

## *Rigiolepis bungeputih* (Ericaceae: Vaccinieae), a new species from northern Gayo Plateau, Sumatra, Indonesia

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### Abstract

*Rigiolepis bungeputih* Mustaqim & M.N.Tamayo, a close relative of blueberries (*Vaccinium* L.) and endemic to the tropical evergreen mossy rainforest of northern Gayo Plateau, Sumatra, Indonesia, is here described. It closely resembles *R. gayoensis* Mustaqim, M.N.Tamayo & P.W.Fritsch, but differs by having a glabrous stem, larger leaves, glabrous pedicels, white corollas, and larger stamens. Photographs, an illustration, and a detailed morphological description are included. *Rigiolepis bungeputih* represents the second endemic *Rigiolepis* Hook.f. species known from the island of Sumatra. This discovery raises the number of *Rigiolepis* species found in this island to four. A discussion on the ovary character of *Rigiolepis* in view of ongoing molecular studies is presented.

### Abstrak (Bahasa Indonesia)

Spesies baru kerabat bluberi atau cantigi biru, *Rigiolepis bungeputih* Mustaqim & M.N.Tamayo, endemik hutan hujan berlumut di Provinsi Aceh, Sumatra, Indonesia, dideskripsikan. Spesies ini sangat mirip *R. gayoensis* Mustaqim, M.N.Tamayo & P.W.Fritsch, tetapi berbeda karena memiliki batang gundul, daun lebih besar dengan tangkai yang gundul, bunga dengan mahkota putih, dan benang sari lebih besar. Foto, ilustrasi, dan deskripsi morfologi rinci disajikan. *Rigiolepis bungeputih* merupakan spesies *Rigiolepis* Hook.f. endemik kedua di Sumatera. Penemuan ini menambah jumlah spesies *Rigiolepis* yang ditemukan di pulau ini menjadi empat. Sebuah diskusi singkat mengenai ciri-ciri bakal buah *Rigiolepis* dikaitkan dengan kajian molekuler yang sedang berlangsung juga disajikan.

### Introduction

Indonesia is a megadiverse country in Southeast Asia (Mittermeier *et al.* 1997) and is considered the largest archipelagic country, composed of more than 17,000 islands (Andréfouët *et al.* 2022). This country is an important biogeographic and floristic area as it holds all three major biogeographic units in the Malesian phytogeographic region (i.e. Sundaland, Wallacea, and Sahul; Myers *et al.* 2000). The angiosperms in Indonesia comprise c. 25,000 species, representing c. 10% of angiosperm diversity worldwide and 55% of which are endemic to the country (Convention on Biological Diversity 2023).

The northern Gayo Plateau is managed as part of Aceh Tengah and Bener Meriah regencies. This area, including all of northern Sumatra, has a complex geologic history resulting from the collision between the Indo-Australian and Eurasian plates during

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the Paleogene (O'Shea *et al.* 2015). The Gayo Plateau harbors a high diversity of Ericaceae being predominantly montane and characterized by thick evergreen mossy rainforest at and above 1500 m elevation. Some endemic Ericaceae species found in this locality include *Rhododendron frey-wysslingii* J.J.Sm. and *Rigiolepis gayoensis* Mustaqim, M.N.Tamayo & P.W.Fritsch (Argent 2015; Mustaqim *et al.* 2023). Botanical excursions in this area remain scarce (De Wilde and Duyfjes 1994), hampering our local knowledge of its biodiversity, albeit recent fieldwork has been successful in discovering new species there (Metusala 2017, 2020; Cavestro 2020a, 2020b; Cavestro and Gruss 2020; Handoyo *et al.* 2020; Yudistira *et al.* 2020; Victoriano 2021; Mustaqim *et al.* 2023, 2024).

The genus *Rigiolepis* (Ericaceae: tribe Vaccinieae) comprises 27 species distributed among the islands of Borneo, Sulawesi, and Sumatra, with a few also occurring in Peninsular Malaysia (Argent 2019; Mustaqim and Ardi 2021; Mustaqim *et al.* 2023). This genus is endemic to Malesia and is closely related to *Vaccinium* (Vaccinieae Rchb.) with which it shares strong morphological resemblance (Smith 1935; Sleumer 1961). It differs by the combination of a generally shorter corolla, yellow or orange fruits that turn red at maturity, and a “truly 10-locular ovary” (Argent 2019). Additionally, *Rigiolepis* is mostly composed of epiphytic species with a swollen stem base or roots similar to those species of *Vaccinium* section *Galeopetalum* (J.J.Sm.) Sleumer and *Agapetes* G.Don, another genus of Vaccinieae with close morphological resemblance to both *Rigiolepis* and *Vaccinium*.

