

A new combination of *Strobilanthes* (Acanthaceae) with two new records from Thailand

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ABSTRACT

Strobilanthes spirei is proposed as a new combination of *Clinacanthus spirei*. *Strobilanthes hypomalla* and *S. spirei* are newly recorded for Thailand. The lectotypification of *S. hypomalla* is made. A detailed description of morphology and pollen features is provided as well as photographs, distribution map, ecology and taxonomic notes.

KEYWORDS: floristic, Lamiales, lectotype, nomenclature, pollen, Strobilanthinae.

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INTRODUCTION

Strobilanthes Blume is the second largest genus of the family Acanthaceae (Ruellieae: Strobilanthinae) after the genus *Justicia* L. It comprises ca 400 species which are distributed mainly in tropical and sub-tropical Asia (Mabberley, 2008; Christenhusz *et al.*, 2017). The genus is defined by the present of rugula and with rows of trichomes retaining the style on the inner surface of posterior corolla. Additional key characters include the transverse fusion of filaments creating a ridge or “strobilantheid” type of filament curtain and the usually laterally compressed stigma with a single anticub lobe. Many *Strobilanthes* species are gregarious, and some have a plietesial life cycle (Wood, 1994; Carine & Scotland, 2002; Wood & Scotland, 2009; Hu *et al.*, 2011; Tripp *et al.*, 2021).

Extensive investigations of the pollen morphology to resolve problems of generic delimitation have been published (Lindau, 1893; Bremekamp, 1944; Scotland, 1993). The two pollen shape classes, ellipsoid and spheroid, and the many pollen types belonging to these pollen shape classes, can be classified by variation in the ornamentation and number, distribution and type of apertures. For instance, 22 pollen types are recognised based on

the examination of 66 species of *Strobilanthes* from southern India and Sri Lanka (Carine & Scotland, 1998), and eight pollen types were found based on the study of 37 *Strobilanthes* species from China (Wang & Blackmore, 2003).

Several studies have been reported on *Strobilanthes* from Thailand, including several new combinations and new species (Hosseus, 1907; Craib 1913 & 1914; Imlay, 1938 & 1939; Bremekamp, 1944, 1955, 1961, 1965, 1966 & 1969; Terao, 1980, 1981 & 1983; Hansen, 1985; Wood, 1994; Wood & Scotland, 2003a, 2003b, 2006 & 2009; Albertson & Wood, 2012; Charoenchai, 2014). Pooma & Suddee (2014) enumerated 20 species for Thailand and, recently, a new species, *S. phyllocephala* J.R.I. Wood & Scotland, was proposed from western Thailand by Wood & Scotland (2017).

During field and herbarium surveys in preparation for the taxonomic account of *Strobilanthes* for the Flora of Thailand, two plant species were found and collected from Bueng Kan and Nakhon Phanom Provinces, in the North-Eastern floristic region of Thailand. One was identified as *S. hypomalla* Benoist and is a new record for Thailand, and the lectotypification of *S. hypomalla* is made here. Another one was initially identified as *Clinacanthus spirei*

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Benoist, however, on examination, we found that it should be placed within *Strobilanthes* by means of floral characters and pollen morphological features, and is the first record of this species for Thailand. The comparison between new records with their similar species, *S. aprica* (Hance) T. Anderson ex Benth. and *S. cumingiana* (Nees) Y.F. Deng & J.R.I. Wood is presented. The distribution map of both new records is provided (Fig. 1).

MATERIALS AND METHODS

Extensive field observations and specimen collections in Thailand were made. The herbarium specimens are deposited at BKF and KKU. The type and non-type specimens were examined from Thai and abroad herbaria: AAU, BK, BKF, CMU, CMUB, K, KKU, KYO, L, P and QBG. The specimens of K, L and P were consulted by means of high-resolution images provided on virtual herbaria and the JSTOR and GBIF websites. The herbarium acronyms cited follow Thiers (2021, continuously updated). The morphological characters and ecological information of *S. aprica* are observed from herbarium specimens and field investigation, and the pollen features follow

Wang & Blackmore (2003). The specimens cited here were all examined. The distribution, habitat and phenology were recorded from the herbarium labels and field information. Vernacular names were obtained from the label. The pollen was investigated under LM (Olympus CH30) and MiniSEM (SNE-4500M). Ten pollen grains were measured to cover their variation.

