

**TWO NEW SPECIES OF GENUS *Helicteres*
(Helicteroideae, Malvaceae) FROM VIETNAM**

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ABSTRACT

Two new species of genus *Helicteres* (Malvaceae, Helicteroideae), *Helicteres Taynguyenensis* and *Helicteres dakmilensis* from the Central Highlands of Vietnam are described and illustrated. *H. taynguyenensis* is morphologically similar to *Helicteres angustifolia* widely distributed in mainland SE Asia to China, Japan and Australia, but differs from the latter by having shorter petioles, larger calyx and petals, and longer androgynophores. *Helicteres dakmilensis* is closely related to *Helicteres poilanei* endemic to Vietnam, but distinguished by shorter petioles, fewer secondary veins, persistent stipules and bracts, larger calyx and fruits. The IUCN conservation status, vernacular name, illustrations, photographs, and comparison with the closest allies are provided for each of the new species.

Keywords: Dak Nong province, *Helicteres*, Helicteroideae, new species, taxonomy.

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INTRODUCTION

Helicteres Linnaeus is a genus of shrubs and small trees distributed in the tropics of Asia and America (Mabberley, 2017). The genus comprises about 60 species of open or secondary habitats, where they are easy to find (Dang et al., 2020). The centre of diversity of the genus lies in central and South America where 38 species are recorded (Cristóbal, 2001).

The genus was established in 1753 based on two species, *Helicteres angustifolia* L. and *Helicteres isora* L. It was traditionally placed in the family Sterculiaceae (Cronquist, 1981). Later, based on molecular phylogenetic studies, *Helicteres* was placed in the family Malvaceae s.l. (APG IV, 2016; Mabberley, 2017). Genus *Helicteres* is a member of the subfamily Helicteroideae together with other genera such as *Achantia* A.Chev., *Boschia* Korth., *Coelostegia* Benth., *Cullenia* Wight, *Durio* Adans., *Hypophyllanthus* Regel, *Kostermansia* Soegeng, *Lahia* Hassk., *Mansonia* J.R.Drumm., *Neoregnellia* Urb., *Reevesia* Lindl., *Triplochiton* Alef., *Veeresia* Monach. & Moldenke, however differs from them in having androgynophore, united sepals, clawed petals, capsular fruit, cylindrical, fusiform or ovoid, spiral or rarely straight and hairy fruits and wingless seeds due to parenchymal expansion (Cristóbal, 2001; Nyffeler et al., 2005; Tang et al., 2007; Chantaranothai & Poompo, 2020; Hoang et al., 2020; Dang et al., 2020).

Helicteres is represented by seven species in India (Masters, 1874), four species in Java (Backer & Van den Brink, 1963), ten species each in Thailand (Phengklai, 2001, Chantaranothai & Poompo, 2020), and China (Tang et al., 2007), seven species in Venezuela (Rondón & Cumana-Compos, 2007) and 13 species in Australia (Cowie, 2011). Tardieu-Blot (1945) documented 13 species of *Helicteres* from the Indo-China region, with six of them from Vietnam. Pham (1999) illustrated seven species and two varieties of *Helicteres* presented in Vietnam. Lately, Dang et al. (2020) reported ten species

and one variety of *Helicteres* for the flora of Vietnam namely *Helicteres angustifolia* L., *Helicteres angustifolia* var. *glaucoides* Pierre, *Helicteres binhthuanensis* V.S.Dang, *Helicteres daknongensis* V.S.Dang & D.T.Bui, *Helicteres elongata* Wall. ex Bojer, *Helicteres hirsuta* Lour., *Helicteres isora* L., *Helicteres lanceolata* DC., *Helicteres lanata* (Teijsm. & Binn.) Kurz, *Helicteres poilanei* Tardieu and *Helicteres viscida* Blume.

