



Taxonomic study of *Ceropegia* L. (Apocynaceae, Asclepiadoideae) for the flora of Laos: One new species and one new record from central Laos

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ABSTRACT: A newly discovered species from central Laos, *Ceropegia longicaudata*, is here described and illustrated. It is compared with the morphologically similar species *Ceropegia cochleata* Kidyoo. *Ceropegia longicaudata* displays clear differences in the leaf pubescence and venation, length of the corolla lobe tips, colour of corolla lobe, and shape of staminal corona lobes. *Ceropegia cochleata* is newly recorded for the Flora of Laos. A key to the now three species of *Ceropegia* in Laos is also provided.

KEY WORDS: *Ceropegia cochleata*, *Ceropegia laotica*, Ceropegieae, Khammouan, new species, Phoukhaokhouay NPA.

INTRODUCTION

The genus *Ceropegia* L. (Apocynaceae, Asclepiadoideae, Ceropegieae), broadly circumscribed by Bruyns *et al.* (2017) to include not only the taxa with pitfall flowers (*Ceropegia* s.str.) but also *Brachystelma* R.Br. and the stem succulent stapeliads, includes around 725 species (Bruyns *et al.* 2020). However, Endress *et al.* (2018) kept the monophyletic stem succulent group separate, and only accepted inclusion of *Brachystelma* in *Ceropegia*, that counts with it ca. 330 species. The distribution area of *Ceropegia* spans from Macaronesia and Africa to northern Australia (Huber 1957; Kambale & Yadav, 2019; Thaithong *et al.*, 2018). Just one species with pitfall flowers, *C. laotica* Rodda & Meve has so far been found in Laos, and is endemic to Champasak Province (Rodda & Meve, 2017). This is in stark contrast with neighbouring countries, such as China, where 18 species have been recorded (Li *et al.*, 1995; Wu *et al.*, 2019), and Thailand, where currently 19 species are recorded (Kidyoo & Suwannakote, 2020). During botanical field surveys in Gnommalard and Nakai District, Khammouan Province (August 2019 and 2020), and Phoukhaokhouay National Protected Area, Vientiane province, central Laos (September 2020), two *Ceropegia* species with pitfall flowers were collected, neither of which could be identified as *Ceropegia laotica*. After additional examination of a number of relevant specimens at AAU, BKF, E, K, P, PE, QBG, RBGE and SING we concluded that the collection from Khammouan province could be identified as *Ceropegia cochleata* Kidyoo, so far thought to be endemic to Thailand. The collection from Vientiane is also similar to *Ceropegia cochleata*, as well as to *Ceropegia beddomei* Hook.f. from India. However, it can be clearly distinguished based on both vegetative and reproductive morphology and thus we describe it as new species. A

key to the then three species of *Ceropegia* so far known to occur in Laos is also provided.

TAXONOMIC TREATMENT

Ceropegia longicaudata Phonep. & Rodda, *sp. nov.*

Figs. 1 & 2

Type. LAOS, Phoukhaokhouay National Protected Area, Vientiane Province, Thoulakhom District, elevation 270 m, 5 September 2020. *Phonepaseuth*, P., *Chounlamany*, V., and *S. Chansavang P005* (holotype, FOF! [FOF0005193], isotype HNL!).

Diagnosis. *Ceropegia longicaudata* is similar to *C. cochleata* in having tuberous rootstock and linear lanceolate laminas. It can be separated by glabrous leaves without distinct nerves (vs. pubescent with distinct nerves in *C. cochleata*), longer corolla lobe tips (25–30 mm in *C. longicaudata* vs. 15–20 mm in *C. cochleata*), colour of corolla lobe completely bright green (vs. basally green with reddish brown apex), and staminal corona lobes distally with recurved diverging apices (vs. straight and converging).

