



NOTE

Taxonomic studies of the genus *Bulbophyllum* (Orchidaceae) from Indo-Myanmar and Himalaya Biodiversity Hotspots: three newly recorded species in the flora of China, four new synonyms of *Bulbophyllum*

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ABSTRACT: Based on field surveys in China conducted from 2021 to 2023, three new records of *Bulbophyllum* are reported: *B. cornu-cervi*, *B. nodosum*, and *B. piluliferum*. Descriptions and illustrations for diagnostic characters are provided for those species, along with information on their types. In addition, four names, e.g., *B. sinhoëense*, *B. contortum*, *B. huangshanense* and *B. tengchongense*, are reduced to the synonymy based on critical examinations of literature surveys, living plants in the field, and herbarium specimens.

KEY WORDS: *Bulbophyllum cornu-cervi*, *Bulbophyllum nodosum*, *Bulbophyllum piluliferum*, Flora, nomenclature.

INTRODUCTION

Bulbophyllum Thouars is one of the largest genera of Orchidaceae, with more than 2200 species, widely distributed in tropical and subtropical regions of the world (Chen and Vermeulen, 2009, Pridgeon *et al.*, 2014, Gamisch *et al.*, 2019). Over 80% of species are found in Asia, which has the greatest species diversity (Pridgeon *et al.*, 2014). A large number of *Bulbophyllum* species can be found in the broad-leaved forests of Asia, making them an ecologically important component.

In China, there is still uncertainty regarding the species diversity of *Bulbophyllum*. The number of species in this genus has increased dramatically in the past decades, from 103 species in 2009 (Chen and Vermeulen, 2009) to about 160 species in 2019 (Zhou *et al.*, 2016, Jin *et al.*, 2019). Moreover, new species and new records have continually been discovered in recent years, e.g., *B. gedangense* Y. Luo, J. P. Deng & Jian W. Li, *B. ximaense* J. D. Ya & T. Zhang, *B. pilopetalum* M. K. Li, J. P. Deng & Y. Luo, *B. gamblei* (Hook.f.) Hook. f. (Luo *et al.*, 2020; Ya *et al.*, 2021; Li *et al.*, 2023a,b).

The genus of *Bulbophyllum* is considered extremely difficult taxonomically (Seidenfaden, 1979; Vermeulen, 2002; Pridgeon *et al.*, 2014). Collectors often overlook this genus because of minute morphological features. It is common for most herbaria to have only one or a few specimens of each *Bulbophyllum* species. Examining the flowers on specimens is difficult because they are very small. In addition, some variable taxonomic characters, such as leaf shape, pseudobulb shape, and flower color, occurring in different populations, have led to a few new

taxa being established. Therefore, more intensive field investigations and careful taxonomic revisions of *Bulbophyllum* from China are needed.

Several botanical explorations were conducted in southwestern China from 2019 to 2023. Morphological characters were observed based on living plants in the field, as well as specimens from 16 herbaria (BR, CAL, P, K, LE, PE, ZJFC, ZM, XZE, Herbarium of Anhui Academy of Forestry, CSH, TAI, TAIF, HN, NTUF, and HITBC; Thiers, 2020). Based on critical examinations of literature surveys, living plants in the field, and herbarium specimens, three newly recorded species were discovered, namely *B. cornu-cervi* King & Pantl., *B. nodosum* (Rolfe) J. J. Sm., and *B. piluliferum* King & Pantl. In addition, four names, e.g., *B. sinhoëense* Aver., *B. contortum* Z. Zhou, P. Y. Wu & Z. J. Liu, *B. huangshanense* Y. M. Hu et X. H. Jin and *B. tengchongense* Z. H. Tsi, have been reduced to synonyms.

TAXONOMIC TREATMENT

New country records

Bulbophyllum cornu-cervi King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 332 (1895 publ. 1896). **Type:** India. Sikkim Himalaya Engo (Tropical Valley), 01 Apr. 1892, R. Pantling 264 (holotype CAL, isotype P! K! BR!).

