Primulina pingguoensis, a New Species of Gesneriaceae from Guangxi (Postprint)

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Abstract

This study reports a new species of Primulina Hance (Gesneriaceae) from Guangxi—Primulina pingguoensis H.S. Ma & B. Pan. This new species is most similar to Primulina carinata Y.G. Wei, F. Wen & H.Z. Lü within the same genus, but the two can be clearly distinguished morphologically: in P. pingguoensis, the corolla lobes are narrowly lanceolate to linear with a length-to-width ratio >2 (vs. orbicular to ovate-orbicular with a length-to-width ratio <1.5; same order below), the inner corolla surface bears purple stripes concolorous with the corolla and lacks obvious nectar guides (vs. brown stripes discolored from the corolla with two yellow nectar guides), the corolla tube is tubular and ventrally swollen (vs. narrowly funnelform with a distinct swelling forming a clear keel), and the leaf blade is elliptic to broadly ovate, 6.5–9.5 × 4.5–6.5 cm (vs. broadly elliptic to ovate, 4.0–5.0 × 3.0–4.0 cm), among other differences.

This new species is currently known only from a large limestone cave at the type locality and its immediate vicinity; livestock farming has recently been initiated within this cave, exerting pressure on the survival space of this species.

This study assessed the extent of occurrence (EOO) and area of occupancy (AOO) of the new species, and based on the currently known populations and threats, it can be preliminarily designated as “Critically Endangered” according to IUCN Red List criteria.

As a traditional Chinese medicine, this species is utilized by local residents for removing fetal toxins in newborns and other purposes, possessing certain conservation and utilization value; ethnobotanical and medicinal botanical research on this species could be further pursued in the future.

This species faces risks of habitat destruction and wild collection; therefore, it is necessary to implement ex situ conservation, reintroduction, and related efforts.

Primulina purpureokylin F.Wen, Yi Huang & W.Chuen Chou, a species distributed in the same township as this species, is distinctly differentiated by its funnelform corolla tube, leaf blades dark green to purple with purplish-red coarse strigose hairs on both surfaces; Primulina alba R.F.Li & B.Pan, distributed within 5 km of this species, is distinguished by its markedly small flowers, tubular corolla, and pure white color.

Through comparison with other Primulina species, it was found that some species also exhibit more or less swollen corolla tubes, such as Primulina lutescens B.Pan & H.S.Ma, Primulina roseoalba (W.T.Wang) Mich. Möller & A. Weber, Primulina dryas (Dunn) Mich. Möller & A. Weber, Primulina polycephala (Chun) Mich. Möller & A. Weber, and Primulina langshanica (W. T. Wang) Yin Z. Wang, among others. It is preliminarily inferred that the swollen corolla tube in Primulina plants may be associated with specific pollinators; however, this hypothesis requires further field investigation and experimental verification.

Full Text

Preamble

Primulina pingguoensis, a new species of Gesneriaceae from Guangxi, China

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Abstract

This paper describes and illustrates *Primulina pingguoensis* H.S. Ma & B. Pan, a new species of Gesneriaceae from Guangxi Zhuang Autonomous Region, China. The new species is most similar to *Primulina carinata* Y.G. Wei, F. Wen & H.Z. Lü within the same genus, but the two can be clearly distinguished morphologically. *Primulina pingguoensis* has corolla lobes that are narrowly lanceolate to linear with a length-width ratio >2 (vs. rounded to ovate with a length-width ratio <1.5), corolla interior with purple stripes that are the same color as the corolla and lack distinct honey guides (vs. brown stripes that differ from the corolla color and have two yellow honey guides), corolla tube tubular and ventrally carinate (vs. narrowly funnelform, strongly carinate forming a clear keel), leaf blade elliptic to broadly ovate, 6.5–9.5 × 4.5–6.5 cm (vs. broadly elliptic to ovate, 4.0–5.0 × 3.0–4.0 cm), among other differences.

