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Primulina heterochroa (Gesneriaceae), a new species from a tropical limestone area in Guangxi, China

Abstract

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Primulina heterochroa (Gesneriaceae) is described and illustrated here. This new species morphologically resembles *P. pungentisepala* and *P. minutimaculata*, but it is easily distinguished from congeners by some qualitative and quantitative characters in leaf, bract, calyx, indumentum, corolla and inflorescence. The conservation status of *P. heterochroa* is assessed as Critically Endangered (CR) according to IUCN Red List categories and criteria.

Additional key words: taxonomy, *Primulina pungentisepala*, *Primulina minutimaculata*, Critically Endangered

Introduction

Molecular studies have shown that some former groups of Old World Gesneriaceae were artificial and unnatural (Li & Wang 2007; Möller & al. 2011; Wang & al. 2011; Weber & al. 2011; Möller & Clark 2013). For example, the previously recognized as unispecific genus *Primulina* Hance has been enlarged to some 163 species not only by the description of new species but also by the inclusion of all species of *Chirita* sect. *Gibbosaccus* C. B. Clarke and *Chiritopsis* W. T. Wang, as well as *Wentsaiboea luochengensis* Yan Liu & W. B. Xu and *W. renifolia* D. Fang & D. H. Qin (Wang & al. 2011; Weber & al. 2011; Xu & al. 2012; see also IPNI 2015+). The limestone areas of SW and S China and N Vietnam possess the highest biodiversity and differentiation of *Primulina* (Wei & al. 2010). As

previously mentioned in many monographs and other literature (Wang & al. 1990, 1998; Hong & al. 2012; Wu & al. 2012; Wen & al. 2012; Zhao & al. 2013; Li & al. 2014; Zheng & Deng 2014), most species of this redefined genus have a narrowly restricted distribution, e.g. they often occur in only one or two limestone caves, sinkholes or small gorges. As a result of further exploring and study, some of these special and unique habitats are now better understood (Xu 2007). Many new taxa of *Primulina* have been reported in recent years, such as *P. bullata* S. N. Lu & Fang Wen (Lu & al. 2013), *P. carinata* Y. G. Wei, F. Wen & H. Z. Lü (Wen & al. 2014), *P. crassirhizoma* F. Wen, Bo Zhao & Xin Hong (Zhao & al. 2013), *P. diffusa* X. Hong, F. Wen, & S. B. Zhou (Zhou & al. 2014), *P. leprosa* (Yan Liu & W. B. Xu) W. B. Xu & K. F. Chung (Xu & al. 2010, under *Chirita*; Xu & al. 2012), *P. ningmingensis*

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(Yan Liu & W. H. Wu) W. B. Xu & K. F. Chung (Wu & al. 2011, under *Chirita*; Xu & al. 2012) and *P. sinovietnamica* W. H. Wu & Q. Zhang (Wu & al. 2012).

In 2008, we collected some living *Primulina*-like plants when we visited a local Chinese medicine market in Pingxiang, Guangxi, China. At first, we considered them to be *P. pungentisepala* (W. T. Wang) Mich. Möller & A. Weber (Weitzman & al. 1997, under *Chirita*; Weber & al. 2011) or *P. minutimaculata* (D. Fang & W. T. Wang) Yin Z. Wang (Wang 1981, under *Chirita*; Wang & al. 2011). However, when the plants flowered, the colour and morphology of the flowers really shocked us: the purplish brown and dark yellow bicoloured corolla had never been found in the genus *Primulina* before. The plants seemed to be a new and unique species. We tried to find the natural habitat of the plants and, fortunately, during a limestone flora survey in 2013, we found by chance a small natural population with fewer than 25 individuals near the Sino-Vietnam border in Pingxiang, Guangxi. After a thorough examination of herbarium material and relevant literature (Wang 1985; Wang & al. 1990, 1998; Li & Wang 2004; Wei & al. 2010; Wang & al. 2011; Weber & al. 2011), we have determined that this is a new species of *Primulina*. It is described, illustrated and compared with the morphologically similar *P. pungentisepala* and *P. minutimaculata*.

