

Didymocarpus sinoindicus (Gesneriaceae), a new species from India and China

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Abstract: We describe a new species of Gesneriaceae, *Didymocarpus sinoindicus* N.S.Prasanna, Lei Cai & V.Gowda from India and China with detailed morphological description, diagnostic characters, illustrations, and colour photographs. The new species is morphologically similar to *D. oblongus* Wall. ex D.Don, *D. hookeri* C.B.Clarke, and *D. adenocalyx* W.T.Wang, but can be easily distinguished from them by its remarkable creamy-white to greenish-yellow sepals and petals and characteristic purple striations on corolla lobes.

Keywords: Kingdon-Ward, Nagaland, Northeast India, Saramati hills, Tengchong, Yunnan.

Introduction

The genus *Didymocarpus* Wall. (Gesneriaceae) was originally considered a large genus having different taxonomic affinities and distributed in Madagascar, Western Ghats and Southeast Asia (Burtt, 1998[“1997”]). After recircumscription of the genus based on morphological characters (Weber & Burtt, 1998[“1997”]; Weber *et al.*, 2000) and further supported by molecular phylogenetic data (Möller *et al.*, 2011; Möller & Clark, 2013), the genus now has over 100 species, distributed from the Himalayas to Malay Peninsula (Möller, 2019; Souvannakh-

oummene *et al.*, 2019; Yang *et al.*, 2019; Adhikari & Möller, this issue). China harbours the highest diversity of this genus with 34 species and five varieties, followed by India with 23 species and two varieties (Möller *et al.*, 2016, 2017; Möller, 2019; Wen *et al.*, 2019; Yang *et al.*, 2019; Lahiri *et al.*, 2020). Several new taxa have been discovered and rediscovered from both China and India recently (Cai *et al.*, 2016; Joe *et al.*, 2016; Yang *et al.*, 2019; Prasanna & Gowda, 2020). In China, *Didymocarpus* is mainly distributed in the South and Southwest of the country (Wang *et al.*, 1998; Cai *et al.*, 2016), whereas in India, the Sikkim-Himalayan region has the highest diversity followed by the Indo-Burma region (Sinha & Datta, 2016; Pandey *et al.*, this issue; Prasanna & Gowda, 2020).

During our field expeditions in Northeast India in 2018, we (NSP, PS, and VG) came across a morphologically distinct, unidentified species of Gesneriaceae. By coincidence, similar specimens were collected by DTL, SZD, and LC from Mt. Gaoligong of western Yunnan, China in 2019. Our field collections included herbarium vouchers, spirit samples, and molecular grade leaf tissues in silica. We took detailed morphological measurements from both fresh samples and preserved flowers using a ruler and digital calipers, and all collections are deposited at BHPL, ASSAM and KUN. Based on

the presence of two fertile stamens, a disc-like stigma, an orthocarpic ovary, and a bivalve capsule which dehisces loculicidally, we attributed it to the genus *Didymocarpus* (Weber & Burtt, 1998[“1997”]). In order to identify the specimens, we extensively examined *Didymocarpus* protologues, monographs and regional revisions (Kanjilal *et al.*, 1939; Wang *et al.*, 1990, 1998; Grierson & Long, 2001; Sinha & Datta, 2016; Roy, 2017). We also consulted herbarium collections including type specimens from ARUN, ASSAM, BHPL, BM, BSHC, CAL, E, HITBC, IBK, K, KUN, PE, digital images from C, M, TCD, and online databases (Global Plants: <https://plants.jstor.org/>; Muséum national d’Histoire naturelle: <https://science.mnhn.fr/>; Smithsonian Institution: <https://www.si.edu/>; The Linnean Collections: <http://linnean-online.org/>; Chinese Virtual Herbarium: <http://www.cvh.ac.cn/>). After comparisons with taxa having similar morphological characters and from related geographic ranges, we came to the conclusion that the specimens being studied represented a new species of *Didymocarpus*. We describe it here as *Didymocarpus sinoindicus* and compare it with three morphologically similar species *D. oblongus* Wall. ex D. Don, *D. hookeri* C.B. Clarke, and *D. adenocalyx* W.T. Wang (Table 1), and illustrate it with photographs and line drawings. We evaluated the conservation status for the species according to the International Union for Conservation of Nature guidelines (IUCN, 2019).

