New taxa of *Pedicularis* (Scrophulariaceae) from the Hengduan Mountains, Southwestern China

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Abstract. One new subspecies and one new variety of *Pedicularis* L. from the Hengduan Mountains region in southwestern China are described. The main diagnostic features of the taxa are compared with closely related taxa, and distributions and morphological photos are provided. The new taxa are: *Pedicularis gyrorhyncha* subsp. *glabrisepala* H. Wang & W. B. Yu and *P. siphonantha* var. *stictochila* H. Wang & W. B. Yu.

Key words: Hengduan Mountains, IUCN Red List, *Pedicularis*, Scrophulariaceae, southwestern China.

Pedicularis L. is one of the largest genera of angiosperms in the northern temperate zone (Li, 1951; Ree, 2005) and belongs to the family Scrophulariaceae as traditionally recognized (Mill, 2001; Yang et al., 1998; Wu et al., 2003; Zhang et al., 2006). There are about 600 to 800 species of this genus distributed primarily in the Arctic and alpine regions of the Northern Hemisphere (Mill, 2001; Wang et al., 2003; Wang & Li, 2005). At least half of the species occur in China, especially in the Hengduan Mountains region of southwestern China, where they represent one of the main centers of species diversity and endemism for this genus (Yang et al., 2003; Wang, 2006).

The flowers of the genus *Pedicularis* show a range of diversity likely unequaled by any other flowering plant genera. The variations of the corolla shape, particularly in the galea (e.g., toothed, toothless, with short or long beak, curved beak, crested), are dramatic among species and infraspecies, as are obvious differences in the corolla tube lengths (from 0.5 mm to 12 cm). Recent phylogenetic analyses of *Pedicularis* indicate extensive parallel evolution in floral traits (Yang et al., 2003; Ree, 2005).

Recently, we conducted extensive field investigations on *Pedicularis* in the Hengduan Mountains region. By careful field observation, we observed interesting and distinct variations in floral color and/or external morphologies, which occur within different populations of the same species. Thus, we propose two new taxa at infraspecific levels within *Pedicularis*.

1. Pedicularis gyrorhyncha Franchet ex Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 32: 545. 1888. TYPE: China. Yunnan: Heqing Co., Dali to Lijiang, Heqing Guolapo (Koua-la-po), 24 July 1883, *J. M. Delavay 70* (holotype, P not seen, P photo KUN; isotype, US, US image online). Figure 1A, B.

1a. Pedicularis gyrorhyncha subsp. **glabrisepala** H. Wang & W. B. Yu, subsp. nov. TYPE: China. Sichuan: Daocheng Co., roadside betw. Mula & Chitu, ca. 3620 m, 18 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 86* (holotype, KUN; isotypes, KUN, MO). Figure 1C–E.

A *Pedicularis gyrorhyncha* subsp. *gyrorhyncha* Franchet ex Maximowicz, plantis parce pubescentibus, bracteis et calycibus glabris, filamentis posticis 2 glabris differt.

Biennial herbs, 30–100 cm tall, not drying black, sparsely pubescent; rootstock vertical; stems erect, solitary or caespitose, 3 to 5, vertical lines of white pubescence, bearing 3 or 4 slender branches at middle and upper portions. Basal leaves opposite, middle and upper leaves in whorls of 3 or 4; petioles to 30 mm; leaf blade ovate-oblong to lanceolate-oblong, pinnatifid to pinnatipartite; lobes linear-lanceolate to ovate, margin denticulate, slightly reflexed. Inflorescences spicate, interrupted; bracts glabrate, the lower bracts proximal foliaceous, upper ones dilated at the base, linear-lanceolate, longer than flowers, membranous, margin denticulate, slightly reflexed; pedicels short, 1–4 mm. Calyx tube campanulate, ca. 5 mm, membranous, with 10 veins, outer wall glabrous or scarcely pubescent along the thick veins; calyx lobes 5, unequal, callous-dentate and brief pubescence at margin, slightly reflexed, posterior calyx lobe triangular, small and entire, lateral ones large, ca. 5 mm, linear-lanceolate, almost entire; corolla pale yellow, 15–18 mm, corolla tube ca. 1 cm;

doi: 10.3417/2006032 Novon 18: 125–129. Published on 27 February 2008.

