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## *Didymocarpus longicalyx* (Gesneriaceae), a new species from southwestern Yunnan, China

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### Abstract

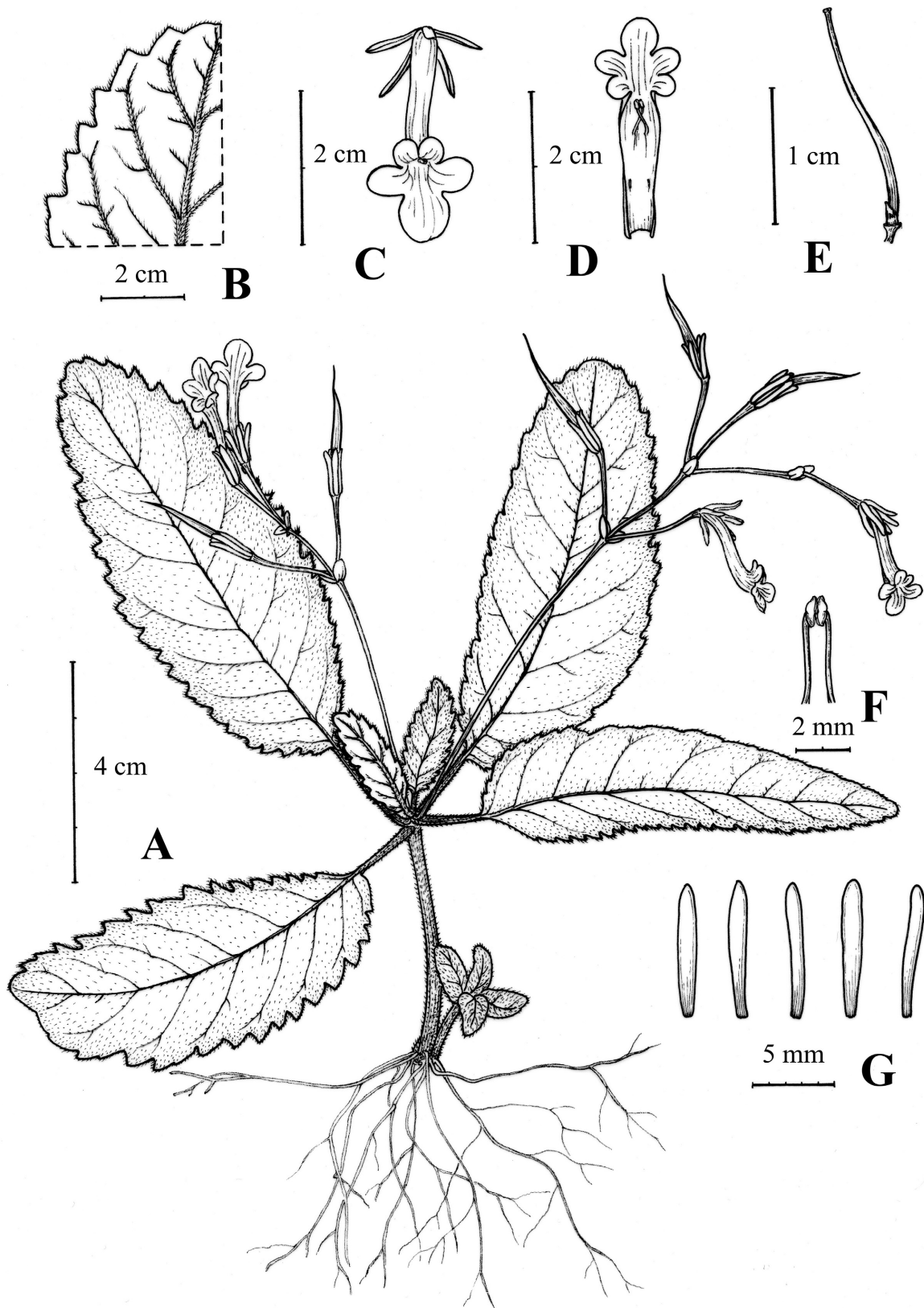
*Didymocarpus longicalyx*, a new species of Gesneriaceae from southwestern Yunnan Province, China is described and illustrated based on detailed morphological comparisons with all known species of the genus *Didymocarpus* from both China and neighbouring countries. Morphologically, it is most similar to *D. medogensis* and *D. glandulosus*, but can be distinguished by its puberulent peduncles, calyx with ca. 8 mm long segments and claret corollas with three yellow spots and a few yellowish striations on upper lip.

