Two New Taxa of *Maianthemum* (Convallariaceae) from Northwestern Yunnan, China

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ABSTRACT. As a result of expeditions to the Gaoligong Mountains in western Yunnan, China, the authors discovered two new taxa. *Maianthemum dulongense* H. Li var. *coriaceum* R. Li & H. Li and *M. fuscum* (Wallich) LaFrankie var. *cordatum* R. Li & H. Li are described, and their differences from the type varieties are discussed.

Key words: China, Convallariaceae, *Maianthemum.*

Maianthemum G. Weber ex Wiggers (including *Smilacina* Desfontaines) is a genus of about 35 species distributed widely in the northern temperate region, the Himalayas, as well as subtropical montane Asia and Central America (Mabberley, 1997; Chen & Kawano, 2000). In the past (Wang & Tang, 1978; Dahlgren, 1980), it was separated into two genera, *Maianthemum* and *Smilacina,* based on whether the flowers are dimerous (4 tepals, 4 stamens, 2 carpels) or trimerous (6 tepals, 6 stamens, 3 carpels). However, because of their overall similarity, the two genera have been continuously combined (Pursh, 1814; Link, 1821; Greene, 1888). Therman (1956) challenged the separation of the two genera on the basis of their uniform karyotype. LaFrankie (1986a, 1986b) studied the New World species of *Maianthemum* and concluded that *Smilacina* and *Maianthemum* should be combined. In his note, LaFrankie summarized the evidence for this combination and transferred the species of *Smilacina* to *Maianthemum* (1986b). Along with Li (1990) and Chen and Kawano (2000), the present authors agree with LaFrankie's transfers.

During the summer of 2000, a botanical expedition was carried out in Gongshan County and Dulongjiang Valley, Northwest Yunnan Province, China, to study the flora of the Gaoligong Mountains. In addition to the two new varieties (*Maianthemum dulongense* var. *coriaceum* and *M. fuscum* var. *cordatum*) herein described, eight other species of *Maianthemum* were found in this region: *M. atropurpureum* (Franchet) LaFrankie, *M. dulongense* H. Li, *M. fuscum* (Wallich) LaFrankie, *M. gongshanense* (S. Y. Liang) H. Li, *M. henryi* (Baker) LaFrankie, *M. oleraceum* (Baker) LaFrankie, *M. purpureum* (Wallich) LaFrankie, and *M. tatsienense* (Franchet) LaFrankie.

LaFrankie (1986b) transferred all the species of *Smilacina* to *Maianthemum*; however, in his note he did not present an infrageneric system for *Maianthemum.* Hara (1987) studied the Asiatic species of *Smilacina* (Hiroshi Hara passed away in September 1986 and had not seen LaFrankie's paper about the transfer of this genus) and gave a synopsis for the infrageneric system. In his note (Hara, 1987), *Smilacina* can be divided into four sections based on the combination of several significant features, such as corolla shape, insertion of stamens, sexuality of flowers, and the surface structure of pollen grains. Hara's (1987) infrageneric classification of the genus *Smilacina* is as follows: Sect. 1. *Smilacina,* Subsect. 1a. *Smilacina*; Subsect. 1b. *Dioica* Hara; Sect. 2. *Tubifera* Hara; Sect. 3. *Oligobotrya* (Baker) Hara; Sect. 4. *Medora* (Kunth) Hara. Li (1990) (the second author) agreed with LaFrankie's taxonomic treatment of *Smilacina* and studied all the species of *Maianthemum* in the world. In her note (Li, 1990), according to the shape of the rhizomes, the number of foliage leaves, the branching pattern of the inflorescence, the basic number and the color of the flowers, a new infrageneric system for *Maianthemum* was presented, which divided the genus into two subgenera and five sections. Also, all the species of *Maianthemum* were recombined and rearranged as a new classification system. Li's infrageneric system of *Maianthemum,* based on Li (1990), is as follows:

I. *Maianthemum* subg. *Medora* (Kunth) H. Li
Individual rhizome units swollen and tuberous; flowers trimerous; foliage leaves numerous.
1. Section *Medora*
Individual rhizome units spherical or subspherical, ovoid; corolla cyathiform, purple, or ashy pale, rarely white.
a. Subsection *Medora*
Inflorescence a panicle.
b. Subsection *Dulongensis* H. Li
Inflorescence a raceme.

