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Petrocodon chishuiensis (Gesneriaceae), a new species endemic to Guizhou, China

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ABSTRACT: A new species, *Petrocodon chishuiensis* Z.B. Xin, F. Wen & S.B. Zhou, from NW Guizhou, China, is described and illustrated here. It shares a rare characteristic with *P. hunanensis* X.L. Yu & Ming Li, *P. tongziensis* R.B. Zhang & F. Wen and *P. longitubus* Cong R. Li & Yang Luo: all have four fertile stamens, a character state distinguishing this clade from the rest of *Petrocodon*. *P. chishuiensis* closely resembles *P. hunanensis* and *P. tongziensis*, but differs in vegetative and generative characters. We found only one population with no more than 60 mature individuals at the type locality. This species is provisionally assessed as Critically Endangered (CR B2ab(iii)) using IUCN criteria.

KEY WORDS: China, Cliff-dwelling, Danxia landform, flora of Guizhou, Gesneriaceae, *Petrocodon,* taxonomy.

INTRODUCTION

The genus *Petrocodon* Hance (Tribe Trichosporeae: Didymocarpoideae: Gesneriaceae) was established by Hance (1883). It is endemic to China, and known as a monotypic genus for over a century. It comprised only one species (*P. dealbatus* Hance) and one variety (*P. dealbatus* Hance var. *denticulatus* (W.T. Wang) W.T. Wang (Wang and Pan, 1990)) for a long time until 2007. Two new species, *P. ferrugineus* Y.G. Wei (Wei, 2007) and *P. multiflorus* F. Wen & Y.S. Jiang (Jiang *et al.*, 2011) were described at the beginning of the 21st century. Based on molecular data and a morphological evaluation, five genera, mostly small-sized and monotypic, i.e. *Calcareoboea* C.Y. Wu ex H.W. Li (Li, 1982), *Dolicholoma* D. Fang & W.T. Wang (Wang, 1983), *Lagarosolen* W.T. Wang (Wang, 1984), *Paralagarosolen* Y.G. Wei (Wei, 2004), *Tengia* Chun (Chun, 1946), and a few species of *Didymocarpus* Wallich (Wallich, 1819), were revised and merged into *Petrocodon* (Wang *et al.*, 2011; Weber *et al.*, 2011). And with new taxa published after 2011, the genus has been expanded and is comprised of 41 species and one variety (IPNI, 2019; Möller, 2019; Wen *et al.*, 2019). Five species were published last year, namely *P. tongziensis* R.B. Zhang & F. Wen (Zhang *et al.*, 2019a), *P. longitubus* Cong R. Li & Yang Luo (Li *et al.*, 2019), *P. chongqingensis* F. Wen, B. Pan & L.Y. Su (Su *et al.*, 2019b), *P. jiangxiensis* F. Wen, L.F. Fu & L.Y. Su (Su *et al.*, 2019a) and *P. rubiginosus* Y.G. Wei & R.L. Zhang (Zhang *et al.*, 2019b).

In October 2010, the authors collected specimens of an unknown species of Gesneriaceae during a botanical expedition in NW Guizhou Province, near Sichuan Province and Chongqing City, China. The newly collected specimen resembled the recently described *Petrocodon hunanensis* X.L. Yu & Ming Li (Yu *et al.*, 2015) (Fig. 3) and *P. tongziensis* (Fig. 4) in flower shape, stamen number and capsule characters, but differs in other characters. Thus, we considered that it represents a new species of *Petrocodon*.

TAXONOMIC TREATMENT

Petrocodon chishuiensis Z.B. Xin, F. Wen & S.B. Zhou, ***sp. nov.*** **赤水石山苣苔 Figs. 1 & 2; Table 1**

***Type*:** CHINA: Guizhou Province: Chishui City, at damp and shaded bottom of cliff in a valley of Danxia landform, 28°21′N, 105°44′E., alt. ca. 732 m, flowering, 01 Oct 2010 *F.W.-Ges20101001* (holotype: IBK!, isotypes: IBK!, TAI!).

