



Primulina zhoui and *P. huangii* (Gesneriaceae), two new species from limestone areas in Guangxi, China

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(Manuscript received 29 December 2017; accepted 16 March 2018; online published 20 March 2018)

ABSTRACT: *Primulina zhoui* and *Primulina huangii*, two new species of Gesneriaceae from the limestone area in Guangxi, China are described and illustrated. *Primulina zhoui* is similar to *Primulina multifida* B. Pan & K.F. Chung, but differs from the latter in its bracts, calyx lobes, corolla, adaxial lip and disc. *Primulina huangii* closely resembles *Primulina bipinnatifida* (W.T. Wang) Y.Z. Wang & J.M. Li, but differs from the latter in its bracts, pedicel, corolla, corolla tube, adaxial lip and pistil.

KEY WORDS: China, Flora of limestone, Gesneriaceae, New taxa, *Primulina multifida*, *P. bipinnatifida*, Taxonomy.

INTRODUCTION

The expanded concept of *Primulina* (Wang *et al.*, 2011; Weber *et al.*, 2011) has been well accepted in recent years. Now the genus comprises over 180 species, including more than 50 newly described species (Xu *et al.*, 2017; Möller *et al.*, 2016; IPNI, 2017).

During an investigation in 2015 in the limestone karst of northern Guangxi (China), two unknown species of *Primulina* with small flowers and lobed leaves reminiscent of *P. multifida* and *P. bipinnatifida* were discovered by two volunteers of the Gesneriad Conservation Center of China (GCCC). They sent some photographs and some living plants to the Gesneriad Conservation Center of China (GCCC) for further observations. Over the two following years, three members of GCCC (WF, LS, XZB) visited the type localities of the two unknown species several times. After analyzing the phenological records on those two interesting species, comparing with the other two similar *Primulina* species in local floras and monographs (e.g. Wang *et al.*, 1990, 1998; Li & Wang, 2004; Wei *et al.* 2010), and referring to the descriptions of the new small-flowered species with lobed leaves in recent references (e.g. Pan *et al.*, 2010; Shen *et al.*, 2010; Wu *et al.*, 2011; Huang *et al.*, 2012; Xu *et al.*, 2012a, 2012b; Ning *et al.*, 2013, 2014; Li *et al.*, 2014; Liang *et al.*, 2014; Wen *et al.*, 2014; Zhou *et al.*, 2014; Zhang *et al.*, 2016; Pan *et al.*, 2017; Wu *et al.*, 2017; Yang & Pan, 2017), we confirmed that they are indeed two new species of *Primulina*. Thus, we described and illustrated them here.

TAXONOMIC TREATMENT

1. *Primulina zhoui* F. Wen & Z.B. Xin, *sp. nov.*

周氏小花苣苔 Figs. 1 & 2; Tab. 1

Type: CHINA: Guangxi: Liuzhou City, Liuzhou District, Liyong Town, Alt. 117 m, N 24°13', E 109°28', 18 Jul. 2015, Fang Wen *et al.*, WF150718-01 (holotype IBK, isotypes IBK, KUN, PE, TAI).

Primulina zhoui resembles *P. multifida* B. Pan & K.F. Chung, differing by its petiole, 5–8 mm in diam. in *P. zhoui* (vs. 1.5–3 mm in diam. in *P. multifida*); bracts obovate and larger, 15–28 × 8–16 mm (vs. bracts ovate to broadly ovate, 3–4 × 1.5–2 mm); larger calyx lobes, 8–10 × 2–3 mm (vs. 3–6 × 0.5–1 mm); with 5 reddish-brown stripes inside corolla (vs. with 2 pale brown stripes inside corolla); adaxial lip 1–1.5 × 1–1.5 mm (vs. 2–3 × 2–3 mm); disc annular, ca. 0.3 mm high (vs. ca. 0.8 mm high).

