



Rhododendron yombuwurii (Ericaceae), a new orange-flowered species of subgenus *Vireya* from Central Sulawesi, Indonesia

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(Manuscript received 9 September 2025; Accepted 18 March 2026; Online published 28 March 2026)

ABSTRACT: A new species of *Rhododendron* subgenus *Vireya* from Central Sulawesi, *Rhododendron yombuwurii*, is described. The species is known from material originating from the Tokorondo Range, northwest of Lake Poso, and is currently cultivated at a lower elevation near Saluopa Waterfall, where it grows epiphytically and produces small, bright orange flowers. We provide a detailed morphological description, comparative microscopic observations, notes on distribution, habitat and ecology, and a preliminary conservation assessment. Phylogenetic analyses based on the nuclear ribosomal ITS region support the placement of the species within subgenus *Vireya* and its distinction from morphologically similar taxa.

KEY WORDS: Flora, Malesia, Mountain flora, Poso, *Rhododendron celebicum*, *Schistanthe*, Tokorondo, Wallacea.

INTRODUCTION

Sulawesi, the fourth largest island in Indonesia, is recognized for its remarkable biological diversity and high level of endemism. Its complex geological history and diverse montane landscapes have provided suitable habitats for a wide range of plant lineages (Hall, 2002; Mendum and Atkins, 2004), including *Rhododendron* (Linnaeus 1753: 392) subgenus *Vireya* (Clarke, 1882: 462). At present, 32 species of *Rhododendron* are recorded from Sulawesi, of which 24 are endemic (Argent, 2015; Argent and Mambrasar, 2019; Hutabarat *et al.*, 2022). This high level of endemism points to Sulawesi as one of the key areas of diversification for *Vireya* *Rhododendrons* in the Wallacea region.

Despite its significance, the flora of Sulawesi remains relatively poorly documented compared to other major islands of Indonesia such as Java, Sumatra, and Borneo. Limited accessibility, rugged terrain, and sparse botanical exploration have long hampered field studies (Whitten *et al.*, 1987; Frodin, 2001; Johns, 1995; Kessler *et al.*, 2002; Middleton *et al.*, 2019). Nevertheless, the discovery of *Rhododendron ardi* Hutabarat, Mambrasar & Mustaqim (Hutabarat *et al.*, 2022) and *R. tjiasmantoi* Mustaqim, Mambrasar & Hutabarat (Hutabarat *et al.*, 2022) in 2022 further demonstrates that unexplored areas of Sulawesi continue to harbor undiscovered taxa.

During fieldwork in June 2023 around Tentena, Central Sulawesi, we encountered a living plant of *Rhododendron* that did not resemble any previously

described Sulawesi species. The plant was associated with the substrate of an epiphytic orchid and had been cultivated in a highly disturbed area adjacent to Saluopa Waterfall, a popular tourist site. This area represents modified primary forest affected by tourism-related activities, where native plants from the surrounding forest are occasionally collected and displayed informally for sale. At the time of the initial encounter, it was not possible to prepare a herbarium specimen. In February 2024, the third author relocated the living plant and obtained information from the orchid vendor that the entire substrate, including the *Rhododendron*, had originally fallen from a large tree in Petirorano, part of the Tokorondo Range to the west of Tentena and Lake Poso, at elevations of about 1000–1800 m (Parkinson, 1998). Remarkably, the plant survived after being transplanted to the lower elevation of Saluopa Waterfall (560 m). Specimens with flowers were subsequently collected and prepared as herbarium vouchers in July and November 2024.

Detailed morphological study, together with comparisons with available herbarium material and relevant monographic treatments (Sleumer, 1966; Argent, 2006, 2015), confirmed that this taxon represents an undescribed species. To further evaluate its taxonomic status and to assess the possibility of hybrid origin, we also conducted molecular analyses using the nuclear ribosomal ITS region, which are presented and discussed in a dedicated section below. We therefore provide its formal description, illustrations, and a proposed scientific name here.



MATERIALS AND METHODS

Morphological examinations and imaging were conducted using a stereomicroscope and a dual-beam focused ion beam (FIB) scanning electron microscope (Aquilos 2) at the National Research and Innovation Agency (BRIN), Cibinong. These observations were used to document diagnostic characters and to compare the new species with morphologically related taxa.