Diagnosis. *Petrocodon chishuiensis* is morphologically similar to *P. hunanensis* (Fig. 3), but differs by its acaulescence (*vs*. stem 5–20 cm long); leaf blades thin chartaceous, oblong or oblanceolate, 5–7 cm long (*vs*. thickly chartaceous, ovate, 2–3.2 cm long); petiole 3–8 cm long, densely white lanate (*vs*. 0.5–2.5 cm long, densely reddish-purple pubescent); bracts oblong, 7–12 mm long (*vs*. lanceolate, 1–3 mm long); calyx lobes linear, 9–10 × ca. 1 mm (*vs*. triangular-lanceolate, 3–5 × ca. 1 mm); staminode absent or extremely indistinctive (*vs*. ca. 1 mm long); ovary 18–20 mm long, no stipitate (*vs*. ca. 10 mm long, distinctly stipitate) and capsule glabrous (*vs*. densely short puberulence). *P. chishuiensis* also resembles

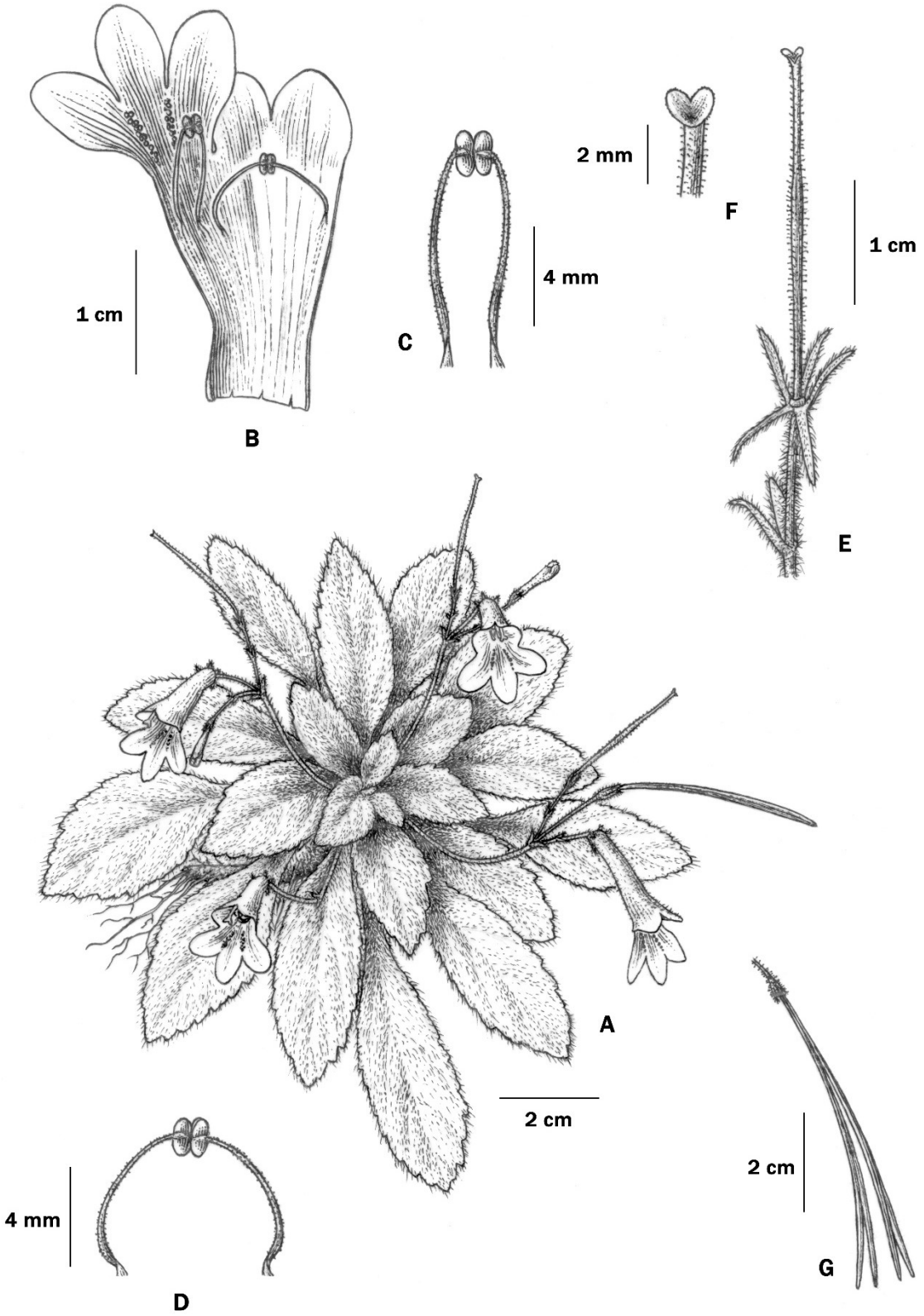

Fig. 1. ***Petrocodon chishuiensis*** sp. nov.: **A:** habit; **B:** cut open corolla with four stamens; **C:** upper stamens; **D:** lower stamens; **E:** pistil with bracteoles and opened calyx; **F:** stigma and part of style; **G:** mature dehisced capsule. From *F.W.-Ges 20101001*(IBK). Drawn by Yun-Xi Zhu.

Table 1. Morphological comparison between *Petrocodon chishuiensis* and its close relatives, *P. hunanensis* and *P. tongziensis*.

Characters	*P. chishuiensis*	*P. hunanensis*	*P. tongziensis*
