



A new dazzling species of Gesneriaceae, *Petrocodon paradelphinus*, from the limestone area of Guangxi, China

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ABSTRACT: *Petrocodon paradelphinus* F.Wen & W.C.Chou, a new species of Gesneriaceae from the limestone area of Guangxi, Southwest China, is described and illustrated here. This new species morphologically resembles *P. fangianus* (Y.G.Wei) J.M.Li & Yin Z.Wang, but it can be easily distinguished from the latter by having peduncles and pedicels puberulent, corolla outside sparsely puberulent, shorter tube 18–20 mm long, orifice from throat to the interior smooth, without protuberances, and lacks nectar guides. The conservation status of *P. paradelphinus* can be assessed provisionally as Critically Endangered [CR B2b(ii, v) + C2(a, i)].

KEY WORDS: flora of Guangxi, Limestone flora, Lithophilous, new taxon, *Petrocodon fangianus*, Taxonomy.

INTRODUCTION

The genus, *Petrocodon* Hance (1883), was once considered a monotypic genus within one type variety (*P. dealbatus* Hance var. *dealbatus*) and a variety (*P. dealbatus* var. *denticulatus* (W.T.Wang) W.T.Wang) before 2005 (Wang *et al.*, 1998; Li and Wang, 2005). Soon afterwards, two species, *P. ferrugineus* Y.G.Wei (2007) and *P. multiflorus* F.Wen & Y.S.Jiang (2010), were reported so that this former monotypic genus was changed as a small genus. Next, based on molecular and morphological evidence, the genus was redefined and all species from three other monotypic genera (*Calcareaoboea* C.Y.Wu ex H.W.Li, *Tengia* Chun, *Dolicholoma* D.Fang & W.T.Wang, *Paralagarosolen* Y.G.Wei, and a small genus (*Lagarosolen* W.T.Wang), and four species of *Didymocarpus* Wall. and *Wentsaiboea tiandengensis* Yan Liu & B.Pan were included into *Petrocodon* (Wang *et al.*, 2011; Weber *et al.* 2011a). Additionally, one species from the former *Primulina* Hance was reclassified and changed to be one member of *Petrocodon* (Xu *et al.*, 2014). By incorporating several recently described species (e.g., Yang *et al.*, 2022; Tan *et al.*, 2023; Zhang *et al.*, 2023, *etc*), the expanded genus *Petrocodon* s.l. at present consists of around 50 species and one variety (GRC, 2024). Most species are discovered to distribute in southern and southwestern China, especially in Guangxi Zhuangzu Autonomous Region, with the limestone regions along the China-Vietnam border being the center of diversity for *Petrocodon*, where about one-third of the species are endemic.

During a field survey in Nandan County, Guangxi in June 2022, we discovered a population of an unknown

species of Gesneriaceae in flowering. Unfortunately, it was the end of the blooming period. To better ascertain the status of this unknown species and whether it is under threat, we conducted several field surveys from the second half of 2022 to the first half of 2024 in similar limestone hill habitats surrounding the known population. We also introduced some live plants into the greenhouses of the National Gesneriaceae Germplasm Resources Bank of GXIB (NGGRB) and the Gesneriad Conservation Center of China (GCCC) for cultivation and observation under controlled environmental conditions. In June 2024, we finally collected specimens from plants in full bloom. The slightly coriaceous leaf blades, straight filaments, and capitate stigmas all suggest that this species might be a member of *Petrocodon* s.l. (Möller and Clark, 2013; Möller *et al.*, 2016; Lu *et al.*, 2017). After thorough field observations and cultivated live plant studies, we believe this unknown *Petrocodon* species from Nandan County, Guangxi, has not appeared or been recorded in any domestic or international monographs (Li and Wang, 2005; Wei *et al.*, 2010) or recently published literature on new taxonomic groups within *Petrocodon*, Gesneriaceae, over the past decade or so. This undescribed taxon of Gesneriaceae, characterized by its slender corolla tube and bright purple flowers, has been named *P. paradelphinus*.