During our field surveys to evaluate the diversity of medicinal plants in the Tay Nguyen plateau of southern central Vietnam during 2019–2020, we collected two interesting specimens of *Helicteres*. After consulting available literature on the genus in Vietnam and adjacent areas (Tardieu-Blot, 1945; Pham, 1999; Phengklai, 2001; Tang et al., 2007; Dang et al., 2020) and comparing the findings against the specimens of *Helicteres* deposited in Institute of Ecology and Biological Resources (HN), Institute of Tropical Biology (VNM) and Vietnam National Museum of Nature (VNMN), those available on the web Harvard University (A), The Natural History Museum (BM) and Muséum National d'Histoire Naturelle (P) (acronyms follow Thiers, 2022), we concluded that our collections belong to two undescribed species of *Helicteres*, which we formally describe below.

MATERIALS AND METHODS

Studied materials were collected from Quang Truc commune of Tuy Duc district and Dak Lao commune of Dak Mil district, Dak Nong province, Vietnam. The measurements and description of the new species are based on our observations of the living and dried specimens. Voucher specimens were thoroughly processed using the standard protocol (Jain & Rao, 1977) and deposited in the VNM Herbarium. Detailed photographs were taken with a Canon 1000D camera fitted with an EF 100 mm f/2.8 Macro USM lens. The conservation assessment of the new species was undertaken following the International Union for Conservation of Nature (IUCN, 2022) criteria.

RESULTS

***Helicteres taynguyenensis* V.S.Dang, Vuong & Naiki, sp. nov.** (Figs. 1, 2)

The new species is similar to *H. angustifolia* Linnaeus in its shrubby habit, shape of leaves and axillary inflorescences. It

is distinguished from the latter in having densely yellowish brown stellate puberulent on branches (vs. gray greenish puberulent), calyx lobes 4–5 mm long (vs. 3–4 mm long) and petals (10–13 mm long vs. 5–10 mm long), and longer androgynophores (8–10 mm long vs. 3–7.5 mm long).