Terrestrial stem	acaulescent	5–20 cm long	acaulescent
Leaf blades	thin chartaceous, oblong or oblanceolate, 5–7 cm long	thickly chartaceous, ovate, 2–3.2 cm long	chartaceous, elliptic to oval-elliptic, 2.5–4.5 cm long
Petiole	3–8 cm long, white lanate	0.5–2.5 cm long, reddish-purple pubescent	1.0–4.5 cm long, white pubescent
Bracts	2, oblong, 7–12 mm long	2, lanceolate, 1–3 mm long	3, oval-lanceolate, 1–2 mm long
Calyx lobes	linear, 9–10 × ca. 1 mm	triangular-lanceolate, 3–5 × ca. 1 mm	linear-lanceolate, 3–5 × ca. 0.5 mm
Staminode	absent/extremely indistinctive	ca. 1 mm long	absent/extremely indistinctive
Ovary	1.8–2 cm long, no stipitate	ca. 1 cm long, distinctly stipitate	ca. 0.8 cm long, no stipitate
Fruit	5–6.5 cm long	2.5–4 cm long	1.5–2.5 cm long
Capsule	glabrous	densely short puberulence	densely short puberulence

Fig. 2. ***Petrocodon chishuiensis*** sp. nov.: **A:** habitat; **B:** plants in flower and leaf blade adaxial surface; **C:** leaf blade abaxial surface; **D:** Frontal view of flower, showing the two rows of conspicuous orange-yellow glandular hairs on lower lip and corolla throat; **E:** lateral view of flower; **F:** flower viewed from below; **G:** pistil, showing the stigma, style and ovary; **H:** mature, dehisced capsule splitting into 4 valves. (Photos: Fang Wen).

