



Mitreola viridiflora (Loganiaceae), a new species from southern Yunnan, China

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ABSTRACT: *Mitreola viridiflora*, a new endemic species from southern Yunnan, China, is described and illustrated. It is morphologically similar to *M. crystallina*, *M. pedicellata* and *M. reticulata*, but can be distinguished from them by its urceolate yellow-green corolla, ovate-triangular corolla lobes, stamens inserted near middle of corolla tube, style much longer than ovary.

KEY WORDS: Flora of Yunnan, limestone areas, *Mitreola crystallina*, *Mitreola pedicellata*, *Mitreola reticulata*, taxonomy.

INTRODUCTION

Mitreola L. is a small genus and mainly distributed in Asia, America, Africa, the Pacific islands and Oceania (Leenhouts, 1962, 1972; Leeuwenberg and Vidal, 1972; Leeuwenberg, 1974; Li and Leeuwenberg, 1996; Islas-Hernández *et al.*, 2019; Li, 2020). As the species *Mitreola minima* B.J. Conn (Conn, 1996) which is distributed in western Australia has been made as a new combination *Adelphacme minima* (B. J. Conn) K. L. Gibbons, B. J. Conn & M. J. Henwood in the new genus *Adelphacme* K. L. Gibbons, B. J. Conn & M. J. Henwood according to the molecular phylogenetic studies (Gibbons *et al.*, 2013), and the current *Mitreola* contains 18 species. Most species of this genus are local endemics except for *M. petiolata* (J.F. Gmel.) Torr. & A. Gray and *M. pedicellata* Benth. There are 14 species recorded in China, and most of them are narrowly distributed in the limestone areas in Chongqing, Guangdong, Guangxi, Guizhou and Yunnan (Li, 1979, 1992; Fang *et al.*, 1995; Li and Leeuwenberg, 1996; Ma *et al.*, 2010; Shan *et al.*, 2019, 2021; You *et al.*, 2020; Liao and Chen, 2021; Liu *et al.*, 2022).

During the fieldwork in the karst regions of Maguan and Hekou Counties, southern Yunnan Province from 2019 to 2023, we discovered a species of *Mitreola* with urceolate yellow-green corolla and style much longer than ovary. After the careful comparison with the known species of *Mitreola* from China and adjacent regions (Leenhouts, 1962, 1972; Tirel, 1969; Li, 1979, 1992; Fang *et al.*, 1995; Li and Leeuwenberg, 1996; Ma *et al.*, 2010; Shan *et al.*, 2019, 2021; You *et al.*, 2020; Liao and Chen, 2021; Liu *et al.*, 2022; Nuraliev *et al.*, 2023), we concluded it to be new to science and describe it as *Mitreola viridiflora* C. Liu & S.W. Guo hereby.

MATERIALS AND METHODS

Voucher specimens of *Mitreola viridiflora* were collected from Maguan and Hekou Counties, southern Yunnan Province. Photographs and phenological information were obtained during the field expeditions. Morphological observations and trait measurements were carried out on living plants and herbarium specimens deposited in KUN. Seeds were photographed using a Keyence VHX-700F Digital Microscope (Keyence, Osaka, Japan). All morphological characters were described according to the terminology presented by Li and Leeuwenberg (1996), and the conservation status was assessed according to the IUCN Red List Categories and Criteria (IUCN, 2022).

TAXONOMIC TREATMENT

Mitreola viridiflora C. Liu & S.W. Guo, *sp. nov.*

綠花度量草 Fig. 1

Type: CHINA. Yunnan Province, Maguan County, Miechang Xiang, the cliff under the limestone forest, 22°51'N, 104°2'E, 1484 m, 19 April 2021, Cheng Liu, Ming-Jian Feng & Chang-Hong Li 21CS20346 (holotype: KUN!, isotypes: KUN!, PE!).

