



Two new species of *Rhododendron* of subgenus *Vireya* (Ericaceae) from Sulawesi, Indonesia

Prima W. K. HUTABARAT^{1,2,*}, Wendy A. MUSTAQIM³, Jasper M. MAMBRASAR^{4,5}

1. Research Center for Plant Conservation & Botanic Gardens - Indonesian Institute of Sciences, Bogor Botanic Gardens, Jl. Ir. H. Juanda No. 13, Bogor 16122, Indonesia. 2. Yayasan Botani Tropika Indonesia (BOTANIKA), Jl Seruni No. 25, Loji, Bogor 16117, Indonesia. 3. Program Studi Biologi, Fakultas Teknik, Universitas Samudra, Jl. Prof. Dr. Syarif Thayeb, Meurandeh, Langsa Lama, Langsa, Aceh 24416, Indonesia. 4. Herbarium Bogoriense, Research Center for Biology, Indonesian Institute of Sciences, Jl. Raya Jakarta-Bogor Km 46, Cibinong, 16911, Bogor, West Java, Indonesia. 5. Graduate Student Department Botany, The University of Wisconsin-Madison, USA. *Corresponding author's emails: hutabaratpwk@gmail.com

(Manuscript received 22 September 2021; Accepted 11 January 2022; Online published 17 January 2022)

ABSTRACT: Two new endemic species of *Rhododendron* of subgenus *Vireya* from Sulawesi are described, viz. *R. ardi* Hutabarat, Mambrasar & Mustaqim, and *R. tjiasmantoi* Mustaqim, Mambrasar & Hutabarat. Detailed morphological descriptions accompanied by a map of geographic distributions, plant illustrations, and discussions on habitat, ecology, and preliminary conservation status are presented.

KEY WORDS: Endemic, mountain plants, *Rhododendron ardi*, *R. tjiasmantoi*, *Schistanthe*, taxonomy, Wallacea.

INTRODUCTION

The number of *Rhododendron* (Linnaeus 1753: 392) subg. *Vireya* (Clarke, 1882: 462), also known as “Malesian rhododendron” or vireya rhododendrons species (sensu Argent, 2015), has recently increased to 328 (Sleumer, 1966; Argent, 2006, 2015; Danet, 2015; Cai *et al.*, 2016; James and Argent, 2017; Mambrasar and Hutabarat, 2018; Argent and Mambrasar, 2019). Subg. *Vireya* is a large group occurs predominantly in Malesia which comprises about one-third of c. 1,156 total species of *Rhododendron* (Khan *et al.*, 2021). The highest diversity of species is in the three subregions of New Guinea, Borneo, and Sulawesi (Sleumer, 1966; Argent, 2006, 2015). Indonesia currently holds 231 *Vireya* species which are distributed throughout the archipelago.

Sulawesi is the fourth largest island in Indonesia and is well known for its high level of biological diversity and endemism, along with a complex geological history (Hall, 2002; Mendum and Atkins, 2004). However, Sulawesi is still considered botanically unexplored, based on its relatively poorly known flora and fewer botanical specimens that have been collected from the island compared to the other large islands in Indonesia (Whitten *et al.*, 1987; Frodin, 2001; Johns, 1995; Kessler *et al.*, 2002; Middleton *et al.*, 2019). Limited road access and extreme landscapes are the main challenges in conducting fieldwork, especially in the highlands of Sulawesi where *Rhododendron* and other ericaceous species grow.

Recent exploration in Sulawesi has kept active the taxonomic work on *Rhododendron* subg. *Vireya*. At least four botanical expeditions were conducted in the highlands of Sulawesi between 2000-2011, with three new species to science discovered and described from

those 3 of 4 expeditions. The vireya expedition in 2000 was to Mount Sojol by Royal Botanic Garden Edinburgh and Indonesia Institute of Sciences (LIPI) (Argent, 2009), followed by another vireya expedition in the South and Central Sulawesi by Gillian Brown & L.A. Craven in 2002 (Craven, 2014). In 2010, A.R. Kartonegoro (LIPI) conducted the botanical exploration and collected some specimens of *Rhododendron* in Latimojong Ranges (Kartonegoro, 2014). The latest, Elizabeth Widjaja and the team from LIPI explored the plant diversity of Mekongga Mountains in 2011 (Argent and Mambrasar, 2019). The completion of monographic work by Argent (2015) indicated that 28 vireya species, 21 of them endemic, were known from Sulawesi. Four years later, another endemic species, *Rhododendron widjajae* Argent & Mambrasar (2019: 27), was described and bringing the total number of Sulawesi species to 29 (22 endemics). Considering the high endemicity of *Rhododendron* in the island and that many species are restricted to a specific mountain, other undescribed *Rhododendron* are likely awaiting discovery from poorly explored parts of the island.

Starting in 2018, additional *Rhododendron* specimens from the central and southern part of the island were collected, yielding discovery of more undescribed species. In this paper, two new endemic species of *Rhododendron* subg. *Vireya* are described based on materials collected from Poso Regency, Sulawesi Tengah Province in 2018 and Mamasa Regency, Sulawesi Barat Province in 2019. Both species belong to the section *Schistanthe* (sensu Argent, 2015) by exhibiting its diagnostic characters: bracts with marginal scales, filament base hairy or glabrous, anthers introrse, corolla mostly funnel shape or trumpet-shaped, and leaf scales with a small centre, stellately lobed or sub-dendroid, and distinctly well-spaced.

**Table 1.** Comparison of morphological characters, distribution and habitat of *Rhododendron ardi* and *R. leptobrachion*.