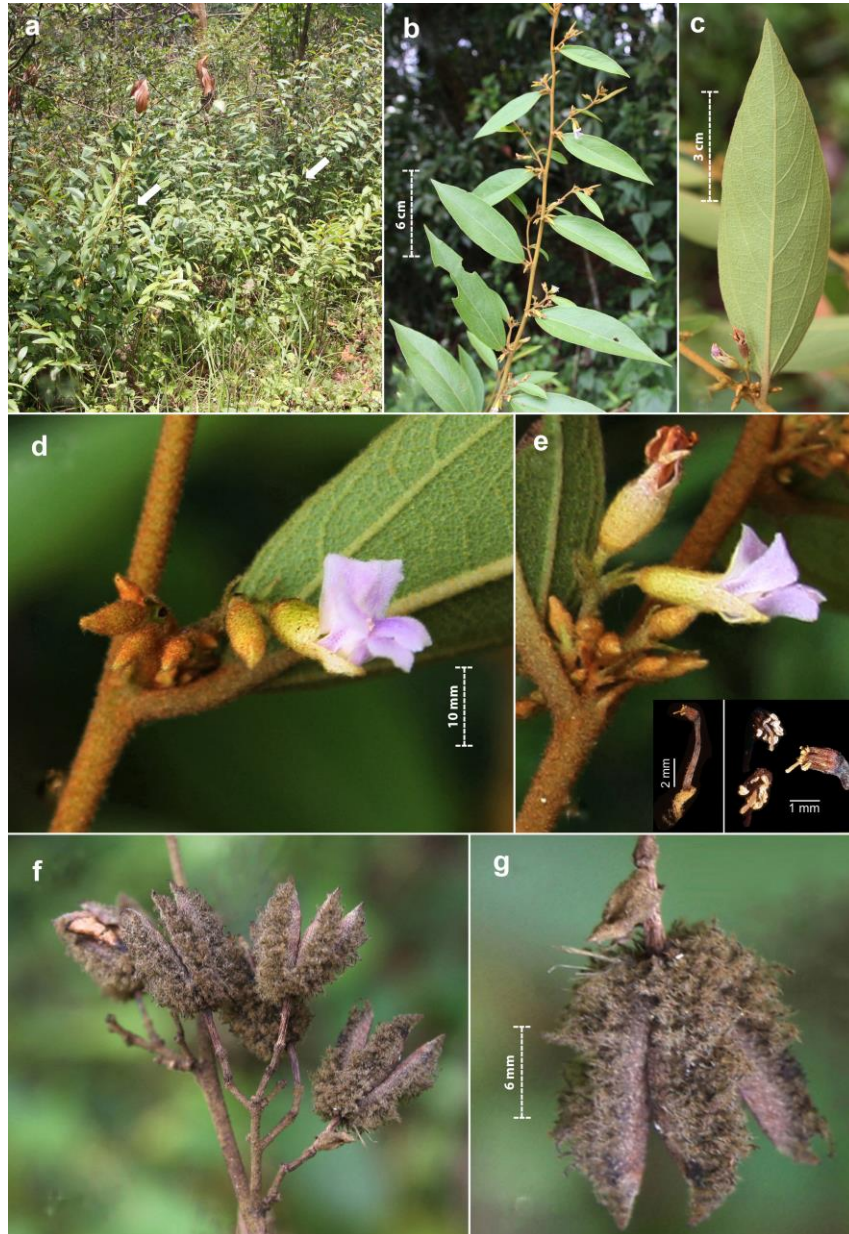


Figure 1. Helicteres taynguyenensis V.S.Dang, Vuong & Naiki, sp. nov. (from the holotype, VNM). a) Habit; b) Flowering branches; c) Leaf abaxial surface; d) and e) Close-up of axillary inflorescence, flowers and androgynophore; f) and g) Close-up of fruits [Photo: Van Son Dang]

