

## ***Petrocosmea weiyigangii* (Gesneriaceae), a new species from a limestone cave in southern China**

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**ABSTRACT.** A new species, *Petrocosmea weiyigangii* F.Wen (Gesneriaceae), is described from southern China. It differs from all other species of *Petrocosmea* in its deeply lobed leaf blades. It is only known from a limestone cave in northwestern Guangxi, China. Following the IUCN Red List categories and criteria, *Petrocosmea weiyigangii* is assessed as Critically Endangered.

**Keywords.** Cave-dwelling plant, Gesneriad, Guangxi, IUCN conservation assessments, limestone flora, new taxa, *Petrocosmea martini*

### **Introduction**

When Dr Li-Bing Zhang from Missouri Botanical Garden, USA and Prof. Hai He from Chongqing Normal University, China carried out a project on cave-dwelling *Polystichum* Roth species in October 2010, they found a distinctive species of Gesneriaceae in a large cave from Tianlin County, Guangxi, China. In this plant the leaf blades are lobed for half or more of the width of each side of the blade to the midrib, but not all the way to the midrib. The collectors sent me photos of this plant nearly three years later and I was unable to identify it. In the intervening period, a new species of *Primulina* Hance, *P. multifida* B.Pan & K.F.Chung (Xu et al., 2012), which has a pinnatifid leaf blade margin, was published. The leaves of the unknown species from Tianlin County (Fig. 1A) look rather like those of *Primulina multifida* (Fig. 1B), leading me to suspect that it may belong to *Primulina* at that time. In the years that followed, I visited Langping Town, Tianlin County many times but without being able to find the cave and this interesting plant. Fortunately, during a field investigation of the limestone flora of Guangxi, China in May 2018, I accidentally found the cave and the distinctive and attractive diminutive plant with deeply lobed leaves. Luckily it was flowering and the flowers more resembled *Petrocosmea* Oliv. than *Primulina*. I was unable to match it to any previously described species of *Petrocosmea* in the Gesneriaceae collections from Guangxi, Yunnan, Guizhou, Xizang and Sichuan in the principal herbaria in the region (e.g. GXMI, HITBC, IBK, IBSC, KUN, PE). I



**Fig. 1.** The similar leaf morphology of **A.** *Petrocosmea weiyigangii* F.Wen. and **B.** *Primulina multifida* B.Pan & K.F.Chung. (Photos: F. Wen).

was also unable to match it to any described species of *Petrocosmea* on comparison to images of specimens available in virtual herbaria (e.g. A, E, K, MO, P), and to descriptions in local floras (Wang et al., 1990, 1998) and monographs (Li & Wang, 2004; Wei et al., 2010; Qiu et al., 2015a).

*Petrocosmea* belongs to subtribe Didymocarpinae, tribe Trichosporeae, subfamily Didymocarpoideae of the Gesneriaceae (Weber et al., 2013). The genus currently comprises 47 species in South, East and Southeast Asia (Möller et al., 2016; Qiu et al., 2015a; Wei et al., 2010; Wang et al., 1990, 1998). Almost all *Petrocosmea* species are found in damp habitats in limestone areas, except *P. melanophthalma* Huan C.Wang et al. (Wang et al., 2013), *P. begoniifolia* C.Y.Wu ex H.W.Li (Li, 1983, Qiu et al., 2015a), *P. chrysotricha* M.Q.Han et al. (Han et al., 2018) and *P. sinensis* Oliv. (Oliver, 1887; Wei et al., 2010; Qiu et al., 2015a), which grow on damp surfaces and in crevices of marble and sandstone rocks and cliffs. All hitherto known species of *Petrocosmea* have leaf margins that are entire to serrate. The pinnatifid leaf blade margin of this new taxon is the most distinctive feature to distinguish it from other species of *Petrocosmea*.

The new species is described and illustrated below. A provisional IUCN conservation assessment following the guidelines by the IUCN Standards and Petitions Subcommittee (2017) is also provided.

