



Ceropegia foetidiflora sp. nov. (Asclepiadoideae, Apocynaceae), a new species from northeastern Thailand

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ABSTRACT: A newly discovered species from northeastern Thailand, *Ceropegia foetidiflora* Kidyoo, is here described and illustrated. Photographs and diagnostic comparison with the morphologically similar species, *C. thorelii* Costantin, are provided. These two species display clear difference in hairiness on the surfaces of the corolla tube and the corolla lobes, and shape of the corolla lobes.

KEY WORDS: Apocynaceae, Asclepiadoideae, Northeastern Thailand, Open sandy area, Strong musty smell.

INTRODUCTION

Ceropegia L. (Apocynaceae, Asclepiadoideae), as classically circumscribed, is the largest genus of the tribe Ceropegieae, including more than 260 species of perennial herbs which are distributed widely over Southeast Asia, India, Madagascar, tropical Arabia, Canary Islands, Africa, New Guinea and Northern Australia (Hooker, 1883; Huber, 1957; Ansari, 1984; Li *et al.*, 1995; Meve, 2002; Rodda and Meve, 2017; Kumar *et al.*, 2018). Despite the remarkable morphological variation observed both in vegetative and reproductive traits, most *Ceropegia* plants can be recognized by various cage-like structures of the corolla lobes (Meve, 2002; Surveswaran *et al.*, 2009). In Thailand, 15 species have been reported, 6 of which, i.e. *C. thailandica* Meve, *C. suddeei* Kidyoo, *C. sootepensis* Craib, *C. jucunda* Kerr, *C. cochleata* Kidyoo and *C. digitiformis* Kidyoo, occur in the northeastern floristic regions (Kerr, 1951; Meve, 2009; Kidyoo and Paliyavuth, 2017; Thaitong *et al.*, 2018). Lately in this same region, an unknown *Ceropegia* plant was found at Phu Lungka National Park, Bueng Kan Province. Meticulous studies of its morphological and ecological characters compared to those of herbarium specimens deposited at BK, BKF, K, L, BM, P, QBG and BCU showed that this plant is obviously different from the known *Ceropegia* species and should be described as a new species. The plant is thus named as *Ceropegia foetidiflora* Kidyoo. The specific epithet alludes to the strong musty smell of its flowers. This newly discovered species is thoroughly described and illustrated. Moreover, its morphological and ecological characters are compared with those of the similar species, *C. thorelii* Costantin.

MATERIALS AND METHODS

Specimens were obtained from their natural habitats

throughout northeastern and eastern Thailand during 2012 to 2017. Voucher specimens were prepared and deposited at BKF and BCU. Morphological characters of vegetative and reproductive structures were examined in the fresh materials obtained from their natural habitat and the preserved specimens available in the following herbaria: BK, BKF, K, L, BM, P, QBG and BCU. The morphological characters of leaves and flowers were mostly observed under stereo light microscope.

TAXONOMIC TREATMENTS

Ceropegia foetidiflora Kidyoo, *sp. nov.* Figs. 1 & 2a-c

Ceropegia foetidiflora is distinguished from *C. thorelii* by its corolla tube which is glabrous outside, lanceolate-oblong corolla lobes that are nearly as long as the tube and densely pubescent on the adaxial surface and glabrous on the abaxial surface. Contrarily, *C. thorelii* bears pubescent corolla tube, ovate-lanceolate corolla lobes that are shorter than the tube and hairy on the midrib of the adaxial surface and pubescent on the abaxial surface as well as margins.

Type: THAILAND. Phu Langka National Park, Bueng Kan Province, 520 m a.s.l., 14 August 2012, *M. Kidyoo 1557* (holotype: BKF, isotype: BCU).

Description: Decumbent or twining herb, with clear sap in all parts. Rootstock tuberous, tubers subglobose, smooth, light brown, 2.5–3.1 cm in diameter, usually with fusiform roots. Stem terete, usually unbranched, pubescent, 15–40 cm long, 1.2–2.0 mm in diameter, green when young but turning reddish brown with age, internodes 2.3–7.7 cm long. Leaves opposite, coriaceous, pubescent; petiole stout, grooved above, pubescent, 0.4–0.7 cm long, 1.7–1.9 mm in diameter; lamina 2.4–5.1 × 1.5–2.4 cm, ovate or ovate-elliptic or elliptic, apex acute, margins entire and ciliate; base acute, obtuse to rounded with 1–2 small colleters, 0.32–0.36 × 0.26–0.3 mm;

