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Ceropegia digitiformis sp. nov. (Apocynaceae, Asclepiadoideae) from northeastern Thailand

Manit KIDYOO* **and Chanita PALIYAVUTH**

Department of Botany, Faculty of Science, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand.
** Corresponding author Email: kidyoo_m@yahoo.co.th*

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ABSTRACT: A new species, *Ceropegia digitiformis* Kidyoo, was discovered from northeastern Thailand. It is here described and illustrated. Photographs and a diagnostic comparison with the morphologically similar related species, *Ceropegia thwaitesii* Hook., are also provided. These two species display clear difference in shapes and pubescence of the corona lobes.

KEY WORDS: Apocynaceae, Asclepiadoideae, *Ceropegia*, northeastern Thailand

INTRODUCTION

Ceropegia L. (Apocynaceae, Asclepiadoideae, Ceropegieae) comprises at least 200 species of small erect or twining herbs occurring widely in Southeast Asia, India, Tropical Arabia, Africa, Madagascar, Canary Islands, New Guinea and Northern Australia. Members of the genus are often characterized by a cage-like structure of flower formed by corolla lobes, which are apically connate to various degrees (Hooker, 1883; Huber, 1957; Ansari, 1984; Li *et al.*, 1995; Meve, 2009; Kullayiswamy *et al.*, 2013). The records acquired from taxonomic revision of *Ceropegia* in Thailand show that there are not less than 10 species described from different regions of the country, with relatively higher species diversity in northeastern region (Kerr, 1951; Boonjaras and Thaithong, 2003; Meve, 2009; Kidyoo, 2014a; Kidyoo, 2014b; Kidyoo, 2015a; Kidyoo, 2015b). Recently, *Ceropegia digitiformis* Kidyoo was discovered from two populations in Bueng Kan Province (northeastern Thailand): Phu Wua Wildlife Sanctuary and Phu Langka National Park. This newly discovered species is meticulously described and illustrated. Its morphological and ecological characteristics are compared with those of its morphologically similar, the Indian and Sri Lankan species *Ceropegia thwaitesii* Hook. (Hooker, 1854; Ansari, 1984).

TAXONOMIC TREATMENT

Ceropegia digitiformis Kidyoo, ***sp. nov.*** **Figs. 1 & 2**

Ceropegia digitiformis can be distinguished from *C. thwaitesii* by its outer corona of the same length as inner corona, glabrous outer coronal lobe whose apex is deeply bifid with linear-lanceolate segments, and linear-lanceolate inner corona lobes.

Type: **THAILAND**: Phu Langka National Park, Bueng Kan Province, 520 m a.s.l., 14 August 2012, *M. Kidyoo 1556* (holotype: BKF, isotype: BCU).

Twining herbs, with clear latex in all parts. Stem: underground stem growing horizontally just below the soil surface and producing tubers; tubers small, subglobose, smooth, light brown, 0.5–1.0 cm in diameter; stem and branches terete, fleshy, glabrous, 0.5–1.5 m long, 2.0–3.4 mm in diameter, green when young and turning reddish brown with age. Leaves opposite; blade ovate, elliptic, oblong to lanceolate, fleshy coriaceous, 4.5–12.6 cm long, 1–2.7 cm wide, base acute to obtuse or rounded, apex acute to acuminate; margins entire, ciliate; adaxial surface green to dark green, glabrous, abaxial surface pale green, glabrous; midrib greenish white, prominently convex, covered with scattered hairs abaxially; lateral veins slightly visible on both surfaces, 5–7 pairs, at acute angles to the midrib; petiole curved, slightly grooved above, sparsely pubescent, green to reddish brown, 0.8–1.2 cm long, 1.5–2.5 mm in diameter, with a basal gland at its attachment to the blade. Inflorescences 1–3 flowered cyme, extra-axillary; peduncle sessile to subsessile, 0–3 mm long, pedicel pale green, pink or reddish brown, glabrous, 5–10 mm long, 2–2.2 mm in diameter; bracts attached at the base of pedicel, minute, lanceolate, pale green to pinkish white, apex acute, caducous. Sepals green or green with reddish brown tint at the apex, linear-lanceolate, apex sharply acute, 4.5–6.3 mm long, 1–1.2 mm wide, glabrous abaxially. Corolla tubular-funnel, upright, slightly curved; corolla tube creamy white with reddish brown bands or dots, outer surface glabrous, 3.2–4.3 cm long, inflated at base, 0.7–0.9 cm in diameter, interior of inflated part purple-brown, glabrous, tube becoming straight above the inflated portion and then gradually widening upward, mouth of the tube 0.9–1.1 cm in diameter, glabrous; lobes triangular-ovate, 1.8–2.1 cm long, 1.2–1.5 cm wide, apex acute to blunt, both surfaces glabrous, folded outward in half lengthwise, apices connate, inside greenish white at base and pinkish white at upper part with reddish brown or purple apex,