Hooker (1873) originally described the genus *Rigiolepis* as having a 10-locular ovary, but in the description of *R. borneensis* in the same work considered that it could be merely 5-locular with 2-ovulated cells. The ascription of 10-locular ovary to *Rigiolepis* was maintained by various authors in their treatment of the genus with more species added by Drude (1889), Ridley (1922) and Smith (1935). In a revision of *Rigiolepis* for Borneo, Argent (2019) also described the ovary of *Rigiolepis* as being 10-locular, applying this character to all 23 species found in this island, and depicting it with a diagram. Argent used the character in part to justify resurrecting *Rigiolepis* as a genus from the sectional placement of Sleumer (1936; 1961, 1967).

During fieldwork in the northern Gayo Plateau region, the authors encountered a population of an epiphytic *Rigiolepis* in an area of mossy rainforest. Our examination of *in situ* material and herbarium specimens that we collected from the population revealed distinct vegetative and morphological characters distinguishing these plants from other previously known species in Malesia. Thus, we here describe this species as new to science, following a morphological species concept (Cronquist 1978).

## Materials and methods

The morphological description of the new species was based on fresh specimens, dried herbarium vouchers, and *in situ* photographs. The flowers were dissected, examined, and measured with a stereomicroscope (up to 50× magnification). Other minute plant parts (e.g. glands and trichomes) were described with an AmScope stereomicroscope (up to 64× magnification). Characters were defined as in Beentje (2016), and relevant taxonomic literature on Malesian species of *Rigiolepis* was consulted (i.e. Ridley 1922; Smith 1935; Sleumer 1936, 1961,

1967; Vander Kloet 2005; Argent 2019; Mustaqim and Ardi 2021; Mustaqim *et al.* 2023). The conservation status of the species was assessed following the IUCN red list guidelines from IUCN Standards and Petitions Committee (2024).

