropastrum*
 - 2b. Plant usually with green leaves, usually autotrophic; anthers opening by pores.
 - 4a. Subshrub; leaves along stem; flowers in corymbs or umbels, or solitary; filaments ciliate on lower half; style thick, short 2. *Chimaphila*
 - 4b. Herb; leaves generally basal; flowers in racemes, or solitary; filaments not ciliate; style slender.
 - 5a. Flower solitary; capsule opening from tip to base, valves without fibers at margins 3. *Moneses*
 - 5b. Flowers in racemes; capsule opening from base to tip, valves with fibers at margins.
 - 6a. Leaves cauline; racemes with flowers on one side; upper portion of scape papillate; disk present 4. *Orthilia*
 - 6b. Leaves appearing basal; racemes with flowers on all sides; scape not papillate; disk absent 5. *Pyrola*
- 1b. Plants woody; petals nearly always fused (absent and replaced by petaloid sepals in *Empetrum*).
 - 7a. Fruit fleshy.
 - 8a. Ovary superior, free from calyx; seeds 4–9, enclosed in stones.
 - 9a. Leaf blade linear, margin entire, slightly reflexed; corolla absent, sepals petaloid, free 13. *Empetrum*
 - 9b. Leaf blade broad, margin serrate or crenate, flat; corolla urceolate, shortly lobed 8. *Arctous*
 - 8b. Ovary inferior, completely or rarely mostly adnate to hypanthium; seeds separate, numerous.
 - 10a. Corolla usually short, to 1 cm, urceolate or campanulate, rarely tubular; anthers free; pedicels usually not expanded toward apex; plants usually terrestrial, rarely epiphytic 21. *Vaccinium*

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- 10b. Corolla usually long, (0.5–)2–6 cm, tubular or cylindric, rarely urceolate; anthers weakly connate or free; pedicels usually expanded toward apex, sometimes forming a cup below calyx; plants often epiphytic 22. *Agapetes*

- 7b. Fruit a capsule.
- 11a. Persistent calyx ± accrescent and succulent; capsule loculicidal, enclosed in fleshy calyx; anthers with 2–4 awns or minute projections 20. *Gaultheria*
- 11b. Persistent calyx withered.
- 12a. Capsule septicial; anthers without appendages.
- 13a. Corolla lobes free 11. *Ledum*
- 13b. Corolla sympetalous.
- 14a. Corolla actinomorphic or somewhat zygomorphic, funnel-shaped, campanulate, rarely rotate or cylindric, more than 10 mm; stamens exserted, rarely included; leaf blade not linear 12. *Rhododendron*
- 14b. Corolla actinomorphic, cylindric or urceolate, 4–7(–11) mm; stamens included; leaf blade linear to linear-oblong.
- 15a. Inflorescence shortly racemose to subcapitate; pedicels very short; corolla cylindric; anthers opening by slits 9. *Diplarche*
- 15b. Inflorescence umbellate; pedicels elongate, 2–2.5(–4) cm; corolla urceolate; anthers opening by terminal pores 10. *Phyllodoce*
- 12b. Capsule loculicidal; anthers with or without appendages.
- 16a. Inflorescence a solitary flower; leaves decussate, imbricate, sessile, scalelike, 5–8 mm 14. *Cassiope*
- 16b. Inflorescences racemose, paniculate, or umbellate, many flowered, or flowers rarely solitary in *Enkianthus*; leaves spirally arranged, petiolate, leaf blade never scalelike, more than 3 cm.
- 17a. Anthers tipped with 2 awns or with dorsal spurs; filaments straight; leaf margin usually serrate.
- 18a. Anther awns reflexed; inflorescences paniculate 17. *Pieris*
- 18b. Anther awns erect or spreading; inflorescences racemose, umbellate, or corymbose.
- 19a. Inflorescences umbellate or corymbose, rachis abbreviated or nearly absent; corolla broadly campanulate to urceolate; seeds winged 1. *Enkianthus*
- 19b. Inflorescences racemose, rachis elongate; corolla suburceolate to tubular; seeds angled or rounded 15. *Leucothoë*
- 17b. Anthers usually without appendages; filaments geniculate, rarely straight; leaf margin entire.
- 20a. Young shoots and both surfaces of leaves lepidote 19. *Chamaedaphne*
- 20a. Young shoots and both surfaces of leaves not lepidote.
- 21a. Corolla tubular or urceolate; capsule subglobose, less than 5 mm in diam., sutures thickened; seeds wingless 18. *Lyonia*
- 21b. Corolla shortly campanulate; capsule depressed globose, more than 10 mm in diam., sutures not thickened; seeds winged on 1 side 16. *Craibiodendron*

1. ENKIANTHUS Loureiro, Fl. Cochinch. 1: 276. 1790.

吊钟花属 diao zhong hua shu

Fang Ruizheng (方瑞征 Fang Rhui-cheng); Peter F. Stevens

Shrubs or small trees, deciduous, rarely evergreen. Leaves clustered at ends of twigs, petiolate; leaf blade serrate or subentire. Inflorescence terminal, in umbels or corymbose racemes, flowers rarely solitary or in pairs, 5-merous. Corolla broadly campanulate to urceolate; lobes short. Stamens much shorter than corolla; filaments flattened, distinctly dilated towards base; anthers oblong, thecae each dehiscent by an elongate slit, awned at apex; pollen grains single. Ovary superior, with few ovules per locule; stigma truncate. Capsule loculicidal, ovoid. Seeds several or one; testa lamellate-winged.

Twelve species: from the E Himalayas through China to Japan, extending south to Indochina; seven species (four endemic) in China.

- 1a. Flowers solitary, rarely in pairs; leaves abaxially puberulous, adaxially glabrous 3. *E. pauciflorus*
- 1b. Flowers in corymbose racemes or umbels; leaves glabrous, or with other than unicellular hairs.
- 2a. Pedicels in fruit pendulous; flowers in corymbose racemes.
- 3a. Leaves glabrous on both surfaces; pedicels glabrous or pubescent 1. *E. chinensis*
- 3b. Leaves abaxially densely or sparsely hispidulous on veins, adaxially sparsely shortly setulose and puberulous on veins or glabrous; pedicels densely pubescent, sometimes also with glandular hairs 2. *E. deflexus*
- 2b. Pedicels in fruit erect; flowers in umbels.
- 4a. Corolla urceolate; leaf margin ciliate, both surfaces glabrous 7. *E. perulatus*
- 4b. Corolla campanulate; leaf margin denticulate or entire, both surfaces glabrous or with hairs.
- 5a. Leaf margin denticulate from base to apex, leaf blade sometimes hispidulous 4. *E. serrulatus*
- 5b. Leaf margin entire or only sinuate-serrulate towards apex; leaf blade never hispidulous.

- 6a. Corolla broadly campanulate; leaf with fine veins distinctly raised on both surfaces; both surfaces glabrous 5. *E. quinqueflorus*
 6b. Corolla tubular-campanulate; leaf with fine veins inconspicuous on both surfaces; abaxially densely floccose towards base on midvein 6. *E. serotinus*

1. *Enkianthus chinensis* Franchet, J. Bot. (Morot) 9: 371. 1895.

灯笼吊钟花 deng long diao zhong hua

Bodinierella cavaleriei H. Léveillé; *Enkianthus brachyphyllus* Franchet; *E. cerasiflorus* (H. Léveillé) H. Léveillé; *E. leveilleanus* Craib; *E. rosthornii* Diels; *E. sinohimalaicus* Craib; *Zenobia cerasiflora* H. Léveillé.

Shrubs or small trees, deciduous, 2.5–8 m tall. Twigs glabrous. Leaf petiole 0.5–1.5 cm, glabrous; leaf blade elliptic or oblong-elliptic, ca. 1.5 × 1.5–2.5 cm, papery to thinly papery, glabrous, midvein raised abaxially, impressed adaxially; secondary and fine veins inconspicuous, base cuneate or broadly cuneate, margin serrulate, apex acute. Inflorescences corymbose-racemose or umbellate; rachis 3–7 cm, slender, 10–20-flowered, glabrous or pubescent. Pedicel 1.5–3 cm, slender, glabrous or pubescent. Calyx glabrous or slightly ciliolate; lobes triangular, 2–3 mm. Corolla yellowish orange-striped and red, broadly campanulate, 7–10 mm; lobes slightly recurved, usually dark red. Filaments puberulous. Ovary glabrous; style glabrous or pubescent. Capsule pendulous, 4–7 mm; stalk distinctly recurved, 1–3.5 cm. Fl. May–Jul, fr. Jul–Sep.

- Mixed forests, disturbed forests, thickets, sunny mountain slopes, mountain ridges; 900–1200(–3100) m. Anhui, Fujian, Guangdong, Guizhou, Guangxi, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang.

2. *Enkianthus deflexus* (Griffith) C. K. Schneider, Ill. Handb. Laubholz. 2: 521. 1911.

毛叶吊钟花 mao ye diao zhong hua

Shrubs or trees, deciduous, 1.5–5 m tall. Twigs subglabrous. Leaf petiole 0.5–1.5 cm, pubescent, hispidulous, or glabrous; leaf blade elliptic, obovate-elliptic, or oblong-elliptic, 3–7 × 1.5–3 cm, thinly papery, abaxially hispidulous on veins or glabrescent, adaxially sparsely shortly setulose and puberulous on veins or glabrous, midvein raised abaxially, adaxially slightly impressed, secondary and fine veins slender and inconspicuous, base cuneate to broadly cuneate, margin serrulate, apex acute. Inflorescence corymbose-racemose; rachis to 5–7 cm, many flowered, densely pubescent or scattered glandular pubescent. Pedicel flattened, terete, 1.5–3 cm, slender, densely pubescent, with glandular hairs or not. Calyx ciliolate; lobes ovate-triangular, 2–3 mm. Corolla white, brick red, or pale yellow, broadly campanulate, 0.8–1.5 cm; lobes erect, broadly triangular. Filaments puberulous. Ovary shortly setulose, pubescent, or glabrous; style pubescent to glabrous. Capsule pendulous, 5–7 mm; stalk erect or distinctly recurved, 2.5–3.5 cm. Fl. Apr–Jul, fr. Jun–Jul.

Pinus or *Quercus* forests, mixed forests on mountain slopes, disturbed forests, thickets; 1000–3300(–3900) m. S Gansu, Guizhou, Guangdong, Hubei, Sichuan, Xizang, Yunnan [Bhutan, NE India (Darjiling), Myanmar, Nepal, Sikkim].

- 1a. Leaf blade with conspicuous hairs on both surfaces, abaxially hispidulous on veins 2a. var. *deflexus*
 1b. Leaf blade glabrescent on both surfaces or abaxially very sparsely hispidulous on midvein 2b. var. *glabrescens*

2a. *Enkianthus deflexus* var. *deflexus*

毛叶吊钟花(原变种) mao ye diao zhong hua (yuan bian zhong)

Rhodora deflexa Griffith, Itin. Pl. Khasyah Mts. [Posthum. Papers 2]: 148. 1848; *Enkianthus deflexus* var. *variegatus* (Forrest) Forrest; *E. himalaicus* J. D. Hooker & Thomson; *E. sulcatus* Craib; *E. variegatus* Forrest.

Leaf petiole pubescent or hispidulous; leaf blade with conspicuous hairs on both surfaces, abaxially hispidulous on veins. Inflorescence rachis and pedicels pubescent.

Pinus or *Quercus* forests, disturbed forests, thickets; 1000–3300(–3900) m. Guizhou, Guangdong, Hubei, Sichuan, Xizang, Yunnan [Bhutan, NE India (Darjiling), Myanmar, Nepal, Sikkim].

2b. *Enkianthus deflexus* var. *glabrescens* R. C. Fang, Novon 9: 162. 1999.

腺梗吊钟花 xian geng diao zhong hua

Leaf petiole glabrous; leaf blade glabrescent on both surfaces or abaxially sparsely hispidulous on midvein. Inflorescence rachis and pedicels pubescent, also with glandular hairs.

- Mixed forests on mountain slopes; ca. 1600 m. S Gansu (Wenxian).

3. *Enkianthus pauciflorus* E. H. Wilson, Gard. Chron., ser. 3, 41: 363. 1907.

少花吊钟花 shao hua diao zhong hua

Shrubs 1–3 m tall. Twigs puberulous. Leaf petiole 2–6 mm, puberulous, winged in upper part; leaf blade elliptic or obovate, 1.5–3 × 1–1.2 cm, thinly papery, abaxially puberulous, adaxially glabrous, midvein raised abaxially, inconspicuous adaxially, secondary and fine veins slightly distinct abaxially, inconspicuous adaxially, base cuneate, margin serrulate, apex acuminate, mucronate. Flowers solitary, rarely in pairs, axillary. Pedicel flattened, ca. 1 cm, puberulous. Calyx glabrous; lobes ovate, 1–1.5 mm, apex acute. Corolla yellow with red stripes, or red, urceolate, 8–10 mm; lobes usually reflexed, short. Filaments pubescent. Ovary glabrous or puberulous; style glabrous. Capsule 3–5 mm; stalk distinctly recurved, ca. 1 cm, slender. Fl. May, fr. Jun–Oct.

- Alpine thickets, humus-clad cliffs on mountains; 3000–3700 m. Sichuan, Yunnan.

4. *Enkianthus serrulatus* (E. H. Wilson) C. K. Schneider, Ill. Handb. Laubholz. 2: 519. 1911.

齿缘吊钟花 chi yuan diao zhong hua

Enkianthus quinqueflorus Loureiro var. *serrulatus* E. H. Wilson, Gard. Chron., ser. 3, 41: 344. 1907; *E. calophyllus* T. Z. Hsu; *E. hirtinervus* M. Y. Fang; *E. serrulatus* var. *hirtinervus* (M. Y. Fang) T. Z. Hsu; *E. serrulatus* var. *sichuanensis* (T. Z. Hsu) R. C. Fang; *E. sichuanensis* T. Z. Hsu.

Shrubs or small trees, deciduous, 3–6 m tall. Twigs glabrous. Leaf petiole 6–10 mm, glabrous or sparsely hispidulous; leaf blade elliptic, oblong-elliptic, or obovate-elliptic, 5–8 × 1.6–2.6 cm, papery, both surfaces hispidulous or glabrous, or abaxially densely floccose toward base and adaxially glabrous, midvein strongly raised abaxially, flat to slightly raised adaxially, secondary and fine veins slightly raised abaxially, inconspicuous adaxially, base broadly cuneate to narrowly obtuse, margin denticulate, apex shortly acuminate. Inflorescence umbellate, 2–6-flowered. Pedicel 1–2 cm, glabrous or pubescent. Calyx lobes triangular, ca. 2.2 mm, glabrous or ciliate. Corolla white, campanulate, ca. 1 cm; lobes recurved. Filaments pubescent. Ovary glabrous or pubescent; style glabrous. Capsule 5-angled, 7–10 mm; stalk erect, 2–3 cm. Fl. Apr, fr. May–Oct.