Character	Species	
	<i>R. ardi</i>	<i>R. leptobrachion</i>
Leaf		
Lateral buds	Ovoid, obtuse tips	Ellipsoid, subulate tips
Lamina	Oblanceolate	Narrowly elliptic
Apex	Obtuse or rounded	Shortly acuminate
Mid-vein above	Raised	Impressed
Lateral veins abaxial	Inconspicuous	Distinct and reticulate
Scale	Brownish center	Blackish, somewhat sparser
Bract	Laxly scaly or scaly along the median band	Hairy
Bracteole	Glabrous or laxly scaly	Hairy
Corolla		
Outer surface	Scaly	Hairy along the middle
Lobes margin	Erose or fringed with scales	entire, glabrous
Disc	Hairy at the apex	Glabrous
Distribution	Northwest of Lake Poso, Sulawesi Tengah Province	Latimojong Ranges, Sulawesi Selatan Province
Elevation range	1050-1830 m	2000-3000 m
Habitat	Open shrubland, road embankment	Mossy montane forest

TAXONOMIC TREATMENT

Rhododendron ardi Hutabarat, Mambrasar & Mustaqim, *sp. nov.* **Figs. 1 & 2**

Type: INDONESIA. Sulawesi: Sulawesi Tengah Province, Poso Regency, Pamona Puselemba District: road side between Tentena and Bada, northwest of Lake Poso. 1050 m, 1 August 2018, *Ardi WI 257* (holotype BO!; isotype E!).

Diagnosis: *Rhododendron ardi* is similar to *Rhododendron leptobrachion* Sleumer (1960: 203) but differs from the later in having ovoid lateral buds (vs. ellipsoid), bract of lateral buds with obtuse tips (vs. subulate), oblanceolate leaf blades with obtuse or rounded apex (vs. narrowly elliptic with shortly acuminate apex), raised mid-vein and lateral veins above (vs. impressed above), inconspicuous abaxial lateral veins (vs. distinct and reticulate), brownish scale center (vs. blackish), bracts with scales along the median band and no hairs (vs. without scales but covered by simple hairs), glabrous or laxly scaly bracteoles (vs. hairy), outer surfaces of the corolla lobes scaly (vs. hairy along the middle), corolla lobes margin erose or fringed with scales (vs. entire and marginal scales absent), disc hairy at the apex (vs. glabrous apex) (Table 1.).

Slender terrestrial shrub, up to c. 2 m. Twigs rounded, 1.5–5 mm across, scaly or laxly scaly, light green when fresh, light brown with golden or yellowish vertical blotches in dried specimens; lateral buds ovoid, apex obtuse, bracts obtuse at the apex, basal most with apex acute, internodes 2.5–14 cm. **Leaves** 3–8 together in loose pseudo-whorls, 4–5 along internodes. **Blades** (27–) 50–85 × (8–) 16–27 mm, oblanceolate, sometimes narrowly oblanceolate, or sub-spathulate; apex obtuse, or rounded; margin entire, often broadly revolute; base acutely tapering, densely scaly on both side when young, glabrescent and finally minutely blackish punctate above, densely scaly beneath. **Scales** with a relatively wide

marginal zone, sub-stellately lobed; centre small and brownish, slightly impressed. Mid-vein raised above in the proximal 2/3, impressed upward, strongly and obtusely prominent beneath, often brownish, similar to the petiole colour, darker beneath in dried specimens; lateral veins 5–7 per side, spreading at c. 45° from the midrib, long ascending, raised above, faint beneath; abaxial lateral veins inconspicuous in the dried specimen. Petiole 4–16 × 1–1.5 mm, cylindrical, weakly grooved, brownish green, densely scaly. Outer bracts ovate, 11.5–14.8 mm long, 7.5–9 mm wide, inner ones spatulate, 21 mm long by 7 wide, subglabrous, laxly scaly or scaly in the middle line outside, glabrous inside, pinkish cream. Bracteoles 7–9.5 × c. 0.3 mm, linear, glabrous or laxly scaly. **Flowers** 3–4 in an open umbel, the flowers half-hanging. Pedicels slender 9.5–25 × (0.4–) 0.6–1.2 mm, pinkish, densely scaly, without hairs. **Calyx** c. 3 mm in diameter, obliquely disc-shaped, 5 lobed, densely scaly outside, glabrous inside. **Corolla** 33–44 × 19–31 mm, tubular, bright glossy red, tube 24–32 cm long, 4–6 wide at base, 8–10 mm wide at apex, cylindrical, straight, sulcate at the base up to ¼ of the total length, densely to laxly scaly along the tube and the lobes outside, subdensely very shortly hairy inside in the proximal ½–¾; lobes 9–15 × 8–10 mm, obovate or sub-circular, ¼ overlapping, spreading, often with irregularly erose margin or fringed with scales. **Stamens** irregularly arranged, exerted to c. (4–) 5–10 mm long; filaments linear, 24–35 mm long, densely sub-patently hairy, or at least in the lower half and glabrous distally; anthers oblong. 2.8–3 × c. 1 mm, base apiculate. Disc prominent, hairy at the apex. **Ovary** 4.5–7 × 1.8–2 mm, sub-cylindrical; very densely patently hairy, very laxly scaly, scales hidden by the hairs; style slender, yellow, 18–32 mm long, shorter or as long as the stamens, hairy in the lower half, sparsely scaly or glabrous, stigma capitate. **Fruit** unknown.

Phenology: Flowering in March, August.