Herbarium specimens designated as types were examined and compared with descriptions and illustrations in relevant monographic treatments (Sleumer, 1966; Argent, 2015), as well as with physical specimens of allied taxa housed at Herbarium Bogoriense (BO), particularly *Rhododendron celebicum*, *R. impressopunctatum*, and other Sulawesi and Maluku Islands species. In addition, digitized herbarium specimens of *R. celebicum*, *R. impressopunctatum*, and *R. vidalii* subsp. *brachystemon* were examined through the Global Biodiversity Information Facility (GBIF) portal, including material from the Royal Botanic Gardens, Kew (K), Royal Botanic Garden Edinburgh (E), Naturalis Biodiversity Center (L), Muséum national d'Histoire naturelle (P), and the Harvard University Herbaria (A).

Silica-dried leaf material of *Rhododendron yombuwurii* and selected related species from Sulawesi, Buru Island (Maluku), and Papua (New Guinea) was collected during fieldwork conducted between 2020 and 2025. Genomic DNA was extracted using the TianGen Plant Genomic DNA Kit (TIANGEN Biotech, Beijing, China), following the manufacturer's protocol. The nuclear ribosomal internal transcribed spacer (ITS) region was amplified following Sun *et al.* (1994) using the universal primers 17SE and 26SE. Polymerase chain reaction (PCR) was performed in a total volume of 50 µl containing approximately 10 ng of genomic DNA, 2 µM of each primer, 25 µl of MyTaq HS Red Mix (Bioline, USA), and 11 µl of nuclease-free water. PCR cycling conditions consisted of an initial denaturation at 94 °C for 5 min, followed by 35 cycles of denaturation at 94 °C for 30 s, annealing at 58 °C for 30 s, and extension at 72 °C for 30 s, with a final extension at 72 °C for 5 min.

PCR products were visualized on a 1% agarose gel stained with Florosafe and documented using a Bio-Rad GelDoc imaging system. Successfully amplified products were sequenced by 1st BASE (Malaysia) through PT Genetika Science. Sequence chromatograms were edited and assembled using MEGA version 12 (Kumar *et al.*, 2024). Comparative ITS sequences of *Rhododendron* subg. *Vireya* were retrieved from GenBank via BLAST searches to ensure adequate taxon sampling; corresponding accession numbers are provided in the phylogenetic tree. Phylogenetic analyses were performed using the Maximum Likelihood method under the K2+I nucleotide substitution model selected based on best-fit criteria, with branch support assessed by 1000 bootstrap replicates.

TAXONOMIC TREATMENT

Rhododendron yombuwurii Hutabarat, Bandjolu & Zulfadli, *sp. nov.* **Figs. 1-3**

Type: INDONESIA, Sulawesi: Sulawesi Tengah, Poso Regency, Pamona Puselemba District, Wera Village, Saluopa waterfall, 560 m, cultivated in disturbed lower montane forest from material collected in the wild, voucher 23 November 2024, *Prima W.K. Hutabarat, Kurniawan P. Bandjolu, Basrul, Fandra Budianto, Forrest A.N. Hutabarat PWH1635* (holotype CEB!, isotype BO!).

Diagnosis: *Rhododendron yombuwurii* is most closely allied to *R. celebicum* (Blume) DC. (de Candolle, 1839), and shows affinity to *R. impressopunctatum* J.J.Sm. (Smith, 1932), and *R. vidalii* subsp. *brachystemon* Argent (Argent, 2003). It differs from *R. celebicum* by its raised midrib and lateral veins (vs. slightly impressed), semi-erect to horizontal inflorescences (vs. pendulous), glabrous calyx externally (vs. densely scaly), and much smaller orange corolla, 17–22 × 12–16 mm (vs. 35–46 × 20–25 mm, pink to red). From *R. impressopunctatum* it differs in having smaller leaves, fewer-flowered inflorescences, smaller orange corollas, and filaments clustered at the corolla mouth rather than exerted. The species further differs from *R. vidalii* subsp. *brachystemon* by its scaly young twigs becoming glabrescent, longer leaves with raised veins, glabrous calyx externally, smaller orange corolla, and a sparsely scaly to nearly glabrescent ovary. Additional distinguishing characters are summarized in Table 1.