MATERIALS AND METHODS

We examined *Petrocodon* specimens stored in major Chinese herbaria, such as IBSC, PE, KUN, IBK, and GXMI, and consulted digitized online specimen data from the Chinese Virtual Herbarium (CVH; <http://www.cvh.ac.cn/>) and the Chinese Field Herbarium



(CFH; <http://www.cfh.ac.cn/>) featuring images of *Petrocodon* species. Simultaneously, we also reviewed herbarium specimen data from internationally renowned herbaria, such as the Kew Herbarium (<http://apps.kew.org/herbcat/navigator.do>), the Royal Botanical Garden Edinburgh Herbarium (<https://data.rbge.org.uk/search/herbarium>), and The Muséum national d'Histoire naturelle (<https://science.mnhn.fr/institution/mnhn/search>).

Additionally, we studied the morphology of this new species and related species using live plants grown in the field and greenhouses. All morphological features were measured using a dissecting microscope and described according to the terminology proposed by Wang *et al.* (1998) and Harris and Harris (2006). The literature study included all relevant monographs (Wang *et al.*, 1990; Li and Wang, 2005; Wei *et al.*, 2010; Wei, 2018, 2023) and recently published articles (e.g., Yang *et al.*, 2022). The specific epithets and the authors' names align with the International Plant Names Index, making sure there are no repetitions (IPNI, 2024; POWO, 2024, both continuously updated). The preliminary conservation assessments followed the *Guidelines for Using the IUCN Red List Categories and Criteria Version 15* (IUCN, 2022).

TAXONOMIC TREATMENT

Petrocodon paradelphinus F.Wen & W.C.Chou, *sp. nov.*

飛燕石山莖苔 Figs 1 & 2

Type: China. Guangxi Zhuangzu Autonomous Region. Hechi City, Nandan County, Lihu Town, Encun village, on moist limestone rock surfaces at the bottom of a limestone hill, 25.071°N, 107.599°E, alt. ca. 900 m, 11st June 2024, Wei-Chuen Chou W.C.Chou240611-01 (Holotype: IBK!).

Diagnosis: Morphologically, *Petrocodon paradelphinus* F.Wen & W.C.Chou resembles *P. fangianus* (Y.G.Wei) J.M.Li & Yin Z.Wang in leaf blade coriaceous and shape elliptic to oblong, differs from the latter in peduncles and pedicels puberulent (*vs.* peduncles and pedicels puberulent and glandu-puberulent in *P. fangianus*, the order same as follows); corolla outside sparsely puberulent (*vs.* sparsely glandular puberulent), tube curved, 18–20 mm long (*vs.* straight, ca. 26 mm long), orifice from throat to the interior smooth, without protuberances, and lacks nectar guides (*vs.* orifice with two oblong, brown, glandular puberulous below the middle lobes of corolla); significant short style ca. 1.5 mm long (*vs.* ca. 26.5 mm long), and filaments adnate to corolla tube ca. 7 mm above the base (*vs.* adnate to corolla tube ca. 19 mm above the base).

Description: Perennial herb, acaulescent. **Rhizome** gray-brown, commonly conical to cylindrical, 5–10 mm long, 2–4 mm in diameter, glabrous; roots brownish gray, numerous, fibrous, lacking of taproot. **Leaves** ca. 6,