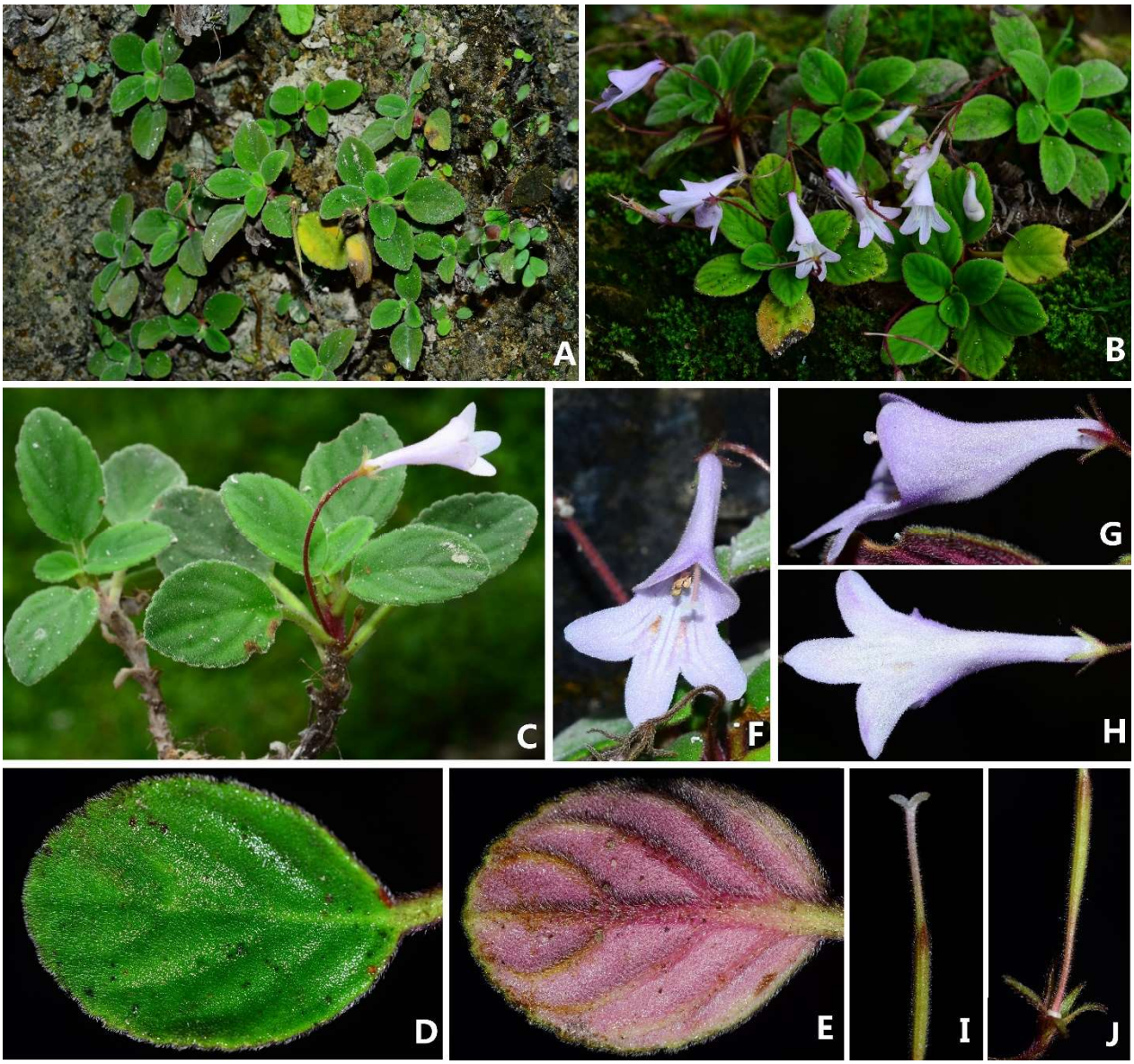

Fig. 3. ***Petrocodon hunanensis*****: A:** habitat; **B:** plants in flower; **C:** shoots with a single flowered cyme and stem with distinct internodes; **D:** leaf blade adaxial surface; **E:** leaf blade abaxial surface; **F:** frontal view of corolla; **G:** lateral view of corolla; **H:** flower viewed from below; **I:** stigma, style and distal part of the ovary; **J:** calyx lobes, disc and stiped ovary. (Photos: Xun-Lin Yu, Jian-Jun Zhou & Ming Li).

P. tongziensis (Fig. 4) but differs by its leaf blades oblong or oblanceolate, 5–7 cm long (*vs*. elliptic to oval-elliptic, 2.5–4.5 cm long); bracts 2, oblong, 7–12 mm long (*vs*. bracts 3, oval-lanceolate, 1–2 mm long); calyx lobes linear, 9–10 × ca. 1 mm (*vs*. linear-lanceolate, 3–5 × ca. 0.5 mm); corolla white with pinkish shading, with 2 conspicuous rows of orange-yellow glandular hairs on abaxial lip (*vs*. pale violet with a lavender shading, a darker purple blotch on abaxial lip); ovary linear, 18–20 × 0.8–1.3 mm (*vs*. cylindrical, ca. 8 × ca. 2 mm); fruit 5–6.5 cm long (*vs*. 1.5–2.5 cm long) and capsule glabrous (*vs*. densely short puberulence).

