

## *Billolivia thongii* (Gesneriaceae), a new species from Central Highlands, Vietnam

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### ABSTRACT

A new species of *Billolivia* is described from Central Highlands, Vietnam. The new species shows similarities with its congener *B. cadamensis* and *B. poilanei* but differs in several vegetative and reproductive attributes. Hence, we described it here as a new species. A detailed description, distribution, ecology and conservation status along with photographs are provided.

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### Introduction

*Billolivia* D.J.Middleton (Gesneriaceae) is a recently established new genus endemic to Vietnam, which shows close similarities with *Cyrtandra* J.R.Forst. & G. Forst. with indehiscent fruits and two fertile stamens. However, the morphological (alternate leaf arrangement) and molecular data are distinct from the former (Middleton et al. 2014a). Since Middleton et al. (2014a), researchers have paid much attention to this genus and eight new species have been published (Middleton et al. 2014b; Vũ et al. 2015; Luu et al. 2015, 2018a, 2018b; Nguyen et al. 2016; Lý 2017) from various parts of Vietnam. At present, the genus consists of 14 taxa including the proposed new species. During the botanical expeditions in Central Highlands, an unknown lithophytic *Billolivia* was collected from Chur Mu forest areas of Đắk Lắk province. After careful examination of the collected materials and comparison with information in the relevant literature (Middleton et al. 2014a, 2014b; Vũ et al. 2015; Luu et al. 2015, 2018a, 2018b; Nguyen et al. 2016; Lý 2017) and herbarium materials, it is revealed that the unknown taxon shows similarities with *B. cadamensis* Q.D.Nguyen, N.L.Vu & Luu and *B. poilanei* D.J. Middleton & H.J.Atkin. However, it shows significant differences in its vegetative and floral structures (Table 1) and is described here as new. In addition, a distribution map of the new species is also provided.

### Materials and methods

The collected floral parts were dissected and preserved in FAA (formalin–acetic acid–alcohol) for subsequent studies. In addition, three flowering or fruiting shoots were taken for voucher specimen preparation. The description was made from the living material as well as preserved

specimens. The dried plant materials were mounted on a herbarium sheet and deposited at HN and VNMN.

### Taxonomic treatment

*Billolivia thongii* Hareesh, T.A.Le & T.T.D.Pham, **sp. nov.** (Figures 1 and 2)

Type: VIETNAM, Central Highlands: Đắk Lắk province, M'Drăk district, the protected forest in Chur Mu, 12°41'24.4"N, 108°53'43.0"E, ±1000 m asl, 26 August 2017, N.D.T. Vo, T.T.D. Pham & T.A. Le LTA 96 (holotype VNMN!, isotype HN!).

### Diagnosis

Similar to *B. cadamensis*, but differs in having glabrous lamina margins; peduncle 10–18 cm long, puberulent to glabrous; bracts ovate to broadly ovate, glabrous on both surfaces except ciliate midrib adaxially and calyx lobes ovate to broadly ovate, glabrous. The new species also differs from *B. poilanei* in having glabrous to sparsely pubescent stem, puberulent petiole, glabrous lamina, pedunculate inflorescence, densely pubescent pedicel and glabrous calyx lobes.

### Description

Lithophytic herb, up to 25 cm tall; stems rhizomatous, creeping and erect towards the distal part, glabrous to sparsely pubescent, pale green to brownish pink. Leaves alternate; petioles 13–17 cm long, puberulent with brown uniseriate hairs when young and glabrous when mature,

**Table 1.** Morphological differences between *Billolivia thongii*, *B. poilanei* and *B. cadamensis*.

Characters	<i>B. thongii</i>	<i>B. poilanei</i>	<i>B. cadamensis</i>
Stem	Glabrous to sparsely pubescent	Densely villous with 3 mm long hairs	Pubescent
Petiole	Puberulent	Densely villous	Pubescent
Lamina	Glabrous	Villous	Glabrous
Lamina margin	Glabrous	Villous	Ciliate
Peduncle	10–18 cm long, puberulent to glabrous	Absent	0.3–1.3 cm long, densely pubescent
Bract	Ovate to broadly ovate, glabrous on both surfaces except abaxially ciliate at midrib	Ovate, villous	Narrowly ovate, sparsely pubescent throughout
Pedicel	1.5–2 cm long, glabrous to pubescent	3.5 cm long, densely villous	1–1.5 cm long, sparsely strigose
Calyx lobes	13–15 × 6–7 mm, ovate to broadly ovate, sub-acute to obtuse at apex, glabrous	7–9 × 4.8–5.8 mm, ovate, apex short acuminate to acute, villous	18–16 × 3–4 mm, narrowly ovate, acute at apex, ciliate