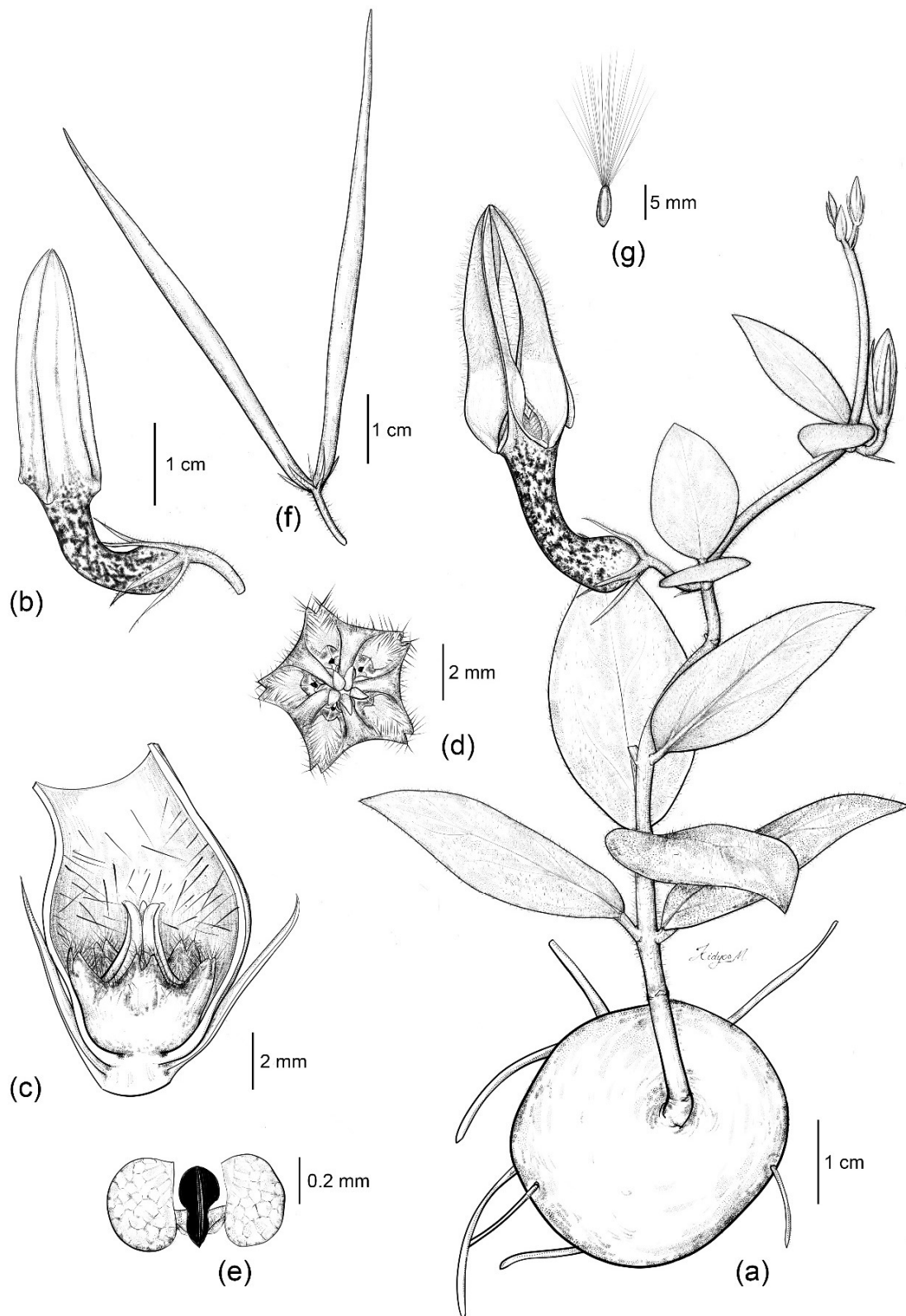


Fig. 1. Illustrations of *Ceropegia foetidiflora* sp. nov. (a) habit, (b) flower bud, (c) longitudinal section of flower showing corona and gynostegium, (d) top view of gynostegium, (e) pollinarium, (f) fruit, (g) seed. Drawn by Maniit Kidyoo from *M. Kidyoo* 1557 (a)–(e) and *M. Kidyoo* 1616 (f)–(g).