**Keywords:** *Didymocarpus*, flora of Yunnan, Gesneriaceae, new taxon, taxonomy

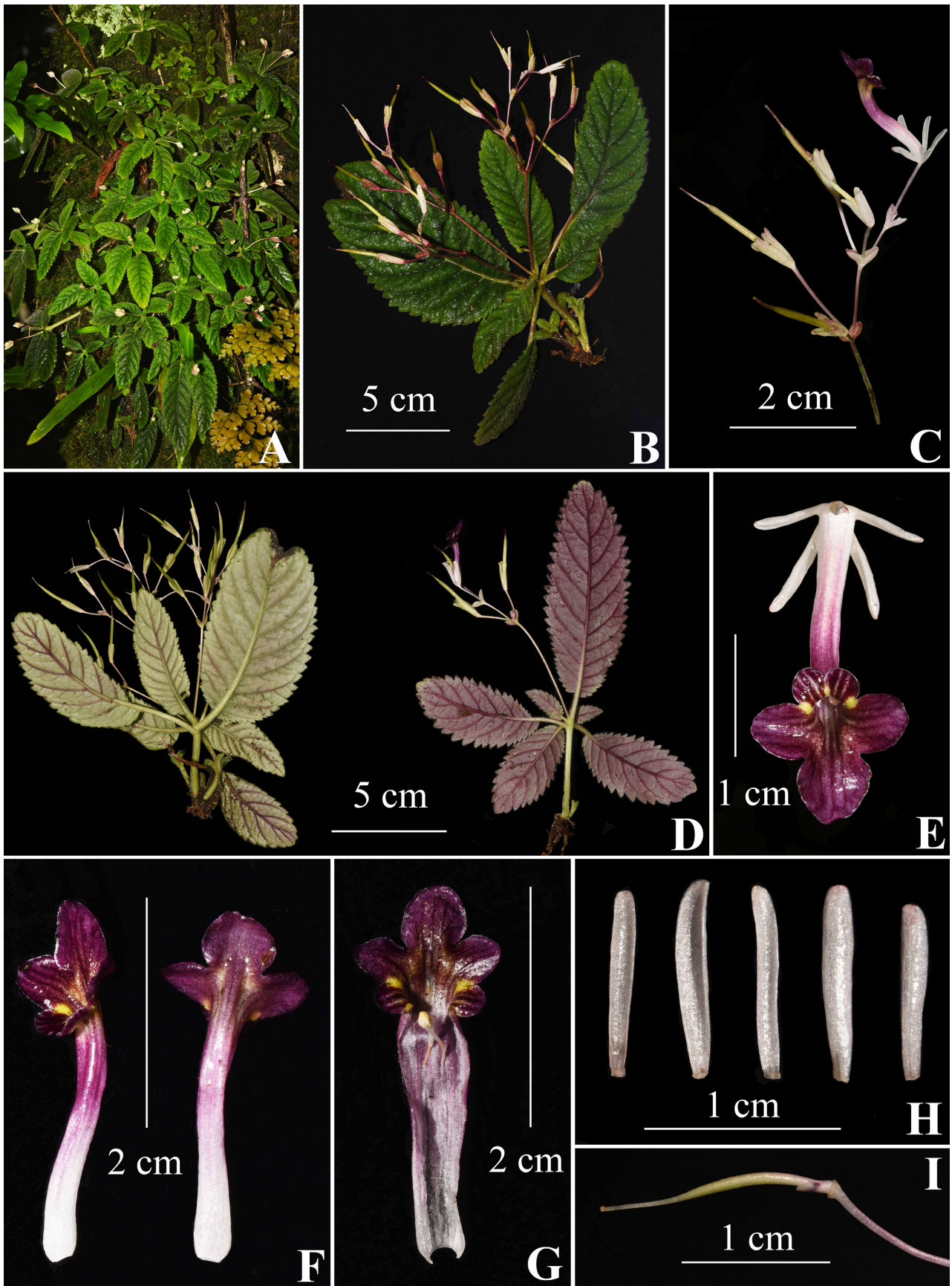
### Introduction

*Didymocarpus* Wallich (1819: 378) (Gesneriaceae) is one of the genera with significant changes on circumscription in the past 30 years. In a broad concept, it had been considered including about 180 species widely distributed in tropical Asia, with a few species in Madagascar and Australia (Wang 1990). Recent morphological and molecular studies have led to a narrower circumscription of the genus (Weber & Burtt 1998; Weber *et al.* 2000; Weber *et al.* 2011; Möller *et al.* 2011; Möller & Clark 2013; Li *et al.* 2016). Nearly 100 species mostly from southern India, Sri Lanka, southern Thailand and Malesia were transferred to three reinstated genera, viz. *Henckelia* Sprengel (1817: 402), *Codonoboea* Ridley (1923: 533) and *Loxocarpus* Brown (1838: 120) (Weber & Burtt 1998; Middleton *et al.* 2013), while a few other species were transferred to *Streptocarpus* Lindley (1828: t. 1173) (two Madagascan species) (Weber & Burtt 1998; Nishii *et al.* 2015), *Petrocodon* Hance (1883: 167) (three species from China and one species from northeastern Vietnam and northern Thailand) (Weber *et al.* 2011; Li *et al.* 2016), and *Tribounia* D.J. Middleton in Middleton & Möller (2012: 1287) (one species from Thailand) respectively. With more than 20 species described mostly from Thailand and China since 1998, the newly circumscribed *Didymocarpus* currently consists of about 100 species distributed from India, Bangladesh, Nepal, Bhutan, southern China, Myanmar, Thailand, Vietnam, Cambodia, Laos, Peninsular Malaysia to Sumatra (Nangngam & Maxwell 2013; Nangngam & Middleton 2014; Möller 2019; Souvannakhommane *et al.* 2019; Yang *et al.* 2019; POWO 2020; Adhikari & Möller 2020; Prasanna *et al.* 2020; Xie *et al.* 2020; Tran *et al.* 2020). This genus is characterized by two anterior fertile stamens, a capitate stigma, an orthocarpic ovary and a bivalve capsule which dehisces loculicidally along the midribs of the carpels (Weber *et al.*