**Figure 1.** *Billolivia thongii* habit. Photo by T.T.D. Pham.

terete, pale green to brownish black; lamina 10–18 × 5–7.5 cm, elliptic to ovate, base rounded to sub-acute, apex acute, margin coarsely dentate, glabrous on both surfaces, dark green above, pale green below; secondary veins 9–11 on each side of the midrib. Inflorescences axillary; peduncle 10–18 cm long, terete, puberulent to glabrous, pale pink to dark pink; bracts 2.4–3 × 1–1.3 cm, broadly ovate, foliaceous, prominently 3–5-ribbed, pale green to pale pink, glabrous on both surfaces except adaxially ciliate at midrib, apex acute, margins minutely ciliate; pedicels 1.5–2 cm long, terete, glabrous or densely golden brown pubescent throughout, pale green to pale pink. Calyx 5-lobed almost divided to base, off white to pale pink, glabrous on both surfaces; lobes 13–15 × 6–7 mm, ovate to broadly ovate, sub-acute to obtuse at apex. Corolla 21–23 mm long, composed of a straight to slightly bent narrow tube which slightly flares towards an oblique mouth and a 2-lipped limb with recurved lobes; tube 12–14 mm long, contracted below the middle, then flaring towards the mouth; tube and lobes white, and pale purple towards the distal part of lobes in both surfaces, inner surface also with dark violet lines starting from the ventral part of the tube towards the proximal part of the lobe and ventral surface of throat and distal half of tube with two yellow streaks alternated with the violet lines; upper lip 2-lobed,

lobes 4.5–5.5 × 5 mm, orbicular; lower lip 3-lobed, lobes 5.5–6 × 3.5–4 mm, slightly obovate; corolla with long colourless hairs outside on upper half of tube towards the lobes, glandular puberulent at top of tube and base of lobes inside. Stamens inserted at 5–6 mm from corolla base; anthers 2.3 × 3.5 mm, dorsifixed, cohering, touching face to face, pale yellow; filaments slightly curved, 6–7 mm long, white, glabrous. Disc an annular ring, c. 1.5 mm high. Ovary 2.5–3 × 2 mm; style 6–7 mm long, densely covered with white glandular hairs; stigma slightly lobed, glabrous. Fruits 11–13 × 5–5.5 mm, ovoid, greenish cream, brown puberulent, basally glabrous, translucent when ripe; seeds many, ovoid, black.

### Etymology

This specific epithet is named in honour of Mr Ngo Dinh Thong Vo, who was the first to notice the plant during the collection in Central Highlands, Vietnam.

### Phenology

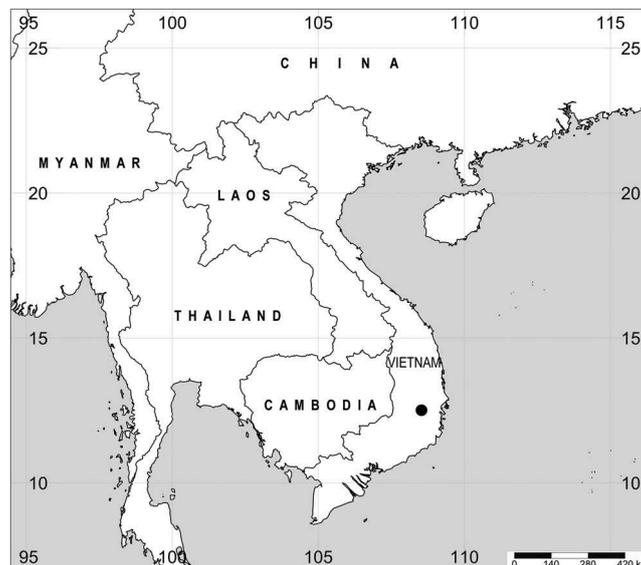
Flowering from August to September. Fruiting was observed in September to November.

