

***Primulina melanofilamenta* sp. nov. (Gesneriaceae) from Guangxi, China**

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A new species of Gesneriaceae, *Primulina melanofilamenta* Ying Liu & F. Wen from Guangxi, China, is illustrated and described. It is morphologically distinct from the most similar species *P. eburnea* and *P. atroglandulosa* by the color of the corolla, dark purplish black filaments, anthers backed with a beard of white hairs, the length of staminodes and the hairs of styles. The somatic chromosome number of *P. melanofilamenta* is also reported as $2n = 36$.

In October 2012, during field work for collection of DNA material of *Primulina eburnea* (Hance) Y. Z. Wang in Xing'An County, Guangxi, we collected a few specimens of an unknown flowering *Primulina* species. It resembles *P. eburnea*, but the latter blooms in April. We collected some specimens and introduced some living individuals to the nursery of the Gesneriads Conservation Center of China (GCCC). After carefully consulting national and local floras and relevant literature (Wang et al. 1990, 1998, Li and Wang 2004, Wei et al. 2010) and many specimens from Chinese and Vietnamese herbaria (ANUB, BJFU, CDBI, CTC, GXMG, GXMI, GZTM, HGAS, HGCM, HIB, HITBC, HN, IBK, IBSC, KUN, MO, NU, PE, VMN), we concluded that it is an undescribed species.

Material and methods

Chromosome preparations

Living plants were collected from wild populations at the type locality in Xing'An County for chromosome analysis. Voucher specimens have been deposited in IBK. Actively growing root tips from leaf-cuttings grown in vermiculite in the GCCC culture room were collected. The young roots were pretreated in 2 mM 8-hydroxyquinoline at 15–18°C for about 6 h, and fixed overnight in an ethanol-acetic acid solution (3:1) below 4°C. Then, the chromosomes were stained and macerated in 2% acetic orcein with 1 N hydrochloric acid (10:1). The best metaphase plates were photographed using an Olympus BX51 microscope with Olympus DP71 camera attachment. The chromosome numbers were

determined in at least 20 cells from 10 different root tips with well-spread chromosomes.

Data available from the Dryad Digital Repository:
<doi:10.5061/dryad.84sp5> (Wen et al. 2015b).

***Primulina melanofilamenta* Ying Liu & F. Wen sp. nov. (Fig. 1–2)**

Differs from both *P. eburnea* and *P. atroglandulosa* by its dark purplish black filaments and anthers backed with a beard of white hairs. From the former it further differs by having pale purple or white corolla, and from the latter by having longer staminodes (ca 1.25 cm long) and pistils (2.5–4.0 cm long) which are densely puberulent with glandular-puberulent hairs.

Type: China. Guangxi Zhuang Autonomous Region: Xing'An County, on northern slope of a limestone hill, 25.6464°N, 110.4668°E, ca 180 m a.s.l., 10 Oct 2012, Ying Liu et al. 121010-1 (holotype: IBK, isotypes: ANU, IBK).

Etymology

The name of the new species refers to its dark purplish-black filaments.

Description

Perennial. Rhizomes nearly terete, 2–20 cm long, 1–2 cm in diameter. Leaves (6–) 8–15, opposite, clustered at the top of the rhizome; petiole compressed, 1.5–5.0 × 0.7–1.0 cm, densely pubescent; leaf blades slightly carnosus, ovate or narrowly ovate, 6.5–20.0 × 3.5–7.5 cm, obtuse or slightly acuminate at apex, attenuate or cuneate at basal, with entire margin, densely appressed pubescent on both surfaces, usually

