



***Bulbophyllum bidoupense* and *Schoenorchis hangiana*—new species of orchids (Orchidaceae) from southern Vietnam**

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Abstract

Bulbophyllum bidoupense (sect. *Brachystachyae*) and *Schoenorchis hangiana* (sect. *Pumila*) are described and illustrated as species new for science. Both species are local endemics of the Bidoup mountain system belonging to the South Annamese floristic province of the Indochinese floristic region within Lam Dong and Khanh Hoa provinces of southern Vietnam. *Schoenorchis hangiana* and allied *S. scolopendria* are rather isolated species recognized among their congeners by plagiotropic creeping plant habit.

Key words: Orchidaceae, plant taxonomy, plant diversity, nature protection

Introduction

The orchid flora of Vietnam is, undoubtedly, one of the richest regional floras in mainland Asia. Numerous field explorations during the past three decades greatly expanded our knowledge and confirm an outstanding orchid diversity within this region. Successive exploratory assessments and reviews of existing literature show the direct relationship between the consistent increase in the number of species and genera encountered and the intensity of scientific investigations. Published landmark inventories show the steadily increasing number of known orchid species in Vietnam from 411 species recorded in year 1934 (Gagnepain & Guillaumin 1934), to 718 species in 1992–1994 (Seidenfaden 1992, Averyanov 1994), 897 species in 2003–2005 (Averyanov & Averyanova 2003, Nguyen Tien Ban *et al.* 2005), 1005 species in 2009 (Averyanov *et al.* 2009), and 1090 species figured in last assessment undertaken in year 2011 (Averyanov 2011). Since this latter inventory, 45 species and 5 genera have been newly discovered and documented for the flora of Vietnam (Averyanov 2012a, 2012b, 2013, Averyanov *et al.* 2012a, b, 2013, Schuiteman *et al.* 2013, Choudhary *et al.* 2013, Kumar *et al.* 2014). When these new data are included, the known orchid flora of Vietnam includes at least 1135 documented species from 165 genera. Despite this exceptional diversity and focused work, the comprehensive inventory of the orchid flora of Vietnam remains far from complete, and each new botanical exploration, particularly in remote mountainous areas, reveals new discoveries. Two orchid species new for science were recently discovered during botanical field investigations conducted by botanists of the Tay Nguyen Institute for Scientific Research, Vietnam Academy of Science and Technology in the northeastern part of Tay Nguyen Plateau called referred to as the Central Highlands of southern Vietnam. Both species are described, illustrated and briefly discussed below.

Material and Methods

Specimens of the new species suitable for description were collected in the field in during 2012–2014. Some previously gathered herbarium collections also provided additional materials and were designated as paratypes. Fresh flowers and inflorescences from living plants were fixed and stored in 70% ethanol. Measurements of the floral parts for the

description were made on both herbarium and liquid-fixed materials. Fresh flowers and their fleshy parts shrink up to 15–20% in size during the drying process of making herbarium specimens. In describing quantitative characters, infrequent extreme values (i.e. rarely occurring minimal and maximal values) of a variation range are parenthesized respectively before and after the normal variation range.

Taxonomic treatment

Bulbophyllum Thouars (1822 tab. sp. 3, u)

Type:—*Bulbophyllum nutans* Thouars (1822 tab. 107).

About 1500 species in tropical and subtropical zone of the World with highest diversity in tropics of Africa and Asia. In Vietnam 100–110 species in 14 sections (Averyanov 1994, Averyanov & Averyanova 2003).

Bulbophyllum sect. *Brachystachyae* Bentham & Hooker (1883: 504)

Type:—*Bulbophyllum repens* Griffith (1851: 293).

Synonyms:

B. grex Cochlia (Blume) Bentham & Hooker (1883: 503); *Cochlia* Blume (1825: 320).

B. sect. Cylindracea Pfitzer in Engler & Prantl (1889: 179).

B. sect. Globiceps Schlechter (1913: 704, 875).

B. sect. Osyricera (Blume) Smith (1914: 35); *Osyricera* Blume (1825: 307).

65–70 species in tropical Southeast Asia and islands of west Pacific. In Vietnam 5 species, 1 species (described here) endemic.