### New species

#### *Petrocosmea weiyigangii* F.Wen, **sp. nov.**

The deeply lobed margin of the leaf blade distinguishes *Petrocosmea weiyigangii* F.Wen from all other species of *Petrocosmea*. – TYPE: China, Guangxi Zhuangzu Autonomous, Tianlin County, Langping town, 24°31'N, 106°19'E, alt. 1330 m, 18 May 2018, flowering, *Wei Yi-Gang & Wen Fang WYG180518-21* (holotype IBK; isotype IBK, KUN). (Fig. 1A, 2–3)



**Fig. 2.** *Petrocosmea weiyigangii* F.Wen. **A.** Habitat. **B.** Habit, with author's finger for scale. **C.** Relative size of the adult plant with author's hand for scale. **D.** Colony of flowering plants. **E.** Corolla viewed from the front. (Photos: F. Wen).

Perennial, stemless, rosulate herb. **Rhizome** extremely short, inconspicuous. **Leaves** inconspicuously spiral, 21 to 30 per plant, petioles subterete, 20–45 mm long, 0.8–1 mm in diam., brown, densely puberulent; leaf blades herbaceous when dried, ovate to rounded, slightly asymmetric to symmetric, 12–15 × 10–12.5 mm, base cordate and truncate, margin deeply lobed, lobes 2–3 on each side of blade, each lobe narrowly oblong to oblong, apices obtuse to nearly rounded, 2–3-veined, adaxially and abaxially glabrous. **Inflorescences** axillary, cymes usually 1-flowered; peduncle 35–50 mm long, densely eglandular-pubescent to pilose; bracts 2, free and opposite, ensiform, 2–3 mm long but usually caducous or withered before anthesis; pedicels 6–10 mm long, pubescent. **Calyx** nearly actinomorphic, equally divided into 5 lobes, with outer surface sparsely pubescent and inner surface nearly glabrous; lobes equal, broadly lanceolate, 6.5–8 × 3.5–5 mm, margin entire, apex acute. **Corolla** purple, throat white, sparsely pubescent outside, glabrous inside; tube c. 9 mm long; adaxial



**Fig. 3.** *Petrocosmea weiyigangii* F.Wen. **A.** A variety of leaves. **B.** Flower viewed from the top. **C.** Abaxial surfaces of calyx lobes. **D.** Calyx lobes, adaxial surfaces. **E.** Corolla, opened up to show stamens and staminodes. **F.** Pistil (Style, ovary and disc). **G.** Stamens with glabrous anthers and white pilose filaments. **H.** Mature dehiscent capsule. (Photos: F. Wen).

lip c. 6.5 mm long, indistinctly 2-lobed with the two small lobes fused for almost their entire length and each lobe folded and rolled laterally to form a carinate-plicate (galeate) structure that encloses the style; abaxial lip c. 19 mm long, 3-lobed to the middle, with oblong to semicircular lobes. **Stamens** 2, c. 10 mm long, adnate to the base of the corolla tube; filaments c. 6 mm long, geniculate near the middle with an angle of about 150°, white pilose from the base to the middle; anthers ovate, c. 3.6 mm long, poricidal, glabrous, dorsifixed, coherent at apex; staminodes 3, adnate to the corolla tube at the base, glabrous. **Disc** greenish yellow, annular, glabrous, c. 1.5 mm high. **Pistil** c. 16 mm long; ovary densely white villous, ovoid, c. 5.5 mm long; style semitransparent to white, c. 10.5 mm long; stigma punctiform, white. **Capsules** straight in relation to pedicel, brown, long ellipsoid, 5–6 mm long, both loculicidally and septicidally dehiscent.



**Fig. 4.** *Petrocosmea martini* (H.Lév.) H.Lév. **A.** Habitat. **B.** Habit, with author's finger for scale. **C.** Plant in flower. **D.** Corolla viewed from the front. (Photos: F. Wen).

*Distribution.* Only known from the type locality, a large limestone cave, near Tiandong Village, Langping town, Tianlin County, Baise City, Guangxi Zhuangzu Autonomous Region, China (Fig. 2A).