Description**:** Perennial acaulescent herb, lithophytic. Leaves 18–25, spiral on a basal rosette; petiole 3–8 cm long, densely white lanate; leaf blades oblong or oblanceolate, 5–7 cm long, 1.5–2.5 cm wide at the widest point, base narrowly cuneate or cuneate, margin serrate, adaxial and abaxial surfaces densely whitish villous; lateral veins 5–6 on each side of midrib, conspicuous on both surfaces, apparently raised on abaxial surface. Cymes 2–8, lax, axillary, 1–3-flowered; peduncles 4–9 cm long, whitish lanate; bracts 2, opposite, oblong, 7–12 mm long, ca. 3 mm wide, apex with an obtuse tip, margin entire, outside whitish pubescent, inside sparsely pubescent; bracteoles 2, opposite, lanceolate, 6–7 mm long, ca. 1.5 mm wide, margin entire, outside whitish pubescent, inside with sparse pubescent; pedicels ca. 1 cm, whitish pubescent. Calyx 5-sect from base; lobes equal,

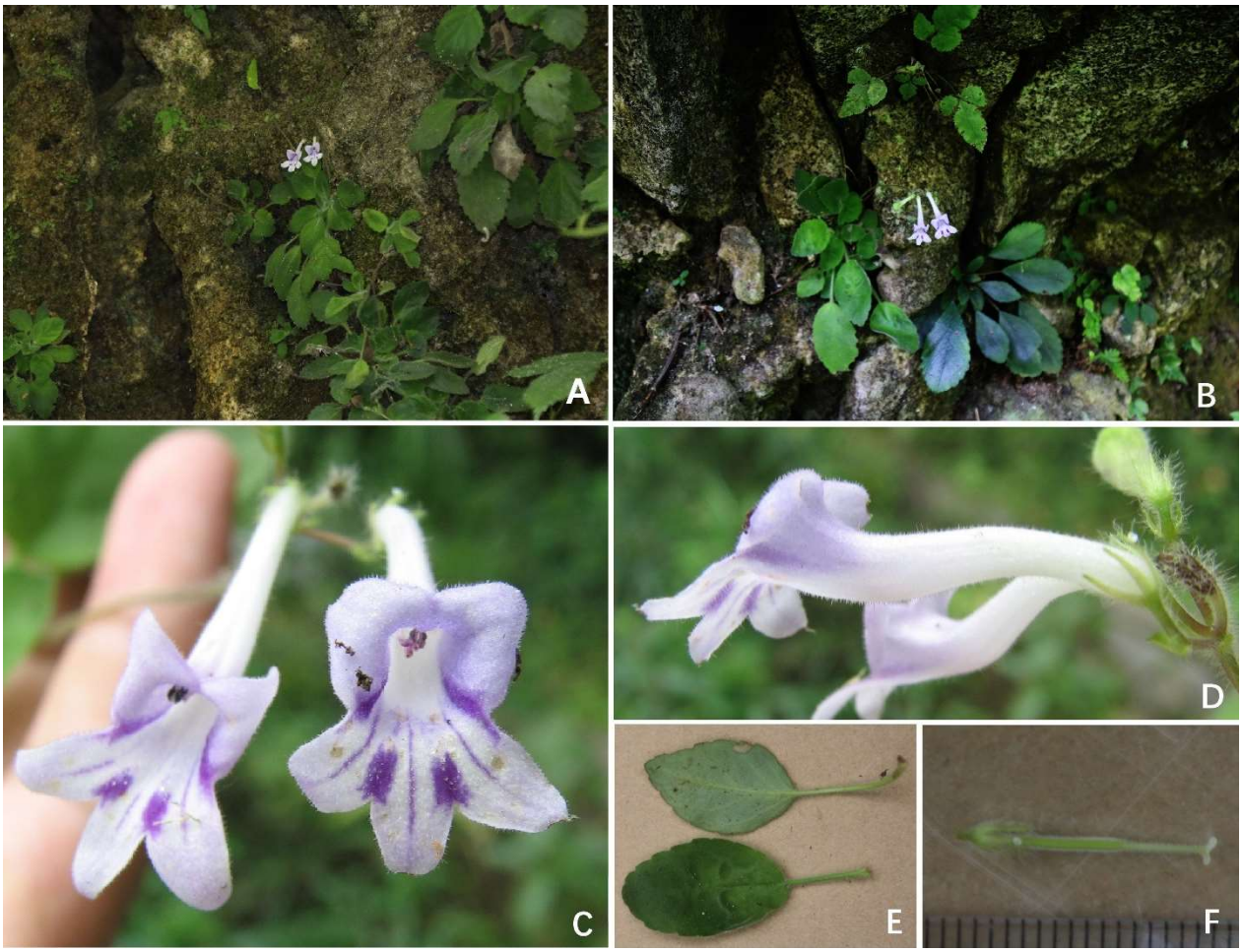

Fig. 4. ***Petrocodon tongziensis*****: A:** habitat; **B:** plant in flowering; **C:** the frontal view of corolla; **D:** the lateral view of corolla; **E:** abaxial and adaxial surfaces of leaf blades and petiole; **F:** pistil. (Photos: Ren-Bo Zhang.)

