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HUANG CY, MENG KK, GUO JQ, et al. *Primulina huangjiniana* (Gesneriaceae), a new species from Guangdong, China [J]. *Guihaia*, 2020, 40(10): 1429–1437.

Primulina huangjiniana (Gesneriaceae), a new species from Guangdong, China

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Abstract: *Primulina huangjiniana*, a new species of Gesneriaceae from Mount Danxia of Guangdong Province in China, is described and illustrated here. The new species is easily distinguished from the most morphologically similar species *P. depressa* by its shorter bracts 2.5–6 mm long (*vs.* 15–30 mm long), subequal (*vs.* unequal) calyx lobes, filaments with glandular puberulence above the middle, and geniculate near the base (*vs.* glabrous and geniculate near the middle), stigma obdeltoid, deeply 2-lobed with two linear lobes (*vs.* lamelliform, slightly 2-lobed with two acute-triangular lobes), and parietal placenta (*vs.* axile placenta). Including this new species, there are six *Primulina* species recorded in Mount Danxia. Among them, *P. danxiaensis* and *P. huangjiniana* are endemic to Danxia landform. Only two populations of *P. huangjiniana* were found with no more than 200 mature individuals in Mount Danxia. This new species could be considered as Critically Endangered (CR) according to IUCN Red List Criteria.

Key words: Danxia, Didymocarpoideae, flora of Guangdong, morphological comparison, *Primulina depressa*

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广东报春苣苔属一新种——黄进报春苣苔

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摘 要: 该文报道了在广东丹霞山发现的报春苣苔属一新种——黄进报春苣苔 (*Primulina huangjiniana*), 并对其进行了描述。该新种与同属物种短序报春苣苔 (*P. depressa*) 最为相似, 但两者在形态特征上能够很好

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地区别:黄进报春苣苔具有更短的、长 2.5~6 mm 的苞片(*vs.* 短序报春苣苔具有长 15~30 mm 的苞片,顺序下同);花萼裂片等长(*vs.* 不等长),花丝基部附近膝状突起,中部以上具腺毛(*vs.* 于中部膝状突起且无毛);柱头倒三角形,深 2 裂成 2 线形裂片(*vs.* 片状,稍 2 浅裂,裂片为三角形),侧膜胎座(*vs.* 中轴胎座)。加上该新种在内,丹霞山目前共记录有 6 种报春苣苔属植物,其中丹霞小花苣苔(*P. danxiaensis*)和该新种均为丹霞地貌特有植物。黄进报春苣苔目前在丹霞山的两个地方有发现,成年植株不超过 200 株,根据 IUCN 红色名录标准,属于极危种。

关键词: 丹霞, 长蒴苣苔亚科, 广东植物区系, 形态学比较, 短序报春苣苔

1 Introduction

The redefined *Primulina* Hance, based on the re-circumscription of recent molecular phylogenetic studies, is the largest genus in the subfamily Didymocarpoideae of Gesneriaceae with about 204 + species (including subspecies and varieties) in China (Wen et al., 2019, 2020), including nearly all previous species of *Chirita* sect. *Gibbosaccus* Clarke, all species of *Chiritopsis* W. T. Wang, and two species of *Wentsaiboea* D. Fang & D. H. Qin (Wang et al., 1998; Fang & Qin, 2004; Möller et al., 2011; Wang et al., 2011; Weber et al., 2011; Xu et al., 2012; Wang et al., 2017). Its species diversity is still growing rapidly due to numerous new species being constantly discovered and described since the past decade (Yang et al., 2018). Interestingly, more than 170 *Primulina* species are endemic to limestone karsts of South to Southwest China and North Vietnam (Wang et al., 2017; Xu et al., 2017; Hong et al., 2018; Wen et al., 2019).