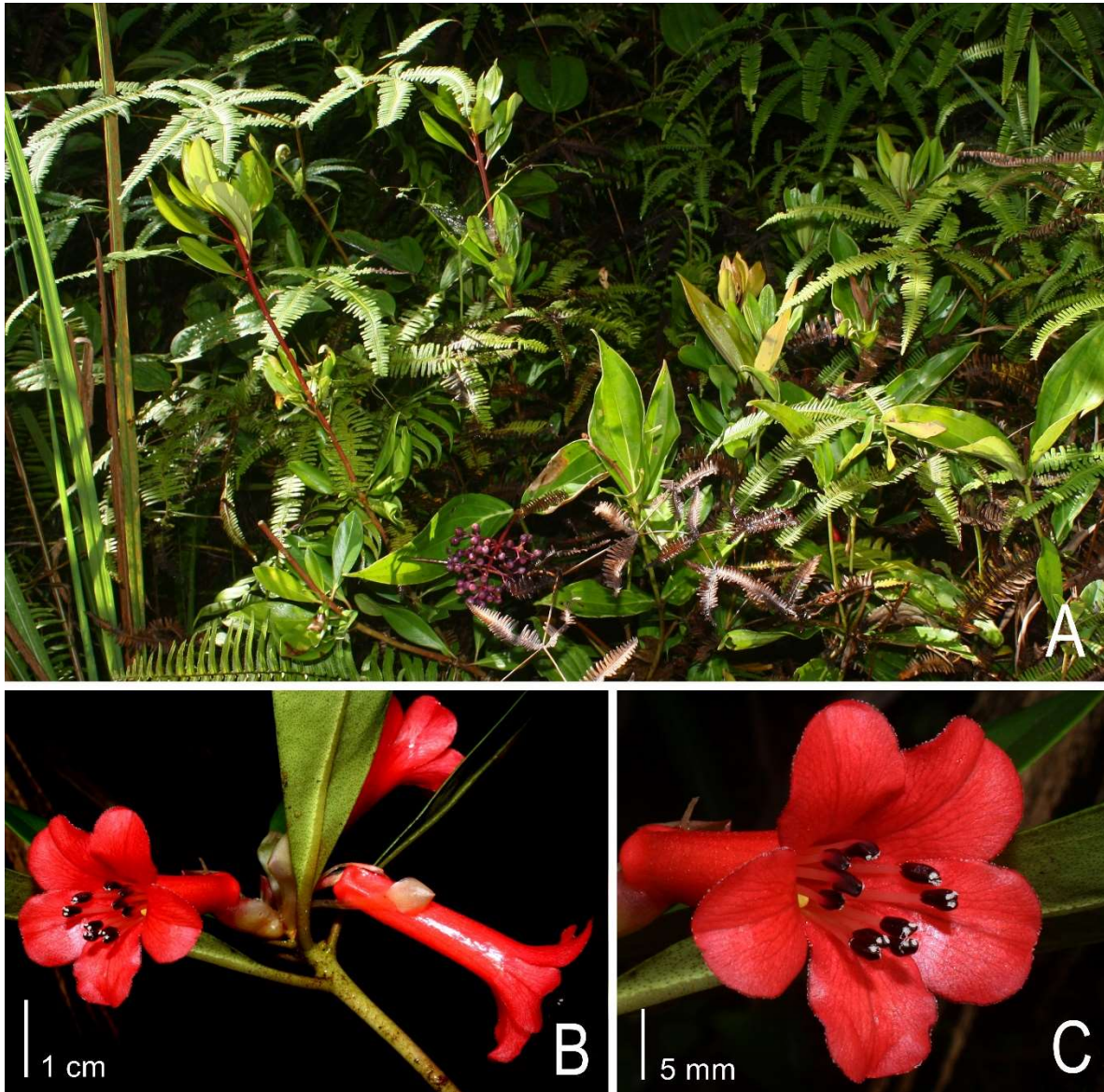


Fig. 1. *Rhododendron ardi* sp. nov. (photographed by W.H. Ardi) A. Habit; B. Flowers; C. Corolla lobes with whitish marginal scales.

Distribution: Endemic to Sulawesi, northwest of Lake Poso, Poso Regency, Sulawesi Tengah Province (Fig. 6).

Habitat: Road embankment, open disturbed shrubland or montane forest, in a thicket of *Dicranopteris linearis* (Burm.f.) Underw. (Underwood, 1907: 250) at 1050–1830 m.

Etymology: Named in honour of the collector of the specimen, Wisnu H. Ardi, botanist at Bogor Botanic Gardens who has explored many parts of Sulawesi since 2008 and made a major contribution to the research and discovery of *Begonia* and some seed plant families in Wallacea.

Provisional conservation status: Data Deficient (DD). *Rhododendron ardi* is known only from two collections from the same road area in northwest of Lake Poso. It is inferred that the species may have a very restricted

distribution. However, the field exploration covered only a small area along the main road; therefore, it was insufficient to assess the habitats and population. The area is not included in any conservation area, but it is relatively close to Lore Lindu National Park. The forest condition at the type locality is considerably good with little anthropogenic threats from the road and tourism activities between Tentena and Bada; thus, habitat may be prone to forest loss and land degradation in the future.

Notes: *Rhododendron ardi* keys to *R. leptobrachion* Sleumer both in Sleumer (1966) and Argent (2015) but have some different characters (see diagnosis). *Rhododendron leptobrachion* grows in mossy montane forest in Latimojong Range, south Sulawesi in the elevation range of 2000–3000 m (Argent, 2015), while *R. ardi* is found in an open shrubland in lower elevation at