Fig. 1

Epiphytic herb. Rhizomes very short. Pseudobulbs minute, crowded, globular, ca.0.3 cm in diam. Leaf erect, obovate-elliptic, 8–12×1.5–2 cm, petiole 2–2.5 cm, fleshy or leathery, apex obtuse. Scape slender, arises from the base of pseudobulb, erect, twice as long as the leaves

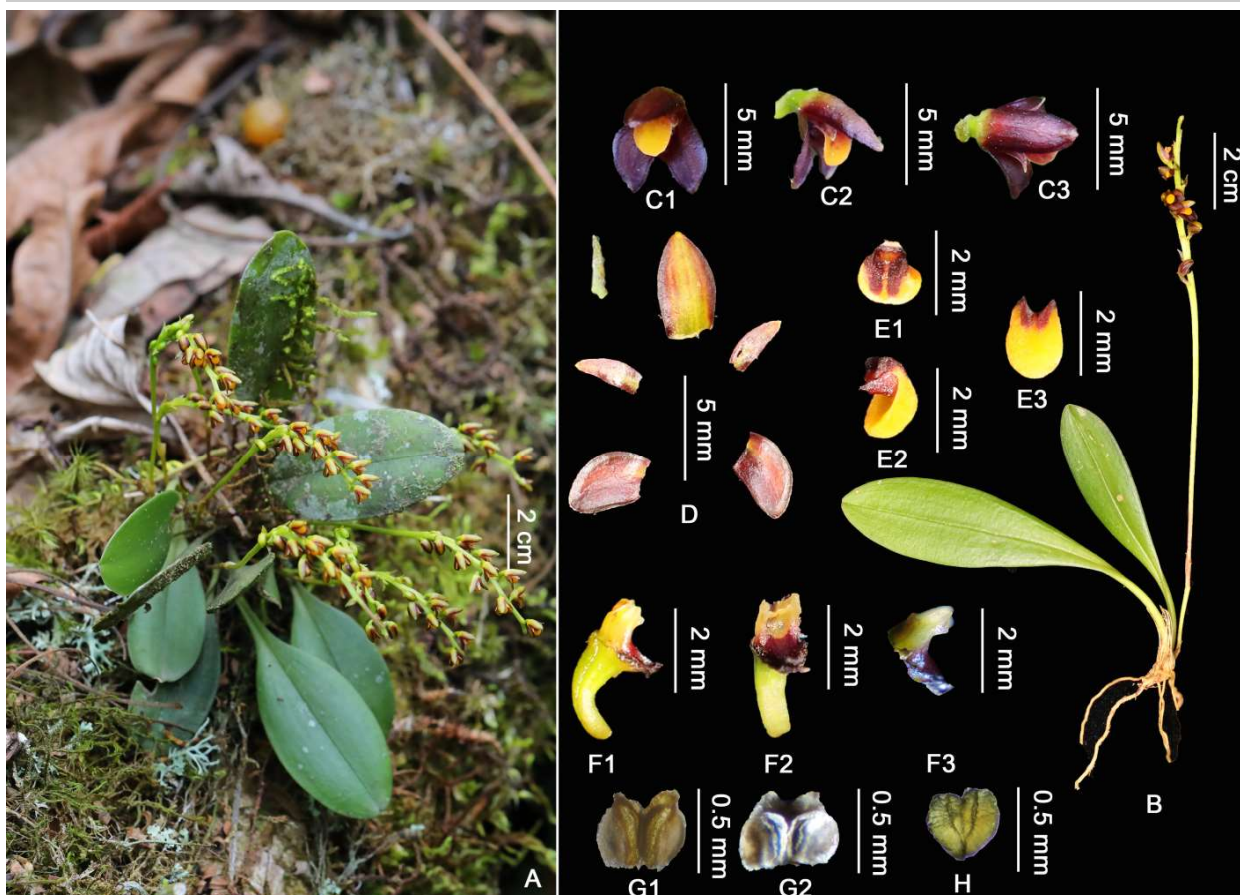


Fig. 1. *Bulbophyllum cornu-cervi* King & Pantl. **A.** plant and habitat; **B.** plant and inflorescence; **C1-C3.** flower; **D.** dissected flower; **E1-E3.** close up of lip; **F1-F3.** column; **G1-G2.** anther cap; **H.** pollinia. (Photographed by M. K. Li).

or longer; raceme erect, densely many flowered; floral bracts ovate, ca. 0.25 cm, as long as pedicel and ovary, acute. Flowers yellow-green with brown markings. Dorsal sepal ovate, ca. 0.5×0.25 cm, apex acute; lateral sepals obliquely ovate, ca. 0.5×0.25 cm, flat and slightly spreading, apex obtuse. Petals oblong-lanceolate, 0.22 – 0.25×0.1 cm, apex acute. Lip fleshy, obovate, ca. 0.2×0.15 cm, much deflexed from about the middle, stipitate, grooved in the center, convex, entire, apex obtuse. Column stout, ca. 0.1 cm long, foot very short, without conspicuous free part, stelia crenate. Anther cap truncate with two apiculates at the apex. Pollinia 4, in 2 pairs, each pair unequal.