2000, 2020). However, the genus is yet not monophyletic, with a few species together with two small genera, viz. *Allocheilos* W.T. Wang (1983) and *Gyrocheilos* W.T. Wang (1981) forming a clade sister to the main part of the genus (Weber *et al.* 2011; Li *et al.* 2016). Further studies are needed for a new circumscription of *Didymocarpus* to make it monophyletic.



**FIGURE 1.** *Didymocarpus longicalyx* G.W.Hu & Q.F.Wang. A, habit; B, abaxial leaf surface to show the hairs on the veins and margin; C, flower in frontal view; D, dissected corolla to show stamens; E, pistil; F, stamens; G, calyx segments. Drawn by Jing Tian based on the holotype G. W. Hu, S. Peng & J. J. Wang HGW-1175 (HIB).



**FIGURE 2.** *Didymocarpus longicalyx* G.W.Hu & Q.F.Wang. A, habit and habitat; B, whole plant in front view; C, cyme; D, two whole plants in back view; E, flower in front view; F, flower in lateral view (left) and back view (right); G, dissected corolla showing stamens; H, calyx segments, adaxial view (left three) and abaxial view (right two); I, pistil. All photographed by Guang-Wan Hu (voucher specimen: G.W. Hu, S. Peng & J.J. Wang HGW-1175, HIB).

In China, *Didymocarpus* is represented by at least 35 species and five varieties including seven species and two varieties published after Wang's treatment in *Flora of China* (Wen *et al.* 2013; Li & Li 2014; Li & Wang 2015; Cai *et al.* 2016; Xu *et al.* 2019; Yang *et al.* 2019; Prasanna *et al.* 2020; Xie *et al.* 2020), but excluding three species that have been transferred into *Petrocodon* (Weber *et al.* 2011). Species of *Didymocarpus* in China receive no more changes except the above updates (Wen *et al.* 2019). They are rather widely distributed in southern and southwestern China, but most of them are restricted in Yunnan Province (Li 2005).