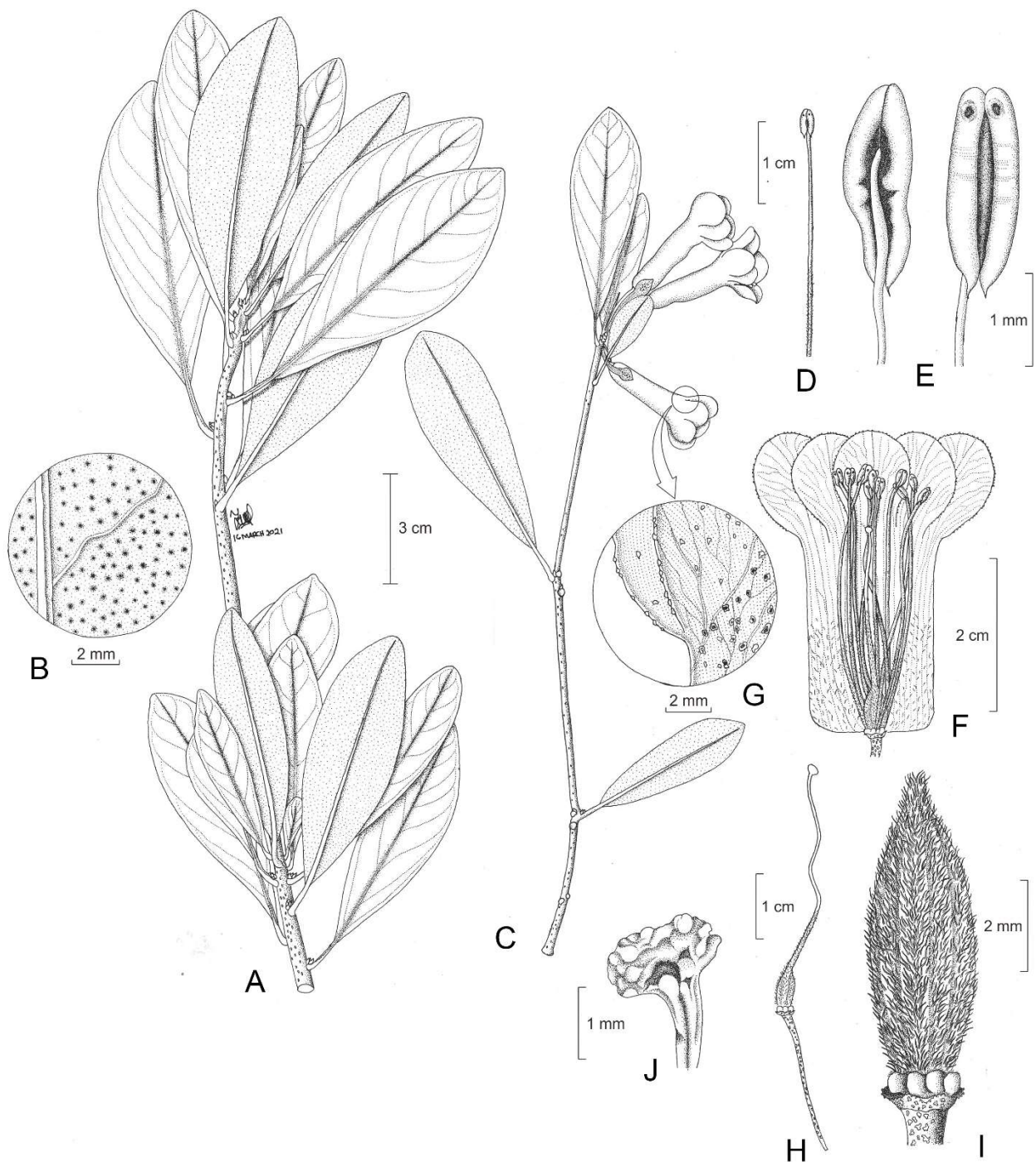


Fig. 2. *Rhododendron ardi* sp. nov. (illustrated by Zakaria Al Anshory, from Ardi *WI* 257) **A.** sterile stem; **B.** Abaxial leaf scales; **C.** Flowering stem; **D.** Stamen with hairy filament; **E.** Anther (dorsal and ventral view); **F.** Corolla (inner view); **G.** Scales on corolla lobes; **H.** Gynoecium; **I.** Ovary; **J.** Stigma.

1050–1830 m. D. Binney recorded *R. leptobrachion* in Mt. Sojol from his expedition in 2003 (Argent, 2007, 2009). He mentioned it had bracts with glabrous outer surface, not hairy as the type materials, glabrous corolla which is extended to 50 mm long, either without or provided with very sparse scales, which was later assumed as new species

by Argent and published as *R. sojolense* in 2009 (Argent, 2009, 2015). The variations, however, do not overlap with the features of *R. ardi*. An additional character that differs between *R. leptobrachion* and *R. ardi* is the prominent abaxial lateral veins of the preceding. At least in the dried specimens and viewed under the microscope, the leaves of

