A new combination and a new species in *Phlegmariurus* (Herter) Holub (Lycopodiaceae) from Southern Vietnam

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ABSTRACT
A new combination is proposed for *Phlegmariurus* (Herter) Holub (Lycopodiaceae): *P. obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov., and a new species of *Phlegmariurus*, *P. lancifolius* V.T. Tran & N.V. Duy, sp. nov., from southern Vietnam, is described and illustrated. It is distinguished from the closely related *P. obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov., by its leaves lanceolate, apex acuminate-acute, 1.1-1.5 × 0.4-0.6 cm, sporophyll cuneiform or broadly ovate, *c.* 2 × 2 mm, apex apiculate with acuminate tip, *c.* 2 mm, sporangia reniform.

KEY WORDS
Lycopodiaceae,
Vietnam,
new combination,
new species.

RÉSUMÉ
Une combinaison et une espèce nouvelles dans Phlegmariurus *(Herter) Holub (Lycopodiaceae) du Vietnam méridional.*
Dans *Phlegmariurus* (Herter) Holub (Lycopodiaceae), une combinaison nouvelle est proposée : *P. obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov., et une nouvelle espèce du sud du Vietnam : *P. lancifolius* V.T. Tran & N.V. Duy, sp. nov., est décrite et illustrée. Cette dernière se distingue de *P. obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov., par ses feuilles lancéolées à apex acuminé-aigu, de 1,1-1,5 × 0,4-0,6 cm, ses sporophylles cunéiformes ou largement ovées de *c.* 2 × 2 mm, à sommet acuminé-apiculé de *c.* 2 mm et ses sporanges réniformes.

MOTS CLÉS
Lycopodiaceae,
Vietnam,
combinaison nouvelle,
espèce nouvelle.

TABLE 1. — Morphological comparison between *Phlegmariurus obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov. and a new taxon from Vietnam, *P. lancifolius* V.T. Tran & N.V. Duy, sp. nov.

Characters		***P. lancifolius* V.T. Tran & N.V. Duy, sp. nov.**	***P. obovalifolius*, comb. nov.**
Leaves	shape	lanceolate, apex acuminate with tip apiculate, 11-15 × 4-6 mm, recurved or reflexed, abaxially prominent and decurrent veins	obovate, 8-10 × 2.5 mm, erected or slightly reflexed, abaxially slightly concave veins
	apex	apex with tip apiculate	apex with tip obtuse
	basal	base narrow or slightly narrow, twisted at the base	base narrow to acute, not twisted at the base
Sporophyll		cuneiform or broadly ovate, *c.* 2 × 2 mm, apex acuminate with apiculate tip, *c.* 2 mm	oval-orbicular, *c.* 1.5 × 1.5 mm long, apex with short apiculate tip
Sporangium		reniform, slightly flat, *c.* 2 × 2 mm	orbicular, not flat, *c.* 1.5 × 1.5 mm

INTRODUCTION

The genus *Phlegmariurus* (Herter) Holub is a very large genus in the family Lycopodiaceae, which consists of *c.* 250 species, and is widely distributed in the tropical, subtropical regions globally (Field & Bostock 2013; Zhang & Iwatsuki 2013). This genus is distinguished from the other related genera of the Lycopodiaceae by homophyllous shoots, lack of gemmae, spores with convex lateral margins and foveolate-fossulate sculpture restricted to their distal surfaces (Øllgaard 1979; Field & Bostock 2013). Since the proposed status of the genus *Phlegmariurus* (Herter) Holub by Holub (1964), the taxonomic of this genus has become complicated. Early treament of this genus has been to place in the family Huperziaceae (Holub 1964), but the trend in recent treatments has been combined with Lycopodiaceae (Øllgaard 1987; Wikström & Kenrick 2000; Field & Bostock 2013).

