



A new species of *Primulina* (Gesneriaceae) from Danxia landform in Jiangxi, China

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ABSTRACT: Based on morphological observations and comparisons, a new species of *Primulina* (Gesneriaceae), *P. inflata* Li.H. Yang & M.Z. Xu, is described and illustrated. This new species resembles *P. xiuningensis* in leaf blade shape and indumentum, and differs from the latter by the white corolla with longitudinally purple-red stripes (vs. yellowish without stripes), inflated tubular corolla tube (vs. tubular) and straight filament (vs. geniculate). The descriptions, illustrations and photographs of this new species are provided here.

KEY WORDS: China, Gesneriaceae, *Primulina*, *Primulina inflata*, *P. xiuningensis*, Taxonomy.

INTRODUCTION

The newly defined genus, *Primulina* (Gesneriaceae), comprises a monophyletic group of perennial herbs (Wang *et al.*, 2011; Weber *et al.*, 2011), and shows a great species diversity with about 200 species (Möller, 2019; Wen *et al.*, 2019). In contrast, it displays a high conservation of edaphic habitat specialization, with the majority of species occurring in calcareous soil originated from karst limestone bedrock (i.e. calciphiles, Hao *et al.*, 2015). In contrast to its general association with karst soil habitats, there are a few species confined to Danxia soil, which is a red or purple soil derived from the red terrigenous sediment beds found in the Danxia landforms. These species include *P. xiuningensis* (X.L. Liu & X.H. Guo) Mich. Möller & A. Weber (Liu and Guo, 1989; Weber *et al.*, 2011), *P. danxiaensis* (W.B. Liao, S.S. Lin & R.J. Shen) W.B. Liao & K.F. Chung (Shen *et al.*, 2010; Xu *et al.*, 2012), *P. langshanica* (W.T. Wang) Yin Z. Wang (Wang, 1992; Wang *et al.*, 2011), *P. bobaiensis* Q.K. Li, Q. Zhang & W.L. Li (Li *et al.*, 2015), *P. suichuanensis* X.L. Yu & J.J. Zhou (Zhou *et al.*, 2016) and *P. hengshanensis* L.H. Liu & K.M. Liu (Tian *et al.*, 2018). Similar to the karst landform, the unique physical and chemical characteristics of Danxia soil generate a range of microclimatic and edaphic habitats, which possibly play an important role in the diversification and evolution of the genus *Primulina* (Hao *et al.*, 2015).

During field investigations of Gesneriaceae in southeastern China in August, 2016, we found a population of Gesneriaceae with small plant size in Xingguo County, Jiangxi Province. We reconciled the results of morphological comparison with its congeners from descriptions in the literature and comparison with

herbarium specimens in IBSC, IBK and PE (Wang, 1981a, b; Liu and Guo 1989; Wang *et al.*, 1998; Fang and Qin 2004; Li and Wang 2004; Wei *et al.*, 2010). We concluded that the characters including the small plant size, slightly fleshy leaves, and chiritoid stigma place it in the hitherto genus *Chiritopsis* W.T. Wang (1981a), which had been incorporated into the redefined genus *Primulina* based on molecular phylogenetical analyses (Wang *et al.*, 2011; Weber *et al.*, 2011). We further observed that the small white flowers with the distinct stripes are reminiscent of those of *P. renifolia* (D. Fang & D.H. Qin) J.M. Li & Yin Z. Wang (Fang and Qin 2004; Wang *et al.*, 2011), although here, the leaf blade is reniform or sub-cordate and glandular puberulent (vs. ovate to broadly ovate, puberulent), the corolla tube is much shorter, abaxially swollen and slightly narrowed at base (vs. inflated in the middle at both abaxial and adaxial directions, strongly narrowed at base), and the stigma is subhippocrepiform and undivided (vs. obtapeziform, divide). The overall plant habit of the newly collected material is morphologically most similar to *P. xiuningensis* despite that this species lacks the stripes in its yellowish corolla. We decided that the new material represented a new species in *Primulina* which is described and illustrated below.