2. Section *Oligobotrya* (Baker) H. Li
   Individual rhizome units ovoid; corolla tubiform; inflorescence racemose or paniculate with a few branches, main axis with a single flower at each node or with 2 to 7 flowers clustered at each node; stamens inserted the throat of the corolla.
3. Section *Tatsienensis* H. Li
   Individual rhizome units claviform or horizontal cylindrical; corolla cyathiform.

II. *Maianthemum* subgenus *Maianthemum*
Individual rhizome units extended and stoloniferous; flowers dimerous or trimerous, snow white; foliage leaves 2 to 4.
1. Section *Smilacina* (Desfontaines) H. Li
   Flowers trimerous.
2. Section *Maianthemum*
   Flowers dimerous.

According to Li's infrageneric system, the new variety *Maianthemum dulongense* var. *coriaceum,* with subspherical individual rhizome units, numerous leaves, racemose inflorescence, trimerous flowers, cyathiform corolla, and maroon perianth, belongs to subsection *Dulongensis* H. Li of section *Medora.* The new variety *Maianthemum fuscum* var. *cordatum,* with moniliform individual rhizome units, numerous leaves, paniculate inflorescence, trimerous flowers, cyathiform corolla, and purple perianth, belongs to subsection *Medora* of section *Medora.*

Maianthemum dulongense H. Li var. **coriaceum** R. Li & H. Li, var. nov. TYPE: China. Yunnan: Gongshan Xian, E side of Gaoligong Mountains, on the trail from Qiqi to Dongshao Fang, wet sloping meadow, 27°41′23″N, 98°28′26″E, 3400–3600 m, 17 July 2000, *Li Heng* with *Bruce Bartholomew, Philip Thomas, Peter Fritsch, Dao Zhi-lin, Wang Zhong-lan & Li Rong 12721* (holotype, KUN). Figure 1A–E.

A *Maianthemo dulongensi* var. *dulongensi* folio coriaceo, cordato-oblongo, nervis 21, nervillis conspicuis, floribus 24, perianthi marronini tepalis interioribus exterioribus longioribus differt.

Terrestrial herb, 22–28 cm tall. Roots uniform, 10 to 15 per rhizome unit, at nodes and internodes, 8–13 cm × 0.5–1 mm. Rhizome a sympodium, 3–4 cm long, the individual units subspherical, densely connected, 4–8 mm diam., stem scar on node conspicuous, orbicular, 3–4 mm diam., internodes very short. Leafy stem upright, 16–18 cm long, dark purple, densely pubescent; foliage leaves 5; internodes 1–2 cm long, shorter apically. Leaf sessile or subsessile; blade deep green, coriaceous, above cordate to oblong, glabrous, apex short-acute, base cordate, 3.6–4.3 × 2.3–3 cm, veins 21, dense-ranked, conspicuous, venulae between veins slightly conspicuous. Inflorescence 10 cm long, a cylindric raceme with 24 flowers, fertile axis erect or arching upward, densely pubescent. Flowers trimerous; pedicel 2–5 mm long, densely pubescent, with a broad triangular bract; perianth maroon, cupuliform, ca. 4 mm diam.; tepals oblong, cuspidate apex, outer ca. 3 × 2 mm, inner longer, ca. 4 × 2 mm; stamens 6, white, filaments short, ca. 1 mm long, anthers ovate, ca. 1 mm long; ovary conical, pubescent, 3 locules, style inconspicuous, stigma 3-lobed. Flowering in July. Fruit not seen.

Distribution and habitat. Known only from the type locality, where it has been collected in primarily evergreen broadleaf forest at 3400–3600 m. This new variety is common in wet sloping meadows by rivers.

Maianthemum dulongense var. *coriaceum* differs from variety *dulongense* in having a coriaceous, cordate-oblong leaf blade with 21 veins and conspicuous venulae, an inflorescence with 24 flowers, a maroon perianth, and inner tepals longer than outer tepals. By contrast, *M. dulongense* var. *dulongense* has a papyraceous, ovate leaf blade with 15 veins and inconspicuous venulae, an inflorescence with 6 to 15 flowers, and a light purple perianth.