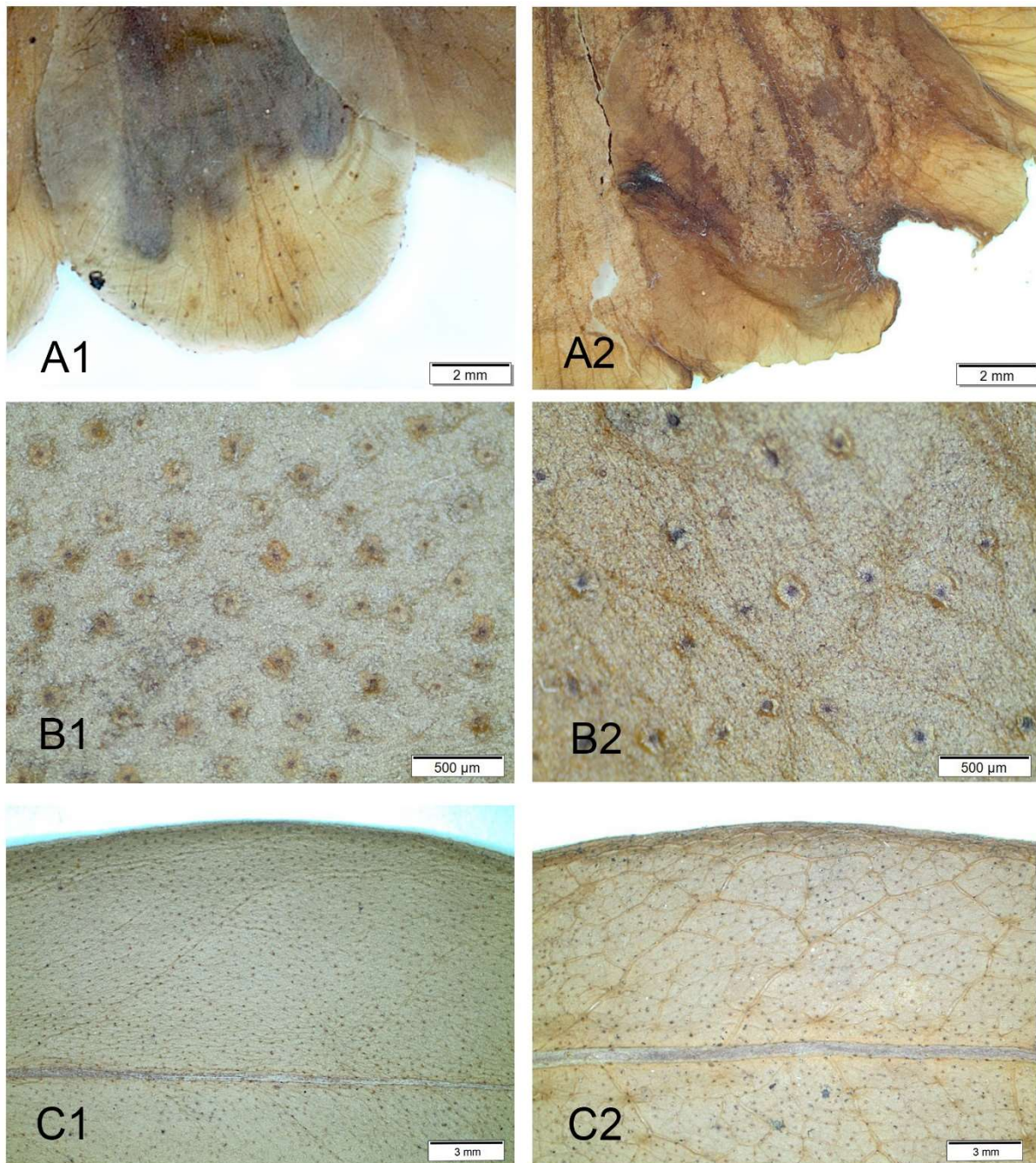


Fig. 3. Morphological characters comparison of *Rhododendron ardi* sp. nov. (1) and *Rhododendron leptobrachion* (2) (photographed by P.W.K. Hutabarat), **A1.** Corolla lobes scaly without hairs; **A2.** Corolla lobes hairy; **B1.** Scales on abaxial leaf; **B2.** Scales on abaxial leaf; **C1.** Lateral veins of abaxial leaf inconspicuous; **C2.** Lateral veins of abaxial leaf reticulated.

R. leptobrachion have reticulate venation whereas the lateral veins are inconspicuous in *R. ardi* (Figs. 3C1, 3C2). In addition, the scales on the abaxial mature leaves of *R. ardi* are somewhat denser than the scales in *R. leptobrachion* (Figs. 3B1, 3B2).

Crenulate, denticulate or erose margins on corolla lobes are common in sect. *Discovireya* but not in sect. *Schistanthe*. The erose margins in *R. ardi* are created by presence of scales scattered irregularly along the margin of the corolla

lobes - a unique morphological feature of *R. ardi* that has never been found in other species of sect. *Schistanthe* (Argent, 2006, 2015). The marginal scales are silvery or whitish in fresh material and often turned blackish when dried. They are not always persistent on each lobe margins, but mostly persisting near the base of the lobes.

Rhododendron ardi is also similar to *R. sojolense* Argent (2009: 1) in many morphological characters. These include the smaller or shorter organs or organ parts,

**Table 2.** Comparison of morphological characters, distribution and habitat of *Rhododendron tjiasmantoi*, *R. celebicum* and *R. poremense*.

Character	Species		
	<i>R. tjiasmantoi</i>	<i>R. celebicum</i>	<i>R. poremense</i>
Leaf			
Arrangement	(1–)5(–6) in tight pseudowhorls	3-7 in loose pseudowhorls	3-6 in pseudowhorls
Apex	Retuse	Obtuse to shortly acuminate	Obtuse to shortly acuminate
Lamina size	(18–) 27–56 × (10–) 14–26 mm	30–70 × 15–30 mm	65–110 × 29–46 mm
Petiole length	1.5–6 mm	4–12 mm	7–9 mm
Inflorescence	Half-hanging to slightly horizontal	Hanging vertically downwards	Unknown
Pedicel	Hairy	Scaly	Densely scaly
Corolla			
Length	30–33 mm	35–46 mm	c. 40 mm
Tube	Tubular	Tubular	Funnel shaped
Lobes length	8–9 mm	8–11 mm	18–20 mm
Stamen			
Filament	Hairy in the proximal 3/4	Glabrous	Laxly hairy in the proximal 1/2
Anther color	Light brown	Dark brown	Unknown
Anther length	1.75 mm	2–2.5 mm	4 mm
Style	Hairy	Glabrous or scaly at the base	Glabrous
Distribution	Mamasa Regency, Sulawesi Barat Province	Mt. Klabat; Mt. Gambuta (Sulawesi Utara Province); Lake Poso area (Sulawesi Tengah Province), and Mt. Rantemario (Sulawesi Selatan Province)	Mt. Porema, Mekongga Mts. (Sulawesi Tenggara Province)
Elevation range	1650–1750 m	1800–2000 m	1400 m
Habitat	Montane slope vegetation	Mossy forest	Unknown

such as smaller leaf blades (50–85 × 16–27 mm vs. 65–180 × 29–55 mm in *R. sojolense*), shorter and narrower petioles (4–16 × 1–1.5 mm vs. 14–25 × 3–4 mm), shorter bracteoles (7–9.5 mm vs. 15–20 mm), smaller corolla (33–44 × 19–31 mm vs. 45–50 × 30–35 mm), smaller ovary (4.5–7 × 1.8–2 mm vs. 8 × 4 mm). *Rhododendron ardi* also differs in its ovoid lateral buds (vs. rounded in *R. sojolense*), oblanceolate leaves (vs. elliptic, broadly elliptic or slightly obovate), scaly bracteoles (vs. without scales but densely hairy), 3–4-flowered inflorescence (vs. 7–10-flowered), outer surfaces of corolla densely scaly (vs. glabrous), corolla lobes scaly along the margin (vs. corolla lobes without scales in the margin), and apiculate anther base (vs. obtuse anther base, without apicle).

Rhododendron ardi and *R. leptobranchion* are very similar morphologically. Examination of the available specimens of *R. leptobranchion* in BO provided an additional important character not reported by either Sleumer (1960, 1966) or Argent (2006, 2015). Both mentioned that the entire outer corolla surface is very laxly scaly or subglabrous, or scales sometime present at the basal part of the tube only. The specimens we observed, including type specimen (*Eyma 647*; *Steenis 10311*; *Kjellberg 1440*; *AR Kartonegoro 495*), showed the presence of minute hairs along the outer midline of corolla lobes, either throughout the length or at least in the proximal half (Fig. 3A2). This character further separates *R. leptobranchion* from *R. sojolense*, which has glabrous outer surfaces of the corolla lobes, and from *R. ardi*, which has scaly outer surfaces of the corolla lobes (Fig. 3A1).

Additional specimens examined. INDONESIA. Sulawesi: Sulawesi Tengah Province, Poso Regency, Pamona Puselemba District: road side between Tentena and Bada, northwest of Lake Poso. 1830 m, 7 March 2020, *P. Hutabarat PWH480* (BO, FIPIA).