Herbs perennial. Stem axis extremely short with indistinct internodes. Leaves 20–30, basal, herbaceous; petiole subterete, 10–17 cm long, 5–8 mm in diam., pubescent and glandular-pubescent; blades reniform to obovate, 5–8 × 8–10 cm, pubescent and glandular-pubescent on both surfaces, base cordate to deeply cordate, margin pinnatifid, apex lanceolate; conspicuously palmately 5–8-nerved. Cymes 8–20, axillary, 1–4-branched, 8–25-flowered; peduncle 10–18 cm long, 1.5–2.5 mm in diam., pubescent and glandular puberulent; bracts 2, opposite, obovate, 15–28 × 8–16 mm, margin entire, pubescent and glandular-pubescent. Calyx 5-parted to base, lobes lanceolate-linear, 8–10 × 2–3 mm, apex acuminate, outside pubescent and glandular-pubescent, inside sparsely puberulent, margins entire. Corolla white, 8–13 mm long, outside

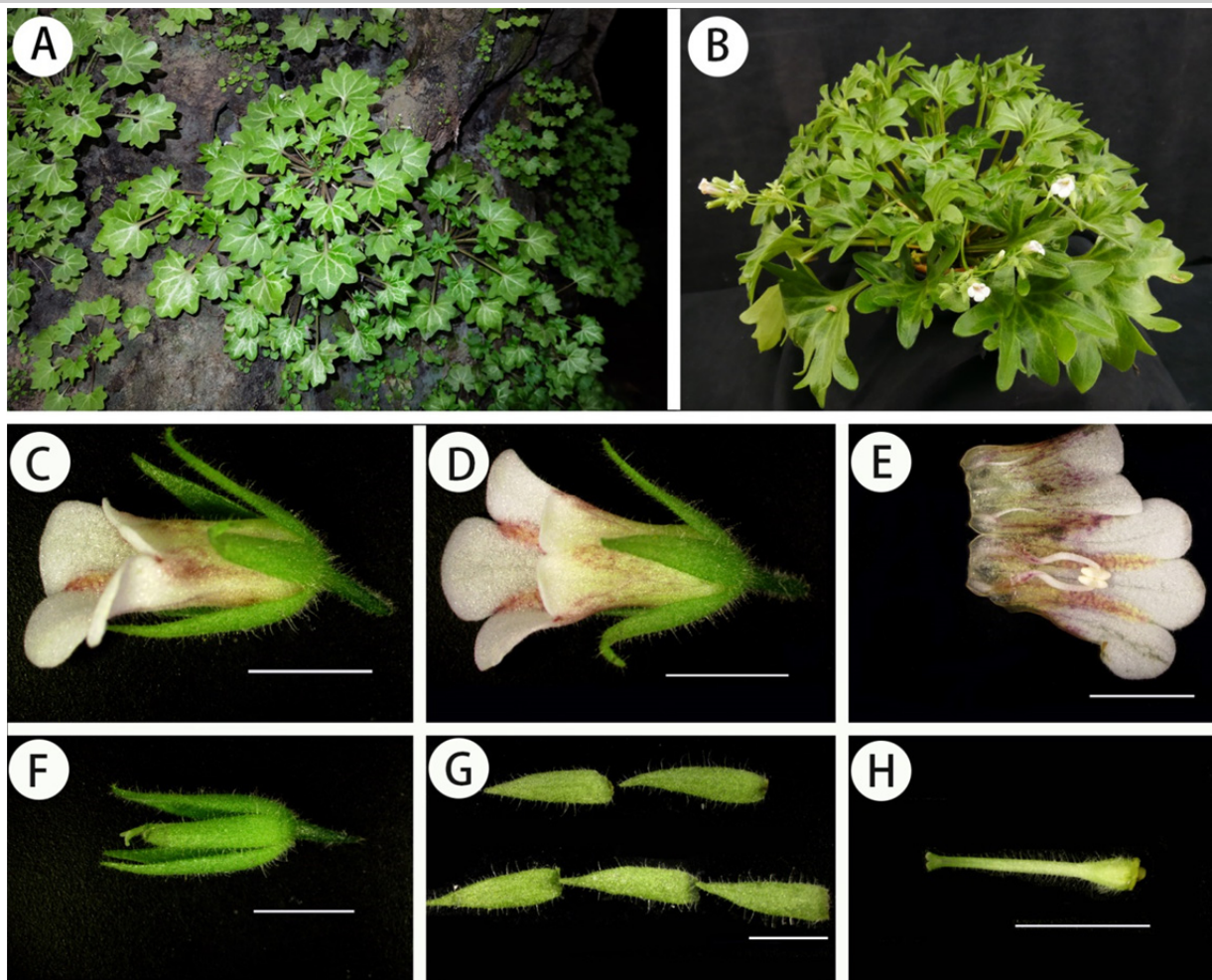


Fig. 1. *Primulina zhoui*. **A:** Habitat. **B:** Habit. **C:** Side view of corolla and calyx. **D:** Top view of corolla and calyx. **E:** Opened corolla showing stamens and staminodes. **F:** Pistil and calyx. **G:** Calyx. **H:** Pistil. **Scale bar:** 5 mm.

puberulent and glandular-puberulent, inside sparsely puberulent, with 5 reddish-brown stripes; corolla tube 6–8 mm long, 3–4 mm in diam.; limb distinctly 2-lipped, white; adaxial lip 2-parted to over the middle, lobes oblong or rounded, 1–1.5 × 1–1.5 mm; abaxial 3-lobed to over the middle, lobes oblong or rounded, 3–4 × 3–4 mm; stamens 2, adnate to 2–3 mm above the corolla