opposite, all basal or crowded at the apex of rhizome after years of growth. **Petioles** green, 10–20 mm long, 1.0–1.2 mm in diameter, densely vertically strigose, cross section nearly rounded. **Leaf blades** adaxially dark green, and abaxially reddish purple but veins whitish purple, elliptic to oblong, commonly eudipleural, 15–25 × 10–14 mm, thick herbaceous and slightly coriaceous, adaxially and abaxially vertically strigose, and margin distinctly ciliate, base cuneate, margins from the base of the leaf blade for approximately 1/3 entire, then from there to the top of the leaf blade, each side 9–10 crenations, apex obtuse; lateral veins 3–4 on each side of midrib, adaxially distinctly impressed, abaxially conspicuously prominent. **Cymes** all axillary, each plant with 2–4 cymes, 1-flowered, rarely 2-flowered in each cyme. **Peduncle** greenish purple to brownish purple, 4–7 mm long, 0.4–0.5 mm in diameter, puberulent; bracts 2, free, opposite, pale green, lanceolate to broadly lanceolate or oblong-ovate, tiny, 0.8–1.0 × ca. 0.5 cm, outside sparsely puberulent, inside nearly glabrous, margin entire, apex acute, usually closely attached to the pedicel, not spreading. **Pedicel** green to pale purplish green, ca. 5 mm long, ca. 0.6 mm in diameter, sparsely inconspicuously puberulent. **Calyx** 5-sect from base; segments equal, green, linear-lanceolate to lanceolate, ca. 2 × 0.5 mm, outside puberulent, inside sparsely puberulent to glabrous, margin entire, apex obtuse. **Corolla** slightly laterally compressed, purple, ca. 3.5 cm long, outside sparsely extremely puberulent, inside very sparsely puberulent to glabrescent; tube narrowly tubular to nearly cylindrical (tube straight when the corolla lobes first open and ca. 1 day after the flower blooms; tube curved forming slightly 'L' curved from the tube base upward to ca. 2/5 of its length when the pistil elongated and stigma mature, about 3–5 days after the flower blooms), 18–20 mm long, orifice 5–7 mm in diameter, and from throat to the interior smooth, without protuberances, and lacks nectar guides; limb distinctly 2-lipped, adaxial lip 2-partite to the base, lobes slightly oblique, oblong, adaxial lobes 6.0–7.0 × 6.0–6.5 mm; abaxial lip 3-partite to middle or slightly over middle, lateral lobes obliquely oblong, 6.0–6.5 × ca. 6.0 mm, the central one slightly obovate, 7.5–8.0 × 5.5–6.0 mm. **Stamens** 2, anterior, adnate to corolla tube ca. 7 mm above the base; filaments white, straight, ca. 1.0 mm long, glabrous; **anthers** pale brownish yellow, fused by their entire adaxial surfaces, oblong, ca. 1.5 × 0.9 mm, glabrous. **Staminodes** 2, white, tiny, glabrous, 0.1–0.2 mm long, adnate to corolla ca. 3.5 mm above base. **Disc** greenish white, glabrous, annular, margin sinuate, but the height of disc uneven, the higher side ca. 0.8 mm high, the lower side ca. 0.5 mm high. **Pistil** ca. 5.0 mm long; **ovary** green, cylindrical, glabrous, ca. 3 mm long, ca. 1.0 mm in diameter; **style** purple, cylindrical, ca. 1.5 mm long, ca. 0.4 mm in diameter, sparsely glandular puberulent. **Stigma** translucent to white, 2, each ligulate, tuberculate, ca. 0.8 mm long, ca. 0.5 mm in diameter. Capsule no seen.