Material and methods

An overview of the genus *Primulina* from S and SW China and adjacent areas of Vietnam was prepared. All available specimens of *Primulina* stored in the following herbaria in China, Vietnam, the United States and the United Kingdom were examined (codes according to Thiers 2015+): ANU, BJFC, CDBI, CTC, E, HGAS, HIB, HN, IBK, IBSC, K, KUN, MO, PE, SZ, VNMN; as was material of *Primulina* from recent field work by the current authors in SW and S China and living mate-

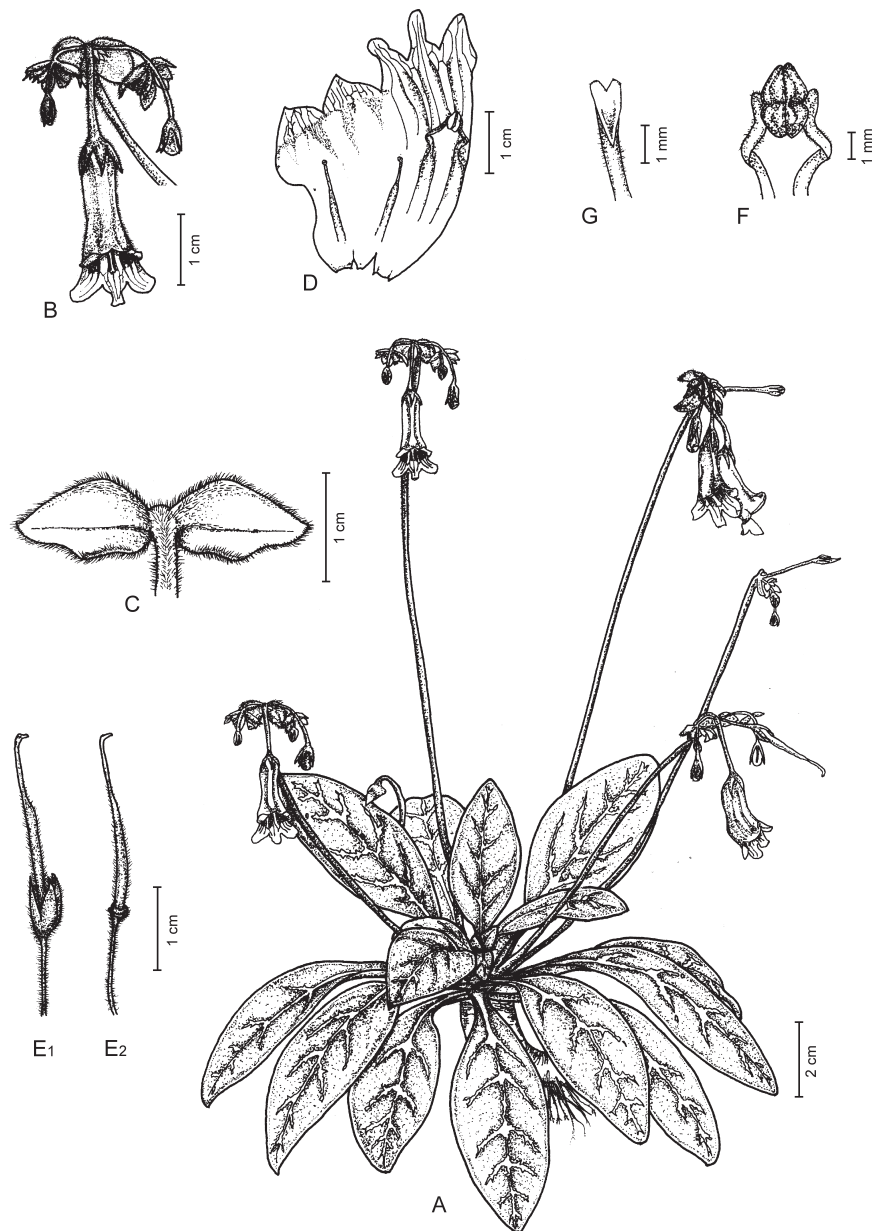


Fig. 1. A–G: *Primulina heterochroa* – A: habit; B: cyme; C: bracts lower surface; D: opened corolla exposing stamens and staminodes; E1: flower with corolla removed showing pedicel, calyx lobes and pistil; E2: with calyx lobes removed showing disk; F: apex of stamens showing anthers; G: stigma. – All drawn from the holotype by Ms B. D. Lai.

rial cultivated at the Gesneriad Conservation Center of China. All morphological characters were studied under dissecting microscopes, and are described using the terminology presented by Wang & al. (1990, 1998).

Results and Discussion

Primulina heterochroa F. Wen & B. D. Lai, **sp. nov.** – Fig. 1 & 2.