TAXONOMIC TREATMENT

Strobilanthes hypomalla Benoist, Bull. Mus. Natl. Hist. Nat. 27: 543. 1921. Type. Vietnam, Dalat, 27 Nov. 1911, *Lecomte & Finet 1524* (lectotype P [P00218435!], designated here) (Fig. 2).

Perennial herbs, 15–40 cm tall, isophyllous. *Stems* 4-angled, sulcate, greenish or yellowish green, glabrous or pubescent. *Leaves* lanceolate or linear-lanceolate, 1.5–6 × 0.4–1.5 cm, glabrous or puberulous on adaxial surface, tomentose on abaxial surface; lateral veins 3–5 pairs, prominent on abaxial surface; apex acute; base cuneate, not decurrent onto petiole; margin entire, recurved; petioles 1–5 mm long, glabrous or puberulous. *Inflorescences* of a terminal or axillary capitate, 1–2-flowered; peduncle very short, 0.5–1.5 mm long or sessile, glabrous or pubescent; bracts oblong or oblong-lanceolate, 10–15 × 3–5 mm, persistent, whitish green, glabrous or pubescent, apex obtuse or acute to acuminate, margin entire; bracteoles linear-oblong, 8–15 × 3–4 mm, greenish, glabrous or pubescent. *Calyx* 5-lobed, subequal, 9–10 × 1–2 mm; lobes linear, whitish green, glabrous or pilose outside, apex attenuate, margin entire. *Corolla* lilac, gibbous, 1.5–2.5 cm long, curved, pubescent outside, almost glabrous inside except trichomes retaining style; tube whitish purple, cylindrical for 0.8–1 cm long; mouth 1–1.5 cm wide; lobes ovate, 6–8 × 4–5 mm, apex obtuse or emarginate. *Stamens* 2, exserted; filaments 3–4 mm long, straight, purple, glabrous; anther thecae 2–3 mm long, purple; pollen 3-colporate, prolate or subprolate in equatorial view, circular in polar view, polar range 50–86 μm, equatorial range 33–70 μm; ectoapertures fusiform, endoapertures lalongate; exine divided into longitudinal ribs, each rib with the aggregations form distinct spines; tectum perforate. *Ovary* oblongoid, pilose; style 2–2.5 cm long, hairy. *Capsule* oblongoid, 6–8 × ca 3 mm, glabrous, 4-seeded. *Seeds* ovate in outline, hairy.

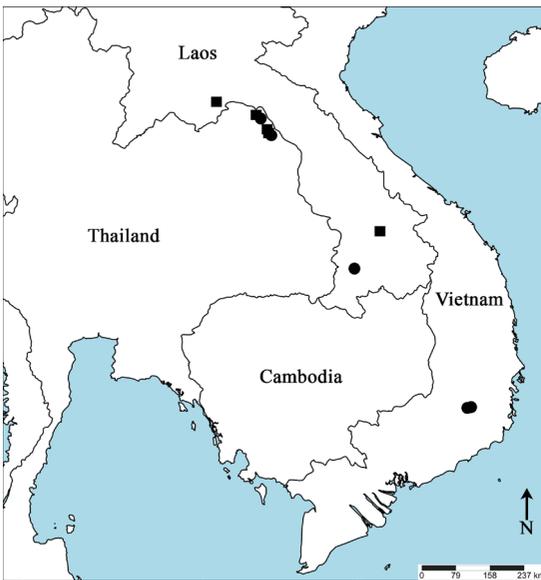


Figure 1. Distribution of two new records of *Strobilanthes* from Thailand; *S. hypomalla* Benoist (●) and *S. spirei* (Benoist) Kladwong & Chantar. (■).

Thailand.— NORTH-EASTERN: Bueng Kan [Phu Wua Wildlife Sanctuary, 340 m alt., 15 Oct. 2016, *Suddee et al.* 5561 (BKF); *ibid.*, trails to Tham Noi Waterfall, 315 m alt., 1 Dec. 2020, *Kladwong et al.* 539 (BKF, KKU); Nakhon Phanom [Phu Langka National Park, 492 m alt., 26 Nov. 2017, *Suddee & Puudjaa* 5333 (BKF)].