During a field investigation in Yingjiang County, Yunnan Province of China in June 2019, we found a plant of Gesneriaceae with flower buds. However, it could not be identified with certainty because the flowers were at budding stage. One month later, we revisited it and conducted careful observations of the flowers in full-bloom stage. Its flowers and fruits fit well the characteristics of *Didymocarpus* as mentioned above. After a comprehensive review of literature on *Didymocarpus* (Wang *et al.* 1998; Burt 1999; Weber *et al.* 2000; Hilliard 2001; Nangngam & Maxwell 2013; Wen *et al.* 2013; Li & Li 2014; Nangngam & Middleton 2014; Li 2005; Li & Wang 2015; Cai *et al.* 2016; Joe *et al.* 2016; Hong *et al.* 2018; Xu *et al.* 2019; Yang *et al.* 2019; Souvannakhoummane *et al.* 2019; Lahiri *et al.* 2020; Souvannakhoummane & Phonepaseuth 2020; Prasanna & Gowda 2020; Prasanna *et al.* 2020; Xie *et al.* 2020) and a thorough examination of herbarium specimens from China and adjacent countries, we confirmed that this unknown species represents a new one to science.

## Materials and methods

Morphological description is based on observations of both fresh materials and dried specimens. Terms used in description follow those defined by Beentje (2016) and Weber *et al.* (2020). To compare and confirm the differences between the new species and those similar ones, specimens of *Didymocarpus* from China, India and Myanmar available in the online databases were carefully examined, including the Chinese Virtual Herbarium (CVH, <http://www.cvh.ac.cn>), China National Specimen Information Infrastructure (NSII, <http://www.nsii.org.cn/>), specimen database of the herbarium of Institute of Botany, Chinese Academy of Sciences (<http://pe.ibcas.ac.cn/>), JSTOR Global Plants (<http://plants.jstor.org/>), Kew Herbarium Catalogue (<http://apps.kew.org/herbcat/>) and Edinburgh Herbarium Catalogue (<https://data.rbge.org.uk/search/herbarium/>).

## Taxonomy

*Didymocarpus longicalyx* G.W. Hu & Q.F. Wang, *sp. nov.* (Figs. 1 & 2)

Type:—CHINA. Yunnan Province: Yingjiang County, Xima Town, 24°47' N, 97°42' E, elevation 1600 m, 27 July 2019, G.W. Hu, S. Peng & J.J. Wang HGW-1175 (holotype, HIB-herb.no. 0283879!; isotypes HIB-herb. nos. 0283800 & 0283801!, IBSC!).

Perennial lithophytic herbs. Stems 1.5–9 cm tall, densely puberulent with white spreading hairs. Leaves 2–3 pairs, opposite and sub-anisophyllous, decussate, whorled at the top of the stem; petiole 0.5–4 cm long, densely puberulent; blade thick herbaceous, elliptic, 2–10 × 1–5 cm, base obtuse, slightly to strongly oblique, apex acute to rounded, margin serrate, sometimes double-serrate, adaxial surface dark green, appressed puberulent, abaxial surface pale green to pale purple, puberulent, more so on veins; venation pinnate, lateral veins 6–11 on each side, with mid-rib depressed adaxially, raised abaxially. Inflorescences 1–4, pair-flowered cymes, 4–20-flowered, axillary towards the top of the stem or terminal; peduncle 2–6 cm long, densely puberulent at lower half, gradually becoming nearly glabrous at upper half; paired bracts present at each dichotomous fork, free, ovate to elliptic, 2–5 mm long, glabrous on both surfaces, margin entire, both surfaces pale green to whitish, sometimes partly purplish. Pedicel 1.2–2.2 cm long, glabrous. Calyx 5-sect from base; segments creamy-white to purplish, equal in length, lanceolate to linear, ca. 8 × 2 mm, apex obtuse, glabrous on both surfaces, margin entire. Corolla bilabiate, 2.2–3 cm long, glabrous on both surfaces, upper part claret, gradually turning to white from median tube to base; tube cylindrical, ca. 2 × 0.3 cm; upper lip ca. 2.5 × 6 mm, 2-lobed, stained with a yellow spot at each sinus, lobes oval-orbicular, 1.6–2.0 × 2.8–3.2 mm, each lobe with two whitish striations; lower lip 7–9 × 12–13 mm, 3-lobed, lobes oval-orbicular, lateral lobes 3.3–4 × 3.3–4.8 mm, central lobe 5.0–5.3 × 5.3–6.4 mm. Stamens 2, glabrous, adnate to corolla tube ca. 1.3 cm from the base; filaments ca. 4 mm long; anthers ca. 2 mm long, dorsifixed, coherent by adaxial surfaces, exerted from the corolla throat. Staminodes

2, ca. 1 mm, adnate to corolla tube ca. 5 mm from the base. Disc shallowly cupulate, ca. 2.5 mm high, apex oblique, margin sinuate, glabrous, persistent. Pistil ca. 1.8 cm long, glabrous; ovary ca. 1.2 cm long, glabrous; style ca. 6 mm long, glabrous; stigma globose, papillose. Immature capsule orthocarpic, linear, 2–3 × ca. 0.3 cm, glabrous.