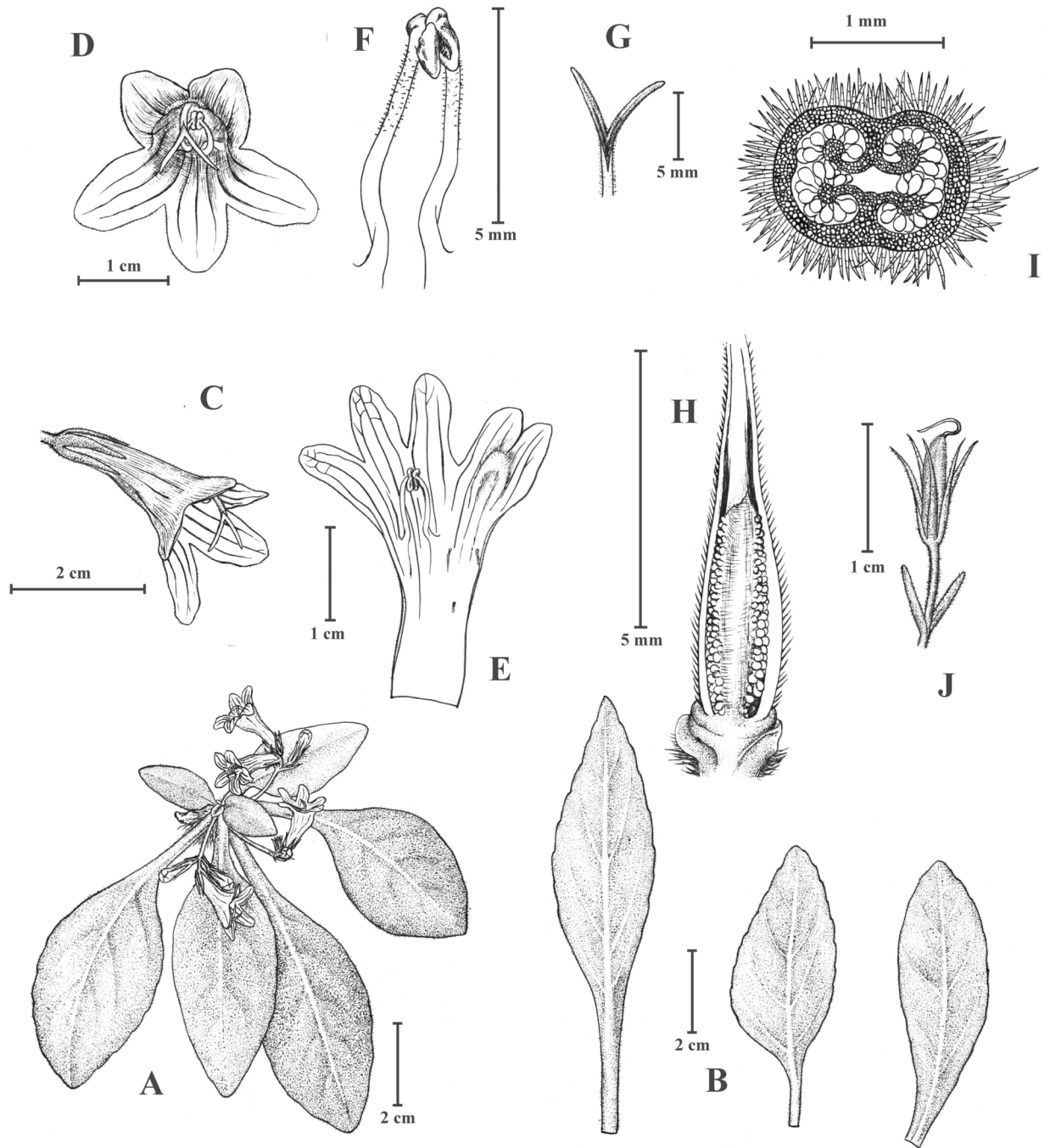
Mount Danxia in Guangdong Province is one of the famous examples of Danxia landform characterized by red-colored sandstones and conglomerates of largely Cretaceous age. In the past three decades, five endemic plant species were found there, namely, *Danxiaorchis sinchiana* J. W. Zhai, F. W. Xing & Z. J. Liu (Zhai et al., 2013), *Diospyros danxiaensis* (R. H. Miao & W. Q. Liu) Y. H. Tong & N. H. Xia. (Zhao et al., 2018; Tong & Xia, 2019), *Firmiana danxiaensis* H. H. Hsue & H. S. Kiu (Xu et al., 1987), *Primulina danxiaensis* (W. B. Liao, S. S. Lin & R. J. Shen) W. B. Liao &

K. F. Chung (Shen et al., 2010; Xu et al., 2012), and *Viola hybanthoides* W. B. Liao & Q. Fan (Fan et al., 2015). The endemism in this unique Danxia landform also arouse people's interests in the biodiversity patterns.