Description: Slender epiphytic shrub, up to c. 1 m tall (Figure 1A; 2A). Twigs rounded, 1–2.5 mm across, scaly when young, glabrescent when mature, light green, turning brown with age; lateral buds ovoid to oblong, scaly; internodes (1–) 1.5–5 cm. **Leaves** 5–8 together in loose pseudo-whorls, often with 1–2 smaller leaves. **Blades** (29–) 37–65 × (10–) 13–20 mm, narrowly elliptic, narrowly oblanceolate or sub-spathulate; apex acute, sometimes obtuse, occasionally with a minutely protruding terminal gland; margin entire, slightly and narrowly revolute in dried specimens; base tapering, slightly decurrent; laxly scaly when young, quickly glabrous above, more persistently densely scaly beneath. **Scales** variable in size, irregularly stellate-lobed, with small dark brown center, impressed in shallow pits (Figure 3). Mid-vein raised above in the proximal ½–⅔, flattened distally, light green, prominent beneath; lateral veins 5–7 per side, ascending at c. 45°, raised above, faint beneath. **Petiole** (2–) 5–10 × (0.5–) 1–1.5 mm, cylindrical, slightly grooved, green or reddish green, scaly. Flower buds to c. 18 × 11 mm, ellipsoid, tips spreading, glossy bright green, sometimes flushed with salmon pink (Figure 1C; 2C). Bracts membranous, outermost pair 7–12 × 2–3 mm, lanceolate or acuminate, densely scaly, glabrous beneath, first and second inner bracts ovate with acuminate