• Forest margins, mountain slopes, roadsides; 800–1800 m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Yunnan, Zhejiang.

5. *Enkianthus quinqueflorus* Loureiro, Fl. Cochinch. 1: 277. 1790.

吊钟花 diao zhong hua

Enkianthus cavaleriei H. Léveillé; *E. dunnii* H. Léveillé; *E. quinqueflorus* var. *ciliatoserrulatus* P. C. Huang & K. M. Li; *E. uniflorus* Benthams; *E. xantoxanthus* H. Léveillé.

Shrubs or small trees, deciduous, 1–3(–10) m tall. Twigs glabrous. Leaf petiole 0.5–1.5 cm, glabrous; leaf blade elliptic, elliptic-lanceolate, or obovate-lanceolate, rarely lanceolate, 5–15 × 1.6–5 cm, leathery, glabrous, midvein abaxially raised, adaxially ± flat, secondary and fine veins distinctly raised on both surfaces, base cuneate, margin entire, sometimes sparsely sinuate-serrulate towards apex, apex acuminate or shortly abruptly acuminate. Inflorescence umbellate, 3–8-flowered. Pedicel 1–2 cm, glabrous. Calyx glabrous; lobes ovate-lanceolate or triangular-lanceolate, 2–3 mm. Corolla pink, red, or white, broadly campanulate, 0.8–1.2 cm; lobes recurved, triangular-ovate. Stamens ca. 4 mm; filaments pubescent. Ovary glabrous or densely pubescent. Capsule 5-angled, 7–12 mm; stalk erect, 2–3.5 mm. Fl. Jan–Jun, fr. Mar–Sep.

2. CHIMAPHILA Pursh, Fl. Amer. Sept. 1: 279. 1814.

喜冬草属 xi dong cao shu

Qin Haining (覃海宁); Peter F. Stevens

Chimaza R. Brown ex de Candolle; *Pipseva* Rafinesque; *Pseva* Rafinesque.

Herbs perennial, decumbent or shrubs dwarf, erect, evergreen. Leaves opposite or subverticillate, shortly petiolate, often crowded; leaf blade leathery, margin serrate. Flowers solitary, terminal, or 1 or 2 on simple or branched, bracteate peduncles, nodding, regular. Sepals 5, persistent. Petals 5, concave. Filaments pilose; anthers opening by pores. Ovary depressed-globose, 5-locular; style obconic, straight, very short. Capsules depressed-globose, long persistent, erect. $n = 13$.

Five species: Bhutan, China, Japan, Korea, Russia; Europe, North America, Central America (Mexico); three species (one endemic) in China.

1a. Flowers 2–7, rarely solitary; bracts broadly linear; sepals ovate-orbicular, ca. as long as wide 3. *C. umbellata*

Mixed forests, hillsides, dry places; 600–1500(–2400) m. Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Sichuan, Yunnan [Vietnam].

6. *Enkianthus serotinus* Chun & W. P. Fang, Acta Phytotax. Sin. 6: 159. 1957.

晚花吊钟花 wan hua diao zhong hua

Enkianthus tubulatus P. C. Tam.

Shrubs deciduous, 1.5–4 m tall. Twigs pilose or subglabrous. Leaf petiole 1–2 cm, glabrous; leaf blade elliptic, rhombic-elliptic, or lanceolate, 5–9 × 1.7–4 cm, thinly leathery, glabrous except abaxially densely floccose towards base on midvein, midvein distinct on both surfaces, secondary and fine veins inconspicuous on both surfaces, base cuneate, margin entire or sinuate-serrulate towards apex, apex acuminate or abruptly acuminate. Inflorescence umbellate, 2–7-flowered. Pedicel recurved, 1–1.5 cm, pilose. Calyx glabrous; lobes lanceolate, 2.5–3 mm. Corolla white, tubular-campanulate, gibbous at base, 8–9 mm; lobes recurved, broadly ovate, ciliate. Filaments pilose. Ovary glabrous. Capsule 8–11 mm tall; stalk erect, 2–3.5 cm. Fl. Apr–Jun, fr. Jul–Sep.

• Forests, thickets on slopes; 800–1500 m. Guangdong, Guangxi, Guizhou, Sichuan, Yunnan.

7. *Enkianthus perulatus* C. K. Schneider, Ill. Handb. Laubholz. 2: 520. 1911.

台湾吊钟花 tai wan diao zhong hua

Enkianthus perulatus var. *taiwanianus* (S. S. Ying) Y. C. Liu; *E. taiwanianus* S. S. Ying.

Shrubs deciduous, to 4 m tall. Twigs glabrous. Leaf petiole 1–2 cm, glabrous; leaf blade oblong, obovate-oblong, or oblong-lanceolate, 4–6 × ca. 1.5 cm, papery, glabrous except ciliate at margin, hairs 1–1.5 mm, midvein raised abaxially, impressed adaxially, base attenuate-cuneate or cuneate, margin and midvein ciliate, apex acuminate, mucronate. Inflorescence umbellate, several flowered. Pedicel 0.8–1.2 cm. Calyx lobes triangular, 2–3 mm. Corolla white, urceolate, 8–9 mm; lobes green, ovate-triangular, 1–1.2 mm. Stamens ca. 2/3 as long as corolla; filaments villous at base. Ovary glabrous. Capsule unknown.

Fagus forest margins; 1100–1600 m. N Taiwan (Taoyuan) [Japan].

This is a rare species.

1b. Flower usually solitary; bracts lanceolate or ovate-elliptic; sepals narrowly lanceolate or obovate, ca. as long as to 2 × as long as wide.

2a. Bracts broadly ovate-lanceolate; sepals 4–6 mm 1. *C. japonica*

2b. Bracts elliptic; sepals 1.5–2 mm 2. *C. monticola*

1. *Chimaphila japonica* Miquel, Ann. Mus. Bot. Lugduno-Batavi 2: 165. 1866.

喜冬草 xi dong cao

Chimaphila astyla Maximowicz; *C. fukuyamae* Masamune.

Herbs perennial, to 15 cm tall. Rhizome descending or creeping, somewhat short, slender, 0.5–1 mm in diam., sparsely branched. Aerial stems erect, 0.5–2 mm in diam. Leaves in 2–5 subverticils of 2–4(–6) each, alternating with 5–7 persistent or caducous scales. Petiole 3–10 mm, glabrous; leaf blade abaxially pale green, rather shiny, adaxially deep green, not shiny, with paler or white midvein, lanceolate to broadly lanceolate, ovate, or broadly elliptic, 1–3.5 cm × 3–15 mm, leathery, glabrous, base rounded to subacute, margin serrate, apex acute or rarely obtuse, mucronate. Flower usually solitary, usually not opening fully. Peduncle erect, 2–5.5(–7) cm, slender, 0.2–0.6 mm in diam., papillose, rarely glabrous, 1(or 2)-flowered. Bracts 1–3, on upper part of peduncle, broadly ovate-lanceolate, 4–7 × 1–3 mm, membranous, base narrowed, sometimes into short stalk, margin irregularly toothed. Sepals 5(or 6), white with black veins when dry, narrowly lanceolate, 4–6(–7) × 1.5–3 mm, membranous, margin irregularly toothed, apex acute, rarely obtuse. Petals white, obovate-orbicular, 6–8 × 3–6 mm, concave, margin irregularly toothed. Stamens: lower dilated portion of filaments obovoid, pilose at margin and abaxially; anthers 1.2–2 mm, without distinct tubes, apex truncate. Ovary glabrous; stigma rounded with 5 undulate teeth, 1.5–2.5 mm in diam. Capsules 4–7 mm in diam. Seeds fusiform to oblong. Fl. Jun–Aug, fr. Sep–Oct.

Common, mainly in dry forests; sea level to 3000 m. Anhui, Guizhou, Hubei, Jilin, Liaoning, Shaanxi, Shanxi, Sichuan, Taiwan, Xizang, Yunnan [Bhutan, Japan, Korea, Russia (Sakhalin)].

2. *Chimaphila monticola* Andres, Acta Horti Gothob. 1: 174. 1924.

川西喜冬草 chuan xi xi dong cao

Herbs suffruticose, to 15 cm tall. Rhizomes long creeping. Aerial stems 10–20 cm long. Leaves opposite and verticillate; petiole 4–7 mm; leaf blade deep green, with paler midvein adaxially, narrowly to broadly elliptic, 1.5–4.6 cm × 6–25 mm, subleathery, base cuneate, margin few toothed, apex acute, mucronate. Flower solitary, or inflorescence 2- or 3-flowered, white, ca. 1 cm in diam.; peduncle 3–7 cm, papillose; bracts elliptic, ca. 3 mm. Sepals obovate, 1.5–2 × ca. 2 mm. Petals oblong-orbicular, 7–8 × ca. 5 mm. Stamens ca. 4 mm. Style sessile, obconoidal; stigma peltate. Capsules depressed-globose, ca. 5 mm in diam. Fl. Sep, fr. unknown.

• Moss-rich virgin forests, mossy ground beneath *Tsuga* canopies; 2600–3000 m. Sichuan, Taiwan.

1a. Plant to 15 cm tall; largest leaf broadly elliptic, 2.3–4.6 × 1.3–2.5 cm; inflorescence (1- or)2- or 3-flowered 2a. subsp. *monticola*

1b. Plant to 10 cm tall; largest leaf narrowly elliptic, 1.5–2.5 × 0.6–1.1 cm; inflorescence 1- or 2-flowered 2b. subsp. *taiwaniana*

2a. *Chimaphila monticola* subsp. *monticola*

川西喜冬草(原亚种) chuan xi xi dong cao (yuan ya zhong)

Plant usually to 15 cm tall. Largest leaf broadly elliptic, 2.3–4.6 × 1.3–2.5 cm. Inflorescence (1- or)2- or 3-flowered. Fl. Sep.

• Moss-rich virgin forests; ca. 3000 m. Sichuan.

2b. *Chimaphila monticola* subsp. *taiwaniana* (Masamune) H. Takahashi, J. Jap. Bot. 65: 376. 1990.

台湾喜冬草 tai wan xi dong cao

Chimaphila taiwaniana Masamune, Trans. Nat. Hist. Soc. Formosa 23: 205. 1933; *C. japonica* Miquel var. *taiwaniana* (Masamune) C. F. Hsieh; *C. monticola* var. *taiwaniana* (Masamune) S. S. Ying.

Plant usually to 10 cm tall. Largest leaf narrowly elliptic, 1.5–2.5 cm × 6–11 mm. Inflorescence 1- or 2-flowered.

• Mossy ground beneath *Tsuga* canopies; 2600–3000 m. Taiwan.

3. *Chimaphila umbellata* (Linnaeus) W. Barton, Veg. Mater. Med. U.S. 1: 17. 1817.

伞形喜冬草 san xing xi dong cao

Pyrola umbellata Linnaeus, Sp. Pl. 1: 396. 1753; *Chimaphila corymbosa* Pursh; *P. corymbosa* (Pursh) Bertoloni.

Shrubs or herbs, to 15 cm tall, clonal, often forming extensive mats. Rhizome long creeping, 1–2 mm in diam., branched. Aerial stems erect or ascending, 1–2.2 mm in diam., simple or branched, angled, glabrous. Leaves cauline, in 2–6 subverticils of 4–9 each, alternating with caducous scales; petiole 3–6 mm, glabrous; leaf blade abaxially pale green, adaxially deep green, oblanceolate, 1–5 cm × 6–8 mm, thickly leathery, shiny, adaxially glabrous and with veins impressed, base cuneate, margin serrate above middle, apex obtuse to subacute. Peduncle erect, 3–6 cm, papillose, 2–7-flowered. Bract broadly linear, 3–4 mm. Sepals 5, persistent, ovate-orbicular, 1–2 × 1–2 mm, margin irregularly toothed, ciliate. Petals white, sometimes rosy, suborbicular, 4–6 × 3–5 mm, concave, margin irregularly toothed, opening fully. Stamens: lower dilated portion of filaments broadly ellipsoid, sparsely papillose; anthers 1.5–2.3 mm, papillate at base, tubes short, pores ca. 0.4 mm wide. Ovary longitudinally papillose, 5-loculed; stigma rounded, with 5 shallow lobes, 1.5–2.5 mm in diam. Capsules 4–7 mm in diam., fibers absent or oblong, 0.6–0.7 mm. Fl. Jul, fr. Sep–Oct. *2n* = 26.

Dry coniferous or deciduous broad-leaved forests; low elevations. Jilin, Liaoning, Nei Mongol [Japan, Russia; widely distributed elsewhere in N temperate zone].

Chimaphila umbellata is an evergreen subshrub occurring princi-

pally in the coniferous forests of the temperate regions of the N hemisphere. This species has been divided into five geographically delimited

infraspecific taxa, and only the typical subsp. *umbellata* is distributed in China.

3. **MONESSES** Salisbury ex S. F. Gray, Nat. Arr. Brit. Pl. 2: 403. 1821.

独丽花属 *du li hua shu*

Qin Haining (覃海宁); Peter F. Stevens

Bryophthalmum E. Meyer; *Odostima* Rafinesque.

Herbs perennial, small, glabrous, stoloniferous. Leaves radical, petiolate, leathery, serrulate. Flower solitary, terminal on long stalk. Sepals 5, deeply lobed, persistent. Petals spreading, white or pink, orbicular. Stamens (8–)10; filaments subulate, base glabrous; anthers with tubes, opening by 2 apical pores; disk obscure. Ovary globose or subglobose; ovules on thickened placentas on inner angles of loculi; style straight, apex clavate; stigma 5-toothed. Seeds small, testa elongated at both ends. $n = 13$.

One or two species: Asia, Europe, North America; one species in China.

1. **Moneses uniflora** (Linnaeus) A. Gray, Man. Bot. 273. 1848.

独丽花 *du li hua*

Pyrola uniflora Linnaeus, Sp. Pl. 1: 397. 1753; *Bryophthalmum uniflorum* (Linnaeus) E. Meyer; *Chimaphila rhombifolia* Hayata; *Moneses grandiflora* Salisbury; *M. rhombifolia* (Hayata) Andres.

Herbs evergreen. Rhizome creeping, slender, 0.2–0.6 mm in diam.; roots long, slender, branched. Aerial stems erect or ascending, terete to angular, 1–5 cm, 0.6–1 mm in diam., not branched, glabrous. Leaves in 3 or 4 subverticils of 2 or 3 each, alternating with ca. 5 scales; petiole (0.5–)1–1.5 cm; leaf blade abaxially pale green, adaxially deep green and slightly shiny, broadly rhombic, 1–1.6 × 1–1.5 cm, abaxially glabrous, base subrounded to broadly cuneate, margin minutely toothed, apex rounded to obtuse. Flower nodding,

regular, opening fully. Scape erect, (4–)5–10 cm tall, 1-flowered, glabrous. Bracts 1 or 2 on upper part of scape, 4–5 × ca. 2 mm, ciliolate. Sepals (4 or)5, ovate-elliptic, ca. 2.5 mm, ciliolate, apex rounded. Petals (4 or)5, white, orbicular to broadly ovate, sessile. Stamens (8–)10; anthers 3–4 mm, tubes distinct and strongly curved. Ovary subglobose; style 4–5 mm; stigma peltate with 5 distinct marginal papillae. Capsules subglobose, 5–6 mm in diam., fibers absent at margin. Seeds narrowly fusiform; testa generally with 7 or 8 cells along longest axis, inner testa walls with scalariform pits. Fl. Jul, fr. Sep. $2n = 26$.