## Taxonomy

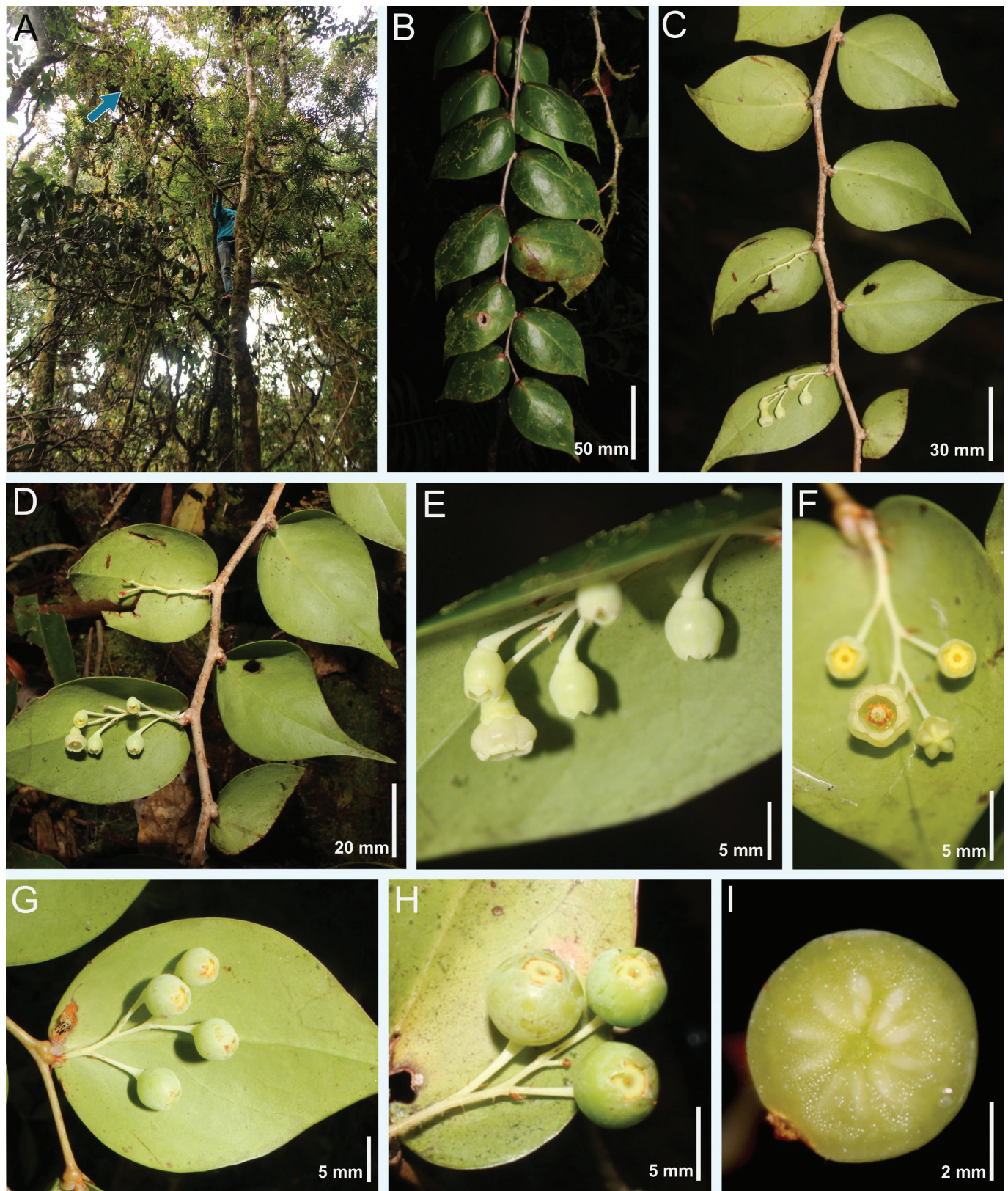
***Rigiolepis bungeputih*** Mustaqim & M.N.Tamayo, *sp. nov.*

**Type:** INDONESIA: Sumatra Island, Aceh Province, Aceh Tengah Regency, Jagong Jeget Subdistrict, Paya Dedep village (4°21'07.4"N, 96°44'04.9"E), 2310 m elevation, 15 June 2023, W.A. Mustaqim 2719 (holotype: LGS; isotype: UIDEP).

**Diagnosis:** *Rigiolepis bungeputih* closely resembles *R. gayoensis* but differs by having a glabrous stem (vs pubescent), larger leaves (60–72 × 35–40 vs 46–55 × 22–25 mm), glabrous pedicels (vs pubescent on 1/2 to 3/5 of pedicel length), white corollas (vs red), and larger stamens (1.8–2.1 vs 1.5–1.7 mm).