Diagnosis: *Mitreola viridiflora* is morphologically most similar to *M. crystallina*, but differs by its yellow-green (vs. blue or pale blue) corolla, ovate-triangular (vs. triangular) corolla lobes, stamens inserted near middle of corolla tube (vs. at base of corolla tube), style longer than ovary (vs. shorter than ovary), capsule subglobose and 2-horned at apex (vs. spheroidal and slightly 2-lobed at apex).

Description: Perennial lithophytic herb, 20–60 cm tall, glabrous. **Stems** erect, 4-angled at least when young and then becoming terete, usually unbranched; internodes 3–10 cm long. **Leaves** opposite; petioles purple-red, 1–5

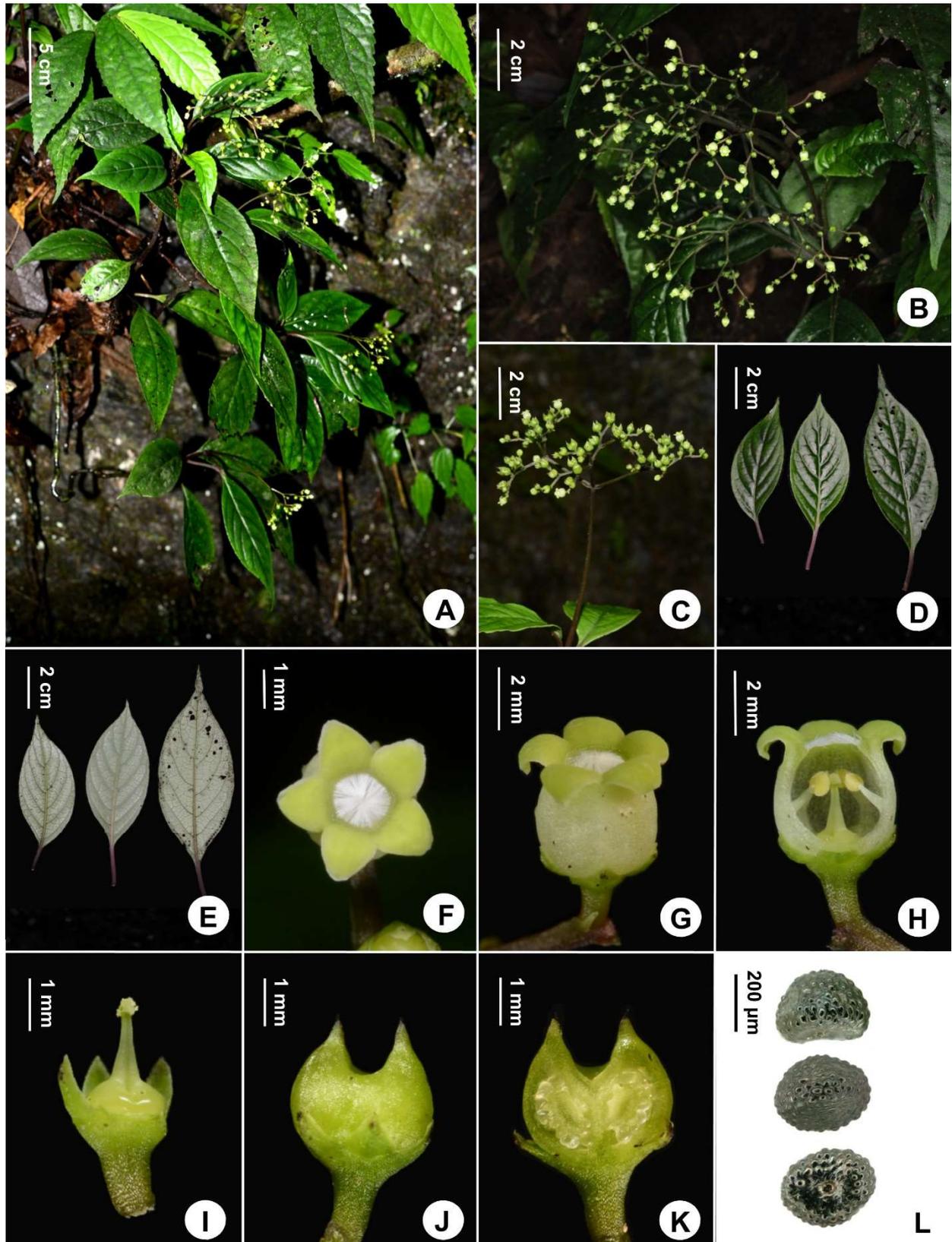


Fig. 1. *Mitreola viridiflora*. **A:** Habitat **B:** Inflorescence **C:** Infructescence **D:** Adaxial leaf surface **E:** Abaxial leaf surface **F:** Flower, front view (showing hairy throat) **G:** Flower, lateral view **H:** Opened corolla (showing stamens) **I:** Ovary and style **J, K:** Young fruit (lateral view and longitudinal section) **L:** Seeds. 21CS20346. Photos: **A** and **C-K** by C. Liu, **B** by S.-W. Guo, **L** by L.-Y. Li.

**Table 1.** Character differences between *Mitreola viridiflora*, *M. crystallina*, *M. pedicellata* and *M. reticulata*.

Characters	<i>M. viridiflora</i>	<i>M. crystallina</i>	<i>M. pedicellata</i>	<i>M. reticulata</i>
Stem	erect, 4-angled when young, becoming terete	erect, 4-angled	erect or creeping, 4-angled when young, becoming terete	creeping, 4-angled
Leaf blades	elliptic	elliptic	lanceolate to oblanceolate, sometimes slightly oblong	narrowly ovate
Sizes	4–15 × 1.8–8.0 cm	15–20 × 5–7 cm	5–15 × 2–5 cm	4–9 × 1.5–3 cm
Apex	acuminate	acute	acuminate to obtuse	acuminate
Secondary veins	6–8 pairs	6–8 pairs	8–10 pairs	6–10 pairs
Bracts	narrowly lanceolate	narrowly triangular	narrowly elliptic	lanceolate