Maianthemum dulongense var. *coriaceum* is restricted to the east side of the Gaoligong Mountains and occurs in a geographical area allopatric to the typic variety, which occurs on the west side of the Gaoligong Mountains and extends to southeastern Xizang (H. Li, 1990, 1997). In our opinion, the shape of the rhizomes, the number of foliage leaves, the branching pattern of the inflorescence, and the basic number and color of the flowers are usually important diagnostic features for evaluating species limits throughout the genus. However, the variety *coriaceum* is distinguished from the typic variety by the shape of the leaf blade, the number of veins, and the number of flowers. Other features are the same, and hence we recognize it as a variety of *M. dulongense.*

Maianthemum dulongense var. *dulongense* was first described in 1990 in *Acta Botanica Yunnanica,* Suppl. 3. In Li's (1990) infrageneric system of *Maianthemum,* it was included in section *Medora* subsect. *Dulongensis* because of its moniliform individual rhizome units, numerous leaves, racemose inflorescence, trimerous flowers, and cyathiform corolla.

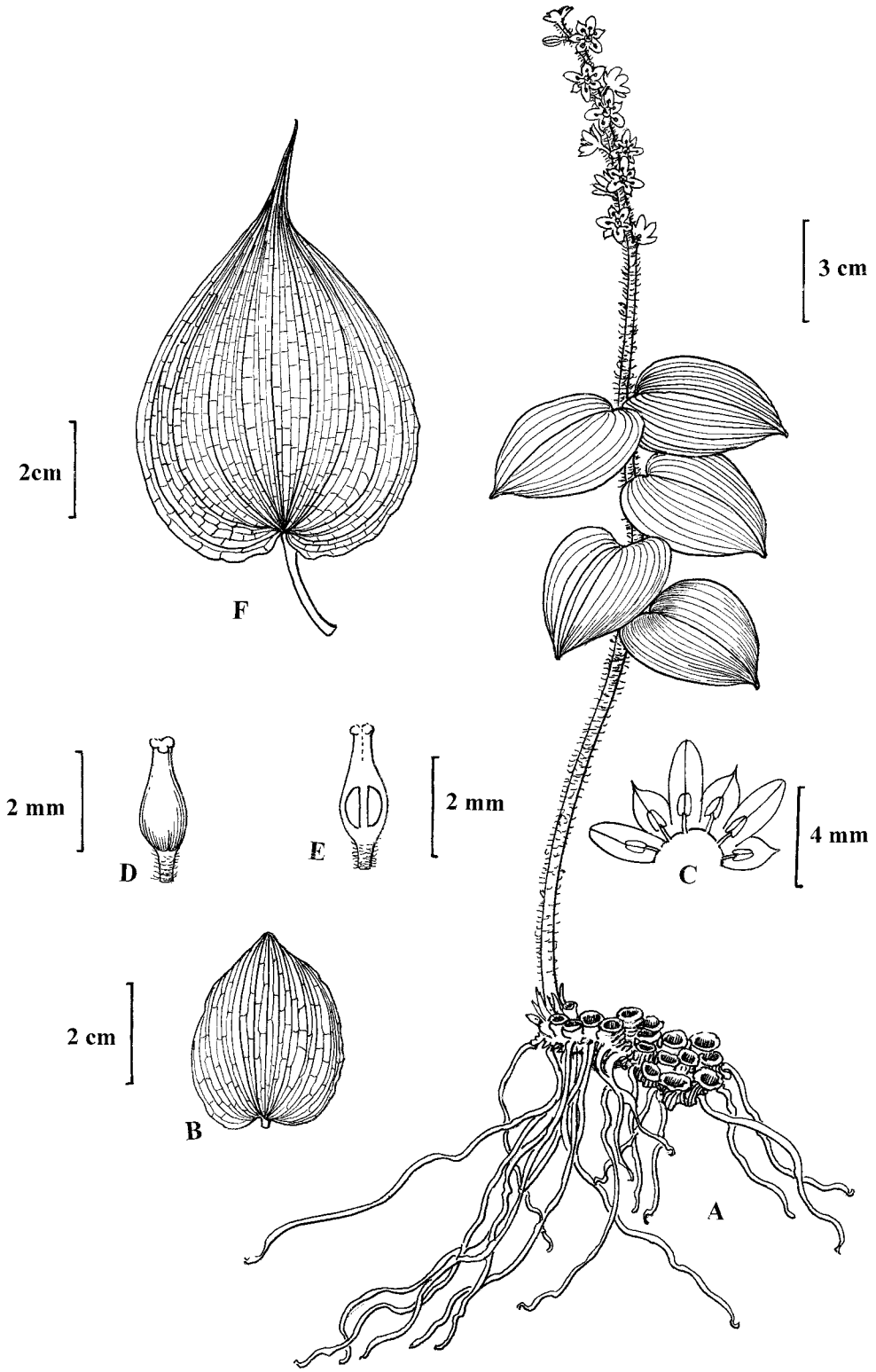

Figure 1. A–E. *Maianthemum dulongense* H. Li var. *coriaceum* R. Li & H. Li. —A. Rhizome, leafy shoot, and infructescence. —B. Leaf. —C. Tepals and stamens. —D. Gynoecium. —E. Ovary, longitudinal section. F. *Maianthemum fuscum* (Wallich) LaFrankie var. *cordatum* R. Li & H. Li. —F. Leaf. (Drawn by Wang Ling from the holotypes.)

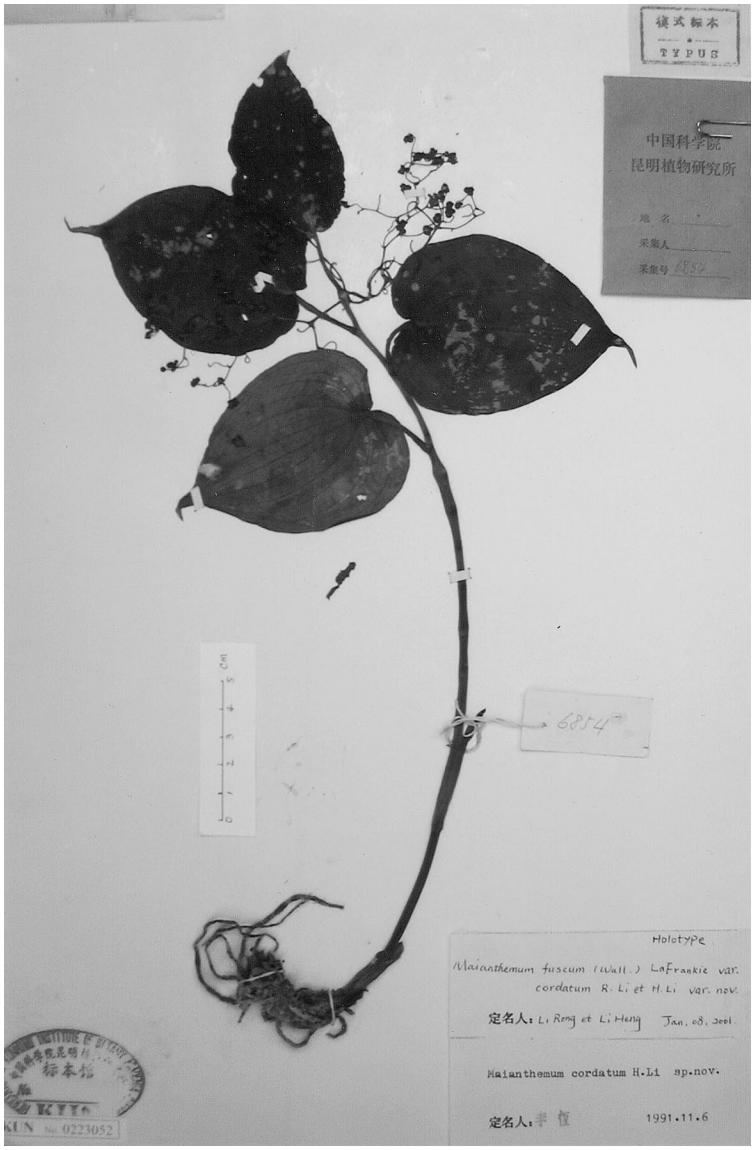

Figure 2. *Maianthemum fuscum* var. *cordatum* (*Dulong Jiang Expedition 6854*, holotype, KUN).

Maianthemum fuscum (Wallich) LaFrankie var. **cordatum** R. Li & H. Li, var. nov. TYPE: China. Yunnan: Gongshan Xian, Dulong Jiang Valley, W side of Gaoligong Mountains, under forest, 2200 m, 16 May 1991, *Dulong Jiang Expedition 6854* (holotype, KUN; isotype, MO). Figures 1F, 2.