In Vietnam, a total of ten species have been recorded (Ho 1991) in the family Lycopodiaceae. A species exhibiting the characteristic features of *Phlegmariurus* was described as a new species, *Lycopodium obovalifolium* in 1923 by Bonaparte based on the collection *Sallet s.n.* (P00522994, P00522995) from Ba Na Mount, Central Vietnam. It is distinguished from *P. phlegmaria* (L.) T. Sen & U. Sen by its leaves obovate (Bonaparte 1923). The name *L. obovalifolium* is not superfluous because it was validly published by Bonaparte (1923). Recently, we got the possibility to examine the type material of *Huperzia obovalifolia* Bonap. (kept at P) and compare it with our collections from the type locality at Ba Na Mount (Da Nang City). The characteristic features of *L. obovalifolium* were essentially similar in all aspects to that described for *Phlegmariurus* , which is characterized by lack gemmae, spores with convex lateral margins and foveolate-fossulate sculpture restricted to their distal surfaces (Field & Bostock 2013; Zhang & Iwatsuki 2013). It is clear that *L. obovalifolium* does not belong to *Huperzia* Bernhardi. Instead, *L. obovalifolium* belongs to *Phlegmariurus* and a new combination is necessary to supersede the legitimate name by *Phlegmariurus obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb.nov.

In addition, during a floristic survey in Lang Bian mountain, Lac Duong district, Lam Dong Province, southern Vietnam, in August 2013, we found an epiphytic species of *Phlegmariurus* on tree in broad-leaved forest between 1900 and 2000 m alt. Specimens of vegetative and reproductive material of *Phlegmariurus* were collected. After having examined the specimens and consulted the relevant literature (Bonaparte 1923: 190; Alston 1939: 551, fig. 65; Ho 1991: 24-35; Zhang & Iwatsuki 2013: 13-34), and also verified the features by consulting herbarium specimens at Herbarium of Vietnam Academy of Science and Technology (HN), HNU (Herbarium of Vietnam National University, Ha Noi), P, using standard morphological comparisons, we found that the new species is very similar in certain characters with *P. obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov., but differs by sterile leaves lanceolate with apex acuminate, 1.1-1.5 × 0.4-0.6 cm, sporophyll cuneiform or broadly ovate, *c.* 2 × 2 mm, apex acuminate with tip apiculate, *c.* 2 mm, sporangia reniform (Figs 1; 3; 4). These features clearly suggest that our plant represents a new species.

SYSTEMATICS

Phlegmariurus obovalifolius (Bonap.) V.T. Tran & N.V. Duy, comb. nov. (Figs 1; 2)

Lycopodium obovalifolium Bonap., *Notes ptéridologiques* 14: 190 (1923). — **Typus**: Vietnam. Annam, à environ 30 km au sud-ouest de Tourane, Massif de Bah-Na, alt. *c.* 1500 m, VIII.1920, *Sallet s.n.* (holo-, P[P00522994]; iso-, P[P00522995]).

Urostachys obovalifolius (Bonap.) Nessel, *Bärlappgewächse*: 249 (1939).

Phlegmariurus lancifolius V.T. Tran & N.V. Duy, sp. nov. (Fig. 3)

A Phlegmariuro obovalifolio *(Bonap.) V.T. Tran & N.V. Duy, comb. nov., lanceolatis foliis paulo majoribus, apice acuminato apiculato; sporangiis reniformibus non orbiculatis praecipue differt.*

TYPUS. — **Vietnam**. Lam Dong Province, Lac Duong District, Lang Bian mountain, elevation 2014 m, 12°02'6.54"N, 108°26'02.78"E, 20.VIII.2013, *Duy N.V. & V.T. Tran 00011* (holo-, Da Lat University – DLU!); iso-, Tay Nguyen Institute for Scientific Research – VTN!).