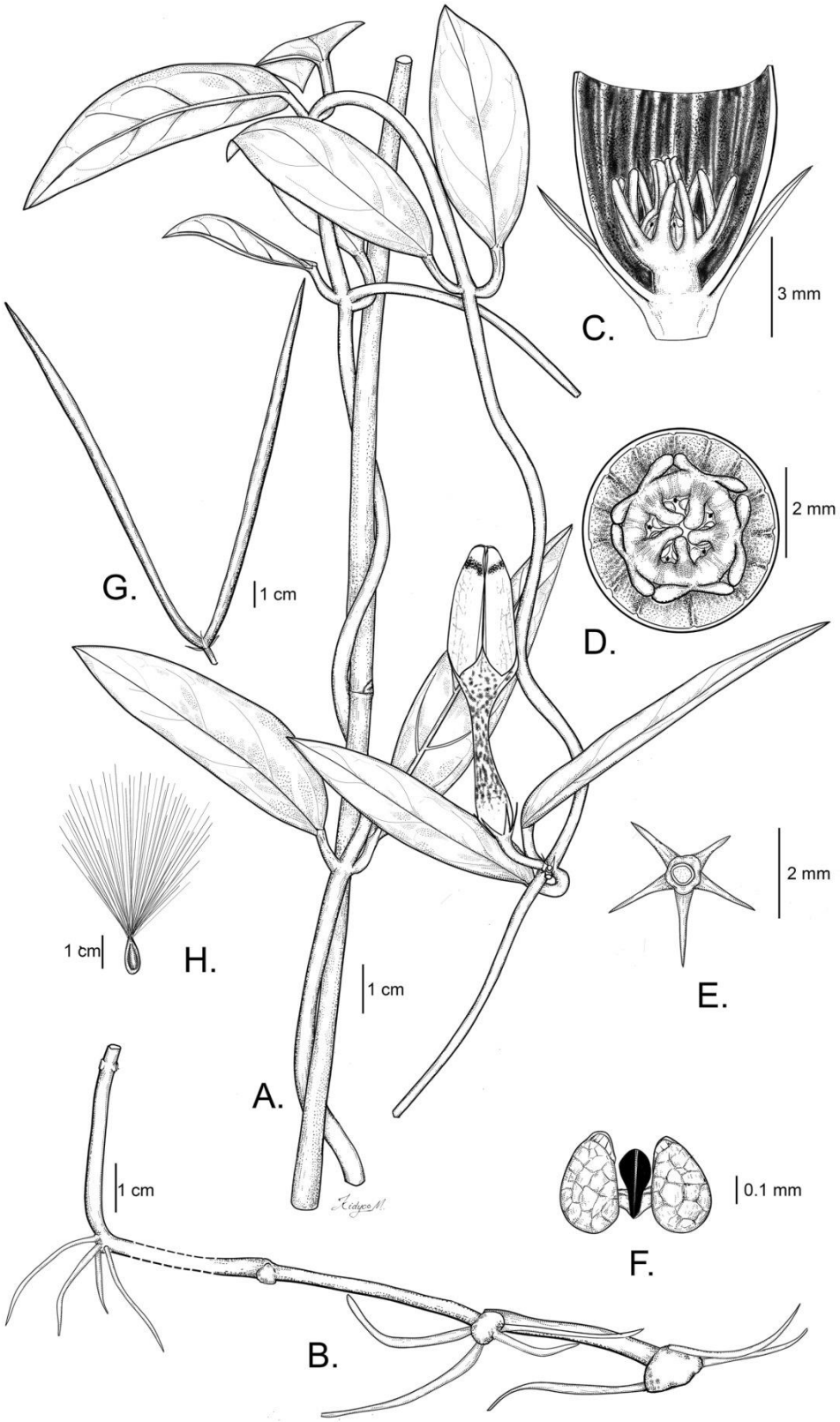

Fig. 1. ***Ceropegia digitiformis*** Kidyoo: **A**. flowering branch, **B**. underground stem, **C**. longitudinal section through inflated part of corolla tube showing corona and gynostegium, **D**. top view of gynostegium, **E**. calyx **F**. pollinarium **G**. fruit H. seed. Drawn by Manit Kidyoo from *M. Kidyoo 1556* (A–F), and *M. Kidyoo 1611* (G–H).