Description. Twining herb, perennial, **Rootstock** tuberous, tubers subglobose to globose, smooth, light brown, 1.5–2 cm in diameter with numerous, straight, fleshy roots. **Stem** terete, not branched, 0.7–1.2 m long, internodes 3–10 cm long, 2–3 mm in diameter, green above, pubescent. **Leaves** petiole stout, grooved on the upper surface, 3–4 mm long, 1.5–2 mm in diameter, puberulent along the margins of the groove; blade linear or linear-lanceolate, 6–10 × 1.2–2.2 cm, apex acuminate, base acute, upper surface mid green, glabrous, lower surface pale green, glabrous except for whitish hairs along midrib; margin ciliate; midrib distinct, slightly grooved on the upper surface, prominent on the lower surface; lateral veins 6–8 on each side of the midrib, almost indistinct on both surfaces. **Inflorescences** 1–(2)-

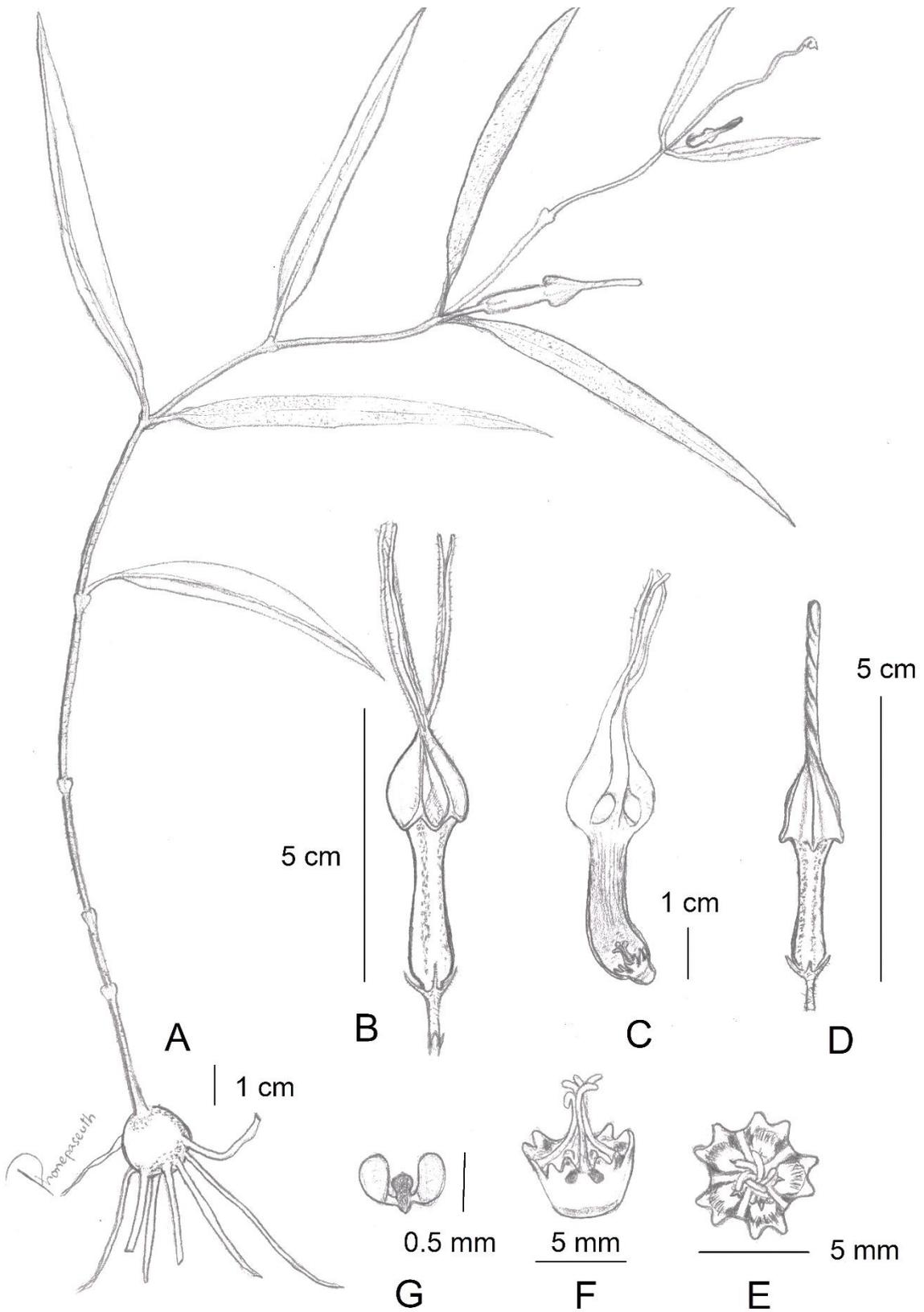


Fig. 1. *Ceropegia longicaudata* Phonp. & Rodda. **A.** habit; **B.** open flower; **C.** longitudinal section of corolla; **D.** young flower bud; **E.** corona top view; **F.** corona side view; **G.** Pollinarium. Drawn by P. Phonpaseuth from P005 (FOF).