Distribution.— Laos [Bolaven, 1,100–1,200 m alt., 27 Nov. 1938, *Poilane* 28634 (L, P-2 sheets)]; Vietnam [Dalat, 27 Nov. 1911, *Lecomte & Finet* 1524 (P); *ibid.*, Cam Ly, 24–25 Oct. 1920, *Evrard* 303 (P-3 sheets)].

Ecology.— In dipterocarp forest, sandstone bedrock, 300–500 m alt., flowering and fruiting from October to December.

Vernacular.— Hom noi phu wua (ฮ่อมน้อยภูวัว) (Proposed here).

Notes.— *Strobilanthes hypomalla* has many features in common with *S. aprica* especially in having a capitate inflorescence, gibbous corolla and two stamens, but can be distinguished because it has greenish or yellowish green stems vs brownish or reddish stems in *S. aprica*. The outside of corolla of *S. hypomalla* is pubescent vs glabrous or subglabrous

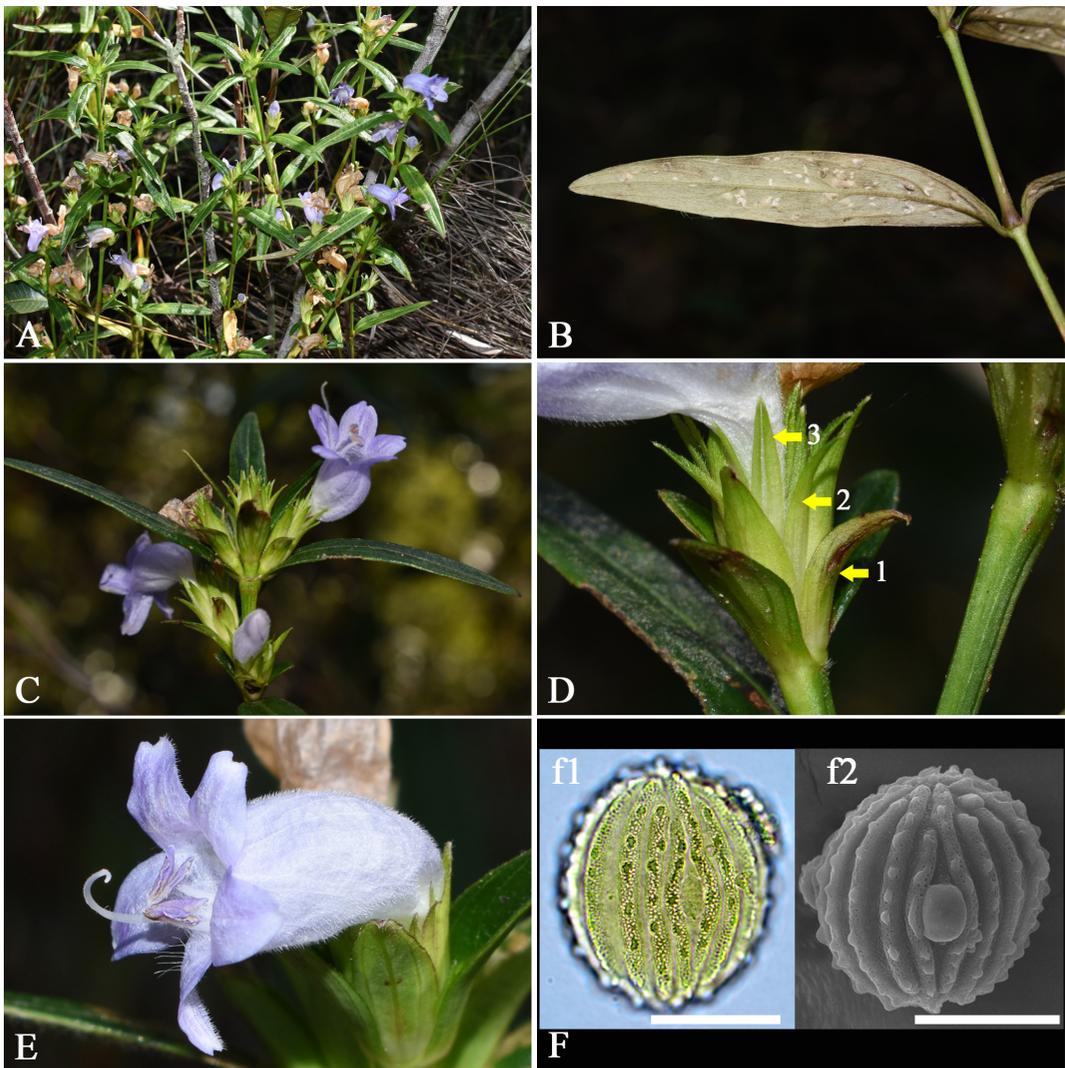


Figure 2. *Strobilanthes hypomalla* Benoist: A. habitat; B. abaxial surface of leaf; C.–D. inflorescences and flowers, (1) bracts, (2) bracteoles, (3) calyx; E. stamens, style and stigma; F. pollen, (f1) LM micrograph of pollen in equatorial view, (f2) SEM micrograph of pollen in subequatorial view. Scale bars 30 μ m.

in *S. aprica*. The pollen is also useful to distinguish the two taxa: the shape of *S. hypomalla* is prolate or subprolate vs spheroidal in *S. aprica*, and the aperture type of *S. hypomalla* is 3-colporate vs 3-cryptoaperturate in *S. aprica*. The exine sculpturing of *S. hypomalla* pollen is divided into longitudinal ribs, each rib with the aggregations forms distinct spines vs short conical spines situated over the surface in *S. aprica* pollen. The comparison of *S. hypomalla* to *S. aprica* is presented in Table 1.

Strobilanthes hypomalla grows in dipterocarp forest on the sandstone bedrock, whereas *S. aprica* is almost exclusively observed in scrub forest on limestone bedrock.

The original protologue of *S. hypomalla* was based on two collections *Lecomte & Finet 1517* and *1524* (Benoist, 1921). These specimens were deposited at P under barcodes P00719351 and P00218435, respectively. On examination, we found *Lecomte & Finet 1524* (P00218435) has more mature leaves, inflorescences and flowers. We, therefore, select this specimen as the lectotype of *S. hypomalla* (Fig. 3).