Bulbophyllum bidoupense Aver. et N.V.Duy, *sp. nov.* **Figs 1A–G, 2**

Small short-creeping epiphyte; pseudobulbs 1-leaved, crowded, touching each other, rudimentary, 1.5–5 mm across; leaves erect, oblanceolate, fleshy, subterete to broadly crescent at cross section, 2.5–8 cm long; inflorescence pendulous lax purple raceme 6–20 cm long; pedicel and ovary 1.5–2 mm long, sparsely verruculose; flowers purple to dark purple, pendulous, not widely opening; sepals free, broadly lanceolate to narrowly ovate, 5–9 mm long, 3-keeled; petals broadly lanceolate, 2.5–3 mm long; lip oblong ovate triangular, strongly recurved, adaxially papillose, 2.2–2.8 mm long, 0.6–1 mm wide; column 1 mm tall, with large 3-lobed stelia much exceeding anther cap; anther cap hemispheric, 0.5–0.6 mm across, at apex truncate, finely erose.

Type:—VIETNAM. Lam Dong province: Lac Duong district, Hon Giao mt., Bidoup Nui Ba national park, canopy epiphyte in broad-leaved, evergreen, humid forest at elev. about 1526 m a.s.l. around point 12°10'28"N, 108°41'58"E. 27 May 2014, *Nong Van Duy, VTN 1030* (holotype, Herbarium of Tay Nguyen Institute of Scientific Research of Vietnamese Academy of Science and Technology; isotype, LE!).

Perennial short-creeping sympodial epiphytic herb. Rhizome short, insignificant, simple or few branching, with erect, densely clustering pseudobulbs. Pseudobulbs 1-leaved, commonly touching each other, very small, rudimentary, dark green, globular to oblate, (1.5–)2–4(–5) mm in diam., sometime slightly oblique, young enveloped by brownish scarious sheaths, old with fibrous remnants at the base. Leaves sessile, erect, oblanceolate, obtuse, rigid, fleshy, succulent, subterete broadly furrowed, broadly crescent at cross section, (2.5–)3.5–6.5(–8) cm long, (2–)3–5(–8) mm wide, (1.5–)2–3(–4) mm thick. Inflorescence raceme, arising from the base of pseudobulb, (6–)8–18(–20) cm long, arching to pendulous; scape dark purple, suberect or almost horizontal, (3–)4–8(–10) cm long, with (1–)2–3 small distant sterile bracts; rachis purple, commonly nodding and pendulous, (3–)4–8(–10) cm long with many spirally arranged lax flowers. Floral bracts purple to dark purple, almost straight, cuneate, conduplicate, acuminate, (2–)3–5(–6) mm long, 0.5–1 mm wide. Pedicel and ovary purple to dark purple, 1.5–2 mm long, sparsely verruculose; ovary obovoid 0.8–1.2 mm long; pedicel cylindrical, 0.8–1 mm long, 0.4–0.5 mm in diam. Flowers pendulous, not widely opening; sepals and petals purple to dark purple, sepals with 3, petals with 2 light purple to whitish stripes, lip purple-brown to olive tinged

with purple, column and anther cap white. Sepals free, subsimilar, straight, 3-veined, diverging toward their apices, broadly lanceolate to narrowly ovate, acuminate, (5–)6.5–8.5(–9) mm long, 1.6–2.2 mm wide, dorsally with 3 distinct keels, lateral sepals slightly oblique and larger. Petals straight, forward directed, oblong broadly lanceolate, 1-veined, acute, 2.5–3 mm long, 0.5–0.8 mm wide. Lip oblong ovate triangular, blunt, strongly recurved, conduplicate in basal half, with indistinct ears at base, densely papillose on adaxial surface, 2.2–2.8 mm long, 0.6–1 mm wide, joined with column foot apex by movable articulation. Column erect, cylindrical, 1 mm tall, 0.6–0.8 mm wide, with large 3-lobed stelia of which 1 lobe forward recurved and 2 lobe erect, much exceeding in length anther cap; column foot 0.8–1.2 mm long, forward curved. Anther cap hemispheric, 0.5–0.6 mm across, beak short, broad, truncate, finely erose along the margin. Pollinia 4, narrowly ovoid, 0.4 mm long. Fruits unknown.

