



***Bidoupia phongii*, new orchid genus and species (Orchidaceae, Orchidoideae, Goodyerinae) from southern Vietnam**

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Introduction

Species of subtribe Goodyerinae (Orchidaceae, Orchidoideae) in the flora of Vietnam have been the subject of a series of taxonomic treatments (Seidenfaden 1992, Averyanov 1994, 2008, Averyanov & Averyanova 2003, Nguyen, Averyanov & Duong 2005). Nonetheless, the inventory of this group remains incomplete due to their sporadic distribution, rarity in nature, and deficiency of available herbarium and living collections. Additionally, almost all *Goodyera*-related species rarely flower either in nature or cultivation, which makes available observations scarce. As a result, new data on species and records for the flora of Vietnam are appearing continuously (Ponert *et al.* 2014, Averyanov *et al.* 2016) in addition to the already completed accounts. One more curious novelty from Goodyerinae discovered recently in southern Vietnam is described and illustrated below.

The unusual plant described here was discovered in 2010 during botanical investigations conducted by international team of botanists under leadership of Nong Van Duy, Vice Director of the Tay Nguyen Institute for Scientific Research, Vietnam Academy of Science and Technology in the northeastern part of Tay Nguyen Plateau (Central Highlands) of southern Vietnam. 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 new species is probably a local endemic of the Bidoup Range, the chain of high mountains along the border between Lam Dong and Khanh Hoa provinces in southern Vietnam. In this region, the species occurs with such typical local endemics as *Arachnis annamensis* (Rolfe 1905: 391) Smith (1912: 73), *Vanda christensonia* (Haager 1993: 39) L.M.Gardiner (2012: 49), *Bulbophyllum clipeibulbum* Vermeulen (2001: 51), *Paphiopedilum delenatii* Guillaumin (1924: 554) and *Schoenorchis hangiana* Averyanov & Duy (2015: 117). This species is rare and known thus far from just a single collection. It is noteworthy that the locality for this plant in primary forest is presently being seriously disturbed by road construction, logging and anthropogenic transformation. For these reasons, it is tentatively assessed as a highly endangered species due to loss of its habitat. It should be especially emphasized that this unique taxon could become extinct in the near future, and its conservation and protection needs further field investigation.

Bidoupia* Aver., Ormerod & Duy, *gen. nov.

Type:—*Bidoupia phongii* Aver., Ormerod et Duy.

Monotypic genus endemic to southern Vietnam.

Etymology:—The name to the Bidoup Mountains where the species was discovered.

Generic diagnosis:—New genus allied to *Dossinia*, *Ludisia*, *Macodes* and *Papuaea* alliance, from which differs in a combination of morphological features such as black leaves (purple-brown below), flowers non-resupinate due to the ovary twisting 360°, subglobular hypochile closed by subquadrate connivent and firmly adpressed side lobes, long tube-shaped arcuate claw warty on flanges, bilobulate epichile with large wing-like lobules, lip with longitudinal

internal keel rising abaxially, column with 2 large, down-directed keels as well as entire stigma, and long linear forward directed arcuate rostellum and anther cap beak.

Bidoupia phongii Aver., Ormerod & Duy, *sp. nov.* (Fig. 1, 2)

Herbaceous perennials with black leaves with white median stripe, purple-brown below. Scape shortly hairy, spike with lax spirally arranged, sessile, widely opening flowers with ovary twisting on 360°. Ovary sparsely hairy, strongly twisted. Sepals free, sparsely hairy outside; median sepal erect, lateral sepals horizontally spreading, twisted at the base. Petals oblique, connivent with dorsal sepal. Lip glabrous, trilobed, spurred; hypochile small subquadrate, closed by small quadrate side lobes connivent and firmly adpressed to each other; mesochile long, terete, strongly recurved; epichile with two large, wing-shaped, denticulate lobules; spur hemispheric, with 2 massive, stalked, clavate glands; lip inside with low longitudinal keel rising abaxially into prominent flat dent. Column short, at base with 2 large, down directed keels; stigma at front of column, entire, slightly convex; rostellum long, linear, forward directed and arcuate; anther cap with long, linear, arcuate beak. Alone species in the genus.

