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SYSTEMATICS

Oreocharis dayaoshanioides, a rare new species of Gesneriaceae from eastern Guangxi, China

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ABSTRACT. *Oreocharis dayaoshanioides* Yan Liu & W. B. Xu, a new species of Gesneriaceae from Guangxi, China, is described and illustrated. This new species is most similar and closely related to *Oreocharis cotinifolia* (W. T. Wang) Mich. Möller & A. Weber (=*Dayaoshania cotinifolia* W.T. Wang), differing from the latter by the distinctly serrulate leaf margin, much branched cymes, smaller and numerous flowers with abaxial lipped-lobes being broadly ovate to orbicular-ovate, and a glabrous pistil. The new species is extremely rare, currently known only from one site in eastern Guangxi.

Keywords: *Dayaoshania*; *Dayaoshania cotinifolia*; *Oreocharis dayaoshanioides*; Gesneriaceae; Guangxi; New species; Rare plant.

INTRODUCTION

The evolutionary relationships unveiled by recent molecular phylogenetic analyses (Möller et al., 2009; 2011a) have spurred considerable realignment of the taxonomy of the Old World Gesneriaceae (Möller et al., 2011b; Puglisi et al., 2011; Wang et al., 2011b; Weber et al., 2011a, b, c; Xu et al., 2012a, b). One of the most drastic changes is the redelimitation and expansion of *Oreocharis* Benth. by Möller et al. (2011b). *Oreocharis* was previously a genus of ca. 28 species distributed mainly in southern China (Wang et al., 1998; Weber, 2004). Based on molecular data and a morphological evaluation, Möller et al. (2011b) demonstrate that the traditionally defined *Oreocharis* was phylogenetically intertwined with ten small and sometimes monotypic Chinese genera: *Ancylostemon* W.G. Craib, *Bournea* Oliv., *Briggsia* W.G. Craib *s.str.*, *Dayaoshania* W.T. Wang, *Deinocheilos* W.T. Wang, *Isometrum* W.G. Craib, *Opithandra* B.L. Burtt, *Paraisometrum* W.T. Wang, *Thamnocharis* W.T. Wang, and *Tremacron* W.G. Craib. Considering the strongly supported phylogenetic conclusions, apparent highly homoplasious floral characters for generic delimitation, and the weakness of the traditionally defined genera, Möller et al. (2011b) synonymize all these genera under *Oreocharis*, raising the total number of species in this genus to ca. 80 and making the genus morphologically the most diverse of the Old Word Gesneriaceae.

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Of the ten genera sunken under *Oreocharis*, the monotypic *Dayaoshania* (i.e., *D. cotinifolia* W.T. Wang) is distinct in having a strongly zygomorphic, butterfly-like corolla (Wang, 1983, 1990; Li and Wang, 2004), which is readily recognizable in the field (Figure 1). With less than 1,000 plants left in the Dayaoshan National Nature Reserve, a plant diversity hotspot in Guangxi (Wang et al., 2008, 2011a; Hou et al., 2010; Zhang et al., 2011), *D. cotinifolia* is a rare and critically endangered (CR) species according to the IUCN categories and criteria (IUCN, 2001). Because of its critical conservation status and evolutionary significance as a monotypic genus, *D. cotinifolia* was amongst the earliest group of plant species listed under the 'First Class of the Key Protected Wild Plants of China' (Wang and Xie, 2004). Moreover, since first established by Wang (1983), *Dayaoshania* has long been regarded to possess "primitive" characters (Wang, 1983) that were crucial to the understanding of the evolution of Gesneriaceae (Wei, 2010), though this was not borne out in recent molecular phylogenetic analyses (Möller et al., 2011a, b).

During a botanical survey in 2007, we collected an undescribed species of Gesneriaceae from Wuzhou City, Guangxi, China. Based on its unique corolla shape, we concluded it to be a new species of *Dayaoshania* and tentatively named it *D. serrulata* Yan Liu & W.B. Xu, *sp. ined.* Although it has not been formally described, the binomial *D. serrulata* has spread around and was mentioned in a recent book "Gesneriaceae of South China" (Wei, 2010). Meanwhile, two samples of *D. serrulata sp. ined*. were supplied by F. Wen to Möller et al. (2011b)