TAXONOMIC TREATMENT

Primulina inflata Li.H. Yang & M.Z. Xu, *sp. nov.*

粗筒小花苣苔 Figs. 1 & 2; Tab. 1

Type: China, Guangdong Province, Guangzhou City, voucher from cultivated plants at South China Botanical Garden, 13 April 2019 (flowering), Li-Hua Yang, YLH1024 (holotype: SCBI0849964, isotypes: SCBI0849965, IBK), originally corrected in Jiangxi

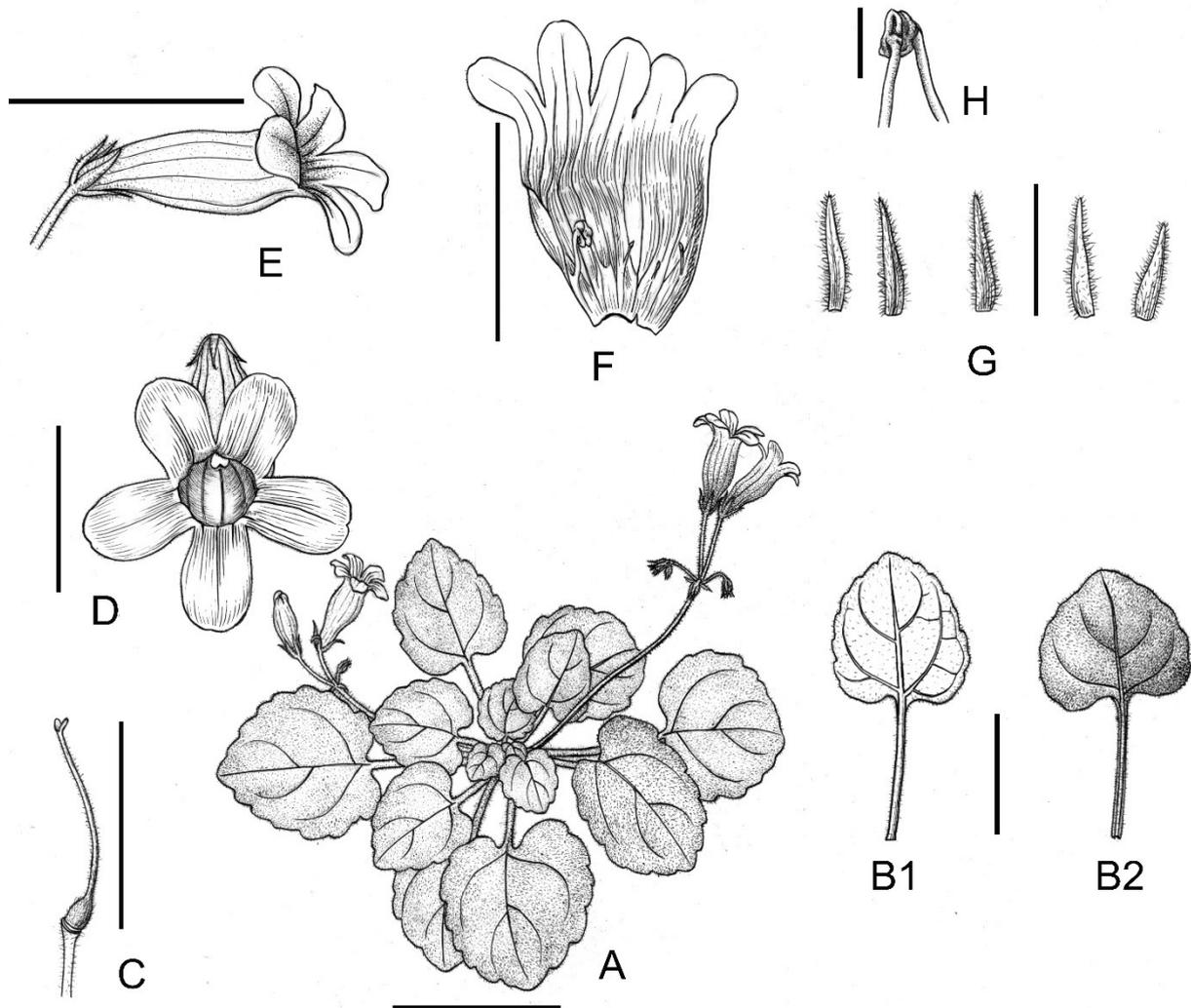


Fig. 1. *Primulina inflata* sp. nov. **A**, habit, **B1**, abaxial leaf surface, **B2**, adaxial leaf surface, **C**, pistil, **D**, flower in front view, **E**, flower in side view, **F**, opened corolla, showing stamens and staminodes, **G**, calyx lobes, **H**, coherent anthers. Scale bars: A, B=20 mm, C, E, F=10 mm, D=5 mm, G=3 mm, H=2 mm. Drawn by Yun-Xiao Liu based on cultivated individual collected from type locality.

Province, Xingguo County, Changgang Town, Bingxindong scenic area, growing on moist rock surface of Danxia landform, elevation ca. 200 m a.s.l., 26°21'47.26"N, 115°25'40.85"E, 8 August 2016, Mei-Zhen Xu *et al.*, JXXG01.

Diagnosis: *Primulina inflata* differs from *P. xiuningensis* by the white corolla with longitudinally purple-red stripes (vs. yellowish without stripes), inflated corolla tube (vs. tubular) and straight filaments (vs. geniculate).