Moist mossy coniferous forests, more rarely in wet *Betula* or *Pinus* woods; middle elevations. Gansu, Heilongjiang, Jilin, Shanxi, N Sichuan, Taiwan, Xinjiang, NW Yunnan [Japan, N Korea, Mongolia, Russia; widely distributed in N temperate and subarctic zones, particularly Europe].

4. **ORTHILIA** Rafinesque, Autik. Bot. 103. 1840.

单侧花属 *dan ce hua shu*

Qin Haining (覃海宁); Peter F. Stevens

Actinocyclus Klotzsch (1857), not Ehrenberg (1837, fossil); *Ramischia* Opiz ex Garcke.

Subshrubs evergreen, herbaceous, small. Leaves spiral or subverticillate at middle of stem, thin. Inflorescence racemose, small; scape small papillose. Flowers 4–15 along one side of raceme, small. Petals not persistent. Anthers lacking tubules. Disk 10-lobed. Stamens 10, erect, projecting; tubes absent. Styles erect, slender; stigmas peltate. Capsule pubescent at margin of valve.

One or two species: circumboreal; two species in China.

- 1a. Leaves broadly ovate, 1.2–2.3 cm, apex obtuse or broadly rounded; inflorescences 4–8-flowered 1. *O. obtusata*
1b. Leaves oblong-ovate, 2.2–3.7 cm, apex acute; inflorescences 8–15-flowered 2. *O. secunda*

1. **Orthilia obtusata** (Turczaninow) H. Hara, J. Jap. Bot. 20: 328. 1944.

钝叶单侧花 *dun ye dan ce hua*

Pyrola secunda Linnaeus var. *obtusata* Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 21(4): 507. 1848; *Orthilia nummularia* (Ruprecht) Y. L. Chou; ?*O. obtusata* var. *xizangensis* Y. L. Chou; *O. secunda* (Linnaeus) House var. *nummularia* (Ruprecht) H. Hara; *O. secunda* subsp. *obtusata* (Turczaninow) Böcher; *O. secunda* var. *obtusata* (Turczaninow) House; *Pyrola nummularia* (Ruprecht) Ruprecht ex Komarov; *P. obtusata* (Turczaninow) Turczaninow ex Komarov; *P. secunda* var. *nummularia* Ruprecht; *P. secunda* subsp. *obtusata* (Tur-

zaninow) Hultén; *P. secunda* var. *pumila* Chamisso; *Ramischia obtusata* (Turczaninow) Freyn; *R. secunda* (Linnaeus) Garcke subsp. *obtusata* (Turczaninow) Andres.

Shrubs evergreen, herbaceous, 4–15 cm high. Rhizome long branched. Leaves subverticillate at base of stem; petiole 0.5–1.5 cm; leaf blade dark green abaxially, light green adaxially, broadly ovate, 1.2–2.3 × 1–2 cm, thinly leathery, base rounded or obtuse to truncate, margin crenulate-serrulate, apex obtuse or nearly rounded. Scape slender, loosely and minutely papillose, scales 1–3 at base, ovate-lanceolate, 3–5 mm. Raceme 1.5–4 mm, with 4–8 rather densely arranged flowers along one side. Bracts broadly lanceolate, 2–3 mm, mem-

branous, apex abruptly acute. Pedicel ca. 2 mm, slender, prominently papillose. Sepals ovate-orbicular, ca. 1 mm, margin minutely toothed, apex obtuse. Petals broadly elliptic, 4–5 × 2–3 mm, margin toothed. Anthers 1.5–1.8 mm, apex truncate; pores 0.6–0.9 mm wide. Style exserted, straight, (1.5–)2–4 mm; stigma peltate with 5 shallow lobes. Capsules depressed-globose, ca. 4 mm in diam. Fl. Jul, fr. Jul–Aug. $2n = 38$.

Coniferous forests. Gansu, Heilongjiang, Nei Mongol, Qinghai, Shanxi, N Sichuan, Xinjiang, Xizang [Mongolia, ?Russia (Siberia)].

2. *Orthilia secunda* (Linnaeus) House, Amer. Midl. Nat. 7: 134. 1921.

单侧花 dan ce hua

Pyrola secunda Linnaeus, Sp. Pl. 1: 396. 1753; *Actinocyclus secundus* (Linnaeus) Klotzsch; *Orthilia parvifolia* Rafinesque; *P. secunda* var. *vulgaris* Turczaninow; *Ramischia secunda* (Linnaeus) Garcke; *R. secundiflora* Opiz.

Shrubs evergreen, herbaceous. Rhizome long creeping, slender, 0.5–1 mm in diam., woody, branched. Stems erect or ascending, 2–10 cm, 0.8–1.5 mm in diam., simple, angular, longitudinally minutely papillose. Leaves in 1–3 subverticils of 2–4

each, alternating with 5–7 scales; petiole 1–2 cm, minutely papillose; leaf blade pale green abaxially, light green adaxially, oblong-ovate to broadly ovate or elliptic, 2.2–3.7 × 1.4–2.6 cm, thinly leathery to herbaceous, abaxially glabrous, adaxially slightly shiny, base obtuse to truncate, margin crenulate-serrulate, apex acute to subobtusate or mucronulate. Scape 7–14 cm tall, slender, 0.4–1 mm in diam., loosely and minutely papillose, angled; scales 5–8 at middle and base, narrowly ovate or broadly lanceolate, 2–5 mm. Raceme with 8–15 rather densely arranged flowers along one side. Bracts broadly oblanceolate or broadly lanceolate, 3–5 mm, membranous, somewhat hyaline-margined, apex abruptly acute. Pedicel ca. 3 mm, slender, rather prominently papillose. Sepals overlapping at base, depressed-orbicular, 0.8–1 mm, margin minutely toothed, apex obtuse. Petals erect, greenish white, 3–5 mm. Anthers 1–1.5 mm, apex truncate; pores 0.3–0.4 mm wide. Style exserted, straight or slightly curved, ca. 4 mm; stigma peltate with 5 shallow lobes. Capsules 5-angular, ca. 4 mm in diam. Seeds with thin testa prolonged at both ends, fusiform to oblong; testa generally with 6–8 cells along longest axis. Fl. Jul–Aug, fr. Sep–Oct. $2n = 38$.

Deciduous broad-leaved or subalpine coniferous forests; sea level to 3200 m. Heilongjiang, Jilin, Liaoning, Nei Mongol, Xinjiang [Japan, Kashmir, N Korea, Mongolia, Russia; widely distributed in N temperate and subarctic zones].

5. PYROLA Linnaeus, Sp. Pl. 1: 396. 1753.

鹿蹄草属 lu ti cao shu

Qin Haining (覃海宁); Peter F. Stevens

Amelia Alefeld; *Braxilia* Rafinesque; *Erxlebenia* Opiz ex Rydberg; *Thelaia* Alefeld.

Herbs suffruticose, evergreen, erect, glabrous. Rootstock long, slender, branched, with sparse fine roots. Aerial stem ascending, not branched, scaly at base. Leaves in a rosette at base of caudex, long petiolate; leaf blade abaxially light green, adaxially green, margin entire or serrate. Scapes long, slender, with scalelike bracts at base. Flowers many, nodding, in racemes. Calyx 5-lobed, persistent. Stamens glabrous; anthers opening by pores. Ovary depressed-globose; style exserted, usually curved distally and dilated apically into a ring; stigma capitate, shortly 5-lobed. Capsules nodding, valves connected by fibers at valve margins. Seeds many, small, with thin testa prolonged at both ends. $n = 23, 46$.

Between 30 and 40 species: N temperate regions, extending south to Indonesia (N Sumatra); 26 species (15 endemic) in China.

Pyrola chouana Chang Y. Yang (Bull. Bot. Res., Harbin 5: 167. 1985) was described from N Xinjiang (Burqin). However, we have seen no specimens and are therefore unable to treat it in this account. Further revision is necessary.

1a. Leaves reniform to cordate-ovate, base cordate.

2a. Leaves cordate-ovate, adaxially green, abaxially purplish red, margin crenate; calyx lobes triangular; bracts ovate 3. *P. atropurpurea*

2b. Leaves reniform or reniform-orbicular, adaxially dark green, abaxially light green, margin sinuate; calyx lobes suborbicular; bracts narrowly lanceolate 19. *P. renifolia*

1b. Leaves not as above.

3a. Corolla purplish red or only brownish purple outside.

4a. Plants 8–10 cm tall; leaves 1.8–2.5 × 1.2–1.7 cm; anthers yellow 13. *P. markonica*

4b. Plants taller than 15 cm; leaves ca. 2.5 × 1.7 cm or more; anthers dark purple or red.

5a. Leaves oblong or oblong-ovate; scale-leaf at base of scape narrowly ensiform; sepals oblong, 2.5–3 mm; style not exserted 6. *P. corbieri*

5b. Leaves suborbicular, ovate, or ovate-elliptic; scale-leaf at base of scape narrowly oblong or ovate-oblong; sepals triangular-lanceolate, 3.5–5 mm; style exserted 2. *P. asarifolia*

3b. Corolla white, green, yellow, or yellowish green, sometime pinkish red.

6a. Leaves only 1(or 2).

7a. Leaves ovate-oblong or elliptic, 1.5–2(–2.5) × 0.8–1(–1.2) cm; sepals lanceolate; style 8–10 mm 11. *P. japonica*

7b. Leaves broadly elliptic or suborbicular, 2.7–3 × 2.5–2.6 cm; sepals oblong; style 4–5 mm 17. *P. monophylla*

6b. Leaves more numerous.

- 8a. Leaves thickly leathery, rough, wrinkled.
- 9a. Bracts broadest above middle; petals oblong, margin dentate, apex broadly rounded 26. *P. xinjiangensis*
- 9b. Bracts broadest at or below middle; petals ovate-lanceolate to ± triangular, margin entire, apex obtuse or acuminate.
- 10a. Margin of leaf blade sinuate; petals ovate-lanceolate or triangular-lanceolate, apex acuminate 21. *P. rugosa*
- 10b. Margin of leaf blade crenate; petals triangular or triangular-ovate, apex obtuse, rarely acute 10. *P. forrestiana*
- 8b. Leaves papery to leathery, smooth, not wrinkled.
- 11a. Sepals broadly triangular, ovate-triangular, or triangular-ovate.
- 12a. Leaves 1–1.6 × 1–1.2 cm; petals triangular-ovate 5. *P. chlorantha*
- 12b. Leaves ca. 2 × 1.5 cm or more; petals broadly triangular or ovate-triangular.
- 13a. Leaves elliptic or ovate-elliptic; style 6–7 mm 22. *P. shanxiensis*
- 13b. Leaves broadly elliptic or suborbicular to broadly ovate; style less than 4 mm.
- 14a. Margin of leaf blade sinuate; styles 3–3.5 mm, slightly curved towards apex 23. *P. sororia*
- 14b. Margin of leaf blade crenate; styles 2–2.2 mm, erect 16. *P. minor*
- 11b. Sepals ovate to oblong or ligulate.
- 15a. Styles less than 6 mm, not or slightly exerted.
- 16a. Leaves elliptic or oblong, 5–7.5 × 2.2–3 cm, margin subentire or sparsely dentate 14. *P. matfeldiana*
- 16b. Leaves suborbicular, elliptic, or broadly ovate, 2.9–3.5 × 2.3–2.6(–3) cm, margin sparsely dentate 15. *P. media*
- 15b. Styles ca. 6 mm or more.
- 17a. Raceme 1.5–2.8 cm, 3–5-flowered 25. *P. tschanbaischanica*
- 17b. Raceme longer than 2.8 cm, 5- or more flowered.
- 18a. Sepals ligulate, apex mucronate, margin slightly sinuate 24. *P. szechuanica*
- 18b. Sepals usually ovate, apex acuminate, margin entire or nearly so.
- 19a. Leaves often with white stripes over veins adaxially.
- 20a. Leaves ovate or ovate-elliptic, 3–4 × 1.5–3 cm, base broadly rounded to cuneate, often oblique; petals obovate-orbicular 1. *P. alboreticulata*
- 20b. Leaves oblong or obovate-oblong, (3–)5–7 × 2.5–3.5(–4) cm, base cuneate; petals ovate-oblong 8. *P. decorata*
- 19b. Leaves without white stripes over veins adaxially, or inconspicuous if present.
- 21a. Leaf margin crenate; petiole more than 1.5 × as long as leaf blade 18. *P. morrisonensis*
- 21b. Leaf margin entire or sinuate; petiole less than 1.5 × as long as leaf blade.
- 22a. Leaves narrowly oblong, leaf blade 2.5–3 × as long as wide, apex acute 9. *P. elegantula*
- 22b. Leaves suborbicular, broadly ovate to elliptic, leaf blade less than 2 × as long as wide, apex obtuse to rounded.
- 23a. Sepals lanceolate-triangular; style 1.1–1.3 cm; bracts linear-lanceolate 11. *P. japonica*
- 23b. Sepals narrowly lanceolate to ovate-lanceolate or ligulate; style shorter than 1 cm; bracts lanceolate or long ligulate.
- 24a. Sepals lanceolate.
- 25a. Flowers 0.8–1 cm in diam.; sepals ca. as long as or slightly longer than petals 12. *P. macrocalyx*
- 25b. Flowers 1.5–2 cm in diam.; sepals ca. 1/2–2/3 as long as petals 20. *P. rotundifolia*
- 24b. Sepals ligulate or ovate-lanceolate.
- 26a. Leaves light green abaxially; flowers ca. 1 cm in diam.; sepals 3–4 mm, margin sparsely slightly denticulate 7. *P. dahurica*
- 26b. Leaves often glaucous abaxially; flowers 1.5–2 cm in diam.; sepals 5–7.5 mm, margin entire 4. *P. calliantha*

1. *Pyrola alboreticulata* Hayata, Icon. Pl. Formos. 3: 142. 1913.

花叶鹿蹄草 hua ye lu ti cao

Herbs to 20 cm tall. Leaves approximate to remote; petiole 3–4 cm; leaf blade deep green with pale veins adaxially, ovate or ovate-elliptic, 3–4 × 1.5–3 cm, leathery, base rounded, abruptly decurrent, margin with remote, minute teeth, apex acute, mucronulate. Scape ca. 10 cm; scales basal; raceme 1–4-flowered, 2–4 cm. Pedicel ca. 4 mm; bract linear, 8–10 mm. Flowers semipendent, 1.5–1.8 cm in diam. Sepals narrowly oblong, 5–6 × ca. 2.5 mm, apex obtuse. Petals white, obovate-orbicular, 7–

7.5 × ca. 6 mm, apex rounded. Filaments complanate, yellow, 3–3.5 × 1–1.2 mm, tubules present. Style exerted, 8–10 mm, upper part curved, dilated at apex, without ring of lobes. Capsules 7–8 mm in diam. Fl. and fr. Jan.