*Habitat.* The new species is only known from a very small area in the northwestern part of Guangxi, where it has been collected on two occasions growing on damp rock surfaces and in crevices at the bottom of a cliff in a large cave located between 1310 m and 1330 m above sea level. *Petrocosmea weiyigangii* appears to be restricted to shady and damp limestone crevices in near-vertical, moss-covered tufa habitats in the cave (Fig. 1A). The top of cliff above the cave mouth is covered in bushes and trees (Fig. 2A), a similar habitat to many species of *Primulina* and *Petrocosmea martini* (Fig. 4).

*Etymology.* The epithet '*weiyigangii*' is coined in honour of the Chinese botanist Prof. Yi-Gang Wei who has discovered, collected and described many new taxa of Gesneriaceae and has contributed much to the study of plant diversity and flora in Guangxi.

*Vernacular names.* 毅刚石蝴蝶. The Chinese pronunciation of *Petrocosmea weiyigangii* is 'Yì Gāng Shí Hú Dié'.

*Provisional IUCN conservation assessment.* Based on available information, the extent of occurrence (EOO) and area of occurrence (AOO) of *Petrocosmea weiyigangii* are both estimated at less than 4 km<sup>2</sup>. The entire population is only known from a single cave which is not in a protected area. This area is subject to human pressure, especially from deforestation and the grazing of goats and cattle. Even if the exact location of the plants is not under direct threat, these local vegetation changes will alter the micro-climate and ecological conditions, thereby impacting humidity and shade and altering the specialised habitat of *Petrocosmea weiyigangii*. This results in a projected continuing decline in both habitat quality and the number of mature individuals (IUCN Standards and Petitions Subcommittee, 2017). I therefore propose that *Petrocosmea weiyigangii* should be provisionally assessed as Critically Endangered CR B1ab(iii,v), B2ab(iii,v).