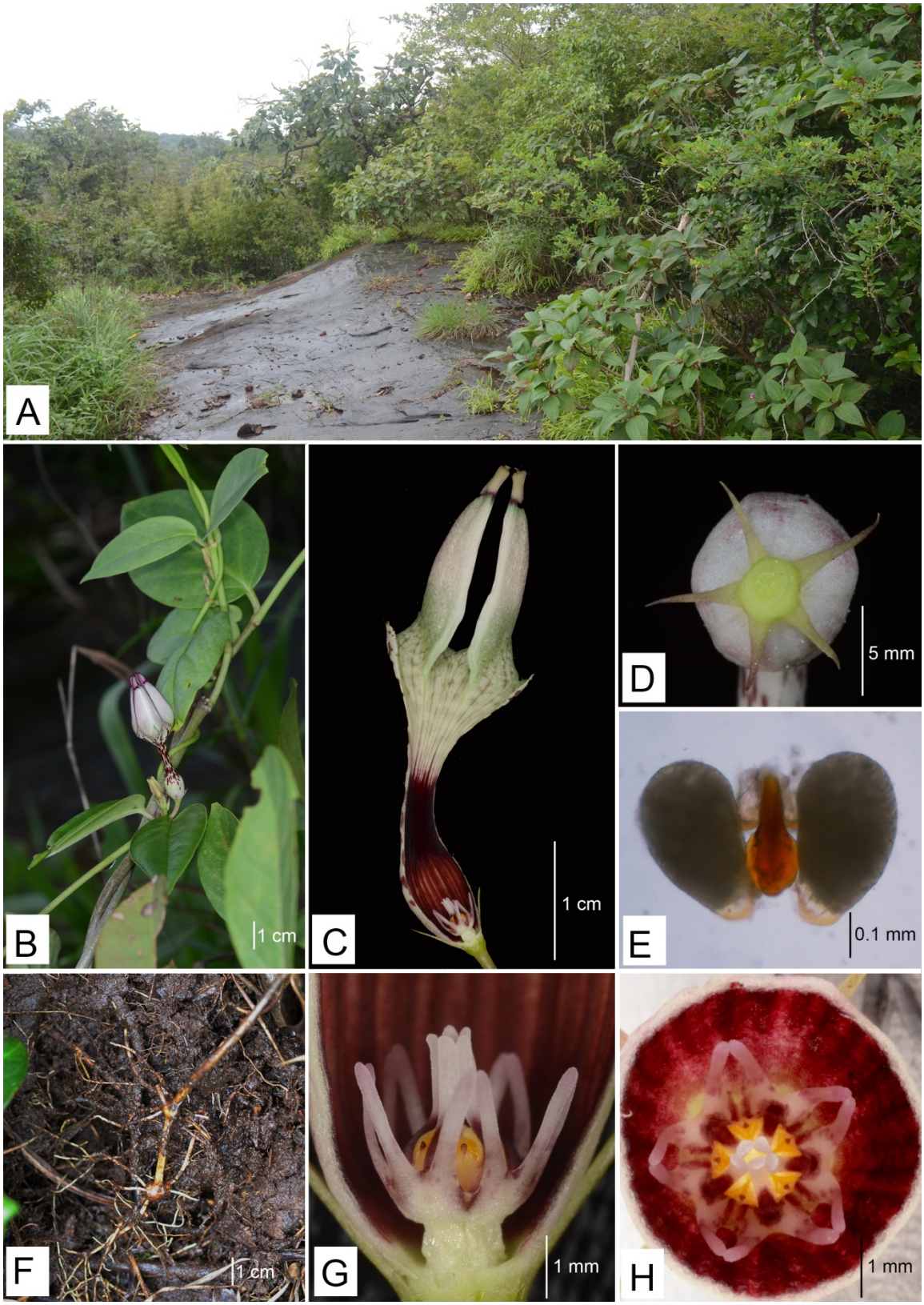

Fig. 2. Photographs showing habitat, vegetative and reproductive parts of ***Ceropegia digitiformis*** Kidyoo: **A**. habitat (Phu Langka National Park), **B**. flowering branch, **C**. long section of flower, **D**. calyx, E. pollinarium, **F**. underground stem with small tubers, **G**. side view of gynostegium, **H**. top view of gynostegium.

TABLE 1. Morphological comparison of ***Ceropegia digitiformis*** and its morphologically similar ***Ceropegia thwaitesii***.

	Ceropegia digitiformis	***Ceropegia thwaitesii***
Leaf		
shape	ovate, elliptic, oblong, ovate-lanceolate	ovate, ovate-lanceolate
base	acute, obtuse to rounded	acute, obtuse to rounded
apex	acute to acuminate	acuminate
	4.5-12.6 x 1-2.7 cm	6.2-7.8 x 2.1-2.5 cm
inflorescence	sessile to subsessile, peduncles up to 2 mm long	pedunculate, peduncles 2.9-4 cm long
	1-3-flowered cyme	3-5–flowered cyme
Flower		
outer corona lobes	deeply divided into finger-like; segment glabrous, subterete with a blunt apex	deeply bifid; segment hairy, subulate with an acute apex
	nearly as long as inner lobes	about half as long as inner lobes
inner corona lobes	linear-lanceolate	linear-spathulate

outside greenish to pinkish white with reddish brown dots and reddish brown or purple apex. Gynostegium stipitate, stipe 0.8–1 mm long, 1.2–1.4 mm in diam. Corona double; outer lobes 5, joined to form a shallow cup, nearly as long as inner lobes, apex of lobe deeply bifid, segments linear-lanceolate with blunt apices, white to reddish white in color; inner lobes 5, terete, linear-lanceolate with acute apices, 2–2.2 mm long, 0.3–0.35 mm in diameter, incumbent on the backs of the anthers, lower