Rhododendron tjiasmantoi Mustaqim, Mambrasar & Hutabarat *sp. nov.*

Figs. 4 & 5

Type: INDONESIA. Sulawesi: Sulawesi Barat Province, Mamasa Regency, road to Talambai Village, 1750 m, 25 November 2019, *Ardi et al. WI 579* (holotype BO!; isotype CEB!).

Diagnosis: *Rhododendron tjiasmantoi* is similar to *R. celebicum* (Blume) DC. (de Candolle 1839: 725) but differs in the tightly pseudo-whorled leaves (vs. loosely in *R. celebicum*), retuse leaf apex (vs. obtuse to shortly acuminate), half-hanging to slightly horizontal flower (vs. hanging vertically downwards), shorter corolla (30–33 mm vs. 35–46 mm), hairy filaments (vs. glabrous), light brown anthers (vs. dark brown), the hairy ovary and style (vs. glabrous). This species is also similar to *Rhododendron poremense* J.J.Sm. (Smith 1937: 203) but differs in having the smaller leaves ((18–) 27–56 × (10–) 14–26 mm vs. 65–110 × 29–46 mm in *R. poremense*) with shorter petiole 1.5–6 mm (vs. 7–9 mm), retuse leaf apex (vs. obtuse or shortly acuminate), hair present on the pedicels (vs. absent), tubular corolla (vs. funnel-shaped), shorter corolla lobes (8–9 mm vs. 18–20 mm long), shorter anthers (1.75 mm vs. 4 mm long), and the hairy style (vs. glabrous). (Table 2)

Slender, epiphytic or terrestrial shrub, up to 2 m. Twigs terete, 0.75–1.75 mm across, becoming slightly angled when dry, scales barely present, internodes vary in length, 1.7–8 cm long. **Leaves** (1–)5(–6) together in tight pseudo-whorls, one of them poorly developed, from the 1–2 uppermost internodes. **Blades** (18–) 27–56 × (10–) 14–26 mm, leathery, obovate, obovate-oblong or subelliptic; apex retuse, margin entire, weakly revolute

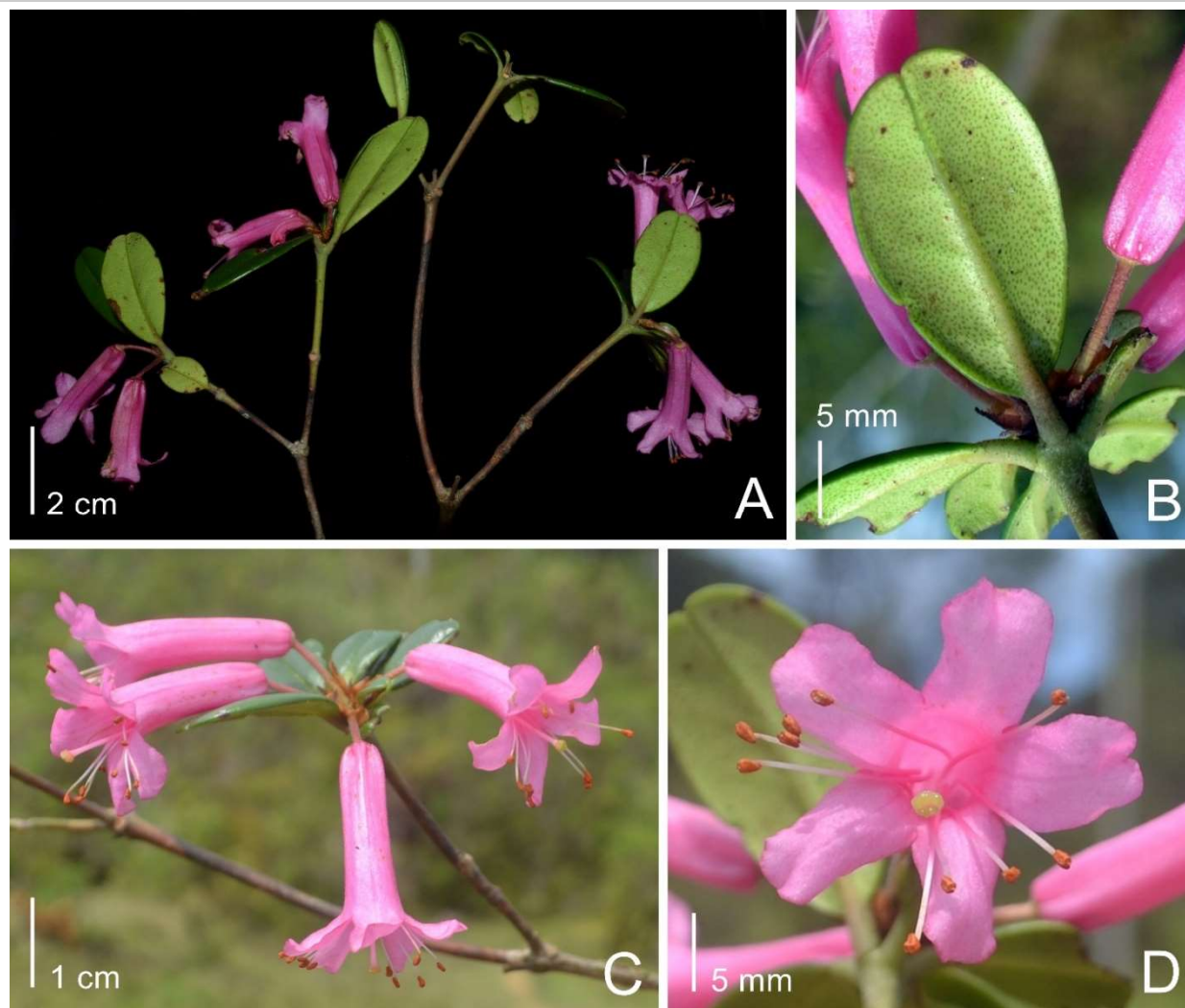


Fig. 4. *Rhododendron tjiasmantoi* sp. nov. (photographed by W.A. Mustaqim) **A.** Habit; **B.** Abaxial leaf; **C.** Flowers; **D.** Corolla lobes.