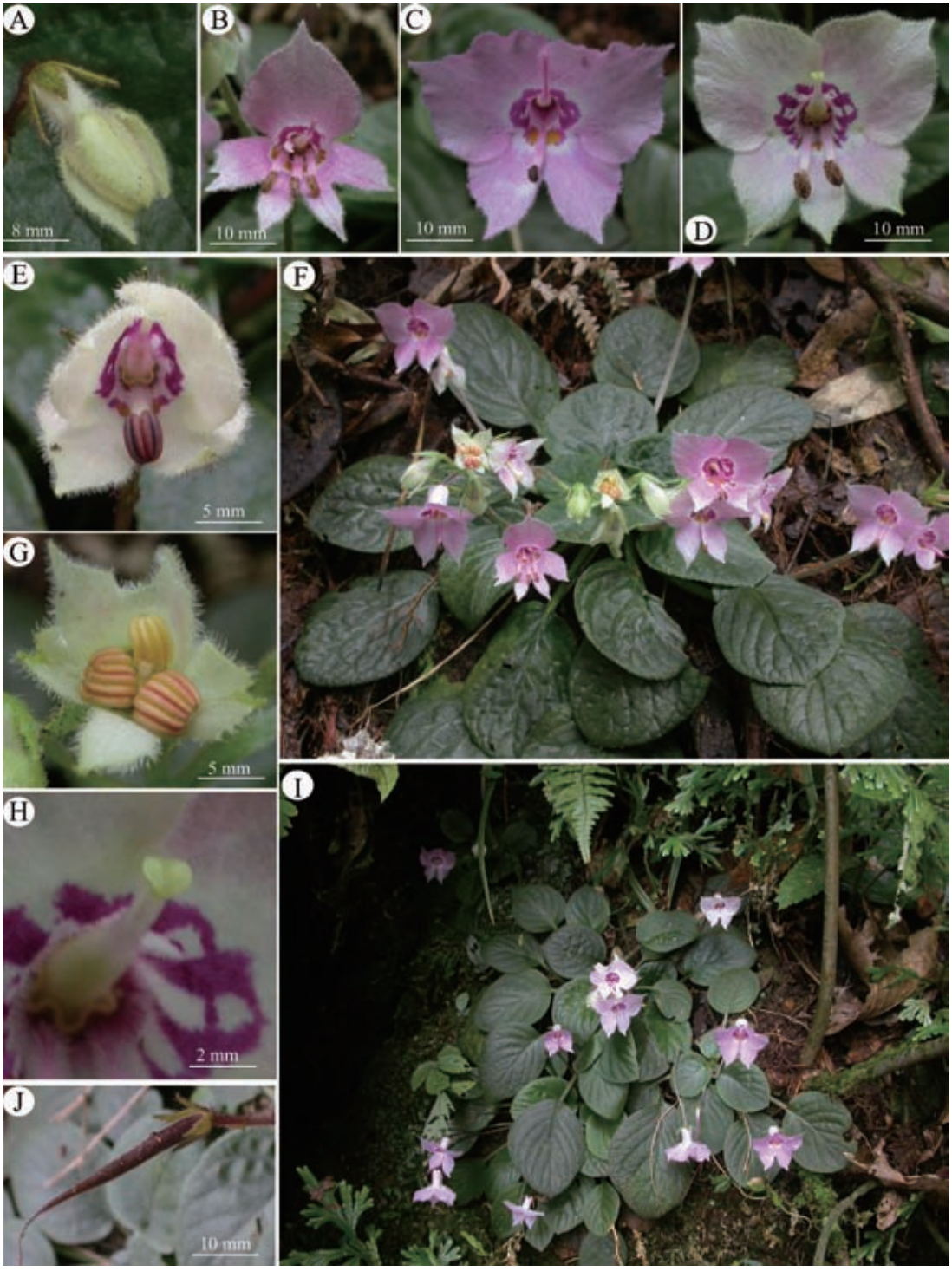

Figure 1. *Oreocharis cotinifolia* (W. T. Wang) Mich. Möller & A. Weber. A, Flower bud; B, Flower with 3 stamens; C, Flower with 1 stamen; D, Flower with 2 stamens; E, Flower, showing 1 fertile stamen; F, Habit; G, Flower, showing three fertile stamens; H, Pistil; I, Habitat; J, Young fruit.