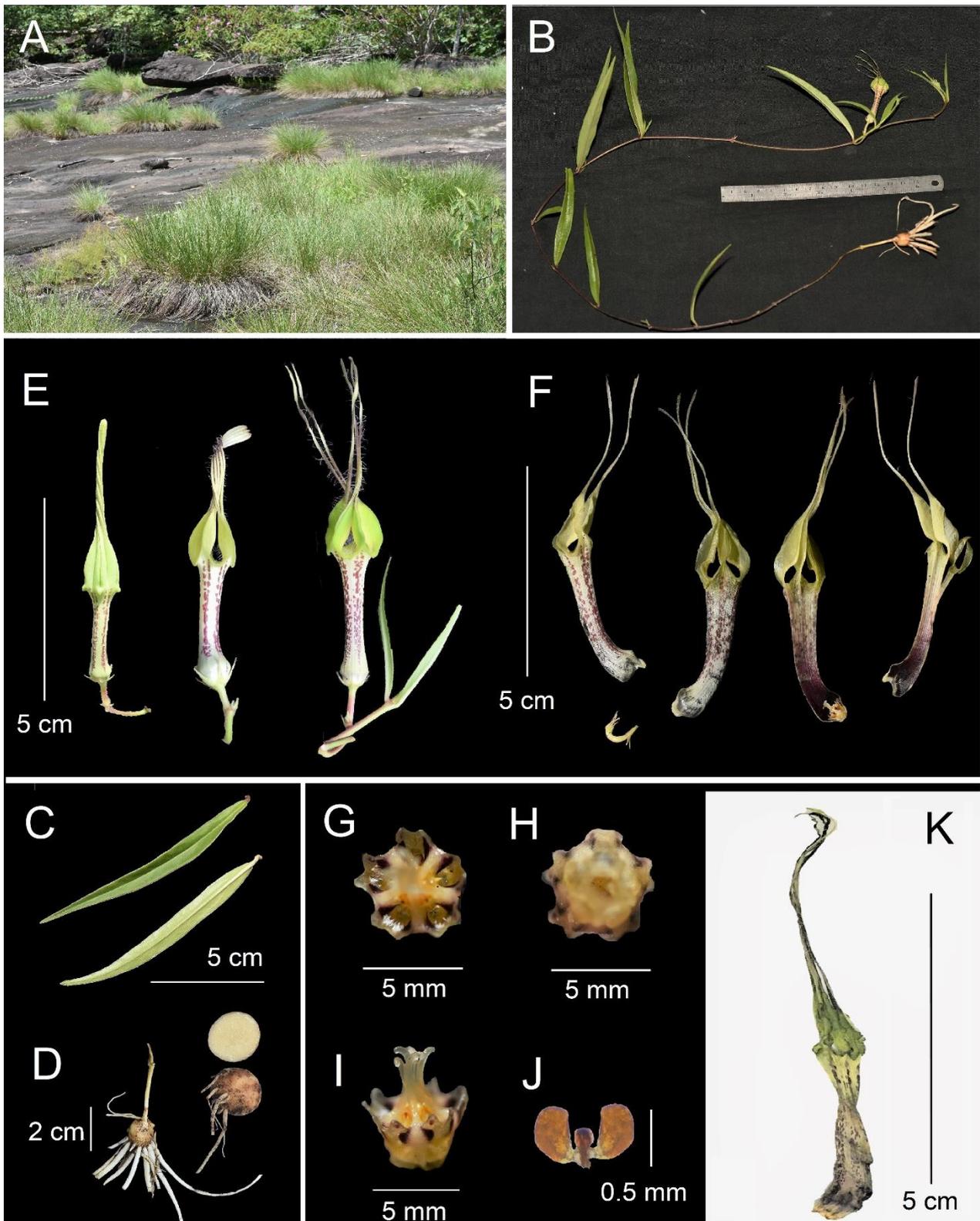


Fig. 2. *Ceropegia longicaudata* Phonep. & Rodda. **A.** habitat; **B.** habit; **C.** leaves adaxial and abaxial side; **D.** tuber; **E.** flower bud and open flower; **F.** longitudinal section of corolla; **G.** corona top view; **H.** corona from underneath; **I.** corona side view; **J.** pollinarium; **K.** dry flower (specimen). Photos by P. Phonepaseuth from P005 (FOF)



flowered. **Peduncle** extra-axillary, 1–1.2 cm long, 1.5 mm in diameter, greenish brown, pubescent; pedicel greenish red, 1–1.2 cm long, 1.5 mm in diameter, pubescent; **bracteoles** at the base of pedicel lanceolate, 1–2 mm long, apex acuminate, pale green to greenish brown, pubescent. Calyx lobes free, lobes, lanceolate, 4–5 × 0.8–1 mm, apex acuminate, pale green, pubescent, ciliate. **Corolla** 7–8 cm long, upright; tube 3.5–4 cm long, 0.5–0.7 cm in diameter at the base, 1.5–1.6 cm in diameter at the mouth, very slightly inflated at base, only very slightly curved, outside white to greenish white with reddish brown blotches aligned along the tube length, glabrous, inside basally reddish brown red turning whitish with dark reddish brown blotches towards the apex, inflated portion with sparse long white hairs, elsewhere glabrous; **corolla lobes** basally broadly ovate, folded inside out, apically linear, 40–50 × 7–8 mm, basal part bright green, glabrous, margins ciliate, apices free at tips, linear, ca. 30 mm long, greenish brown pubescent inside, light green glabrous outside. **Gynostegium** sessile. Corona biserate; interstaminal corona joined to form a shallow cup, 4.5–5.5 mm in diameter, lobes bifid, each segment deltate with blunt apex, translucent white with a purplish centre, inside each with a beard of white hairs; staminal corona lobes terete, linear to slightly ligulate, 3–3.5 mm long, 0.35–0.4 mm in diameter, incumbent on the backs of the anthers, proximal part connivent-erect, distal erect with recurved diverging apices, translucent, glabrous. **Pollinaria**: pollinium broadly ovoid, yellow, 0.4–0.5 × ca. 0.3 mm, germination crest sub-apical; caudicles rectangular, stout, hyaline; corpusculum spatulate, reddish-brown, 0.3–0.35 × 0.15–0.2 mm. **Follicles** and **Seeds** not seen.