Phenology. Flowering from April to May.

Distribution and habitat. China (Xizang), India, Bhutan. Growing on trees in broad-leaved forest at 1300 m.

Vernacular name. Lu Jiao Shi Dou Lan 鹿角石豆兰 (Chinese name, *nov.*).

Specimens examined. CHINA. Xizang: Mêdog County, Dexing village, 1300 m, epiphytes on tree trunks in evergreen broad-leaved forest, 09 May 2022, *M. K. Li 2022079* (XZE).

Notes. *Bulbophyllum cornu-cervi* belongs to *B.* section *Brachystachya* Benth. & Hook. f. This species is

endemic to the Eastern Himalaya. It is miniature-sized with minute pseudobulbs carrying a coriaceous obovate-elliptic leaf and a long laxly several-flowered inflorescence. The species is named after its column apex, which resembles the horns of an elk (King and Pantling, 1898).

Bulbophyllum nodosum (Rolfe) J. J. Sm., Bull. Jard. Bot. Buitenzorg, sér. 3, 8: 26 (1912). **Type:** India. Tamil Nadu (South India), Nilgiri hills, cultivation, Aug. 1892, *J. O'Brien s.n.* (K!).

Fig. 2

Epiphytic herb. Rhizome stout, woody, 0.5–1.1 cm in diam., 3–8 cm long between pseudobulbs. Pseudobulbs ovoid-oblong, shallowly ridged, yellowish on maturity, sheathed when young, ca. 2–2.7 cm. Leaf erect, oblong, 12–24×2–4 cm, petiole thickly coriaceous, often purplish or green speckled with purplish, 2–4 cm long, apex obtuse-emarginate. Scape slender, arises from the base of matured pseudobulbs, 9–15 cm long, distinctly shorter than the leaf, umbellate, with a rosette of 6–8 flowers. Floral bracts narrowly lanceolate, acute, ca. 0.6 cm, speckled with purple. Flowers greenish-yellow, speckled and spotted with purplish brown. Dorsal sepal ovate-oblong, ca. 0.9×0.4 cm, obtuse apiculate at apex; lateral