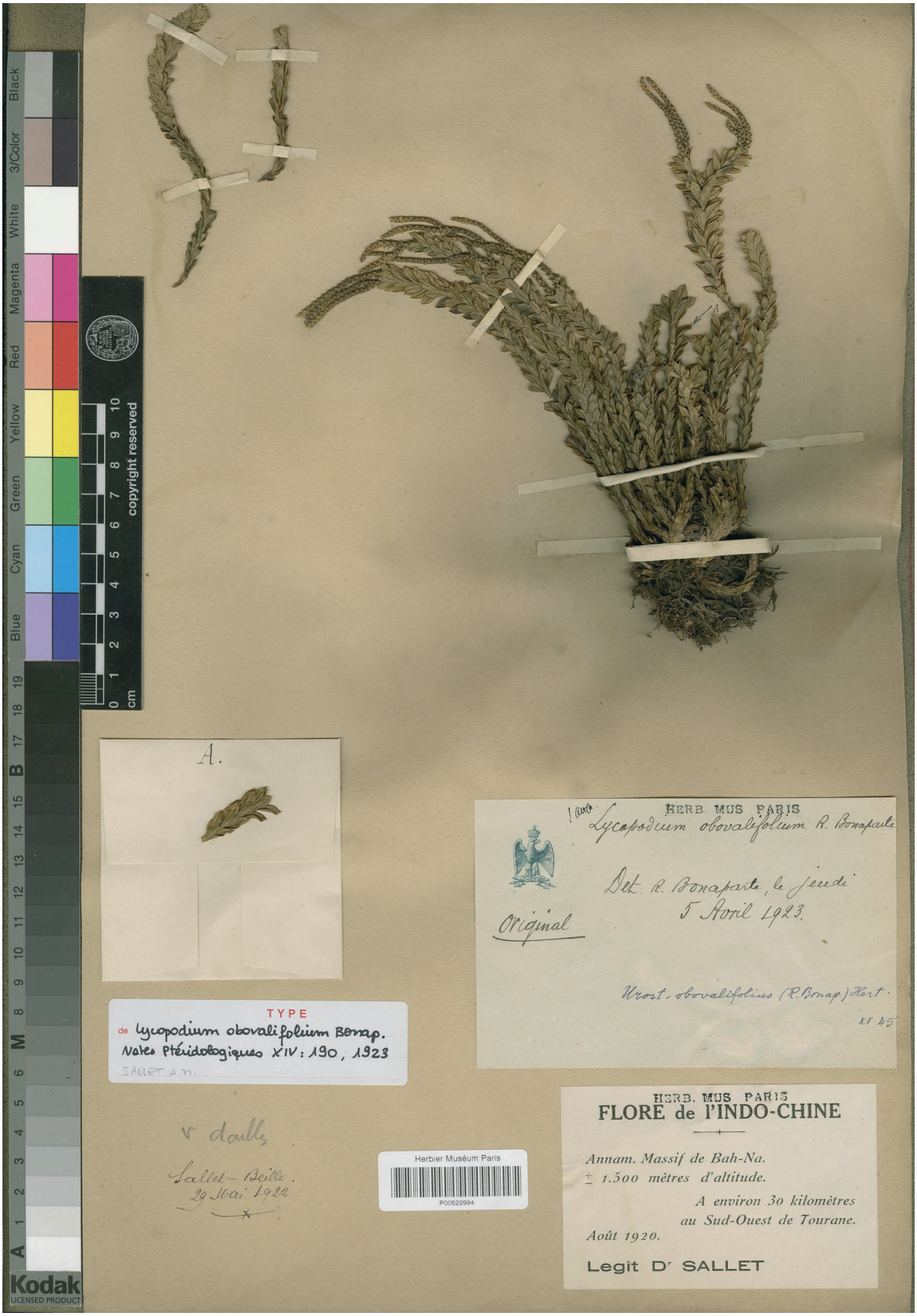

FIG. 1. — Holotype of *Phlegmariurus obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov. (P00522994).

Fig. 2. — Isotype of *Phlegmariurus obovalifolius* (Bonap.) V.T. Tran & N.V. Duy, comb. nov. (P00522995).