Corolla	yellow-green	blue or pale blue	white	white
Lobes of corolla	ovate-triangular	triangular	ovate	ovate to triangular
Stamen	inserted near middle of corolla tube	inserted at base of corolla tube	inserted near middle of corolla tube	inserted at middle of corolla tube
Style	longer than ovary	shorter than ovary	shorter than ovary	shorter than ovary
Capsule	subglobose, apex 2-horned	spheroidal, apex slightly 2-lobed	subglobose, apex 2-horned	subglobose, apex 2-horned
Sources	this study	You <i>et al.</i> , 2020	Li & Leeuwenberg, 1996	Li & Leeuwenberg, 1996

cm long; leaf blades elliptic, 4–15 × 1.8–8.0 cm, membranous to papery when dry, base cuneate, apex acuminate, margin entire; secondary veins 6–8 at each side of the midvein, impressed above and prominent beneath. Interpetiolar stipules in the form of a transverse ridge. **Cymes** terminal, many-flowered; peduncles (3–)5–10 cm long; bracts and bracteoles narrowly lanceolate, 1–4 mm long; pedicels 1–2 mm long. **Calyx** green, occasionally light purple-red; tube 0.5–1 mm long; lobes 5, triangular, 1 × 0.5–0.8 mm, margin membranous. **Corolla** urceolate, yellow-green; tube 2–2.5 mm long, 1.8–3 mm in diam., much longer than lobes; lobes 5, reflexed, ovate-triangular, 1.0–1.2 × 1.2–1.4 mm, apex obtuse to rounded; corolla glabrous except for a ring of long hairs at throat. **Stamens** 5, inserted near middle of corolla tube, glabrous, filaments ca. 0.7 mm long, anthers broadly ovate, ca. 0.5 mm long; **Ovary** subglobose, 0.5–0.8 × 1–1.3 mm; ovules numerous per locule; style free at base, ca. 1 mm long, longer than ovary, stigma capitate. **Capsule** bilobed, connate for 1/2 to 2/3 of the length, 1.5–3 × 2–3 mm, glabrous, with two erect apical horns, at base with persistent calyx. **Seeds** hemispherical, black, 0.38 × 0.32 × 0.23 mm, with tuberculate surface.