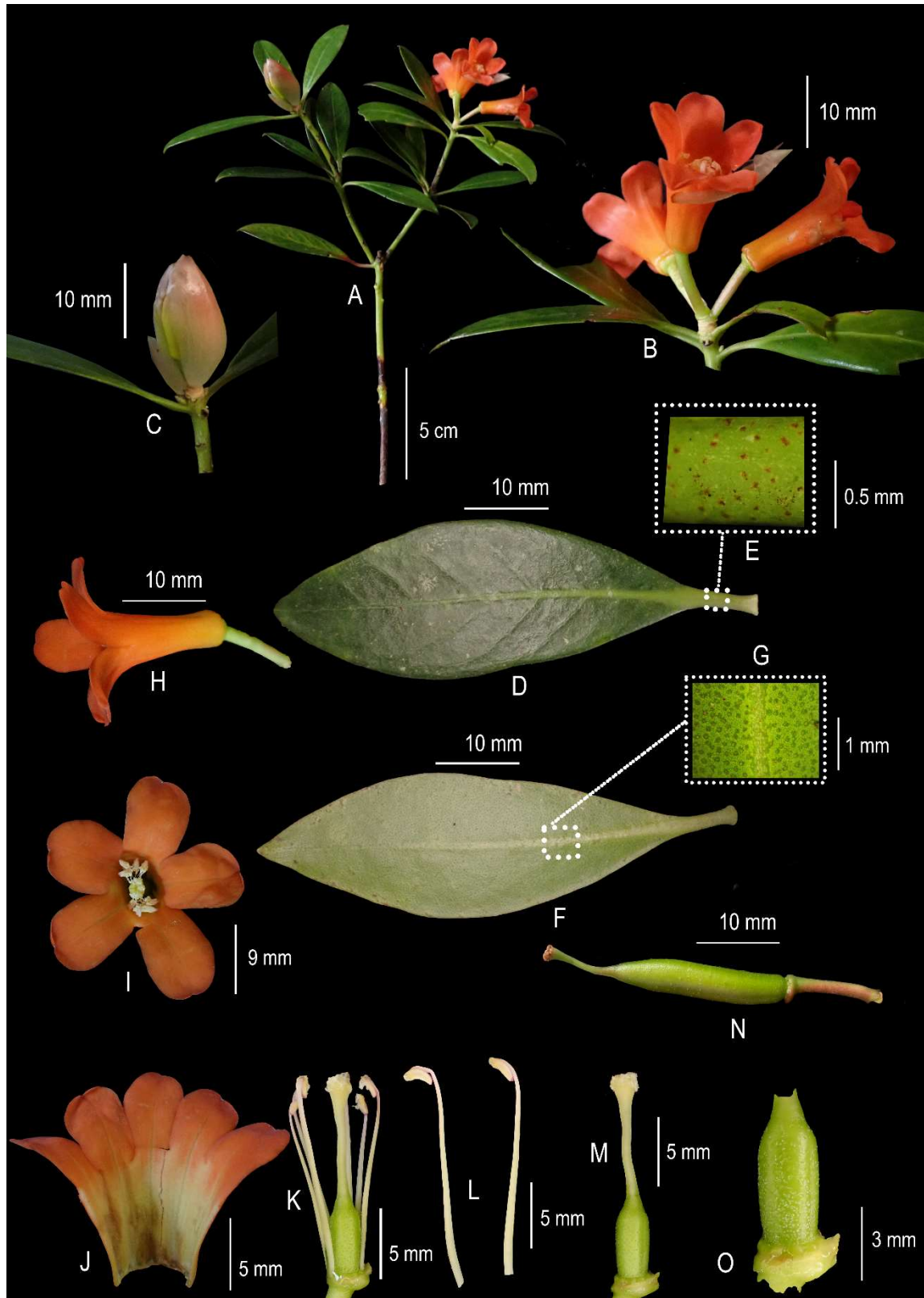


Fig. 1. Morphology of *Rhododendron yombuwurii* Hutabarat, Bandjolu & Zulfadli, sp. nov. **A.** flowering stem; **B.** Semi-erect inflorescence; **C.** Flower bud; **D.** Glabrescent adaxial leaf; **E.** Scaly petiole; **F.** Scaly abaxial leaf; **G.** Scales on abaxial leaf; **H.** Narrow funnel-shaped corolla; **I.** Corolla lobes and stamen position; **J.** Corolla (inside); **K.** Androecium and gynoecium; **L.** Stamen; **M.** Gynoecium; **N.** Immature fruit; **O.** Laxly scaly ovary (Photographed by Zulfadli)

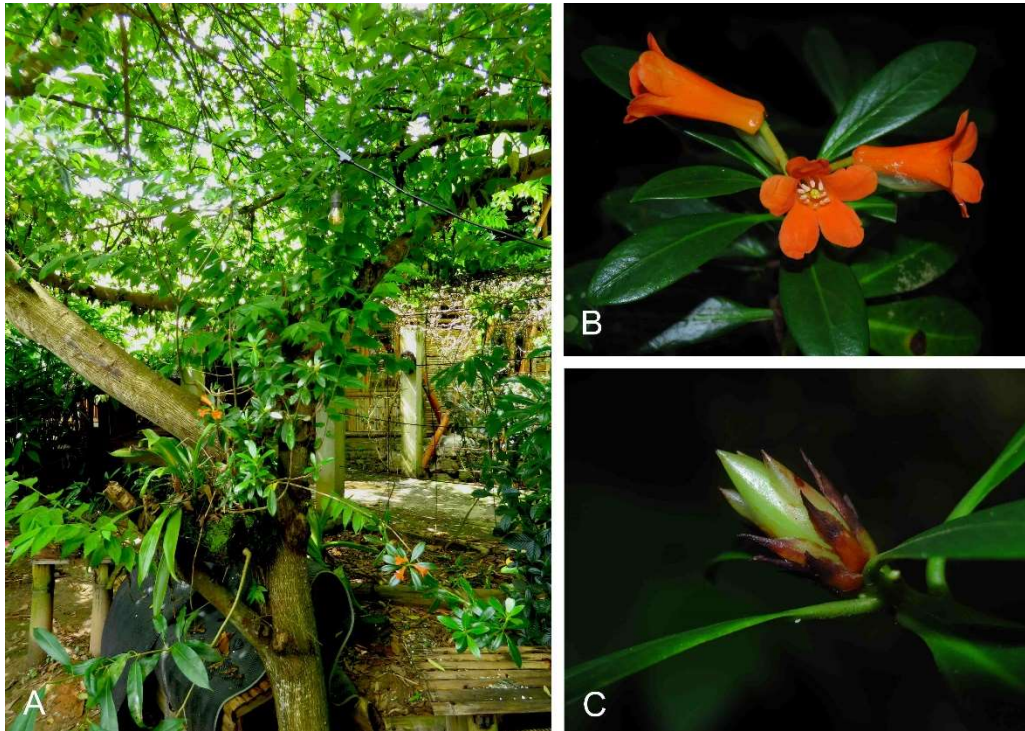


Fig. 2. A. *Rhododendron yombuwurii* thriving and flowering as an epiphyte beneath the canopy of a small tree in Tentena, Central Sulawesi; B. The fresh material of the type specimen PWH1635; C. Flower bud of *Rhododendron yombuwurii*. (Photographed by P.W.K. Hutabarat)

Table 1. Comparison of diagnostic characters among *Rhododendron yombuwurii*, *R. celebicum*, *R. impressopunctatum* and *R. vidalii* subsp. *brachystemon*.