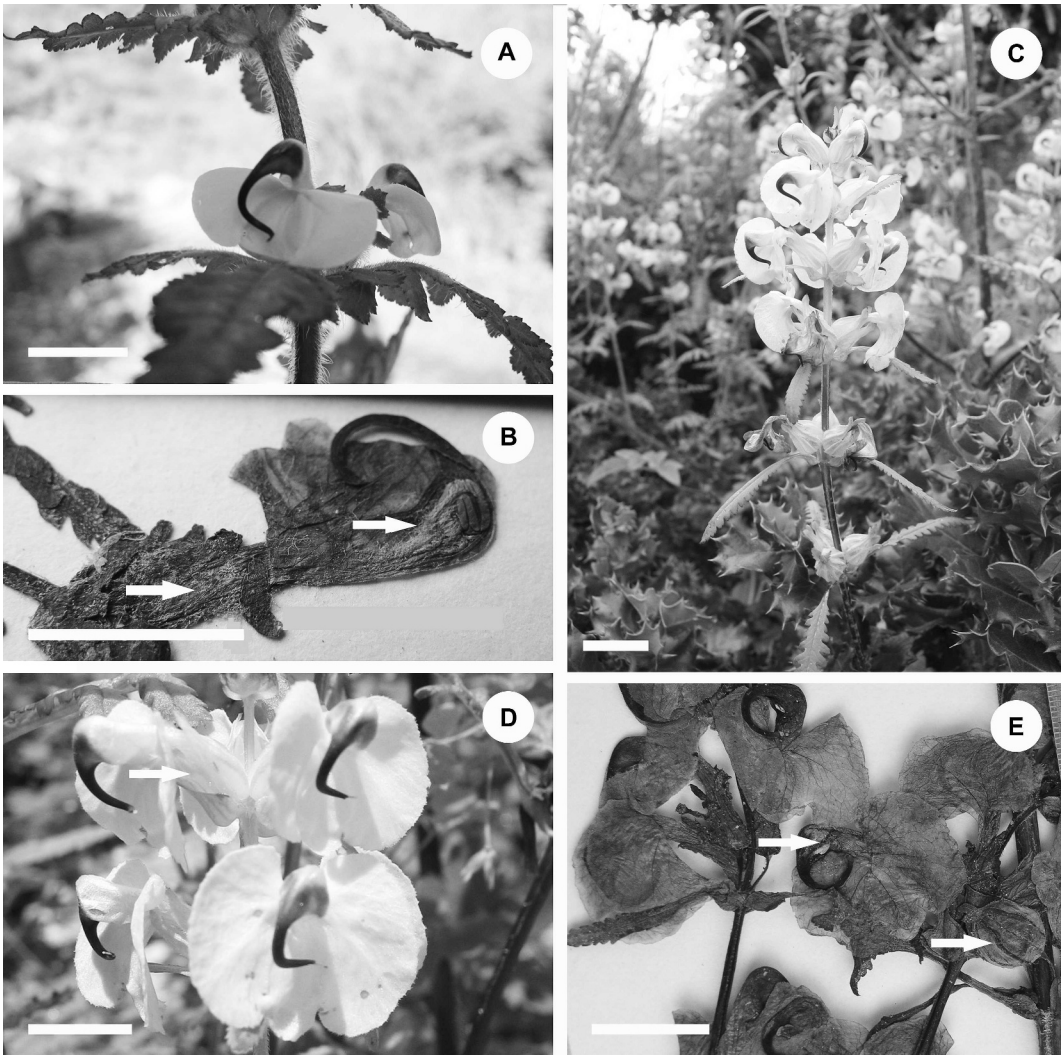

Figure 1. A, B. *Pedicularis gyrorhyncha* subsp. *gyrorhyncha* Franchet ex Maximowicz. —A. Habit (photographed in Shika Mountains of Zhongdian Co., Yunnan Prov., China). —B. Flower, with the pubescent stamens and sepals indicated by arrows (*R. C. Ching 23511* [KUN], collected at the type locality in Heqing Co., Yunnan Prov., China). C–E. *Pedicularis gyrorhyncha* subsp. *glabrisepala* H. Wang & W. B. Yu. —C. Habit. —D. Flower, with the glabrous sepals indicated by an arrow (photographed at the type locality in Daocheng Co., Sichuan Prov., China). —E. Flower, glabrous posterior pair filaments of stamens and calyx marked by arrows (holotype, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 86*, KUN). Scale bars = 1 cm.