Etymology. The specific epithet ‘longicaudata’ refers to long corolla lobes that characterize this species.

Distribution. Only known from Phoukhaokhouay National Protected Area, in Laos. It is found at two locations, the type locality in Vientiane Province (Fig. 5), and from a locality 25–30 km eastwards, in Bolikhamxay Province, where it was photographed by Bertrand Laville in 2016

(<https://theceropegiablog.wordpress.com/2016/02/22/a-new-locality-for-ceropegia-cochleata/>).

Ecology and habitat. This species rooted in very thin soils over large sandstone boulders growing together with grasses. The plants were climbing over grasses in open areas partially exposed, at 270–300 m a.s.l. Flowering August–September.

Vernacular name. ດອກຈິນດາພູເຂົາຄວາຍ ‘Dok Chinda Phoukhaokhouay’ [Phoukhaokhouay jewelry flower] (proposed here).

Provisional conservation assessment. *Ceropegia longicaudata* is so far known only from two populations within Phoukhaokhouay National Protected Area. At the type locality it occupies a small area, ca. 2 × 2 m² on a

large sandstone rock. Of the eight individuals observed in the field, three have flower buds and flowers. Although some plantlets of this species are growing near to the mature individuals and the type locality is within a protected area, the collection site is along a tourist trail view point of this District and is at risk of disturbance. The second population in Bolikhamxay Province consists of about 10 individuals (Bertrand Laville, pers. comm.). Since the suitable habitat for *Ceropegia longicaudata* in Phoukhaokhouay National Protected Area has not been extensively surveyed we consider its conservation status as Data Deficient (DD) (IUCN, 2012). If no further populations are discovered during future field expeditions the conservation assessment of *Ceropegia longicaudata* will have to be updated to Critically Endangered (CR) under criterion D.