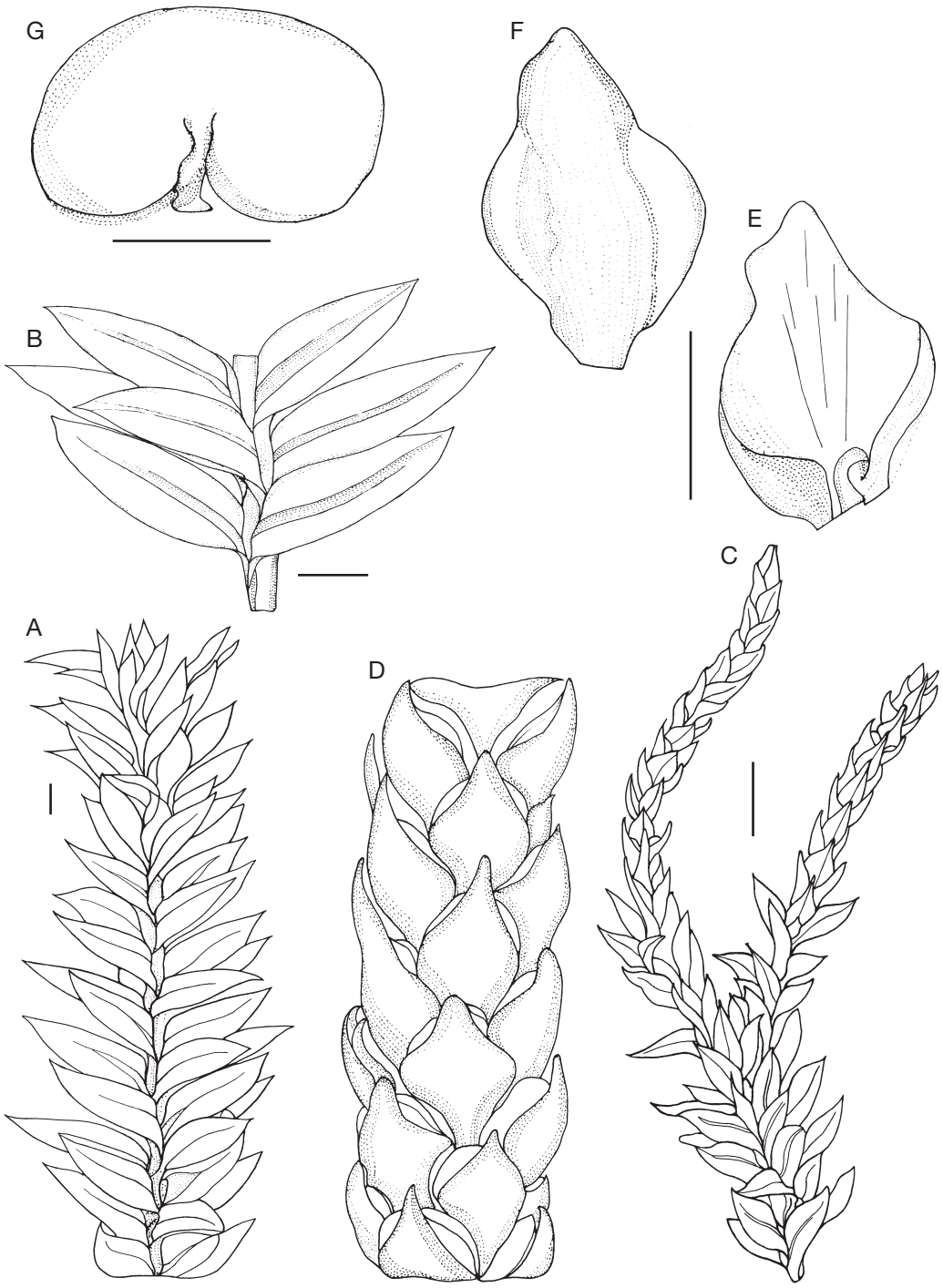

Fig. 3. — *Phlegmariurus lancifolius* V.T. Tran & N.V. Duy, sp. nov.: **A**, habit; **B**, segment of leafy branch ; **C**, strobili; **D**, segment of strobili; **E**- **F**, ventral and dorsal views of sporophyll; **G**, sporangium. *Duy N.V. & V.T. Tran 00011* (holo-, DLU!). Drawn by Tran Van Tien. Scale bars: A, 4 mm; B, 5 mm; C, 2 cm; E, 1 mm.