The new species has only been found at the type locality in a large limestone karst cave and its surrounding area. Currently, animal husbandry is being developed within the cave, which is putting pressure on the survival space of this

species. This paper assesses the extent of occurrence (EOO) and area of occupancy (AOO) for this new species. Based on the currently known populations and threats, according to IUCN Red List criteria, it can be preliminarily designated as 'Critically Endangered'. As a traditional Chinese medicine, the species is used by local residents for removing fetal toxins in newborns, among other purposes, giving it certain conservation and utilization value. Further research on the ethnobotany and medicinal properties of this species could be conducted in the future. The species faces risks of habitat destruction and wild collection, making it necessary to carry out ex situ conservation and reintroduction work.

Primulina purpureokylin F.Wen, Yi Huang & W.Chuen Chou, distributed in the same township, differs significantly by having a funnelform corolla tube, dark green to purple leaves, and coarse purple-red appressed hairs on both leaf surfaces. *Primulina alba* R.F.Li & B.Pan, distributed within 5 km, differs by having distinctly smaller flowers, a tubular corolla, and pure white coloration.

By comparing this species with other *Primulina* species, we found that some also have more or less inflated corolla tubes, such as *Primulina lutescens* B.Pan & H.S.Ma, *Primulina roseoalba* (W.T.Wang) Mich. Möller & A. Weber, *Primulina dryas* (Dunn) Mich. Möller & A. Weber, *Primulina polycephala* (Chun) Mich. Möller & A. Weber, and *Primulina langshanica* (W. T. Wang) Yin Z. Wang, among others. We preliminarily infer that corolla tube inflation in *Primulina* may be related to specific pollinators, though this hypothesis requires further field investigation and experimental verification.

Keywords: limestone areas, flora, *Primulina carinata*, taxonomy

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1 Introduction

The genus *Primulina* Hance (Hance, 1883) has become the largest genus of Gesneriaceae in China, following generic recircumscriptions based on recent molecular phylogenetic analyses (Wang et al., 2011; Weber et al., 2011; Xu et al., 2019). The newly revised *Primulina* consists of 230 species (excluding infraspecific taxa) primarily distributed from southern and southwestern China to northern Vietnam (GRC, 2023; Wen et al., 2019, 2021). Up to date, there are 213 accepted species (excluding infraspecific taxa) of *Primulina* recorded from

China (GRC, 2023; Wen et al., 2021). The tropical and subtropical limestone mountainous areas of Guangxi, China, are the centers of species diversity and diversification of this genus (Li et al., 2019). Many new taxa of *Primulina* from South and Southwest China have been discovering and publishing since two decades (Guo et al., 2015; Möller, 2019; Wen et al., 2021). In the past decade, the number of new species in *Primulina* has averagely increased by about 10 a year (Xu et al., 2019). In the course of a floristic survey of limestone areas in July 2020, we discovered a rare plant of Gesneriaceae from Pingguo city, Guangxi, China. The species is recognized as *Primulina* by the following characters: the single chiritoid stigma, where the upper lobe of the stigma is not developed (Wang et al., 2011; Weber et al., 2011). After consulting the relevant literature (Xu et al., 2012; Wen et al., 2014; Guo et al., 2015; Möller, 2016; Ma et al., 2017; Li et al., 2019; Zhang et al., 2021), as well as detailed comparison with relevant specimens and taxonomic publications (Wang et al., 1998; Li & Wang, 2004; Wei et al., 2010; Wang et al., 2017), a new species of *Primulina* is identified, which is described and illustrated below.

Primulina pingguoensis H.S. Ma & B. Pan, sp. nov. (Fig. 1 [Figure 1: see original paper], Fig. 2 [Figure 2: see original paper]) The new species is similar to *Primulina carinata* Y.G. Wei, F. Wen & H.Z. Lü in floral characteristics, but it differs from the latter by lobes narrowly lanceolate-linear, length-width ratio >2 (rounded-ovate, length-width ratio <1.5), 8–10 purple stripes from corolla throat to the bottom of corolla tube, without honey guides (vs. brown stripes, 2 yellow honey guides inside, leaf blade elliptic to broadly ovate, 6.5–9.5 × 4.5–6.5 cm (vs. broadly elliptic to ovate, 4.0–5.0 × 3.0–4.0 cm), leaf blade base slightly cuneate (vs. rounded), corolla tube tubular, ventrally carinate, (vs. narrowly funnelform, strongly carinate, forming a clear keel), etc.