**Habitat:**—This species grows on rocks or trunks of big trees covered with mosses at elevations of 1550–1600 m.

**Distribution:**—It is currently known from only one location in southwestern Yunnan Province of China. Since the type locality is not far from Myanmar, it is not surprising that this species may be also found in future expeditions to northern Myanmar where botanical surveys are yet far from enough.

**Phenology:**—This species flowers from June to July and bears immature fruits in late July.

**Etymology:**—The specific epithet “*longicalyx*” is a combination of the adjective latin *longus* (long) and the nominative latin noun *calyx* that is derived from ancient Greek κάλυξ (*kálux*), referring to the long calyx segments.

**Notes:**—Morphologically, *Didymocarpus longicalyx* is most similar to *D. medogensis* Wang (1982: 41) which is currently known only from Medog County, southeastern Xizang of China and *D. glandulosus* (Smith 1912: 151) Wang (1984: 14) that has a larger distribution area in southwestern China. They all have a stem below the aggregated top leaves, and calyx wholly divided into 5 equal segments. However, *D. longicalyx* can be easily distinguished from the latter two species by corolla colour, the size of calyx, and indumentum of peduncle. The corollas of *D. longicalyx* are claret, gradually to white at base, with yellow spots and striation on upper lip, while the corollas are wholly purple in *D. medogensis* and wholly purplish-red in *D. glandulosus*. The peduncles are densely puberulent and distally to nearly glabrous in *D. longicalyx*, but glabrous in *M. medogensis* and sparsely glandular puberulent in *D. glandulosus*. The calyx segments are ca. 8 mm long in *D. longicalyx* surrounding nearly half length of the corolla tube while they are only 2–3 mm long surrounding less than 1/5 length of the corolla tube in *D. medogensis* and *D. glandulosus*. Leaves of the new species are up to 10 × 5 cm, while leaves of *D. medogensis* are always smaller (up to 4.8 × 2.2 cm) and leaves of *D. glandulosus* are always much larger (up to 18.5 × 7.6 cm). In addition, the ovaries of *D. longicalyx* are ca. 12 mm long, while they are about 18 mm long in *D. medogensis* and about 9 mm in *D. glandulosus*. Detailed morphological comparisons among them are shown in Table 1. Although *D. margaritae* W.W. Smith (1912: 151) from Yunnan Province, China also has a stem and calyx 5-lobed to base, it has much shorter stems (up to 5.5 cm) and nearly orbiculate leaves, which are very different from those of this new species.

**TABLE 1.** Morphological comparisons of *Didymocarpus longicalyx*, *D. medogensis* and *D. glandulosus*.

Character	<i>D. longicalyx</i>	<i>D. medogensis</i>	<i>D. glandulosus</i>
Stem	spreading puberulent	retorse pubescent	appressed puberulent
Leaf size	up to 10 × 5 cm	up to 4.8 × 2.2 cm	up to 18.5 × 7.6 cm
Peduncle	densely puberulent to distally nearly glabrous	glabrous	sparsely glandular puberulent
Calyx segment size	ca. 8 × 2 mm	ca. 3 × 1–1.2 mm	2–2.5 × ca. 1 mm
Corolla	claret, gradually to white at base, with yellow spots and striation on upper lip, ca. 2.8 cm long	wholly purple, 2.5–3 cm long	wholly purplish-red, 1.6–2.2 cm long
Stamen placement	13 mm above the corolla base	9.5 mm above the corolla base	8 mm above the corolla base
Filament length	ca. 4 mm	ca. 7 mm	ca. 3.5 mm
Staminodes length	ca. 1 mm	ca. 3.2 mm	ca. 1.5 mm
Disk	shallowly cupulate, ca. 2.5 mm high	cupulate, ca. 1 mm high	annular, ca. 1 mm high
Pistil length	ca. 18 mm	ca. 20 mm	ca. 11 mm
Ovary length	ca. 12 mm	ca. 18 mm	ca. 9 mm

**Additional specimen examined (paratype)** :—CHINA. Yunnan Province, Yingjiang County, Xima Town, 24°47'32" N, 97°40'42" E, elevation 1550 m, 19 June 2019, *G.W. Hu et al. HGW-2024* (HIB).

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