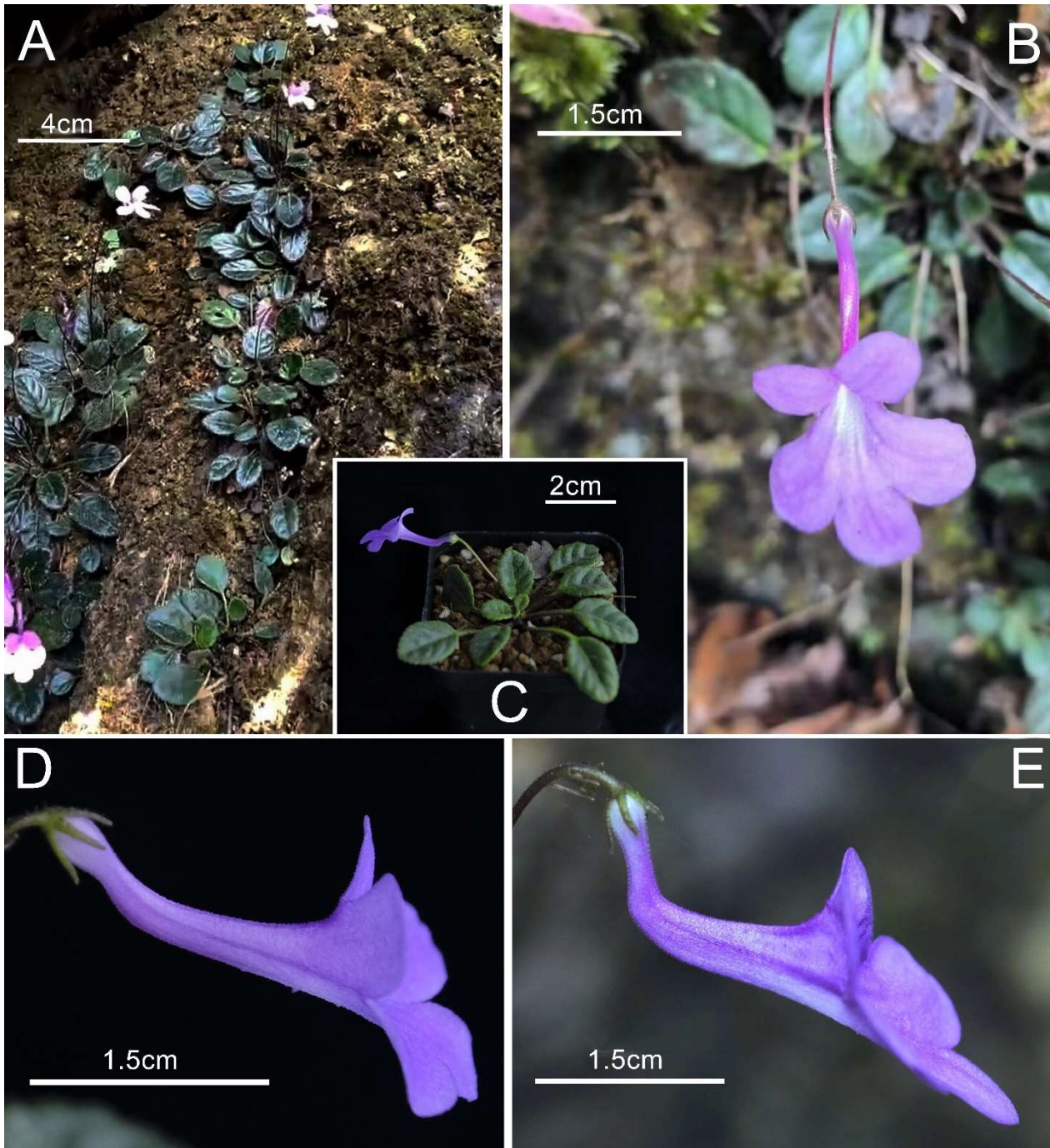


Fig 1. Photographs of *Petrocodon paradelfinius* F.Wen & W.C.Chou sp. nov. **A.** Habitat at the type location. **B.** The flowering plant in the field. **C.** The cultivated plants. **D.** The lateral view of corolla ca. 1 day after the flower blooms. **E.** The lateral view of the corolla ca. 5 days after the flower blooms. (A-B photoed by Wei-Chuen Chou, C-E photoed by Fang Wen).

Phenology: The flowering period is in June. Based on the typical pattern of post-flowering to fruit maturation in *Petrocodon* species, the fruiting period should occur about three months after the end of the flowering period, which would be around September.

Etymology: The specific epithet '*paradelfinius*' of this new species is composed of two parts. The prefix

'*para-*' is derived from the Greek '*παρά*' (*para*), meaning 'beside, similar, or alike,' and it is often used to indicate that two plants have similar but not identical characteristics in plant nomenclature. The latter part '*-delfinius*' is derived from the genus, *Delphinium* Linn., and has been modified to a masculine form following the pattern of the genus, *Petrocodon*. This epithet indicates

