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Mitreola liuyanii (Loganiaceae), a new species from Guizhou, China

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ABSTRACT: *Mitreola liuyanii*, a new species from Guizhou Province, China, are described and illustrated in this study. Morphologically, it is most similar to *M. pingtaoi* but can be distinguished from the latter in the characteristics of leaves arranged in a basal rosette or clustered at the stem or branch apex, shorter stem internodes and petioles, smaller narrowly oblanceolate leaf blades with ciliate margin, narrowly lanceolate bracts and glabrous capsules.

KEY WORDS: Flora of Guizhou, limestone caves, *Mitreola pingtaoi*, *M. liui*, *M. petiolatoides*, new taxon, taxonomy.

INTRODUCTION

Mitreola L. (Linnaeus, 1758) is a pantropical genus of family Loganiaceae (Chen, 1995), which comprises about 16 species distributed in Africa, America, Asia, Oceania and the Pacific islands (Leenhouts, 1962, 1972; Leeuwenberg and Vidal, 1972; Leeuwenberg, 1974; Li and Leeuwenberg, 1996; Islas-Hernández *et al.*, 2019; Li, 2020). It can be easily characterized by cymose inflorescences, 5-merous flowers, cleft styles, and bilobed capsules with two erect or incurved horns (Leeuwenberg, 1974; Li and Leeuwenberg, 1996; Li, 2020). Some new species of this genus have been discovered and reported in recent years (Ma *et al.*, 2010; Shan *et al.*, 2019, 2021; You *et al.*, 2020; Liao and Chen, 2021). Until now, there were 13 species recorded in southern, southwestern and central China, and most species are endemic to limestone areas (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).

Guizhou Province is one of the most concentrated karst areas in the world, with the largest area of contiguous exposed carbonate rocks and intensively developed karst (Chen *et al.*, 2013). It is located in the eastern part of the Yunnan-Guizhou Plateau, occupying an area of 176,167 km^2, of which the karst landform area covers 109,084 km^2, accounting for 61.9% of the total (Star Map Press, 2016). There are more than 8,612 vascular plant species in Guizhou Province (Rong and Yang, 2004; Luo *et al.*, 2015; Shu and Luo, 2019), most of them are endemic to karst area, with several new taxa have also been discovered in recent years in this area (Han *et al.*, 2017; Wang *et al.*, 2020; Zhang *et al.*, 2021).

During the field investigation of native plants occurring in the caves of the limestone area of Yunnan-Guizhou Plateau in 2015, one of us (M.-Q. Han) collected a tiny species of *Mitreola* which had the narrowly oblanceolate leaf blades with ciliate margin and leaves arranged in a basal rosette or clustered at the stem or branch apex. We recollected it again from the same locality in order to get more information of flower characters in April 2021. After the careful comparison of diagnostic morphological and anatomical features of closely related species from China and adjacent regions (Leenhouts, 1962, 1972; 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), we concluded that it is new to science and thus describe and illustrate it hereby.

MATERIALS AND METHODS

Voucher specimens of *Mitreola liuyanii* were collected from Pingtang County, Guizhou Province. Photographs and phenological information were obtained during the field expeditions. Morphological observations and measurements were carried out on living plants and on herbarium specimens from IBK, KUN and PE. All morphological characters are described according to the terminology presented by Li and Leeuwenberg (1996), and the conservation status is assessed according to the IUCN Red List Categories and Criteria (IUCN, 2019).

TAXONOMIC TREATMENT

Mitreola liuyanii C.Liu & M.Q.Han, ***sp. nov.***
睫毛度量草 Fig. 1

***Type*: CHINA.** Guizhou Province, Pingtang County, Tangbian Town, shady areas of limestone cliff, 25°36′N, 106°49′E, 1030 m a.s.l., 20 May 2015, *M.-Q. Han & J.-Q. Huang HMQ372* (holotype: IBK!, isotype: KUN!, PE!).

