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## ***Raphiocarpus taygiangensis* (Gesneriaceae), a new species from Central Vietnam**

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### **Abstract**

*Raphiocarpus taygiangensis*, a new species of Gesneriaceae from Tay Giang District, Quang Nam Province, Central Vietnam, is here described and illustrated. The new species is diagnostic by the combination of its long stem, serrate leaf margin, purple spots, purple longitudinal lines, and glandular short hairs inside corolla. Morphological distinctiveness of the new species from the most similar species, *Raphiocarpus axillaris*, is discussed. The conservation status of this species is estimated as Vulnerable (VU D2) according to the IUCN Red List Criteria.

### **Keywords**

Endemism, flora of Vietnam, new taxon, plant diversity, plant taxonomy, *Raphiocarpus*

### **Introduction**

The genus *Raphiocarpus* Chun (1964) from Gesneriaceae family includes about 15 species, distributed from south and southwestern China (Li and Wang 2004, Weber 2004; Zhang et al. 2010; Chen et al. 2015) to central Vietnam (Pham 2000; Phuong 2005; Phuong and Xuyen 2010; Phuong et al. 2012; Middleton et al. 2021). During last two decades, 7 new taxa were found and described in Vietnam, namely *R. asper* (Drake) B.L.Burtt, *R. axillaris* D.J.Middleton, *R. petelotii* (Pellegr.) B.L.Burtt., and *R. tamdaoensis* Phuong, Xuyen & Y.G.Wei from northern Vietnam and *R. annamensis* (Pellegr.) B.L.Burtt, *R. clemensiae* (Pellegr.) B.L.Burtt, and *R. evrardii* (Pellegr.) B.L.Burtt from Central Vietnam.

During the botanical fieldwork in Quang Nam Province, Tay Giang district, A Xan village in Central Vietnam in April 2022, we collected several samples of an unusual species of Gesneriaceae. These plants are characteristics of subshrub, opposite leaves spreading along stem, axillary 1-3-flowered cyme, 5-lobed calyx parted from base, 4 fertile stamens arranged in two pairs, and 2-lobed stigma which allows us to assign them representing a species of the genus *Raphiocarpus*. After consulting relevant literatures (Pellegrin, 1930; Chun, 1946; Weber & Burtt, 1997; Wang et al., 1998; Ho, 2000; Wei et al., 2010; Zang et al., 2010; Phuong et al., 2012; Phuong, 2017; Chen et al., 2015; Middleton et al., 2021) and directly or indirectly

examining specimens of the *Raphiocarpus* in numerous herbaria as E, K, P, LE, PE, IBK, KUN, VNMN, ,..., we considered our plants as a new species, well segregated from all known species of *Raphiocarpus* by its morphological characters of basally prostrate and distally upright long stem, sericeous hairs on young stem, leaf petiole and adaxial mid-vein, sparsely and minutely serrate leaf margin, axillary inflorescence, sparsely long gland-tipped hairs on the peduncle, pedicel, calyx, outside corolla and pistil, calyx 5-disparted from the base, purplish-white flower with purple stripes inside corolla tube, twining filaments, and dish-shaped stigma formed by 2 semi-orbicular lobes horizontally expanding. Therefore, we conclude that it is a new species as described and illustrated here.

## Material and methods

All collected and studied specimens of the newly discovered species are presently stored in the herbaria of Vietnam (HN, VNF) and Russia (LE). Colour photos of plants were taken in natural habitats. Morphological observations and measurements were made on living plants, dried specimens, and spirit materials. Morphological characters were described using the terminology proposed by Wang et al. (1998).

## Taxonomic treatment

*Raphiocarpus taygiangensis* C.H.Nguyen, K.S.Nguyen & Aver., sp.nov.

Figs 1, 2

**Type.** VIETNAM. Quang Nam Province: Tay Giang District, A Xan Village, primary evergreen broad-leaved forest, around point 15°48'57"N 107°19'47"E, altitude 1270 m, 20 April 2022, C.H. Nguyen, K.S. Nguyen, H.X. Cao, CKH 2022042068 (holotype VNF; isotypes HN, LE).

**Diagnosis.** The new species is somewhat similar with *R. axillaris* in leaf blade and flower shapes, but can be distinguished from the latter by having serrate leaf margin, purple spots and glandular short hairs inside corolla, purple longitudinal lines extending to the median lobe of lower lip, and pubescent filaments stamens and pistil (Table 1).