Characters	<i>R. yombuwurii</i>	<i>R. celebicum</i> ¹	<i>R. impressopunctatum</i> ¹	<i>R. vidalii</i> ssp. <i>brachystemon</i> ²
Twig surface	Scaly when young, soon glabrescent	Subdensely scaly, becoming glabrescent	Densely scaly, becoming glabrescent	Minutely hairy, very sparse, often laxly scaly
Petiole surface	Scaly	Scaly	Densely scaly, minutely hairy	Scaly, sometimes minutely hairy
Leaf blade	(29–) 37–65 × (10–) 13–20 mm	30–70 × 15–30 mm	62–83 × 24–32 mm	15–40 × 10–20 mm
Mid-vein (above)	Raised in proximal ½–¾, impressed distally	Slightly impressed	Slightly impressed	Impressed
Inflorescence	(2–) 3–4 flowers, semi-erect or horizontal	3–8 flowers, hanging vertically	5–7 flowers	2–4 flowers, semi-hanging
Pedicel surface	Scaly or laxly scaly, minutely hairy	Densely scaly, papillose, not hairy	Sparsely scaly, minutely hairy	Scaly, long-hairy, sometimes glabrous
Calyx (outside)	Glabrous	Densely scaly	Glabrous or laxly hairy	Shortly hairy
Corolla color	Orange	Pink to red	Red	White
Corolla size	17–22 × (7.6–) 12–16 mm	35–46 × 20–25 mm	30–35 × 5–20 mm	22–30 × 20–25 mm
Corolla surface	Glabrous on both sides	Glabrous inside, laxly to very laxly scaly outside	Glabrous on both sides	Glabrous or laxly hairy inside; laxly hairy and scaly outside
Filament position	Clustered at corolla mouth	Irregular at corolla mouth, or exerted to 8 mm	Exserted 1–4 mm	Exserted 8–12 mm
Filament surface	With a few scattered hairs at the basal ¼, sometimes glabrous	Glabrous	Densely patently hairy at the basal ¼	Densely subpatently hairy in the lower ½, glabrous distally
Disc	Prominent, glabrous, patently hairy on upper margin	Prominent, glabrous	Prominent, glabrous	Prominent, glabrous, shortly hairy on upper margin
Ovary size	4.4–4.9 mm long	5–6 mm long	5–6 mm long	c. 3 mm long
Ovary surface	Laxly scaly, glabrescent distally, or scaly at the base	Very densely scaly	Densely scaly	Densely hairy and scaly
Style	Glabrous	Glabrous, or scaly at the base	Glabrous	Patently hairy in the lower ½–¾, glabrous distally
Distribution	Indonesia, Central Sulawesi	Indonesia, North and Central Sulawesi	Buru Island, Maluku	Philippines, Mindoro (Mt. Halcon)

Notes: ¹Data from Argent (2015), Sleumer (1966), our observation at Herbarium Bogoriense (BO), and digital herbariums online at GBIF; ²Data from Argent (2015), Sleumer (1966) and digital herbariums online at GBIF.

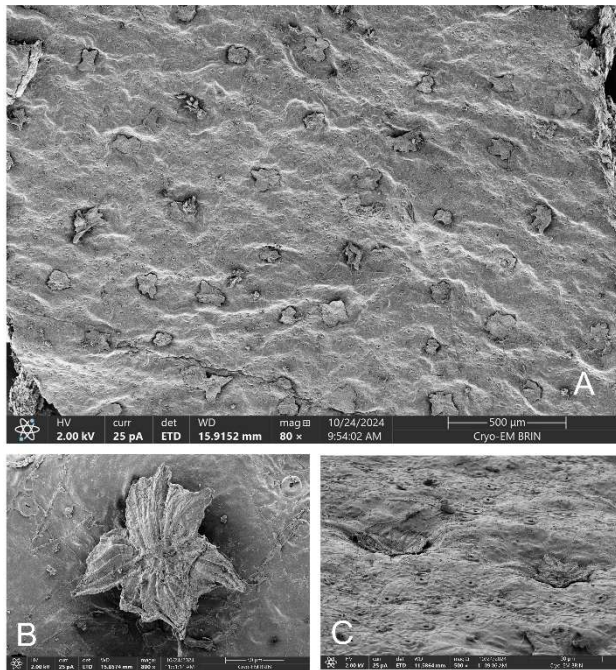


Fig. 3. Image of scales on the abaxial leaf surface of *Rhododendron yombuwurii* (from *Bandjolu s.n.*) taken with a Scanning Electron Microscope (Dual-Beam FIB Aquilos2). **A.** Scales variable in size and shape. **B.** A stellate scale with irregular lobes, indicating the species belongs to section *Schistanthe*. **C.** Scales seated in shallow pits on the leaf surface.