Holotype: China, Guangxi Zhuang Autonomous Region, Pingxiang city, Baiyun town, Jiaoguo village, near Sino-Vietnam border, 22.255854°N, 106.716474°E, 150 m,

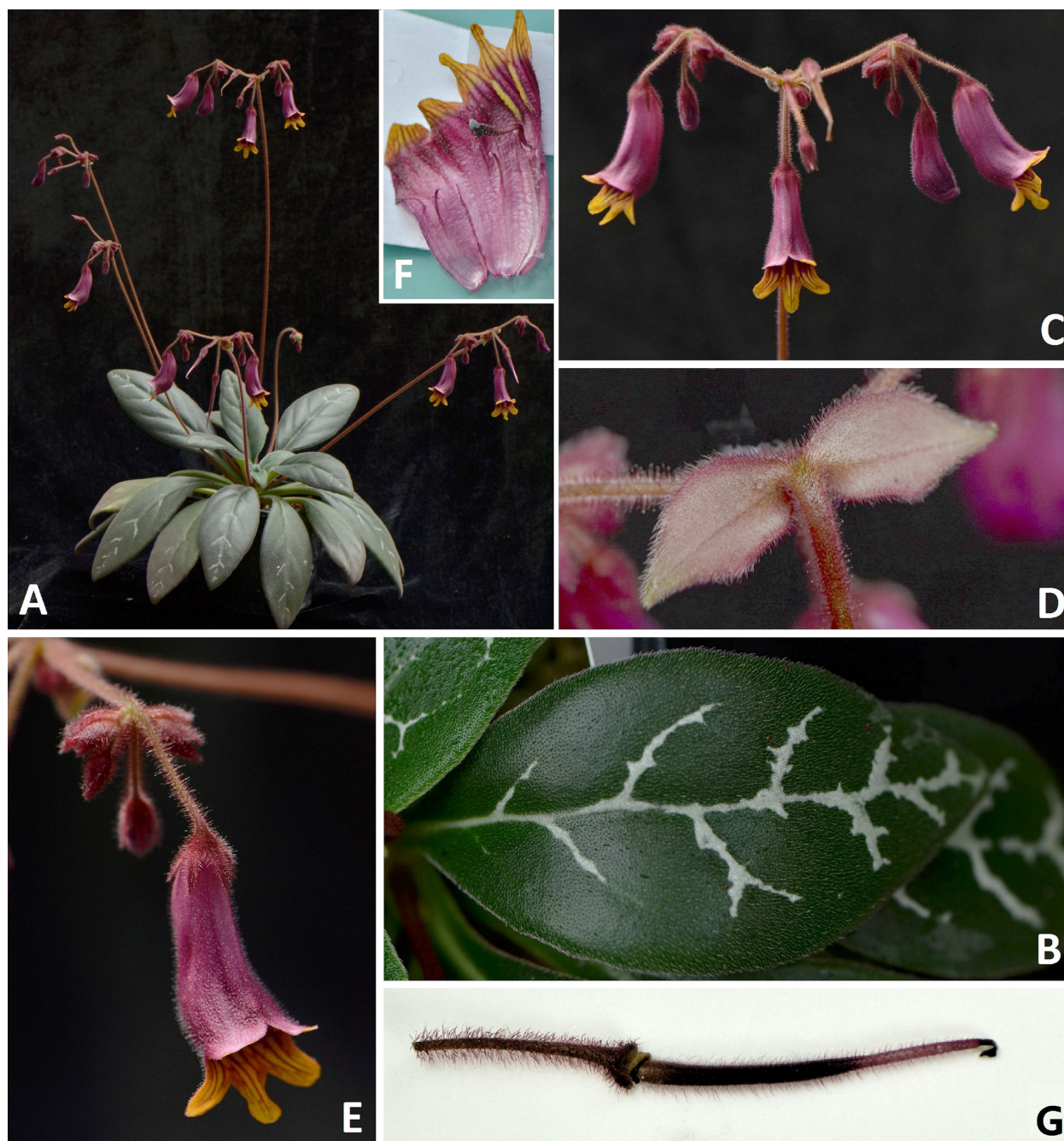


Fig. 2. A–G: *Primulina heterochroa* – A: habit; B: leaf blade upper surface; C: cyme; D: bracts lower surface; E: flower oblique view; F: opened corolla exposing stamens and staminodes; G: flower with corolla and calyx lobes removed showing pedicel, disk and pistil. – A–G: collected from type locality, 22 Jul 2013, photographed in nursery of Gesneriad Conservation Center of China, Guilin, 23 Jul 2013, by Ms B. D. Lai & Mr B. M. Wang.

on moist tufa and rocky surface of limestone cliff, 22 Jul 2013, F. Wen, B. D. Lai & F. Y. Nong 20130722-01 (IBK!; isotype: IBK!).