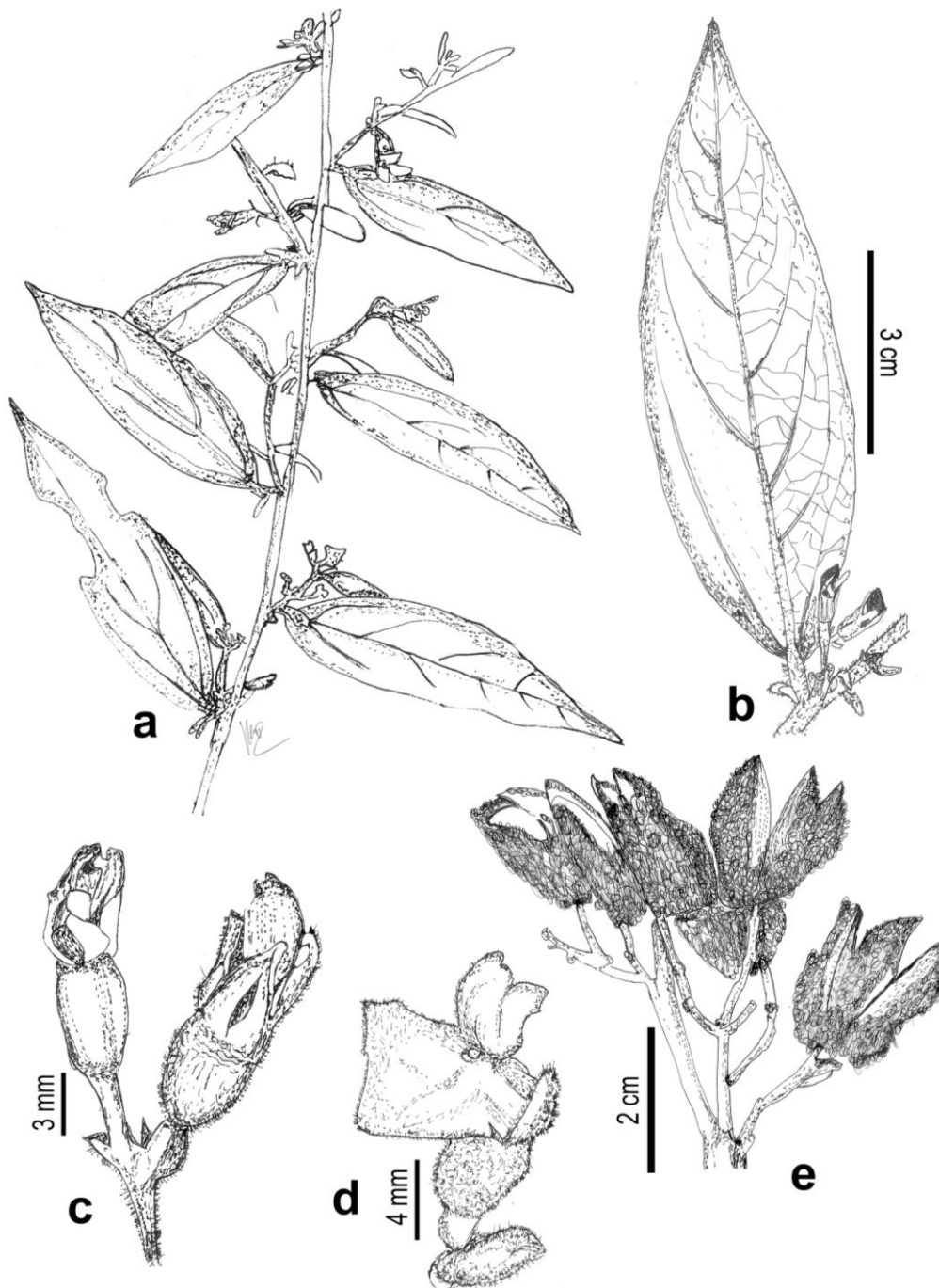


Figure 2. *Helicteres taynguyenensis* V.S.Dang, Vuong & Naiki, sp. nov. (from the holotype, VNM). a) Flowering branches; b) Leaf abaxial surface; c) and d) Close-up of axillary inflorescence and flowers; e) Close-up of fruits [Drawn: Ba Vuong Truong]

Shrubs, 1–1.5 m tall; branches terete, 1–2 mm in diam., densely yellowish brown stellate puberulent. Leaves alternate; leaf

blades elliptic, oblong-lanceolate or oblanceolate, 8–10.5 × 2–3.5 cm, coriaceous, yellowish brown when dry, above surface

glabrous except midrib and secondary veins, beneath surface densely brownish puberulent, apex acute or acuminate to obtuse, base subrounded or obtuse, symmetric, margin entire; midrib flat above surface, distinct and prominent beneath surface; secondary veins 4–6 pairs, flat or obscure above surface, slightly prominent beneath surface; petioles 2–3 mm long, densely yellowish brown puberulent. Stipules persistent, 4–6 mm long, linear or filiform, densely pubescent. Inflorescences axillary, cymose, 10–20 mm long, 2–10-flowered; bracts 1–3 mm long; peduncles 1–3 mm long. Flowers with short pedicel, 1–2 mm long. Calyx tubular to campanulate, 10–12 mm long, whitish green, villous to hirsute; tube 6–7 mm long; lobes 5, triangular, 4–5 mm long, tips acute. Petals 5, unequal in length, 11–13 mm long, whitish pink or purplish, darker at base, reflexed at anthesis, limb broadly cuneate, hirsute, with callus near base, apex truncate, 3 shorter petals with 1–2 auricles on margins of claw; 2 longer petals with 2 prominent appendages on claw. Androgynophore 8–10 mm long, straight, tomentose at base; stamens 10, connate at base. Staminodes 5, linear to lanceolate, short; filaments coalescent, surrounding ovary; anthers oblong. Ovary

ovoid, 5-locular, tomentose; style 1–1.5 mm long; stigma 5-toothed, terete. Fruit a capsule, ovate to oblong, 1.2–1.6 × 0.8–1.2 cm, splitting in 5 longitudinal lobes, villous, apex beaked, black when mature; seeds many, small, 2–3 × 1.5–1.8 mm, irregularly rugose, dark brown when dry.

Types

Vietnam, Dak Nong province, Tuy Duc district, Quang Truc commune, 250 km south of Ho Chi Minh City, at the edge of the secondary forest, 12°15'08.40"N, 107°14'58.08"E, elev. 800 m, 20 November 2019, Van Son Dang & Nguyen Tran Nhan Tam, Dang 148 (holotype VNM!; isotypes HN!, VNM!, VNNM!).