Strobilanthes hypomalla was formerly known in Vietnam, Dalat (Benoist, 1921) and Laos, Bolaven (Newman *et al.*, 2007 & 2017–present). This is the first record in Thailand where it distributes in the North-Eastern floristic region. The Thai specimen extends the distribution of this species north-west ward of its range. Further fieldwork and specimen collections are needed to obtain a better understanding of this species distribution.

Strobilanthes spirei (Benoist) Kladwong & Chantar., **comb. nov.**— *Clinacanthus spirei* Benoist, Notul. Syst. (Paris) 5: 131. 1936. Type: Laos, Salavan, Phonthan [Phon Thane], Dec. 1903, *Spire 154* (holotype P [P03565803!]) (Fig. 4).

Perennial herbs, creeping, 0.3–1.5 m long, isophyllous. *Stems* 4-angled, sulcate, greenish but dark purple at node, sparsely scabrous. *Leaves* lanceolate or oblong-lanceolate, 5–14 × 1.5–5 cm, scabrous with dense cystoliths on adaxial surface; lateral veins 6–8 pairs, prominent on both surfaces; apex attenuate to acuminate; base obtuse, not decurrent onto petiole;

Table 1. Morphological comparison of *Strobilanthes aprica* and *S. hypomalla*.

Characters	<i>Strobilanthes aprica</i>	<i>Strobilanthes hypomalla</i>
Habit	erect herbs or shrubs 0.3–1.5 m tall	herbs 15–40 cm tall
Stem	white hirsute, brownish or reddish	glabrous or pubescent, greenish or yellowish green
Leaf blade	elliptic or oblong-elliptic, 2–11 × 0.7–4.5 cm	lanceolate or linear-lanceolate, 1.5–6 × 0.4–1.5 cm
Inflorescence	capitate, 2–7-flowered	capitate, 1–2-flowered
Peduncle	hirsute	glabrous or pubescent
Bract shape	ovate-lanceolate or oblong-lanceolate or rarely linear	oblong or oblong-lanceolate
Bract apex	acute to acuminate	obtuse or acute to acuminate
Bracteoles	linear, 6–11 × 1 mm	linear-oblong, 8–15 × 3–4 mm
Calyx lobe apex	acuminate	attenuate
Corolla	gibbous, glabrous or subglabrous outside	gibbous, pubescent outside
Corolla lobes	ovate or suborbicular	ovate
Corolla lobe apex	obtuse	obtuse or emarginate
Filaments	1–3 mm long	3–4 mm long
Pollen shape	spheroidal*	prolate or subprolate
Pollen aperture	3-cryptoaperturate*	3-colporate
Pollen exine	short conical spines situated over the surface*	divided into longitudinal ribs, each rib with the aggregations forms distinct spines
Capsule	8–13 × 2–2.5 mm, glabrous except for pilose at tip	6–8 × ca 3 mm, glabrous
Seed number	4	4