**Habit** epiphytic shrubs, terrestrial, evergreen, branches weak, flexuose, clambering, sub-densely branched, c. 0.5 m tall. **Young branchlets** pale reddish green, glabrous. **Mature branchlets** greyish brown or grey, glabrous, 3–5 mm wide, sparsely lenticellate, with a pair of prominent bulges at petiole junction; perennating buds narrowly triangular, 2–3 mm long, with several obscurely overlapping scales, margin entire, minutely ciliolate, apex acuminate. **Leaves** imbricate persistent on older branchlets, laxly crowded, alternate, distichous; **petiole** white and waxy when young, reddish green or brown at maturity, 2–3.5 × 1.5–2 mm, glabrous, in cross section abaxially and adaxially rounded; **leaf blade** ovate or broadly lanceolate, imbricate, larger leaves on each branchlet 60–72 × 35–40 mm, coriaceous, abaxial surface pale green, glabrous, adaxial surface glossy green, glabrous, base rounded to cordate, margin entire, thinly revolute, apex acuminate, acumen 10–15 mm long, marginal glands 1 per side, 1.5–2 mm from petiole, slightly sunken, 0.5–0.7 mm diameter; **midvein** raised abaxially and adaxially, slightly sunken on 1/4 length towards leaf blade apex, secondary veins 3 to 4(5) on each side of midvein with first pair arising from base and remainder along midvein, arc-ascending, obscure abaxially, slightly prominent adaxially; **tertiary veins** inconspicuous. **Inflorescences** axillary, racemose, developing beyond confines of perennating bud, concealed under the leaves and nearly appressed to abaxial leaf surface, 1 per axil, 25–30 mm long, always shorter than the leaves, 3–5(–7)-flowered, with ± persistent, broadly to narrowly triangular scales at base; **peduncle** white or pale green, 6–7 mm long, with occasional glandular trichomes 0.6–0.7 mm long, **rachis** white or pale green, 23–25 mm long, non-ridged, trichomes same as peduncle; **bracts** light brown or reddish, lanceolate, subtending pedicels, ± persistent until anthesis, 1.5–2 × 0.5–0.7 mm, margin minutely ciliolate, apex acuminate, cucullate. **Flowers** white, articulated at junction with pedicel, 7–8(–9) mm long. **Pedicel** white or light green, dilated towards hypanthium, nodding, 8–9 × 0.7–0.8 mm at anthesis, glabrous; bracteoles 2, ± persistent until anthesis, borne at (0.8–)1–1.2 mm from pedicel, light brown or reddish, acicular or narrowly elliptic, 0.5–0.6 × 0.2–0.3 mm, margin entire, minutely ciliolate, apex acuminate. **Hypanthium** white or pale yellowish green, cupuliform, 2.5–3 × 2–2.5 mm, glabrous, covered with a waxy coat; **calyx limb** 0.8–1 mm long, glabrous; **calyx lobes** broadly triangular, 1.2–1.3 × 1.2–1.5 mm, glabrous,





**Figure 1.** *Rigiolepis bungeputih*. A. Habitat and epiphytic habit (plant indicated by a blue arrow). B. Branchlet showing leaf adaxial surface. C, D. Branchlet showing leaf abaxial surface and inflorescence. E. Inflorescence, lateral view. F. Flower, anterior view. G. Immature infructescence. H. One mature (left) and two immature (right) fruits. I. Cross section of fruit showing a pseudo-10-locular ovary. Photos: Wendy A. Mustaqim.