linear, 0.9–1 cm long, ca. 1 mm wide, outside densely pubescent, margin entire. Corolla tubular, white with pinkish shading, zygomorphic, 2.4–3 cm long; corolla tube 1.6–1.9 cm × 1.5–4 mm; limb 2-lipped, adaxial lip short, 2-lobed to the middle, lobes oblong or broadly triangular, ca. 0.5 cm long, abaxial lip 3-lobed, ovate, central one longer than lateral ones, ca. 1 cm long, lateral ones ca. 0.8 cm long, with 2 conspicuous rows of orange-yellow glandular hairs on abaxial lip and corolla throat. Stamens 4, two longer ones adnate to corolla tube ca. 1.4 cm from the base, filaments ca. 0.9 cm long, two shorter ones adnate to corolla tube ca. 1.3 cm from the base, filaments ca. 0.8 cm long, all filaments linear, slightly arched from middle to base, pink, densely with glandular-puberulent hairs especially at the base; anthers dorsi-fixed, reniform to elliptic, ca. 1.8 mm long, ca. 0.8 mm wide, coherent in pairs, thecae confluent at middle, glabrous, dehiscing longitudinally; staminode absent or extremely indistinctive. Disc annular, ca. 1 mm high, margin entire. Pistil densely glandular-pubescent; ovary linear, 1.8–2 cm long, 0.8–1.3 mm wide, 1-loculed, placentas 2, parietal. Style ca. 8 mm long, ca. 0.8 mm wide, with glandular hairs, stigmas 2, ovate, ca. 1.5 mm long, ca. 0.8 mm wide, puberulent. Fruit 5–6.5 cm long, capsule linear-cylindrical, 4-valved, glabrous. Seeds appendaged.

Etymology**:** The specific epithet is derived from the type locality, Chishui City, Guizhou Province, China.

Phenology**:** Flowering from late September to November, fruiting from October to December.

Distribution and habitat**:** The new species is only known from its type locality, Chishui city, Guizhou province, China. This species grows at damp and shaded bottom of cliff in a valley of Danxia landform, at an altitude of 730–752 m, 28°21′N, 105°44′E.

Conservation status**:** *Petrocodon chishuiensis* is known from a single population in Chishui City, Guizhou Province. It is clearly scarce, being known from one very small area of occupancy, estimated at 20 m^2 on a rock surface in a valley of Danxia landform. Obviously, this area of occupancy of *P. chishuiensis* we found so far is significantly lower than the smallest AOO unit of IUCN is 4 km^2 (2 × 2 km^2 grid) for Critically Endangered B2. According to the detailed information from our careful

field investigation on the surroundings of the type area for more than ten times in recent years, the population size of this new species is fewer than 60 plants at the sole site. Potential direct threats to the plants come from the high visitor density in this famous scenic spot. The information on abundance, highly restricted range, and direct threats indicate that this species is facing an extremely high risk of extinction, and is assessed provisionally as Critically Endangered (CR B2ab(iii)) (IUCN, 2019) before more populations being discovered.

Notes*: *Petrocodon chishuiensis shares the character of four fertile stamens with *P. longitubus*, *P. hunanensis* (Fig. 3) and *P. tongziensis* (Fig. 4), it resembled *P. hunanensis* and *P. tongziensis* in flower shape, stamen number and capsule characters, but differs in other characters. Morphological comparison of *P. chishuiensis* and its two relatives are summarized in Table 1.

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LITERATURE CITED

Chun, W.-Y. 1946. Gesneriacearum novae Sinicarum. Sunyatsenia **6**: 271–304.

Hance, H. F. 1883. New Chinese Cyrtandreae. Journal of Botany **21**: 165–170.

IPNI. 2019. The International Plant Names Index. Available from: http://www.ipni.org (accessed December 2019)

IUCN Standards and Petitions Committee. 2019. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee.
http://www.iucnredlist.org/documents/RedListGuidelines.pdf.