apex, glabrous or scaly along the midline, margins with or without scales, glabrous beneath, inner bracts gradually longer and wider, oblanceolate to elliptic, 18–20 × 9–10 mm, glabrous on both side. Bracteoles 10–20 × 1–2 mm, linear or narrowly spatulate, apex acuminate or caudate, glabrous. **Flowers** (2–) 3–4 in an open umbel, semi-erect or horizontal. Pedicels (7–) 12–15 × 0.3–0.8 mm, green flushed with orange, scaly or laxly scaly, with minutely whitish-hairy. **Calyx** 2.5–3 mm in diameter, obliquely disc-shaped, glabrous on both sides. **Corolla** 17–22 × (7.6–) 12–16 mm, narrowly funnel-shaped, bright orange, sometimes with yellowish tube base (Figure 1B; 2B); tube 10.3–13 mm long, 2.5–3.6 wide at base, 3.8–7.4 mm wide at apex, straight, sulcate at the base to c. ¼ of the total length, glabrous on both sides; lobes 5.5–9.1 × 3.4–5 mm, subcircular, sometimes emarginate at apex, overlapping only at the base, spreading. **Stamens** clustered in the mouth of the corolla; filaments linear, 14–18 mm long, very laxly hairy or a few scattered hairs at the basal ¼, or occasionally glabrous throughout; anthers oblong. 2.1–2.2 × 0.7 mm, base obtuse, minutely apiculate. Disc prominent, glabrous, with patent hairs on the upper margin. **Ovary** 4.4–4.9 × (0.5–) 1.5–2 mm, subcylindrical, tapering distally, sparsely laxly scaly, often glabrescent distally, or at least scaly at the base, without hairs; style yellowish, 9–12 mm long, or as long as the stamens, glabrous, stigma capitate. **Fruit** 25–30 × 3–4 mm, sub-cylindrical, slightly curved, glossy green when immature.

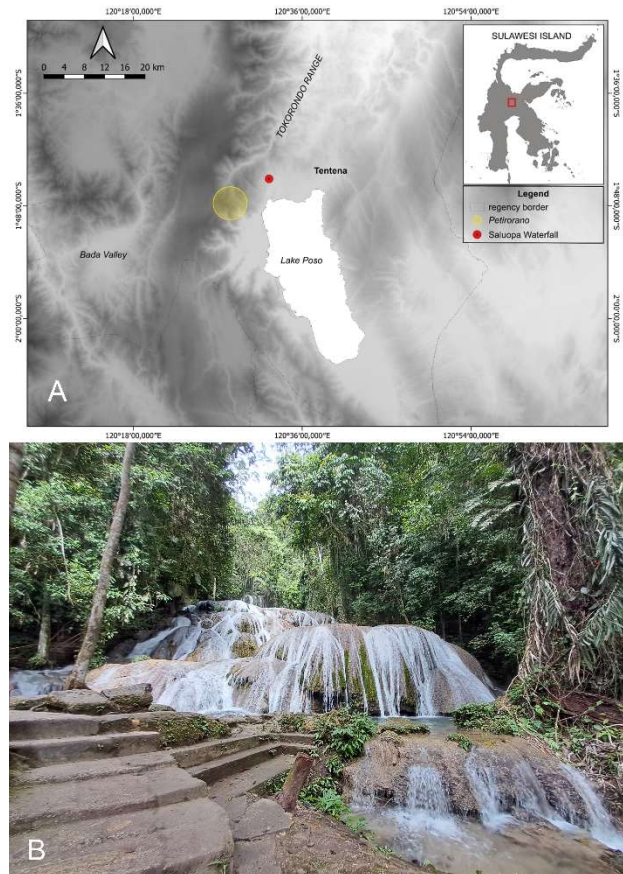


Fig. 4. **A.** Type locality of *Rhododendron yombuwurii* in the Tokorondo Range, Poso Regency, Central Sulawesi. The red dot marks Saluopa Waterfall, where the type specimen was collected as a cultivated plant, while the yellow circle indicates Petirorano, the presumed original source of the species. **B.** Saluopa Waterfall, a lower montane site at 560 m elevation, characterized by a cool and humid climate.

Phenology: Flowering twice a year, June–July & November; fruiting in January & August.