Didymocarpus sinoindicus N.S. Prasanna, Lei Cai & V. Gowda, **sp. nov.** **Figs. 1, 2 & 3**

Didymocarpus sinoindicus is morphologically similar to *D. oblongus* Wall. ex D. Don, but differs from it in having longer petioles (1.5–6.5 cm *vs.* 0.2–1.5 cm long), bicrenate or serrate leaf margins (*vs.* serrate to doubly serrate), and creamy-white to greenish-yellow (*vs.* purplish) corolla tube. It differs from *D. hookeri* C.B. Clarke in having shorter stems (2–8 cm *vs.* 4–17 cm long), and glabrous (*vs.* pubescent) corolla tubes. The new species differs from *D. adenocalyx* W.T. Wang in having glandular pedicels and calyces (*vs.* eglandular), and shorter corolla tubes (0.7–1 cm *vs.* c. 1.4 cm long).

Type: INDIA, Nagaland, Kiphire district, Mount Saramati, N 25°45'11", E 94°59'26", 2580 m, 29.08.2018, Preeti Saryan VG2018NL3679 (holo BHPL!; iso ASSAM!).

Perennial, lithophytic herbs. 6–15 cm tall. Dry season stem inconspicuous, juvenile leaves distinct, blades with much denser indumentum than when mature. Rainy season stem dark purple, erect, 2–8 × 0.2 cm, terete, densely puberulent with multicellular eglandular hairs, densely covered with globular golden pigment glands. Leaves 2–3 pairs, opposite and anisophyllous, decussate, whorled at the top of the stem; petioles terete, 1.5–6.5 cm long, eglandular pubescent and pigmented as on the stem; lamina ovate to oblong or falcate oval, 4–20 × 2–10.5 cm, base cuneate or oblique, occasionally rounded, margins bicrenate or serrate; apex obtuse to acute; adaxial surface dark green, pubescent with multicellular eglandular hairs interspersed with globular golden pigment glands; abaxial surface light green, sparsely eglandular pubescent along the veins, glabrous otherwise, sparsely covered with pigment glands; midrib with 6–10 lateral veins on each side, depressed adaxially, raised abaxially. Inflorescences 1–4, pair-flowered cymes, 6–25-flowered, pedunculate, axillary towards the top of the stem or terminal; peduncle terete, 2–5 cm long, light green, pubescent with multicellular hairs, pigment glands present, glands dense between bracteoles and the peduncle; paired bracteoles present at each dichotomous fork; primary bracteoles (at first inflorescence fork) 2, cupular, ovate to orbicular, 0.6–1.2 × 0.6–1.0 cm, opposite, connate at base, light green, margins entire or sometimes crenate, glabrous, rarely pubescent towards margins, ventral surface sparsely glandular, veins visible when dried; secondary bracteoles (at subsequent inflorescence fork) cupular to navicular, ovate to suborbicular, c. 2 × 6 mm, connate at base, greenish-white, ventral surface sparsely glandular; pedicels 0.5–1 cm long, sparsely covered with gland tipped multicellular hairs, pigment glands present. Calyx campanulate, 4–6 mm long, creamy-white to greenish-yellow, basally connate, 5-lobed, to c. 1/5 of the length; lobes ovate to ovate-triangle,