Since 2004, we have conducted continuous biological surveys on Mount Danxia in order to elucidate the biodiversity patterns of Danxia landforms (Peng et al., 2011). During the expeditions, a distinct *Primulina* species was collected by the third author (JQG) in 2016. Including this putative new taxon, a total of six *Primulina* species occur in Mount Danxia. The rest are *P. danxiaensis*, *P. depressa* (Hook. f.) Mich. Möller & A. Weber, *P. rotundifolia* (Hemsl.) Mich. Möller & A. Weber, *P. fimbrisepala* (Hand.-Mazz.) Y. Z. Wang, and *P. eburnea* (Hance) Y. Z. Wang (Wang et al., 1998; Wei et al., 2010; Möller et al., 2011; Weber et al., 2011; Wang et al., 2011). At the first glance, the putative new taxon looks similar to *P. depressa*, which is a relatively common species on Mount Danxia. However, after two years' field observations and the comprehensive literature studies, we confirm that it is a new species and obviously distinguished from *P. depressa*. Therefore, it is described and illustrated here.

2 Materials and Methods

Morphological observations of the new species and its close relatives were carried based on living plants in the field as well as dry specimens. High resolution image of the holotype specimen of *Primulina depressa* (deposited in K, barcoding number K000858361) was consulted on JSTOR Global Plants (<https://plants>).



A. Habit; B. Leaves; C. Flower, lateral view; D. Flower, front view; E. Detached corolla, showing stamens and staminodes; F. Fertile stamens; G. Stigma; H. Ovary, in longitudinal section; I. Ovary, in transverse section; J. Young capsule with sepals and bracts. (Drawn by Yunxiao Liu from the holotype)

Fig. 1 Illustration of *Primulina huangjiniana*

jstor. org/, accessed 10 July 2019). All morphological characters were measured using a micrometer and a stereomicroscope (Leica S8APO, Leica Microsystems Inc., Germany) and descriptions

were made following the terminology presented by Wang et al. (1998) and Li & Wang (2005). The voucher specimens are deposited in IBSC, IBK and SYS.

3 Taxonomic Treatment

Primulina huangjiniana W. B. Liao, Q. Fan & C. Y. Huang, sp. nov. Fig. 1, 2

Similar to *Primulina depressa*, but differs from it by its shorter bracts 2.5–6 mm long (*vs.* 15–30 mm long), calyx lobes subequal (*vs.* unequal), filaments glandular-puberulent above the midpoint and geniculate near the base (*vs.* glabrous and geniculate near the middle), deeply 2-lobed obdeltoid stigma with two linear lobes (*vs.* slightly 2-lobed lamelliform stigma with two acute-triangular lobes), and parietal placenta (*vs.* axile placenta).

Type. CHINA. Guangdong Province, Renhua County, Mount Danxia, on the moist rocks in forest edge, 30 m a. s. l., 20 April 2018, Q. Fan and Y. S. Huang 16997 (holotype: SYS!; isotypes: IBK!, IBSC!, SYS!).