Diagnosis — *Primulina heterochroa* F. Wen & B. D. Lai differs from its congeners, *P. pungentisepala* (W. T. Wang) Mich. Möller & A. Weber and *P. minutimaculata* (D. Fang & W. T. Wang) Yin Z. Wang, by the following combination of characters: peduncle densely covered with spreading reddish purple eglandular and glandular

hairs; bracts purple, outside reddish brown pubescent, inside densely purple glandular pubescent; calyx lobes outside densely spreading purple pubescent, inside sparsely shortly pubescent; corolla outside dark reddish purple to purplish brown, densely reddish purple pubescent, lobes inside dark yellow or bronzed yellow with dark brown longitudinal stripes (see also Table 1).

Description — *Herbs* perennial. *Rhizome* cylindrical, 4–6 cm long, 1–1.5 cm in diam. *Leaves* 15–18, ba-

Table 1. Morphological comparison of *Primulina heterochroa*, *P. pungentisepala* and *P. minutimaculata*.

Characters	<i>Primulina heterochroa</i>	<i>Primulina pungentisepala</i>	<i>Primulina minutimaculata</i>
Leaf blade indumentum	lower surface densely strigose and appressed pubescent, upper surface densely appressed pubescent	upper surface densely appressed pilose	sparsely appressed puberulent to nearly glabrous
Peduncle indumentum	densely spreading reddish purple eglandular and glandular pubescent	spreading white puberulent and glandular puberulent	spreading white glandular puberulent and strigose
Bract colour	purple	green	green
Bract shape	slightly rhombic to broadly lanceolate	triangular-linear	ovate
Bract size	12–15 × 5–6 mm	c. 6 × 1.2 mm	15–25 × 8–12 mm
Bract indumentum	outside reddish brown pubescent, inside densely purple glandular pubescent	outside pubescent, inside glabrous	outside strigose, inside glabrous
Calyx lobe shape	lanceolate	narrowly triangular-linear	linear-lanceolate
Calyx lobe size	c. 7 × 2 mm	c. 6 × 1.2 mm	c. 5.5 × 0.8 mm
Calyx lobe indumentum	outside densely spreading purple pubescent, inside sparsely shortly pubescent	outside pubescent, inside glabrous	outside densely glandular puberulent, inside glabrous
Corolla colour	outside dark reddish purple to purplish brown, lobes inside dark yellow or bronzed yellow with dark brown longitudinal stripes	pink, with 2 yellow stripes inside	pale purple to purple
Corolla indumentum	outside densely reddish purple pubescent, inside nearly glabrous	outside sparsely appressed puberulent, inside pilose below filaments	outside with densely semitransparent erect glandular hairs, inside glabrous
Flowering time	July	April	June

sal; *petiole* compressed, 3–4.5 × 0.6–0.8 cm, sparsely shortly strigose; *leaf blade* dark green with silvery lateral veins, narrowly oblong to oblong-elliptic, 6–10 × 3.5–4 cm, slightly fleshy, thickly chartaceous when dried, lower surface densely strigose and appressed pubescent, upper surface densely appressed pubescent, base attenuate to cuneate, margin entire, apex acute; *lateral veins* 4 or 5 on each side of midrib, slightly prominent on lower surface, inconspicuously sunken on upper surface. *Cymes* 5 or more, axillary, 3–5(–12)-flowered or more; *peduncle* brown, 8–15 cm long, c. 2.5 mm in diam., densely covered with spreading reddish purple eglandular and glandular hairs; *bracts* 2, opposite, purple, slightly rhombic to broadly lanceolate, 12–15 × 5–6 mm, persistent at flowering, occasionally withered; outside reddish brown pubescent, inside densely purple glandular pubescent, margin entire, apex acute. *Calyx* 5-parted to base; *lobes* lanceolate, c. 7 × 2 mm, nearly equal, outside densely spreading purple pubescent, inside sparsely shortly pubescent, margin entire, apex acute. *Corolla* outside dark reddish purple to purplish brown, throat with 2 bright yellow stripes, upper portion of inside corolla surface with 2 dark purple swollen sparsely short glandular hairy lines, inside of lobes dark yellow or bronzed yellow with dark brown longitudinal stripes, corolla c. 3 cm long, outside densely