Distribution and habitat

Helicteres taynguyenensis is only known from the Tuy Duc district, Dak Nong province, Vietnam. It grows at the edges of the secondary forests dominated by the species belonging to Connaraceae, Poaceae, Fabaceae, Melastomataceae, Euphorbiaceae, Clusiaceae and Myrtaceae.

Phenology

Flowering and fruiting specimens were collected in November.

Table 1. Comparison of *Helicteres taynguyenensis* V.S.Dang, Vuong & Naiki, sp. nov. and *Helicteres angustifolia* (the characters of *Helicteres angustifolia* are taken from Pham (1999), Phengklai (2001), Tang *et al.* (2007), Cowie (2011))

Characters	<i>Helicteres taynguyenensis</i>	<i>Helicteres angustifolia</i>
Indumentum on branches	Densely yellowish brownstellate puberulent	Gray greenish puberulent
Petiole length	2–3 mm	3–15 mm
Size of leaf blade	8–10.5 × 2–3.5 cm	3–15 × 1–4 cm
Secondary veins	3–4 pairs	3–7 pairs
Stipule length	4–6 mm	3.5–6 mm
Bract length	1–3 mm	1.5–2 mm
Calyx tube length	6–7 mm	ca. 6 mm
Calyx lobe length	4–5 mm	3–4 mm
Color at anthesis	Whitish pink or purplish	Bluish or pink
Petal length	10–13 mm	5–10 mm
Androgynophore length	8–10 mm	3–7.5 mm
Number of staminodes	5	unknown
Size of fruits	2–2.5 × 1–1.5 cm	1–3 × 0.5–1.5
Seed length	2–3 mm	2–3.5 mm

Etymology

The specific epithet “*taynguyenensis*” refers to the type locality of the new species, the Central Highlands (Tay Nguyen), southern central Vietnam.

Vernacular name

To ken Tay Nguyen.

Preliminary conservation assessment

Helicteres taynguyenensis was collected from a small population with less than 200 mature individuals at the edges of the secondary forests in the Tuy Duc district of Dak Nong province at an elevation of 800–900 m. The habitat of this new species is prone to disturbance by anthropogenic activities. Thus, following the IUCN Red List Categories (IUCN 2022), we propose its status as Vulnerable (VU).

Notes

Helicteres taynguyenensis is morphologically most close to *H. angustifolia* L., which is widely distributed in Australia, Cambodia, China, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Thailand, and Vietnam, but differs from the latter in the several characters indicated in Table 1.

Helicteres dakmilensis V.S.Dang, Vuong & Bao, sp. nov. (Figs. 3, 4)

The new species is similar to *H. poilanei* Tardieu in the shape of leaves and axillary inflorescences. It differs from the latter in having shorter petioles (2–3 mm long vs. 10 mm long), fewer secondary veins (3–4 pairs vs. 4–5 pairs), obvious bracts 1–2.5 mm long (vs. inconspicuous), larger calyx (6–8 mm long vs. ca. 6 mm long), and bigger fruits 2–2.5 × 1–1.5 cm (vs. 1.5–2 × 0.8–1 cm).

Small shrubs, up to 1.5 m tall; branches slender, 1–2 mm in diam., glabrous or subglabrous to sparsely strigose when young. Leaves alternate; blades oblanceolate to oblong-lanceolate, 6–8 × 2–3 cm, coriaceous, above surface dark green and subglabrous, abaxially greyish white and soft puberulent, apex obtuse or slightly acute, base rounded to subcordate, symmetric, denticulate along

apical half, margin entire; veins slightly depressed or dull at above surface, prominent at beneath; secondary veins 3–4 pairs; petioles 2–3 mm long, densely puberulent. Stipules persistent, 4–7 mm long, filiform or linear, densely pubescent. Inflorescences axillary, cymose, 7–15 mm long, with 1–3 flowers; bracts 1–2.5 mm long; peduncles 2–6 mm long. Flowers with short pedicel, 1–1.5 mm long. Calyx tubular to campanulate, 6–8 mm long, 5 lobes, covered densely villous; tube portion 4–5 mm long; upper portion free; lobes unequal, lanceolate to triangular, 2–3 mm long. Petals not seen. Fruit a capsule, ovoid to ellipsoid, 2–2.5 × 1–1.5 cm, splitting along 5 locules when dehiscent, densely villous, apex short-beaked, dark brown when mature; seeds numerous, rhomboid, small, 1.5–2 × 1–1.5 mm, dark brown when dry.

