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Primulina curvituba sp. nov. (Gesneriaceae) from a limestone area in Guangxi, China

Li-Hua Yang, Bo Pan and Ming Kang

L.-H. Yang (http://orcid.org/0000-0003-3676-3264) and M. Kang (mingkang@scbg.ac.cn), Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou, P. R. China. LHY also at: Univ. of Chinese Academy of Sciences, Beijing, P. R. China. – B. Pan, Guangxi Inst. of Botany, Guangxi Zhuang Autonomous Region and Chinese Academy of Sciences, Guilin, P. R. China.

Primulina curvituba B. Pan, L.H. Yang & M. Kang, a new species of *Primulina* (Gesneriaceae) from Guangxi, China, is described and illustrated. This new species is mainly diagnosed by its strongly curved corolla tube, which is a rare character in *Primulina*. The morphological relationship and differences between this species and its related congeners are discussed. The conservation status of *P. curvituba* is assessed as 'Critically Endangered' (CR) according to IUCN.

In recent years, the genus *Primulina* has attracted much attention from botanists, and over 50 new species have been described in the past five years. It now comprises more than 180 species. However, in contrast to its high species diversity, the morphological variation of *Primulina* is relatively limited compared to other genera (Möller et al. 2016). Especially the flower morphology is relatively monotonous, and most species possess straightly infundibuliform corolla and are only differentiated by size (e.g. corolla lobes size, corolla tube length, corolla tube width) and coloration. Here, we describe a rare new species with strongly curved corolla tube, a character not previously reported in *Primulina*.

During field investigations of Gesneriaceae in Huanjiang city, northwestern Guangxi in 2012, one of us (PB) first found the plants concerned, but without flowers. The vegetative characters of these plants, e.g. their conspicuous and branched rhizome, opposite leaves, and fleshy and linear-elliptical leaf blade, indicated that they might be a species of *Primulina*, somewhat similar to *P. pseudolinearifolia* (Yan Liu & W.B. Xu) W.B. Xu & K.F. Chung (Xu et al. 2012) and *P. linearicalyx* F. Wen, B.D. Lai & Y.G. Wei (Wen et al. 2016). Further field work was conducted in April 2016, but we still did not find any flowering plants. Then, several living were brought into at SCBG and GBG. Here, flowers were observed in July 2016. To our surprise, the gross morphology of flowers, such as their strongly curved corolla tube, were obviously different from all other species of *Primulina*. Instead, the slender and curved corolla tube was somewhat similar to *Petrocodon lui* (Yan Liu & W.B. Xu) A. Weber & Mich. Möller (Weber et al. 2011), of which this character, curved corolla tube, had been ignored in the protologue (Xu et al. 2010), but received more attention from Wei et al. (2010). However, further detailed observation showed that our new species has a chiritoid stigma (lower lobe obtrapeziform, upper lobe disappeared), and both the vegetative and reproductive characters show that it is a species of *Primulina*, rather than *Petrocodon*. Significant differences in floral characters between our new species and *P. pseudolinearifolia* and *P. linearicalyx* indicate that these species are not closely related. Instead, the slender corolla tube and straight filaments adnate to near the corolla tube base, indicate that it is more closely related to *P. vestita* (D. Wood) Mich. Möller & A. Weber and *P. speluncae* (Hand.-Mazz.) Mich. Möller & A. Weber. Further literature study (Wang et al. 1998, Wang 2004, Wei et al. 2010) and morphological comparison convinced us that we had found a new species, which is described and illustrated below.

Primulina curvituba B. Pan, L.H. Yang & M. Kang sp. nov. (Fig. 1–2)

A species mainly differing from *P. vestita* and *P. speluncae* by its branched and conspicuous rhizome (vs unbranched, inconspicuous), and laterally compressed and strongly curved corolla tube (vs cylindric, straight).