corolla beak dark purple, semicircular, ca. 10 mm, 2-lobed at tip; lower lip larger, ca. 10 × 15 mm, ciliate, middle corolla lobe ± rounded, hooded; filaments of stamens attached at the middle of tube, the anterior 2 pubescent, the posterior 2 glabrous; style exserted from beak, spherical. Capsule enclosed by persistent and accrescent calyx, ovate-oblong, apiculate, smooth, ca. 1.5 cm long; immature seed long-oblong, brown.

Distribution. *Pedicularis gyrorhyncha* subsp. *glabrisepala* is endemic to southwestern Sichuan province between 3400 and 4000 m elevation, whereas the subspecies *gyrorhyncha* is endemic to northwestern Yunnan province between 2700 and 4000 m (Fig. 2). The two subspecies are separated by the xerothermic riverside of the Yangtze River and the Daxueshan Mountains.

IUCN Red List category. The new subspecies is not common, occurring in isolated, small populations or as solitary plants at high altitudes. *Pedicularis gyrorhyncha* subsp. *glabrisepala* is probably not threatened because of the high altitude at which it occurs and can be considered Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

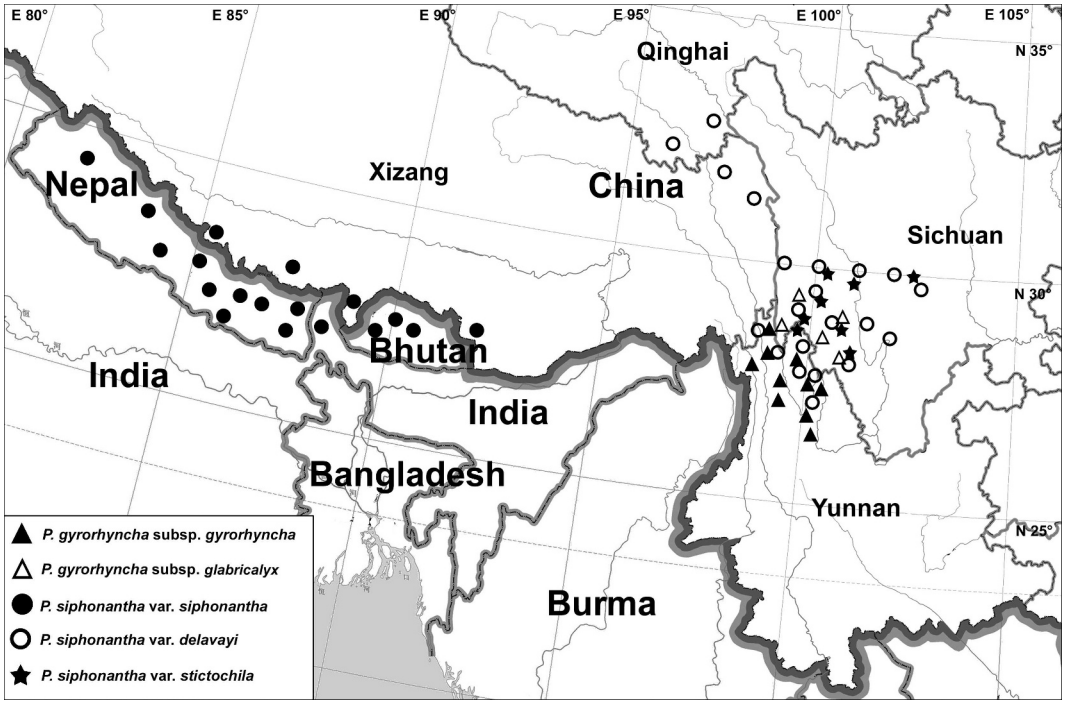

Figure 2. Distribution map of *Pedicularis gyrorhyncha* and *P. siphonantha*.