Type:—VIETNAM. Lam Dong Province: Lac Duong district, near Giang Ly Forest Protection Department station, Bidoup Ridge, primary humid, broad-leaved forest at 1526–1530 m, around 12°10'36"N, 108°42'43"E, 12 December 2010, *Nong Van Duy, VTN 1465/AL 91* (holotype: Herbarium of Tay Nguyen Institute of Scientific Research of Vietnamese Academy of Science and Technology!; isotype: LE!; cultivated and flowered in the botanical garden of Tay Nguyen Institute of Scientific Research of Vietnamese Academy of Science and Technology. Type specimen prepared from a cultivated plant, 27 August 2015). (Fig. 1, 2).

Perennial sympodial terrestrial creeping herb. Plagiotropic part of stem dull brownish-pink with olive tint, epigeous, leafless, fleshy, rooting at nodes, (10)12–18(24) cm long, (3.5)4.0–6.0(7.5) mm in diam., apically erect; erect leafy shoot glabrous, (4)5–6(7) cm long, with (2)3–4(5) closely spaced, spirally arranged leaves, terminated by an erect inflorescence (16)18–22(25) cm tall. Leaves shortly petiolate; petiole and sheath (8)12–15(20) × (3)4–5(6) mm; leaf blade narrowly ovate to ovate, slightly oblique, irregularly undulate along margin, with 1 main vein, acute to shortly acuminate, (2.0)3.0–6.0(7.0) × (1.6)2.0–3.0(3.5) cm, velvety black with white median stripe above, uniform glossy pale purple-brown below. Inflorescence a lax spike with (5)6–8(10) spirally arranged flowers, distantly spaced on 8–12 mm. Scape and rachis erect, straight, pink, more or less densely hairy with short soft hairs; scape (8)10–14(16) cm long, with 1–2(3) sterile tubular, triangular, obtuse bracts (8)10–14(16) × (3.5)4.0–5.0(5.5) mm (when flat); rachis (5)6–8(10) cm long, with (4)5–6(8) lax flowers. Floral bracts pale pink-purple, outside sparsely hairy, narrowly triangular-ovate, tubular-convolute, acute, (9.0)10.0–12.0(13.0) × (5.5)6.0–7.0 (7.5) mm (when flat), scarious and finely erose-ciliate along margin. Ovary sparsely hairy in apical half, glabrous at the base, cylindric, reddish-brown to olive-purple, (12)14–15(16) mm long, (1.2)1.4–2.0(2.2) mm in diameter, slightly narrowing to the apex, twisted 360°. Flowers sessile, widely opening, 1.6–1.8 cm in diameter; sepals pale brownish-pink; petals pure white; lip white, spur light dull pinkish, claw (mesochile) at the base greenish; column and anther cap white. Sepals free, 1-veined, abaxially near the apex with short sparse, stiff hairs; median sepal narrowly ovate, concave, straight, erect, slightly attenuate, usually cucullate at obtuse apex, (9.0)9.5–10.5(11.0) × (3.6)3.8–4.2(4.4) mm; lateral sepals oblique ovate triangular, (8.5)9.0–10.0(10.5) × (4.0)4.5–5.0(5.5) mm, more or less flat, horizontally spreading, somewhat twisted at the base, obtuse. Petals as long as median sepal, (3.6)3.8–4.2(4.4) mm wide, glabrous, straight, strongly oblique, half (longitudinally) pyriform, narrowing from broad, strongly oblique base to slightly attenuate, obtuse apex, 1-veined, connivent and forming narrow hood with the dorsal sepal. Lip glabrous, trilobed, spurred, clawed, apically 2-lobuled, about 9 mm long, distinctly divided into hypochile, mesochile (claw) and epichile. Hypochile rudimentary, in form of small subquadrate concave hollow 2.8–3.0 × 2.8–3.0 mm, closed by flat, subquadrate side lobes firmly adpressed to each other. Mesochile (claw) in form of terete, strongly recurved tube, (3.8)4.0–4.5(4.7) mm long, 0.8–1.0 mm in diameter, grooved adaxially. Epichile in form of 2-lobuled plate, placed at the apex of mesochile; lobules adaxially spreading, oblong to oblong triangular, wing-shaped, (4.2)4.5–5(5.2) mm long, (1)1.2–1.4(1.5) mm wide, finely papillose, few-denticulate and acute at apex, joined to each other by a small forwardly curving neck. Spur small, rudimentary, hemispheric, (2.6)2.8–3.0(3.2) × (2.6)2.8–3.0(3.2) mm, inside with low longitudinal keel rising near apex of hypochile into prominent flat dent 1.0–1.2 mm tall, outside longitudinally shallowly grooved and obscurely notched at apex, covered by concave bases of lateral sepals, inside with 2 massive, fleshy, stalked, clavate, peltate (with triangular rough apical surface about 1.5 mm long and wide) glands 2.2–2.5 mm long. Column short and broad, (1.8)2.0–2.2(2.4) mm tall, (2.6)2.8–3.0(3.2) mm long and wide; in basal half at front with 2 large keels, triangular in cross section, each keel 2.0–2.2 mm long and tall, 0.8–1.0 mm wide, narrowly winged at lower angles, each with transversal annular callus; stigma large, as wide as column, placed at front of column, entire, obscurely bilobed, flat, rough, slightly convex, white; rostellum prominent, linear, longitudinally concave, forward directed and arcuate, 2.8–3.2 mm long; anther cap