Notes. The new species can be separated from *C. cochleata* on the vegetative and reproductive characters mentioned in the diagnosis. Another similar species with tuberous rootstock and linear-lanceolate laminae is the Indian endemic grassland species *C. beddomei*, which can be separated from *C. longicaudata* because its inflorescences have much longer peduncles, 3.0–7.5 cm long, whereas *C. longicaudata* has peduncles only around 1 cm length. Additionally, the staminal corona lobes are distally divergent in both species but are conspicuously inflated in *C. beddomei* and not inflated in *C. longicaudata*. Our new species can be separated from the other *Ceropegia* species endemic of Laos, *C. laotica* on the stem pubescence (pubescent in *C. longicaudata*, glabrous in *C. laotica*) and on the shape and size of the corolla lobes (basally broadly ovate, upper regions linear, 40–50 × 7–8 mm in *C. longicaudata*, broadly ovate, acuminate, (12–)15–17 × 7–8.5 mm in *C. laotica*). For further comparison between the four species see Table 1.

New record

***Ceropegia cochleata* Kidyoo**, Nordic Journal of Botany 33: 668–672. 2015. Type: Thailand, Phu Hin Rong Kla National Park, Pitsanulok Province, 1300 m a.s.l., 11 Jun 2013, M. Kidyoo 1596 (holotype: BCU, isotype: BKF).

Figs. 3 & 4

Specimens examined: Laos, Khammouan Province, Nakai District, Sanseda Orchids Trail, elevation 700 m. 30 August 2020. *Phonepaseuth, P., Choumlamany, V. & Chansavang, S. P003* (FOF! [FOF0005192], HNL!). Phou Ak escarpment, Nam On catchment, Nakai Nam Theun NBCA, 22 May 2006, *Newman, M. F.; Thomas, P. I.; Armstrong, K. E.; Sengdala, K. & Lamxay, V. LAO 1217* (E! [E00264832]).

Distribution. Laos, Thailand (Fig. 5).

Ecology and habitat. This species was observed in Laos growing in very thin soils with moss (2–5 cm thick) over large sandstone boulders partially exposed. The plants were climbing over grasses and *Phalaenopsis pulcherrima* (Lindley) J.J. Smith (Orchidaceae) in open areas. Flowering August–September.