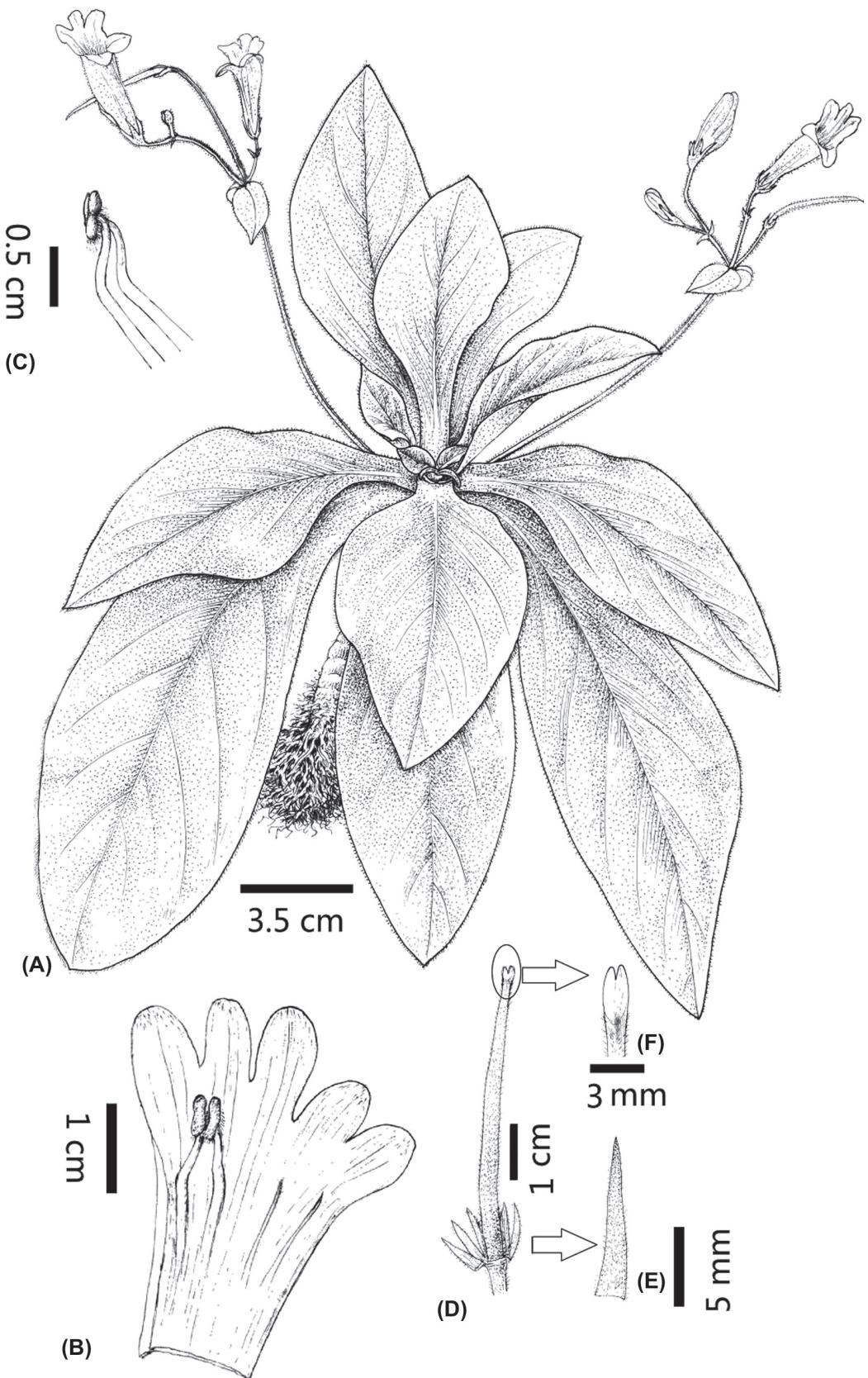


Figure 1. *Primulina melanofilamenta* sp. nov. (A) habit, (B) opened corolla with stamens and staminodes exposed, (C) stamens and anthers, (D) pistil and opened calyx lobes, (E) the abaxial surface of calyx lobe, (F) stigma. Drawn by Qing-Long Mo from the holotype, Ying Liu et al. 121010-1.



Figure 2. *Primulina melanofilamenta* sp. nov. (A) habitat, (B) habit, (C) cyme, buds and young capsules, (D) lateral view of corolla, (E) top view of corolla, (F) frontal view of corolla for showing purplish black filaments, (G) mature leaf, (H) young leaf. Photo by Ying Liu.

ciliate along margin, with 4–5, or occasionally 6, nerves on each side of midrib. Cymes 2–6; peduncles 10–15 cm long, ca 2 mm in diameter, densely erectly pubescent; pedicels 1.0–4.2 cm long, 1.0–1.2 mm in diameter, densely pubescent and sparsely glandular-pubescent. Flowers 3–8 per inflorescence; bracts 2, opposite, small, narrowly ovate to broadly lanceolate, sometimes cordate, 1.5–2.5 × 0.7–0.9 cm, usually withered at blooming time. Calyx 5-parted to near base, its lobes brownish purple, lanceolate, 9–10 mm long, 1.2–1.8 mm width at base, outside densely puberulent and erectly glandular-puberulent, inside nearly glabrous but near apex sparsely pubescent. Corolla lilac to white, 3.5–4.0 cm long, outside puberulent and sparsely glandular-puberulent, inside