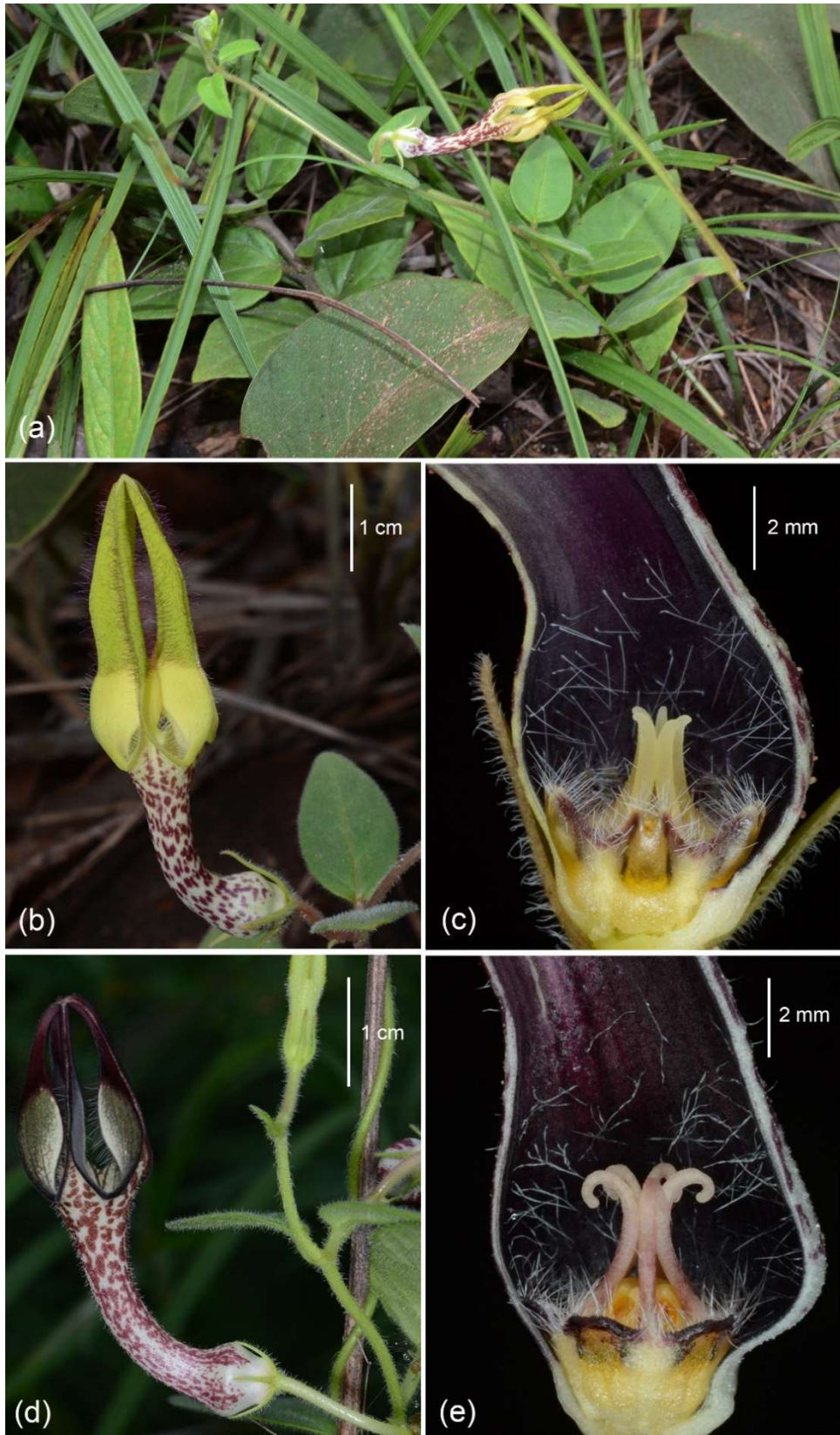


Fig. 2. Vegetative and reproductive parts of *Ceropegia foetidiflora* sp. nov. (a–c) compared with those of *C. thorelii* (d–e): (a) habit; (b), (d) flower; (c), (e) side view of gynostegium. Photograph by Manit Kidyoo.