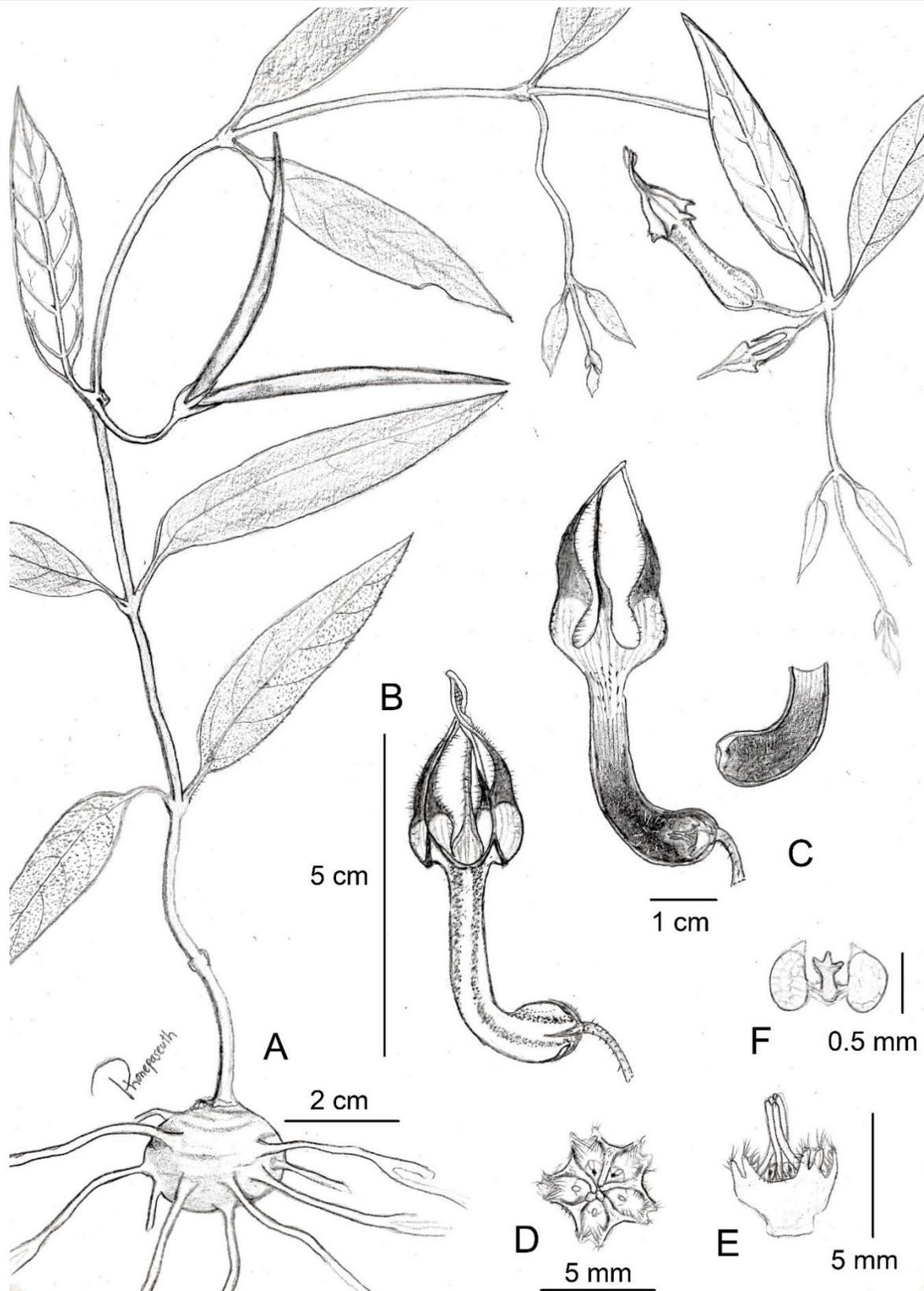


Fig. 3. *Ceropegia cochleata* Kidyoo. **A.** habit; **B.** open flower; **C.** longitudinal section through corolla tube showing corona and gynostegium at the base of the flower; **D.** top view of gynostegium; **E.** side view of gynostegium with corona; **F.** pollinarium. Drawn by P. Phonepaseuth from P003 (FOF).