Perennial herb. Rhizomatous stem subterete, 5–10 mm long, 2–5 mm in diameter. Leaves 8–12, basal, more or less opposite at young stage, spiral in mature plants; petiole 15–25 × ca. 1.5 mm, puberulent; leaf blade slightly fleshy when fresh, thinly chartaceous when dried, ovate to broadly ovate, 20–25 × 18–22 mm, with adaxial

surfaces densely puberulent and abaxial surfaces slightly puberulent, obtuse or subacute at apex, subcordate to broadly cuneate at base, with repand-denticulate to nearly entire margin; lateral veins 3 on each side, abaxially prominent, adaxially impressed. Cymes 3–6, axillary, one per axil, 4–8-flowered; peduncles 30–50 mm long, densely puberulent; bracts 2, opposite, lanceolate-linear, 2–3 × ca. 1 mm, outside densely puberulent, inside glabrescent, margin entire. Pedicel 8–12 mm long, ca. 1 mm in diameter, densely puberulent. Calyx 5-parted to near base, lobes lanceolate-linear, 2–3 × ca. 1 mm, outside densely puberulent, inside glabrescent, margin entire. Corolla 12–15 mm long, white, outside puberulent, inside glabrescent and with three longitudinally purple-red stripes per lobe, and the stripes are more prominent on the adaxial side; corolla