**Description.** Perennial herb with stem to 3 m long ascending to 1 m tall. Stems branching, velutinous when young, becoming glabrous with age. Leaves opposite, equal to unequal in size; petioles 1.5–3.5 cm long, densely hirsute with appressed hairs; leaf blade symmetrically elliptic, 8–16 × 3.4–6.2 cm, 2.3–2.6 times as long as wide, base cuneate, apex acute to acuminate, serrate, hirsute with appressed hairs on both sides, more densely on veins, with 8–14 pairs of secondary veins, eucamptodromous, tertiary venation ramified. Inflorescences arising in axils of lower leaves and in leaf scar axils, 1- or 2-flowered, up to 3 inflorescences in a single axil, 5–6 cm long (including flower); all axes with long glandular hairs; peduncle 10–18 mm long; bracts narrowly elliptic, 4–5 × 0.8–1 mm long, greenish, with long glandular hairs; flowers directed almost horizontally to little pendulous; pedicels 10–12 mm long. Calyx of 5 lobes free from the base, lobes 6–7 × 1.3–1.5 mm, with long glandular hairs outside, glabrous inside. Corolla infundibular,

outside whitish to purple, inside white with purple spots on adaxial lip and purple longitudinal lines extending to the median lobe of abaxial lip, 4.2–4.8 cm long, sparsely covered with long glandular hairs outside, inside with glandular short hairs on top of adaxial lip, with two to three prominent ridges ventrally from throat into tube, limb distinctly two-lipped; tube 3.5–3.9 cm long, the lower 8–10 mm narrower, but slightly wider at base, the upper part broadening towards throat; adaxial lip 2-lobed, lobes subequal, nearly half round, 5–6 mm long, lobes 5–6 × 7–9 mm, sinus 4–5.5 mm deep; adaxial lip 3 (4)-lobed, lobes unequal, 14–16.5 mm long, lateral lobes 6–8 × 7–9 mm, middle lobe 7–9.2 × 4.8–6.1 mm. Stamens 4 (5), in 2 pairs, each pair adnate at their apices, divergent, coherent in pairs at the anther, filaments filiform, distally shortly glandular puberulent, geniculate near the middle; adaxial pair adnate to 14–16 mm above the corolla base, 9–11 mm long, 1 mm in diameter, anthers 0.8–1 × 1.1–1.3 mm long; anthers glabrous, sometimes velutinous; abaxial pair, adnate at c.14 mm above the corolla base, 6–8 mm long, 0.8 mm in diameter, anthers glabrous; staminode 1, slightly hooked, 3–4 mm long. Disc circular, lemon-yellow, 1–1.2 mm high, margin repand, glabrous. Pistil 20–22 mm long, puberulent throughout; ovary 12–13 mm long; style 6–7 mm long; stigma c. 2 mm, 2-lobed. Capsule green when young, bent at the base, narrowly conoid, pubescent, dehiscing adaxially, straight, not twisted.

**Distribution and habitat.** The new species is only known from A Xan Commune, Tay Giang District, Quang Nam Province, Central Vietnam. *Raphiocarpus taygiangensis* usually grows at moist shady places around waterfalls, along streams and occasionally on the slopes of sandstone mountains covered by evergreen broad-leaved forests at elevations 1200–1300 m a.s.l. Some main plants accompanying with the new species have been recorded as *Molineria capitulata* (Lour.) Herb., *Angiopteris evecta* (G. Forst.) Hoffm., *Asplenium unilaterale* Lam., *Begonia spp.*, *Impatiens claviger* Hook. f., *Aeschynanthus bracteatus* Wall. ex A. DC., *Phymatosorus lucidus* (Roxb.) Pic. Serm., *Leptochilus sp.*, *Asplenium spp.*, *Crepidomanes auriculatum* (Blume) K. Iwats., *Rhaphidophora decursiva* (Roxb.) Schott, *Rhynchotechum ellipticum* (Wall. ex D. Dietr.) A. DC., *Symplocos banaensis* Guillaumin, *Mycetia sp.*, *Hedyotis sp.*, and *Ardisia spp.*

**Phenology.** Flowering from April to May, fruiting from May to June.

**Etymology.** The specific epithet refers to the name of the district of type location (Tay Giang District of Quang Nam Province).

**Proposed IUCN conservation status.** The special field studies around the type location revealed no other populations outside of the occupant area at about 5 km<sup>2</sup>. The type location consists of approximately 500 mature individuals growing in moist shady places around waterfall and along the stream. The population does not place in a protected area, and future protection measures are needed. The area has been relatively undisturbed due to its significance to the surrounding village, although local people continue to forage in it for firewood. Considering the small population size and fragile habitat, we propose that *Raphiocarpus taygiangensis* requires classification as Vulnerable (VU D2) according to criteria IUCN (2019).

**Note.** A comparison of the most significant morphological characters of *Raphiocarpus taygiangensis* and its closest species, *R. axillaris* is summarized in table 1.