reddish purple pubescent, inside nearly glabrous; *tube* nearly tubular, c. 2 cm long, orifice c. 1.1 cm in diam.; *limb* distinctly 2-lipped; *upper lip* 2-lobed, lobes triangular, c. 6 mm long; *lower lip* 3-lobed, lobes oblong, c. 9 mm long, lobe mid-portion often twisted or constricted. *Stamens* 2, inserted c. 1.5 cm above corolla base; *filaments* dark purple, c. 6 mm long, geniculate c. 2 mm above insertion, pubescent just below anthers, otherwise glabrous; *anthers* reniform, constricted at middle, c. 2.5 mm long; *staminodes* 3, lateral ones inserted 9–10 mm above corolla base, reddish purple, linear, c. 6 mm long, glabrous, apex small capitate, central staminode inserted c. 6 mm above corolla base, punctiform, c. 0.5 mm long. *Disk* annular, c. 0.6 mm high; *pistil* c. 2.2 cm long (boundary of ovary and style ambiguous), densely covered with dark purple eglandular and glandular hairs; *stigma* 2-lobed, c. 3 mm long. *Fruit* not seen.

Phenology — Flowering specimens were collected in July; the fruiting time is unknown.

Distribution — *Primulina heterochroa* is known only from a single population at the type locality in Pingxiang city, SW Guangxi Zhuang Autonomous Region, S China, near the border with Vietnam (Fig. 4). It might be eventu-