Paratypes. — **Vietnam**. Annam, Ba Na, elevation 1500 m a.s.l., 15.VII.1923, *Poilane 7205* (P[P01228678]!); Annam, Dent du Tigre, Quảng Trị Province, elevation 1200 m asl, 27.XI.1924, *Poilane 10302* (P[P01228677!, P01228685]); Annam, Massif du Lang Bian, elevation 2000-2500 m asl, 16.X.1919, *Chevalier 30878* (P[P01228674]!); Annam, Massif du Braian, près de Dfiring, du Haut Donai Prov., *Poilane 23942* (P[P01228681!, P01293442]); Dalat, 6.VI.1921, *Hayata 127* (P[P01228679]!); Quangnam-Danang Province, Ngoc Linh Mountain, elevation 1800 m asl, 24.III.1995, *VH 914* (P[P01216719]!).

Distribution, habitat. — Epiphytic on tree trunks in broad leaves and cloud forests, high mountain, 1000-2400 m. Lang Bian, Braian, Lam Đong Province; Ba Na, Đa Nang City; Quang Tri Province. And the species easily recognized by lanceolate-acuminate with apex acuminate.

Etymology. — The species epithet refers to the lanceolate leaves shaped.

Description

Lycophytes. Plants terrestrial, erect when young and ascending when mature, forming small clumps, 1-4 times dichotomously branched, 30-40 cm long. Shoots almost homophyllous or slightly smaller in terminal division, and equally thick throughout, main stems together with leaves *c.* 4 mm in diam., cordlike. Stems excl. leaves 1-2.5 mm at the base, almost completely concealed by leaf bases. Leaves densely crowded at the base and slightly spaced near terminal divisions. Sterile leaves lanceolate, spiral spreading, leathery, 1.1-1.5 × 0.4-0.6 cm, firmly coriaceous, green, apex acuminate, base narrow, sessile, abaxially flat, with slightly prominent vein abaxially and adaxially, at least in the basal half with a distinct, margin entire. Strobili terminal on branches, linear, 0-2 times dichotomously branched, 4-8 × 0.2-0.5 cm. Sporophylls coriaceous, sparsely arranged, cuneiform or broadly ovate, *c.* 2 × 2 mm, midrib distinct, margin entire, apex acuminate with tip apiculate, *c.* 2 mm, base sessile. Sporangia in axils of sporophylls of upper portion of stem or branchlets, yellowish, reniform shaped, slightly flat, *c.* 2 × 2 mm, vertically bisected. Spores with convex lateral margins.

Remarks

This remarkable species is distinguished from the closely related *P. obovalifolius* by its leaves lanceolate, apex acuminate with tip apiculate, 1.1-1.5 × 0.4-0.6 cm, apex acuminate, sporophyll cuneiform or broadly ovate, *c.* 2 × 2 mm, apex acuminate with apiculate tip, *c.* 2 mm, sporangia reniform.

CONCLUSION

The completion of the current studies for Vietnam *Phlegmariurus* based on literature survey, both herbarium and field observations. Addition, evidence of morphology was used in the analysis. The generic knowledge of *Phlegmariurus* has now reached the point at which it is possible to define a formal classification, with two new taxon treated here, which is likely to be stable in the face of new data to synonymisation for species which may always be closely related.