for molecular phylogenetic analysis. Interestingly but not surprisingly, in the phylogenies of Möller et al. (2011b), *D. serrulata* sp. ined. was shown to be sister to *D. cotinifolia* W. T. Wang for which a new combination, *Oreocharis cotinifolia* (W.T.Wang) Mich. Möller & A.Weber, was made in the same article. The observed phylogenetic relationship suggests also that, rather than *Dayaoshania*, this plant is better described as a new species of *Oreocharis* (Möller et al., 2011b). However, under the new definition of *Oreocharis*, many species also possess serrulate leaves (Wang et al., 1998; Li and Wang, 2004; Wei, 2010; Möller et al., 2011b), rendering the specific epithet '*serrulata*' less informative. To better characterize this unique new species and highlight its morphological similarity and

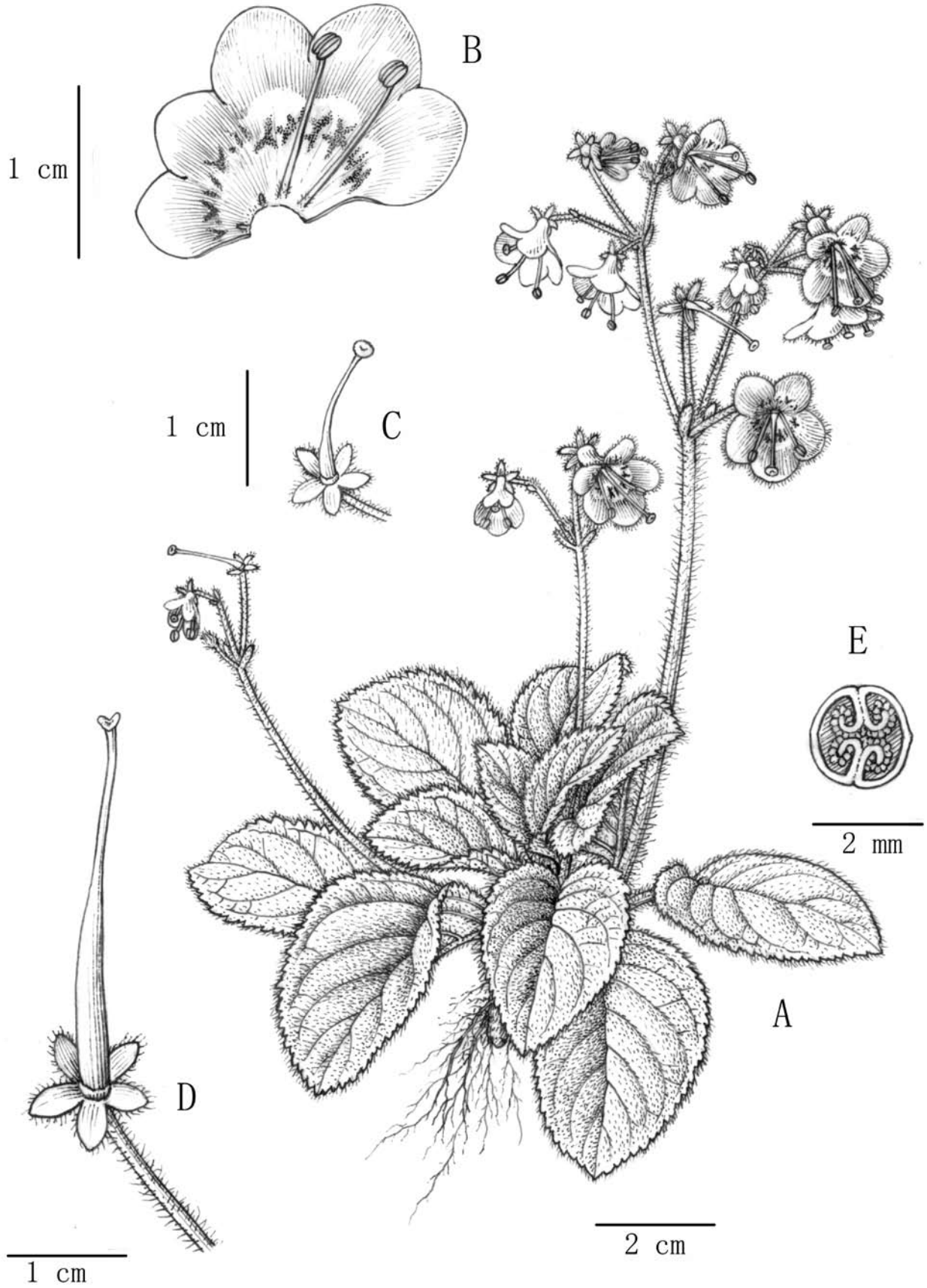

Figure 2. *Oreocharis dayaoshanioides* Yan Liu & W. B. Xu. A, Habit; B, Corolla, dissected to show stamens and staminodes; C, Disc and pistil; D, Fruit; E, Ovary, cross section. Line drawings prepared by S.Q. He. (All from the type, *Yan Liu and Wei-bin Xu 08018*, IBK).