Phenology. Collected with flowers in August, and with flowers and fruits in September.

Etymology. The epithet "*glabrisepala*" refers to the glabrous sepals of the flowers (Fig. 1D, E), the most distinct characteristic feature in the subspecies.

Relationships. *Pedicularis gyrorhyncha* subsp. *gyrorhyncha* differs from subspecies *glabrisepala* by the dense pubescence on the whole plant, especially at the stem apex, the bracts, the calyx, and the filaments of the four stamens. In contrast, plants of the new subspecies *glabrisepala* are only sparsely pubescent, with glabrous bracts, a glabrous calyx, and the two posterior filaments of the stamens also glabrous.

Paratypes. CHINA. **Sichuan:** Daocheng Co., ca. 4000 m, 31 Aug. 1981, *Qing-Zang Exped. 5875* (KUN, PE); Derong Co., ca. 3400 m, 4 Aug. 1981, *Qing-Zang Exped. 3242* (KUN, PE); Muli Co., ca. 3800 m, 7 Sep. 1983, *Qing-Zang Exped. 515* (KUN, PE); Xiangcheng Co., 3800–3900 m, 9 Aug. 1981, *Qing-Zang Exped. 3859* (KUN, PE).

2. Pedicularis siphonantha D. Don, Prodr. Fl. Nepal. 95. 1825. TYPE: Nepal. Gosaingshan, in alpine, *Wallich s.n.* (type, BM not seen). Figure 3A.

2a. Pedicularis siphonantha var. **delavayi** (Franchet ex Maximovicz) Tsoong, Fl. Reipubl. Popularis Sin. 68: 374. 1963. *Pedicularis delavayi* Franchet ex Maximovicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 32: 531–532. 1888. TYPE: China. Yunnan: Lijiang (Li-kiang monte Sueechan collibus), ca. 4000 m, *J. M. Delavay s.n.* (type, P not seen). Figure 3B, C.

2b. Pedicularis siphonantha var. **stictochila** H. Wang & W. B. Yu, var. nov. TYPE: China. Yunnan: Zhongdian Daxueshan Mtn., Zhongxiang rd., ca. 3750 m, 27 July 2003, *H. Wang, J. Cai, L. Lu & H. B. Chu 03-041* (holotype, KUN; isotype, MO). Figure 3D, E.

A *Pedicularis siphonantha* var. *siphonantha* D. Don, foliorum segmentis magoribus, corollarum tubis longioribus, galea rostro sigmoideo exauriculato instructis, labo maculis 4, atro-purpuratis facile differt.

Perennial herbs, drying slightly black or not; taproots cylindric, ca. 5–7 cm; stems solitary and ± erect, or sometimes caespitose, outer ones procumbent and to 30 cm, striate, pubescent. Leaves basal and cauline, basal ones densely fascicled; petiole of basal leaves 3–5 cm, petiole of cauline leaves 1–3.5 cm, winged, glabrescent or sparsely long-pubescent; leaf blade lanceolate to linear, ca. 1.5–8 × 0.7–1.9 cm, sparsely long-pubescent along midvein and both leaf surfaces, pinnatisect, leaf segments in 7 to 18 pairs, to ca. 6 × 8 mm; lobes somewhat lanceolate to broadly ovate or triangular, pinnatifid or double-dentate, callous-dentate, slightly reflexed. Flowers axillary,