Distribution and Habitat: The species is known only from the Tokorondo Range region, Central Sulawesi. At its current site near Saluopa Waterfall, it grows epiphytically in disturbed lower montane forest at around 560 m asl, under shaded and humid conditions, and is commonly associated with orchids, ferns, and mosses (Figure 2A; 4B). However, this represents a transplanted individual, and the present cultivated habitat may not fully reflect the species' natural ecological conditions. Based on information obtained from local collectors, the species is presumed to originate from montane forest in the Petirorano area of the Tokorondo Range, at elevations of approximately 1000–1800 m, about 19 km west of Saluopa Waterfall (Figure 4A).

Etymology: The epithet honors the late Pastor Yombu Wuri, a distinguished religious and cultural figure of the Pamona Tribe, recognized for his advocacy of biodiversity conservation in Poso.

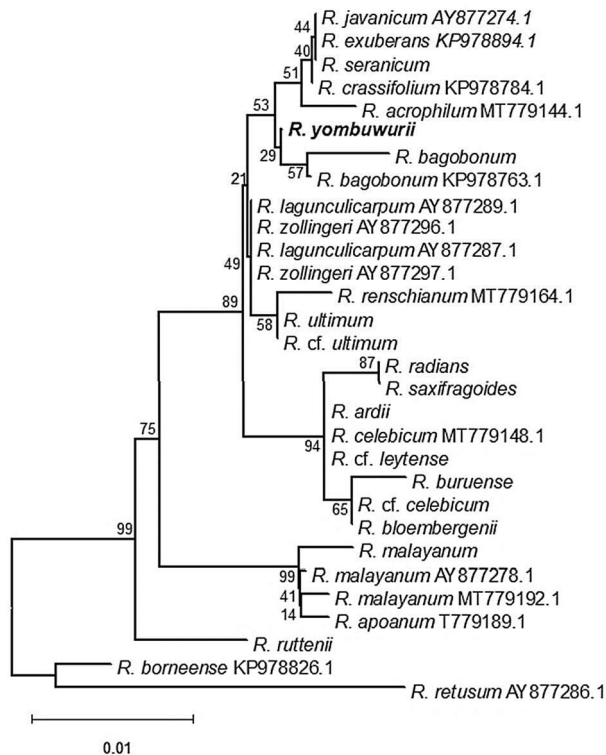


Fig. 5. Taxonomic placement of *Rhododendron yombuwurii* (in bold) inferred from a phylogenetic tree reconstructed using the Maximum Likelihood method based on ITS region. Bootstrap support values are shown at the nodes, and branch lengths represent genetic distances.

Provisional IUCN conservation assessment: Data Deficient (DD). This species is known from a single collection made near the primary forest of Saluopa Waterfall, Wera Village, Poso Regency. The locality could not be georeferenced with certainty, and the population has not been observed in the field.

Field surveys have been conducted in Petirorano and adjacent areas on several occasions since 2020; however, these surveys were limited in duration and largely confined to areas near roads and accessible paths. Systematic exploration of the interior forest has not yet been undertaken. The region remains botanically underexplored, and additional individuals or populations may be discovered with more extensive fieldwork.

Phylogeny: Maximum Likelihood analysis of the nuclear ITS dataset produced a well-resolved phylogenetic tree for *Rhododendron* subgenus *Vireya* (Figure 5). The topology shows generally moderate to strong bootstrap support for the major clades and is broadly congruent with previously published phylogenetic hypotheses for the group.

The tree recognizes three principal lineages corresponding to sections of subgenus *Vireya* sensu Argent (2015). Section *Discovireya*, represented by *R. borneense* and *R. retusum*, forms the basal lineage and was designated as the outgroup. Section *Malayovireya*

includes *R. malayanum* and *R. apoanum*, forming a well-supported clade. The remaining taxa belong to the large and heterogeneous clade of section *Schistanthe*.

Within section *Schistanthe*, *Rhododendron yombuwurii* is resolved as sister to *R. bagobonum* with moderate bootstrap support (Figure 5). Despite this phylogenetic proximity, the two species are clearly distinct morphologically in several vegetative and floral characters. Notably, *R. celebicum*, which is morphologically among the most similar taxa, is placed in a different subclade within section *Schistanthe*.

Most species observed in the Tokorondo Range region were included in the analyses, namely *Rhododendron seranicum*, *R. bogobonum*, *R. zollingeri*, *R. radians*, *R. ardi*, *R. celebicum*, and *R. malayanum*. However, three species native to the region, *R. tjiasmantoi*, *R. meliphagidum*, and *R. nanophyton*, could not be included in the analysis due to the lack of suitable molecular material. In addition, ITS sequences are currently unavailable for *R. impressopunctatum* from Buru Island and *R. vidalii* subsp. *brachystemon* from Mindoro. Nevertheless, the available molecular data clearly place *R. yombuwurii* as a distinct lineage within section *Schistanthe*.