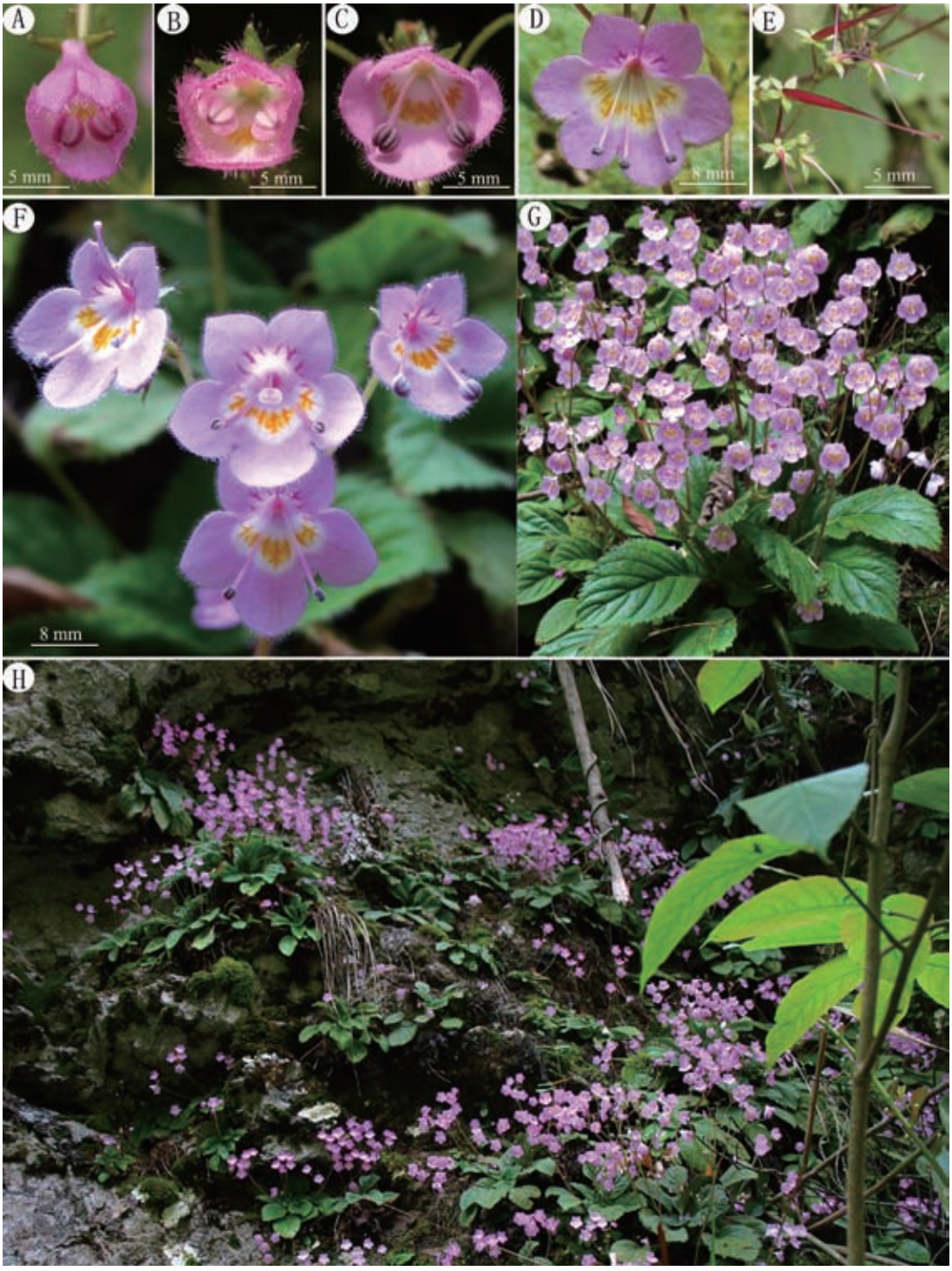

Figure 3. *Oreocharis dayaoshanioides* Yan Liu & W. B. Xu. A, Flower bud; B, C, D, Flower showing variation in corollas; E, Young fruit; F, Inflorescence; G, Habit; H, Habitat.

phylogenetic affinity to *Dayaoshania cotinifolia*, we propose to name it *Oreocharis dayaoshanioides*.