• Middle elevations. Taiwan.

2. *Pyrola asarifolia* Michaux subsp. ***incarnata*** (de Candolle) E. Haber & H. Takahashi, Bot. Mag. (Tokyo) 101: 492. 1988.

红花鹿蹄草 hong hua lu ti cao

Pyrola rotundifolia Linnaeus var. *incarnata* de Candolle, Prodr. 7: 773. 1839; *P. asarifolia* var. *incarnata* (de Candolle) Fernald; *P. incarnata* (de Candolle) Freyn; *P. incarnata* var.

ovatifolia Y. Z. Zhao; *P. rotundifolia* subsp. *incarnata* (de Candolle) Krylov; *P. rotundifolia* var. *purpurea* Bunge.

Herbs 1–5 cm tall. Rhizome creeping, long, somewhat thick, 0.7–2 mm in diam., branched, with sparse fine roots. Stems ascending. Leaves appearing radical, 3–8, in 2 or 3 subverticils of 3 or 4 each; petiole 3–5 cm; leaf blade pale green abaxially, green and shiny adaxially, elliptic or ovate-elliptic, 2–5.5 × 1.5–5.5 cm, base rounded or scarcely cordate, rarely subacute, margin obscurely serrulate, apex rounded to obtuse. Scape erect, 10–25 cm tall, angled, glabrous, with 4 or 5 broadly lanceolate-elliptic membranous basal scales and 1–4 lanceolate scales near middle; raceme densely 7–15-flowered. Bracts broadly lanceolate, membranous, apex acuminate. Flowers drooping, zygomorphic. Sepals narrowly ovate to broadly lanceolate, ca. 2 × as long as wide, 1.7–4.7 × 1.1–2.3 mm, apex acute to acuminate. Petals rose, 5–9 × 3–6 mm. Filaments curved upward; anthers dark purple, gathered above style, 1.4–3 mm, tubules present, opening by narrow terminal pores. Style exerted, curved, 6–10 mm, dilated at apex into a ring; stigma with a collar and 5 erect cylindrical lobes. Capsules 7–8 mm in diam. Fl. Jun, fr. Jul–Oct.

Dry deciduous broad-leaved and coniferous forests; sea level to 2500 m. Hebei, Heilongjiang, ?Henan, Jilin, Liaoning, E Nei Mongol, ?Ningxia, Shanxi, ?Sichuan, Xinjiang [Japan, N Korea, Mongolia, Russia].

3. *Pyrola atropurpurea* Franchet, J. Bot. (Morot) 9: 372. 1895.
紫背鹿蹄草 *zi bei lu ti cao*

Pyrola atropurpurea var. *gracilis* Andres; *P. gracilis* (Andres) Andres.

Herbs 7–18 cm tall. Rhizome slender, branched. Leaves 2–4, crowded at base of aerial shoots; leaf blade reddish purple abaxially, green adaxially, cordate-ovate, (1–)1.5–3 × (1–)1.2–3 cm, papery, base cordate, margin slightly crenulate, apex obtuse. Scape erect, slender, without scales or 1 or 2 scale-shaped leaves, green-brown, lanceolate, membranous; raceme 2–4(–5) mm, naked or with 1 or 2 minute lanceolate bracts, 2–4-flowered. Pedicel 3–5 mm; bracts ovate, ca. 2 mm. Flowers nodding, cup-shaped, 0.8–1.5 cm in diam. Sepals reddish purple, ovate-triangular, ca. 1.5 × 1.5 mm, apex obtuse. Petals white, oblong-obovate, 5–7 × 3–5 mm, apex obtuse. Filaments glabrous; anthers yellow, ca. 3 × 1.5 mm, tubules present. Style exerted, recurved, 9–11 mm, dilated at apex into ring; stigma thickened, with 5 round lobes. Capsules 5–6 mm in diam. Fl. Jun–Jul, fr. Aug–Sep.

• Montane coniferous forests, mixed forests; 1800–4000 m. Gansu, ?Henan, Qinghai, ?Shaanxi, Shanxi, Sichuan, Xizang, Yunnan.

4. *Pyrola calliantha* Andres, Acta Horti Gothob. 1: 173. 1924.
鹿蹄草 *lu ti cao*

Pyrola andresii Křisa; *P. calliantha* var. *tibetana* (Andres) Y. L. Chou; *P. hopeiensis* Nakai; *P. rockii* Křisa; *P. rotundifolia* Linnaeus subsp. *chinensis* (Andres) Andres; *P. rotundifolia* var. *chinensis* Andres; *P. rotundifolia* var. *communis* Andres; *P. rotundifolia* var. *laurifolia* Andres; *P. rotundifolia* var. *sphaeroides* Andres; *P. rotundifolia* subsp. *tibetana* (Andres) Andres; *P. rotundifolia* var. *tibetana* Andres.

Herbs (10–)15–30 cm tall. Rhizome long, slender, branched, producing adventitious roots and aerial stems at nodes; caudex ribbed, 15–30 cm, with a basal rosette of crowded leaves and 1 or 2 bracts; bracts brownish, oblong-ovate, sheathing, scales. Petiole 2–5.5 cm; leaf blade purplish and often glaucous abaxially, green adaxially, elliptic or ovate, (2.5–)3–6 × 2–3.5 cm, leathery, base broadly cuneate or suborbicular, margin entire or crenate, apex obtuse or rounded. Scape with 1 or 2 ovate-lanceolate or lanceolate scalelike bracts sheathing at base; raceme 9–13-flowered, 12–16 cm. Pedicel 5–8(–10) mm; bracts ligulate, 6–7.5 mm. Flowers spreading or rarely nodding, rotate, 1.5–2 cm in diam. Sepals ligulate, (3–)5–7.5 × (1.5–)2–3 mm, margin entire, apex often acute. Petals pure white, obovate-elliptic or obovate, 6–10 × 5–8 mm. Filaments glabrous; anthers yellow, (2.1–)2.5–4 × 1–1.4 mm, tubules present. Style ± exerted, light red, 6–8(–10) mm, nearly erect or upper part slightly curved upward, dilated at apex into a ring. Capsule 7–9 mm in diam. Fl. Jun–Aug, fr. Aug–Sep.

• Montane coniferous forests, mixed forests; 700–4100 m. Anhui, Fujian, Gansu, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Qinghai, Shandong, Shanxi, Sichuan, Xizang, Yunnan, Zhejiang.

5. *Pyrola chlorantha* Swartz, Kongl. Vetens. Acad. Nya Handl. 190. 1810.

绿花鹿蹄草 *lü hua lu ti cao*

Pyrola solunica S. D. Zhao; *P. virens* Schweigger; *Thelaisia chlorantha* (Swartz) Alefeld.

Herbs 11–18 cm tall. Rhizome long, slender, branched. Aboveground stem very short. Leaves 2–4, basal; petiole 2–5 cm; leaf blade pale abaxially, dark green adaxially, rather dull, suborbicular, 1–1.6 × 1–1.2 cm, leathery, base rounded to acute, margin minutely crenulate, apex rounded. Scape including inflorescence 10–20 cm high, usually with a solitary scale; raceme laxly 2–8-flowered, slightly nutant, nodding, 1.5–3.5 cm. Pedicel 4–5 mm; bracts lanceolate. Flowers cup-shaped, ca. 1 cm in diam. Sepals triangular-ovate, ca. as long as wide, 1–1.5 mm, basal widest 1–1.5 mm, apex ± acute or obtuse. Petals greenish white, ovate or elliptic, 5–6 mm. Filaments dilated at base; anthers yellow, oblong, mucronate at distal end; tubules curved, pores oblique. Style exerted, longer than petals, strongly bent, somewhat thickened upwards, dilated at apex into ring. Capsule ca. 6 mm in diam. Fl. Jun, fr. Aug.

Pinus sylvestris var. *mongolica* forests; below 1000 m. Nei Mongol [Mongolia].

6. *Pyrola corbieri* H. Léveillé, Bull. Acad. Int. Géogr. Bot. 12: 254. 1903.

贵阳鹿蹄草 *gui yang lu ti cao*

Pyrola chlorantha Swartz subsp. *fallax* Křisa.

Herbs 11–33 cm tall. Rhizome ascending, slender, branched. Leaves 2–6, basal. Scales at stem base 1–3 mm wide, not or slightly sheathing. Petiole 1–3.5 cm; leaf blade dark green with pale veins adaxially, oblong or oblong-ovate, 3.5–7 × 1.5–3.5 cm, slightly leathery, base cuneate or attenuate, margin entire or shallowly crenate, apex subacute. Scape ca. 2 mm in diam., narrowly winged, scalelike leaves 1 or 2, brown, narrowly lin-

ear, 1–1.5 cm, base slightly amplexicaul, apex acuminate or acute; raceme 4–9-flowered, short, 1.5–2.5(–4) cm. Flowers nodding, broadly saucer-shaped, relatively large. Pedicel 5–8 mm, bract axillary, narrowly lanceolate, 5–8 mm, longer or ca. as long as pedicel, membranous, apex acuminate. Sepals purplish brown, oblong, ca. 4 × 1.5–2 mm, apex obtuse or acute. Petals white, obovate or orbicular, 5–7 × 4–5 mm. Filaments glabrous; anthers red, ca. 3 mm. Style included or slightly exerted, distinctly curved, dilated at apex into a ring. Capsule 6–8 mm in diam. Fl. Jul–Aug, fr. Sep–Oct.

Streamsides in *Pinus* forests; 2100–2700 m. Guangxi, Guizhou, Sichuan [Bhutan].

7. *Pyrola dahurica* (Andres) Komarov, Trudy Imp. S.-Peterburgsk. Bot. Sada 39: 96. 1923.

兴安鹿蹄草 *xing an lu ti cao*

Pyrola americana Swartz var. *dahurica* Andres, Deutsche Bot. Monatsschr. 22: 50. 1911; *P. forrestiana* Andres subsp. *dahurica* (Andres) Křisa; *P. incarnata* (de Candolle) Freyn subsp. *dahurica* (Andres) Křisa; *P. rotundifolia* Linnaeus subsp. *dahurica* (Andres) Andres.

Herbs 15–23 cm tall. Rhizome long, slender, branched. Leaves (2 or) 3–6 (or 7), crowded at base of caudex; petioles 2.8–4.5 cm; leaf blade light green abaxially, green adaxially, suborbicular or broadly ovate, (2.5–) 3–5 × 2.5–4 cm, leathery, base broadly cuneate or orbicular, margin entire or slightly crenate, apex obtuse or rounded. Raceme 5–10-flowered, 4–8(–10) cm. Pedicel 4–5 mm; bracts ligulate or lanceolate, 4–5 mm. Flowers nodding, spreading, ca. 1 cm in diam. Sepals ligulate, rarely lanceolate, 3–4 × ca. 1.5 mm, margin remotely denticulate, apex often acute. Petals white, obovate, 5–7 × 4–5 mm, apex rounded. Filaments short, ca. 5 mm, glabrous; anthers yellow, 2.5–2.7 × 1–1.5 mm, tubules present. Style slightly exerted, 6–7 mm, upper part curved upward, dilated at apex into a ring, conspicuously so at least at fruiting. Capsule ca. 5 mm in diam. Fl. Jul, fr. Aug.

Coniferous forests, mixed forests, becoming dominant in herbaceous layer; 700–1800 m. Heilongjiang, Jilin, Liaoning, Nei Mongol [Mongolia].

8. *Pyrola decorata* Andres, Notes Roy. Bot. Gard. Edinburgh 8: 7. 1913.

普通鹿蹄草 *pu tong lu ti cao*

Pyrola alba Andres; *P. alba* var. *viridiflora* Andres; *P. decorata* var. *alba* (Andres) Y. L. Chou & R. C. Zhou; *P. handeliana* Andres; *P. oreodoxa* Andres.

Herbs 15–35 cm tall. Rootstock long, slender, branched. Leaves 3–6, crowded at base of caudex; petiole 2–3 cm; leaf blade light green and purplish abaxially, deep green with pale veins adaxially, oblong or obovate-oblong, (3–) 5–7 × 2.5–4 cm, thinly leathery, base cuneate, decurrent, margin with remote minute teeth, apex acute or mucronulate. Scape slender, with 1 or 2 scalelike leaves at base; raceme 4–10-flowered, 2.5–4 cm. Pedicel 5–9 mm; bract lanceolate, 5–9 mm, membranous. Flowers ± nodding, saucer-shaped, 1–1.5 cm in diam. Sepals ovate-oblong, 3–6 × 2–2.5 mm, apex acute. Petals light green to white, obovate-oblong, 6–8 × 5–7 mm, apex rounded. Filaments

glabrous; anthers yellow, 3–4 × 1–1.5 mm, tubules present. Style exerted, 6–10 mm, curved, dilated at apex into a ring. Capsules 7–11 mm in diam. Fl. Jun–Jul, fr. Jul–Aug.

Pinus or broad-leaved forests, scrub; 600–3000 m. Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangxi, Shaanxi, Sichuan, Xizang, Yunnan, Zhejiang [Bhutan].

9. *Pyrola elegantula* Andres in Handel-Mazzetti, Symb. Sin. 7: 764. 1936.

长叶鹿蹄草 *chang ye lu ti cao*

Pyrola elegantula var. *jiangxiensis* Y. L. Chou & R. C. Zhou.

Herbs 14–25 cm tall. Rhizome long, slender, branched. Leaves 3–6, crowded at base of caudex; petiole 2–3 cm; leaf blade light green abaxially, deep green adaxially, narrowly oblong, 4–8 × 1.5–3 cm, thinly leathery, base cuneate, decurrent to petiole, margin with remote minute teeth, apex acute. Scape slender, with 1 or 2 scalelike leaves; raceme 4–6-flowered, 2–4 cm. Pedicel 4–9 mm; bracts lanceolate, 4–9 mm, membranous. Flowers spreading, broadly cup-shaped, 1–1.5 cm in diam. Sepals narrowly ligulate, 3–6 × 1–2 mm, apex acuminate. Petals white, obovate-oblong, 7–10 × 4–6 mm, apex rounded. Filaments 5–6 mm, glabrous; anthers yellow, 3–4 mm, tubules present. Style exerted, curved, 9–13 mm, dilated at apex into a ring. Capsules 8–10 mm in diam. Fl. Jun, fr. Jul.

• Montane forests; 1200–1800 m. Fujian, Guangdong.

10. *Pyrola forrestiana* Andres, Notes Roy. Bot. Gard. Edinburgh 8: 8. 1913.