tube base; filaments linear, 3–5 mm long, geniculate near the base, sparsely puberulent and glandular-puberulent; anthers 1.2–2 mm long, dorsifixed, glabrous, 2 anthers cohering; staminodes 3, lateral ones 2–3 mm long, apex capitate, sparsely puberulent and glandular-puberulent, adnate to 1–1.5 mm above corolla tube base, middle one ca. 0.3 mm long, inconspicuously, adnate to ca. 0.7 mm above base of corolla tube. Disc annular, ca. 0.3 mm high, margin repand, glabrous. Pistil 6–8 mm long, ovary narrowly ovoid, 2–3 mm long, ca. 1.5 mm across, glandular-puberulent; style 3–4 mm long, glandular-puberulent; stigma dichotomous, ca. 1 mm long, 0.5–0.8 mm wide.

Table 1. Morphological comparison of *Primulina zhoui* and *P. multifida*.

Characters	<i>P. zhoui</i>	<i>P. multifida</i>
Petiole	5–8 mm in diam.	1.5–3 mm in diam.
Bracts	obovate, 15–28 × 8–16 mm	ovate to broadly ovate, 3–4 × 1.5–2 mm
Calyx lobes	8–10 × 2–3 mm	3–6 × 0.5–1 mm
Corolla	5 reddish-brown stripes inside corolla	2 pale brown stripes inside corolla
Adaxial lip	1–1.5 × 1–1.5 mm	2–3 × 2–3 mm
Disc	ca. 0.3 mm high	ca. 0.8 mm high

Distribution and habitat: *Primulina zhoui* is known only from the type locality in Liyong Town, Liujiang District, Liuzhou City, Guangxi Zhuangzu Autonomous Region, China. It grows on moist limestone rock surfaces at karst cave entrance.

Phenology: Flowering from July to August.

Etymology: The new species is named after Mr. Wei-Quan Zhou, who firstly discovered and collected this rare species.