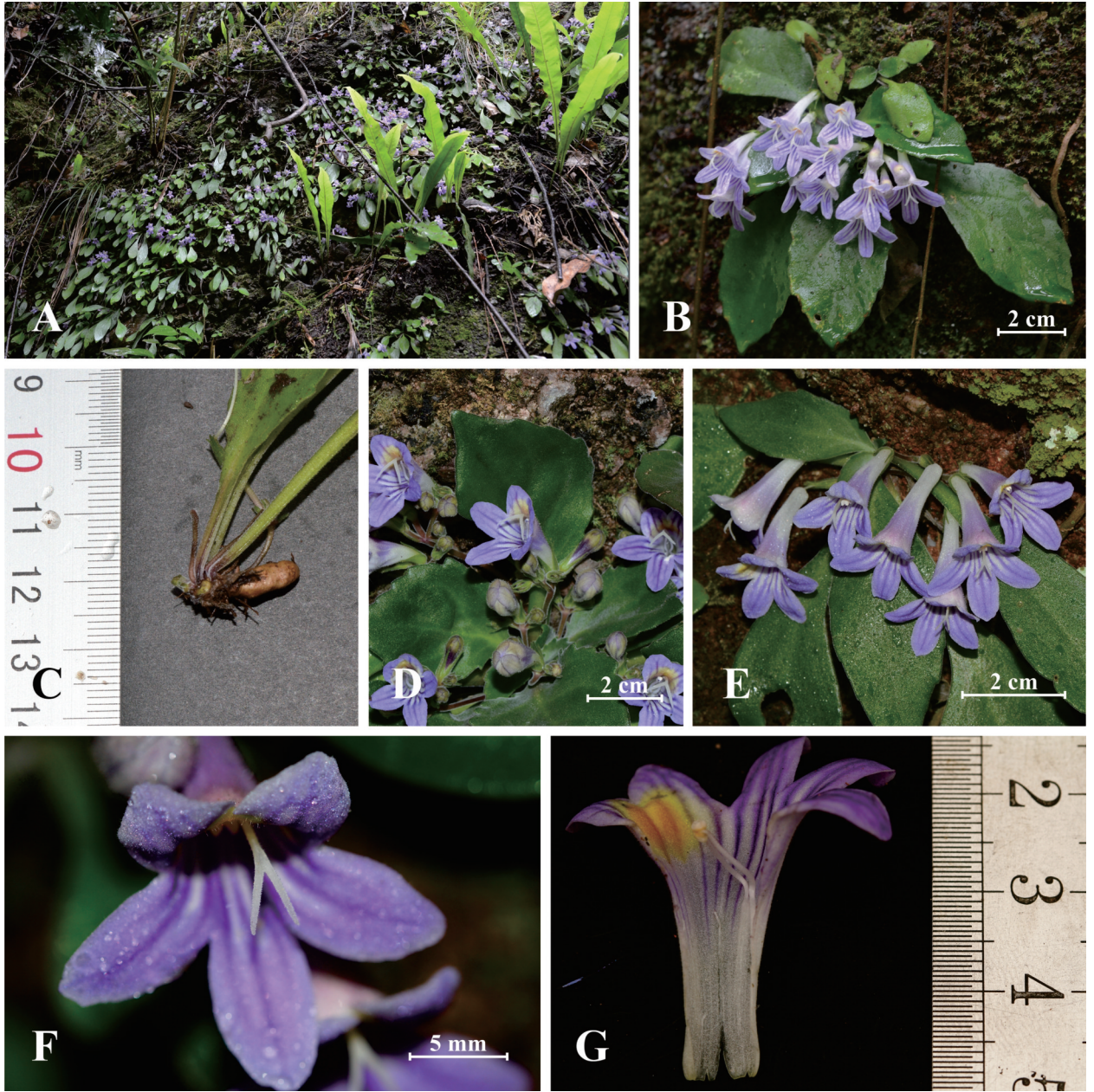
Description. Perennial herbs. Rhizome subterete, 0.5–2 cm long, 2–5 mm in diameter, internodes inconspicuous. Leaves 4–10, crowded at the apex of rhizome; petiole flattened, (0.5–) 1–4 (–7) cm long, 2–5 mm wide, pubescent; leaf blade fleshy when fresh, thin chartaceous when dried, ovate to oblong-elliptic, (2–) 3–7.5 (–10) × (1–) 1.5–4 (–5.5) cm, both surfaces densely pubescent, apex acute to obtuse, base cuneate, margin repand or inconspicuously serrate; lateral veins 3–4 on each side, inconspicuous. Cymes 2–7 or more, 1–2-branched, 1–5-flowered; peduncle 0.5–1.5 cm long, ca. 1 mm in diameter, densely pubescent; bracts 2, opposite, green, linear–lanceolate, 2.5–6 × ca. 1 mm, margin entire, apex acute, densely pubescent on both surfaces; pedicel 2–5 mm long, ca. 1 mm in diameter, densely pubescent. Calyx 5-parted to base; lobes lanceolate, 6–12 × 1–1.5 mm, margin entire, both surfaces densely pubescent. Corolla 3.5–4.0 cm long, pale blue-purple or white, with bluish purple stripes inside, upper part of the interior of the corolla with a yellowish brown