A. Flowering plant; B. Corolla opened, showing stamens and staminodes; C. Calyx anatomy; D. Calyx and pistil; E. Enlarged abaxial veins.

Fig. 1 Line drawings of *Primulina pingguoensis*

Type: CHINA, Guangxi, Pingguo City, Guohua Town, Longyang Village, elevation 220 m, 23°16 N, 107°29 E, 20 July 2020, Hu-Sheng Ma & Bo Pan MHS2020072001 (Holotype: IBK!, Isotypes: PE! and IBK!).

2 Description

Perennial herbs. Rhizomatous stem subterete, 1–4 cm long, ca. 9 mm in diameter. Leaves 8–17, basal; petiole subterete, 4.5–8 cm long, 4–6 mm wide; leaf blade elliptic,to broadly ovate, 6.5–9.5 × 4.5–6.5 cm, apex obtuse to round, base slightly oblique, cuneate, margin entire, rarely repand, puberulent on both sides, lateral veins 3–5 on each side, prominent abaxially. Cymes axillary, 4–6, 1–4-branched, 3–8-flowered per cyme, peduncle 8.0–16.5 cm long, 2–3 mm in diam., with erectly white glandular pubescent; bracts opposite, pale green, linear or linear-lanceolate, ca. 8 × 1.8 mm, pubescent outside, glabrous inside, margin entire to sparsely dentate; bracteoles 2, opposite, the shape, indumen-

tum characteristics and color same as bracts but obviously smaller, ca. 4 × 0.8 mm; Pedicel 1.1–3.5 cm long, densely pubescent, 0.9–1.2 mm in diam. Calyx 5-parted nearly to the base, lobes linear-lanceolate, 4–5 × 0.8–1 mm, pale green, apex acuminate, sparsely white pubescent outside, inside nearly glabrous, margins entire. Corolla pinkish purple, with 8–10 longitudinal dark purple stripes from the throat to the bottom of the corolla tube, 16–20 mm long, externally glandular pubescent, internally sparsely puberulent; tube tubular, ventrally carinate, purplish purple to pink, 10–11 mm long, ca. 6 mm in diam. at the base, 8–10 mm in diameter in medium . Limb distinctly 2-lipped, purplish adaxial lip 2-parted to the middle, lobes oblong, ca. 6 × 3 mm, three purplish vertical lines on each corolla lip; abaxial lip 3-parted to over the middle, lobes broadly oblong, ca. 9 × 4 mm, rounded at apex. Stamens 2, adnate to ca. 6 mm above the corolla tube base, filaments linear, white to translucent, ca. 6.5 mm long, geniculate over middle, glabrous; anthers elliptic to reniform, connate at adaxial surface, dorsifixed, ca. 2 mm long, glabrous. Staminodes 3, translucent, ca. 1 mm long, glabrous, slightly swollen at apex, adnate to ca. 6 mm above the corolla tube base. Disk ringlike, ca. 0.8 mm high, margin repand. Pistil 11–15 mm long, linear, densely puberulent, ovary yellowish brown, 6–8 mm long, ca. 1 mm in diam., style densely puberulent, white to translucent, 6–8 mm long, nearly glabrous; stigma obtrapeziform, ca. 1 mm long, apex 2-lobed, Capsule linear, outside pubescent, 18–24 mm long, ca. 2.5 mm in diam., valvate dehiscence when mature.

A. Habitat; B. Habit; C. Lateral view of corolla; D. Frontal view of corolla; E. Corolla opened with stamens and staminodes; F. Cyme and flowers; G. Calyx and pistil; H. Adaxial and abaxial leaf.