大理鹿蹄草 *da li lu ti cao*

Herbs 20–27 cm tall. Rhizome slender, branched. Leaves 3–7; petiole 2–4.5 cm; leaf blade light green abaxially, green adaxially, triangular ovate, obovate, or suborbicular, 2.5–4.5 × 2–3.5 cm, thickly leathery, rough, base rounded or truncate, margin conspicuously crenate, apex obtuse. Scales at base of scape, narrowly oblong, 8–12 × 3–5 mm; raceme 6–9 cm, 9–12-flowered. Pedicel 5–10 mm; bracts oblong-lanceolate, slightly longer than pedicel, membranous, apex acute. Flowers nodding, saucer-shaped, 1–1.5 cm in diam. Sepals triangular or triangular-ovate, 1.5–2.5 × 1.5–2 mm, apex obtuse. Petals greenish yellow, ovate or suborbicular, 7–9 × 5–7 mm. Filaments flattened; anthers yellow, oblong, tubules present. Style exerted, ca. 1 cm, curved at upper part, dilated at apex into a ring. Capsules 5–7 mm in diam. Fl. Jul–Aug, fr. Aug–Sep.

• Moist shaded forests; 1500–3800 m. Hubei, Hunan, Sichuan, ?Xizang, Yunnan.

11. *Pyrola japonica* Klenze ex Alefeld, Linnaea 28: 57. 1856.

日本鹿蹄草 *ri ben lu ti cao*

Pyrola asarifolia var. *japonica* (Klenze ex Alefeld) Miquel; *P. incarnata* (de Candolle) Freyn var. *japonica* (Klenze ex Alefeld) Koidzumi; *P. japonica* var. *subaphylla* (Maximowicz) Andres; *P. japonica* f. *subaphylla* (Maximowicz) Ohwi; *P. rotundifolia* Linnaeus var. *albiflora* Maximowicz; *P. rotundifolia* f. *subaphylla* (Maximowicz) Makino; *P. subaphylla* Maximowicz.

Herbs 5–30 cm tall. Rhizome descending and sometimes creeping, somewhat thick, 0.8–2 mm in diam., sparsely branched; roots somewhat thick, to 0.5 mm in diam. Stems ascending, sometimes branched. Leaves appearing radical, 3–6, in 1 or 2 subverticils of 1–3 each; petiole 3–8 cm; leaf blade pale green or reddish abaxially, deep green with pale or white veins adaxially, elliptic, broadly elliptic, or obovate, rarely orbicular, (3–)4–7 × 2.5–4.5 cm, somewhat thick, base rounded, obtuse, or subacute, margin rather sparsely and obscurely serrulate, apex rounded to obtuse. Scape erect, (6–)15–30 cm tall, with 3–6 scales near base; scales narrowly to broadly lanceolate or oblanceolate, costate, up to 2 leaflike scales and sometimes 1 smaller, lanceolate scale near middle; raceme rather sparsely 5–12-flowered, 6–10 cm. Pedicel with bracts broadly linear to lanceolate, 5–8 mm, apex long acuminate. Flowers drooping, zygomorphic, 10–12 mm in diam. Sepals broadly lanceolate to narrowly ovate, (1–)2.5–5(–6) × (2–)4–6 mm, apex acute. Petals ovate-elliptic, 3.5–4 × 1.6–2 mm, apex acuminate. Filaments curved upward; anthers creamy white, orange-yellow near apex, 2–3 mm, prolonged into terminal tubules, opening by terminal pores. Style exerted, sometimes scarcely so, curved to somewhat slightly so, 1.1–1.3 cm, dilated at apex but without ring-shaped protuberance; stigma with a collar and 5 erect cylindrical lobes. Capsules 7–8 mm in diam. Fl. Jun–Aug, fr. Sep–Oct.

Common, mainly in dry forests; sea level to 1500 m. Hebei, Heilongjiang, Henan, Jilin, Liaoning, Nei Mongol, Taiwan [Japan, Korea].

12. *Pyrola macrocalyx* Ohwi, Acta Phytotax. Geobot. 1: 80. 1932.

长萼鹿蹄草 chang e lu ti cao

Herbs 14–21 cm tall. Rhizome long, slender, branched. Leaves 2–6, crowded at base of caudex; petiole 1.5–3.5 cm, often shorter than blade; leaf blade light green with purple abaxially, green adaxially, elliptic, obovate, or ovate, 2.3–4.2 × 1.4–3.8 cm, leathery, base broadly cuneate or orbicular, margin entire or slightly crenate, apex obtuse or rounded. Scape subtended by 1–3 scalelike bracts; raceme 6–10(–15)-flowered, 3–5 cm. Pedicel 3–4 mm; bracts lanceolate, 5–7 × 1.4–1.5 mm, longer than pedicel, membranous. Flowers spreading, saucer-shaped, ca. 1 cm in diam. Sepals lanceolate, 4.5–5 × ca. 1 mm, margin entire, apex acuminate. Petals white, obovate, 5–6 × 3–4 mm, apex acute or obtuse. Filaments glabrous; anthers yellow, 2–2.5 × ca. 1 mm, tubules present. Style not or slightly exerted, 6–6.5 mm, nearly erect or upper part curved upward, without dilated ring at apex. Capsule 4–6 mm in diam. Fl. Jul–Aug, fr. Aug–Sep.

Betula forests, coniferous forests; 700–2100 m. S Jilin (Changbai Shan) [Korea].

13. *Pyrola markonica* Y. L. Chou & R. C. Zhou, Bull. Bot. Res., Harbin 1(4): 113. 1981.

马尔康鹿蹄草 ma er kang lu ti cao

Herbs 8–10 cm tall. Rhizome long, slender, branched. Leaves 4–7, basal, petiole 1–2 cm; leaf blade light green abaxially, deep green adaxially, broadly obovate-elliptic or elliptic, 1.8–2.5 × 1.2–1.7 cm, subleathery, base rounded or broadly cuneate, margin minutely glandular sinuate, apex obtuse. Scape

subtended by 2 or 3 ovate-oblong, scalelike leaves; raceme 6–8-flowered, 1.5–2 cm. Pedicel 3–4 mm; bracts lanceolate, 6.5–7 mm, longer than pedicel, membranous. Flowers slightly nodding, broadly cup-shaped, 1–1.5 cm in diam. Sepals oblong, 4–4.5 × 2–2.5 mm, apex cuspidate. Petals purplish red, obovate-oblong, 8–9 × 5–6 mm, apex rounded. Filaments glabrous; anthers yellow, ca. 3 mm, tubules present, with acuminate base and projecting at apex. Style exerted, curved, ca. 7 mm, apex dilated but without ring-shaped protuberance. Capsules ca. 6 mm in diam. Fl. Jul–Aug, fr. Aug–Sep.

• *Abies* and *Picea* forests; ca. 3500 m. Sichuan.

14. *Pyrola mattfeldiana* Andres, Repert. Spec. Nov. Regni Veg. 40: 235. 1936.

贵州鹿蹄草 gui zhou lu ti cao

Herbs 20–28 cm tall. Rhizome long, branched, ascending. Leaves 3–7, crowded at base of caudex; petiole usually shorter than blade; leaf blade abaxially brown, adaxially deep green, elliptic or oblong, 5–7.5 × 2–3 cm, thinly leathery, base cuneate, margin entire or with obscure small teeth, apex obtuse. Scapes thick, with 2 or 3 acute bracts; raceme 5–12-flowered, 3.5–5 cm. Pedicel 5–6 mm; bracts ovate-lanceolate, 5–6 mm. Flowers nodding, 7–8 mm in diam., subglobose. Sepals ovate-oblong or ovate-lanceolate, ca. 4 × 2 mm, margin yellowish, apex obtuse. Petals white, oblong, ca. 7 × 6 mm, apex rounded. Filaments glabrous, flattened, ca. 1.5 mm wide at base; anthers yellow, ca. 3 × 1.5 mm, tubules present. Style not exerted, earlier erect, later declined and curved, dilated at apex into a ring. Capsule 7–9 mm. Fl. Jun, fr. Jul.

• Montane forests; 2600–3000 m. Guizhou, Sichuan.

15. *Pyrola media* Swartz, Kongl. Svenska Vetenskapsakad. Handl. 257. 1804.

小叶鹿蹄草 xiao ye lu ti cao

Amelia media (Swartz) Alefeld; *Thelasia media* (Swartz) Alefeld.

Herbs 10–30(–33) cm tall. Rhizome brown, slender, strongly branched. Leaves 4–6, rosulate; petiole usually longer than blade; leaf blade slightly green abaxially, green adaxially, orbicular or orbicular-ovate, 2.9–3.5 × 2.3–2.6(–3) cm, leathery, base rounded or cuneate-rounded, margin obscurely crenate with shallow and broad or sometimes flat crenations, apex rounded. Scapes 10–33 cm, with a solitary acute bract at or below middle; raceme 3–5(–7) cm, 5–12-flowered. Pedicels (5–)8–9 mm in fruit; bract oblong, longer than pedicel, 4–6 × 1.5–2.5 mm, apex rounded. Flowers slightly nodding, half-opened, saucer-shaped. Sepals reddish, ovate-lanceolate, margins not overlapping, apex acuminate, often recurved at tip. Petals white or at base pinkish, elliptic or suborbicular, 6–8 × 4.5–6 mm, apex rounded. Filaments connivent around pistil, flattened, glabrous; anther yellow, (1.9–)2.1–2.3(–2.5) mm. Style slightly exerted, somewhat declined, 5–5.5 mm, dilated at apex into a ring; stigma 5-lobed. Capsule compressed-globose, 4–5 × 6.5–8 mm. Fl. Jun–Jul.

Coniferous forests; 1900–2600 m. S Jilin (Changbai Shan), N Xinjiang (Altay Shan) [Mongolia, Russia; C Asia, Europe].

16. *Pyrola minor* Linnaeus, Sp. Pl. 1: 396. 1753.

短柱鹿蹄草 duan zhu lu ti cao

Amelia minor (Linnaeus) Alefeld; *Braxilia minor* (Linnaeus) House; *B. parvifolia* Rafinesque; *Erxlebenia minor* (Linnaeus) Rydberg; *E. rosea* Opiz.

Herbs (7–)12–20 cm tall. Rhizome creeping, long, somewhat slender, 0.5–1 mm in diam., branched, with sparse fine roots. Aerial stems ascending, short or somewhat long, 0.5–2.5 cm, not branched. Leaves appearing radical, 4–8, in 2 or 3 subverticils of 2–4 each; petiole 1–2.5 cm; leaf blade pale green abaxially, green adaxially, broadly elliptic to orbicular, 1.5–4.5 × 1.5–3 cm, base obtuse to truncate, margin crenulate to obsolete serrulate, apex obtuse or mucronulate. Scape erect, 8–18 cm tall, angled, glabrous, with 3–5 broadly lanceolate-elliptic or broadly oblanceolate scales at base, up to 2 leafy scales or leaves near base, and up to 2 narrowly lanceolate to broadly linear scales near middle; raceme densely 7–16-flowered, 2–3.5 cm. Pedicel 3–6 mm; bracts broadly linear, 3–6 mm, usually longer than pedicel. Flowers drooping, regular, 6–7 mm in diam. Sepals depressed-deltoid or broadly ovate, 1–2 × 1–2 mm, apex obtuse to acuminate. Petals white, 3–6 mm, apex retuse. Filaments connivent, surrounding pistil, short, thick, glabrous; anthers yellow, 0.9–1.4 mm, without distinct tubules, apex truncate, opening by wide terminal pores. Style included, ca. 2 mm, straight or slightly curved, not dilated at apex into a ring; stigma with a collar and 5 radially arched lobes. Capsules 4–6 mm in diam. Fl. Jul, fr. Aug. $2n = 46$.

Subalpine deciduous broad-leaved forests; 500–2500 m. Heilongjiang, Jilin, Xinjiang, Xizang, Yunnan [Japan, N Korea, Russia; widely distributed in cool N temperate and subarctic zones].

This is a rare species in China.

17. *Pyrola monophylla* Y. L. Chou & R. C. Zhou, Bull. Bot. Res., Harbin 1(4): 111. 1981.

单叶鹿蹄草 dan ye lu ti cao

Herbs 11–19 cm tall. Rhizome long, slender, branched. Leaf solitary, basal; petiole ca. 3 cm; leaf blade glaucous abaxially, green adaxially, broadly elliptic or suborbicular, ca. 3 × 2.5 cm, thinly leathery, base subrounded, margin entire or crenulate, apex obtuse or rounded. Scape thick, with 3–5 ovate-lanceolate bracts, sheathed at base; raceme 5- or 6(–9)-flowered, 3–4(–8.5) cm. Pedicel 5–6 mm; bracts oblong-lanceolate, 6–7 mm, membranous. Flowers nodding. Sepals ovate-oblong or triangular-oblong, 3.5–4 × 2–2.5 mm, apex often acute. Petals white, ovate-oblong, 6–7 × 3–3.5 mm. Filaments glabrous; anthers yellow with purple, ellipsoid, 2.6–2.9 mm, tubules present. Style upper part curved upward, short, ca. 4 mm, dilated at apex into a ring; stigma shallowly 5-lobed. Capsule 5–6 mm in diam. Fl. Aug, fr. Sep.

• Montane mixed forests; ca. 2700 m. Yunnan.

18. *Pyrola morrisonensis* (Hayata) Hayata, J. Coll. Sci. Imp. Univ. Tokyo 25(19): 155. 1908.

台湾鹿蹄草 tai wan lu ti cao

Pyrola elliptica Nuttall var. *morrisonensis* Hayata, Bot. Mag. (Tokyo) 20: 18. 1906.

Herbs to 20 cm tall. Rhizome ascending, slender, branched. Leaves 3–8, basal, alternate or subopposite; petiole 5–6 cm, complanate; leaf blade slightly green abaxially, green adaxially, ovate-suborbicular to ovate-rhombic, 2–3 × 2–2.5 cm, base rounded or truncate to subacute, margin crenulate-serrulate, apex rounded, obtuse, or emarginate. Scape 4–8.5(–25) cm; scales narrowed; raceme 6–11-flowered, 10–25 cm. Pedicel 7–8 mm; bracts narrowly oblong, ca. 8 × 3 mm, apex acute. Flowers ± nodding, saucer-shaped, ca. 1.5 cm in diam. Sepals ovate, ca. 2.5 × 2 mm, apex obtuse or acute. Petals white, orbicular-oblong, 6–7 × 5–6 mm, margin obscurely denticulate, apex rounded. Filaments 6–7 mm; anthers yellow, occasionally with purple, 2–2.6 × 1–1.5 mm, tubules present. Style upper part curved upward, 7–9 mm, exerted, dilated at apex into ring. Capsules ca. 5 mm in diam. Fl. and fr. unknown.

• High mountains; 1900–3200 m. Taiwan.

19. *Pyrola renifolia* Maximowicz, Mém. Acad. Imp. Sci. St.-Petersbourg Divers Savans 9 [Prim. Fl. Amur.]: 190. 1859.