Types

Vietnam, Dak Nong province, Dak Mil district, Dak Lao commune, 250 km south of Ho Chi Minh city, in deciduous and dry dipterocarp forest, 12°31'56.40"N, 107°38'28.08"E, elev. 550 m, 21 November 2019, Van Son Dang & Nguyen Tran Nhan Tam, Dang 139 (holotype VNM!; isotypes HN!, VNM!, VNNM!).

Distribution and habitat

Helicteres dakmilensis is only known from Dak Mil District, Dak Nong Province, southern central Vietnam. It occurs in deciduous and dry dipterocarp forests, at an elevation of around 500–600 m. The forest is dominated by *Dipterocarpus intricatus* Dyer, *Dipterocarpus obtusifolius* Teijsm. ex Miq., *Dipterocarpus tuberculatus* Roxb. (Dipterocarpaceae), *Dillenia ovata* Wall. ex Hook.f. & Thomson (Dilleniaceae), *Cratogeomys formosum* (Jack.) Benth. & Hook.f. ex Dyer (Hypericaceae), *Anogeissus acuminata* (Roxb. ex DC.) Wall. ex Guill. & Perr. (Combretaceae), *Buchanania siamensis* Miq., *B. glabra* Wall. (Anacardiaceae), *Stereospermum fimbriatum* DC. (Bignoniaceae), *Canarium subulatum* Guillaumin (Burseraceae), *Irvingia malayana* Oliv. ex A.W.Benn. (Irvingiaceae).