Type: China. Guangdong Province, Guangzhou City, cultivated in South China Botanical Garden, introduced from Guangxi Zhuangzu Autonomous Region, Huanjiang County, Luoyang Town, elevation ca 250 m a.s.l.,

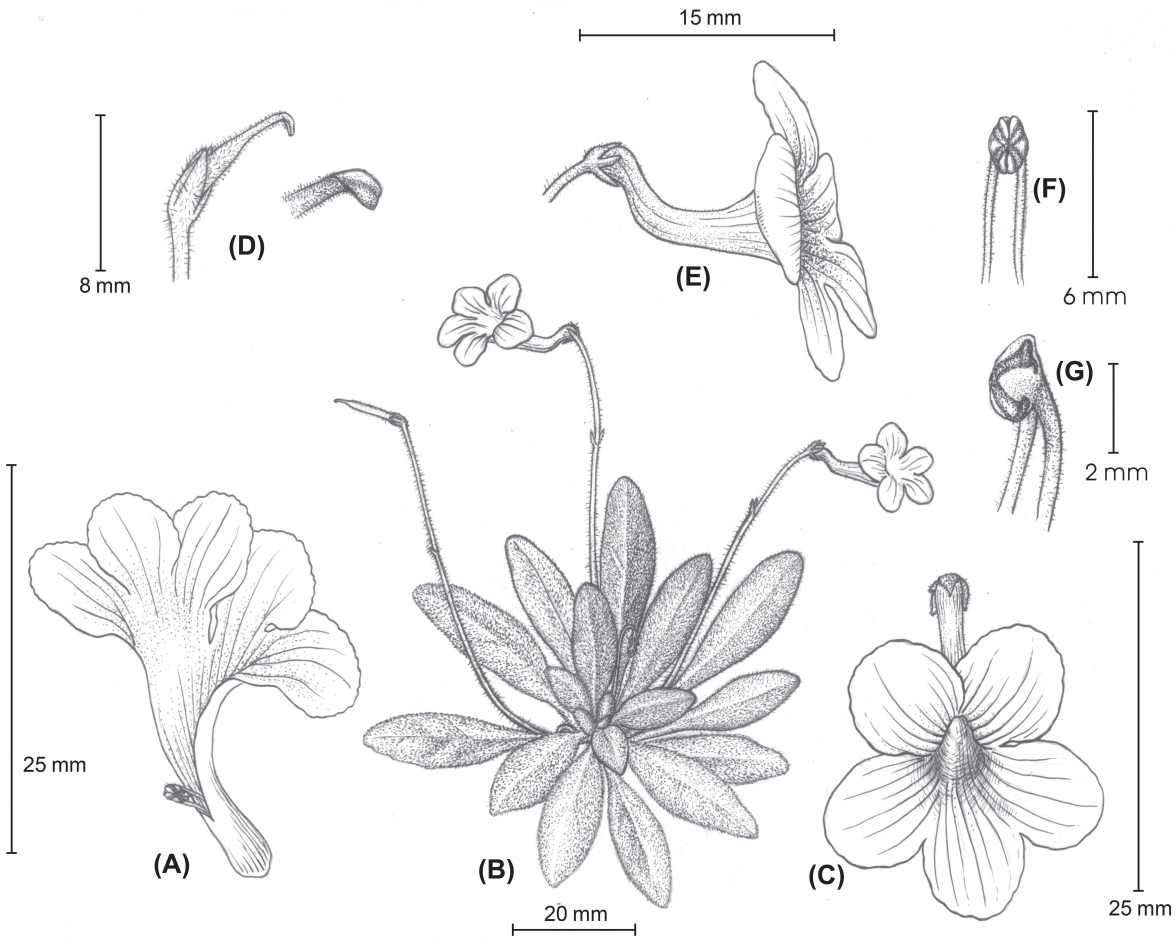

Figure 1. *Primulina curvituba* sp. nov. (A) opened corolla, (B) habit, (C) flower in front view, (D) pistil and stigma, (E) flower in side view, (F) anthers in front view, (G) anthers in side view. Drawn by Yun-Xiao Liu based on cultivated individual collected from the type locality.

25°11′31.83″N, 108°14′52.41″E, growing on the moist rock surfaces of limestone hills, 29 Jul 2016 (flowering), Li-Hua Yang, YLH368 (holotype: IBSC).

Etymology

This specific epithet is derived from the curved corolla tube.