肾叶鹿蹄草 shen ye lu ti cao

Pyrola soldanellifolia Andres.

Herbs 10–21 cm tall. Rhizome creeping, long, slender, 0.2–0.8 mm in diam., branched, with sparse fine roots. Aerial stems ascending, short, usually ca. 0.5 cm, rarely to 2 cm. Leaves appearing radical, 1–3(–6), in 1 or 2 subverticils, long petiolate; leaf blade pale green abaxially, deep green with paler or white veins adaxially, reniform, 1–3 × 1.5–4 cm, base cordate, often with overlapping margins, margin crenulate or obsolete serrulate, apex rounded or shallowly emarginate. Scapes erect, but nodding earlier, 7–21 cm tall, slender, somewhat angled, glabrous, with 2–4 minute lanceolate or broadly linear or oblanceolate scales at base and sometimes one minute scale near middle; raceme rather sparsely 1–3(–6)-flowered, 1.8–3.5(–5) cm. Pedicel 3–8 mm; bracts linear-lanceolate, 1–2 mm. Flowers drooping, zygomorphic, 1–1.5(–1.5) mm in diam. Sepals suborbicular to depressed-triangular, 1–1.5 × 1.4–2 mm, apex obtuse to rounded. Petals white to greenish, sometimes becoming black when dry, obovate, 5–7 × 3–5.5 mm. Filaments curved upward; anthers creamy white, 2–4 mm, prolonged into terminal tubules, opening by small terminal pores, terminal tubules orange-yellow. Style exerted, 5–10 mm, curved, slightly dilated at apex into a ring; stigma with a collar and 5 erect cylindrical lobes. Capsules 5–7 mm in diam. Fl. Jun–Jul, fr. Aug–Sep.

Shaded coniferous, mixed, and deciduous broad-leaved forests, mossy soil especially near rotting tree trunks; sea level to 200 m. Hebei, Heilongjiang, Jilin, Nei Mongol, Liaoning [Japan, Korea, Russia (Sakhalin)].

20. *Pyrola rotundifolia* Linnaeus, Sp. Pl. 1: 396. 1753.

圆叶鹿蹄草 yuan ye lu ti cao

Thelasia rotundifolia (Linnaeus) Alefeld.

Herbs 15–25(–30) cm tall. Rhizome long, slender, branched, producing adventitious roots and aerial stems at nodes; aerial stems 15–30 cm, ribbed, with a basal rosette of

crowded leaves, and higher up with 1 or 2 oblong-ovate sheathing, scalelike, brownish bracts. Rosulate leaves 4–7, semievergreen; petiole ca. 2 × or ca. as long as blades; leaf blade slightly green abaxially, green adaxially, slightly shiny, orbicular to ovate, (2–)3–6 × (1.5–)2.5–5.5 cm, leathery, base sometimes subcordate, margin obscurely crenate or nearly entire, apex rounded. Rachis-inserted scale-shaped leaves 1 or 2; raceme 8–15-flowered, 6–16 cm. Pedicel 4.5–5 mm; bracts axillary, imbricate, lanceolate, membranous. Flowers spreading or rarely nodding, 1.5–2 cm in diam., widely opened, fragrant (scent of *Convallaria majalis* Linnaeus). Sepals ovate-lanceolate to lanceolate, 3.5–5.5 mm, reflexed at tip, apex rounded. Petals incurved, pure white, orbicular-ovate, 6.5–10 × 4–6 mm, rather thick, apex obtuse. Stamens arched toward upper side of flower; filaments glabrous, anthers yellow, tubules present. Style 7.5–10 mm, deflexed at base and facing lower part of corolla, dilated at apex into a ring. Capsule (6–)7–8 mm in diam. Fl. Jun–Jul, fr. unknown.

Picea forests, mountain thickets, grassy slopes; 1400–3200 m. Gansu, ?Hebei, ?Jiangsu, ?Liaoning, ?Ningxia, ?Shaanxi, Sichuan, N Xinjiang (Altay), Xizang, Yunnan [Japan, Mongolia, Myanmar, Russia; Europe].

According to Haber (Syst. Bot. 8: 277–298. 1983), one of the main areas of taxonomic difficulty in *Pyrola* occurs in *P.* sect. *Pyrola* (see Křisa, Bot. Jahrb. Syst. 90: 476–508. 1971, for sectional subdivisions). The type of the section is *P. rotundifolia* Linnaeus, a white-flowered species common throughout Europe and eastward to just beyond Lake Baikal in Siberia (cf. Hultén, Amphi-Atlantic Pl. map 123. 1958). Numerous taxa, both white- and pink-flowered, have been recognized as segregates of this widespread species, or described as distinct but related to *P. rotundifolia*. The assessment of taxonomic affinities within this “complex” has been problematic because of the lack of clear morphological discontinuities (Haber & Takahashi, Bot. Mag. (Tokyo) 101: 483–495).

21. *Pyrola rugosa* Andres, Repert. Spec. Nov. Regni Veg. 40: 233. 1936.

皱叶鹿蹄草 zhou ye lu ti cao

Herbs 14–27 cm tall. Rhizome ascending, slender, branched. Leaves 3–7; petiole 4.5–6.5 cm; leaf blade reddish abaxially, green and shiny adaxially, broadly ovate or suborbicular, 3–4.5 × 2.5–3.5 cm, thickly leathery, base rounded or truncate, margin conspicuously crenate, apex obtuse. Scape: scales 1 or 2, oblong, 8–10 × 3–4 mm; raceme 5–13-flowered, 4–9 cm. Pedicel 5–7 mm; bracts lanceolate, ca. as long as petiole or slightly longer, membranous. Flowers nodding, saucer-shaped, ca. 1 cm in diam. Sepals lanceolate or lanceolate-triangular, 3–4 × 1.5–2 mm, margin entire or obscurely crenate, apex acuminate. Petals white, ovate-lanceolate or suborbicular, 6–8 × 4–6 mm, apex acute. Filaments flattened, 7–8 mm; anthers yellow, ellipsoid, ca. 3 × 1 mm, tubules present. Style not exerted, 7–10 mm, slightly curved at upper part, dilated at apex into a ring. Capsules 5–9 mm in diam. Fl. Jun–Jul, fr. Aug–Sep.

• Montane coniferous or broad-leaved forests; 1900–4000 m. Gansu, Shaanxi, Sichuan, Yunnan.

22. *Pyrola shanxiensis* Y. L. Chou & R. C. Zhou, Bull. Bot. Res., Harbin 1(4): 112. 1981.

山西鹿蹄草 shan xi lu ti cao

Herbs 16–21 cm tall. Rhizome long creeping, somewhat slender, 0.5–1 mm in diam., branched. Leaves 2–6, appearing radical; petiole 1.8–2 cm; leaf blade pale green abaxially, green adaxially, elliptic or ovate-elliptic, ca. 2.5 × 1.5 cm, thinly leathery, base obtuse to broadly truncate, margin entire or crenulate, apex obtuse. Scape erect, 9–17 cm tall, glabrous, with 1 scalelike leaf at base; raceme 5–8(or 9)-flowered, 5–7 cm. Pedicels shorter than bracts, 3.5–4 mm; bracts broadly linear, 4–5 mm. Flower horizontal. Sepals triangular or ovate-triangular, ca. 2.5 × 2.5 cm, apex acute. Petals white. Style 6–7 mm at fruiting, straight to slightly curved, dilated at apex into a ring. Capsules 7–8 mm in diam. Fl. unknown.

• Forests on shaded mountain slopes; ca. 1800 m. Shanxi.

23. *Pyrola sororia* Andres, Notes Roy. Bot. Gard. Edinburgh 8: 8. 1913.

珍珠鹿蹄草 zhen zhu lu ti cao

Herbs 15–30 cm tall. Rhizome ascending, branched. Scales at stem base 4–8 mm wide, sheathing. Leaves 6–8, basal; petiole 1–3 cm; leaf blade pale green abaxially, green adaxially, broadly ovate or suborbicular, 2.5–3 × 2–2.5 cm, thinly leathery, base rounded, margin remotely sinuate, apex rounded or subacute. Raceme 7–11-flowered, 3–7 cm. Pedicel 3–4 mm; bracts axillary, strap-shaped, longer than pedicel, membranous. Flowers nodding, saucer-shaped, 7–9 mm in diam. Sepals ovate-triangular, 2–2.5 mm, apex retuse. Petals white or yellowish green, broadly ovate or suborbicular, 7–8 × 5–6 mm, apex rounded. Filaments flattened, glabrous; anthers yellow, ca. 2 mm, base usually with mucro. Style slightly exerted, straight or becoming curved in upper half, 3–3.5 mm. Capsules 7–9 mm in diam. Fl. Jul–Aug, fr. Aug–Sep.

• Forests, scrub; 2700–3900 m. Xizang, Yunnan.

24. *Pyrola szechuanica* Andres, Acta Horti Gothob. 1: 170. 1924.

四川鹿蹄草 si chuan lu ti cao

Herbs 15–25 cm tall. Rhizome long, slender, branched. Leaves 3–7, crowded at base of caudex; petiole 6–7.5 cm; leaf blade light green abaxially, green and slightly shiny adaxially, broadly ovate, ovate, or broadly oblong, 4–5(–6) × (3.5–)4–5(–6.5) cm, thinly leathery, base suborbicular or subcordate, margin with remote teeth, apex obtuse. Scape with 2–4 scalelike leaves at base; raceme 6–12-flowered, 4–6 cm. Pedicel to 1 cm at fruiting; bracts lanceolate, 8–10 mm. Flowers ± nodding, widely opened, saucer-shaped, ca. 1 cm in diam. Sepals ligulate, 4–6 × 1.5–3 mm, apex mucronulate. Petals yellow or yellowish white, broadly ovate, 6–10 × 5–7 mm, apex rounded. Filaments glabrous; anthers yellow, ca. 2 mm. Style exerted, 7–9 mm, curved, dilated inconspicuously at apex into a ring. Capsules 7–8 mm in diam. Fl. Jun–Jul, fr. Aug–Sep.

• Evergreen or mixed forests; 1400–2700 m. Sichuan.

25. *Pyrola tschanbaischanica* Y. L. Chou & Y. L. Chang, Bull. Herb. N.-E. Forest. Acad., Harbin 1: 6. 1959.

长白鹿蹄草 chang bai lu ti cao

Herbs 8–13 cm tall. Rhizome long, slender, branched. Leaves 3–5 (or 6); petiole 1.8–4 cm; leaf blade light green abaxially, green adaxially, elliptic, 1.8–2.5 × 1.3–1.9 cm, leathery, base cuneate, margin entire, slightly incurved, apex obtuse or rounded. Scape with 1–3 scalelike leaves at base; raceme 3–5-flowered, 1.5–2.8 cm, with 1–3 scalelike bracts subtending scape. Pedicels 3–4 mm; bracts ovate-lanceolate, 4.3–4.5 mm. Flowers nodding, spreading, broadly saucer-shaped, ca. 1 cm in diam. Sepals oblong or ovate-oblong, ca. 3 × 1.5 mm, apex acute. Petals white, obovate, 5–6 × 3–4 mm, margin entire and incurved, apex obtuse. Filaments glabrous; anthers yellow, ca. 2 × 1 mm. Style exerted, upper part slightly curved, ca. 8 mm, dilated at apex into an inconspicuous ring. Capsule 5–6 mm in diam. Fl. Aug, fr. Sep.

- Alpine tundra; ca. 2100 m. S Jilin (Changbai Shan).

26. *Pyrola xinjiangensis* Y. L. Chou & R. C. Zhou, Bull. Bot. Res., Harbin 1(4): 113. 1981.

新疆鹿蹄草 *xin jiang lu ti cao*

Herbs 19–21 cm tall. Rhizome ascending, slender. Leaves 6–9, basal; petiole 2.5–4 cm; leaf blade light green abaxially, dark green adaxially, elliptic or suborbicular, 3–4 × 2.5–3.5 cm, thickly leathery, veins raised abaxially, impressed adaxially, base rounded or truncate, margin crisped, entire or remotely glandular, apex obtuse. Scape with 1 scalelike leaf or not at base; raceme 7–11-flowered, 6.5–7.5 cm. Pedicel 5–7 mm; bracts oblong or lanceolate. Flowers nodding, saucer-shaped, ca. 1 cm in diam. Sepals oblong, 3–4 × ca. 2 mm, margin entire or remotely crenate, apex obtuse. Petals 5, white, oblong, ca. 6 × 4 mm, adaxially sparsely hairy, margin dentate, apex rounded. Filaments flattened, ca. 5.5 mm; anthers yellow, ellipsoid, ca. 3 mm, tubules present. Style slightly exerted, ca. 6 mm, curved at upper part, dilated at apex into a ring. Fl. Jul, fr. Aug.

- Montane forests; ca. 1800 m. Xinjiang (Urumqi).

6. *MONOTROPA* Linnaeus, Sp. Pl. 1: 387. 1753.

水晶兰属 *shui jing lan shu*

Qin Haining (覃海宁); Gary D. Wallace

Hypopithis Rafinesque (1808); *Hypopitys* Hill (1756); *Monotropion* Saint-Lager.

Herbs perennial, mycoparasitic, lacking chlorophyll. Axis nodding, white to reddish. Leaves absent or reduced to laminar structures. Inflorescence scapose or racemose arising from persistent root system. Flowers solitary or in several-flowered racemes, often nodding at anthesis, usually erect in fruit, bracteate. Sepals 4 or 5, usually appressed to petals. Petals 3–6, oblong, often saccate at base, apex dilated. Stamens 8–12 in two series of alternating unequal lengths; anthers horizontally reniform, with terminal slit. Disk of 8–10 distended paired lobes adnate to base of ovary. Ovary (3–)5 (or 6)-loculed, with axile placentation; style base sharply differentiated from ovary. Capsules globose to narrowly ovoid, loculicidally dehiscent, valves with marginal fibers; perianth segments early deciduous at fruiting. Seeds many, fusiform, minute; testa thin, prolonged at both ends, minutely reticulate. $n = 16, 24$.

Two species: cool to temperate regions of the N hemisphere, extending to N South America; two species in China.

One of us (Wallace) notes that several taxa included here in synonymy under species of *Monotropa* and *Monotropastrum* are ambiguous minor variants in numbers of flowers per raceme and degree of pubescence. Numbers of perianth parts often differ among flowers in the same inflorescence or clump. “Features such as color, number of perianth segments, degree of pubescence, numbers of flowers per axis in multiflowered taxa, and floral sizes were found to be extremely variable even among inflorescences from a single root cluster” (Wallace, Taxon 36: 128–130. 1987).

- 1a. Inflorescence pale yellow-brown, racemose, (1 or)2–11-flowered; style slender, about as long as ovary; disk lobes stout 1. *M. hypopitys*
 1b. Inflorescence white, scapose, 1-flowered; style thick, shorter than ovary; disk lobes slender, elongate 2. *M. uniflora*

1. *Monotropa hypopitys* Linnaeus, Sp. Pl. 1: 387. 1753.