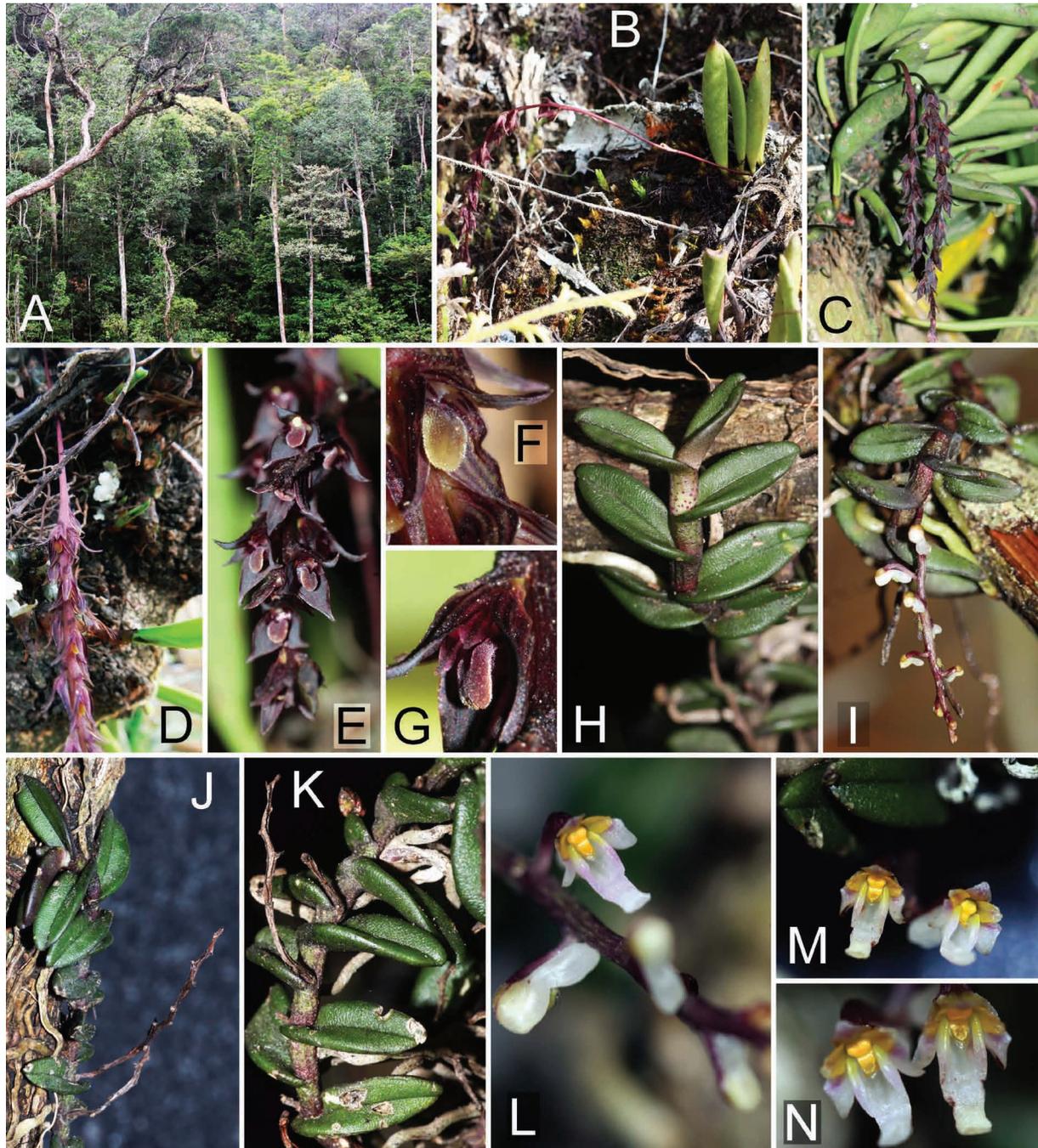


FIGURE 1. A. Habitat of *Bulbophyllum bidoupense* Aver. & N.V.Duy and *Schoenorchis hangiana* Aver. & N.V.Duy, primary broad-leaved evergreen forest on slopes of Hon Giao Range in Bidoup Mountains. *Bulbophyllum bidoupense*. B, C. Flowering plants in nature habitat. D, E. Inflorescence of plants from different populations. F, G. Flowers, half-side and side views (B—type specimen, VTV 1030; C, E–G—specimen L.Averyanov s.n. April 2010; D—specimen Nguyen Van Canh s.n. 8 March 2013). *Schoenorchis hangiana*. H–K. Flowering and fruiting plants. L. Portion of inflorescence. M, N. Flowers (type specimen VTN 984). [Photos of Nong Van Duy, L. Averyanov and Nguyen Van Canh, correction and design by L. Averyanov].