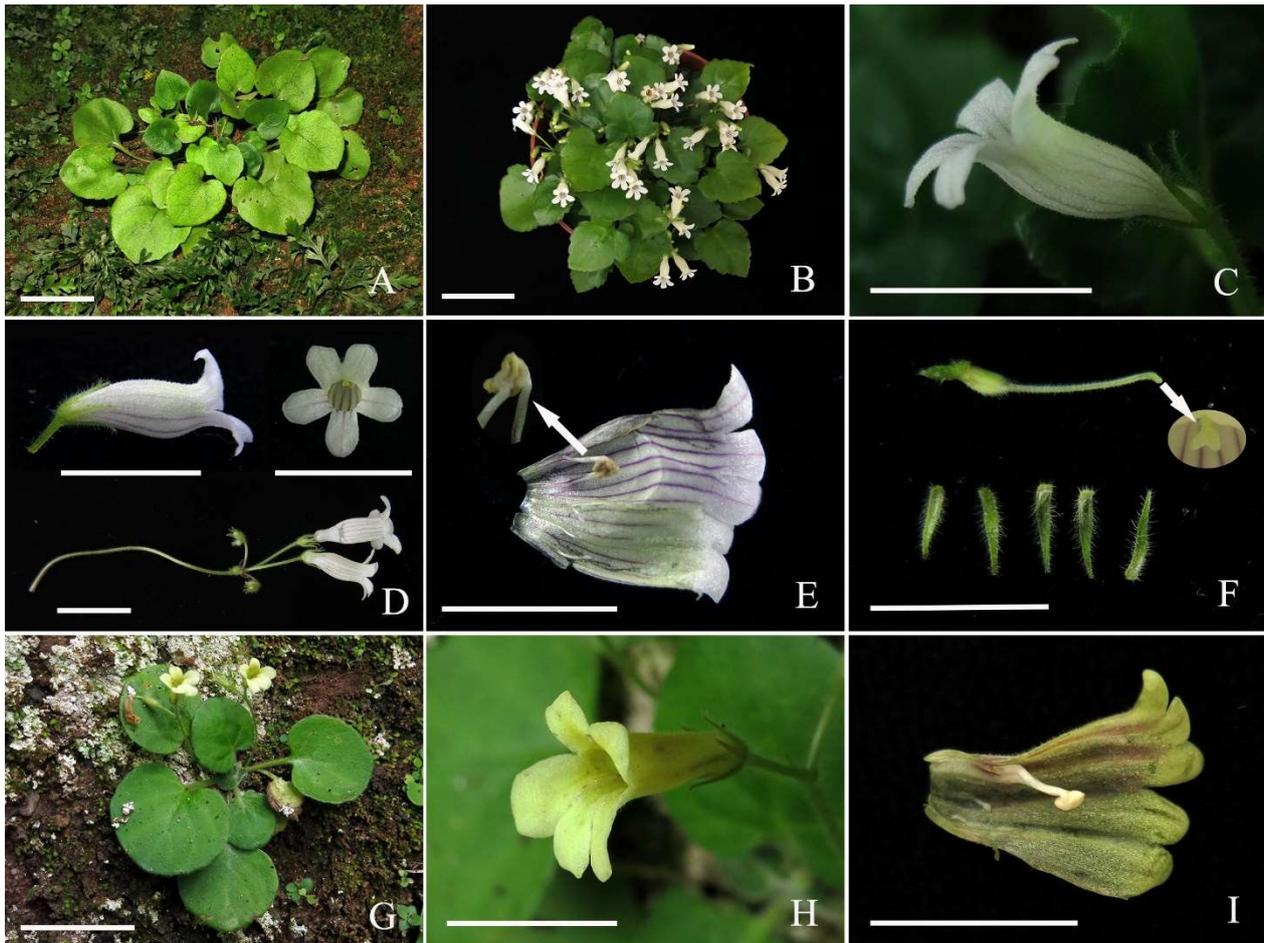


Fig. 2. *Primulina inflata* sp. nov. (A–F) and *P. xiuningensis* (G–I). **A, G.** habit, **B.** flowering plant cultivated in SCBG, **C, H.** flower in side view, **D.** cyme, **E, I.** opened corolla, showing stamens and staminodes, **F.** pistil and calyx lobes, inset enlarged view of stigma. Scale bars: A, B, G=20 mm, C–F, H, I=10 mm. Arrows indicate the anthers (in E) and stigma (in F).

tube inflated in the middle, 8–10 mm long, 2–3 mm in diameter at the mouth, 4–5 mm in diameter in the middle; limb distinctly 2-lipped; adaxial lip 2-parted, with lobes oblong, ca. 3 × ca. 2 mm, rounded at apex; abaxial 3-lobed, with lobes oblong, ca. 3 × ca. 2 mm, rounded at apex. Stamens 2, adnate to ca. 2 mm above the corolla tube base; filaments linear, ca. 3 mm long, white, straight, glabrous; anthers reniform, fused by entire adaxial surfaces, ca. 1.5 mm long, glabrous; staminodes 3, adnate to ca. 2 mm above the corolla tube base, lateral ones ca. 2 mm long, middle one ca. 1 mm long. Disc annular, ca. 0.3 mm in height. Pistil ca. 10 mm long; ovary narrowly ovoid, ca. 2 mm long, ca. 1 mm in diameter, densely puberulent; style ca. 8 mm long, densely puberulent; stigma chiritoid, lower lobe obtrapeziform and ca. 1 mm long, lobes ca. 0.3 mm long. Capsule narrowly ovoid, straight, ca. 5 mm long.