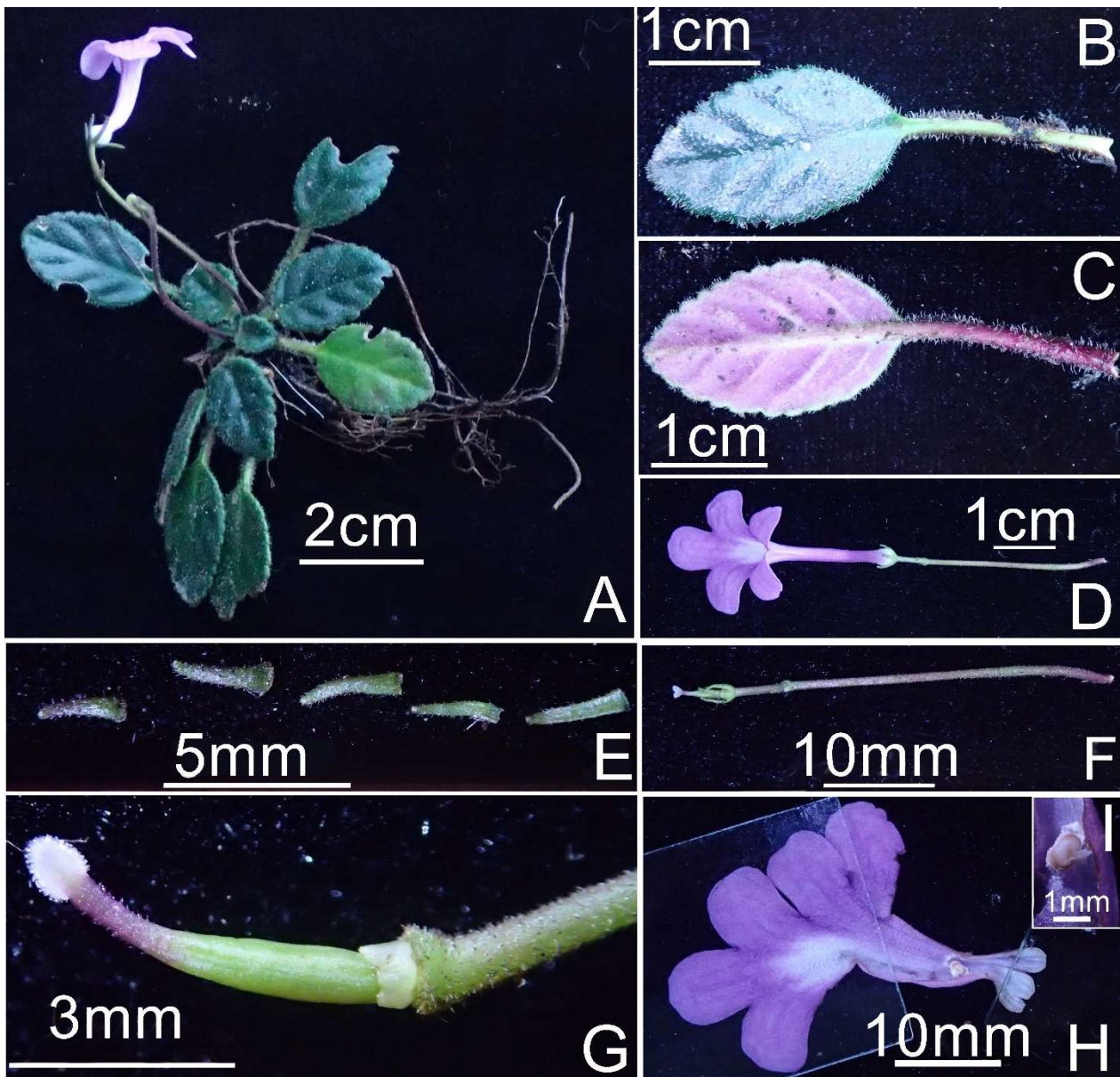


Fig 2. Photographs of *Petrocodon paradelphinus* F.Wen & W.C.Chou sp. nov. **A.** Habit. **B.** The adaxial view of leaf. **C.** The abaxial view of leaf. **D.** The top view of cyme. **E.** The calyx lobes. **F.** The cyme after removing the corolla. **G.** Pistil. **H.** Opened corolla. **I.** Stamens (Photoed by Fang Wen).

that the new species' slender corolla tube resembles the elongated spur of flowers in *Delphinium*. Additionally, the new species' spreading, larger corolla lobes, and bluish-purple hues make it reminiscent of flowers in *Delphinium*, hence the name '*paradelphinus*'.