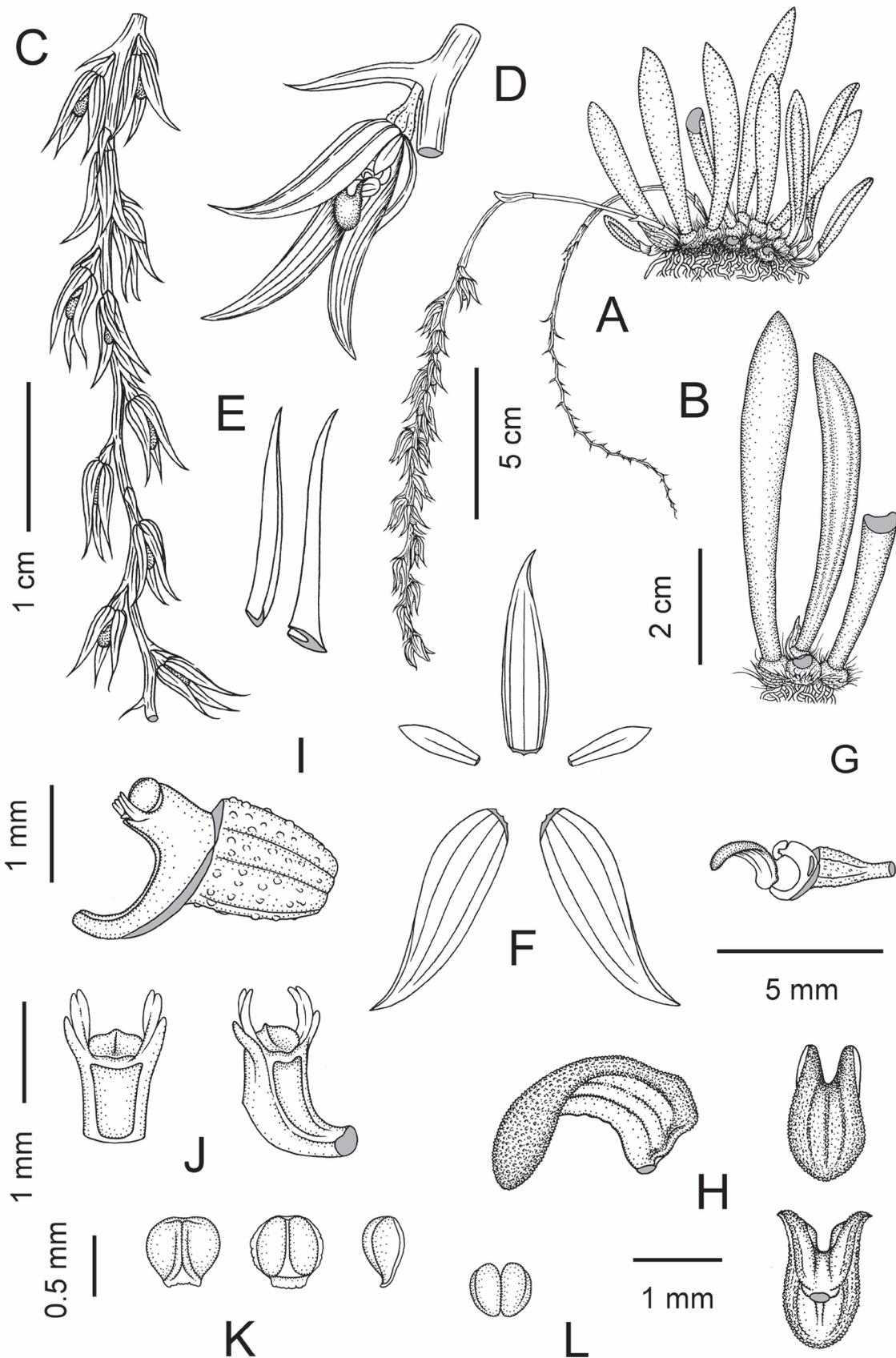


FIGURE 2. *Bulbophyllum bidouense*. A. flowering plants. B. Leaves and pseudobulbs. C. Portion of inflorescence. D. Flower, half-side view. E. Floral bracts. F. Flattened sepals and petals. G. Ovary, column and lip with removed sepals and petals, side view. H. Lip, side view, frontal view and view from behind. I. Ovary and column with removed tepals and lip. J. Column, frontal and half-side view. K. Anther cap, views from above, from below and half-side view. L. Pollinia. [All drawn from the type—VTN 1030 by L. Averyanov and T. Maisak].