Distribution and habitat: As most other *Primulina* species, *P. inflata* is a species endemic to Xingguo County, Jiangxi Province. Based on our field investigations, this new species is only found at its type

locality at Bingxindong scenic area in a Danxia Geopark. Plants of this new species grow on the moist rock surface of a cave entrance. We observed about 200 mature individuals of this new species at the type locality in 2016, but no more than 50 mature individuals in 2018. The serious reduction of the population size mostly resulted from human disturbance. Based on this information, *P. inflata* is considered as Critically Endangered (CR): B2a,b(iii,v); C2a(i), following the IUCN categories and criteria (IUCN 2016). However, our field investigations on this species are insufficient, and more fieldwork is required to comprehensively understand its geographical distribution.

Phenology: Flowering time is April, fruiting time is May.

Etymology: The specific epithet is derived from the inflated corolla tube of this new species.

Notes: We describe a new species, *Primulina inflata*, which is morphologically similar to *P. xiuningensis* (Fig. 2). Both of these two species occurring in the Danxia landform in southeastern China (Wang *et al.*, 1998; Li and

**Table 1.** Morphological comparison of *Primulina inflata* and *P. xiuningensis*.

Characters	<i>P. inflata</i>	<i>P. xiuningensis</i>
Peduncle length	30–50 mm long	30–140 mm long
Corolla tube	inflated in the middle	not inflated
Corolla color	white	yellow
Corolla inside	with longitudinally purple-red stripes	without stripes
Filament	straight	geniculate
Flowering time	April	July–August

Wang 2004; Wei *et al.*, 2010), but without overlapping distributions. We provide the detailed morphological comparison between the new species and *P. xiuningensis* in Table 1. *Primulina inflata* is most characterized by a small habit and small white corolla with distinct stripes. Such gross morphology, particularly in flower characteristics is reminiscent of other species among Chinese Gesneriaceae such as *Metapetrocosmea peltata* (Merr. & Chun) W.T. Wang (Wang, 1981b). However, the capitate stigma and nearly globose capsule of the latter (Wang *et al.*, 1998) readily differentiates it from *P. inflata* with its chiritoid stigma and narrowly ovoid capsule. These characteristics are typical for species in the enlarged genus *Primulina* (Weber *et al.*, 2011). A small striped corolla occurs also in other *Primulina* species, such as *P. renifolia* (Wang *et al.*, 1998), but there are other differences in corolla and leaf characteristics that distinguishes it from the new species. The inflated corolla tube of the new species is an unusual feature in *Primulina* and thus provided the species epithet for the new species, *P. inflata*.