A *Maianthemo fusco* var. *fusco* folio cordato, floribus 20, pedicello tenui differt.

Terrestrial herb, 20–40 cm tall. Roots uniform, 8 to 13 per rhizome unit, at nodes and internodes 7–15 cm long. Rhizome a sympodium, 3–8 cm long, the individual units moniliform or subcylindrical, densely connected, 1–1.5 cm diam., stem scar on node conspicuous, discoidal, 3.4 mm diam., internodes very short. Leafy stem arcuately ascending, 15–30 cm long, green, cylindrical, glabrous; foliage leaves 3–7; internodes 1.5–3 cm long. Leaf petiolate, 2–3 cm long; blade green, chartaceous, glabrous, ovate-cordate, 7–12 × 4–6.5 cm, abruptly attenuate with an acumen of 1.1–1.8 cm at the apex, deeply cordate at the base. Inflorescence 5–10 cm long, a panicle with 20 flowers, rachis conspicuously zigzagged, glabrous; shortly pedunculate, 8–15 mm long, glabrous, bractless. Flowers

trimerous; pedicel tenuous, 4–9 mm long, glabrous, with a ca. 1 mm long triangular bract at the base; perianth purple, subrotate, ca. 5–8 mm diam., 6-lobed nearly to the base, connate part ca. 0.5 mm long; tepals ovate, obtuse at the apex, outer 3 lobes much smaller, ca. 2 × 2 mm, inner 3 lobes larger, ca. 3 × 3 mm wide; stamens 6, light yellow, filaments ovoid, carnose, white, ca. 0.5 mm long, inserted to the base of the corolla lobes, anthers small, roundish, yellow, ca. 0.4–0.5 mm long, basifixed; ovary ovate, ca. 1 mm long, 3 locules, style very short, pyramidal, ca. 0.4 mm long, stigma obscurely 3-lobed. Flowering in April–May, fruiting in June–December.

Distribution and habitat. The new variety occurs in northwestern Yunnan and southeastern Xizang, China. The type specimen was collected in Dulong Jiang Valley by the Dulong Jiang Expedition in 1991. The plant grows in evergreen broadleaf forest at 1800–3000 m.

Maianthemum fuscum var. *cordatum* differs from variety *fuscum* in having a cordate leaf blade, an inflorescence with 20 flowers, and a tenuous pedicel. By contrast, variety *fuscum* has a lanceolate leaf blade, an inflorescence with 3 to 10 flowers, and a filiform pedicel.

Maianthemum fuscum var. *cordatum* is restricted to the northern Gaoligong Mountains and southern Xizang and occurs in a geographical area sympatric with the typic variety, which occurs in western Yunnan, southern Xizang, and extends to eastern Himalaya (including Nepal, Sikkim, Bhutan, northeastern India, and northern Burma) (Noltie, 1994; H. Li, 1997). As mentioned earlier, we consider the shape of the rhizomes, the number of foliage leaves, the branching pattern of the inflorescence, and the basic number and the color of the flowers usually to be the important diagnostic features for evaluating species limits throughout the genus. However, the shape of the blade and the number of flowers are quite variable for variety *fuscum*. With the exception of the minor differences mentioned above, other morphological features between the new taxon and variety *fuscum* are the same, and hence we recognize this taxon as a variety of *M. fuscum*.

Maianthemum fuscum var. *cordatum* resembles *M. fuscum* var. *pilosum* (Hara) S. Karthikeyan but grows allopatric to it (the latter occurs in Nepal and Bhutan [Hara, 1987]), and it can be separated by a few constant characters. Variety *cordatum* is distinguished from variety *pilosum* in having a glabrous leaf blade and the rachis of the inflorescence conspicuously zigzagged and glabrous. By contrast, variety *pilosum* is ciliate on the margin of the leaf blade, and the rachis of the inflorescence is almost straight, sometimes with stiff spreading hairs.

In Hara's (1987) opinion, *Maianthemum fuscum* var. *fuscum* belonged to *Smilacina* sect. *Medora,* but it was subsequently transferred to *Maianthemum* by LaFrankie (1986b). In Li's (1990) infrageneric system of *Maianthemum,* it was rearranged in section *Medora* subsect. *Medora* because of its moniliform individual rhizome units, numerous leaves, paniculate inflorescence, trimerous flowers, cyathiform corolla, and purple perianth. Therefore, both *M. fuscum* and *M. dulongense* belong to the same subgenus and section, but in different subsections.