nearly glabrous or occasionally sparsely pubescent; tube tubular-infundibuliform, pale lilac to white, 2.5–3.5 cm long, 1.2–1.4 cm in diameter at the middle of the corolla tube, 1.3–1.5 cm in diameter at the mouth of the corolla; limb distinctly 2-lipped; adaxial lip bipartite to the middle, its lobes slightly obliquely oblong, 5.0–6.5 mm long, ca 5 mm wide; abaxial lip tripartite, its lateral lobes slightly obliquely linguiform, ca 10 mm long, 6.0–7.5 mm wide, its central lobe oblong, 7.5–8.5 mm long, ca 6 mm wide. Stamens 2, adnate to 1.0–1.1 cm above the corolla base; anthers pale purple, reniform, 4.0–4.5 mm long, 2.0–2.5 mm in diameter, slightly constricted at the middle, glabrous except for the abdominal with a beard of white hairs; filaments purplish

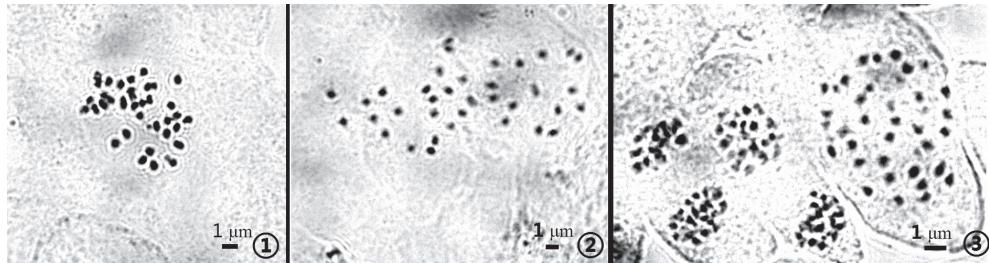


Figure 3. Somatic chromosomes at metaphase of *Primulina melanofilamenta* sp. nov. $2n = 36$, from the leaf cuttings of Ying Liu et al. 121010-1, IBK. 1–3 are microphotographs from different cells.

black, ca 1.5 cm long, flaky in their lower half, pubescent at base, geniculate at one-third, glabrous. Staminodes 2, linear, adnate to ca 1 cm above the corolla base, ca 1.25 cm long, glabrous, capitellate at apex. Disc ring-like, ca 1 mm high, with margin repand, glabrous. Pistil 2.5–4.0 cm long, 3.5–4.0 mm in diameter; ovary linear, with style densely puberulent and glandular-puberulent; stigma elliptic, 2.5–3.0 mm long, 1.5–2.1 mm in diameter, 2-lobed at apex, with lobes ca 0.8 mm long. Capsule linear, 5–8 × ca 0.2 cm, densely glandular-pubescent and pubescent.

Phenology

Flowering from the end of September to mid-October; fruiting in November.

Vernacular name

Hēi Sī Bào Chūn Jù Tái is the Chinese name for *P. melanofilamenta*, referring to the dark purplish-black filament.

Distribution, ecology and conservation status

Primulina melanofilamenta Ying Liu & F. Wen is narrowly endemic, only known from the type locality. It grows in moist and shady rocky crevices and tufa surfaces of a limestone hill. The average temperature of Xing'An County is 17.8°C, and the average annual precipitation has been estimated as ca 1842 mm. *Primulina melanofilamenta* occurs among subtropical evergreen broad-leaved trees and bushes. At present, only one population at the type locality is known, with about 65 mature individuals. Based on the

current information, *P. melanofilamenta* should be considered as 'Critically Endangered' (CR, CR B1a+D) following the IUCN categories and criteria (IUCN 2011).

Karyology

Chromosomes of *Primulina* have been studied, measured and found to be small in size according to the classification of Lima-de-faria (1980), within the range 0.6–2.4 μm (Liu et al. 2012). The somatic chromosomes of *P. melanofilamenta* at metaphase are illustrated in Fig. 3. It was identified as diploid with $2n = 36$ chromosomes. The size of the *P. melanofilamenta* chromosomes fall within the range of the genus, i.e. small (0.8–1.0 μm) and with only a slight variation in size. At present, almost all known chromosome numbers in this genus appear to represent a diploid number with a basic number of $x = 18$ (Christie et al. 2012, Kang et al. 2014).