marking, outside sparsely puberulent, inside glabrous; corolla tube tubular to infundibuliform, 2.4–3.1 cm long, 7–10 mm in diameter at the mouth, 3–4 mm in diameter at the base; limb distinctly 2-lipped, adaxial lip 2-lobed, lobes ovate, 8–10 × 5–7 mm, abaxial lip deeply 3-lobed, lobes oval to oblong, 10–12 × 5–7 mm. Stamens 2, adnate to 1.5–2 cm above the corolla tube base; filaments linear, 8–13 mm long, geniculate near the base, with glandular trichomes above the midpoint; anthers fused by the entire adaxial surfaces, 1.5–3.5 mm long, glabrous. Staminodes 3, the lateral ones 2–5.5 mm long, apex capitate, adnate to 1.3–2 cm above the corolla tube base, the middle one 0.5–1 mm long, sometimes absent, adnate to 1–1.2 cm above the corolla tube base, glabrous; Disc annular, ca. 1 mm in height. Pistil 2.6–3.2 cm long, ovary conical, 3–4.5 mm long, 1–2 mm in diameter, densely pubescent; style 2.6–3.2 cm long, ca. 0.8 mm in diameter, pubescent; stigma obdeltoid, deeply 2-lobed, 4–8 mm long, lobes linear. Capsule ovoid to cylindrical, 4–9 mm long, 2–3 mm in diameter, densely pubescent.

Distribution and habitat. *Primulina huangjiniana* is currently known only from two localities on Mount Danxia, Renhua County, North Guangdong, China. The species grows on moist rocks in forest edge or on sunny rocks of the cliff. The associated herb species mainly include *Microsorium fortunei* (T. Moore) Ching, *Onychium japonicum* (Thunb.) Kze., *Selaginella davidii* Franch., *S. delicatula* (Desv.) Alston and *Youngia heterophylla* (Hemsl.) Babcock & Stebbins.

Preliminary conservation status. Only two populations were found with no more than 200 mature individuals in a total area of about 0.5 km². The localities of two populations are over 10 km apart. Thus, the species could be considered as Critically Endangered (CR, B2a) according to IUCN Red List Criteria (IUCN, 2017).

Phenology. Flowers from March to May and fruits from April to June (observation by QF and JQG in the field from March 2017 to November 2018).



A. Habitat; B. Habit; C. Rhizome; D. Cymes with flowers and flower buds; E. Flowers in front view, showing the tubular corolla; F. Flower in front view, showing the deeply bifid stigma and the linear lobes; G. Detached corolla, showing the yellowish brown marking on upper part of the interior of the corolla. [Photos taken by Qiang Fan (A-E) and Zaixiong Chen (F-G)]

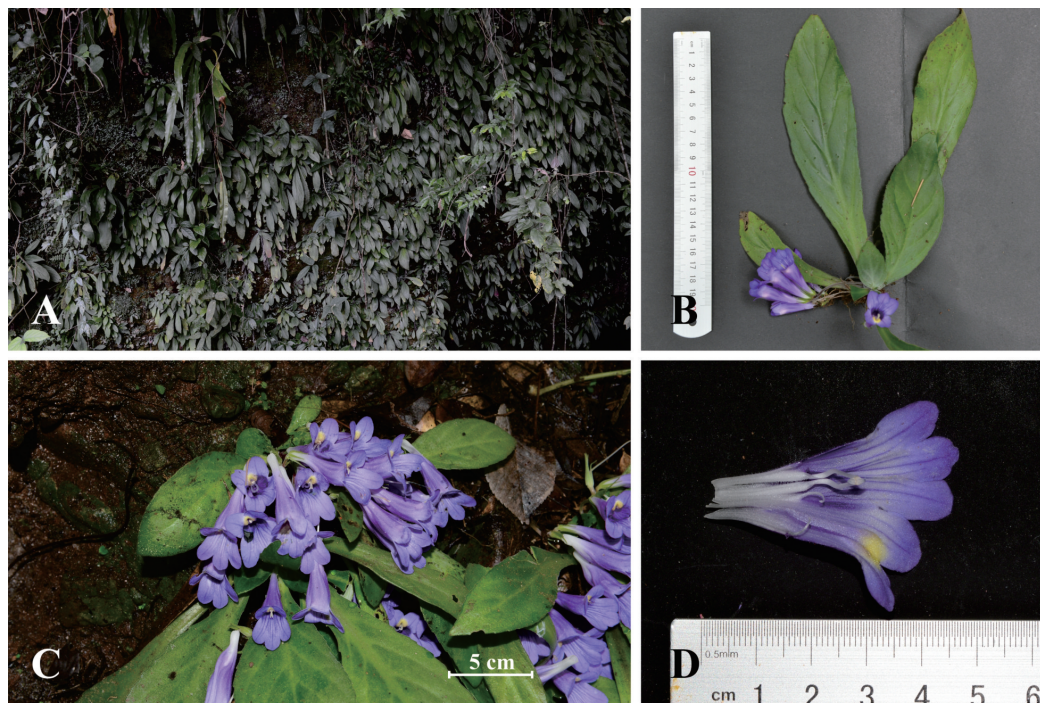
Fig. 2 Photographs of *Primulina huangjiniana*

Etymology. The specific epithet is in honor of Prof. Jin Huang (1927 – 2016) of Sun Yat-sen University, a brilliant expert who made a great contribution to Danxia landform research.