Fig. 2 *Primulina pingguoensis*

3 Distribution and Habitat

Up to date, the new species has only been found in Pingguo City, Guangxi, on the surface of wet crevices of rocks surrounding a big karst cave, elevation 220 m, 23°16 N, 107°29 E. It grows on the shady surface of limestone rocks. The main associated species are *Adiantum flabellulatum* L., *Alchornea trewioides* (Benth.) Müll.Arg., *Arachniodes chinensis* (Rosenst.) Ching, *Asplenium sampsoni* Hance, *Selaginella moellendorffii* Hieron and so on.

3.1 Phenology

Flowering occurs from July to August, and fruiting occurs from August to September.

3.2 Etymology

The specific epithet ‘pingguoensis’ refers to the type locality of this new species.

3.3 Conservation status

Primulina pingguoensis is currently known only from the type locality. The total population size of this new species is small. The mature individuals of the new species are 187. Besides, there is a continuing decline in quality of habitat slightly prominent as local villagers have developed animal husbandry in the karst cave and used *P. pingguoensis* as traditional Chinese medicine by local inhabitant according to our observations and interviews. The EOO is 4 km^2 and the AOO is 0.64 km^2. Thus, based on currently available information, we propose that *P. pingguoensis* should be considered as 'Critically Endangered' (CR): B1+ B2a), C2b, according to the IUCN red list categories and criteria (IUCN 2022). This species is confronted with habitat destruction and wild extraction, therefore, it is necessary to carry out conservation actions, such as: ex situ conservation and field return, etc.

3.4 Similar species

This new species is morphologically similar to *Primulina carinata* Y.G.Wei, F. Wen & H.Z.Lü in floral characteristics, but the two species show several diagnostic differences (Table 1).

By comparing the new species with other species in *Primulina*, not only *P. carinata*, we found that there are other species with carinate corolla more or less, e.g., *Primulina dryas*, *P. polycephala*, *P. langshanica*, and *P. roseoalba*, etc. The tube is transitional from funnelform to tubular. All these transitional characters are related to pollination biology through experimental observation in greenhouse as well as in wild. Through comparison of this species with other *Primulina* species, we found that some species also have more or less inflated corolla tubes, such as *Primulina lutescens* B.Pan & H.S.Ma, *Primulina roseoalba* (W.T.Wang) Mich. Möller & A. Weber, *Primulina dryas* (Dunn) Mich. Möller & A. Weber, *Primulina polycephala* (Chun) Mich. Möller & A. Weber, and *Primulina langshanica* (W. T. Wang) Yin Z. Wang, among others. We preliminarily infer that corolla tube inflation in *Primulina* may be related to specific pollinators, though this hypothesis requires further field investigation and experimental verification.

Table 1 Morphological comparison of *Primulina pingguoensis* and *P. carinata*

Characters	*P. pingguoensis*	*P. carinata*
Corolla lobes	Narrowly lanceolate-linear, length-width ratio >2	Rounded-ovate, length-width ratio <1.5
Adaxial lobe width	ca. 6 mm	8–9 mm
Abaxial lobe width	ca. 9 mm	7.2–7.8 mm
Corolla stripes	8–10 purple stripes from corolla throat to bottom of tube, without honey guides	Brown stripes, 2 yellow honey guides inside

Characters	*P. pingguoensis*	*P. carinata*
Leaf blade	Elliptic, ovate or broadly ovate, 6.5–9.5 × 4.5–6.5 cm	Broadly elliptic to ovate, 4.0–5.0 × 3.0–4.0 cm
Leaf base	Slightly oblique, cuneate	Rounded
Leaf texture	Carnose	Subcoriaceous
Corolla color	Pinkish purple to pink	Purple or purplish red
Corolla tube	Tubular, ventrally carinate	Narrowly funnelform, strongly carinate forming a clear keel
Flowering period	July to August	August to September

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Note: Figure translations are in progress. See original paper for figures.