Similar species

Even if the new species resembles *Primulina eburnea*, some special characteristics indicate they are not the same. The fact that these two species share similar habitats in this limestone area suggests that the similarity in morphology might be the result of convergent evolution. Another morphologically similar species is *P. atroglandulosa* (Weitzman et al. 1997, Wang et al. 1998) endemic to Longzhou County, Guangxi. The morphology of these three similar species is compared in Table 1.

Table 1. Diagnostic characters of *Primulina melanofilamenta* sp. nov. and the morphologically similar species *P. eburnea* and *P. atroglandulosa*.

Characters	<i>P. melanofilamenta</i>	<i>P. eburnea</i>	<i>P. atroglandulosa</i>
Leaf blade	Ovate or narrowly ovate, margin entire, apex obtuse or slightly acuminate	Ovate to elliptic or obovate, margin entire, apex acute	Narrowly elliptic to narrowly ovate, margin subentire to repand, apex acute
Bracts (cm)	Narrowly ovate to broadly lanceolate, sometimes cordate, 1.5–2.5 × 0.7–0.9	Ovate, broadly ovate to orbicular-ovate, 1.0–4.5 × 0.8–2.8	Ovate to narrowly ovate, 0.65–0.70 × 0.25–0.30
Corolla	Outside puberulent and sparsely glandular-puberulent, inside nearly glabrous or occasionally sparsely pubescent	Outside and inside sparsely puberulent, and abaxial inside with two villose lengthways stripes	Outside sparsely puberulent, inside puberulent near base of adaxial lip and below filaments
Filaments	Pubescent basally, glabrous	Sparingly puberulent basally	Black glandular-puberulent above middle
Anthers	Glabrous, except for the abdominal with a beard of white hairs	Nearly glabrous	Glabrous
Staminodes (mm)	ca 125	4–6	ca 3
Pistil length (cm)	2.5–4.0	2.2–3.0	ca 1.5
Florescence	September–October	April	June

Discussion

The differentiation center of *Primulina* is in the limestone areas of southwestern and southern China and northern Vietnam. Here, the highest biodiversity of this genus is found (Wei et al. 2010). *Primulina* shows a wide range of diversity in morphology, for example in leaf shape, cyme mode, corolla form and color. In *Primulina*, ridges on the corolla floor have frequently been reported to have colors different from the rest of the corolla, but only a few species have been reported of to have distinctly different colored filaments, e.g. *P. swinglei* (Merr.) Mich. Möller & A. Weber (orange filaments), *P. bicolor* (W. T. Wang) Mich. Möller & A. Weber (light purple filaments), *P. roseoalba* (W. T. Wang) Mich. Möller & A. Weber (purple-black filaments), *P. heterochroa* F. Wen & B. D. Lai (dark purple filaments) (Wen et al. 2015a). The differently coloured filaments appear to have evolved independently several times. For example, *P. swinglei* and *P. bicolor*, are not closely related (Kang et al. 2014).

The variation of leaves of *Primulina* is relatively large even within species, while the characteristics of flowers or reproductive organs are relatively stable. Careful observation of *Primulina* species distributed in south China revealed that share similar vegetal organs but have different flowers, e.g. *P. eburnea* (Hance) Y. Z. Wang, *P. pseudoeburnea* (D. Fang & W. T. Wang) Mich. Möller & A. Weber, *P. xiziae* Fang Wen, Yue Wang & G. J. Hua, *P. pseudoroseoalba* Jian Li, F. Wen & L. J. Yan, *P. lutea* (Yan Liu & Y. G. Wei) Mich. Möller & A. Weber, *P. pteropoda* (W. T. Wang) Yan Liu, *P. polyccephala* (Chun) Mich. Möller & A. Weber, *P. maguanensis* (Z. Yu Li, H. Jiang & H. Xu) Mich. Möller & A. Weber, and the new species described here. Some species prefer drier and sun-exposed rocks or cliffs while others appear to need moister and shaded conditions. Furthermore, *P. eburnea*, *P. xiziae* and *P. lutea* have similar leaves and habit and fall in one clade, suggesting that they are closely related (Kang et al. 2014). Thus, they are likely to share this characteristics by descent, whereas *P. pseudoeburnea* is only distantly related to this clade and thus represents a parallelism. As noted above, species which may have come from a common ancestor split into different lineages and types to adapt to different pollinators in different habitats and areas.

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