Etymology:—Species epithet refers to Bidoup Mountains where the largest population of this species was recently found.

Ecology:—Creeping epiphyte; primary broad-leaved, evergreen, humid montane forests. (600)800–1,800 m a.s.l. Fl. May–June. Rare. Estimated IUCN Red List status—DD.

Distribution:—Vietnam: Dak Nong (Dak Glong district, Nam Nung nature reserve), Lam Dong (Dalat City area; Lac Duong district), Ninh Thuan (Ninh Son district). Endemic.

Additional specimens studied (paratypes):—VIETNAM: Ninh Thuan province, Ninh Son district, Phuoc Binh municipality, in 34 km to NE from Dalat city (12°07'N, 108°42'E), 4 April 1997, *Averyanov, Binh, Loc VH 3598* (LE!, HN); Lam Dong province, Lac Duong district, Da Chay municipality, 35 km to NE from Dalat city, W macroslope of Gia RinH Ridge (12°09'N, 108°41'E), 4 May 1997, *Averyanov, Binh, Hiep, Loc, Lowry VH 4554* (LE!, HN); Lam Dong province, Dalat City area, April 2010, *Averyanov s.n.* (LE-photo!); Dak Nong province, Nam Nung nature reserve, 8 March 2013, *Canh s.n.* (LE-photos!).

Notes:—This species is similar to members of sect. *Brachystachyae* on its overall morphology and plant habit, as well as in purple colouring of the flowers, a wing-like tooth on the upper margin of the stelidia and 4 pollinia (Vermeulen *et al.* 2015). However, it has no close relation to species of this section presently recorded in Vietnam such as *Bulbophyllum holttumii* Hawkes (1956: 92) (= *B. apiferum* Carr (1930: 133)), *B. khasyanum* Griffith (1851: 284), *B. repens* Griffith (= *B. poilanei* Gagnepain (1930: 147)) and *B. xylophyllum* Reichenbach (1874: 151). The described plant may be more or less closer to the east Himalayan *B. cylindraceum* Wallich ex Lindl. in Lindley (1840: 53) and *B. nujiangense* X.H.Jin & W.T.Jin in Jin *et al.* (2014: 157) (= *B. anodon* Vermeulen *et al.* (2014: 14), *B. cylindricoides* W.H.Chen & Y.M.Shui in Shui & Chen (2006: 217)), from which it distinctly differs in having a miniature habit, small leaves, lax inflorescence, narrow acuminate 3-keeled sepals and large 3 lobed stelidia. It is remarkable that the long laxly inflorescence and narrow, acuminate sepals indicate a rather uncertain intermediate position of *B. bidoupense* between section *Brachystachyae* and sect. *Stachysanthes* (Blume 1825: t. 64) Averyanov (1994: 276) (Vermeulen & O'Byrne 2008: 152). There are no closely related species in section *Stachysanthes* resembling this newly described plant. Compared to all species within both mentioned sections, *B. bidoupense* differs in having small, succulent, fleshy, sub-terete leaves, 3-keeled sepals and a large 3-lobed stelidia much exceeding the anther cap in length.

Bulbophyllum bidoupense is endemic to higher elevation areas spreading across the central part of southern Vietnam and known in Vietnamese geography as the Central Highlands or Tay Nguyen Plateau. Phytogeographically, the largest part of this area coincides with the South Annamese floristic province of the Indochinese floristic region that is particularly rich in plant diversity and endemism (Averyanov *et al.* 2003). The species is probably fairly common here in the forests of the highest mountain formations, particularly within the Bidoup, Gia RinH and Hon Giao Ranges. This miniature plant typically grows within the canopies of tall trees and, thus, is difficult to observe directly. It has small unattractive flowers and is easily overlooked during botanical investigations and this explains why it is scarce in herbarium collections. As a result, the exact distribution of this species and its Red List status remain uncertain.

Schoenorchis Blume (1825: 361)

Lectotype:—*Schoenorchis juncifolia* Blume (1825: 361), chosen by Garay (1972: 202).