* Based on report of Wang & Blackmore (2003).



Figure 3. Lectotype of *Strobilanthes hypomalla* Benoist. Image © Muséum national d'Histoire naturelle, Paris (France) Collection: Vascular plants (P) Specimen P00218435. (<https://science.mnhn.fr/institution/mnhn/collection/p/item/p00218435>)

margin recurved, slightly sinuate; petioles 1–8 mm long, sparsely scabrous. *Inflorescences* of a terminal single or compound spike; peduncle 0.5–2.5 cm long, tomentose; bracts ovate-lanceolate, 2–3 × 0.8–1.5 cm, persistent, dark purplish red or sometimes greenish, densely purplish red or whitish glandular trichomes on both surfaces, apex acute to attenuate, margin entire, densely glandular trichomes; bracteoles linear-oblong, 8–10 × 1–2 mm, densely glandular trichomes or absent. *Calyx* 1.5–2 cm long, 2-partite; lobes linear, 1–2 mm wide, subequal, purplish red, densely purplish red glandular trichomes outside, sericeous inside, apex attenuate, margin with glandular trichomes. *Corolla* dark purple or bluish purple, with 2-yellowish bands inside, funnel-shaped, 3.5–5 cm long, curved, pubescent outside, glabrous inside except trichomes retaining style; tube whitish purple, cylindrical, ca 1.5 cm long; mouth 1.5–2 cm wide; lobes ovate, 8–10 × 4–6 mm, apex obtuse or emarginate. *Stamens* 4, included, didynamous; short filaments 1.5–2 mm long, straight, purple, glabrous; long filaments 3–4 mm long, straight, purple, white

tomentose; anther thecae 3–4 mm long, yellow; pollen 3-colporate, prolate or subprolate in equatorial view, circular in polar view, polar range 56–91 µm, equatorial range 34–59 µm; ectoapertures fusiform, endoapertures lalongate; exine divided into longitudinal ribs, each rib with a coarse ladder-like reticulum. *Ovary* oblongoid, sparsely pilose; style 3–4.5 cm long, hairy. *Capsule* cylindrical, 13–15 × ca 3 mm, glabrous, 8-seeded. *Seeds* orbicular in outline, 1.5–2 mm in diam., hairy.

Thailand.— NORTH-EASTERN: Bueng Kan [Bung Khla, 8 Nov. 1996, *Niyomdham 4906* (BKF); Phu Wua Wildlife Sanctuary, 177 m alt., 27 Dec. 2011, *Norsaengsri & Tathana 8633* (BKF, QBG); *ibid.*, 173 m alt., 27 Dec. 2011, *Norsaengsri & Tathana 8641* (BKF, QBG); *ibid.*, 13 Dec. 2012, *Kantachote 94* (BKF); *ibid.*, Chet Si Waterfall, 30 Nov. 2020, *Kladwong et al. 537* (BKF, KKU); *ibid.*, Tham Noi Waterfall, 1 Dec. 2020, *Kladwong et al. 538* (BKF, KKU)]; Nakhon Phanom [Phu Langka National Park, Huai Po, 100 m alt., 17 Nov. 1966, *Smitinand 10081* (BKF); *ibid.*, 8 Nov. 2006, *Pornpongrungrueng 507*

Table 2. Morphological comparison of *Strobilanthes cumingiana* and *S. spirei*.