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LITERATURE CITED

- Chang, Y., A. Ebihara, S. Lu, H. Liu and H. Schneider. Fang, D. and D.-H. Qin. 2004. *Wentsaiboea* D. Fang & D. H. Qin, a new genus of the Gesneriaceae from Guangxi, China. *Acta Phytotaxon. Sin.* **42**(6): 533–536.
- Hao, Z., Y.-W. Kuang and M. Kang. 2015. Untangling the influence of phylogeny, soil and climate on leaf element concentrations in a biodiversity hotspot. *Funct. Ecol.* **29**(2): 165–176.
- IUCN. 2016. Guidelines for using the IUCN red list categories and criteria, ver. 12. IUCN Standards and Petitions Subcommittee.
- Liu, X.-L. and X.-H. Guo. 1989. A new species of *Chiritopsis* from Anhui. *Bul. Bot. Res.* **9**(3): 51–54. (in Chinese)
- Li, Z.-Y. and Y.-Z. Wang. 2004. Plants of Gesneriaceae in China. Henan Science and Technology Publishing House, Zhengzhou, China, pp 171–261. (in Chinese)
- Li, Q.-K., Q. Zhang, T. Deng, B. Pan, Y.-S. Huang and W.-L. Li. 2015. *Primulina bobaiensis*, a new species of Gesneriaceae from Guangxi, China and its phylogenetic placement revealed by the chloroplast *matK* gene. *Guihaia* **35**(2): 143–150.
- Möller, M. 2019. Species Discovery in Time: An Example from Gesneriaceae in China. *Guangxi Sciences.* **26**(1): 1–15.
- Shen, R.-J., S.-S. Lin, Y. Yu, D.-F. Cui and W.-B. Liao. 2010. *Chiritopsis danxiaensis* sp. nov. (Gesneriaceae) from Mount Danxiashan, south China. *Nord. J. Bot.* **28**(6): 728–732.
- Tian, J., L. Liu, S.-Y. Xiao, X.-W. Zhu, Y.-J. Wu, L. Zhou, J. Yin, L. Pen, X.-Z. Cai, L.-H. Liu, Y.-D. Liu and K.-M. Liu. 2018. *Primulina hengshanensis* (Gesneriaceae), a new species from Danxia landform in Hunan, China. *Phytotaxa* **333**(2): 293–297.
- Wang, W.-T. 1981a. Quinque genera nova Gesneriacearum E Sina. *Bull. Bot. Res.* **1**(3): 21–28.
- Wang, W.-T. 1981b. Notulae de Gesneriaceis Sinensibus (II). *Bull. Bot. Res.* **1**(4): 35–75.
- Wang, W.-T. 1992. Study on Gesneriaceae from China (X). *Guihaia* **12**(4): 289–300.
- Wang, W.-T., K.-Y. Pan and Z.-Y. Li. 1998. Gesneriaceae. In: Wu, Z.-Y. and P.-H. Raven (eds.), *Flora of China* 18. Science Press, Beijing, China and Botanical Garden Press, St. Louis, Missouri, USA. pp 77–120.
- Wang, Y.-Z., R.-B. Mao, Y. Liu, J.-M. Li, Y. Dong, Z.-Y. Li and J.F. Smith. 2011. Phylogenetic reconstruction of *Chirita* and allies (Gesneriaceae) with taxonomic treatments. *J. Syst. Evol.* **49**(1): 50–64.
- Weber, A., D. J. Middleton, A. Forrest, R. Kiew, C. L. Lim, A. R. Rafidah, S. Sontag, P. Triboun, Y.-G. Wei, T.-L. Yao and M. Möller. 2011. Molecular systematics and remodeling of *Chirita* and associated genera (Gesneriaceae). *Taxon* **60**(3): 767–790.
- Wei, Y.-G., F. Wen, M. Möller, A. Monro, Q. Zhang, Q. Gao, H.-F. Mou, S.-H. Zhong and C. Cui. 2010. Gesneriaceae of South China. *Guangxi Science and Technology Publishing House*, pp 457–490. (in Chinese and English)
- Wen, F., S. Li, Z.-B. Xin, L.-F. Fu, X. Hong, L. Cai, J.-Q. Qin, B. Pan, F.-Z. Pan and Y.-G. Wei. 2019. The Updated Plant List of Gesneriaceae in China against the Background of Newly Chinese Naming Rules. *Guangxi Sciences* **26**(1): 37–63. (in Chinese with English abstract)
- Xu, W.-B., Q. Zhang, F. Wen, W.-B. Liao, B. Pan, H. Chang and K.-F. Chung. 2012. Nine new combinations and one new name of *Primulina* (Gesneriaceae) from South China. *Phytotaxa* **64**(1): 1–8.
- Zhou, D.-S., J.-J. Zhou, M. Li and X.-L. Yu. 2016. *Primulina suichuanensis* sp nov (Gesneriaceae) from Danxia landform in Jiangxi, China. *Nordic J. Bot.* **34**(2): 148–151.