松下兰 *song xia lan*

Hypopitys monotropa Crantz; *H. multiflora* Scopoli; *H. multiflora* var. *glabra* Ledebour; *Monotropa chinensis* Koidzumi; *M. hypophegea* Wallroth; *M. hypopitys* f. *atricha* (Domin) Kitagawa; *M. hypopitys* subvar. *atricha* Domin; *M. hypopitys* var. *glaberrima* H. Hara; *M. hypopitys* var. *glabra* Roth; *M. hypopitys* var. *hirsuta* Roth; *M. hypopitys* subsp. *lanuginosa* (Michaux) H. Hara; *M. lanuginosa* Michaux; *M. multiflora* (Scopoli) Fritsch; *M. taiwaniana* S. S. Ying.

Herbs pale yellow-brown, rather fleshy, becoming brown when dry, usually pubescent on upper part of inflorescence. Inflorescence racemose, (1 or)2–11-flowered, 5–30 cm tall, 1–5 mm in diam. below lowermost flower, emerging from soil in

nodding position. Inflorescence bracts below soil level shorter and thicker and more densely crowded on axis than upper bracts. Inflorescence bracts above soil level, sessile, ± erect, ovate to oblong, 7–15 × 3–15 mm, rather fleshy, somewhat pubescent to glabrous, margin entire or erose to irregularly toothed, apex acute to acuminate. Flowers nodding, tubular-campanulate. Bracts 1, rarely to 3, similar to inflorescence bracts in size and shape. Sepals 3–5, occasionally absent, oblong to broadly elliptic, 6–10 × 2–5 mm, shorter than petals, base attenuate, margin irregularly toothed, apex acute or acuminate. Petals 4–6, oblong, 1–1.5 cm × 3–6 mm, abaxially finely pubescent, adaxially long pubescent, base saccate, margin entire and irregularly denticulate or erose in upper part, apex acute or rounded. Stamens 8–12; filaments 7–14 mm, pubescent; anthers hippocrepiform, short, 0.8–1.5 mm, opening by a solitary terminal slit over connate sacs. Ovary 4–8 mm, 3–6 mm in diam.

at anthesis, placentae axile; style 2–10 mm, ca. as long as ovary, slender, pubescent, articulation between style and ovary conspicuous. Stigma yellow, funnellform, 1.5–3 mm in diam., often subtended by a ring of short hairs, usually pubescent. Nectary at base of ovary with 8–10 paired lobes directed downward between staminal bases opposite saccate bases of petals. Capsules erect, broadly ellipsoid, 6–10 mm, 4–8 mm in diam. Fl. Jul–Aug, fr. Sep–Oct.

Damp mixed and coniferous forests; 100–2500 m. Anhui, Fujian, Gansu, W Hubei (Shennongjia), Hunan, Jilin, Jiangxi, Liaoning, Qinghai, Shaanxi, Shanxi, N Sichuan (Barkam), Taiwan, Xinjiang, Xizang, Yunnan [Afghanistan, Bhutan, India, Japan, Kashmir, Korea, Mongolia, Myanmar, Nepal, Pakistan, Russia, Sikkim, Thailand; SW Asia, Europe, North America, Central America (Mexico)].

2. *Monotropa uniflora* Linnaeus, Sp. Pl. 1: 387. 1753.

水晶兰 shui jing lan

Herbs white when fresh, fleshy, becoming black when dry, usually glabrous. Inflorescence erect, scapose, 1-flowered, 10–30 cm tall, 1.5–2 mm in diam. below flower, emerging from soil in nodding position. Inflorescence bracts scale-form, below soil level shorter and thicker and more densely crowded than upper bracts. Inflorescence bracts above soil level thin, ± erect,

ovate to oblong, 1–2 cm × 4–8 mm, sessile, usually glabrous, margin entire or erose to irregularly toothed, apex acuminate. Flowers nodding at anthesis, tubular-campanulate. Bracts not distinguishable from upper inflorescence bracts. Sepals 3–5, scalelike, lanceolate to oblong, 1–1.5 cm × 3–5 mm, mostly glabrous, margin irregularly toothed, apex acute to acuminate. Petals 3–8, obovate-oblong, 1.2–2.2 cm × 4–8 mm, fleshy, abaxially glabrous, adaxially usually pubescent, base saccate, margin entire, irregularly denticulate or erose in upper part, apex rounded. Stamens usually 10; filaments 1–1.5 cm, pubescent; anthers yellowish, short, appearing peltate, to 2 mm in diam.; sacs connate, opening by a distal slit. Ovary essentially glabrous, grooved along sides where capsule segments separate; placenta axile; style 2–3 mm, shorter than ovary, thick, articulation between style and ovary conspicuous; stigma yellow-brown, ca. 4 mm in diam., funnellform, glabrous. Nectary at base of ovary usually with 10 paired lobes directed downward between staminal bases. Capsules erect, ellipsoid-globose, 1–1.5 cm. Old spent axes remaining erect throughout season. Fl. (Aug–)Sep–Oct(–Nov), fr. Oct–Nov.

Damp deciduous or mixed forests; 100–1500 m. Anhui, Gansu, Guizhou, Hubei, Jiangxi, Qinghai, Shaanxi, Shanxi, Sichuan, Xizang, Yunnan, Zhejiang [Bangladesh, Bhutan, India, Japan, Korea, ?Myanmar, Nepal, Sikkim; North, Central, and N South America].

7. **MONOTROPASTRUM** Andres in Handel-Mazzetti, Symb. Sin. 7: 766. 1936.

沙晶兰属 sha jing lan shu

Qin Haining (覃海宁); Gary D. Wallace

Eremotropa Andres; *Monotropanthum* Andres.

Herbs perennial, obligate mycoparasitic, from persistent root system. Roots forming a rather dense mass. Stems absent. Leaves absent. Inflorescences scapose or racemose, arising in nodding position from roots; inflorescence bracts laminar, sessile, usually appressed to inflorescence axis. Flowers solitary on scapes or in several flowered racemes, each flower usually nodding at anthesis, erect in fruit. Sepals (1–)3(–5), occasionally absent, appressed to petals. Petals 3–5, oblong, abaxially glabrous, adaxially finely pubescent, base broadly saccate, apex dilated. Stamens ca. as long as petals, usually 6–10 in two series of alternating lengths. Anthers horizontally reniform, with terminal slits. Disk of paired lobes at bases of shorter series of stamens. Ovary 1-loculed, with 4 or 5 or more parietal placentae; style 3–6 mm, slender, merging imperceptibly with ovary, without visible dehiscence lines. Fruit an indehiscent berry. Seeds minute, numerous, ovoid, cell reticulate, without wings or appendages.

Two species: Bhutan, China, India, Indonesia (Sumatra), Japan (including Ryukyu Islands), Korea, Laos, Myanmar, Nepal, Russia (Sakhalin), Sikkim, Thailand, Vietnam; two species (one endemic) in China.

See the taxonomic comment under *Monotropa* above.

Monotropastrum arisanarum Andres (Notizbl. Bot. Gart. Berlin-Dahlem 12: 698. 1935) was described from Taiwan. We have seen no specimens and are therefore unable to treat it in this account. Further revision is necessary.

- 1a. Inflorescence scapose, flower solitary; petals similar to sepals but broadly saccate at base; disk lobes elongate, slender 1. *M. humile*
1b. Inflorescence racemose, flowers 2 to several; petals distinct from sepals, narrowly saccate at base; disk lobes short, stout 2. *M. sciaphilum*

1. *Monotropastrum humile* (D. Don) H. Hara, J. Jap. Bot. 36: 78. 1961.

球果假沙晶兰 qiu guo jia sha jing lan

Monotropa humilis D. Don, Prodr. Fl. Nepal. 151. 1825; *Cheilothea humilis* (D. Don) H. Keng; *C. humilis* var. *glaberrima* (H. Hara) H. Keng & C. F. Hsieh; *C. humilis* var. *pubescens* (K. F. Wu) C. Ling; *C. macrocarpa* (Andres) Y. L. Chou; *C. pubescens* (K. F. Wu) Y. L. Chou; *Monotropa uniflora* Lin-

naeus var. *pentapetala* Makino; *M. uniflora* var. *tripetala* Makino; *Monotropanthum ampullaceum* Andres; *Monotropastrum baranovii* Y. L. Chang & Y. L. Chou; *M. globosum* Andres ex H. Hara; *M. globosum* var. *baranovii* (Y. L. Chang & Y. L. Chou) Y. C. Zhu; *M. globosum* var. *pentapetalum* (Makino) Honda; *M. globosum* var. *tripetalum* (Makino) Honda; *M. humile* var. *glaberrimum* H. Hara; *M. humile* var. *tripetalum* (Makino) H. Hara; *M. lungchuanense* K. F. Wu; *M. macrocarpum* Andres; *M. pubescens* K. F. Wu; *M. tschanbaischan-*

icum Y. L. Chang & Y. L. Chou; *M. tschanbaischanicum* var. *baranovii* (Y. L. Chang & Y. L. Chou) Y. L. Chou.

Inflorescences scapose, 10–20 cm tall, 2–8 mm in diam. below flower, emerging from soil in nodding position, 1-flowered. Flowers nodding at anthesis, tubular-campanulate. Sepals 1–5, oblong, 8–20 × 2–11 mm, usually glabrous. Petals 3–5, usually oblong, 10–20 × 5–15 mm, slightly longer than sepals, abaxially glabrous, adaxially pubescent, base broadly saccate. Disk of paired, elongate, slender lobes protruding from ovary toward basal saccate portions of petals. Berries erect to nodding, white, ovoid-globose, 9–20 × 10–24 mm, seeds numerous embedded in fleshy interior. Fl. Apr–Aug, fr. May–Sep.

Damp deciduous and mixed forests; 100–2500 m. Heilongjiang, Hubei, Jilin, Liaoning, Taiwan, Xizang, Yunnan, Zhejiang [Bhutan, India, Indonesia (Sumatra), Japan (including Ryukyu Islands), Korea, Laos, Myanmar, Nepal, Russia (Sakhalin), Sikkim, Thailand, Vietnam].

8. ARCTOUS (A. Gray) Niedenzu, Bot. Jahrb. Syst. 11: 180. 1889.

北极果属 bei ji guo shu

Fang Ruizheng (方瑞征 Fang Rhui-cheng); Peter F. Stevens

Arctostaphylos Adanson sect. *Arctous* A. Gray, Syn. Fl. N. Amer. 2(1): 27. 1878.

Shrubs dwarf, deciduous. Twigs smooth, bark exfoliating in papery sheets; leaf or leaf bases marcescent. Leaf blade broad, margin serrate or crenate, flat. Flowers pendulous, 5-merous, in short terminal racemose clusters, with scales at base. Corolla urceolate, shortly lobed, abaxially glabrous, adaxially pubescent. Stamens included; filaments pubescent, much dilated below 1/3 length; anthers with 2 reflexed awns near apex, opening by 2 terminal pores. Ovary superior, glabrous, with one ovule per locule. Fruit a drupe; stones separate.

Four species: E and N Asia, Europe, North America, extending to the Arctic; three species (one endemic) in China.

- 1a. Leaves 0.2–0.6(–1.7) × 0.2–0.7 cm; plants 2.5–3.5 cm tall 2. *A. microphyllus*
1b. Leaves 2–5 × 0.7–2 cm; plants 3–20(–40) cm tall.
2a. Leaves thickly papery; berry black-purple 1. *A. alpinus*
2b. Leaves papery; berry brick-red or scarlet 3. *A. ruber*

1. *Arctous alpinus* (Linnaeus) Niedenzu, Bot. Jahrb. Syst. 11: 180. 1889.

北极果 bei ji guo

Arbutus alpina Linnaeus, Sp. Pl. 1: 395. 1753; *Arctostaphylos alpina* (Linnaeus) Sprengel; *Mairania alpina* (Linnaeus) Desvaux; ?*Arctous alpinus* var. *japonicus* (Nakai) Ohwi; ?*A. japonicus* Nakai.

Shrubs dwarf, tufted or prostrate, 3–20(–40) cm tall. Twigs terete, glabrous. Leaf blade obovate to spatulate-obovate, rarely oblanceolate, 2–5 (including petiole) × 0.7–2 cm, thickly papery, glabrous, fine veins abaxially reticulate, subglaucous, adaxially distinctly impressed, base attenuate-cuneate, decurrent into winged petiole, margin crenate-serrate, ciliate in basal 1/2 at least along petiole, apex acute or rounded. Racemes 3–7-flowered. Pedicel ca. 5 mm, glabrous. Calyx lobes broadly ovate, apex acute. Corolla white, 4–6 mm; lobes greenish. Stamens 1–2 mm; filaments pubescent. Drupe black-purple, globose, 6–9 mm in diam. Fl. May–Jul, fr. Jul–Aug. *2n* = 26, 28.

Alpine thickets, among rocks, sandy areas; 1900–3000 m. Gansu, Nei Mongol, Qinghai, Shaanxi, N Sichuan, Xinjiang [Japan, Mongolia, Russia; Europe, North America].

The fruit is edible.

2. *Monotropastrum sciaphilum* (Andres) G. D. Wallace, Taxon 36: 129. 1987.

荫生沙晶兰 yin sheng sha jing lan

Eremotropa sciaphila Andres, Bot. Jahrb. Syst. 76: 107. 1955; *E. wuana* Y. L. Chou.

Inflorescences to 4–11 cm tall, to 5 mm diam. below lowest flower, 2- to several flowered racemes. Flowers nodding at anthesis, tubular-campanulate. Sepals 4 or 5, elliptic-oblong, to 9 × 4 mm. Petals 4 or 5, oblong, to 15 × 8 mm, decidedly longer than sepals, base shallowly saccate. Disk of paired, short blunt lobes protruding from base of ovary opposite saccate portions of petal bases. Fl. and fr. unknown.

- *Quercus* forests; ca. 2200 m. Yunnan (near Kunming).

The berry is not mature on the type specimen of *Eremotropa sciaphila*, the only specimen seen by one of us (Wallace).

2. *Arctous microphyllus* C. Y. Wu, Yunnan Redai Yaredai Zhiwu Quxi Yanjiu Baogao [Rep. Stud. Pl. Trop. Subtrop. Yunnan] 1: 5. 1965.

小叶当年枯 xiao ye dang nian ku

Shrubs dwarf, tussock-forming or prostrate, 2.5–3.5 cm tall. Twigs terete, glabrous. Leaf blade pale abaxially, dark green adaxially, oblanceolate, obovate, or elliptic, 2–6(–17) × 2–7 mm, thickly papery, glabrous, veins impressed adaxially, base attenuate, decurrent into winged petiole, margin crenate-serrate, densely ciliate or white setose along petiole, apex obtuse-acute. Racemes 2- or 3-flowered; scales brown, elliptic, longer than pedicel, margin ciliate, apex acute. Pedicel ca. 5 mm. Calyx lobes triangular, 1–1.5 mm, apex acuminate. Corolla and stamens unknown. Immature drupe white-green, subglobose, 4–5 mm in diam. Fl. May–Jun, fr. Jul.