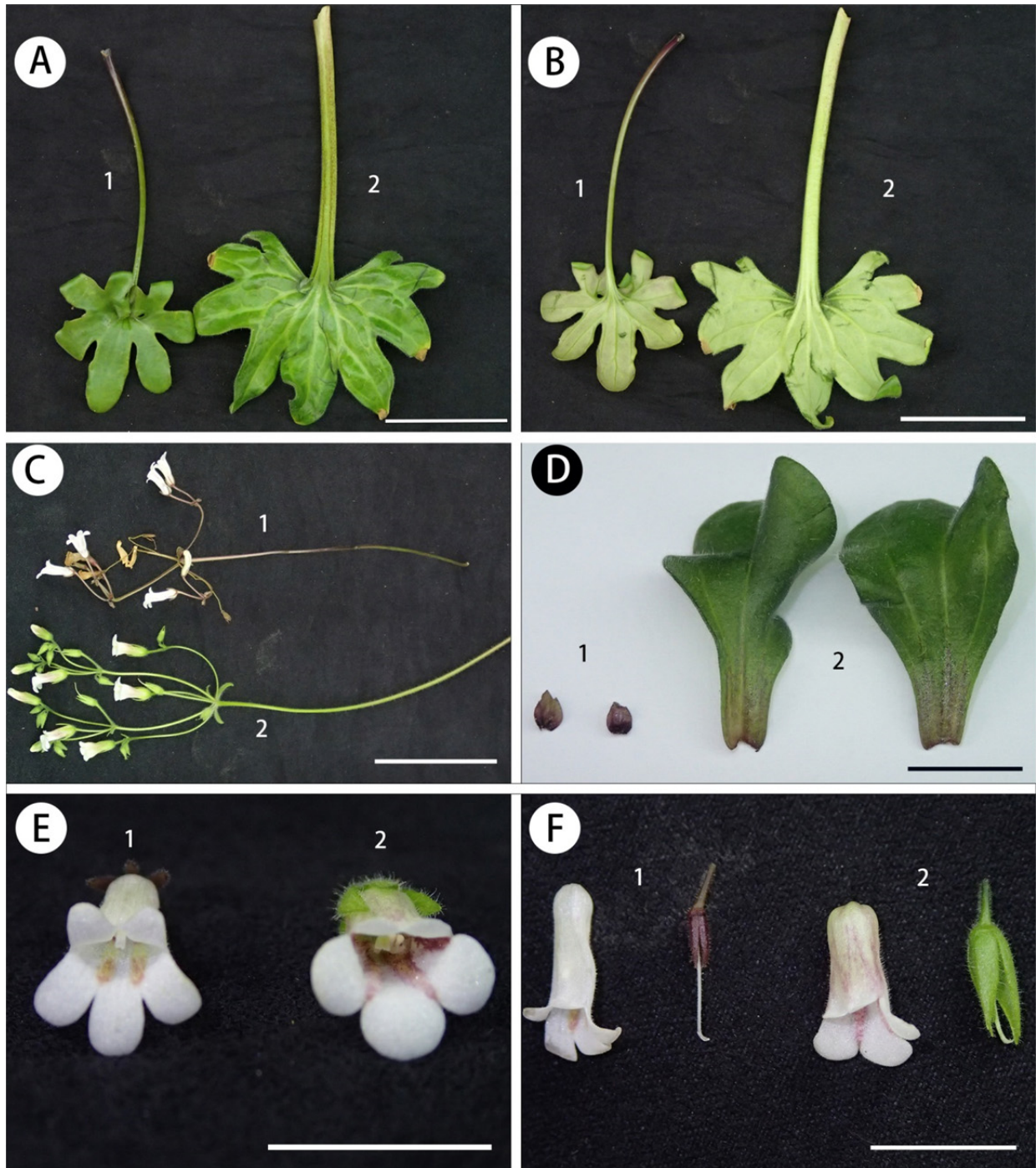


Fig. 2. Morphological comparison of *Primulina zhoui* and *P. multifida*. 1. *P. multifida*; 2. *P. zhoui*. A: The adaxial surface of leaf blades. B: The abaxial surface of leaf blades. C: Cymes. D: Bracts. E: Frontal view of corolla. F: Corolla, pistil and calyx. Scale bar: A-C = 5 cm; D-F = 1 cm.