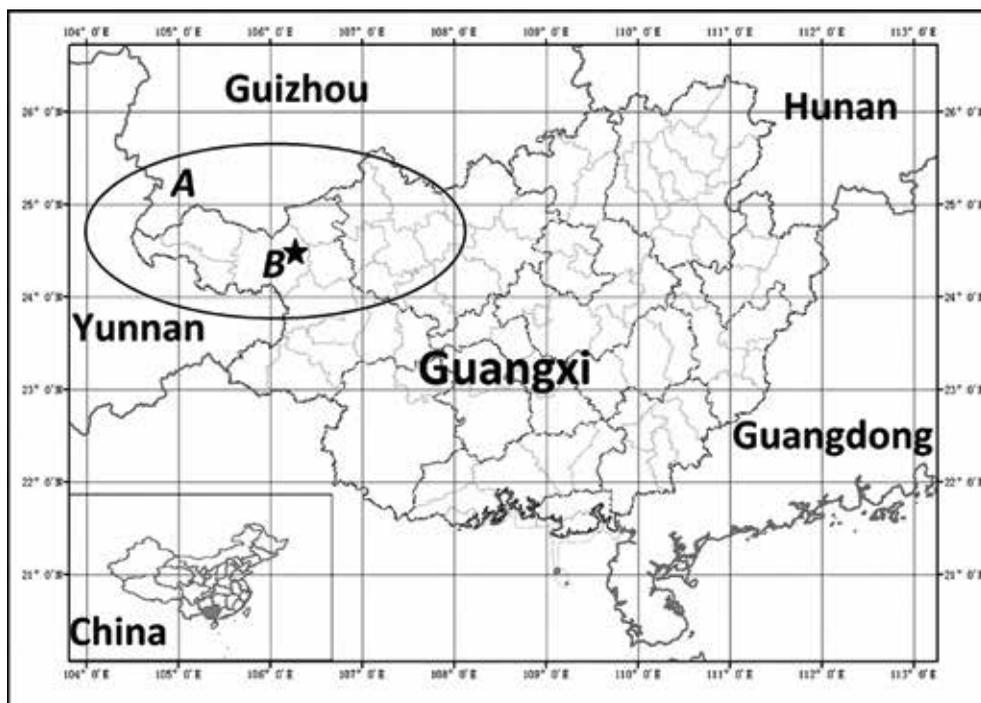
*Notes.* When this new taxon was first discovered by Dr Zhang and Prof. He, none of the plants were in flower, leading me to suspect it was a *Primulina* from the photos they sent me. When I observed its flowers and fruits in the field I discovered it possessed a number of characters typical of *Petrocosmea*: corolla tube broadly tubular and shorter than limb; filaments inserted at base of corolla; no disc; stigma capitate; capsule straight in relation to pedicel, narrowly ellipsoid to oblong to ovoid, nearly as long as calyx, dehiscent loculicidally to base, valves 2, straight, not twisted. *Petrocosmea* was previously divided into three sections, namely *Petrocosmea* sect. *Petrocosmea* Craib, *Petrocosmea* sect. *Anisochilus* Hemsl. and *Petrocosmea* sect. *Deinantha* W.T.Wang (Wang, 1985). Now this genus has been restructured into five sections: those above plus *Petrocosmea* sect. *Minor* Z.J.Qiu and *Petrocosmea* sect. *Barbatae* Z.J.Qiu based on morphological and molecular evidence (Qiu et al., 2011, 2015a, 2015b). The characters of *Petrocosmea* sect. *Anisochilus* include not having constricted anthers, an actinomorphic calyx divided into five segments and the calyx lobe margins entire. There are not many species of *Petrocosmea* in Guangxi: only *P. forrestii* Craib., *P. iodoides* Hemsl., *P. martini* (H.Lév.) H.Lév. and *P. minor* Hemsl. have previously been recorded. Of all species found in Guangxi, *Petrocosmea martini* (Fig. 4) is clearly the most similar to *P. weiyigangii* (Table 1). They have a similar floral structure: notably, the upper lip is conspicuously galeate and is about half the length of the lower lip. The flowers of the two species differ in corolla size with the corolla of *Petrocosmea weiyigangii* larger than *P. martini* (tube c. 9 mm long, adaxial lip c. 6.5 mm long and abaxial lip c. 19 mm long in *P. weiyigangii* vs. tube c. 3 mm long, adaxial lip c. 3 mm long and abaxial lip c. 6.5 mm long). These floral characters suggest that *P. weiyigangii* belongs to *Petrocosmea* sect. *Anisochilus* ser. *Iodioides* W.T.Wang. Unlike *Petrocosmea weiyigangii*, *P. martini* (Fig. 4) is widely distributed on the Yunnan-Guizhou Plateau (including Guizhou and Yunnan provinces and

**Table 1.** Morphological comparison of *Petrocosmea weiyigangii* and *P. martini*.

Characters		<i>P. weiyigangii</i>	<i>P. martini</i>
1. Leaf blade	a. Shape	Ovate to rounded	Ovate to orbicular-ovate
	b. Margin	Deeply 2–3-lobed on each side of blade, each lobe narrowly oblong to oblong	Crenulate to denticulate, not lobed
	c. Indumentum	Adaxially and abaxially glabrous	Adaxially pilose, abaxially densely pilose
2. Calyx lobe shape and size		Broadly lanceolate, 6.5–8 × 3.5–5 mm	Narrowly lanceolate, 2.5–3 × 0.8–1.5 mm
3. Filament length and indumentum		c. 6 mm long, white pilose from the base to the middle	2–3 mm long, rusty-brown puberulent or glabrous
4. Staminode number		3	2
5. Pistil length		c. 16 mm long	6–8 mm long
6. Style length		c. 10.5 mm long	1.5–2 mm long

northwestern Guangxi). The distribution of *Petrocosmea weiyigangii* is entirely within the range of distribution of *P. martini* (Fig. 5) and they are likely to be closely related with the unique morphological features of the former due to adaptation to its special cave environment or by the long geological isolation (Monro et al., 2018; Tao et al., 2015).

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**Fig. 5.** Distribution of *Petrocosmea weiyigangii* F. Wen (★), marked as ‘B’, and its relative, *P. martini* (H.Lév.) H.Lév. (in the elliptical area, marked as ‘A’) in China.

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