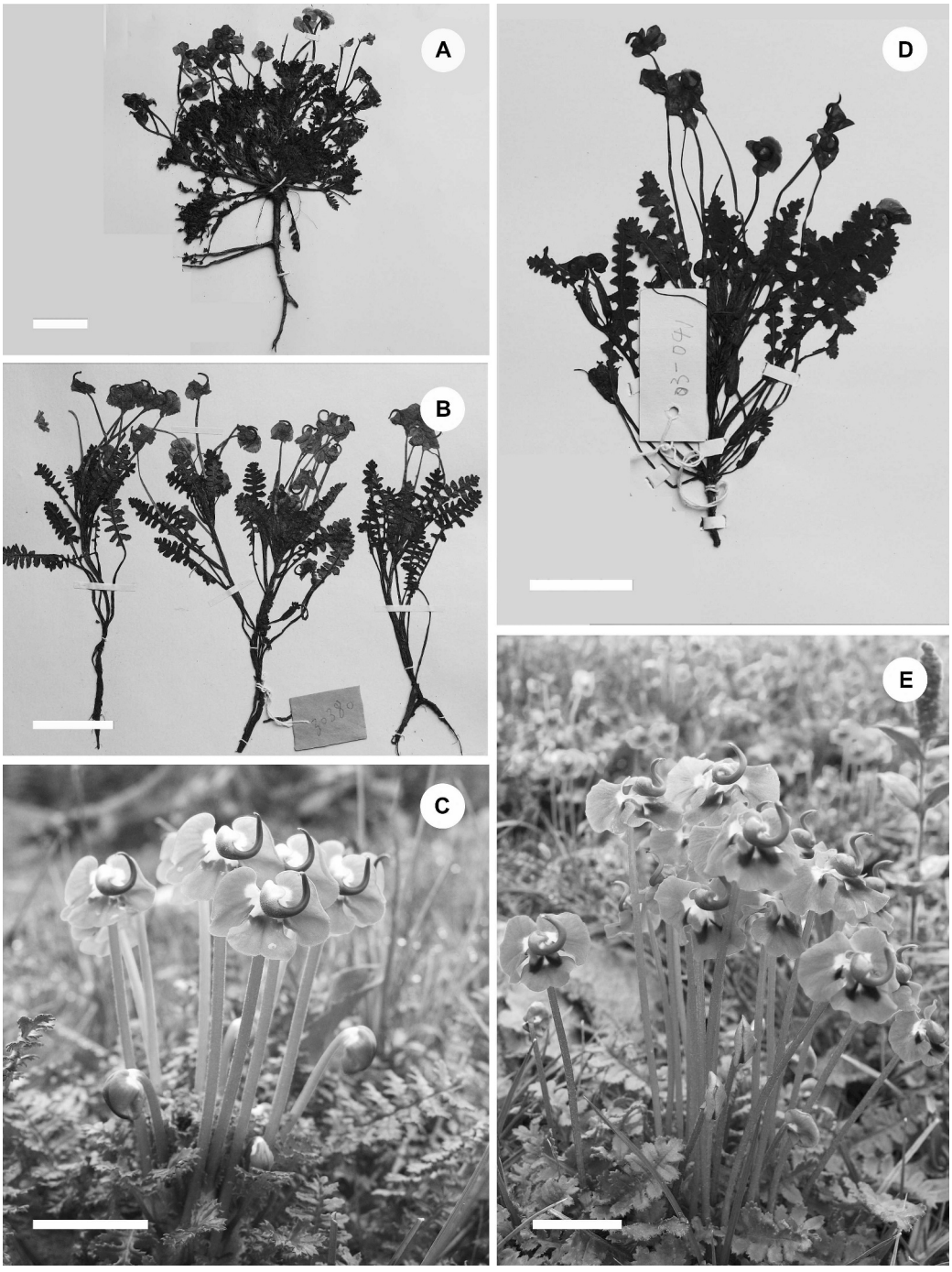

Figure 3. —A. *Pedicularis siphonantha* var. *siphonantha* D. Don (*H. Ohba 8350696* [KUN], collected at Gandaki Zone, Nepal). B, C. *Pedicularis siphonantha* var. *delavayi* (Franchet ex Maximowicz) Tsoong. —B. Specimen collected at the type locality in the Yulong Mountains, Lijiang City, Yunnan Prov., China (*Z. G. Zhao 3038*, KUN). —C. Habit (photographed in Dabasi, Zhongdian Co., Yunnan Prov., China). D, E. *Pedicularis siphonantha* var. *stictochila* H. Wang & W. B. Yu. —D. Holotype (*H. Wang*, *J. Cai*, *L. Lu* & *H. B. Chu 03-041*, KUN). —E. Habit (photographed at the type locality in Zhongdian Daxueshan, Zhongdian Co., Yunnan Prov., China). Scale bars = 2 cm.