Description

Perennial herb. Rhizomatous stem subterete, 30–75 mm long, 6–10 mm in diameter, often branched from the middle or base. Leaves 18–36, opposite in young plants and congested at rhizome apex in mature plants; petiole 12–28 × ca 2 mm, densely white pubescent; leaf blade fleshy when fresh, thickly papery when dried, elliptical to linear-elliptical, 14–33 × 9–15 mm, with both surfaces densely white pubescent, subacute to obtuse at apex, cuneate at base, with entire and revolute margin; lateral veins 3–4 on each side, abaxially conspicuous, adaxially inconspicuous. Cymes 6–11, axillary, 1–2-flowered; peduncles 30–65 mm long, densely white pubescent; bracts 2, opposite, lanceolate, 2.0–3.5 × 1.0–1.5 mm, with entire margin and acute apex, densely white pubescent outside, glabrescent inside. Pedicel 20–30 mm long, densely white pubescent. Calyx 5-parted to near base; lobes lanceolate, 2–3 × 1.0–1.5 mm, densely white pubescent outside, glabrescent inside, with entire margin. Corolla 20–28 mm long, pubescent outside, glabrescent inside; lobes purple-blue; tube base purple-red; corolla tube infundibuliform, laterally compressed at mouth, strongly curved downwards at base (5–7 mm from the base), then bent forwards, 16–20 mm long, 5–7 mm in diameter at the mouth, 2–3 mm in diameter at the base; limb distinctly 2-lipped; adaxial lip 2-parted, with lobes broadly oblong, 10–12 × 9–11 mm, rounded at apex, with slightly praemorse margin; abaxial lip 3-lobed, with lobes broadly oblong, 11–14 × 9–11 mm, rounded at apex, with slightly praemorse margin. Stamens 2, adnate to 3–4 mm above the corolla tube base; filaments linear, 5–6 mm long, white, straight, glandular-pubescent; anthers elliptic, fused by entire adaxial surfaces, ca 2 mm long, glabrous; staminodes 3, adnate to the corolla tube base, lateral ones 1–2 mm long, middle one ca 1 mm long. Disc annular, ca 1 mm in high. Pistil 7–8 mm long; ovary cylindrical, 5–6 mm long, ca 1 mm in diameter, densely glandular-pubescent; style ca 2 mm long, densely glandular-pubescent; stigma 1, its upper lobe lacking, lower lobe obtrapeziform, undivided at apex, ca 1 mm long, ca 1 mm wide. Capsule linear, 10–15 mm long, densely pubescent.

Phenology

Primulina curvituba is flowering from July to September, and fruiting from August to October.