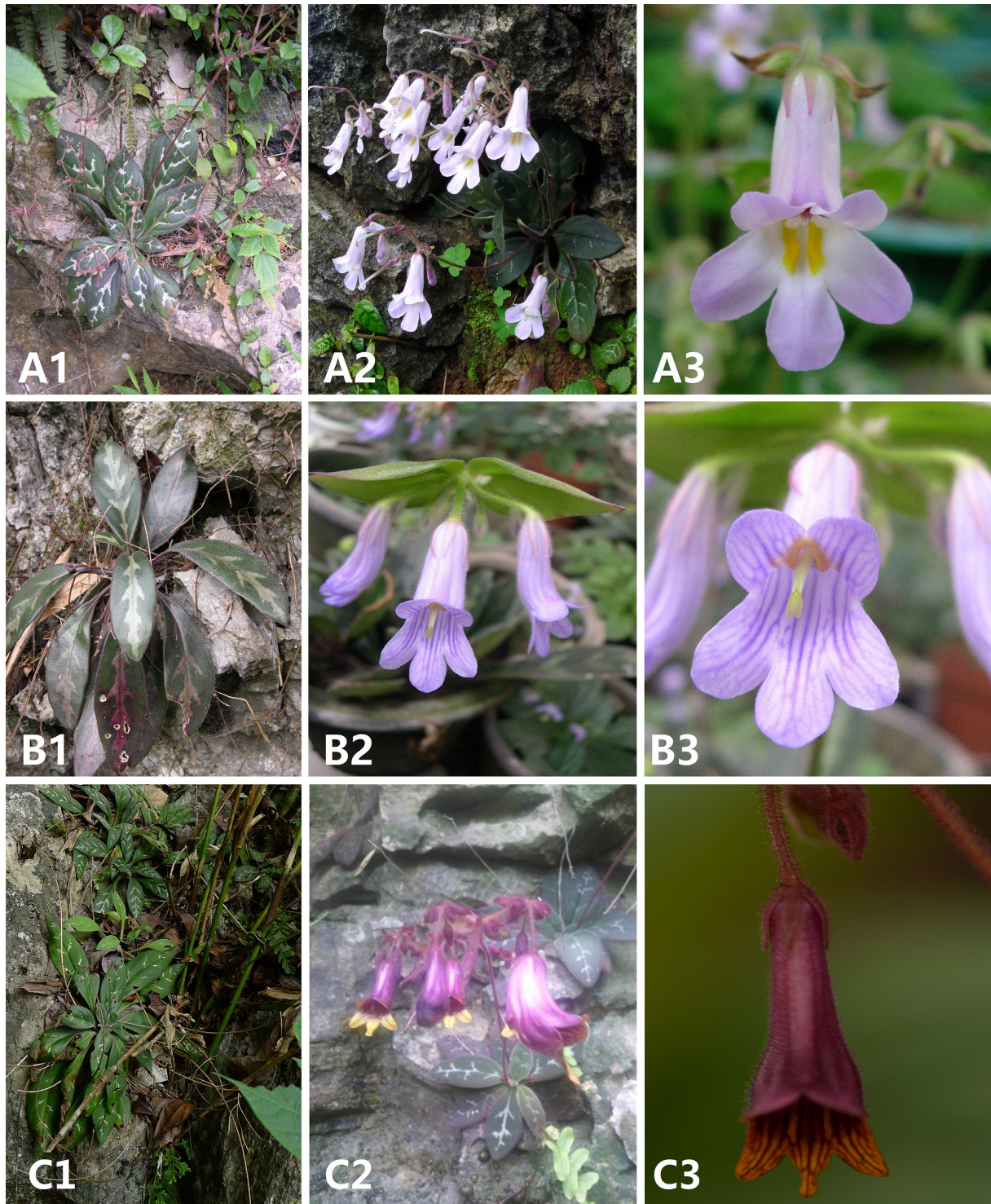


Fig. 3. Comparison of *Primulina pungentisepala* (A), *P. minutimaculata* (B) and *P. heterochroa* (C) showing habit (1), cyme (2) and corolla (3). – A1, A2, B1 photographed at Longzhou, Guangxi, 7 Apr 2012 (A1, A2) and 18 Jul 2013 (B1) by F. Wen; A3, B2, B3 photographed in nursery of Gesneriad Conservation Center of China, 12 Apr, 2013 (A3) and 11 Jun 2013 (B2, B3) by F. Wen; C1–C3 photographed at type locality of *P. heterochroa*, 22 Jul 2013 by F. Wen (C1), F. Y. Nong (C2) and B. D. Lai (C3).

ally discovered in the adjacent county of Longzhou and in Vietnam.

Ecology — *Primulina heterochroa* grows on shaded moist tufa of limestone cliffs under northern tropical limestone seasonal rain forest on the N-facing slope of

a limestone hill at an altitude of about 150 m. The average annual temperature of Pingxiang is 21°C, the average annual precipitation is c. 1400 mm. Dominant plants at the type locality belong to *Apocynaceae*, *Begoniaceae*, *Euphorbiaceae*, *Lauraceae*, *Moraceae*, *Rubiaceae* and *Urticaceae*.

Conservation status and provisional Red List category — The new species is known only from one population with fewer than 50 mature individuals. We could not find a second population or any individual plants around the type locality despite careful field explorations on five occasions over the past several years. We therefore assess that *Primulina heterochroa* should be provisionally considered as Critically Endangered: CR B1ab(ii,iii,v)+2ab(ii,iii,v); D, according to IUCN Red List categories and criteria (IUCN 2012).

Etymology — The specific epithet “*heterochroa*” is a Greek-derived compound adjective meaning different-coloured, referring to the remarkable contrasting colours of the corolla.

Vernacular name — Chinese: 异色报春苣苔 (yì sè bào chūn jù tái). The first two characters mean “different colour” and thus mirror the specific epithet in referring to the corolla colours. The last four characters are the Chinese name for the genus *Primulina*.

Remarks — Several characters place this new species in the genus *Primulina*, e.g. stamens 2, stigma 1, capsule linear, straight, significantly longer than the persistent calyx lobes. *Primulina heterochroa* is very similar to *P. pungentisepala* and *P. minutimaculata* from a morphological point of view, but it can be distinguished from the latter two species by certain qualitative and quantitative characters in leaf, inflorescence, bract, calyx, corolla, hairs, etc. The three species share some similar characteristics, e.g. thicker and nearly fleshy leaf blades with silvery lateral veins, and thick pubescent hairs on the peduncles and pedicels. This hints at convergent evolution in three different species adapting to the subtropical monsoon climate with warm year-round temperatures and obviously alternating dry and wet seasons. The morphological differences between the three species are itemized in Table 1 and illustrated in Fig. 3.

Many new taxa of *Primulina* have been discovered, described and published recently, including this new one. We now know that the biodiversity of *Primulina* in limestone areas is very dependent on specialized habitats, such as caves, cliffs, crags, overhanging rocks, crevices, damp tufa, and so on, which are on a calcium-rich sub-



Fig. 4. Distributions of *Primulina heterochroa* (star), *P. pungentisepala* (dot) and *P. minutimaculata* (triangle).

strate further enriched from the weathering of the limestone. In exploring for plants in the past, the above-mentioned localities were usually ignored. Thus we expect additional undescribed taxa to be discovered in future field investigations.

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