- Low valley forests; ca. 3500 m. NW Yunnan (Zhongdian).

One of us (Stevens) questions whether this is a good species.

3. *Arctous ruber* (Rehder & E. H. Wilson) Nakai, Trees Shrubs Japan 1: 156. 1922.

红北极果 hong bei ji guo

Arctous alpinus (Linnaeus) Niedenzu var. *ruber* Rehder & E. H. Wilson in Sargent, Pl. Wilson 1: 556. 1913; *Arctostaphylos rubra* (Rehder & E. H. Wilson) Fernald.

Shrubs dwarf, 3–15(–20) cm tall. Twigs terete, glabrous. Leaf blade pale abaxially, dark green adaxially, obovate or oblanceolate, 2–4 (including petiole) × 1–1.4 cm, papery, glabrous, veins impressed adaxially, base attenuate-cuneate, decurrent into winged petiole, margin crenate, sparsely ciliate along petiole, apex obtuse-acute. Racemes 2–5-flowered; scales

broadly ovate, 5–7 mm, margin densely ciliate. Pedicel ca. 6 mm. Calyx lobes ovate, ca. 1 mm. Corolla white to cream, 3–4 mm; lobes spreading, ovate or orbicular. Stamens 1.5–2 mm; filaments puberulous. Drupe brick-red or scarlet, globose, 6–10 mm in diam. Fl. Jun, fr. Aug–Sep. $2n = 26$.

Among mosses and rocks on mountain summits, streamsides, localities rich in calcareous deposits; 2900–3300(–4000) m. Gansu, Jilin, Nei Mongol, Ningxia, N Sichuan [Japan, Korea; NW North America (Alaska)].

9. DIPLARCHE J. D. Hooker & Thomson, Hooker's J. Bot. Kew Gard. Misc. 6: 382. 1854.

杉叶杜鹃属 shan ye du juan shu

Yang Hanbi (杨汉碧 Yang Han-pi); David F. Chamberlain

Shrubs dwarf, evergreen, densely pulvinate. Leaves crowded, sessile; leaf blade linear or linear-elliptic, small, leathery, margin serrate or long-ciliate, apex subacute or ending in a gland. Inflorescence terminal, racemose or subcapitate. Bracts and bracteoles leaflike, margin glandular-ciliate. Calyx lobes 5, leathery, margin glandular-ciliate. Corolla rose, small, deciduous; tube cylindrical; lobes 5, patent. Stamens 10, included: 5 basal or hypogynous, 5 inserted high on corolla and alternating with corolla lobes; anthers elliptic, dehiscing longitudinally. Ovary globose, 5-celled, glabrous; style short; stigma capitate, 5-lobed. Capsule globose, enclosed by calyx, septically 5-valved; wall of cells splitting into two layers. Seeds many; testa with reticulate veins.

Two species: China, Myanmar, Sikkim; two species in China.

- 1a. Inflorescence 8–12(–20)-flowered; leaf blade 6–6.5 mm; branches sparsely glandular-pubescent; lower 5 stamens attached to corolla; calyx lobes linear-oblong 1. *D. multiflora*
1b. Inflorescence 2–6-flowered; leaf blade 3–4 mm; branches usually glabrous; lower 5 stamens free from corolla; calyx lobes ovate-oblong 2. *D. pauciflora*

1. Diplarche multiflora J. D. Hooker & Thomson in Hooker's J. Bot. Kew Gard. Misc. 6: 383. 1854.

多花杉叶杜鹃 duo hua shan ye du juan

Plants 8–16 cm tall. Branchlets dark brown, sparsely glandular-pubescent. Leaf blade linear, 6–6.5 × 1–1.1(–1.4) mm, base obtuse, margin spinescent-serrate (teeth usually ending in a glabrous, shining gland), apex subacute. Inflorescence subcapitate, ca. 1 cm, 8–12(–20)-flowered. Bracts elliptic-ovate, 2.5–5.5 mm. Calyx lobes linear-oblong, ca. 4 mm. Corolla ca. 7 mm; tube ca. 4 mm; lobes rounded, ca. 3 mm, patent apex usually slightly sinuate. Stamens: lower 5 attached to corolla, ca. 2 mm. Style purple, ca. 1 mm. Capsule peduncle elongating in fruit to 7 cm, pubescent. Fl. and fr. Jun–Sep.

Thickets, alpine meadows, rocky slopes, cliffs; 3500–4100 m. SE Xizang, NW Yunnan [Myanmar, Sikkim].

2. Diplarche pauciflora J. D. Hooker & Thomson, Hooker's J. Bot. Kew Gard. Misc. 6: 383. 1854.

少花杉叶杜鹃 shao hua shan ye du juan

Plants 4–7 cm tall. Branchlets usually glabrous. Leaf blade linear-elliptic, 3–4 × 1(–1.2) mm, base tapering, margin spinescent-serrate, glabrous, shining, apex obtuse, mucronate. Inflorescence subcapitate, ca. 1 cm, 2–6-flowered. Bracts oblong-ovate to broadly ovate, ca. 4 mm. Calyx lobes ovate-oblong, ca. 3 mm. Corolla ca. 4 mm; tube ca. 2 mm; lobes as long as tube, patent, rounded or ovate apex usually slightly sinuate. Stamens: lower 5 free from corolla and often surrounding capsule after corolla has fallen. Style ca. 1 mm. Capsule peduncle elongating in fruit to 4 cm, glandular-pubescent. Fl. Jun–Jul, fr. Aug–Sep.

Pastures, slopes, alpine rocks, cliffs; 3500–4800 m. NW Sichuan, NW Yunnan [Sikkim].

10. PHYLLODOCE Salisbury in Hooker, Parad. Lond. t. 36. 1806.

松毛翠属 song mao cui shu

Yang Hanbi (杨汉碧 Yang Han-pi); David F. Chamberlain

Shrubs evergreen, small. Leaves alternate or decussate; leaf blade linear, margin serrulate. Inflorescence terminal, umbellate, 2–15-flowered, bracteate. Calyx small, 5-parted, persistent. Corolla urceolate, 5-toothed. Stamens (8–)10(–12), included; anthers dehiscing by pores. Style slender. Capsule globose, 5-locular, loculicidal. Seeds ovoid, lustrous.

About seven species: widespread N temperate regions; two species (one endemic) in China.

- 1a. Calyx lobes strongly deflexed in flower; style longer than corolla tube, nearly as long as whole corolla; leaf blade ca. 10 × 1 mm; pedicels geniculate above middle 1. *P. deflexa*
1b. Calyx lobes not deflexed in flower; style slightly shorter than corolla tube; leaf blade (5–)7(–10) × ca. 1.2 mm; pedicels somewhat recurved 2. *P. caerulea*

1. Phyllodoce deflexa Ching ex H. P. Yang, Acta Phytotax. Sin. 28: 403. 1990.

反折松毛翠 fan zhe song mao cui

Shrubs ca. 20 cm tall; usually much branched. Branchlets purplish brown, slender, very leafy, sparsely glandular-hairy. Leaves decussate, usually sessile; leaf blade linear, ca. 10 × 1 mm, abaxially densely lanate along midvein, adaxially glabrous, base cuneate, margin serrulate, apex obtuse. Inflorescence subumbellate, 3–7-flowered; bracts 2, broadly ovate, 2–3 mm; pedicels geniculate above middle, purple, filiform, to 2.5 cm in flower, elongating in fruit, densely purple glandular-hairy. Calyx purple-brown, cylindrical-oblong; lobes strongly deflexed in flower, lanceolate, ca. 3 mm, glandular-pilose. Corolla long-ovoid-urceolate, ca. 8 mm, densely glandular-hairy outside. Stamens 10, included; anthers purple. Style longer than corolla tube, nearly as long as whole corolla; stigma capitate. Capsule subglobose. Fl. and fr. Jun–Aug.

- Forests; ca. 1700 m. Jilin.

2. *Phyllodoce caerulea* (Linnaeus) Babington, Man. Brit. Bot. 194. 1843.

松毛翠 song mao cui

Andromeda caerulea Linnaeus, Sp. Pl. 1: 393. 1753; *Phyllodoce taxifolia* Salisbury, nom. illeg. superfl.

Shrubs 10–30(–40) cm tall, prostrate to erect, much branched. Branchlets slender, leafy, glabrous. Leaves alternate; petiole ca. 0.5 mm; leaf blade linear, (5–)7(–10) × ca. 1.2 mm, adaxially with prominent midvein, base broadly cuneate, margin slightly serrulate, glabrous, apex obtuse. Inflorescence clustered, (1–)2–5(–6)-flowered; bracts 2, persistent; pedicels somewhat recurved, reddish, ca. 2 cm in flower, elongating to 4 cm in fruit, glandular-hairy. Calyx red-purple, glandular-pilose; lobes not deflexed in flower, lanceolate, 3–4(–5.5) mm. Corolla red or bluish rose, urceolate, 7–8(–11) mm, sparsely glandular-hairy outside. Stamens 10, included; anthers purple. Style slightly shorter than corolla tube; stigma capitate. Capsule globose, 3–4 mm. Fl. Jun–Jul, fr. Aug.

Subalpine scrub, alpine meadows, grasslands, stony tundra, rocks. Jilin, Nei Mongol, Xinjiang [Japan, Korea, Russia; Europe, North America].

11. *LEDUM* Linnaeus, Sp. Pl. 1: 391. 1753.

杜香属 du xiang shu

Fang Ruizheng (方瑞征 Fang Rhui-cheng); David F. Chamberlain

Shrubs evergreen, small, multibranched, with fragrant resin. Leaves shortly petiolate; leaf blade linear, linear-lanceolate, or narrowly oblong, leathery, abaxially with white and/or rusty brown-pilose or woolly indumentum, margin entire, recurved. Inflorescences terminal, racemose, many-flowered; bracts present at peduncle base, dry, membranous, soon deciduous; bractlets absent. Calyx small, 5-lobed, persistent. Corolla white, divided to base; lobes imbricate in bud. Stamens (5–)8–10, protruding beyond corolla; filaments linear; anthers small, abaxially connected, globose, without appendages. Flower disk 8–10-lobed. Ovary globose, 5-locular, lepidote. Style linear; stigma obtuse, 5-lobed. Capsule ellipsoid or cylindrical, opening from base. Seeds tiny.

Three or four species: circumboreal in temperate and cold-temperate regions; one species in China.

DNA sequencing has shown that this genus should be included within *Rhododendron* subg. *Rhododendron*, as *R.* subsect. *Ledum* (Linnaeus) Kron & Judd (Syst. Bot. 15: 67. 1990). It has affinities with *R.* subsect. *Micrantha*.

Ledum subulatum (Nakai) A. P. Khokhrjakov & Mazurenko (in Kharkevich, Sosud. Rast. Sovetsk. Dal'nego Vostoka 5: 125. 1991; *L. palustre* var. *subulatum* Nakai, Bot. Mag (Tokyo) 31: 103. 1917; *Rhododendron subulatum* (Nakai) Harmaja) was described from N Korea and has been recorded also from Japan and (mainly) Russia. Harmaja (Ann. Bot. Fenn. 39: 183–184. 2002) also cited “NE China,” but without locality. The taxon is said to have a subulate leaf blade, 10–36 × 1–3 mm, with a revolute margin and reddish brown, floccose hairs abaxially. From this description it is unclear how distinct *L. subulatum* is from *L. palustre*.

1. *Ledum palustre* Linnaeus, Sp. Pl. 1: 391. 1753.

杜香 du xiang

Shrubs erect or creeping, to 50 cm tall. Branches slender; young branches densely covered with rust-colored wool; terminal buds conspicuous, ovoid, scales densely rufous-woolly. Leaf blade linear, linear-lanceolate, or narrowly oblong, 1–8 × 0.1–1.5 cm, abaxially densely rufous-hairy or woolly, sometimes also white-pubescent, with raised midvein, adaxially dark green and wrinkled, margin strongly or slightly recurved. Inflorescence many-flowered; pedicels thin. Calyx lobes 5, ovate, 5–8 mm, persistent. Corolla milky white, 5–25 mm, densely rufous-woolly. Stamens 10; filaments pilose at base. Style persistent, 2–4 mm. Capsule ovoid, 3.5–4 mm. Fl. Jun–Jul, fr. Jul–Aug.

Coniferous forests, forest margins, marshes, wet meadows; 400–

1400 m. Heilongjiang, Jilin, Nei Mongol [N Korea, Mongolia, Russia; NE Asia, C and N Europe, North America].

- 1a. Leaf blade linear-lanceolate or narrowly oblong, 2–8 × 0.4–1.5 cm 1b. var. *dilatatum*
- 1b. Leaf blade linear, 1–3 × 0.1–0.3 cm.
 - 2a. Shrubs creeping; leaf blade abaxially densely rufous-hairy and white-pubescent 1c. var. *decumbens*
 - 2b. Shrubs often erect; leaf blade abaxially densely rufous-woolly, not white-pubescent 1a. var. *palustre*

1a. *Ledum palustre* var. *palustre*

杜香(原变种) du xiang (yuan bian zhong)

Ledum tomentosum Stokes, nom. illeg. superfl.; *Rhododen-*

dron palustre (Linnaeus) Kron & Judd (1990), not Turczaninow ex de Candolle (1839); *R. tomentosum* Harmaja.

Shrubs often erect. Leaf blade linear, 1–3 × 0.1–0.3 cm, abaxially densely rufous-woolly, not white-pubescent, margin strongly recurved.

Often dominant in coniferous forests, marshes; 400–1400 m. Heilongjiang, Nei Mongol [Mongolia; NE Asia, C and N Europe, North America].

1b. *Ledum palustre* var. *dilatatum* Wahlenberg, Pl. Lapp. 103. 1812.

宽叶杜香 kuan ye du xiang

Leaf blade linear-lanceolate or narrowly oblong, 2–8 × 0.4–1.5 cm, abaxially rufous-hairy and white-pubescent, margin slightly recurved.

Coniferous forests, forest margins, marshes, wet meadows. Heilongjiang, Jilin [N Korea, Russia; NE Asia, N Europe].

1c. *Ledum palustre* var. *decumbens* Aiton, Hort. Kew. 2: 65. 1789.

小叶杜香 xiao ye du xiang

Ledum decumbens (Aiton) Loddiges ex Steudel; *Rhododendron subarcticum* Harmaja; *R. tomentosum* Harmaja subsp. *subarcticum* (Harmaja) G. D. Wallace.

Shrubs creeping. Leaf blade linear, 1–1.5 × 0.1–0.15 cm, abaxially densely rufous-hairy and white-pubescent, margin slightly recurved.

Often dominant in coniferous forests, marshes. Heilongjiang, Nei Mongol [Mongolia; NE Asia, C and N Europe, North America].