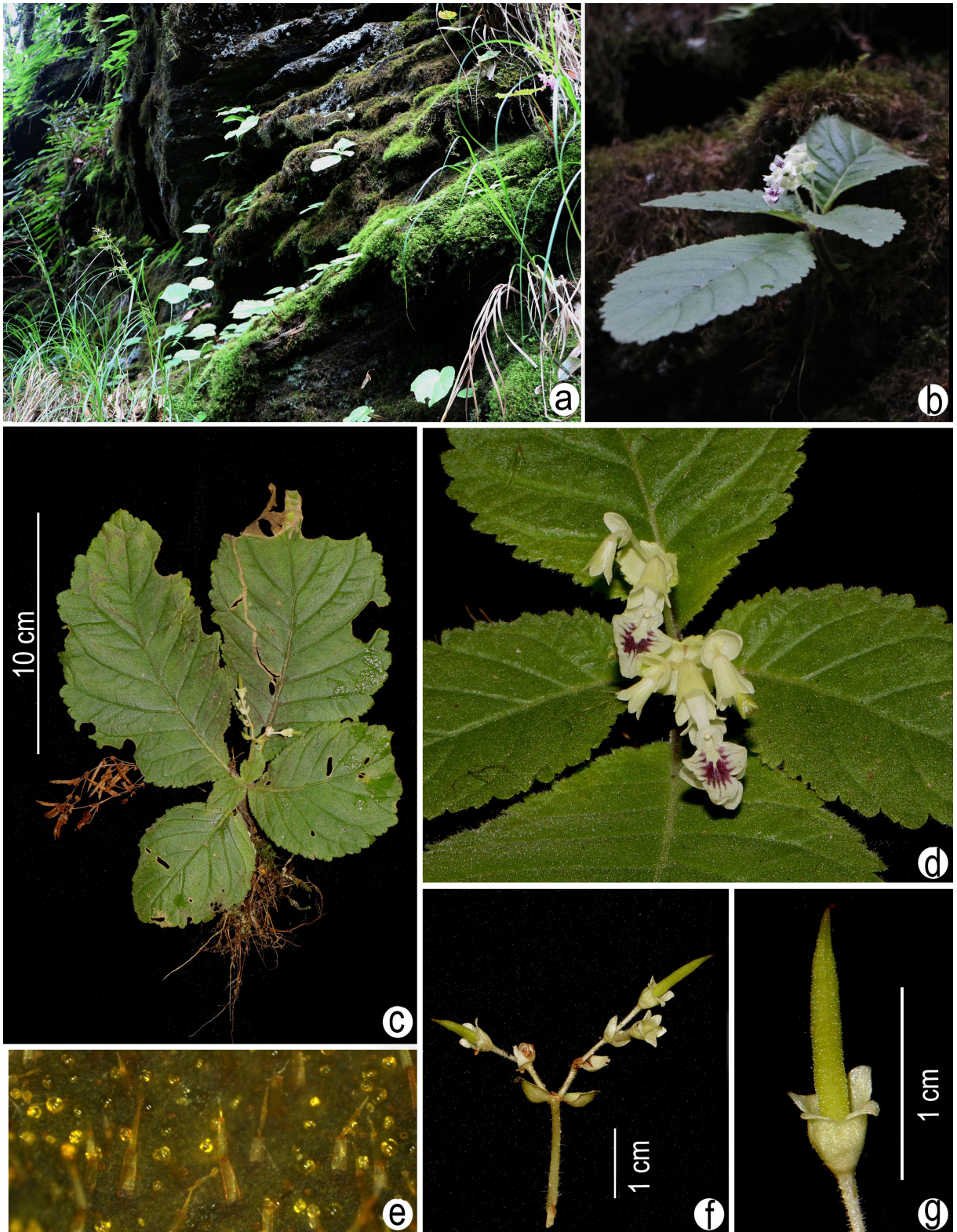


Fig. 1. *Didymocarpus sinoindicus* N.S.Prasanna, Lei Cai & V.Gowda in India: **a.** Habitat; **b.** Habit; **c.** Whole plant with inflorescence and infructescence; **d.** Inflorescence; **e.** Glands on the abaxial surface of leaves; **f.** Cyme with fruits; **g.** Young fruit (photos by Preeti Saryan).