Paratypes. CHINA. **Yunnan:** Gongshan Xian, Dulong Jiang Valley, W side of Gaoligong Mountains, in evergreen forest, 2200 m, 20 May 1991, *Dulong Jiang Expedition 6939* (KUN); Zhiyenandai, in broadleaf evergreen forest, 2200 m, 4 Sep. 1982, *Qizang Expedition 9918* (KUN); Fugong Xian, Quanmugulu-A'ludeng, 2500–3000 m, 31 July 1979, *Nujiang Expedition 791658* (KUN). **Xizang:** Dingjie Xian, Chengtangqi, in broadleaf forest, 2300 m, 6 June 1975, *Qizang Expedition 5545* (KUN); Medog, Hanmi, under forest, 2300 m, 26 Oct. 1992, *Expedition to Medog 0571* (KUN), 2100 m, 27 Oct. 1992, *Expedition to Medog 0846* (KUN), 1900 m, 28 Oct. 1992, *Expedition to Medog 0938* (KUN); Beiben, the back hill of Xirah, under forest, 2200 m, 8 Dec. 1992, *Expedition to Medog 2074* (KUN); Pangxin, Pangguo, in forest, 2100 m, 28 Feb. 1993, *Expedition to Medog 4090* (KUN); Damu, under forest, 2000 m, 6 Mar. 1993, *Expedition to Medog 4234* (KUN); Rengqiangpeng, in forest, 2000 m, 22 Apr. 1993, *Expedition to Medog 5691* (KUN); Denxin, Wenlang, in forest, 1800 m, 29 Apr. 1993, *Expedition to Medog 6069* (KUN).

The following key to the species of *Maianthemum* in the Gaoligong Mountains includes the two new varieties described herein.

KEY TO THE SPECIES OF *MAIANTHEMUM* IN THE GAOLIGONG MOUNTAINS

1a. Corolla distinct or connate at the base.
  2a. Inflorescence a raceme.
    3a. Leaf papyraceous, ovate; blade with 15 veins and inconspicuous venulae; inflorescence with 6 to 15 flowers; perianth light purple . . . . . *M. dulongense* var. *dulongense*
    3b. Leaf coriaceous, cordate-oblong; blade with 21 veins and conspicuous venulae; inflorescence with 24 flowers; perianth maroon . . . . . *M. dulongense* var. *coriaceum*
  2b. Inflorescence a panicle.

4a. Plant pubescent.
5a. Foliage leaves more than 4; inflorescence with more than 10 flowers.
6a. Leaf elliptic-ovate to broadly lanceolate, 12–21 cm long, long-cuspidate at the apex; style conspicuous, 2–2.5 mm long . . . . . *M. oleraceum*
6b. Leaf elliptic to oblong, 7–13 cm long, acuminate at the apex; style short, 1.2 mm long . . . . . *M. purpureum*
5b. Foliage leaves 2; inflorescence with 1 to 4 flowers; plant 5–20 cm tall; leaf ovate to elliptic-ovate, pubescent, 2–5 cm long, 1.5–3 cm wide . . . . . *M. gongshanense*
4b. Plant glabrous.
7a. Petioles 1–4 cm long; tepals ovate, 3–4 mm long; stigma obscurely 3-lobed.
8a. Blade lanceolate; inflorescence with 3 to 10 flowers, pedicel filiform . . *M. fuscum* var. *fuscum*
8b. Blade cordate; inflorescence with 20 flowers, pedicel tenuous . . . . . *M. fuscum* var. *cordatum*
7b. Petioles short, less than 1 cm long; tepals narrowly lanceolate, 2–2.5 mm long; stigma deeply 3-lobed . . . . . *M. tatsienense*
1b. Corolla conspicuously connate.
9a. Plant 30–80 cm tall; rhizome moniliform; flowers salver-shaped; corolla tube cylindric, 6–7 mm long; style ca. 2 mm long, stigma 3-lobed; berries green with purple spots . . . . . *M. henryi*
9b. Plant 80–150 cm tall; rhizome nodose; flowers broadly campanulate or rotate; corolla tube cupulate, 1–2 mm long; style ca. 0.5 mm long, stigma obscurely 3-lobed; berries red . . . . . *M. atropupureum*

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