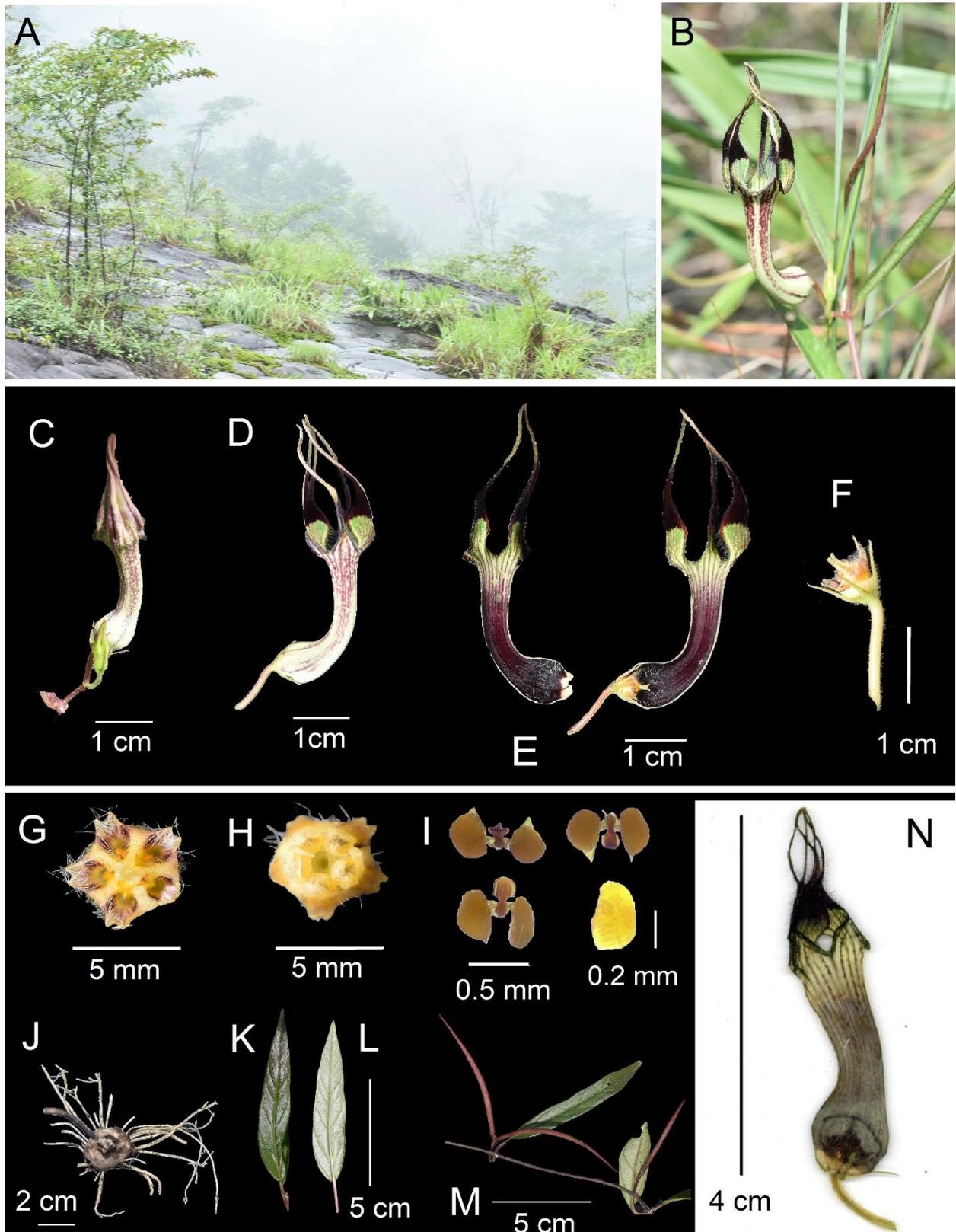


Fig. 4. *Ceropegia cochleata* Kidyoo. A. habitat; B. habit; C. flower bud; D. open flower; E. corolla longitudinal section; F. corona side view with pedicel and sepal; G. corona top view; H. corona from underneath; I. pollinarium; J. tuber; K. leaves adaxial side; L. leaf abaxial side; M. fruiting branch; N. dry flower (specimen). Photos by P. Phonpaseuth from P003 (FOF).