Distribution and habitat: *Mitreola viridiflora* is endemic to China, and currently only known from Maguan and Hekou Counties, southern Yunnan Province. It grows in shady areas on limestone cliffs together with *Ophiorrhiza paniculiformis* H.S. Lo and *Leptomischus erianthus* H.S. Lo (Rubiaceae), *Pholidota chinensis* Lindl. (Orchidaceae) and *Elatostema* sp. (Urticaceae), at elevations between 1000 m and 1531 m.

Phenology: *Mitreola viridiflora* was observed flowering from March to April and fruiting from April to June.

Etymology: The specific epithet ‘viridiflora’ refers to the yellow-green flowers of the new species.

Chinese name: The Chinese name is proposed as “绿花度量草” (绿花 refers to the yellow-green flowers, 度量草 refers to *Mitreola*).

Additional specimens examined (paratypes): CHINA.

Yunnan Province, Hekou County, Qincaitang in Nanxi Town, on the limestone slope, 22°40'N, 104°1'E, 1111 m a.s.l., 13 January 2010, *Southeastern Yunnan expedition of DNA Barcoding GBOWS752* (KUN!); Longyinchong in Nanxi Town, under the forest, 22°40'N, 104°1'E, 1000 m a.s.l., 28 June 2009, *Yu-Ming Shui, Wen-Hong Chen & Zhi-Dan Wei 83051* (KUN!). Maguan County, Miechang Xiang, shady areas on limestone cliff, 22°51'N, 104°2'E, 1484 m a.s.l., 16 April 2021, *Shi-Wei Guo GSW2021-085* (KUN!); on the road from Miechang Xiang to Gulinqing, on the roadside cliff under the forest, 22°51'N, 103°58'E, 1531 m a.s.l., 15 March 2023, *Jie Cai, Wei Zhang & Ming-Zhong Mo, 23CS24047* (KUN!).

Preliminary conservation status: *Mitreola viridiflora* is only known from 4 small populations in Maguan and Hekou Counties with less than 30 mature individuals observed in total. Most of its habitats are fragmented and disturbed by the human activities such as plantations of *Lanxangia tsao-ko* (Crevost & Lemarié) M.F. Newman & Škorničk. and road construction. Further detailed investigations of this species are required for better understanding of its distribution and abundance, and we temporarily suggest the conservation status of this species as data deficient (DD) following the IUCN guidelines (IUCN, 2022).

Similar species: *Mitreola viridiflora* is similar to *M. crystallina* Y.M. Shui & W.H. Chen (You *et al.*, 2020) in perennial glabrous habit, 4-angled stem, elliptic leaf blades, 6–8 secondary veins at each side of the midvein and black seeds with tuberculate surface. The new species differs from the latter by the yellow-green (vs. blue or pale blue) corolla with ovate-triangular (vs. triangular) corolla lobes, stamens inserted near middle of corolla tube (vs. at base of corolla tube), style longer than ovary (vs. shorter than ovary), capsule subglobose and 2-horned at apex (vs. spheroidal and slightly 2-lobed at apex).

The new species is also similar to *M. pedicellata* Benth. and *M. reticulata* Tirel in having 4-angled stem, stamens inserted near middle of corolla tube, subglobose capsule and 2-horned at apex. *Mitreola viridiflora* is distinguished from *M. pedicellata* by its elliptic (vs. lanceolate to oblanceolate, sometimes slightly oblong)



leaf blades, 6–8 (vs. 8–10) secondary veins at each side of the midvein, narrowly lanceolate (vs. narrowly elliptic) bracts, yellow-green (vs. white) corolla and ovate-triangular (vs. ovate) lobes, style longer than ovary (vs. shorter than ovary). It also differs from *M. reticulata* by the erect (vs. creeping) stem, elliptic (vs. narrowly ovate) leaf blades, yellow-green (vs. white) corolla, style longer than ovary (vs. shorter than ovary) (Table 1).

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