NEW SPECIES

Oreocharis dayaoshanioides Yan Liu & W. B. Xu, sp. nov.—TYPE: CHINA. Guangxi Zhuang Autonomous Region: Wuzhou City, suburb, on moist rock face, at 60 m elevation, 24 March 2008, Yan Liu and Wei-Bin Xu 08018 (holotype, IBK; isotypes, HAST, PE).
齒葉瑤山苣苔 Figures 2, 3

Dayaoshania serrulata Yan Liu & W.B Xu, sp. ined. in Wei (ed.), Gesneriaceae of South China 152, 153. 2010; Möller et al., Phytotaxa 23: 2, 3, 7, 19. 2011, nom. nud.

Figure 4. Distribution of *Oreocharis dayaoshanioides* (■) and *O. cotinifolia* (●) in Guangxi, China

Herbs perennial, stemless. Rhizome subterete, ca. 1 cm in diam. Leaves basal, 7-12, petiolate; blades papery, ovate to elliptic, 3-8.5 × 2.5-5.5 cm, apex acute, base slightly oblique, cuneate to widely cuneate, margin distinctly serrulate, adaxially villous, abaxially villous along the nerves; lateral veins 4-6 on each side of midrib, impressed adaxially and prominent abaxially; petiole 2-6.5 cm long, villous. Scapes 2-10, 5.5-15 cm high, purple pilose, cymes 1-4-branched, flowers numerous; bracts 2, opposite, linear, 4.5-8 × 1.5-3 mm, margin entire, pilose abaxially; pedicels 0.8-1.7 cm, pilose, hairs purple.. Calyx 5-lobed almost to the base, lobes long ovate, 2-4 × 0.8-1.5 mm, margin entire, pilose abaxially. Corolla pink, 1.4-1.6 cm long, tube 5-6 mm long, 4-7 mm across; limb 2-lipped, 1.3-2 cm across, margin ciliate; adaxial lip 3-5 mm long, 2-parted, lobes broadly ovate to orbicular-ovate; abaxial lip 6-8 mm long, 3-lobed to middle, lobes broadly ovate to orbicular-ovate, ca. 7 mm wide. Stamens 2, (occasionally 1 or 3), adnate to ca. 0.6 mm above corolla base; filaments narrowly linear, 8-12 mm long, glabrous; anthers dim gray, dorsifixed, nearly spherical, ca. 1.5 mm across, glabrous; staminodes absent or 2, linear, ca. 0.8 mm long. Disc ring-like, 0.8 mm high, glabrous. Pistil 1.5-1.7 cm, ovary linear, 3.5-4 × 1 mm, glabrous; style ca. 10 mm long, glabrous; stigma capitate, suborbicular, ca. 1 mm across, impressed in the center. Capsule linear, ca. 2 cm long and 3mm across, glabrous.

Additional specimens examined. **CHINA.** Guangxi Zhuangzu Autonomous Region: Wuzhou City, suburb, 15 April 2007, *Wei-Bin Xu and Yan Liu, 07235* (IBK).

Ecology. On moist rock face in a ravine.

Phenology. Flowering from March to April; fruiting from April to May.

Distribution. Known only from the type locality, Wuzhou City, Guangxi, China (Figure 4).

Etymology: The specific epithet '*dayaoshanioides*' is derived from *Dayaoshania* to highlight its close affinity to *Dayaoshania cotinifolia* (synonym of *Oreocharis cotinifolia*).

Pollen grains (SEM): size(p×E1), 20.8(18.9-21.6) × 13.6(12.2-14.3) μm, circular in polar view and elliptical in equatorial view, tricolpate, colpi long, wide, exine bearing reticulate ornamentation, without granule in lumina (Figure 5).

Proposed IUCN Red List category. Current information shows that the new species is known only from one population with fewer than 250 mature individuals. We therefore assess *Oreocharis dayaoshanioides* as critically endangered (CR) using the IUCN categories and criteria (IUCN, 2001).