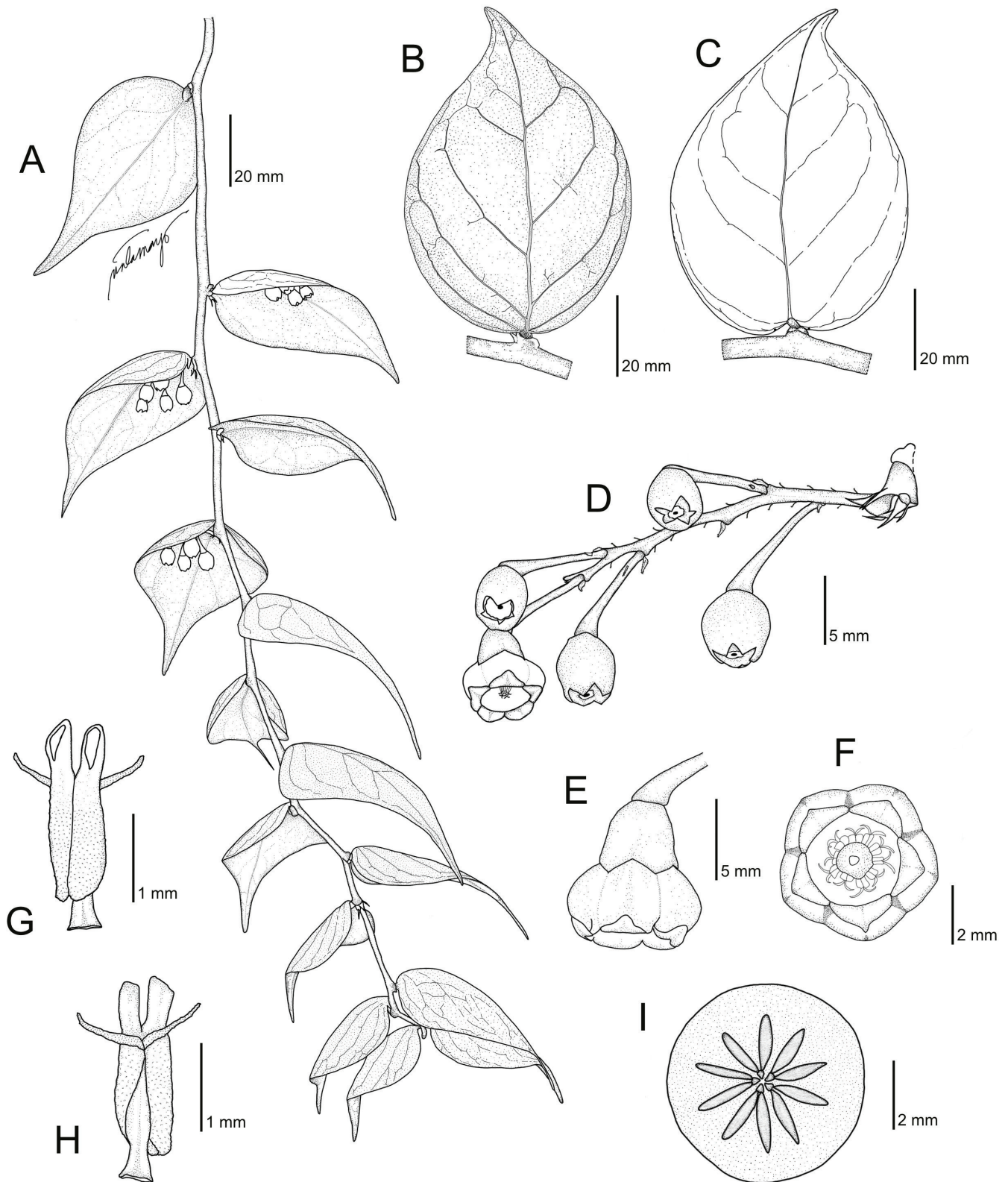
margin entire, apex acute or obtuse, sessile terminal gland absent. *Corolla* white, broadly urceolate, prominently 5-sulcate, 4–5 × 3.5–5 mm, glabrous on both surfaces; *corolla lobes* 5, recurved at anthesis, 1–1.2 × 1.6–1.8 mm, apex obtuse. *Stamens* 10, monomorphic, 1.8–2.1 mm long; *filaments* straight, slightly

dilated at base, 1–1.2 mm long, glabrous; *anthers* 1.7–1.9 mm long; *cells* 1.2–1.3 mm long, minutely echinulate; *tubules* parallel, erect, cylindric, 0.5–0.6 mm long, slightly narrowed at the middle, turning slightly dilated towards apex, opening by oblique ventrally oriented apical pores, pore apex oblong, spurs present,