Characters	<i>Strobilanthes cumingiana</i> *	<i>Strobilanthes spirei</i>
Habit	erect herb up to 50 cm tall	creeping herbs 0.3–1.5 m long
Stem	sparsely deflexed, unicellular hairs	sparsely scabrous
Leaf blade	narrowly ovate to ovate, occasionally lanceolate, hairy	lanceolate or oblong-lanceolate, scabrous
Leaf base	round or shortly truncate	obtuse
Petioles	1.4–2.6 cm long	0.1–0.8 cm long
Inflorescence	single or compound spike	single or compound spike
Bracts	ovate, multicellular hairs	ovate-lanceolate, with densely purplish red or whitish glandular hairs
Bract apex	acute to acuminate	acute to attenuate
Bracteoles	absent	present, linear-oblong or absent
Calyx lobes	0.6–0.9 cm long, with unicellular and multicellular hairs along margins	1.5–2 cm long, densely purplish red glandular hairs outside
Corolla	funnel-shaped, white	funnel-shaped, dark purple or bluish purple, with 2-yellowish bands inside
Corolla lobes	2.2–2.6 mm long	8–10 mm long
Long filaments	2.2–3.1 mm long, hairy	3–4 mm long, white tomentose
Short filaments	0.9–1.5 mm long, glabrous	1.5–2 mm long, glabrous
Anther	1.5–1.9 mm long	3–4 mm long
Capsule	8.5–9.3 × 1–1.5 mm, pubescent in upper half	13–15 × ca 3 mm, glabrous
Seed number	6–8	8

* Based on description of Moylan *et al.* (2002).