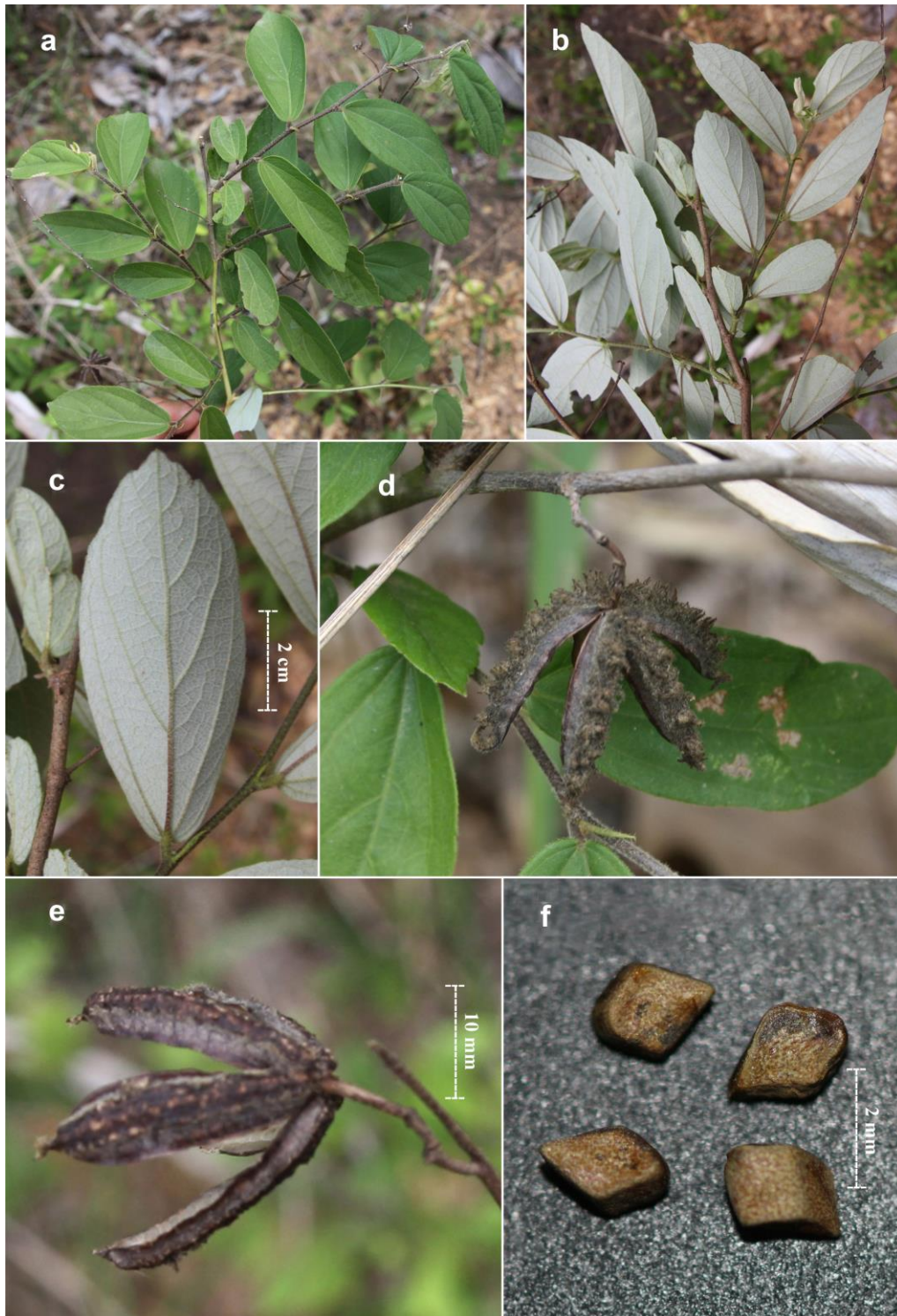


Figure 3. *Helicteres dakmilensis* V.S.Dang, Vuong & Bao, sp. nov. (from the holotype, VNM).
a) and b) Fruiting branches; c) Leaf abaxial surface; d) and e) Close-up of fruits; f) Seeds
[Photo: Van Son Dang]