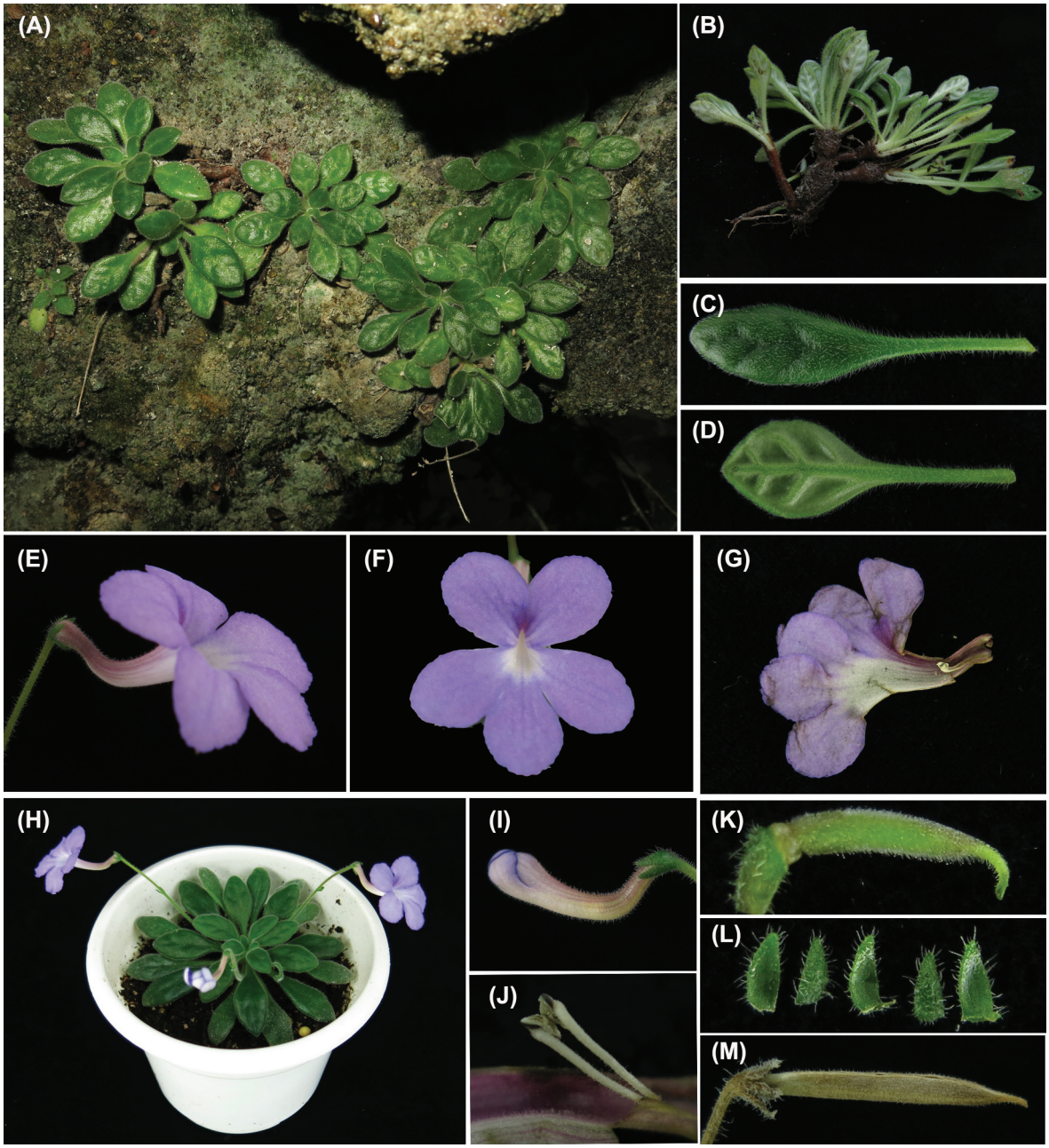

Figure 2. *Primulina curvituba* sp. nov. (A) habitat, (B) habit, (C) adaxial leaf surface, (D) abaxial leaf surface, (E) flower in side view, (F) flower in front view, (G) opened corolla, showing stamens and staminodes, (H) flowering plant cultivated in SCBG, (I) flower bud, (J) fertile stamens, (K) pistil, (L) calyx lobes, (M) capsule. Photo by Li-Hua Yang.

Vernacular name

Chinese: 弯花报春苣苔（Wān Huā Bào Chūn Jù Tái).

Distribution, ecology and conservation status

Based on our field investigation, at present only one population of *Primulina curvituba* is known (at the type locality). About 150 mature individuals were observed in this population, where it grows on moist and shady limestone rock surfaces. The population is located near to farmland, and serious human disturbance may make it vulnerable and subject to destruction. Based on currently available information, *P. curvituba* should be considered as 'Critically Endangered' (CR): B1, B2a, B2b(V), C2b, following the IUCN categories and criteria (IUCN 2016).

Similar species

Primulina curvituba is mostly similar to *P. vestita* and *P. speluncae* in flower characters, such as the slender corolla tube, straight filaments adnate to near the corolla tube base, but differs by the characters summarized in Table 1.

The curved corolla tube of this new species is very peculiar in *Primulina*, but is somewhat similar to *Petrocodon lui*. A curved corolla may also be found in species of *Oreocharis*, such as *O. pumila* (W. T. Wang) Mich. Möller & A. Weber

Table 1. Morphological comparison of *Primulina curvituba* sp. nov., *P. vestita* and *P. speluncae*.

Characters	*P. curvituba*	*P. vestita*	*P. speluncae*
Rhizome	branched, conspicuous	unbranched, inconspicuous	unbranched, inconspicuous
Leaves	18–36	less than 10	less than 10
Leaf blade	fleshy	thin papery	papery
Pedicel (mm)	21–29	3–5	ca 4
Corolla tube (mm)	laterally compressed, strongly curved near base, 16–20	cylindric, straight, ca 21	cylindric, straight, ca 6
Pistil (mm)	7–8	ca 22	ca 3.8
Stigma	obtrapeziform, undivided	cuneate, 2-lobed	oblate, undivided

(Möller et al. 2011) and *O. curvituba* J.J. Wei & W.B. Xu (Wei et al. 2016). The curved corolla tube may have evolved from a straight corolla tube to adapt to a specific pollinator when the pollination environment is unstable. For example, a curved corolla tube may indicate a transition from nectar-feeding bees to pollen-feeding bees as pollinators (Guo and Wang 2014).

Additional specimen examined (paratype)

China. Guangxi Zhuangzu Autonomous Region, Guilin City, cultivated in Guilin Botanical Garden, introduced from the same locality as the holotype, 23 Jul 2012 (flowering), Bo Pan, PB285 (paratype: IBK).

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