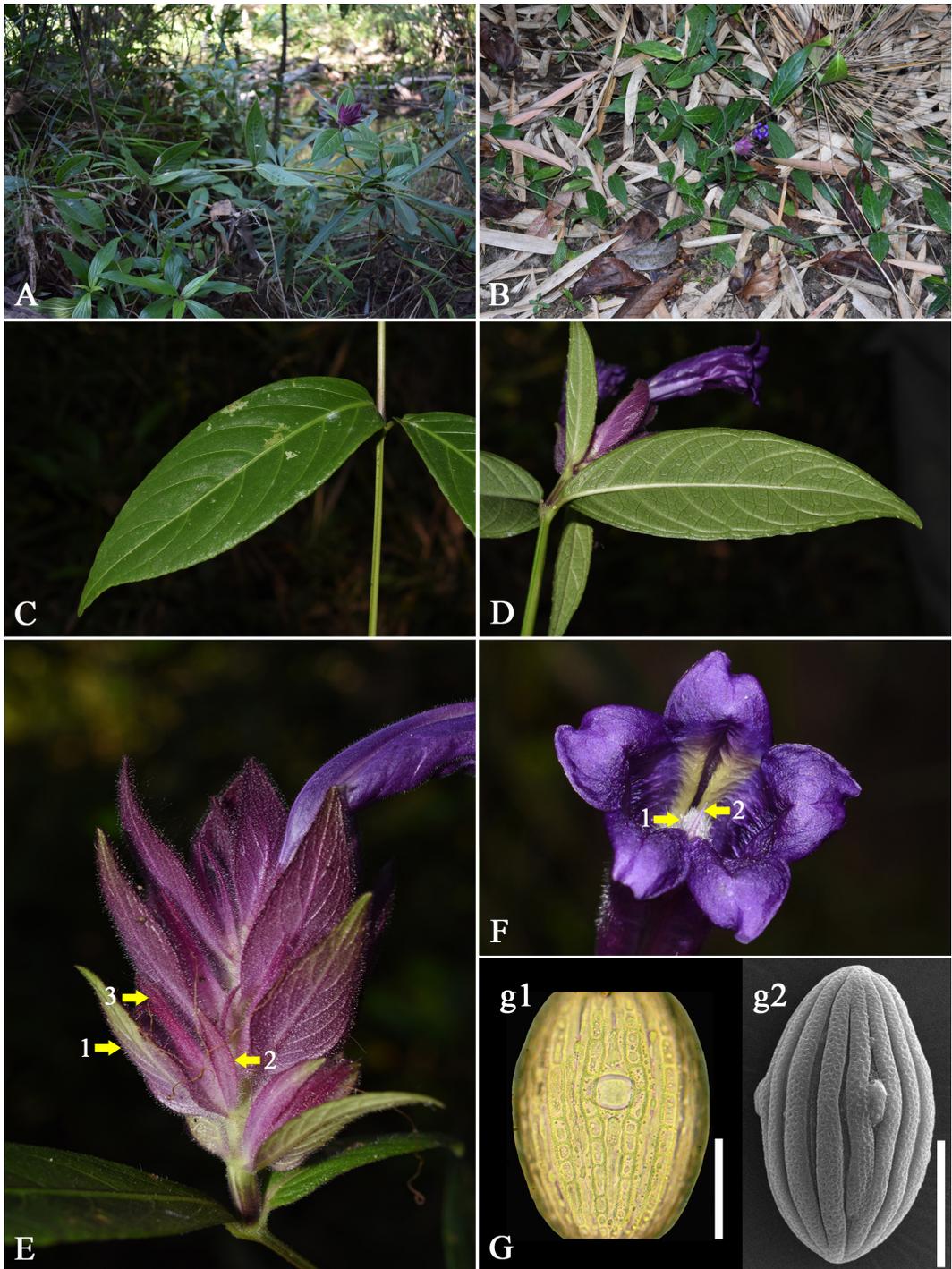


Figure 4. *Strobilanthes spirei* (Benoist) Kladwong & Chantar.: A. habitat; B. habit; C. adaxial surface of leaves; D. abaxial surface of leaves; E. inflorescences, (1) bracts, (2) bracteoles, (3) calyx; F. flower, top view, (1) trichomes retaining style, (2) stigma; G. pollen, (g1) LM micrograph of pollen in equatorial view, (g2) SEM micrograph of pollen in equatorial view. Scale bars 30 μ m.

(**BKF**); *ibid.*, Tat Kham Waterfall, 2 Dec. 2020, *Kladwong et al.* 542 (**BKF**, **KKU**); *ibid.*, Tat Pho Waterfall, 2 Dec. 2020, *Kladwong et al.* 543 (**BKF**, **KKU**).

Distribution.— Laos [Bolikhamsai, Tad Luek Waterfall, 260 m alt., 3 Jan. 1994, *Fukuoka & Koyama* 65140 (**BKF**); Salavan, Phonthan, Dec. 1903, *Spire* 154 (**P**)].

Ecology.— In mixed deciduous or evergreen forest under the shade near a stream, 100–250 m alt., flowering in November and fruiting from December to January.

Vernacular.— Ma seuk si deang (ม้าศึกสีแดง) (Proposed here).

Notes.— *Strobilanthes spirei* resembles *S. cumingiana* in having a funnel-shaped corolla and a single or compound spike inflorescence, but differs based on its creeping stem vs an erect stem in *S. cumingiana*. In addition, *S. spirei* has scabrous leaves and ovate-lanceolate bracts whereas *S. cumingiana* has hairy leaves and ovate bracts. *Strobilanthes spirei* is also different from *S. cumingiana* by its longer anther, 3–4 mm and dark purple or bluish purple corolla with 2-yellowish bands inside vs shorter anther, 1.5–1.9 mm and white corolla in *S. cumingiana*. A detailed comparison of *S. spirei* and *S. cumingiana* is given in Table 2. The morphological characters of *S. cumingiana* are taken from Moylan *et al.* (2002).

Clinacanthus spirei was first described by Benoist (1936), but on closer examination, we found that it has contorted corolla lobes, trichomes retaining style and 4 stamens, monadelphous at the base which are the defining characters of *Strobilanthes*, rather than *Clinacanthus*. Moreover, the present of a coarse ladder-like reticulum of the pollen corresponds to pollen type 3 and *S. polyneuros* type which were reported by Carine & Scotland (1998) and Wang & Blackmore (2003), respectively. Therefore, we conclude that *C. spirei* should be placed in the genus *Strobilanthes*.

Strobilanthes spirei was known only from the type locality in Salavan Province in Laos (Benoist, 1935 & 1936). On investigation, we found that it also occurs in Tat Luek Waterfall, Bolikhamsai Province in Laos based on specimen *Fukuoka & Koyama* 65140 deposited in **BKF**. Moreover, this species is also a new record for Thailand where it is

found in Bueng Kan and Nakhon Phanom Provinces in the North-Eastern floristic region. The Thai specimens represented a population occur between two localities in Laos.

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