***Diagnosis*:** *Mitreola liuyanii* is most similar to *M. pingtaoi*, but can be distinguished from the latter by its shorter stem internodes, 0.1–0.5 (–2) cm (vs. 0.2–5 cm),

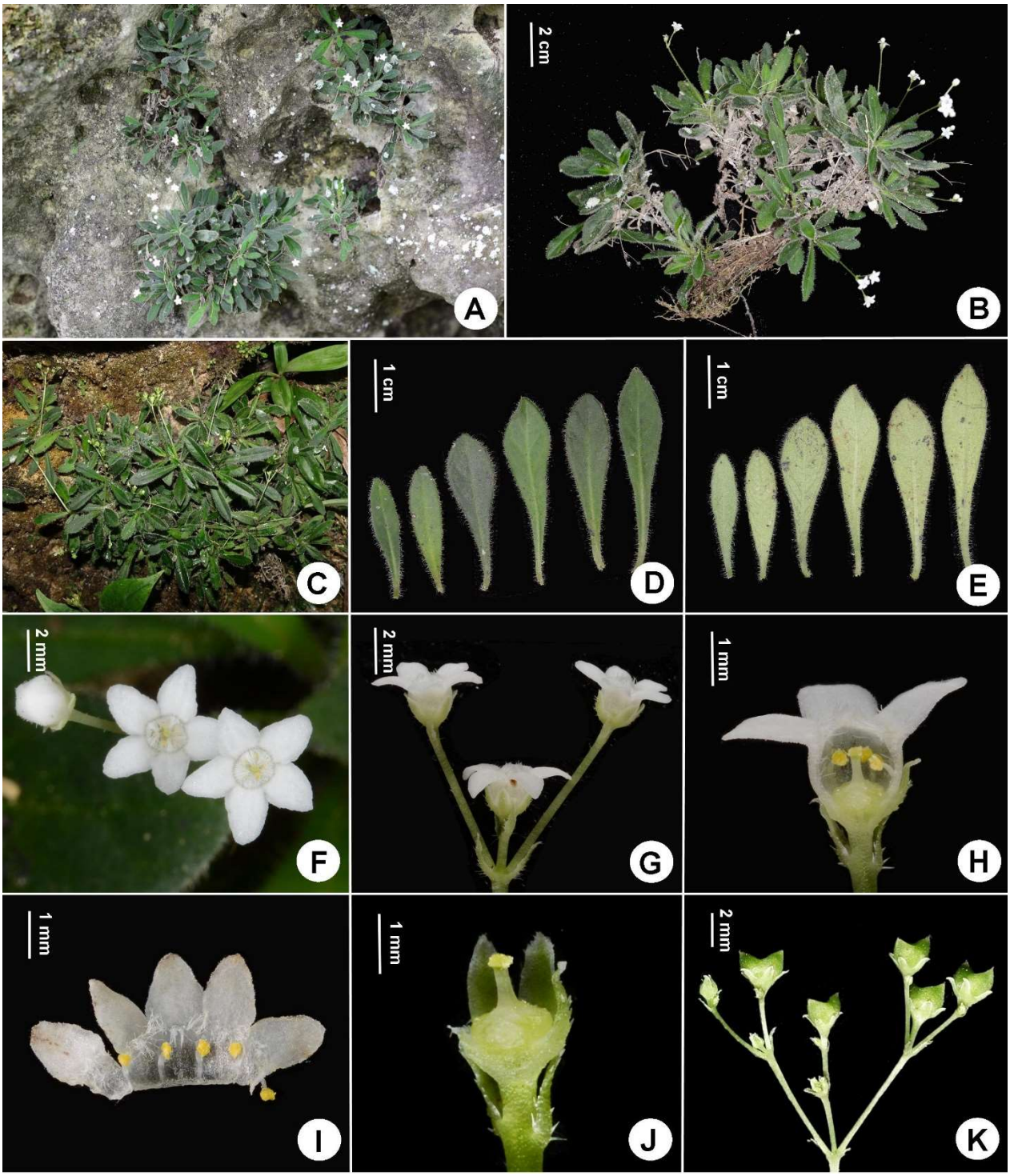

Fig. 1. Morphology of ***Mitreola liuyanii*** C.Liu & M.Q.Han, *sp. nov*. **A:** Habitat. **B:** Plant with flowers. **C:** Plant with fruits. **D:** Adaxial leaf surface. **E:** Abaxial leaf surface. **F:** Flowers, front view. **G:** Inflorescence, and showing the lateral view of flowers. **H:** Opened corolla (showing stamens, ovary and style). **I:** Opened corolla (showing stamens). **J:** Ovary and style. **K:** Infructescence, and showing fruits. (Photos: **A–B** and **D–J** by C. Liu, **C** and **K** by M.-Q. Han)