25–30 species in tropics and subtropics of Asia, Australia and islands of west Pacific with the highest diversity in continental Southeast Asia. In Vietnam 7 species in 3 sections (Averyanov 1994, Averyanov & Averyanova 2003).

Schoenorchis sect. *Pumila* Averyanov (1994: 394)

Type:—*Schoenorchis fragrans* (Reichenbach 1874: 197) Seidenfaden & Smitinand (1965: 611).

5 species in mainland tropical Southeast Asia. In Vietnam 4 species.

Schoenorchis hangiana Aver. et N.V.Duy., *sp.nov.* Figs 1A, H–N, 3

Short-creeping epiphyte; stem simple or branching, creeping, to 18 cm long, 3–5 mm wide with internodes to 12 mm long; leaves distichous, narrowly ovate, fleshy, broadly crescent in cross section, 1–1.8 cm long, 5–10 mm wide, oblique bilobe at apex, finely pustulate-verruculose; inflorescence lateral, raceme, to 6 cm long, with few distant flowers; flowers 3–3.5 mm across, sepals, lip and spur white sometimes with purple tint; petals, column and anther cap yellow; median sepal broadly

ovate, 1.8–2 mm long; lateral sepals oblique, semicircular, 2.5–3 mm long; petals oblong narrowly obovate, 1.6–2 mm long; lip spurred, 4–5 mm long, 3-lobed; side lobes rectangular, erect, 1.5–2 mm tall, median lobe narrowly ovate, 2.5–3 mm long, with large bilobulate callus at middle and thin up-curved lamellate apex, with bilobulate callus at the base of median lip lobe and large entire callus at the lip base, spur saccate, at right angle, (2–)2.5(–3) mm long, with incomplete longitudinal septum; column small, at front with 2 large, acute, protruding rostellum arms; anther cap in form of twin hemispheres, with large, S-curved beak; viscidium very large, boat-shaped, forward protruding, 1.4–1.6 mm long, 0.5–0.6 mm wide; pollinia 2, each half-split into 2 unequal hemi-obovoid portions.