**Table 1.** Most significant morphological discriminative characters of *Raphiocarpus taygiangensis* and *R. axillaris*

Characters	<i>R. taygiangensis</i>	<i>R. axillaris</i>
Stems	to 3 m long, ascending to 1 m tall	to 0.7 cm long and tall
Leaf margin	serrate	entire
Corolla	whitish to purple, inside with purple spots and purple lines extending; glandular-hairy inside	whitish to pale pink; glabrous inside
Stamens	4 to 5; filaments puberulent	4; filaments, glabrous
Staminodes	hooked	clavate
Pistil	puberulent	glabrous

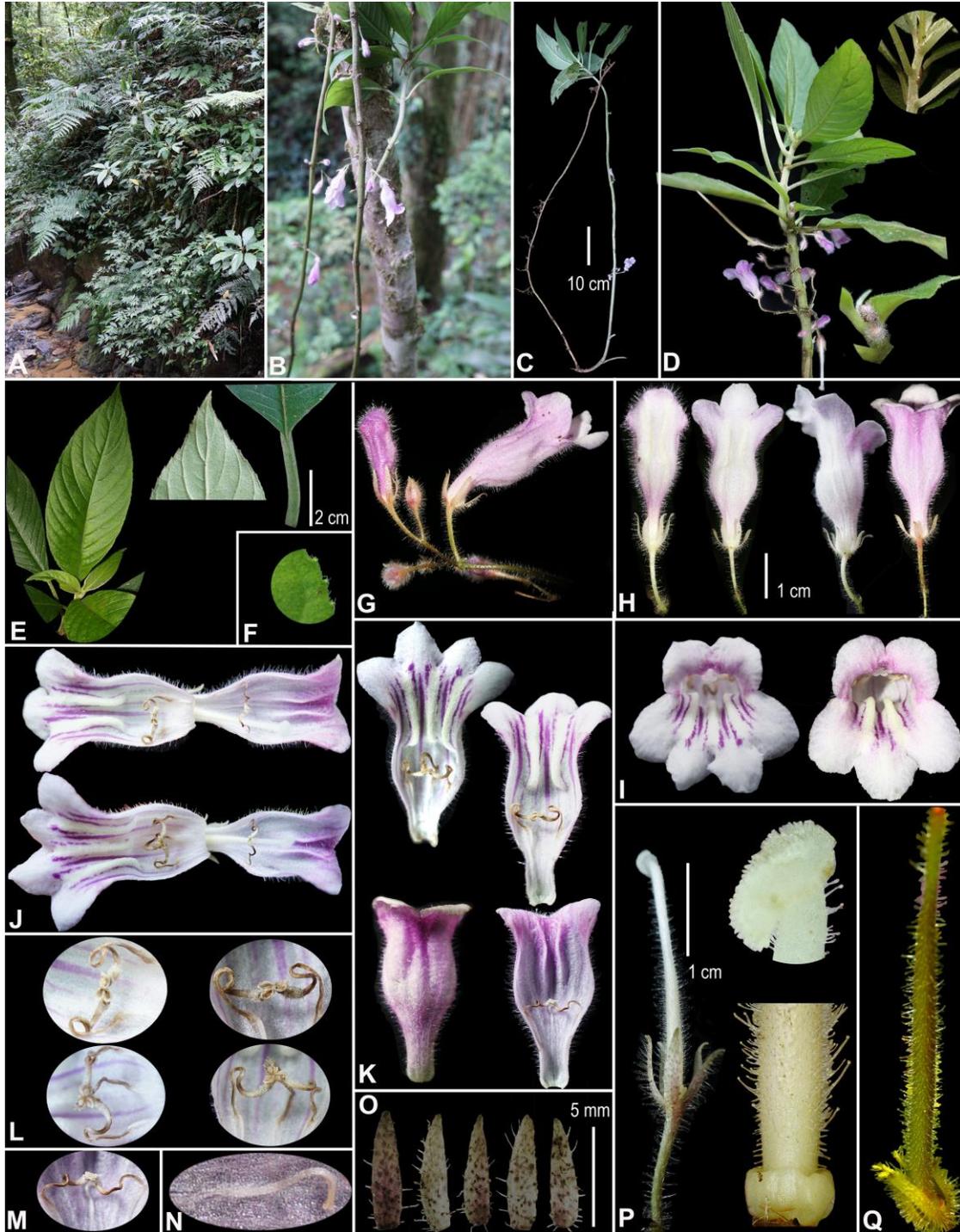
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**Figure 1.** *Raphiocarpus taygiangensis* C.H.Nguyen, K.S.Nguyen & Aver., sp. nov. **A** habitat **B - D** flowering plant in natural habitat **E** leaves **F** marginal leaf **G** inflorescences **H** flowers, side and half side views **I** flower, frontal views **J** section of corolla showing inner surface with stamens and staminodes **K** flower inside and outside views **L - M** stamens **N** staminode **O** calyx lobes **P** pistil, base of pistil and its apex with stigma **Q** young fruit. Photos of Cuong Huu Nguyen and K.S.Nguyen, correction and design by Cuong Huu Nguyen.



**Figure 2.** *Raphiocarpus taygiangensis* C.H.Nguyen, K.S.Nguyen & Aver., sp. nov. Holotype specimen detail. Cuong *et al.*, CKH 2022042068 (VNF).



**Figure 3.** *Raphiocarpus axillaris* D.J.Middleton, sp. nov. (photographed by Nguyen Van Ly) **A** habitat **B** flowering plant in natural habitat **C - D** corolla from the front **E** young fruit. Correction and design by Cuong Huu Nguyen