leaves arranged in a basal rosette or clustered at the stem or branch apex (vs. along length of stem), shorter petioles 0.2–0.8 cm (vs. 0.5–1.5 cm), leaf blades narrowly oblanceolate (vs. obovate, long-obovate or ovate), 0.4–5.6 × 0.2–1 cm (vs. 2–8 × 0.7–3 cm), margin ciliate (vs. pilose), bracts lanceolate (vs. linear) and capsules glabrous (vs. pilose).

Table 1. Diagnostic character differences between ***Mitreola liuyanii***, ***M. pingtaoi***, ***M. liui*** and ***M. petiolatoides***.

Characters	*Mitreola liuyanii*	*M. pingtaoi*	*M. liui*	*M. petiolatoides*
Habit	Perennial	Perennial	Perennial	Annual
Internodes	0.1–0.5 (–2) cm	0.2–5 cm	0.2–0.5 (–1) cm	0.1–0.3 cm
Leaves	Basal rosette or clustered at the stem or branch apex	Along length of stem	Along length of stem	Along length of stem
Petioles	0.2–0.8 cm	0.5–1.5 cm	0.2–0.5 (–1) cm	0.3–0.5 cm
Leaf blade shape	Narrowly oblanceolate	Obovate, long-obovate or ovate	Long elliptic to oblanceolate	Ovate
Size	0.4–5.6 × 0.2–1 cm	2–8 × 0.7–3 cm	1.5–10.5 × 0.5–3.8 cm	0.5–2 × 0.3–1 cm
Margin	Ciliate	Pilose	Pilose	Pilose
Bracts	Narrowly lanceolate	Linear	Narrow-triangular	Lanceolate
Inflorescence	Terminal, 3 to many flowers	Terminal or axillary, many flowers	Terminal or axillary, many flowers	Terminal, 1–3 flowers
Stamens	Inserted near middle of corolla tube	Inserted at middle of corolla tube	Inserted at base of corolla tube	Inserted at base of corolla tube
Capsules	Glabrous	Pilose	Glabrous	Unknown

***Description*:** Perennial herb, up to 9 cm tall. **Stems** terete, erect or creeping, branched at the base but unbranched in juvenile plants; internodes 0.1–0.5 (–2) cm, sparsely pilose or glabrescent. **Leaves** opposite, arranged in a basal rosette in juvenile plants and clustered at the stem or branch apex in older plants; petioles 0.2–0.8 cm long, pilose; leaf blades narrowly oblanceolate, 0.4–5.6 × 0.2–1 cm, papery, pilose on both surfaces, base decurrent, margin entire and ciliate, apex acute to rounded; lateral veins 4–6 pairs, inconspicuous. Stipules linear, interpetiolar, c. 0.5 mm. **Cymes** terminal, with 3 to many flowers; peduncles slender, up to 5 cm long, sparsely pilose; bracts narrowly lanceolate, 2–3 mm long, sparsely pilose on abaxial surface, bracteoles narrowly lanceolate, 1–2 mm long, sparsely pilose on abaxial surface; pedicels 1–8 mm long, sparsely pilose. **Calyx** lobes 5, ovate, c. 1.3 × 1 mm, margin membranous, with abaxial surface sparsely pilose. **Corolla** campanulate, white, c. 5 mm in diam.; tube 1.2–1.5 mm, lobes 5, ovate, 1.3–1.6 × 1.2–1.5 mm, glabrous, except for a ring of long hairs at throat. **Stamens** 5, inserted near middle of corolla tube, glabrous, filaments c. 0.3 mm long, anthers broadly ovate, c. 0.3 mm long. **Ovary** semi-inferior, bilocular, c. 0.5 × 1.0 mm, ovules numerous per locule; style c. 0.5 mm long, free at base, stigma capitate. **Capsules** bilobed, connate for 1/2 to 2/3 their length, two horns erect, 1.5–3 × 2–3 mm, glabrous, sepals persistent at base.