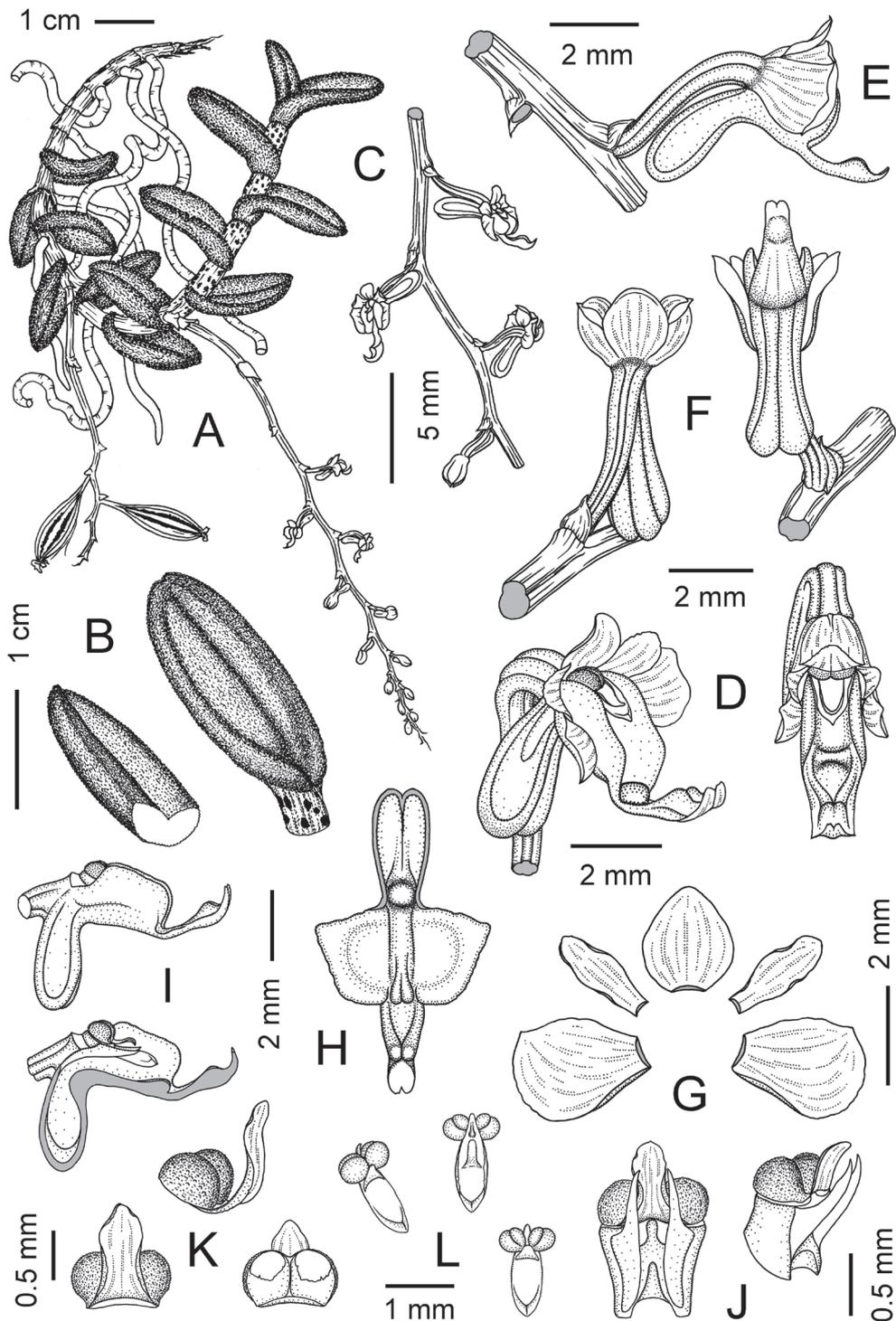


FIGURE 3. *Schoenorchis hangiana*. A. Flowering and fruiting plant. B. Leaf and leaf cross section. C. Portion of inflorescence. D. Flower, frontal and half-side views. E. Flowers and portion of the rachis, side view. F. Flower, view from above and from below. G. Flattened sepals and petals, adaxial surface. H. Flattened lip and spur longitudinal section. I. Lip, side view and lip sagittal section. J. Column, frontal and half-side views. K. Anther cap, frontal view, side view and view from below. L. Pollinarium, view from above, view from below and half-side view. [All drawn from the type-*VTN 984* by L. Averyanov and T. Maisak].

Type:—VIETNAM. Herbarium type specimen collected from cultivated plant. 7 July 2014, *Nong Van Duy*, VTN 984 (holotype, Herbarium of Tay Nguyen Institute of Scientific Research of Vietnamese Academy of Science and Technology!; isotype, LE!). Living plant originated from southern Vietnam, Khanh Hoa province, Khanh Vinh district, Hon Giao Ridge, Khanh Vinh Pass., canopy epiphyte in broad-leaved, evergreen, humid forest at elevation about 1000 m a.s.l., around point 12°12'50"N 108°45'09"E. 1 November 2013, *Nong Van Duy*, (cultivated in the Garden of Tay Nguyen Institute of Scientific Research of Vietnamese Academy of Science and Technology).