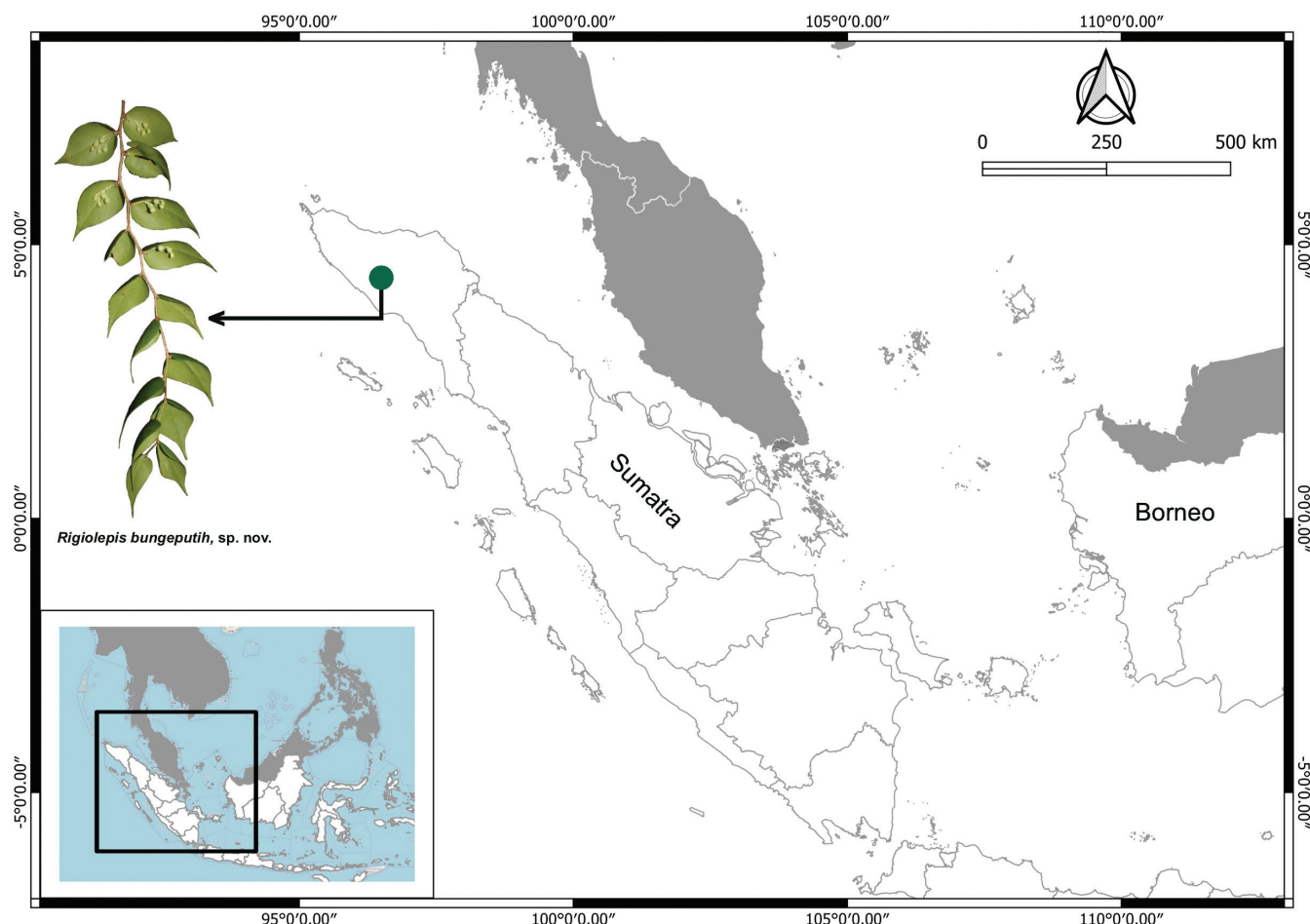


erect to slightly upcurved, 0.6–0.7 mm long. *Ovary* 5-locular, pseudo-10-locular with ovules in two columns per locule, each column separated by an incomplete false partition nearly extending towards axis; *disk* annular, non-bulky, with ridges on margin, 2–2.5(–3) × 2–2.5(–3) mm, glabrous; *style* tubular, slightly

dilated at the middle, not exerted from corolla, 3–4 mm long, glabrous, stigma rounded or truncate, with minute papillae. *Fruiting pedicels* 7–9 mm long, trichomes persistent. *Mature fruit* pale green to pale yellow, fleshy and shiny, glabrous, globose, 5–6 × 5–7 mm. Figures 1–2.



**Figure 2.** Illustration of *Rigiolepis bungeputih* based on the type material (W.A. Mustaqim 2719). A. Flowering branchlet. B. Leaf (adaxial view). C. Leaf (abaxial view). D. Lateral view of inflorescence. E. Flower (lateral view). F. Flower (anterior view). G. Stamen (ventral view). H. Stamen (dorsal view). I. Fruit cross section showing a pseudo-10-locular ovary. Illustration by Maverick N. Tamayo.



**Figure 3.** Type locality of *Rigiolepis bungeputih* at Jagong Jeget Subdistrict, northern Gayo Plateau, Sumatra, Indonesia.

**Distribution:** Endemic to Sumatra; only known from one location within the tropical evergreen mossy rainforest of northern Gayo Plateau, Indonesia (Fig. 3).

**Habitat and Ecology:** An epiphyte in mossy forest that clings to branches of large trees 10–15 m above the ground.

**Phenology:** Flowering and fruiting in June.

**Etymology:** The epithet “bungeputih” is derived from the Gayonese words “bunge” (flowers) and “putih” (white), in reference to the white corolla of the species.

**Conservation Status:** The mountain range where this species was found remains largely undisturbed and under-explored. As such, additional populations likely exist in this area, especially at higher elevations. Because of data limitations in assessing this species under IUCN guidelines, we propose a conservation status of Data Deficient (DD) (IUCN Standards and Petitions Committee 2024).