Notes. *Oreocharis dayaoshanioides* is similar to *O. cotinifolia* (synonym: *Dayaoshania cotinifolia*), from which it can be distinguished by a leaf margin distinctly serrulate (vs. margin nearly entire to indistinctly crenulate), cymes 1-4-branched, flowers numerous (vs. cymes lax, 1-2-flowered), lobes of abaxial lip broadly ovate to orbicular-ovate (vs. triangular), pistil glabrous (vs. puberulent). A comparison of salient characters between the two species is shown in Table 1.

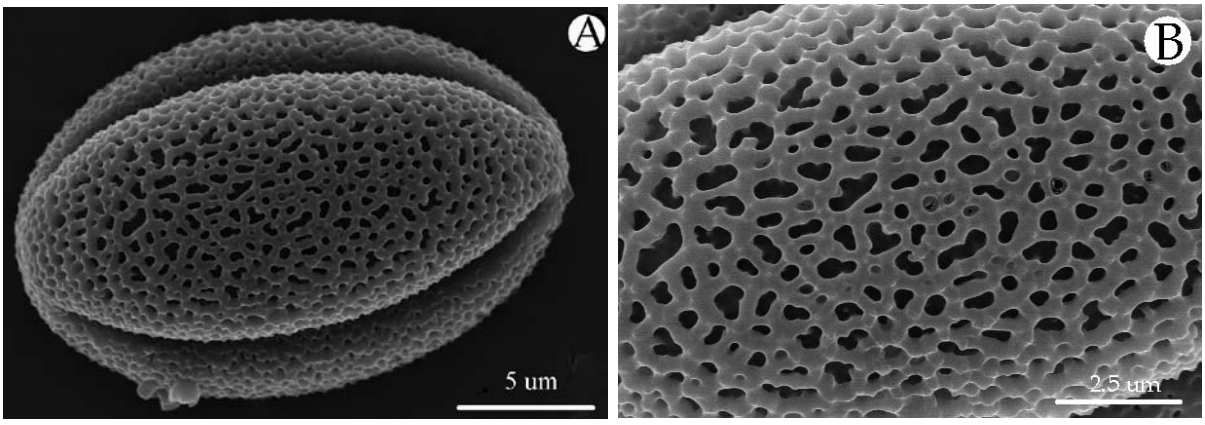

Figure 5. Pollen grain of *Oreocharis dayaoshanioides* under Scanning Electron Microscope (SEM). A, Equatorial view; B, Partial view.

Table 1. Comparison of *Oreocharis dayaoshanioides* and *O. cotinifolia*.

	Oreocharis dayaoshanioides	*Oreocharis cotinifolia*
Leaf		
Margin	Distinctly serrulate	Subentire to obscurely crenulate
Adaxial surface	Villous	Pubescent
Cymes	2-10, each 1-4-branched	2-4, lax
Flowers	Numerous per cyme	1 or 2 per cyme
Lobes of abaxial lip	Broadly ovate to orbicular-ovate	Triangular
Pistil	Glabrous	Puberulent

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LITERATURE CITED

Hou, M.F., J. López-Pujol, H.N. Qin, L.S. Wang, and Y. Liu. 2010. Distribution pattern and conservation priorities for vascular plants in Southern China: Guangxi Province as a case study. Bot. Stud. **51:** 377-386.

IUCN (International Union for Conservation of Nature and Natural Resources). 2001. IUCN Red List Categories and Criteria, Version 3.1. IUCN, Gland and Cambridge.

Li, Z.Y. and Y.Z. Wang. 2004. Plants of Gesneriaceae in China. Henan Science and Technology Publishing House, Zhengzhou, Henan.

Möller, M., A. Forrest, Y.G. Wei, and A. Weber. 2011a. A molecular phylogenetic assessment of the advanced Asiatic and Malesian didymocarpoid Gesneriaceae with focus on non-monophyletic and monotypic genera. Pl. Syst. Evol. **292:** 223-248.

Möller, M., D. Middleton, K. Nishii, Y.-G. Wei, S. Sontag, and A. Weber. 2011b. A new delineation for *Oreocharis* incorporating an additional ten genera of Chinese Gesneriaceae. Phytotaxa **23:** 1-36.

Möller, M., M. Pfosser, C.G. Jang, V. Mayer, A. Clark, M.L. Hollingsworth, M.H.J. Barfuss, et al. 2009. A preliminary phylogeny of the 'Didymocarpoid Gesneriaceae' based on three molecular data sets: incongruence with available tribal classifications. Amer. J. Bot. **96:** 989-1010.