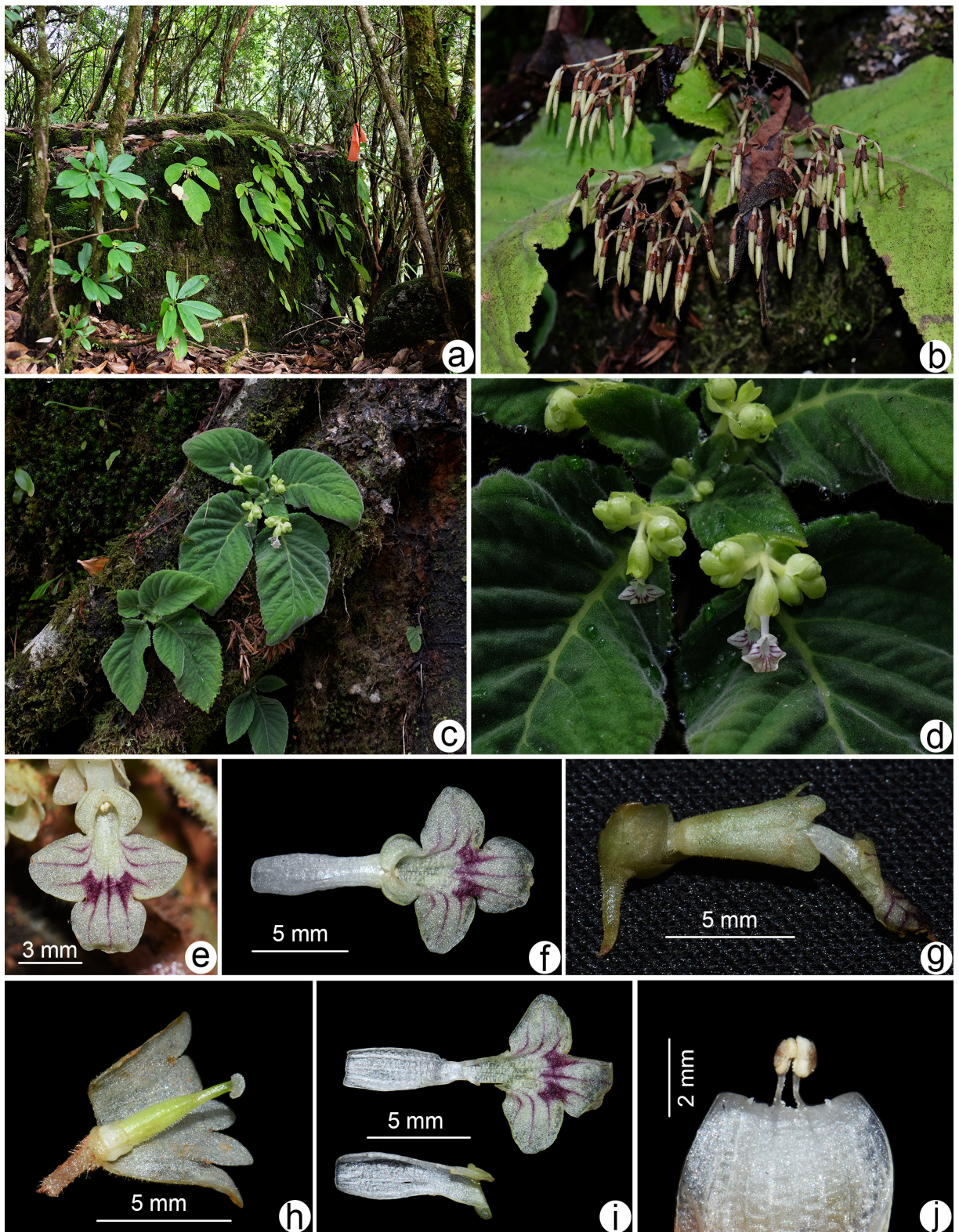


Fig. 2. *Didymocarpus sinoindicus* N.S.Prasanna, Lei Cai & V.Gowda in China: **a.** Habitat; **b.** Fruits; **c.** Plants with flowers and old fruits; **d.** Inflorescence and adaxial leaf surface; **e.** Mouth of a flower; **f.** Front view of corolla; **g.** Lateral view of flower showing calyx and bracts; **h.** Pistil with calyx and disc; **i.** Opened corolla showing internal structure; **j.** Stamens and staminodes (photos by Lei Cai & De-Tuan Liu).