dense, sometimes interrupted at basal position; bracts leaf-like, membranous; calyx tubular, ca. 0.7–1.1 cm excluding lobes, sparsely long-pubescent, 1/3 cleft anteriorly. Calyx lobes 3, leaf-like, posterior lobe smallest; corolla purple or rose-red, white at throat; corolla tube erect, ca. 8–10 cm, slender, tube wall finely pubescent; galea strongly twisted at apex, without auriculate, with numerous small dark purple spots; corolla beak slender, conspicuously S-shaped, bent upward, to 1.1 cm; lower lip ciliate, ca. 0.8 × 1.5 cm, with 4 deep purple spots, 2 on middle lobe, 1 on each lateral lobe; middle lobe slightly smaller, emarginate, 2-lobed; filaments attached near tube throat, anterior pair pubescent, posterior pair sparsely pubescent or glabrous. Capsule ovate-oblong; immature seed linear-ovate, brown.

Distribution. *Pedicularis siphonantha* var. *siphonantha* is only distributed in the Himalayas from western Nepal to Bhutan and southeastern Xizang Autonomous Region. The other variety *delavayi* is distributed in southeastern Qinghai, eastern Xizang, western Sichuan, and southwestern Yunnan of China. The distribution of variety *stictochila* overlaps with variety *delavayi* in southwestern Sichuan province, but the two varieties were not observed to occur in the same population (Fig. 2).

IUCN Red List category. *Pedicularis siphonantha* var. *stictochila* is not common, and it is restricted to alpine meadows. Its habitats are not likely to be threatened by human activities, but its continued existence may well be threatened by climate change. This variety can be considered Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Collected with flowers in July, and with flowers and fruits in August.

Etymology. The specific epithet "*stictochila*" refers to the variety's lower lip with four dark purple spots (Fig. 3E). This morphological character is distinctive from other varieties of *P. siphonantha*. However, because of the close relationship and sympatry with *P. siphonantha* var. *delavayi*, it is treated at the varietal level here.

Relationships. *Pedicularis siphonantha* var. *siphonantha* differs from other varieties in having a conspicuous auriculate protrusion at the base of the floral galea. *Pedicularis siphonantha* var. *delavayi* and the typical variety bear leaves ca. 1–6 × 0.7–1.6 cm, the leaf segments in 6 to 15 pairs, ca. 1.5–4 × 6 mm, the corolla tubes less than 7 cm, the lower corolla lip lacks the dark purple maculation, and the corolla beak is semicircular or slightly S-shaped. In contrast, *P. siphonantha* var. *stictochila* has leaves ca. 1.5–8 × 0.7–1.9 cm, the leaf segments are in 7 to 18 pairs, and to ca. 6 × 8 mm, the corolla tube is longer than 8 cm, the lower lips of the corolla are remarkable for their four dark purple spots, the floral galea lacks an auriculate protrusion, and the beak is conspicuously S-shaped.

Paratypes. CHINA. **Sichuan:** Xiangcheng Co., alpine meadows, ca. 3600–3900 m, 17 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 74* (KUN); meadow slope, ca. 4200 m, 10 Aug. 1973, *Xiang 3038* (KUN, PE). **Yunnan:** Zhongdian Co., Daxueshan, under forest or meadow, ca. 3800 m, 28 Aug. 2002, *Wen-li Li & Xue Yang 091* (KUN, MO); alpine meadows, ca. 4100–4200 m, 16 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 44* (KUN).

Acknowledgments. This study was supported by grants from the National Natural Science Foundation of China (grant no. 30570115) and the Keynote Project of the Knowledge Innovation Program, Chinese Academy of Sciences (grant no. KSCX2-YW-Z-034). We are grateful to two anonymous reviewers and Victoria C. Hollowell for valuable comments and suggestions; to De-zhu Li for helpful discussion; to Zhi-yun Su for assistance with Latin; to Jie Cai, Jun He, Na-na Lin, Lu Lu, and Ding Wu for assistance in the field in southwestern China; and to the curators of the herbaria (KUN, PE) for making the specimens available.

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