Provisional IUCN Conservation Assessment: CR B2ab (ii, iii). Following the 2012 IUCN Red List Categories and Criteria (IUCN 2012), this species is assessed as critically endangered because of an estimated area of occupancy less than 10 km² (criterion B2), only one known-to-exist location (B2a), an inferred decline in the area of occupancy (B2bii), and a

decline in the area, extent, and/or quality of habitat (B2biii). Furthermore, only about 1,500 individuals were founded scattered along the cave entrance of a limestone hill. At present, the single population is threatened by the exposure to direct sunlight because of the deforestation around the cave and by the destruction due to the local quarrying project.



Fig. 3. *Primulina huangii*. A: Habitat. B: Habit. C: Side view of corolla and calyx. D: Top view of corolla and calyx. E: Opened corolla showing stamens and staminodes. F: Pistil and calyx. G: Calyx. H: Pistil. **Scale bar:** 5 mm.

2. *Primulina huangii* F. Wen & Z.B. Xin, *sp. nov.*

黄氏小花苣苔 Figs. 3 & 4; Tab. 2

Type: CHINA: Guangxi: Liuzhou City, Liunan District, Taiyangcun Town, Alt. 130 m, N 24°21', E 109°16', 22 Aug. 2015, Fang Wen *et al.*, WF150822-01 (holotype IBK, isotypes IBK, KUN, PE, TAI).

Primulina huangii resembles *P. bipinnatifida* (W.T. Wang) Y.Z. Wang & J.M. Li, differing by the bracts, ca. 3×0.75 mm in *P. huangii* (vs. ca. 4.5×3 mm in *P. bipinnatifida*); pedicel 10–20 mm long (vs. 4–10 mm long); corolla 14–16 mm long (vs. ca. 10 mm long); corolla tube 11–12 mm long (vs. ca. 7 mm long); adaxial lip ca. 3 mm long (vs. ca. 1.2 mm long); staminodes 3, lateral ones 2–2.5 mm long (vs. ca. 0.8 mm long); pistil 10–12 mm long (vs. ca. 8 mm long).

Herbs perennial. Stem axis extremely short with indistinct internodes. Leaves 20–30, basal, herbaceous; petiole subterete, 8–12 cm long, 2–3 mm in diam., pubescent and glandular-pubescent; blade ovate to

rhombic, $3\text{--}5 \times 2\text{--}4$ cm, pubescent and glandular-pubescent on both surfaces, base cordate to deeply cordate, margin bipinnatifid, apex lanceolate; conspicuously palmately 5–8-nerved. Cymes 5–15, axillary, 1–3-branched, 15–20-flowered; peduncle 8–11 cm long, ca. 1 mm in diam., pubescent and glandular-pubescent; bracts 2, opposite, lanceolate, ca. 3×0.75 mm, margin entire, pubescent and glandular-pubescent; pedicel 10–20 mm long, pubescent and glandular-pubescent. Calyx 5-parted to base, lobes lanceolate-linear, $4\text{--}7 \times 0.5\text{--}1$ mm, apex acuminate, outside pubescent and glandular-pubescent, inside sparsely puberulent, margins entire. Corolla white, 14–16 mm long, outside puberulent and glandular-pubescent, inside sparsely puberulent, with 2 pale brown stripes at the bottom of the corolla; corolla tube 11–12 mm long, 3–4 mm in diam. at the mouth, ca. 2 mm in diam. at the base; limb distinctly 2-lipped, white; adaxial lip 2-parted to over the middle, lobes