part of lobe reddish brown, apical part usually long, connivent-erect, apex blunt, slightly recurved, creamy white. Pollinaria 5; pollinium broadly ovoid, yellow, 0.38–0.4 mm long, 0.22–0.24 mm wide, translator stout, hyaline, ca. 0.07×0.1 mm, corpusculum spathulate, reddish-brown, 0.27–0.30 mm long, 0.12–0.13 mm wide. Follicles usually 2, linear-lanceolate in outline, green when young and turning reddish brown with age, 13–15 cm long, 0.4–0.5 cm in diameter. Seeds ovate-oblong, 8–10 mm long, 3–4 mm wide; coma 3.5–4.5 cm long, silky white.

Distribution and habitat**:** *Ceropegia digitiformis* is a perennial herb usually found intermingled with grasses and small shrubs in dry deciduous forest. Two populations were found in northeastern Thailand at 200-500 m elevation, one in Phu Wua Wildlife Sanctuary(*M. Kidyoo 1556*) and one other in Phu Langka National Park(*M. Kidyoo 1606*). Ecological observations in the two localities revealed that *C. digitiformis* is most likely adapted to a particular ecological niche. The individuals of *C. digitiformis* always grow in moist, sandy soil or sandy rock substrate of semi-open mountain slopes or sandstone hills at the forest edges (Fig.2A). There are small watercourses running through these areas in the rainy season (May-October), thereby providing necessary moisture and probably nutrients, allowing the plants to rapidly develop new leaves and additional above-ground stems and branches. The plants then flower in August-September. During the dry season (November–April), they lose all of their leaves, and even though the fleshy aerial stems and underground storage organs survive, their growth ceases until the next rainy season.