Vernacular name. The Chinese pronunciation of this new species is Huáng Jìn Bào Chūn Jù Tái (黄进报春苣苔).

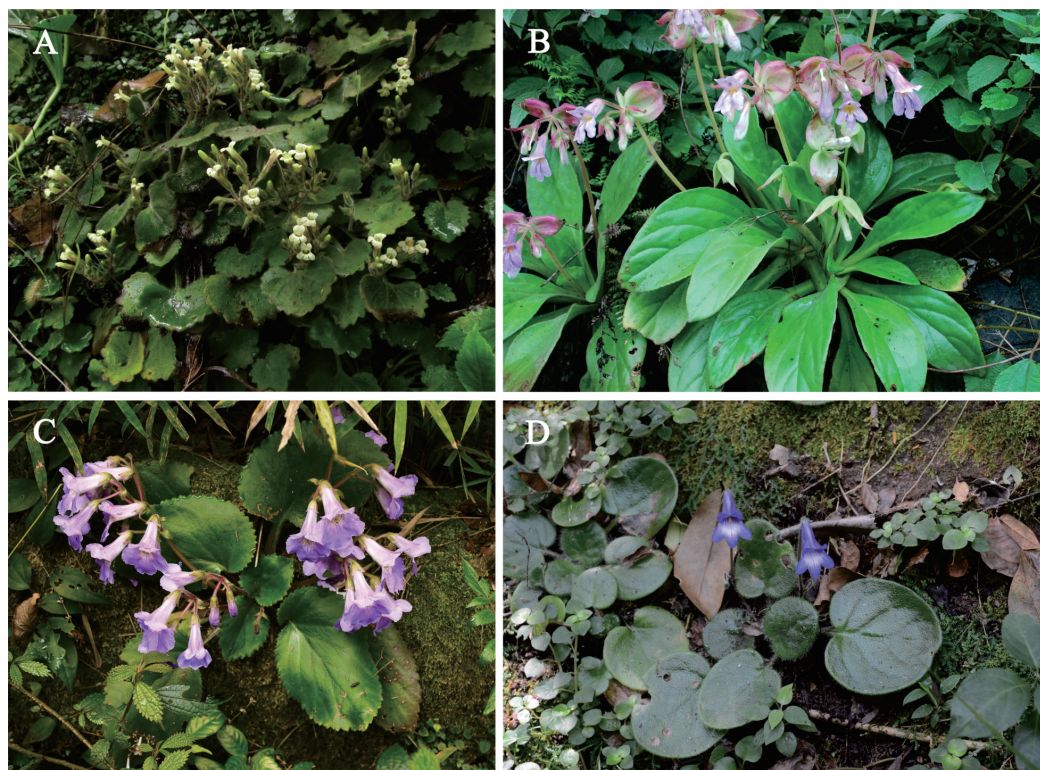
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Notes. The closest relative of *Primulina huangjiniana* on morphological grounds appears to be *P. depressa* (Fig. 3), which is also an endemic species in North Guangdong, China. The type locality of *P. depressa* was recorded in a district on North River of



A. Habitat; B. Habit; C. Flowers, front view; D. Detached corolla, showing stamens and staminodes. (Photos taken by Qiang Fan)

Fig. 3 Photographs of *Primulina depressa*



A. *Primulina danxiaensis*; B. *P. eburnea*; C. *P. fimbripesala*; D. *P. rotundifolia*. [Photos taken by Qiang Fan (A, D), Huagu Ye (B) and Feifei Li (C)]

Fig. 4 Photographs of four *Primulina* species on Mount Danxia

Table 1 Diagnostic character differences between *Primulina huangjiniana* sp. nov. and its close relatives *P. depressa*