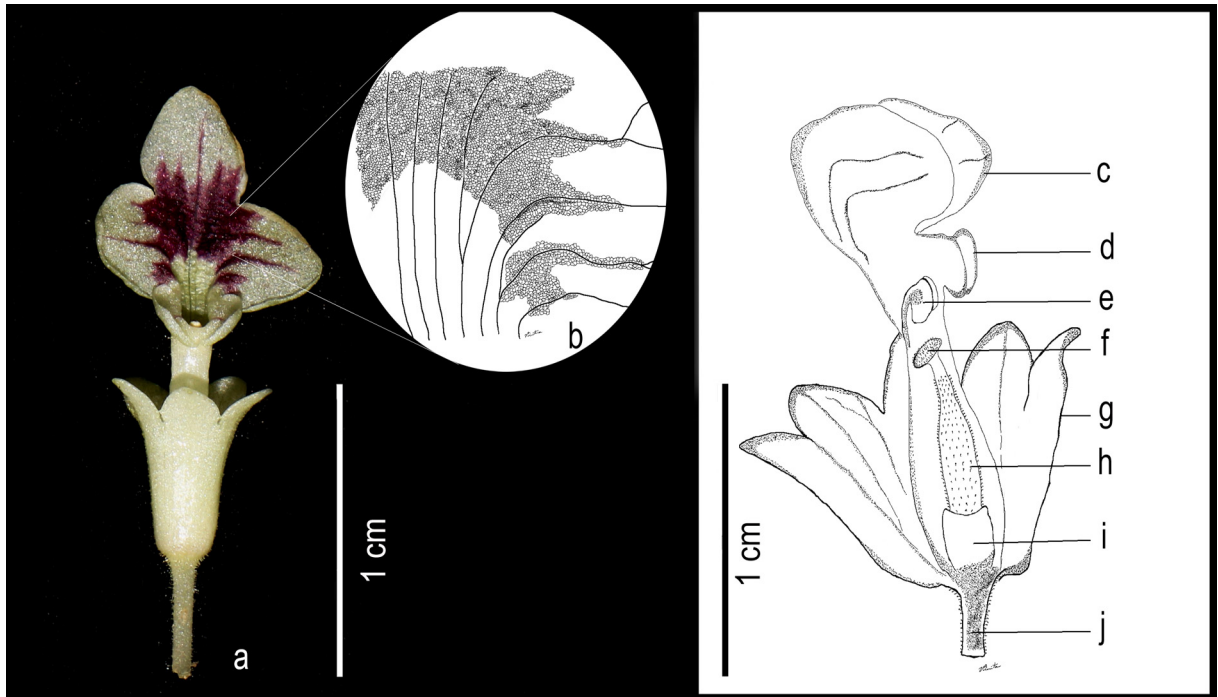


Fig. 3. *Didymocarpus sinoindicus* N.S.Prasanna, Lei Cai & V.Gowda: **a.** Flower; **b.** Blotch at the junction of the three lower lobes; **c.** Lower lobes; **d.** Upper lobes; **e.** Androecium; **f.** Stigma; **g.** Calyx; **h.** Ovary; **i.** Disc; **j.** Pedicel (photos by Preeti Saryan; illustration by Vinita Gowda).

Table 1. Comparison of morphological characters of *D. sinoindicus*, *D. adenocalyx*, *D. hookeri* and *D. oblongus*

Characters	<i>D. sinoindicus</i> N.S.Prasanna, Lei Cai & V.Gowda	<i>D. adenocalyx</i> W.T.Wang*	<i>D. hookeri</i> C.B.Clarke**	<i>D. oblongus</i> Wall. ex D.Don***
Stem	2–8 cm long	c. 20 cm long	4–17 cm long	2.5–17 cm long
Lamina	4–20 × 2–10.5 cm, bicrenate or serrate, Pigment glands present	1.8–4.2 × 1.5–2.4 cm, denticulate, pigment glands absent	4–17 × 3–7 cm, crenate to serrate, pigment glands present	1.5–12.5 × 1.2–4.5 cm, serrate to doublyserrate, pigment glands present
Petioles	1.5–6.5 cm long	0.4–1.1 cm long	4–7 cm long	0.2–1.5 cm long
Peduncles	Glandular	Eglandular	Glandular	Glandular
Calyx tube	3.5–4 mm long, glandular	c. 2.6 mm long, eglandular	2–3 mm long, eglandular	2–3.5 mm long, eglandular
Corolla tube	0.7–1 cm long, glabrous, creamy-white to greenish-yellow	c. 1.4 cm long, glabrous, reddish purple	2–2.5 cm long, pubescent, yellowish white	0.8–1.4 cm long, glabrous, purplish
Staminal filament	0.8–1.5 mm long	c. 4 mm long	5.5–7.2 mm long	c. 5 mm long
Staminodes	Inconspicuous or minimal, c. 0.15 mm long	1.2–1.5 mm long	c. 2 mm long	Inconspicuous

*Based on Wang (1986), Wang *et al.* (1990, 1998); ** Clarke (1874), Sinha & Datta (2016), Roy (2017); *** Don (1825), Grierson & Long (2001), Roy (2017).

equal, 1–1.8 × 1–1.5 mm, covered with peltate pigment glands outside, glabrous inside. Corolla bilabiate creamy-white to greenish-yellow with purple striations on the limbs; tube 7–10 × 1.5–3 mm, broader at the base, narrow towards lobes, glabrous; corolla limb bilabiate, glabrous, eglandular, upper lip 2-lobed, lobes suborbicular, 1.5–2 × 1 mm, held at right angles to the lower lobes, creamy white, lower lip 3-lobed, lobes semiorbicular to ovate, 3–4 × 3–4 mm, creamy-white with purple blotch at the junction of the three lower lobes, purple striations extending from the base of each lobe towards the tip. Stamens 2, adnate to corolla, 5–6 mm from the base, inserted above the midpoint of the tube; filaments 0.8–1.5 mm long, glabrous; anthers *c.* 0.8 mm long, glabrous, dorsifixed, coherent by adaxial surfaces, exerted. Staminodes 2, inconspicuous or minimal, *c.* 0.15 mm long, adnate to corolla 5–6 mm from base. Disc tubular with undulating upper margins, 1–1.2 mm long, glabrous, persistent. Pistils 5.5–6.5 mm long. Ovary cylindrical, 3–3.5 mm long, stipe absent, covered with peltate pigment glands; style *c.* 2 mm long, glabrous; stigma peltate, pubescent. Capsules linear, bivalved, dehisce loculicidally, *c.* 1.4–1.6 × 0.15 cm, covered with glands; seeds unknown.