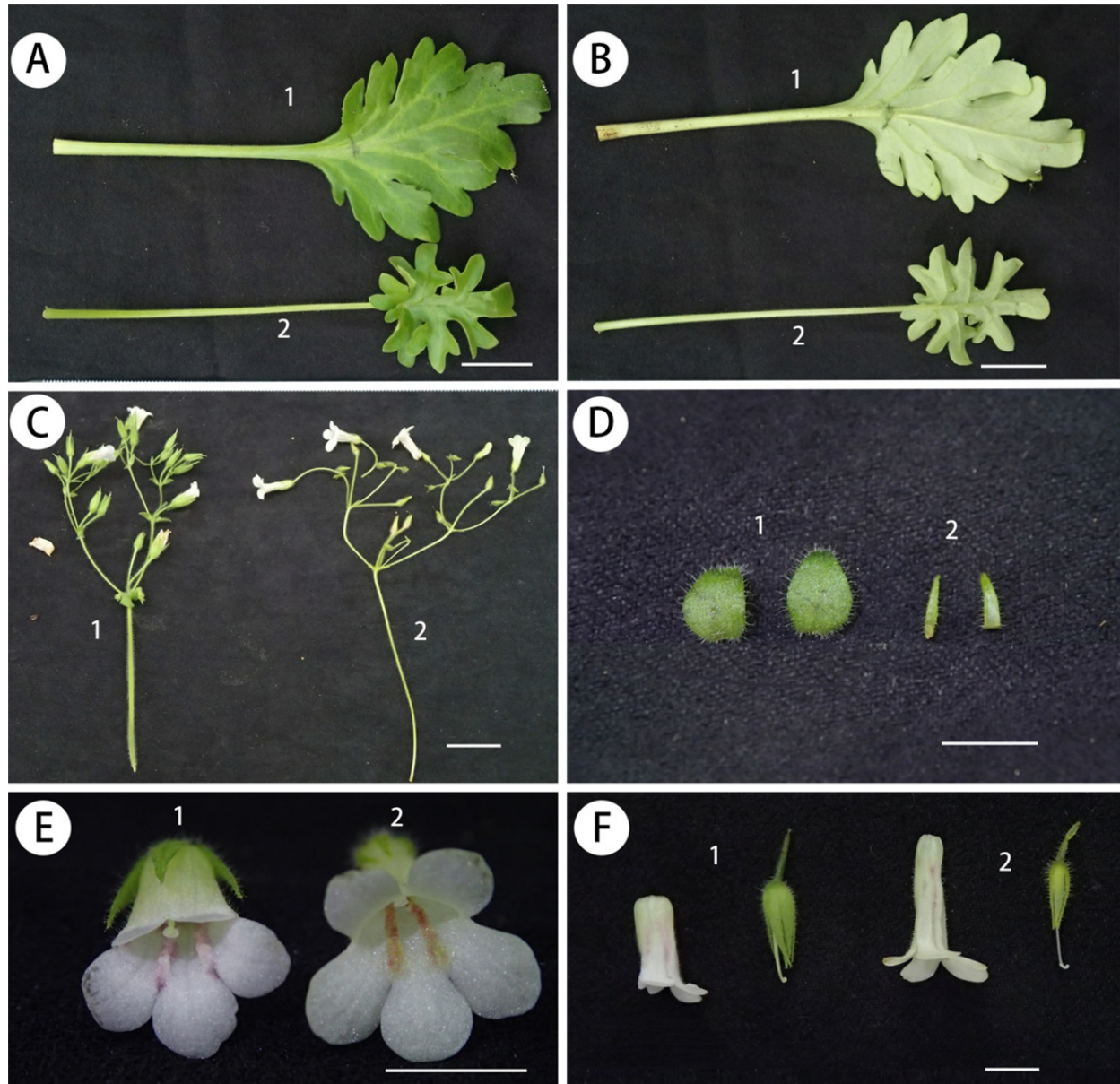


Fig. 4. Morphological comparison of *Primulina huangii* and *P. bipinnatifida*. 1. *P. bipinnatifida*; 2. *P. huangii*. **A:** The adaxial surface of leaf blades. **B:** The abaxial surface of leaf blades. **C:** Cymes. **D:** Bracts. **E:** Frontal view of corolla. **F:** Corolla, pistil and calyx. **Scale bar:** A-C = 2 cm; D-F = 5 mm.