Puglisi, C., D.J. Middleton, P. Triboun, and M. Möller. 2011. New insights into the relationships between *Paraboea*, *Trisepalum*, and *Phylloboea* (Gesneriaceae) and their taxonomic consequences. Taxon **60:** 1693-1702.

Wang, S. and Y. Xie. 2004. China Species Red List, Volume 1: Red List. Higher Education Press, Beijing, 405 pp.

Wang, W.T. 1983. Duo genera nova Gesneriacearum e Sina. Acta Phytotax. Sin. **21:** 319-324.

Wang, W.T. 1990. *Dayaoshania* W.T. Wang. *In* W.T. Wang (ed.), Flora Reipublicae Popularis Sinicae, Vol. 69. Science Press, Beijing, pp. 271-274.

Wang, W.T., K.Y. Pan, Z.Y. Li, A.L. Weitzman, and L.E. Skog. 1998. Gesneriaceae. *In* Z.Y. Wu and P.H. Raven (eds.), Flora of China, Vol. 18. Science Press and Missouri Botanical Garden Press, Beijing and St. Louis, pp. 244-401.

Wang, Y.B., H.W. Liang, F.J. Chen, K.P. Qin, and N.B. Mo. 2008. The endangered causes and protecting strategies for *Dayaoshania cotinifolia*, a endemic plant in Guangxi. Ecol. Environ. **17:** 1956-1960.

Wang, Y.B., H.W. Liang, N.B. Mo, K.P. Qin, and G.G. Tang. 2011a. Flower phenology and breeding system of rare and endangered *Dayaoshania cotinifolia*. Acta Bot. Boreal.-Occident. Sin. **31:** 861-867.

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

Weber, A. 2004. Gesneriaceae. *In* K. Kubitzki and J.W. Kadereit (eds.), The Families and Genera of Vascular Plants, Volume VII, Flowering Plants: Dicodyledons; Lamiales (except Acanthaceae including Avicenniaceae). Springer, Berlin, pp. 63-158.

Weber, A., Y.G. Wei, S. Sontag, and M. Möller. 2011a. Inclusion of *Metabriggsia* into *Hemiboea* (Gesneriaceae). Phytotaxa **23:** 37-48.

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

Weber, A., D.J. Middleton, A. Forrest, R. Kiew, C.L. Lim, A.R. Rafidah, S. Sontag, et al. 2011c. Molecular systematics and remodelling of *Chirita* and associated genera (Gesneriace-

ae). Taxon **60:** 767-790.

Wei, Y.G. (ed.). 2010. Gesneriaceae of South China. Guangxi Science and Technology Publishing House, Guilin, Guangxi, 777 pp.

Xu, W.B., B. Pan, Y. Liu, C.I. Peng, and K.F. Chung. 2012a. Two new species, *Primulina multifida* and *P. pseudomollifolia* (Gesneriaceae), from karst caves in Guangxi, China. Bot. Stud. **53:** 165-175.

Xu, W.B., Q. Zhang, F. Wen, W.B. Liao, H. Chang, and K.F. Chung. 2012b. Nine new combinations and one new names of *Primulina* (Gesneriaceae) from South China. Phytotaxa. (Accepted)

Zhang, B., H.W. Wang, Y.Q. Cheng, Y.Z. Ye, and Z.S. Wang. 2011. Microsatellite markers for *Dayaoshania cotinifolia* (Gesneriaceae), a critically endangered perennial herb. Amer. J. Bot. **98:** e256-e258.

中國廣西東部苦苣苔科一稀有新種植物：齒葉瑤山苣苔

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本文報導了中國廣西壯族自治區馬鈴苣苔屬（苦苣苔科）一新種：齒葉瑤山苣苔（*Oreocharis dayaoshanioides* Yan Liu & W. B. Xu），並提供了線繪圖和彩色照片以資辨認。齒葉瑤山苣苔與瑤山苣苔（*Oreocharis cotinifolia*）相似，但不同在於葉邊緣具明顯的鋸齒，聚繖花序 1-4 回分枝，花多數，花冠簷部上唇裂片寬卵形至圓形，雌蕊無毛。齒葉瑤山苣苔極其稀有，目前在廣西僅知一個分布點。

關鍵詞：瑤山苣苔屬；瑤山苣苔；齒葉瑤山苣苔；苦苣苔科；廣西；新種；稀有植物。