**Table 1.** Morphological comparison of *Ceropegia longicaudata* and similar species.

Characters	<i>Ceropegia longicaudata</i>	<i>Ceropegia cochleata</i> ¹	<i>Ceropegia laotica</i> ²	<i>Ceropegia beddomei</i> ³
Stem	Pubescent, 0.7–1.2 m long	Pubescent, 0.3–0.5 m long	Glabrous, to 2 m long	Hispid
Leaf blade	linear or linear-lanceolate, apex acuminate, base acute, upper surface glabrous, lower surface glabrous except for whitish hairs along midrib	elliptic, oblong to lanceolate, coriaceous, base acute to attenuate	linear(-lanceolate), slightly fleshy but flexible, base attenuate, apex acute, sparsely pubescent above, underneath pubescent along main vein only	linear-lanceolate, acute at apex, narrow towards base, sparsely hairy on both surfaces
Leaf size	6–10 × 1.2–2.2 cm	4.0–9.5 × 0.5–1.6 cm	(4–)5– 10(–12) × 0.5–1.2 cm	7.5–20.5 × 0.6–0.9 cm
Pedicel	1–1.2 cm long, 1.5 mm in diameter, greenish brown to reddish brown, pubescent	0.5–0.7 cm long, 1.0–1.2 mm in diameter, pale green, pink or reddish brown, pubescent	0.8–1.5 cm long × c. 1.5 mm in diameter, reddish green to whitish, glabrous or very sparsely pubescent	1.0–1.5 cm long, puberulous
Cymes	1–(2) flowered	1–2-flowered	1–2 flowered	2–3 flowered
Corolla tube	3.5–4 cm long	2.7–3.1 cm long	(2–)2.3–2.7 cm long	3.0–4.3 cm long
Corolla lobes	4–5 cm long, loosely twisted or not twisted with free tip	2.5–3.2 cm, tightly twisted with free tip	(1.2–)1.5–1.7 × 0.7–0.85 mm, not twisted, with connate tip	3.5–5.5 cm, twisted
Staminal corona lobes	Linear to slightly ligulate, 3–3.5 mm long, 0.35–0.4 mm in diameter, incumbent on the backs of the anthers, distal part erect with recurved diverging apices, translucent.	Linear-lanceolate with acute apices, 2.6–2.8 mm long, 0.2–0.3 mm in diameter, incumbent on the backs of the anthers, their distal part connivent-erect, yellowish white	Linear, terete, connivent-erect, 1–1.2 × 0.25–0.35 mm, pinkish white	Erect-divergent, inflated above.
Indumentum of inter-staminal corona lobes	Pubescent inside	Pubescent inside	Pubescent inside and outside	Pubescent inside and along margins

Note: ¹Kidyoo (2015), ²Rodda & Meve (2017) and ³Kambale and Yadav (2019)

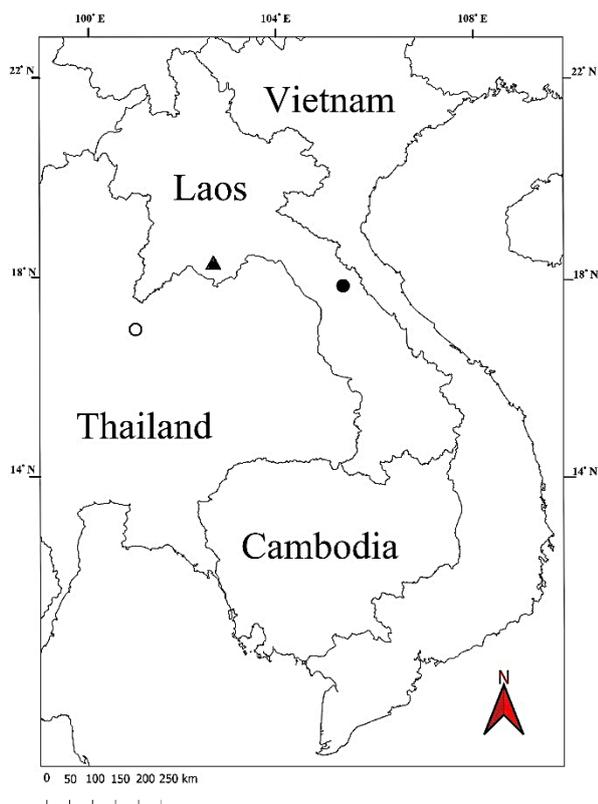


Fig. 5. A. Distribution of *Ceropegia cochleata* Kidyoo. (O) in Thailand, (●) in Khammouan province, Laos; *Ceropegia longicaudata* Phonp & Rodda (▲) in Vientiane Province, Laos.

Notes. This newly recorded species was formerly endemic to Thailand. In Laos, this species was first found in May 2006 at Phu Ak Khammoun province by Newman et al. LAO 1217 (E). Then in 2019 the first author observed it in Nakai District, Khammouan Province and in August 2020 a specimen was prepared. The Lao collections have corolla lobes slightly shorter than the tube (vs. as long as or longer than tube in *C. cochleata* in Thailand).

Key to the species of *Ceropegia* in the flora of Laos

- 1a. Stems glabrous, corolla lobes not terminating in into long linear tips *C. laotica*
- 1b. Stems pubescent, corolla lobes terminating into long linear tips 2
- 2a. Corolla lobe tips 15–20 mm long staminal corona lobes convergent *C. cochleata*
- 2b. Corolla lobe tips 25–30 mm long, staminal corona lobes divergent *C. longicaudata*

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