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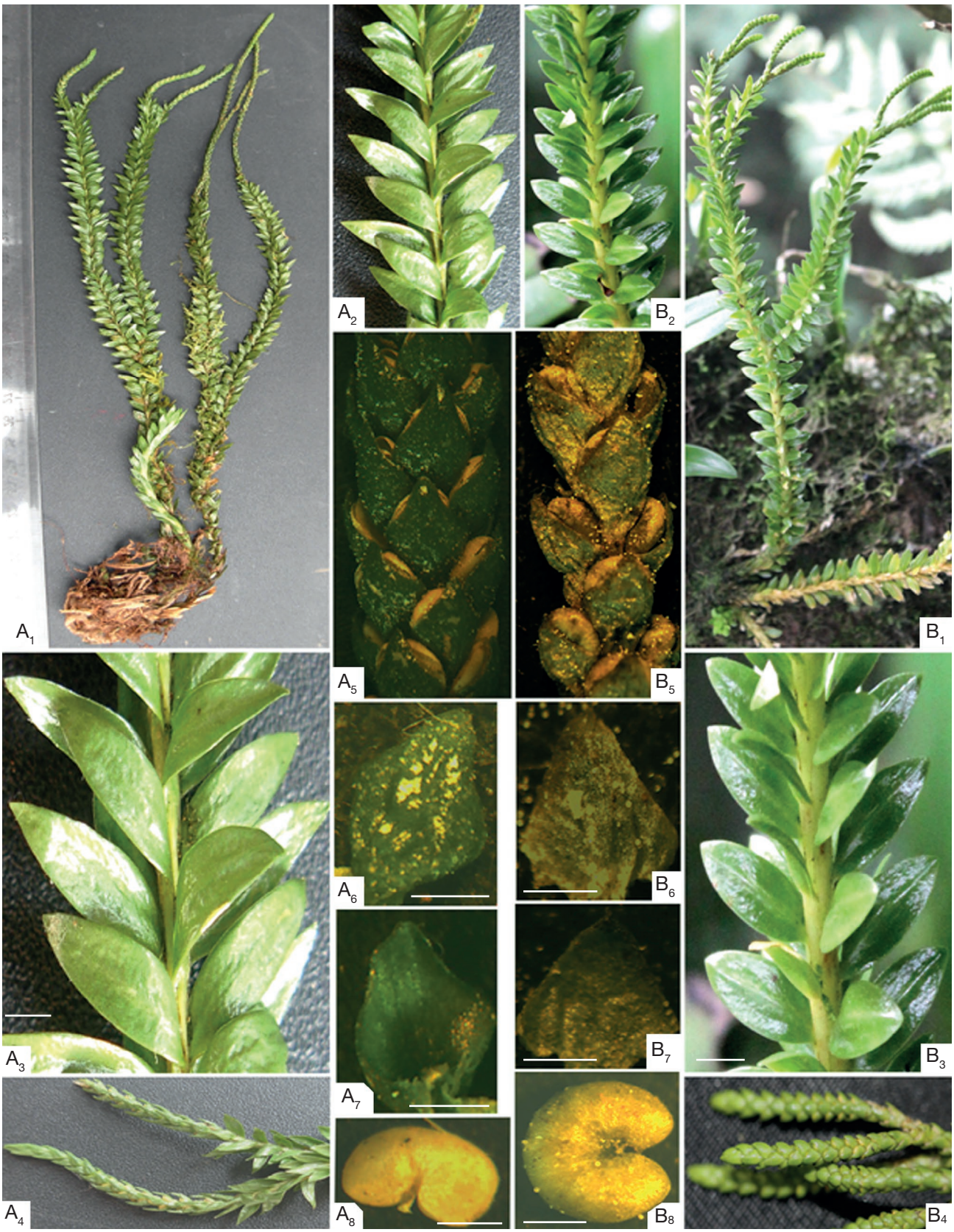

Fig. 4. — *Phlegmariurus lancifolius* V.T. Tran & N.V. Duy, sp. nov. (from Lang Bian mountain, type locality): **A_1**, segment of leafy branch; **A_2**, strobili; **A_3**, section of leafy branch; **A_4**, strobili; **A_5**, sections of strobilus; **A_6**, dorsal view of sporophyll; **A_7**, ventral view of sporophyll; **A_8**, sporangium. *Phlegmariurus obovalifolius* V.T. Tran & N.V. Duy (from Ba Na mountain, type locality): **B_1**, segment of leafy branch; **B_2**, strobili; **B_3**, section of leafy branch; **B_4**, strobili; **B_5**, section of strobilus; **B_6**, dorsal view of sporophyll; **B_7**, ventral view of sporophyll; **B_8**, sporangium. Photos by Tran Van Tien & Nong Van Duy from the type locality. Scale bars; A_1, 0.3 cm; A_3, 0.5 mm; B_1, 0.75 cm; B_8, 0.8 mm.