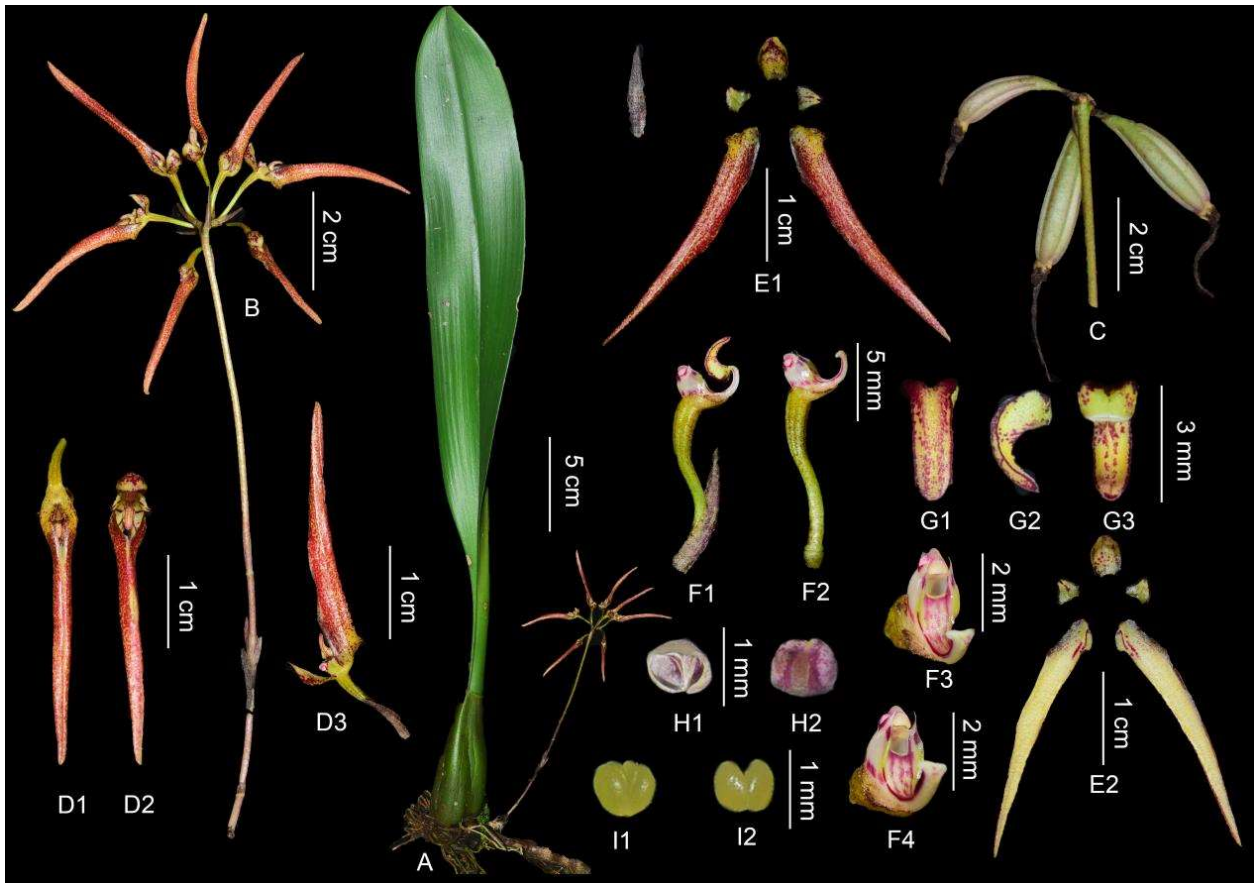


Fig. 2. *Bulbophyllum nodosum* (Rolfe) J.J. Sm. **A.** plant and inflorescence; **B.** inflorescence; **C.** fruits; **D1-D3.** flower; **E1-E2.** dissected flower; **F1-F2.** column and ovary; **F3-F4.** column; **G1-G3.** close up of lip; **H1-H2.** anther cap; **I1-I2.** pollinia. (Photographed by P. Y. Ma).

sepals lanceolate, ca. 0.3×0.4 cm, narrower above, connate along upper and lower margins forming a compact tube, free at base. Petals free, $0.3-0.35 \times 0.25-0.3$ cm, broadly triangular-ovate, sub-acute with a small apiculum. Lip fleshy, simple, ovate-oblong, ca. $0.3-0.35 \times 0.13-0.15$ cm, strongly curved, entire, obtuse, auriculate at base, centrally grooved with two thickened bands from base to apex. Column $0.25-0.3$ cm long, laterally winged from base; foot $0.3-0.4$ cm long, upcurved; stelidia ca. 0.1 cm long, broad at the base, filiform-awned above. Anther 2-lobed. Pollinia 4, in 2 unequal pairs, without any appendages; stigmatic cavity flask-shaped.

Phenology. Flowering from August to September.

Distribution and habitat. China, India, Vietnam. Growing on tree trunks in sub-tropical evergreen forest at elevation between 700 and 1300 m.

Vernacular name. Ni Jiao E Juan Ban Lan 拟角萼卷瓣兰 (Chinese name, *nov.*).

Specimens examined. CHINA. Yunnan: Mengla County, Mengyuan village, 900 m, epiphytes on tree trunks, 2 Oct. 1998, *H. Wang* 3169 (HITBC); Mengla County, Mengxing village, 1200 m, epiphytes on tree trunks in sub-tropical evergreen forest, 16 Sept. 2015, *J. W. Li* 4420 (HITBC); Mengla County, Guanlei village, 1100 m,

epiphytes on tree trunks or rocks in sub-tropical evergreen forest, 30 Aug. 2023, *P. Y. Ma* 2023066 (HITBC); Xizang: Médog County, Dexing village, 800 m, epiphytes on tree trunks in evergreen broad-leaved forest, 15 Dec. 2021, *M. K. Li* 2021329 (XZE). VIETNAM. Dien Bien: Tua Chua, Sin Chai Municipality, 1000 m, primary humid evergreen broad-leaved forest on very steep rocky slopes and tops of remnant mountain, Aug. 2013, *Averyanov, Leonid Vladimirovich, et al.* CPC982a/03 (LE); Son La: Thuan Chau District, 28 Aug. 2021, *Truong Ba Vuong, BV* 1260 (LE).