***Distribution and habitat*:** *Mitreola liuyanii* is endemic to China, currently only known from the type locality, Tangbian Town, Pingtang County, Guizhou Province. It grows in shady areas of limestone cliff together with species of *Petrocosmea viridis* M.Q.Han & Yan Liu (Gesneriaceae), *Begonia cavaleriei* H.Léveillé (Begoniaceae), *Anemone begoniifolia* H.Léveillé & Vaniot (Ranunculaceae), *Aletris* sp. (Liliaceae) and *Viola* sp. (Violaceae), at an elevation of c. 1030 m.

***Phenology*:** *Mitreola liuyanii* was observed flowering from March to April and fruiting from May to July.

***Etymology*:** We dedicate this new species of *Mitreola* to Prof. Yan Liu for his substantial contributions to the botanical research in the karst area of southwest China.

***Vernacular name*:** The Chinese name is proposed as Jié Máo Dù Liáng Cǎo (睫毛度量草), means that the hairs on the margin of leaf blades like eyelashes.

***Additional specimens examined (paratypes)*:** CHINA: Guizhou, Pingtang County, Tangbian Town, shady areas of the limestone cliff, 25°36′N, 106°49′E, 1030 m a.s.l., 14 November 2015, *M.-Q. Han HMQ868* (IBK!); Ibid., 25 April 2021, flowering, *C.Liu, M.-J. Feng & C.-H. Li 21CS20394* (KUN!).

***Conservation status*:** In the field investigations, *Mitreola liuyanii* was only found from the type locality with less than 50 mature individuals in an area of c. 5, 000 m^2 area (100 × 50 m). All discovered individuals were occurring in the natural scenic spot, where the habitat was in good condition. The further detailed investigation of the same habitats is also needed to give a better understanding of its natural distribution and abundance, and this species is temporarily assessed as data deficient (DD) according to IUCN (2019).

***Similar species and notes*:** Morphologically, *Mitreola liuyanii* is also similar to *M. liui* X.L.Du & Z.J.Mu (Shan *et al.*, 2019) and *M. petiolatoides* P.T.Li (1979), but can be distinguished from *M. liui* by its leaves arranged in a basal rosette or clustered at the stem or branch apex (vs. along length of stem), leaf blades narrowly oblanceolate (vs. long elliptic to oblanceolate), 0.4–5.6 × 0.2–1.0 cm (vs. 1.5–10.5 × 0.5–3.8 cm), bracts narrowly lanceolate (vs. narrow-triangular), stamens inserted near middle of corolla tube (vs. inserted at base of corolla tube). And it can also be distinguished from *M. petiolatoides* by its perennial (vs. annual) habit, leaves arranged in a basal rosette or clustered at the stem or branch apex (vs. along length of stem), leaf blades narrowly oblanceolate (vs. ovate), 0.4–5.6 × 0.2–1 cm (vs. 0.5–2 × 0.3–1 cm), apex acute to rounded (vs. obtuse), inflorescence with 3 to many flowers (vs. 1–3 flowers), stamens inserted near middle of corolla tube (vs. inserted at base of corolla tube) (Table 1).

Guizhou Province is rich in plant resources, several species are unique in China and even in the world, such as *Abies fanjingshanensis* W.L.Huang *et al.*, *Cycas guizhouensis* K.M.Lan & R.F.Zou and *Petrocosmea cavaleriei* Lévl. To date, there are three species of genus *Mitreola* (*M. pedicellata* Benth., *M. petiolata* (J.F.Gmel.) Torr. & A.Gray and *M. reticulata* Tirel-Roudet) have been recorded in Guizhou Province (Cai *et al.*, 2015; Luo *et al.*, 2015), the finding of *M. liuyanii* brings the number of species of *Mitreola* in Guizhou to four and has a great significant meaning to study the plant diversity and conservation in this area, but more extensive investigations in the karst areas of Guizhou Province are also needed to be carried out in future.

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