Note: Based on its substellate scales and other morphological traits, *Rhododendron yombuwurii* is placed in section *Schistanthe* (Schlechter, 1917: 140) (Figure 3), subsection *Euvireya* sensu Argent (2006, 2015). In Argent's (2015) key, it runs to either *R. celebicum* (Blume) DC or *R. impressopunctatum* J.J.Sm due to the presence of both hairy and glabrous filaments. *R. celebicum* closely resembles *R. yombuwurii* in vegetative morphology, making sterile material difficult to separate. However they are clearly distinct in several reproductive characters (see Diagnosis). In the field, the flowers of *R. celebicum* are significantly larger, pink to red in color, and never orange. Moreover, *R. celebicum* has not been recorded in the east of the Tokorondo Range, where *R. yombuwurii* is presumed to be native. Smith (1932) noted that *R. impressopunctatum*, is closely related to *R. celebicum* but differ in having densely impressed scales and hairs at the filament base, a feature that also shows some affinity to *R. yombuwurii*. However, *R. impressopunctatum* is endemic to Buru Island and differs in its larger leaves with rounded bases and much larger flowers.

The species also comes close to *R. vidalii* subsp. *brachystemon* in Argent's (2015) key to subsection *Malesia*, which includes members of section *Schistanthe* with mid-sized leaves. Superficially, *R. yombuwurii* resembles this taxon, but *R. vidalii* subsp. *brachystemon* is distinguished by its smaller leaves and slightly larger corolla, which is white, scaly, and hairy. Moreover, this subspecies is endemic to Mindoro Island in the Philippines. Whereas the flowers of *R. celebicum* appear as a larger, pink to red counterpart of *R. yombuwurii*, sterile specimens of *R. vidalii* subsp. *brachystemon* may be mistaken for a smaller-leaved form of *R. yombuwurii*.



The Tokorondo Range, part of the Pompangeo Schist Complex in Central Sulawesi (Parkinson, 1998), separates the valley that forms Lake Poso from the western part of Central Sulawesi, including the Bada Valley and the forests of Lore Lindu National Park. Despite its biological potential, the area remained botanically unexplored until recently, because of limited access by poor roads and past socio-political problems. Since 2018, however, botanical expeditions have yielded at least three new species of Ericaceae (Mustaqim and Ardi, 2019; Hutabarat *et al.*, 2022), two species of Zingiberaceae (Ardiyani *et al.*, 2020; 2021), and several noteworthy records, with additional manuscripts in preparation. The discovery of *R. yombuwurii* further underscores the range's potential for biodiversity exploration and the likelihood that more species remain undocumented.

Additional specimen examined: INDONESIA, Sulawesi: Sulawesi Tengah, Poso Regency, Pamona Puselemba District, Tentena, Saluopa waterfall, 560 m, cultivated in a private garden from material collected in the wild, voucher 3 July 2024, *K. P. Bandjolu s.n.* (CEB!, BO!, FIPIA!).

ACKNOWLEDGMENTS

We would like to express our gratitude to the *Rumah Program 2024* of the Research Organization for Life Sciences and Environment – BRIN and RIIM Biodiversity Expedition Program, supported by LPDP (contract no. 7501/II.7.5/FR.06.00/11/2024 and B-7766/III.5/FR.06.00/11/2024) for supporting the type collecting fieldwork and analyses. We thank the Natural Resources Conservation Agency (BKSDA) of Central Sulawesi – the Ministry of Forestry of the Republic of Indonesia for granting permission to collect specimens, and the local government of Pamona Puselemba District, Poso Regency, for allowing exploration of the highland area between Tentena and Bada. We are also grateful to the International Association for Plant Taxonomy (IAPT) for funding botanical exploration through the IAPT 2023 Research Grant awarded to PWKH, which supported the acquisition of the living specimen. Special thanks go to the Cryogenic Electron Microscopy Laboratory (Cryo-EM), Deputy for Research and Innovation Infrastructure – BRIN, for providing SEM imaging using the Dual-Beam FIB Aquilos2, and to Herbarium Bogoriense (BO), Directorate of Scientific Collection Management – BRIN, for access to herbarium materials. Finally, we warmly thank our local friends Fandra Budianto, Nenek Liesbeth Nyolonyolo, Evan Gogani, and Raynton Rare'a for their invaluable support and hospitality during several fieldwork activities in Sulawesi.

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