Distribution, habitat and preliminary conservation

status: Currently, there are fewer than 50 mature individuals at the type locality. Over the past five years, the habitat on this limestone mountain has been continuously degraded due to local residents cutting firewood, leading to severe vegetation decline on the hills. As a result, this species is now only found growing in the crevices of limestone rocks within a vertical groove at the

north-facing foot of the hill. The surrounding trees and shrubs are still relatively well-preserved. However, this species is highly dependent on moist calcium-rich tufa so that it is difficult to migrate. In the second half of 2022, Guangxi suffered a drought that lasted for half a year, which led to a significant decline of the population. By early 2023, approximately half of the adult plants were observed to have died due to drought stress. Due to the plant's small size and relatively large flowers, which have high ornamental value, local residents have been collecting them as wild ornamental plants for online sales. This has also caused a significant decline in the population, with a reduction in the number of individuals.



Only a few dozen individuals remain in inaccessible locations at the top of the groove. Therefore, according to the IUCN Red List Categories and Criteria (<https://www.iucnredlist.org/resources/categories-and-criteria>), we provisionally assess *P. paradelphinus* as Critically Endangered (CR B2b(ii, v) + C2(a, i)).

Notes: As mentioned above, this new species is morphologically similar to *Petrocodon fangianus* (Y.G.We) J.M.Li & Yin Z.Wang (Wei, 2004; Wang *et al.*, 2011; Weber *et al.*, 2011). Meanwhile, other congeneric species with medium to large purple flowers include *P. chongqingensis* F.Wen, B.Pan & L.Y.Su (Su *et al.*, 2019) and *P. hunanensis* X.L.Yu & Ming Li (Yu *et al.*, 2015). However, the latter two species have a tubular to broadly tubular corolla tube, which is distinctly different from the slender corolla tube of this new species. Other congeneric species with slender corolla tubes include some groups formerly classified under *Lagarosolen*-like group, such as *Petrocodon albinervius* D.X.Nong & Y.S.Huang (Nong *et al.*, 2021), *P. hechiensis* (Y.G.We, Yan Liu & F.Wen) Y.G.We & Mich.Möller (Wei *et al.*, 2008), *P. hispidus* (W.T.Wang) A.Weber & Mich.Möller (Wang, 1984), *P. integrifolius* (D.Fang & L.Zeng) A.Weber & Mich.Möller (Fang *et al.*, 1993), *P. ionophyllus* F.Wen, S.Li & B.Pan (Li *et al.*, 2020), *P. jingxiensis* (Yan Liu, H.S.Gao & W.B.Xu) A.Weber & Mich.Möller (Xu *et al.*, 2008), and so on. However, these species typically have a narrowly funnel-shaped corolla tube with sub-acute to acute apexes of corolla lobes, which can be easily distinguished from this new species. *Petrocodon lui* (Yan Liu & W.B.Xu) A.Weber & Mich.Möller (Xu *et al.*, 2010) can be differentiated by its herbaceous leaf blades and distinctly narrow funnel-shaped corolla tube, while the new species has nearly coriaceous to coriaceous leaf blades and a straight, nearly uniformly cylindrical corolla tube.

Voucher specimen (*Petrocodon fangianus* (Y.G.We) J.M.Li & Yin Z.Wang = former *Paralagarosolen fangianum* Y.G.We) examined: CHINA. Guangxi Zhuang Autonomous Region: Baise city, Napo County, Pohe Town, Pohe village, growing at the crevices of limestone cliffs in Karst landscape, elevation ca. 1080 m, 27 October 2003 (fl.), *Y.G.wei 0301* (holotype IBK!, isotype GXMI!, IBK!); same locality, 25 October 2002, *Yi-Gang Wei Y.G.We 0211* (IBK!).

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