midrib distinct, slightly grooved on upper surface, prominent on lower surface; lateral veins visible abaxially and slightly obscure adaxially, 5–6 pairs, at acute angles to the midrib; adaxial surface green, abaxial surface pale green. Inflorescences 1–2-flowered cymes, extra-axillary; peduncle sessile to subsessile, up to 5 mm long, 1–1.5 mm in diameter, green to reddish brown, pubescent; pedicel yellowish green, pink or reddish brown, pubescent, 0.7–1.2 cm long, 1.5–1.7 mm in diameter; bract solitary, attached at base of pedicel, subulate, pubescent, 2–3 × 0.5–0.6 mm, yellowish green or pinkish brown, apex acuminate. Calyx deeply 5-parted; lobes yellowish green or reddish brown, linear, sharply acute at apex, 6–9 × 1.0–1.4 mm, abaxially pubescent. Corolla tubular-funnel shaped, upright, curved; corolla tube yellowish white to pinkish white with reddish brown bands or dot lines alternate to the sepals, glabrous, 2.9–3.7 cm long, inflated at base, 0.7–0.8 cm in diameter, the interior of the inflated portion maroon, purple brown to dark purple and covered with long white hairs, the tube becoming straight above the inflated portion and then gradually widening upwards; mouth of the tube 1.3–1.5 cm in diameter, covered with long white hairs inside; corolla lobes lanceolate, 3.0–3.5 × 0.6–0.7 cm, apex acute, each lobe reduplicate from near the base, tip connate, lower part of lobe (about one third of the length of a lobe) yellow, adaxial surface covered with long white hairs only at the midrib, upper part of lobe (about two third of the length of a lobe) green, abaxial surface and margins covered with purplish hairs. Gynostegium sessile. Corona double, interstaminal corona formed by five lobes, joined to form a shallow cup, 5.1–5.3 mm diameter, apex of lobes bifid, segments triangular, 0.6–0.8 mm long, apex acute, purple to dark purple in color and covered with white hair; staminal corona formed by five lobes, terete, 3.0–3.3 mm long, 0.4–0.5 mm in diameter, lower part yellow with purple borders, incumbent on dorsal surface of the anthers, apical part connivent-erect, yellowish white, apex acute and slightly recurved. Pollinaria five; pollinium broadly ovoid, yellow, 0.38–0.39 × 0.29–0.30 mm; translator arms stout, hyaline; corpusculum spatulate, reddish brown, 0.33–0.35 × 0.18–0.19 mm. Fruits follicles usually 2, linear-lanceolate in outline, green when young but turning reddish brown with age, 6.5–7.2 cm long, 0.30–0.35 cm in diameter. Seeds oblong, brown, 4–5 × 1.9–2.1 mm; coma 1.3–1.7 cm long, silky white.

Habitat, ecology and distribution: *Ceropegia foetidiflora* occurs about 520 m a.s.l. in Phu Langka National Park, Bueng Kan Province, northeastern Thailand (Fig. 3). It is perennial herb growing in sandy soil, open areas of dry deciduous dipterocarp forest. Flowering July–October.

Additional specimens examined (paratype): Thailand, Phu Langka National Park, Bueng Kan Province, 520 m a.s.l., 3 September 2014, M. Kidyoo 1616 (BCU).

IUCN Red List category: The new species is endemic to Thailand. It is apparently rare, known from a single degraded locality. About 20 mature individuals were found growing in the sandy open area of 1 km². Following the IUCN Red List Categories and Criteria (IUCN, 2017), it is strongly suggested that *C. foetidiflora* should be treated as critically endangered species (CR).

A key to the identification of 7 *Ceropegia* species occurring in the northeastern Thailand and *C. thorelii* is provided below.

Key to the species

- 1a. Aerial stem arising from a subglobose tuber 2
- 1b. Aerial stem arising from a cluster of fusiform roots or from a long creeping underground stem 8
- 2a. Stem erect 3
- 2b. Stem twining or decumbent 5
- 3a. Corolla tube ovoid-urceolate, base swollen with a short constriction above *C. thailandica*
- 3b. Corolla tube tubular-urceolate, base inflated with a long narrow portion above 4
- 4a. Cymes, in 1 flowered, peduncle slender; corolla lobes linear; corolla tube hairy inside *C. suddeei*
- 4b. Cymes, in 1–3 flowered, subsessile; corolla lobes lanceolate; corolla tube glabrous inside *C. sootepensis*
- 5a. Stem glabrous; leaves puberulent on upper surface *C. sootepensis*
- 5b. Stem pubescent; leaves pubescent on both surfaces 6
- 6a. Leaves narrowly lanceolate to linear; corolla lobes narrowly lanceolate, twisted *C. cochleata*
- 6b. Leaves broadly ovate to ovate-elliptic; corolla lobes ovate or lanceolate, not twisted 7
- 7a. Corolla lobes lanceolate-oblong, as long as tube; corolla tube glabrous outside *C. foetidiflora*
- 7b. Corolla lobes ovate-lanceolate, shorter than tube; corolla tube pubescent outside *C. thorelii*
- 8a. Cymes, in 5–7 flowered, peduncles slender; corolla lobes spatulate *C. jucunda*
- 8b. Cymes, in 1–3 flowered, sessile or subsessile; corolla lobes ovate *C. digitiformis*