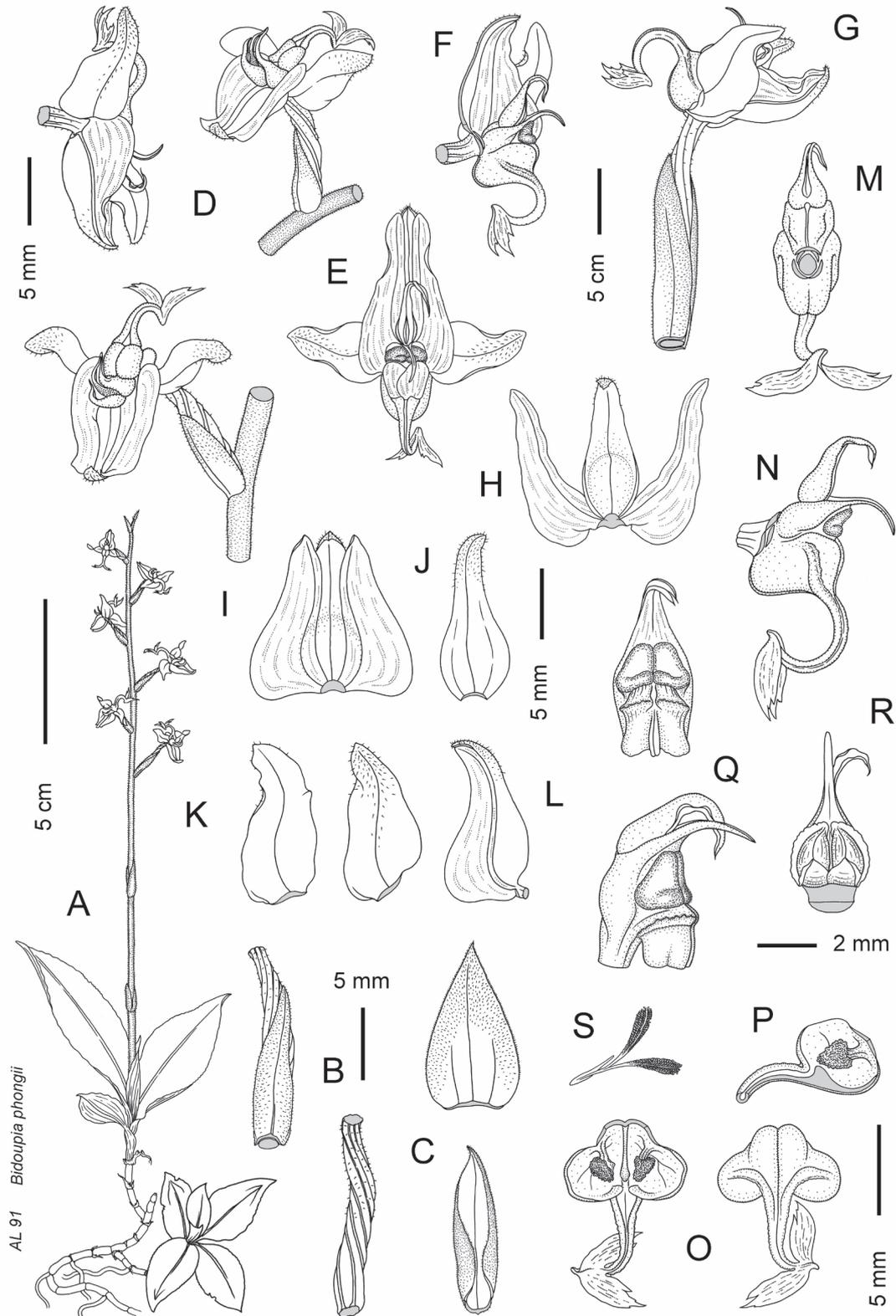


FIGURE 1. *Bidoupia phongii*. A. Flowering plant. B. Ovary with and without floral bract. C. Intact and flattened floral bracts. D. Intact flowers, views from different sides. E. Slightly flattened flower, frontal view. F. Flower with lateral sepal and petal removed, side view. G. Young intact flower with ovary and floral bract, side view. H–I. Flattened median sepal and petals (adaxial surface). J. Median sepal (abaxial surface). K. Lateral sepals (adaxial and abaxial surface). L. Lateral sepal and petal, side view. M. Column and lip, view from behind. N. Column and lip, side view. O. Flattened lip with artificially retorted side lobes, frontal view and from below. P. Base of lip, sagittal section. Q. Column, frontal and side views. R. Column, view from below. S. Pollinarium, side views. All drawn from the type, *Nong Van Duy, VTN 1465/AL 91*, by L. Averyanov and T. Maisak.



FIGURE 2. *Bidoupia phongii*. Digital epitype, EXSICCATES OF VIETNAMESE FLORA 0249/VTN 1465/AL 91. Photos by Nong Van Duy, design and image correction by L. Averyanov.

narrowly obovoid, (5.2)5.5–6.0(6.5) × (2.2)2.4–2.6(2.8) mm, with a long, linear, conduplicate, attenuate and arcuate beak; viscidium linear, 1.0–1.4 mm long, white. Pollinia 2, white, stalked, clavate, secund, sectile, (2.2)2.5–2.8(3.0) mm long, 0.4–0.5 mm in diameter, each consisting of 2 hemipollinaria. Fruit unknown.

Etymology:—Named in honor of Nong The Duy Phong, son of the discoverer, Nong Van Duy.

Habitat, phenology and conservation status:—Creeping terrestrial herbs in primary, humid, broad-leaved and mixed evergreen forests (with *Pinus dalatensis* and *P. krempfii*) on granite. 1500–1550 m. Flowering August–September. Rare. Estimated IUCN Red List status: EN/DD.

Distribution:—Endemic thus far to the type locality.

Notes:—*Bidoupia phongii* has an isolated taxonomic position of unclear position in subtribe Goodyerinae. Tentatively, it belongs to an alliance of genera including *Dossinia* Morren (1848: 171), *Ludisia* Richard (1825: 137), *Macodes* (Blume 1825: 407) Lindley (1840: 496) and *Papuaea* Schlechter (1919: 105). Among them, it may be more or less close to *Macodes*, particularly