Flowering & fruiting: Flowering from July to September in India and April to August in China and fruiting from August to November in both India and China.

Habitat: *Didymocarpus sinoindicus* grows on moss covered, rocky cliffs in heavily shaded forests at an altitude of 2200 to 2600 m. In India, it occurs along with *Rhododendrons* in the temperate forests. In China, it occurs in evergreen broad-leaved forest along with *Rhododendron delavayi* Franch., *R. ovatum* (Lindl.) Planch. ex Maxim., *Vaccinium* sp. and *Gaultheria griffithiana* Wight (Ericaceae), *Viburnum cylindricum* Buch.–Ham. ex D. Don (Caprifoliaceae), *Myrsine semiserrata* Wall. (Myrsinaceae), *Rubus lineatus* Reinw. (Rosaceae) and a few other species of Theaceae and Fagaceae.

Distribution: Currently, it is known from only two locations in India and one location in China, all of

them bordering Myanmar. In India, the type locality is near the base camp of Mount Saramati in Kiphire district in the northeastern state of Nagaland. There is a historical collection site on the nearby Japvo ridge in Nagaland. In China, it is found in Danzha Village of Tengchong in Yunnan Province. It is likely to be present in the high elevation areas of Sagaing and Kachin states of northern Myanmar due to its similar habitat and proximity to the type locality.

Etymology: The specific epithet '*sinoindicus*' refers to the two collection localities from where the species has been collected and is known until now (China and India). It also acknowledges the serendipitous, simultaneous description of this species from two different research groups from India and China which happened to arrive at the same conclusions.

Specimens examined: CHINA, Yunnan, Tengchong City, Houqiao Town, Danzha Village, Langyashan, 25°30' N, 98°17' E, elev. 2528 m, 09.10.2019, D.T. Liu *et al.* CL19005 (KUN). INDIA, Nagaland, Naga hills, Japvo ridge, 7200 ft (2194 m), 11.11.1949, F. Kingdon-Ward 19018 (BM [BM011026036, BM011026038], E [E00627990], NYBG [NYBG02652121 digital image]).

Conservation status: We found only a small population of five mature individuals at Mt. Saramati, Nagaland, India. This is a community protected area with very little anthropogenic disturbance. The current status of the population at the Japvo ridge locality, 100 km distant from the Mt. Saramati locality, is unknown. The collection from China is limited to only one location. Although there are suitable habitats in between the currently known locations, there is lack of systematic survey for a conservation assessment. Thus we categorize it as data deficient (DD) following the IUCN guidelines (IUCN, 2019).

Notes: In 1949, the English botanist Kingdon-Ward collected a few specimens of *Didymocarpus* from the Japvo ridge of Nagaland, India which resembles

D. sinoindicus (F. Kingdon-Ward 19018). He had identified the specimens as *Didymocarpus* species based on vegetative structures and fruits, but failed to assign a species name due to lack of flowers.

This manuscript is an outcome of an unexpected collaborative work between two independent research groups from India (NSP, PS and VG) and China (DTL, SZD and LC). 69 years after Kingdon-Ward's collection, the Indian group collected specimens in 2018 and the Chinese group in 2019. Coincidentally, both manuscripts were submitted for publication in the special issue of *Rheedea* on Gesneriaceae. Both the groups had described their respective new species using specific epithet that reflected the respective type localities (Saramati hills in India and Tengchong in China). Incidentally, the reviewers and the editor discovered the similarities in the two species and suggested for further study by the authors which has resulted in this collaborative work, and a collaborative description of *D. sinoindicus*. This study therefore illustrates the need for more collaborative floristic studies between India and China which will give us a better insight in our shared biodiversity, allow us to implement better conservation practices, and reduce taxonomic confusions.

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