Discussion

Morphologically, *Ceropegia foetidiflora* is closely allied to *C. thorelii* and also share similarities to *C. cochleata*. They are decumbent or twining herbs with pubescent stems and leaves. They produce 1–3-flowered inflorescences. Their corolla tubes are slightly inflated at the base and progressively broadened to form a funnel-shaped upper part, ending with five pubescent corolla lobes. However, *Ceropegia cochleata* markedly differs from other species in the creeper-twining group in many aspects. First, it grows in hill evergreen forest. Second, it produces narrowly elliptic to lanceolate leaves and flowers with narrowly lanceolate and twisted corolla lobes which are free at the tips. *Ceropegia foetidiflora* is thus more similar to *C. thorelii* than to *C. cochleata*. Both species grow in dry deciduous dipterocarp forest. They have broadly ovate to elliptic leaves and corolla

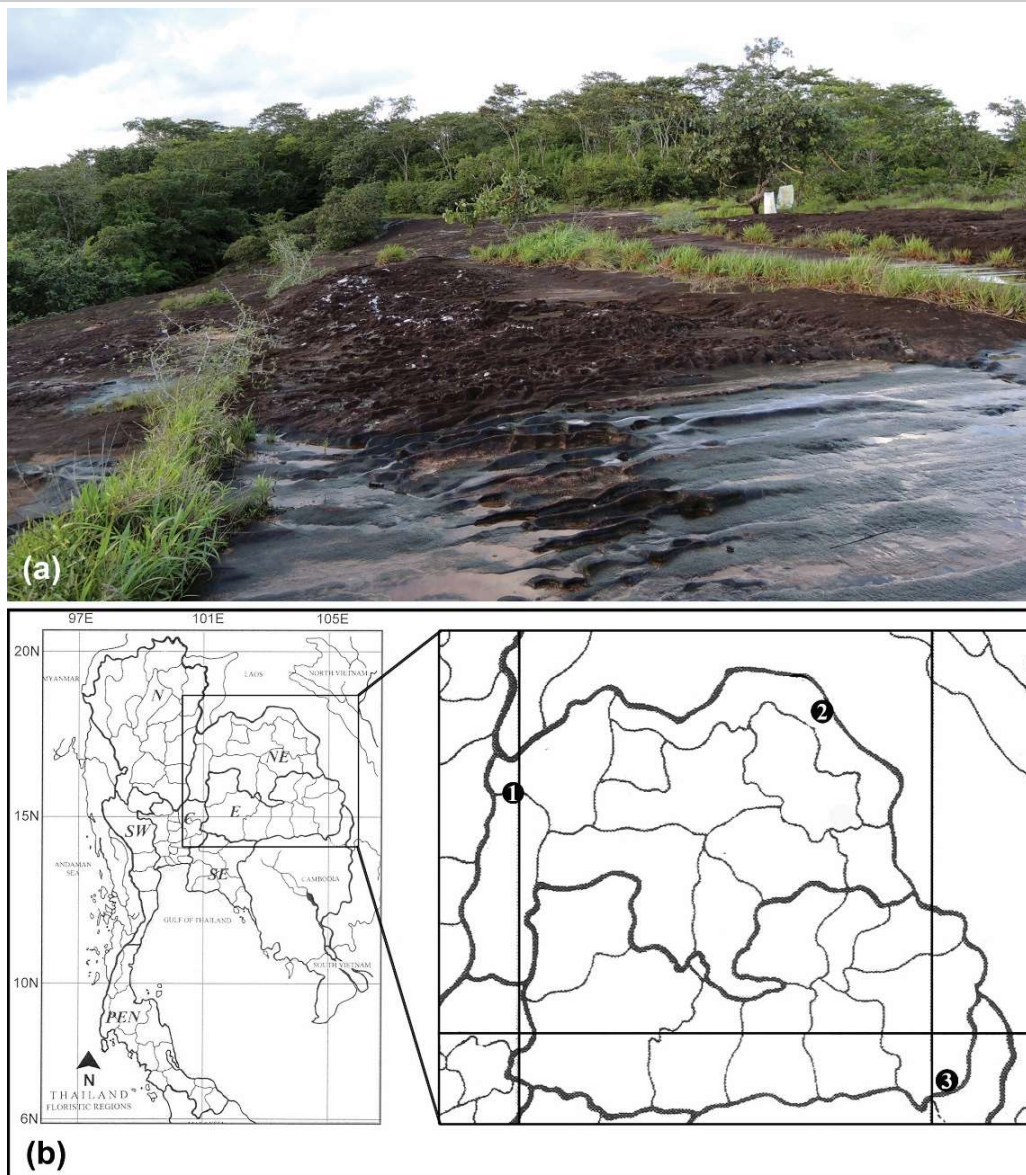


Fig. 3. Habitat of *Ceropegia foetidiflora* sp. nov. (a), and distribution map (b) of *C. cochleata* (1: Phu Hin Rong Kla National Park, Pitsanulok Province), *C. foetidiflora* (2: Phu Langka National Park, Bueng Kan Province) and *C. thorelii* (3: Phu Chong-Na Yoi National Park, Ubon Ratchathani Province).

lobes which are connate at the tips. However, despite sharing some features, a number of disparities separate *C. foetidiflora* from its close relative (Table 1 & Fig. 2). The new species has a corolla tube that is glabrous outside, the lanceolate-oblong corolla lobes which are nearly as long as the tube and the staminal corona lobes with slightly recurved apex. In contrast, *C. thorelii* has corolla tube surface on the outside covered with hairs, the ovate-lanceolate corolla lobes which are shorter than the tube length, and the staminal corona lobes with strongly recurved apex.

Note: *Ceropegia thorelii* Costantin was first discovered from in 1866–1868 from Stung-treng,

Cambodia. (Costantin, 1912; Maxwell, 2009). It is also found in Ubon Ratchathani Province of Thailand which is located near the type locality and reported for the first time in this paper. This species was once subsumed under *C. macrantha* Wight by some authors (Huber, 1957; Meve, 2002). However, the recent comprehensive analysis of the type specimens and the protologues under both names supported that *C. macrantha* is a well separate species (Wight, 1834; Costantin, 1912). *Ceropegia thorelii* has a stem arising from a subglobose tuber. The plant is pubescent throughout and produces 1–2-flowered inflorescence. Its corolla tube is inflated at the base and covered with hairs on the entire inner