except at the very apex, epiphytic specimen with more revolute margin, base broadly tapering to tapering; laxly scaly above when young, glabrescent or sometimes rather soon, densely scaly beneath, persistent or quite soon glabrescent and leaving the blackish punctate surface. **Scales** with broad marginal flanges, irregular, not lobed, centre slightly large, darkish. Midrib narrowly impressed above except at the apex, strongly and obtusely raised beneath for most of its length; lateral veins 4–8 on each side of the midrib, rather regular, spreading c. 45°, obscure above, faint beneath. **Petiole** 1.5–6 × 1–1.25 mm, sulcate above, subdensely scaly, partially glabrescent. Basal bracts subulate, to c. 3.5 mm long, outer bracts ovate, c. 5 × 3 mm, inner bracts ovate, c. 5 × 4 mm. Bracteoles linear, c. 3.5 mm long, laxly hairy. **Inflorescence** 2–5-flowered, open umbel, flower half-hanging or slightly horizontal. Pedicels 10–11.5 × c. 0.5 mm, pubescent, hairs almost patent, laxly scaly. **Calyx** 2.5–2.75 mm across, disc-shaped, densely scaly mixed with hairs. **Corolla** 30–33 × 17–19 mm, tubular, pink;

tube 21–22 long, 3.5–4 wide at base, c. 7.5 mm wide at apex, cylindrical, distinctly sulcate at the base up to ¼ of the total length, laxly scaly, also laxly pubescent in the lower half, inner side pubescent in the lower half, upward glabrous; lobes 8–9 × 3.5–5.5 mm, oblong or subspathulate, slightly overlapping, half-spreading to almost horizontal, apex rounded. **Stamens** irregularly arranged, exerted for 7.5–10 mm; filaments linear, pink with white apex, patently hairy at the very base, gradually becoming sparse up to c. ¾ of its length, later glabrous; anthers oblong, 1.5 × 0.75 mm, light brown. Disc slightly prominent, hairy at the apex. **Ovary** 3 × 1.25 mm, subcylindrical, densely covered with subappressed hairs and scales, tapering distally; style slender, c. 23 mm long, clad with patent hairs, glabrous at the very apex, not scaly, stigma capitate, lobed, light yellowish green. **Fruit** unknown.

Phenology: Flowering in November.

Distribution: Endemic to Sulawesi; known only from two specimens collected from the type location in Mamasa Regency, Sulawesi Barat Province (Fig. 6).

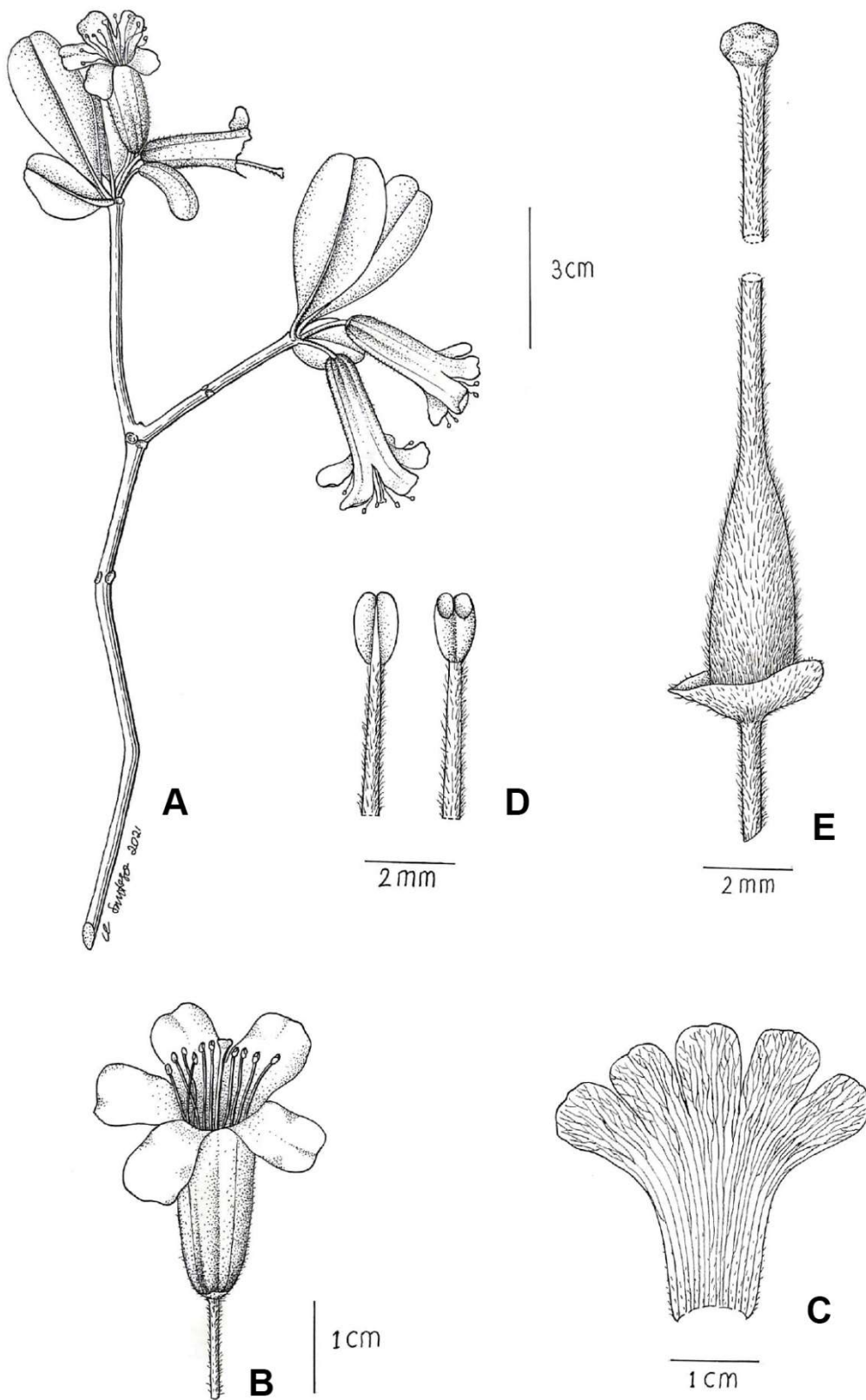


Fig. 5. *Rhododendron tjiasmantoi* sp. nov. (illustrated by Wahyudi Santoso, from Ardi et al. *WI* 578) A. flowering stem; B. Flower; C. Corolla (inner view); D. Anther (dorsal and ventral view); E. Gynoecium.