Jiang, Y.-S., Y. Zhang, Y. Wang and F. Wen. 2011. *Petrocodon multiflorus* sp. nov. (Gesneriaceae) from Guangxi, China. Nord. J. Bot. **29(1)**: 57–60.

Li, C.-R., F.-P. Liu, S. R. Gadagkar and Y. Luo. 2019. *Petrocodon longitubus* (Gesneriaceae), a new species from Guizhou, China. Phytotaxa **408(4)**: 267–275.

Li, H.-W. 1982. Two new genera and one little known genus of Gesneriaceae from Yunnan. Acta Botanica Yunnanica **4**: 241–247.

Möller, M. 2019. Species discovery in time：An example from Gesneriaceae in China. Guangxi Sciences **26(1)**: 1–16.

Su, L.-Y., B. Pan, X. Hong, Z.-G. Zhao, L.-F. Fu, F. Wen and S. Maciejewski. 2019a. *Petrocodon jiangxiensis* (Gesneriaceae), a new species from Jiangxi, China. Ann. Bot.i Fenn. **56(4-6)**: 277–284.

Su, L.-Y., T. Peng, Z.-G. Zhao, B. Pan and F. Wen. 2019b. *Petrocodon chongqingensis*, a new species of Gesneriaceae from Chongqing City, China. Guihaia **39(8)**: 997-1006.

Wallich, N. 1819. Notice of the progress of botanical science in Bengal. A. Constable, Edinburgh Philosophical Journal: Exhibiting a view of the progress of discovery in natural philosophy, chemistry, natural history, practical mechanics, geography, statistics, and the fine and useful abts.**1**: 378.

Wang, W.-T. 1983. Three new genera of Gesneriaceae from China. Bulletin of Botanical Research **1**: 15–24.

Wang, W.-T. 1984. Notulae de Gesneriaceis Sinensibus (VI). Acta Botanica Yunnanica **6**: 11–26.

Wang, W.-T. and K.-Y. Pan. 1990. Gesneriaceae. In: Wang W.-T. (ed.) Flora Reipublicae Popularis Sinicae **69**, Beijing, Science Press.

Wang, Y.-Z., R.-B. Mao, Y. Liu, J.-M. Li, Y. Dong, Z.-Y. Li and J. F. Smith. 2011. Phylogenetic reconstruction of *Chirita* and allies (Gesneriaceae) with taxonomic treatments. J. Syst. Evol. **49(1)**: 50–64.

Weber, A., Y.-G. Wei, A. Forrest, C. Puglisi, F. Wen, V. Mayer and M. Möller. 2011. A new definition of the genus *Petrocodon* (Gesneriaceae). Phytotaxa **23(1)**: 49–67.

Wei, Y.-G. 2004. *Paralagarosolen* Y.G.Wei, a new genus of the Gesneriaceae from Guangxi, China. J. Syst. Evol. **42**: 528–532.

Wei, Y.-G. 2007. *Petrocodon ferrugineus* (Gesneriaceae), a New Species from Guangxi, China. Novon **17(1)**: 135–137.

Wen, F., S. Li, Z.-B. Xin, L.-F. Fu, X. Hong, L. Cai, J.-Q. Qin, B. Pan and F.-Z. Pan. 2019. The updated plant list of Gesneriaceae in China under the new Chinese naming rules. Guangxi Sciences **26(1)**: 37–63.

Yu, X.-L., M. Li, J.-J. Zhou and P.-W. Li. 2015. *Petrocodon hunanensis* (Gesneriaceae), a new species identified by both morphological and molecular evidence from limestone area in Hunan, China. Phytotaxa **195(1)**: 65–72.

Zhang, R.-B., T. Deng, L.-F. Fu, S. Li, L. He, Q.-L. Dou and F. Wen. 2019a. *Petrocodon tongziensis* (Gesneriaceae), a new species from limestone areas in Guizhou, China based on morphological and molecular evidence. Nord. J. Bot. **37(2)**: e01774.

Zhang, R.-L., S. Li, S. Maciejewski and Y.-G. Wei. 2019b. *Petrocodon rubiginosus*, a new species of Gesneriaceae from Guangxi, China. PhytoKeys **666**: 1–7.