Notes. *Bulbophyllum nodosum* is large-sized with purple leaves abaxially. It resembles *B. helenae* (Kuntze) J. J. Smith in brown pseudobulbs sheathed when young, an umbellate inflorescence, and petals with fine teeth. However, it is different from *B. helenae* in having rhizomes distinctly swollen at nodes between two pseudobulbs; ovary, and sepals with warty-papillate; lateral sepals slightly long, and involute into a tubular shape.

Bulbophyllum piluliferum King & Pantl., Ann. Roy. Bot. Gard. (Calcutta) 8: 76 (1895). **Type:** India. Teesta Valley, May 1891, *R. Pantling* 141 (holotype CAL, isotype K!).

Fig. 3

Epiphytic herb. Rhizome near none. Pseudobulbs globose or depressed-globose, $0.6-0.7 \times 0.3-0.35$ cm. Leaf fleshy, linear-oblong, $10-11.6 \times 1.25-1.3$ cm, the base



Fig. 3. *Bulbophyllum piluliferum* King & Pantl. **A.** plant and habitat; **B.** plant and inflorescence; **C.** inflorescence; **D1-D3.** flower; **E.** dissected flower; **F1-F3.** close up of lip; **G1-G2.** column; **H1-H2.** anther cap; **I.** pollinia. (Photographed by M. K. Li).

narrowed to the very short petiole, ca. 3 cm long, apex obtuse. Scape slender, erect, 7–8 cm long, the pedicel with one or two bracts at the base and one or two at intervals above, racemes shortened into globose, ca. 1 cm long, with more than ten flowers. Flowers reddish-brown; floral bracts ovate-triangular, ca. 0.2 cm long, apex acute; pedicel and ovary ca. 0.2 cm long. Dorsal sepal oblong, ca. 0.6×0.23–0.25 cm, apex acute, 3-veins; lateral sepals obliquely ovate, 0.4–0.5×0.35–0.4 cm, slightly spreading, apex acute, 3-veins. Petals oblong-lanceolate, 0.35–0.4×0.1 cm, lanceolate, apex acute, 1-veined. Lip elliptic, ca. 0.5×0.3 cm, tumid, papillose, much deflexed from the base, the posterior portion deeply grooved, the anterior convex with entire edges and rounded apex. Column short, ca. 0.06 cm long, foot ca. 0.1 cm long, stelia broadly triangular, apices slightly erose. Anther cap truncate. Pollinia 4, in 2 pairs, each pair unequal.

Phenology. Flowering from April to May.

Distribution and habitat. China (Xizang), India, Bhutan. Growing on trees in broad-leaved forest at 1650 m.

Vernacular name. Ying Tao Shi Dou Lan 櫻桃石豆兰 (Chinese name, *nov.*).

Specimens examined. CHINA. Xizang: Médog County, Dexing village, 1650 m, epiphytes on tree trunks in evergreen broad-leaved forest, 27 Apr. 2022, M. K. Li 2022032 (XZE).

Notes. *Bulbophyllum piluliferum* belongs to *B.* section *Brachystachya*. Its specific epithet means “pill-shaped” referring to the small pseudobulbs. It is characterized by its globose shortened raceme and is probably most close to *B. poilanei* Gagnep. But this plant differs from *B. poilanei* in its sepal apex acute, lip elliptic, anther cap apex not denticulate.

New synonyms

Bulbophyllum gamblei (Hook. f.) Hook. f., Fl. Brit. India 6: 188 (1890); *Bulbophyllum leptanthum* var. *gamblei* Hook. f., Fl. Brit. India 5: 759 (1890). **Type:** India, Sikkim, Goompahar, 2130 m, Jun. 1876, J. S. Gamble, 783A (holotype K!).

Fig. 4

Bulbophyllum sinhoëense Aver., Taiwania 52(4): 294 (2007), *syn. nov.* **Type:** Vietnam, Lai Chau Prov., Sin Ho Distr., Phin Ho Mun., Ta Genh village, 1326 m, upper slopes and ridges of limestone mountains, 12 Jun. 2006, P.K. Loc, N.T. Vinh, N.S. Khang, P.N. Quan, L.H. Phong, HAL 8791 (holotype HN, isotype LE!).