**Notes:** In the key to the *Rigiolepis* of Sumatra (Mustaqim *et al.* 2023), *R. bungeputih* best keys to *R. lanceolata* (Blume) J.J.Sm. The new species is distinct from *R. lanceolata*, however, by having a glabrous stem (vs pubescent), slightly sunken (vs protruding) basal leaf blade glands, a glabrous (vs pubescent) petiole, fewer flowers per inflorescence [(3–5(–7) vs 8–15-flowered)], a shorter inflorescence rachis [23–25 vs (2.5–)3–5(–6.5) mm long], and a

glabrous (vs pubescent) outer surface of the corolla. At the type locality, *R. bungeputih* is sympatric with *R. gayeri*; however, *R. bungeputih* is easily distinguished from this species by its glabrous branches (vs pubescent), larger leaves (60–72 × 35–40 vs 46–55 × 22–25 mm), and white (vs red) corolla.

An updated key to the *Rigiolepis* of Sumatra based on Mustaqim *et al.* (2023) is provided below to accommodate *R. bungeputih*. In the key to *Rigiolepis* of Borneo (Argent 2019), *R. bungeputih* best keys to *R. moultonii* (Merr.) J.J.Sm. subsp. *moultonii*; however, *R. bungeputih* is distinct from this species by having glabrous petioles (vs pubescent), a cordate leaf blade base (vs decurrent), a glabrous pedicel (vs pubescent), and fewer flowers per inflorescence [(3–5(–7) vs 8–12-flowered)].

The hypanthium of *Rigiolepis bungeputih* is covered with white wax (Figs 1E, 1G, 1H), a character that has not been recorded from any *Rigiolepis* species outside of Sumatra (it is occasionally present in *R. gayeri*; Mustaqim and Tamayo pers. obs.). As such, this character is unusual for *Rigiolepis*, although it is often present in north-temperate species of *Vaccinium* (e.g. *V. myrtillus* L., *V. uliginosum* L., *V. macrocarpon* Aiton, *V. vitis-idaea* L., and *V. corymbosum* L.). This character is not usually observed in the tropical blueberries, although it is present in some species (e.g. *V. myrtilloides* (Blume) Miq.; Tamayo pers. obs. and *V. ceraceum* Argent (as filamentous wax); Argent and Christie 2021). Moreover, the pale-yellow mature fruit colour of

*R. bungeputih* (Fig. 1H) is rather unusual in *Rigiolepis*, as most species exhibit red fruits at maturity.

During our fieldwork in Sumatra and Borneo, we have only observed a pseudo-10-locular condition in *Rigiolepis*, with sampling of four species (Mustaqim et al. 2023; Tamayo and Fritsch pers. obs.), including *R. bungeputih* (Figure 1I, as illustrated in Figure 2I). Our observations indicate that in *Rigiolepis*, the false partition extends more deeply into the axis than in other groups with pseudo-10-locular ovaries (e.g. *Vaccinium* section *Bracteata*), thus rendering it 10-locular in appearance. Sampling more of the species that are placed into this genus both for molecular phylogenetic placement and the condition of the ovary regarding this character is warranted.

### Key to the species of *Rigiolepis* in Sumatra

1. Leaf base attenuate or cuneate; inflorescence 8–15-flowered; filaments pubescent; disk pubescent ..... 2
- 1: Leaf base rounded or cordate; inflorescence 3–7-flowered; filaments glabrous; disk glabrous ..... 3
2. Leaf basal glands protruding; leaves 90–140 mm long; pedicels stout, 2–3 mm long ..... *R. lanceolata* (Blume) J.J.Sm.
- 2: Leaf basal glands sunken; leaves 45–150 mm long; pedicels slender, 4–8 mm long ..... *R. leptantha* (Miq.) J.J.Sm.
3. Stem pubescent; leaves 60–72 mm long; corolla red; filaments undulate ..... *R. gayeri* Mustaqim, M.N.Tamayo & P.W.Fritsch
- 3: Stem glabrous; leaves 46–55 mm long; corolla white; filaments linear ..... *R. bungeputih* Mustaqim & M.N.Tamayo

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