to *M. cupida* Ormerod (2002: 212) discovered in the same geographic area. *Macodes cupida* has many characters of *B. phongii*, such as spreading lateral sepals, broad petals and elongate rostellum brachia. However, the new plant has many differences, such as a long, tube-shaped mesochile that is warty on the flanges, an untwisted column, large bilobulate epichile and broad, subquadrate vertical, skirt-like wings. These features are occasionally observed in some species of *Rhomboda* Lindley (1857: 181). It is possible that our plant is an ancient hybrid of plants like *Macodes cupida* and a species of *Rhomboda* aff. *petelotii* (Gagnepain 1933: 349) Ormerod (1998: 63). This would account for the *Rhomboda*-like characters of the plant, such as the pinkish suffusion of the stems and leaves, white stripe on a dark leaf, lax inflorescence, squarish hypochile (subglobose in *Macodes*), discoid keel on the hypochile, and bilobed (entire in *Macodes*) epichile with dentate lobules. Generally, *Macodes* species have ligulate petals, but *M. cupida* is the only one with broad petals. In addition, from all representatives of *Macodes*, *B. phongii* differs in having the column wings perpendicular to the stigma lobes (base of wings in line with stigma lobes in all other *Macodes*), and bilobed epichile (entire and small in all *Macodes* species).

Ludisia is another genus that may be related to *Bidoupia phongii*. However, all its species do not have column wings, and the column is bent at right angles medially; furthermore the lip lacks any internal keels or external ridges and a narrow mesochile. The plant also cannot be included in *Rhomboda* due to narrow column brachia and entire stigma (not separated into two stigma lobes). It is not an *Odontochilus* either, which commonly has a small hypochile and mesochile with fringes or teeth on its flanges.

A detailed comparison of *B. phongii* with known genera of Goodyerinae emphasises its unique combination of morphological features that confirm its proposed generic status as a fifth genus in an alliance of more or less related genera, *Dossinia*, *Ludisia*, *Macodes* and *Papuaea*.

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