Taxonomic notes. *Bulbophyllum sinhoëense* Aver. was described on the basis of a single collection from Sin Ho district, Lai Chau Province, Vietnam. The authors believed that it was related to Malayan *B. planibulbe* (Ridl.) Ridl and *B. diplantherum* Carr., belonging to sect. *Desmosanthes* (Blume) J. J. Smith. Huang et al. (2023)



Fig. 4. Type specimens of *Bulbophyllum gamblei* (Hook.f.) Hook. f. and *B. sinhoense* Aver. and *B. gamblei* in the wild. **A.** The holotype of *B. gamblei* (K000829163, <https://powo.science.kew.org/>); **B.** The holotype of *B. sinhoense* Aver. (LE 01057846, <http://re.herbariumle.ru/01057846>); **C.** *B. gamblei* in Mêdog, Xizang, China. (Photographed by M. K. Li).

accepted it and recognized the plant collected from Mêdog County as a newly recorded species for China. Based on type specimens, Averyanov's species (LE 01057846, Fig. 4B) resembles Himalayan *B. gamblei* (K000829163, Fig. 4A) on the dwarf plant, short raceme with 1-2 flowers from the base of pseudobulb, white flowers and floral architecture, such as ovate-lanceolate with long acuminate sepals, ovate-lanceolate petals with acute apex, white, curved, linguiform and ovate-lanceolate lip (Li *et al.*, 2023a). We demonstrate that *B. sinhoense* is conspecific with *B. gamblei*. We also conducted a field observation in Mêdog County and confirmed the plant (Fig. 4C) should be recognized as *B. gamblei* (Li *et al.*, 2023a). We recognize *B. gamblei* as an independent species but treat *B. sinhoense* as a synonym of *B. gamblei*.

Specimens examined. CHINA. Xizang: Mêdog County, Beibeng village, 1350 m, Jun. 2020, M. K. Li 20200739 (XZE); Mêdog County, Deergong village, 1600 m, 14 Jun. 2020, J. P. Deng & Z. Chen 2054 (HITBC). VIETNAM. Dien Bien: Tua Chua District, Sin Chai Municipality, 1350-1500 m, Jun. 2013, Averyanov *et al.* CPC982a/6 (LE); Lai Chau: Sin Ho District, *Khang Sinh Nguyen AL1329* (LE).

Bulbophyllum lemniscatum C. S. P. Parish ex Hook. f., Bot. Mag. 98: t. 5961 (1872). *Phyllorchis lemniscata* (C. S. P. Parish ex Hook. f.) Kze., Rev. Gen. 2: 677, 1891. *Hordeanthos lemniscatus* (C. S. P. Parish ex Hook. f.) Szlach., Richardiana 7: 89, 2007. **Type:** Myanmar: Zwakabin, Moulmein, *Parish 211* (holotype K!).

Bulbophyllum contortum Z. Zhou, P. Y. Wu & Z. J. Liu, Phytotaxa (3): 560 (2022), **syn. nov.** **Type:** CHINA, Zhenyuan, Yunnan, epiphytic on branches in forests, 2100 m, 12 Oct. 2017, cultivated and flowered in Wenzhou, 10 Apr. 2020, *Zhou 2020041001* (ZM).

Taxonomic notes. *Bulbophyllum lemniscatum* was discovered in Myanmar in 1872 and later found in

Thailand (Hooker, 1872; Seidenfaden, 1979). In 2021, Zhang *et al.* collected this species in Zhenyuan County, Yunnan Province in southwestern China, and reported it as a new record for China (Zhang *et al.*, 2021). However, the plant from the same locality in China was recognized as a new species, e.g., *B. contortum* Z. Zhou, P. Y. Wu & Z. J. Liu, by Zhou *et al.* (2022). They suggested that their species differed from *B. lemniscatum* and *B. lemniscatoides* in the shape and size of pseudobulbs, inflorescence shape, flower color, and shape and size of the sepal appendages. According to our knowledge of the taxonomy of *Bulbophyllum*, pseudobulbs morphology and flower color are usually variable and cannot be used as diagnostic characters. *Bulbophyllum contortum* should be treated as a synonym of *B. lemniscatum*.

Specimens examined. CHINA. Yunnan: Zhenyuan County, March 25, 2021, Y. Zhang & Z. Zhang 053 (HITBC).