### Habitat, ecology and conservation status

*Billolivia thongii* is known only from the protected forest in Chur Mur, M'Drăk district, Đăk Lăk province, Central Highlands, Vietnam (Figure 3). Populations were observed in the shady areas in the evergreen forests. The new species was growing in thick moss covering moist rocks near a stream in association with *Didymocarpus* Wall., *Phyllagathis* Blume, *Begonia* L., etc. During the study, we observed less than 50 mature individuals in two populations. The major threat we observed was the continuing deforestation in the area. Using the IUCN Red List Categories and Criteria (EN) D1 (IUCN 2017), the new species has been assigned as Endangered.



**Figure 2.** *Billolivia thongii*. (a) Habit. (b) Inflorescence. (c) Inflorescence showing a single flower. (d) Flower front view. (e) Flower side view. (f) Dissected corolla showing stamens and carpel. (g) Capsule. (h) Cross-section of capsule. Photos by T.T.D. Pham.



**Figure 3.** Collection locality of *Billolivia thongii* in Vietnam (source: V.S. Hareesh).

### Notes

Apart from *B. cadamensis* and *B. poilanei*, *B. thongii* shows affinities towards *B. moellerii*, but differs in

having puberulent to glabrous petiole (vs densely covered with a mixture of small and appressed hairs); glabrous lamina and lamina margin (vs adaxially with

sparsely long hairs throughout and ciliate margin); pedunculate inflorescence with puberulent to glabrous texture (sub-sessile); broadly ovate bracts (vs narrowly triangular); calyx lobes equal to the corolla tube, ovate to broadly ovate, glabrous (vs three-quarters the length of the corolla tube, deltoid, densely long pubescent); corolla with violet lines on upper and lower lip towards the corolla tube (vs lines on the upper lip only).

### Additional specimens examined (paratypes)

VIETNAM: Central Highlands, Đắk Lắk province, M'Drăk district, The protected forest in Chu Mu, 12° 41'24.4"N, 108°53'43.0"E, ±1000 m asl, 2 September 2018, N.D.T. Vo & T.T.D. Pham LTA 357 (VNMN!).

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### Disclosure statement

No potential conflict of interest was reported by the authors.

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### References

- IUCN Standards and Petitions Subcommittee. 2017. Guidelines for using the IUCN red list categories and criteria. Version 13. Prepared by the Standards and Petitions Subcommittee. [accessed 2017 July 3]. Available from: <http://www.iucnredlist.org/documents/RedListGuidelines.pdf>
- Luu HT, Pham HN, Nguyễn QĐ, Nguyễn TV, Nguyễn TM, Vũ NL. 2018b. Two new species of *Billolivia* (Gesneriaceae) from the Langbiang Plateau, Vietnam. *Phytotaxa*. 385:37–42.
- Luu HT, Pham HN, Tran G, Ngo TTD, Dinh NL, Ton TM. 2015. *Billolivia kyi* (Gesneriaceae), a new species from Vietnam. *Ann Bot Fennici*. 52:362–365.
- Luu HT, Trần HĐ, Pham HN, Nguyễn TQT, Nguyễn QĐ, Vũ NL. 2018a. Two new species of *Billolivia* (Gesneriaceae) with yellow flowers from Vietnam. *Phytotaxa*. 362:227–232.
- Lý NS. 2017. A new species of *Billolivia* (Gesneriaceae) from Central Vietnam. *Phytotaxa*. 291:89–93.
- Middleton DJ, Atkins H, Luu HT, Nishii K, Möller M. 2014a. *Billolivia*, a new genus of Gesneriaceae from Vietnam with five new species. *Phytotaxa*. 161:241–269.
- Middleton DJ, Leong-Škorničková J, Nguyễn QB. 2014b. A new species of *Billolivia* (Gesneriaceae) from Vietnam. *Gardens' Bull Singapore*. 66:189–194.
- Nguyen QD, Dinh NL, Nguyen HC, Vu NL, Luu HT. 2016. *Billolivia cadamensis* (Gesneriaceae), a new species from central Vietnam. *J Biol (Vietnam)*. 38:492–496.
- Vũ NL, Phạm HN, Nguyễn TV, Luu HT. 2015. *Billolivia tichii* (Gesneriaceae), a new species from Vietnam. *Phytotaxa*. 219:190–194.