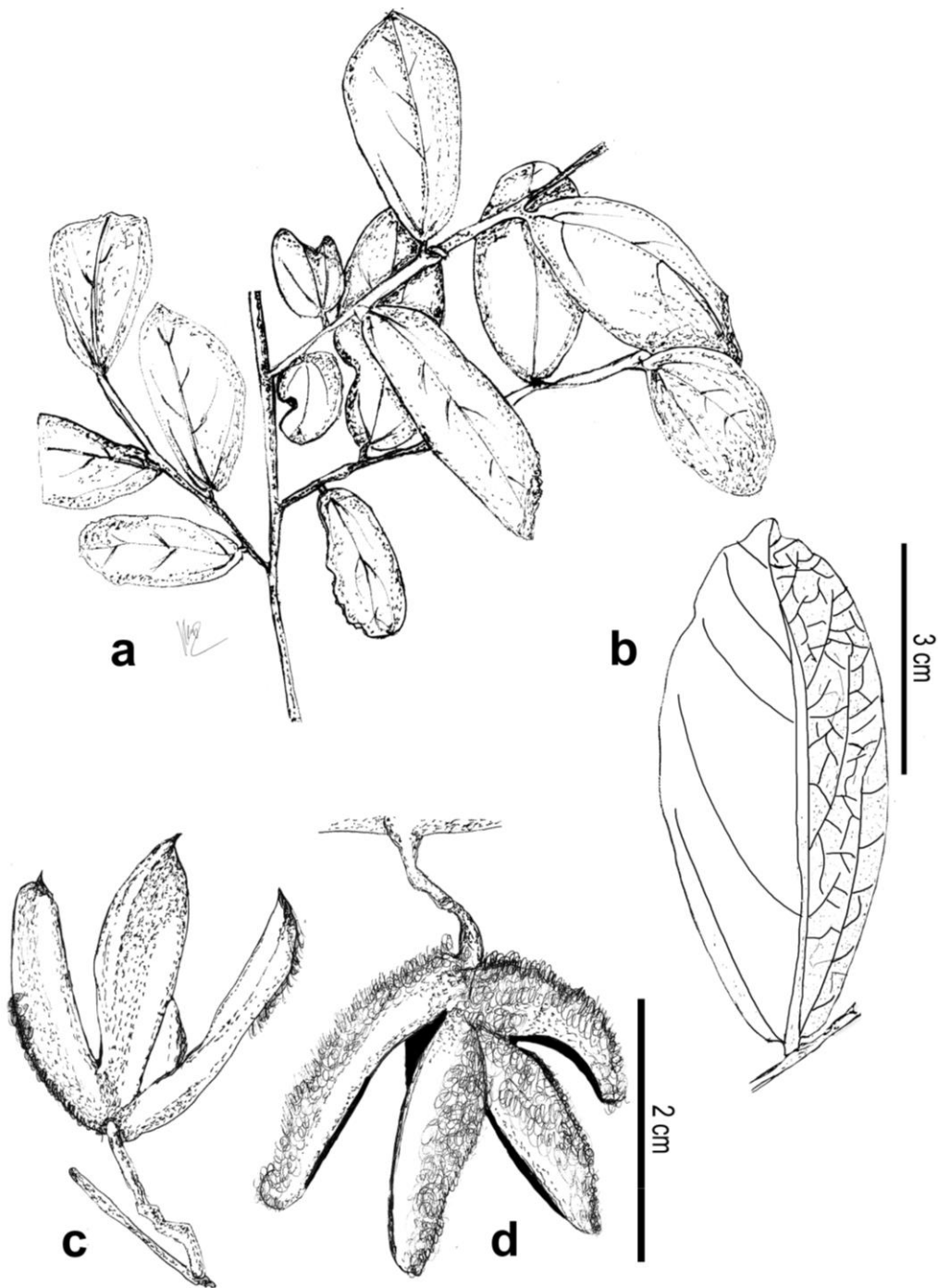


Figure 4. *Helicteres dakmilensis* V.S.Dang, Vuong & Bao, sp. nov. (from the holotype, VNM).
a) Branches; b) Leaf abaxial surface; c) and d) Close-up of fruits [Drawn: Ba Vuong Truong]

Phenology

The species flowers in July and develops fruits in November.

Etymology

The species epithet is derived from the name of the type locality, Dak Mil District

(Dak Nong province, southern central Vietnam).

Vernacular name

To ken Dak Mil.

Preliminary conservation assessment

Helicteres dakmilensis was collected from a single population with less than 10 mature individuals in deciduous and dry dipterocarp forests, prone to anthropogenic

activities. Therefore, we propose its conservation status as Critically Endangered (CR) based on the IUCN Red List Categories (IUCN 2022).

Notes

Helicteres dakmilensis is morphologically allied to *H. poilanei* Tardieu which is endemic to Vietnam but differs from the latter in several characters mentioned in Table 2.

Table 2. Comparison of *Helicteres dakmilensis* V.S.Dang, Vuong & Bao, sp. nov. with *Helicteres poilanei* (the characters of *Helicteres poilanei* are taken from Tardieu-Blot (1942), Dang 332* and Poilane 8978*)

Characters	<i>Helicteres dakmilensis</i>	<i>Helicteres poilanei</i>
Plant height	up to 1.5 m	0.5 m
Indumentum on branches	Glabrous or subglabrous to sparsely strigose	Stellate puberulent
Petiole length	2–3 mm	10 mm
Size of leaf blade	6–8 × 2–3 cm	8–10 × 2–3 cm*
Secondary veins	3–4 pairs	4–6 pairs
Stipule length	4–7 mm	Early deciduous
Bract length	1–2.5 mm	Inconspicuous
Calyx length	6–8 mm	ca. 6 mm
Size of fruits	2–2.5 × 1–1.5 cm	1.5–2 × 0.8–1 cm*
Seed length	1.5–2 mm	1–1.5 mm*

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