Bulbophyllum ningboense G. Y. Li ex H. L. Lin et X. P. Li, J Zhejiang A & F Univ (6): 31(2014). **Type:** China, Fenghua County, Zhejiang Province, on wet shade rocky cliffs, Danxia landform 100 m, 10 May 2013; H. L. Lin et X. P. Li, *FH 20130510* (ZJFC).

Bulbophyllum huangshanense Y. M. Hu et X. H. Jin, Nord. J. Bot. 33 (2015), **syn. nov.** **Type:** China. Anhui, Yuexi County, Kujingyuan, epiphytic on stone under evergreen broad-leaved forest, 519 m, west slope, 20 May 2014, *Hu Y. M., Liu J. L. and Han W. Y. 003* (holotype Herbarium of Anhui Academy of Forestry, isotype PE).

Taxonomic notes. *Bulbophyllum ningboense* G. Y. Li ex H. L. Lin et X. P. Li was described on the basis of a single collection from Fenghua County, Zhejiang Province (Lin *et al.*, 2014). *Bulbophyllum huangshanense* Y. M. Hu et X. H. Jin was described on the basis of a single collection from Yuexi County in western Anhui,

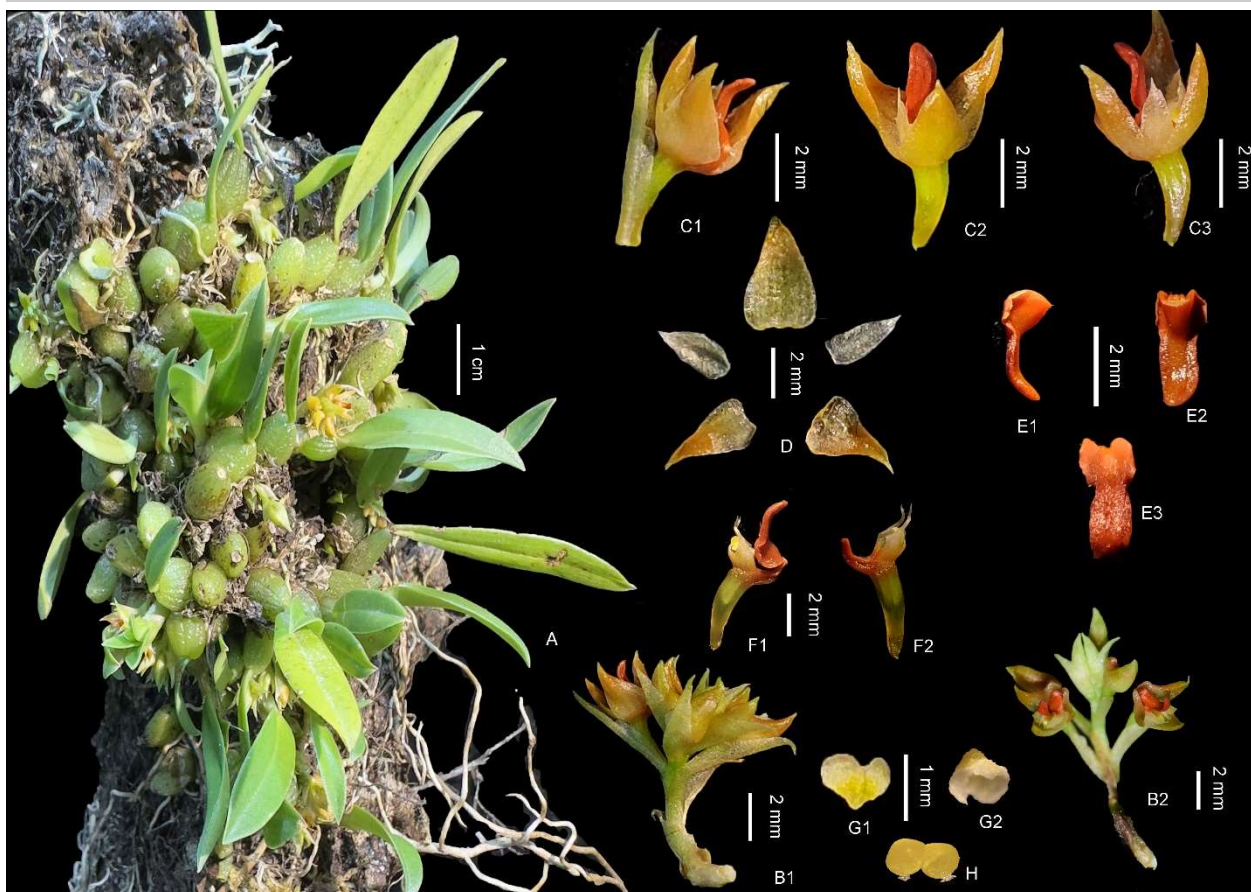


Fig. 5. Living plants of *Bulbophyllum tengchongense* Z. H. Tsi (= *B. rubrolabellum* T. P. Lin), showing morphological characters and the variations of floral bracts. **A.** habit; **B1-B2.** inflorescence; **C1-C3.** flower; **D.** dissected flower; **E1-E3.** close up of lip; **F1-F2.** column and ovary; **G1-G2.** anther cap; **H.** pollinia. (Photographed by P. J. Deng).

China (Hu *et al.*, 2015). Those two *Bulbophyllum* species show certain similarities in many morphological features, such as dwarf plant, inflorescences longer than leaves, yellow flowers, and broadly ovate petals with obtuse apex, thick-lingual, fleshy and orange-red lip. Although the type specimens of *B. ningboense* and *B. huangshanense* are not available, based on the illustrations in their protologue, and many in-situ photos of both species photographed in Zhejiang, Anhui, and Hubei, China in Plant Photo Bank of China (PPBC, <http://ppbc.iplant.cn>), we demonstrate that those two similar species co-occurred in the same geological region and *B. huangshanense* is conspecific with *B. ningboense*.

Specimens examined. CHINA. Hubei: Luotian County, May 20, 2015, *B. Chen* CB09160 (CSH).