**Table 1.** Morphological comparison of *Ceropegia foetidiflora*, *C. thorelii* and *C. cochleata*.

Characters	<i>C. foetidiflora</i>	<i>C. thorelii</i>	<i>C. cochleata</i>
Habitat	dry deciduous dipterocarp forest, about 500 m a.s.l.	dry deciduous dipterocarp forest, about 300 m a.s.l.	hill evergreen forest, about 1,300 m a.s.l.
Leaves	broadly ovate to elliptic, base acute, obtuse to rounded.	broadly ovate to elliptic, base acute, obtuse, rounded to subcordate.	narrowly elliptic to lanceolate, base acute to attenuate.
Corolla tube	tubular-funnel shaped, glabrous outside.	tubular-funnel shaped, densely pubescent outside.	tubular-funnel shaped, glabrous to sparsely pubescent outside.
Corolla lobes	lanceolate-oblong, not twisted, adaxial surface: basal part covered with long white hairs at the midrib, upper part covered with densely purplish hairs; abaxial surface glabrous.	ovate-lanceolate, not (or slightly) twisted, adaxial surface: covered with long white hairs only at the midrib but glabrous elsewhere; abaxial surface pubescent.	narrowly lanceolate, twisted, adaxial surface: basal part covered with long white hairs at the midrib, upper part covered with densely purplish hairs; abaxial surface glabrous; free at the tips.
Interstaminal corona lobes	bifid, segments triangular with acute apices.	retuse or shallowly bifid with obtuse to rounded apices.	slightly bifid, segments triangular with acute apices.
Staminal corona lobes	lanceolate, apex acute, slightly recurved.	linear-lanceolate, apex acute-obtuse, strongly recurved.	linear-lanceolate, apex acute, slightly recurved.

surface. Its interstaminal corona lobes are shallowly bifid with triangular segments that are shorter than the staminal corona lobes. In contrast, *C. macrantha* produces fascicle roots, 4–5-flowered inflorescence and glabrous pedicels and sepals. Its corolla tube is inflated at the base with a ring of hairs present inside the mouth. Its intersataminal corona lobes are deeply bifid with lanceolate segments that are nearly as long as the staminal corona lobes.

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