oblong or rounded, ca. 3 × 3 mm; abaxial 3-lobed to over the middle, lobes oblong or rounded, 3–4 × 3–4 mm; stamens 2, adnate to 2–2.5 mm above the corolla tube base; filaments linear, 4–5 mm long, geniculate near the base, sparsely puberulent and glandular-puberulent; anthers 1.5–2 mm long, dorsifixed, glabrous, 2 anthers cohering; staminodes 3, lateral ones 2–2.5 mm long, apex capitate, sparsely puberulent and glandular-puberulent, adnate to 1.5–2 mm above corolla tube base, middle one 0.5–0.8 mm long, inconspicuously, adnate to 0.5–0.8 mm above base of corolla tube. Disc annular, ca. 0.7 mm high, margin repand, glabrous. Pistil 10–12 mm long, ovary

narrowly ovoid, 2–3 mm long, 1–1.5 mm across, glandular-puberulent; style 7–8 mm long, glandular-puberulent; stigma linguiform, ca. 1 mm long, ca. 0.8 mm wide.

Distribution and habitat: *Primulina huangii* is only known from the type locality in Taiyangcun Town, Liunan District, Liuzhou City, Guangxi Zhuangzu Autonomous Region, China. It grows on moist limestone rock surfaces and crevices of limestone hills.

Phenology: Flowering from August to September.

Etymology: The new species is named after Mr. Yi Huang, who first discovered and collected this species.

Provisional IUCN Conservation Assessment: EN



B2ab (i, ii, iii). Following the 2012 IUCN Red List Categories and Criteria (IUCN 2012), this species is assessed as endangered based on an estimated area of occupancy less than 10 km² (criterion B2), no more than five known-to-exist locations (B2a), a projected decline in the extent of occurrence (B2bi), the area of occupancy (B2bii) and the area, extent, and/or quality of habitat (B2biii). At present, the known populations are mainly threatened by the serious dust pollution caused by a large cement factory nearby., which leads to limestone-vegetation degradation. At the same time, their local limestone-mining project for the cement factory is also slowly encroaching on the area known as the only habitat of *Primulina huangii*. Both factors have aggravated the endangered condition of the specie.

Table 2. Morphological comparison of *Primulina huangii* and *P. bipinnatifida*

Characters	<i>P. huangii</i>	<i>P. bipinnatifida</i>
Bracts	ca. 3 × 0.75 mm	ca. 4.5 × 3 mm
Pedicel	10–20 mm long	4–10 mm long
Corolla	14–16 mm long	ca. 10 mm long
Corolla tube	11–12 mm long	ca. 7 mm long
Adaxial lip	ca. 3 mm long	ca. 1.2 mm long
Staminodes	lateral ones 2–2.5 mm long	lateral ones ca. 0.8 mm long
Pistil	10–12 mm long	ca. 8 mm long

ACKNOWLEDGEMENTS

This study was supported by the Foundation of Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences; the Foundation of Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain (16-A-01-01, 16-A-01-02, 16-B-01-01, 17-259-23); the Natural Science Foundation of Guangxi (2015GXNSFB139004); Guangxi science and technology project (Guike AB16380053); the Open Project of Beijing Engineering Research Center of Rural Landscape Planning and Design (kf2017061); the STS Program of the Chinese Academy of Sciences (Grant No. KFJ-3W-No1) and Science Research Foundation of Guangxi Academy of Science (no. 2017YJJ23022). We also thank the anonymous reviewers' valuable suggestions for improvements to this paper.

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