Perennial short-creeping monopodial epiphytic herb. Stem simple or branching, rigid, creeping, often curved or flexuose, slightly laterally compressed, (3–)4–14(–18) cm long, 3–4.5(5) mm wide, with distichous leaves and wiry flexuose roots arising from internode opposite leaf axil, internodes (2–)3–12(–14) mm. Leaves narrowly ovate, straight, fleshy, succulent, indistinctly conduplicate, broadly crescent in cross section, (1–)1.2–1.6(–1.8) cm long, (5–)6–8(–10) mm wide, 1.5–2(–2.5) mm thick, blunt and oblique bilobe at apex, finely alveolate-verruculose, dark green, often with purple tint; leaf sheath of young leaves smooth to finely verruculose, light green with purple marks, old sheaths green-purple or purple-brown, transversally finely wrinkled. Inflorescence lateral, straight raceme, (2–)3–5(–6) cm long, arising from stem opposite leaf axil, scape and rachis dull purple; scape (1–)1.5–2.5(–3) cm long, with 1–3 small distant, ovate, sterile bracts; rachis (1–)1.5–5(–6) cm long, slightly zig-zag curved, with few lax, spirally arranged flowers distant on (3–)4–5(–6) mm. Floral bracts dark purple, minute, triangular, acute, 0.8–1.2 mm long and wide. Pedicel and ovary cylindric, 4–5 mm long, 0.5–0.8 mm in diam., dull purple to dark purple-violet, slightly broadening and curved toward the apex. Flowers broadly campanulate, 3–4(–5) mm across; sepals, lip and spur white, sometime tinged with purple; petals, column and anther cap yellow. Median sepal erect, broadly ovate, 1.8–2 mm long, 1.5–1.8 mm wide; lateral sepals reflexed, very oblique, semicircular, 2.5–3 mm long, 1.6–1.8(–2) mm wide. Petals oblong narrowly obovate, slightly reflexed, 1.6–2 mm long, 0.8–1 mm wide, undulate and finely erose dentate along margin. Lip spurred, 4–5 mm long and wide being flattened, 3-lobed; side lobes rectangular, erect, fleshy, 1.5–2 mm tall, 2.2–2.4 mm wide; median lobe narrowly ovate, 2.5–3 mm long, 0.8–1 mm wide, with large bilobulate callus at middle and thin up-curved lamellate apex finely erose or notched at apex; disk fleshy, with twin-tops bilobulate callus at the base of median lip lobe and large entire callus at the lip base at spur entrance; spur narrowly obovoid, saccate, slightly dorso-ventrally flattened, down curved at right angle, (2–)2.5(–3) mm long, 1.2–1.5 mm broad, at apex round and slightly notched, inside with incomplete short longitudinal septum. Column small, about 0.5 mm high and wide, at front with 2 large, acute, knife-shaped parallel, forward directed rostellum arms, 1–1.2 mm long, 0.3 mm wide at the base. Anther cap in form of twin hemispheres, finely papillose, 1–1.2 mm wide and 0.5–0.6 mm tall, with large, oblong triangular, scarious, S-curved beak 0.6–0.8 mm wide, 0.8–1 mm long. Stipe (tegula) simple, small, in form of flat, erect triangular plate, 0.2–0.3 mm long and wide; viscidium very large, concave at apex from below, boat-shaped, forward protruding, 1.4–1.6 mm long, 0.5–0.6 mm wide. Pollinia 2, each half-split into 2 unequal hemi-obovoid portions, 0.3–0.4 mm long. Fruits narrowly ellipsoid capsule 0.8–1.2 cm long, 3.5–4.5(–5) mm in diam., placed more or less horizontally on straight rigid stalk 2–3 mm long.

Etymology:—Species epithet refers to the name of Mrs. Nguyen Thi Thanh Hang, wife of the species discoverer, co-author of this paper — Dr. Nong Van Duy.

Ecology:—Creeping epiphyte; primary broad-leaved, evergreen, humid, submontane forests on granite. 1000 m a.s.l. Fl. May–July. Very rare. Estimated IUCN Red List status—CR.

Distribution:—Vietnam: Khanh Hoa (Khanh Vinh district). Endemic.

Notes:—*Schoenorchis hangiana* is obviously related to *S. scolopendria* Averyanov (2012: 134) having certain similarities both in plant growth habit and in floral morphology. However, it distinctly differs in having large, distant, obtuse leaves and a long inflorescence. Both species are unique among their congeners for their plagiotropic creeping shoot, forming distinctly isolated group inside the genus. In lip structure, both species of this group resemble *S. fragrans*, *S. seidenfadenii* Pradhan (1978: 912) and *S. tixieri* (Guillaumin 1958: 462) Seidenfaden (1975: 102) (sect. *Pumila* Aver.). At the same time, their relationship with species of other sections of the genus is very problematic.

Schoenorchis hangiana is probably a local endemic of Hon Giao Range—the chain of high mountains spreading along the border between Lam Dong and Khanh Hoa provinces in southern Vietnam. In this region, the species is part of the very rich orchid flora of these mountains and occurs there with such typical local endemics of high taxonomical rank as *Arachnis annamensis* (Rolfe 1905: 391) Smith (1912: 73), *Ascocentrum christensonianum* Haager (1993: 39), *Bulbophyllum clipeibulbum* Vermeulen (2001: 51) and *Paphiopedilum delenatii* Guillaumin (1924: 554). The described plant grows as a miniature branch epiphyte in the canopies of high trees of primary forest and is therefore difficult to observe and collect without cutting of host trees. It is very rare and known until now by single collection. It is noteworthy that the lone locality of primary forest habitat for this plant is presently being destroyed due to

road construction, forest logging and anthropogenic transformation of landscape. For this reason, this new species is tentatively assessed as critically endangered (CR) due to fatal decline of its habitat area.

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