Etymology: The specific epithet 'digitiformis' refers to the finger-like structure of the outer corona, brought about by division of each outer corona lobe at the apex extending through most of its whole length into two segments. Each segment is linear-lanceolate, subterete, slightly compressed with a blunt apex (Fig.1C & 2G)

Similar species and diagnostic characters

In Thailand, many *Ceropegia* species, i.e. *C. thailandica* Meve, *C. tribounii* Kidyoo, *C. suddeei* Kidyoo, *C. tenuicaulis* Kidyoo, and *C. acicularis* Kidyoo, are grass-like having erect stems arising from subglobose or globose tubers and linear leaves, while others are non-erect herbs. The latter group includes *C. arnottiana* Wight, *C. hirsuta* Wight & Arn., *C. cochleata* Kidyoo, *C. sootepensis* Craib, *C. jucunda* Kerr, *C. siamensis* Kerr and the new species *C. digitiformis.* Within the group of non-erect plants, *C. digitiformis* is clearly distinguished from all the others species by the fact that its perennial fleshy aerial stem persists year round, while those of the other species completely die back each dry season and regrow the following rainy season. Moreover, *C. digitiformis* has an underground stem which grows horizontally just below the soil surface and produces small tubers with fusiform roots. On the contrary, the other species have long slender stem arising either from a cluster of fusiform roots (*C. jucunda* and *C. siamensis*) or from a globose or subglobose tuber (*C. arnottiana*, *C. hirsuta*, *C. cochleata* and *C. sootepensis*). Moreover, *C. digitiformis* has glabrous on both surface of leaves that similar to leaves of *C. jucunda*, but different in texture by fleshy coriaceous in *C. digitiformis* and membranous in *C. jucunda.* While *C. siamensis*, *C. arnottiana and C. sootepensis* have sparasely puberulent or pubescent on upper surface of leaves and have densely pubescent on both surface in *C. hirsuta* and *C. cochleata.* Considering the floral morphology, *C. digitiformis* has a quite unique flower. Its outer corona lobes are nearly as long as the inner lobes and deeply bifids with glabrous linear-lanceolate segments, whereas the other non-erect species have hairy triangular or lanceolate outer corona

lobes which are shorter than or about half length of the inner corona lobes (except for *C. sootepensis* the outer corona lobes of which are glabrous).

The above detailed comparison highlights a number of peculiar morphological characters in *C. digitiformis* which make it quite distinct from others non-erect species occurring in Thailand. After an intensive investigation, it is found that the species most similar to *C. digitiformis* is the Indian and Sri Lankan species *C. thwaitesii* (Table 1). These two species are climbing herbs with glabrous stems and leaves. They produce ovate to lanceolate leaves with ciliated margins and 1-3-flowered inflorescences. Their corolla tubes are inflated at base and progressively broadened to form a funnel-shaped at the apical portion. They have ovate corolla lobes that are folded outward in half lengthwise and joined at their tips. Moreover, both of them have deeply bifid corona lobes. However, while sharing several features, the two species can be reliably distinguished by shapes and hairiness of their outer corona lobes. *Ceropegia digitiformis* has glabrous linear-lanceolate and terete outer corona lobes, each with a blunt apex. These outer corona lobes are nearly as long as the linear-lanceolate inner lobes. On the contrary, *C. thwaitesii* has pubescent linear-lanceolate outer corona lobes, each with an acute apex. Its inner corona lobes are linear-spathulate (see Fig t.4758 in Hooker, 1854). Moreover, the inflorescences of *C. digitiformis* are sessile or subsessile, whereas those of *C. thwaitesii* are distinctly pedunculate.

Additional specimens examined

Ceropegia digitiformis Kidyoo (paratype): THAILAND: Phu Langka National Park, Bueng Kan Province, 500 m, 27 October 2013, *M. Kidyoo 1611* (BCU); Phu Wua Wildlife Sanctuary, Bueng Kan Province, 214 m, 27 July 2013, *M. Kidyoo 1606* (BCU).

Ceropegia thwaitesii Hook.: **SRI LANKA**: *Thwaites, G.H.K. 738* (K).

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