Bulbophyllum rubrolabellum T. P. Lin, *Taiwania* 20(2): 163 (1975). *Bulbophyllum odoratissimum* (Smith) Lindl. var. *rubrolabellum* (T. P. Lin) S. S. Ying, *Coloured Illustr. Orchid Fl. Taiwan* 2: 113 (1990). **Type:** Taiwan. Miaoli county, Taiwan, on the trunk of a broad-leaved forest, 25 Oct. 1972, *T. P. Lin*. 129 (holotype TAI118097).

Bulbophyllum fenghuangshanianum S. S. Ying, *Coloured Illustr. Orchid Fl. Taiwan* 2: 417 (1990). **Type:** Taiwan. Nantou county, Fenghuang, May 1987, *S. S. Ying s.n.* (NTUF).

Bulbophyllum tengchongense Z. H. Tsi in *Bull. Bot. Res.* 9 (2): 29, t. 4 (1-4). 1989, **syn. nov.** **Type:** China. Tengchong County, on the trunks, 2000 m, 20 Jul. 1981, *Z. H. Tsi* 147 (PE!).

Taxonomic notes. *Bulbophyllum rubrolabellum* Lin was described on the basis of collections from Miaoli, Taiwan (Lin *et al.*, 1975). *Bulbophyllum tengchongense* Z. H. Tsi was described on the basis of a single collection from Tengchong County in southwestern China (Tsi, 1989). *Bulbophyllum rubrolabellum* Lin is endemic to Taiwan and characterized by having a unique labellum, which is red, ligulate, and tongue-shaped (Chen and Vermeulen, 2009). Based on observations of type specimens and living plants of *B. tengchongense* from Tengchong County (Type locality) and Zhenyuan County, Yunnan, China, any important taxonomic characters, such as leaves and pseudobulbs shape, shortened umbel, whitish-yellow subequal sepals and red lip, of this species in Yunnan, are not different from those of *B. rubrolabellum* (Fig. 5). Tsi (1989) indicated that his new species was different from *B. rubrolabellum* in having longer floral bracts. Actually, the shape and length of

Fig. 5



floral bracts of *B. tengchongense* seem variable in wild populations, some individuals with ovate-lanceolate floral bracts longer than pedicel and ovary, and some individuals with narrowly lanceolate (Fig. 5B1, B2). Therefore, we suggest *B. tengchongense* should be reduced to a synonym of *B. rubrolabellum*.

Specimens examined. CHINA. Yunnan: Tengchong County, 16 Mar. 2007, *X. H. Jin* 8922 (PE); Tengchong County, 10 May 2023, *J. P. Deng* LY6416 (HITBC); Jingdong County, 6 Sept. 2023, *P. Y. Ma* LY6302 (HITBC).

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