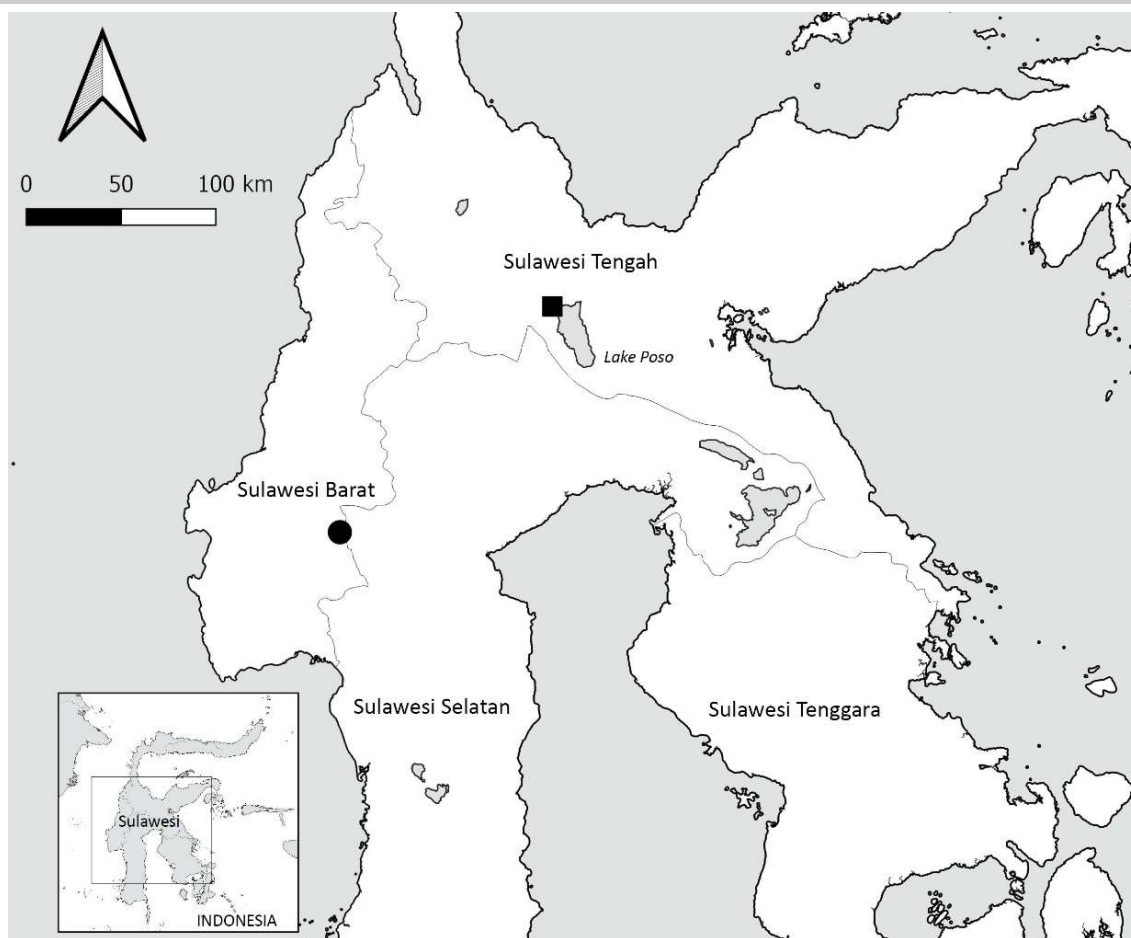


Fig 6. Distribution map for *Rhododendron ardi* sp. nov. (a square) and *Rhododendron tjiasmantoi* sp. nov. (a circle).

Habitat: This species grows either as terrestrial or epiphytic shrubs. Both collections were gathered from two sites located in montane slope vegetation at 1650 to 1750 m.

Etymology: The epithet refers to Wewin Tjiasmanto, a plant diversity enthusiast, for his invaluable support to various botanical explorations in Indonesia including the exploration where the materials of this species were collected.

Notes: *Rhododendron tjiasmantoi* keys out as *R. celebicum* in Argent (2015) and Sleumer (1966) with the differences to each noted in the diagnosis. *Rhododendron celebicum* is a common species in the central part of Sulawesi and is also a quite variable species. Two quite distinct ‘forms’ have been recognized, one with pink flowers and the other with red flowers (Argent, 2015).

Provisional conservation status: Data Deficient (DD). Despite only known from two collections in much disturbed vegetation, the area where this species collected is poorly explored. The notable threats include habitat conversion into agricultural field or settlements. Our field exploration of the site was brief and, therefore, did not other possible suitable habitats. Until further exploration will be conducted, a Data Deficient is considered as the most appropriate conservation status for this species.

Additional specimen examined: INDONESIA. Sulawesi: Sulawesi Barat Province, Mamasa Regency, road to Talambai Village, road in Talambai Village, 1650 m, *Ardi et al. WI 578* (BO, CEB).

ACKNOWLEDGMENTS

We would like express our gratitude to the Yayasan Konservasi Lahan Basah via Mr. Wewin Tjiasmanto, for his support for both expeditions, Sulawesi Tengah in 2018 and 2020, and Sulawesi Barat Expedition in 2019; to Wisnu Handoyo Ardi, collector of both specimens, for helpful information and photographs regarding the collection of the species; the Natural Resources Conservation Agency (BKSDA) of Sulawesi Selatan and the Natural Resources Conservation Agency (BKSDA) of Sulawesi Tengah, the Ministry of Environment and Forestry Republic of Indonesia, for the permit given to collect the specimens; to the curators of BO for allowing us access to herbarium material. We also thank to Wahyudi Santoso and Zakaria Al Anshory for preparing the illustration. We are grateful to other team members for their companionship on the Sulawesi Tengah Expedition (Roland Pribadi, Zulfadli, and Adrianus Thomby) and the Sulawesi Barat Expedition (Marlina Ardiyani, Slamet, Andarias Sambokaraeng, Luther, and especially to Julianus for his great enthusiasm).



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