Characters	<i>P. huangjiniana</i>	<i>P. depressa</i>
Rhizome	0.5–2 cm long, 2–5 mm in diameter	1–3.5 cm long, 6–12 mm in diameter
Leaf blade	Ovate to oblong-elliptic, (2–) 3–7.5 (–10) × (1–) 1.5–4 (–5.5) cm	Broadly lanceolate to oblong, 8–20 × 3–7 cm
Petiole	(0.5–) 1–4 (–7) cm long	4–10 cm long
Bracts	2.5–6 × ca. 1 mm	15–30 × 1.5–3 mm
Calyx lobes	Subequal, 6–12 × 1–1.5 mm	Unequal, 13–2 × 1.5–2 mm
Corolla	3.5–4 cm long, abaxial lip 3-partite, and lobes oblong	4.5–5 cm long, abaxial lip 3-lobed, and lobes rounded
Filaments	With glandular trichomes above the midpoint, geniculate near the base	Glabrous, geniculate near the midpoint
Stigma	Obdeltoid, deeply 2-lobed, and lobes linear	Lamelliform, slightly 2-lobed, and lobes acute-triangular
Placenta	Parietal placenta	Axile placenta

Key to differentiate the new species and other species from Mount Danxia of Guangdong, China

1. Corolla yellowish, smaller, 12–15 mm long *Primulina danxiaensis*
1. Corolla non-yellow, bigger, ≥ 25 mm long 2
 2. Leaf blade margin serratus to dentate 3
 2. Leaf blade margin entire 5
 3. Peduncle 6–28 cm long or longer, corolla inside purple-stained *P. fimbrisepala*
 3. Peduncle ≤ 5 cm long or shorter, corolla inside no purple-stained 4
 4. Bracts 15–30 × 1.5–3 mm, corolla 4.5–5 cm long *P. depressa*
 4. Bracts 2.5–6 × ca. 1 mm, corolla 3.5–4 cm long *P. huangjiniana*
 5. Leaf blade orbicular-ovate to orbicular-reniform, bracts narrowly triangular, 4–6 × 0.8–1 mm
..... *P. rotundifolia*
 5. Leaf blade ovate to elliptic or obovate, bracts ovate to orbicular-ovate, 10–45 × 8–28 mm
..... *P. eburnea*

Guangdong Province (Hooker, 1892), but without detailed location. In fact, it is a very common species on the moist rocks of Mount Danxia, but interestingly, it never grows together with *P. huangjiniana*. It had been mistaken to be *P. depressa* before anatomical studies were done to find its parietal placenta differed from *P. depressa*'s axile placenta.

The two species share some similar characters, e.g. peduncles usually shorter than the petioles that makes the flowers appear nestled among the leaves, a

piece of yellowish brown marking on the upper part of the interior of the corolla, and a relatively smaller capsules (less than ca. 1 cm long in length) compared to other *Primulina* species having large corolla which usually have longer linear capsules with the length 1–5 cm (except the previous *Chiritopsis* and *Wentsaiboea* species). However, *Primulina huangjiniana* can be readily distinguished from *P. depressa* by its slender rhizome (2–5 mm vs. 6–12 mm in diameter), shorter leaf blade (3–7.5 cm long vs. 8–20 cm long) and bracts

(2.5–6 mm long *vs.* 15–30 mm long), calyx lobes subequal (*vs.* unequal), filaments with glandular-puberulent above the middle and geniculate near the base (*vs.* filaments glabrous and geniculate near the middle), deeply 2-lobed obdeltoid stigma with two linear lobes (*vs.* slightly 2-lobed lamelliform stigma with two acute-triangular lobes), and parietal placenta (*vs.* axile placenta) (Table 1). In addition, the two species have different flowering time. After two years' field observation on Mount Danxia, we found that *P. huangjiniana* blossomed from March to May, while *P. depressa* blossomed from April to June.

Differences between the new species, its morphologically related species and other species from the Mount Danxia are shown in the following identification key (Fig. 3, Fig.4):

Additional specimen examined (paratypes).

CHINA. Guangdong Province, Renhua County, Mount Danxia, on sunny rocks, 466 m a. s. l., 20 April 2018 (fl.), *Q. Fan and Y. S. Huang* 16995 (SYS); the same locality, 125 m a.s.l., 2 June 2018 (fr.), *Q. Fan* 17003 (SYS).

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