

Ericaceae of Sulawesi: A new species of *Diplycosia*, a new variety of *Vaccinium paludicolum* and one rediscovery

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Abstract

Diplycosia jiewhoei Mustaqim and *Vaccinium paludicolum* var. *hirsutulum* Mustaqim are described as new taxa. *Diplycosia retusa* has been rediscovered after a lapse of 116 years and is here illustrated with photographs, and the first description of the fruits of this species is presented.

Keywords: *Diplycosia*, Ericaceae, new species, taxonomy, *Vaccinium*, Wallacea

Abstrak (Bahasa Indonesia)

Diplycosia jiewhoei Mustaqim and *Vaccinium paludicolum* var. *hirsutulum* Mustaqim dipertelakan sebagai takson-takson baru. *Diplycosia retusa* telah ditemukan kembali setelah jeda 116 tahun dan foto beserta pertelaan pertama lengkap dengan buah untuk jenis ini disajikan.

Kata kunci: *Diplycosia*, Ericaceae, jenis baru, taksonomi, *Vaccinium*, Wallacea

Introduction

Ericaceae is among the larger families of woody plants consisting of 124 genera and about 4250 species that are widely distributed in the world. It is also the largest plant family in the order Ericales (Christenhusz and Byng 2016). At least 758 species from this family have been recorded from Malesian region (Sleumer 1964, 1967). The literature suggests that most of them are endemic, either to Malesia, a single island or even a single mountain (Sleumer 1967; Argent 2014, 2015; Conlon 2015).

Sulawesi is the largest island in Wallacea and is home for many endemic species of Ericaceae and, for the family, is the third richest flora after Borneo and New Guinea (Argent 2015; Sleumer 1967). Eight species from this family have been described from the island in the last ten years (Argent 2009, 2014; Argent and Widjaja 2015; Argent and Mambrasar 2019). In this paper a new species and a new variety are added to the Ericaceae

based on materials collected from a recent visit to the central part of the island. *Diplycosia retusa* Sleumer, which was formerly known only from the type collection, has also been rediscovered.

A New Species of *Diplycosia*

Unlike *Rhododendron*, *Diplycosia*, which consists of about 120 species and almost confined to the Malesian region (Argent 2014, Sleumer 1967), is a poorly known genus of Ericaceae (Conlon 2015). This is because many of the plants are epiphytic in habit and small, especially the flowers, which allows the plants to be easily overlooked (Argent and Widjaja 2015). Therefore, it is not surprising that some new species from various regions in Malesia have been described recently such as *D. rigidifolia* (Fritsch and Bush 2016), *D. platyphylla* (Fritsch and Amoroso 2016), *D. kalimantanensis* (Wilkie and Argent 2016), *D. kitangladensis* (Fritsch and Amoroso 2017) and *D. benitotanii* (Argent 2018).

After the publication of the monographic work by Sleumer (1967) where he recognized 17 species, the taxonomy of *Diplycosia* in Sulawesi was updated by Argent (2014), where he described some new species and made some taxonomic assessments on previously known taxa. In that account, Argent also stated that even with the new species added, further exploration is highly likely to yield further new species and a year later, another species named *D. mekonggaensis* was added to the Sulawesi flora (Argent and Widjaja 2015). With a new species described in this paper, the number of *Diplycosia* species recorded in Sulawesi is now 23, the second richest island after Borneo.

***Diplycosia jiewhoei* Mustaqim, sp. nov.**

Diagnosis: Similar to *Diplycosia elliptica* Ridl. (northern Sumatra, Peninsular Malaya and Borneo) but differing in having leaves with a protruding apical gland (vs minute), longer pedicels (c. 4 mm vs 1(–2) mm long), an urceolate-subglobose corolla (vs short-cylindric or subcampanulate), oblong anthers (vs sagittate) and shorter tubules (0.3 mm vs 1 mm long).

Type: INDONESIA: Central Sulawesi: Poso Regency: Tentena-Bada road divide, 1 Aug 2018, *WH Ardi* 258 (holotype: BO!; isotypes: CEB!, SING!).

Etymology: Named after Tan Jiew Hoe, the Singaporean philanthropist and plant enthusiast who supports many botanical explorations including the one on which this species was collected.

Epiphytic, subclambering shrub, c. 40 cm tall. *Twigs* red-brown at first, turning greyish brown, finally greyish and somewhat blackish, slender, angular, covered by appressed bristles and lax patent puberulous hairs. *Perulae* stipule-like, subulate, persistent at least at the current year of twigs, finally deciduous. *Petiole* 1.75–2 × c. 0.75 mm, grooved above, inserted on a slightly developed cushion, laxly clad with appressed bristles. *Leaf lamina* green above, pale whitish beneath, sub-densely arranged, leathery, elliptic, less frequently subovate, 12.5–25 × 6.25–18.75 mm, base obtuse or rounded, apex acute or shortly acuminate, apiculate, terminal gland protruding from the apex, margin crenulate throughout, setose, the bristles partially persistent, mid-vein narrowly impressed above, rather raised beneath especially in the lower half, lateral veins 1 from near the base of the lamina, slightly impressed above which is more conspicuous in the living plant, obscure beneath; upper surface laxly clad with sub-patent to patent bristles, glabrescent or sometimes with a few bristles remaining and long persistent; lower surface laxly clad with appressed bristles, mixed with punctate glands, finally punctate or with a few bristles persisting. *Inflorescence* axillary from leafy or sometimes defoliate branches, a 1–4-flowered fascicle, but only with 1 or 2 flowers open at any one time. *Pedicels* green, c. 4 mm at anthesis, laxly covered with muriculate and few minute glandular hairs; bracteoles green, broadly ovate, c. 0.5 mm long, obtuse, dorsally glabrous except at the apex of the dorsal keel where there are a few hairs, margin shortly glandular muriculate and or ciliate apex, these hair types sometimes mixed. *Flowers* 5-merous. *Calyx* creamy white and reddish except at the lobes, campanulate, totally c. 4.5 mm long, dorsally muriculate; lobes 1.75 mm long, acute, margin with glandular hairs, hairs mostly club-shaped, except at the apex. *Corolla* pure white, urceolate-subglobose, narrowed at the base, c. 7 mm long by c. 6.25 mm wide, glabrous; lobes c. 1.5 mm long, strongly reflexed, glabrous. *Stamens* 10, filaments c. 3.75 mm long, linear, slightly tapered to apex, glabrous, slightly curved; anthers oblong, c. 1.3 mm long, echinulate, tubules short, c. 0.3 mm long, broad. *Ovary* subdepressed globose, glabrous. *Style* simple, cylindrical, c. 3 mm long, glabrous, slightly enlarged at the middle of the lower half. *Fruit* (early stage with accrescent calyx) light yellowish green, pyriform. Figs 1, 2.

Distribution: Sulawesi. Known from three collections from the type locality (Fig. 3).

Habitat and ecology: Growing in the upper montane forest ecosystem, with a granitic substrate, epiphytic on tree with litter accumulations, 1700 m.

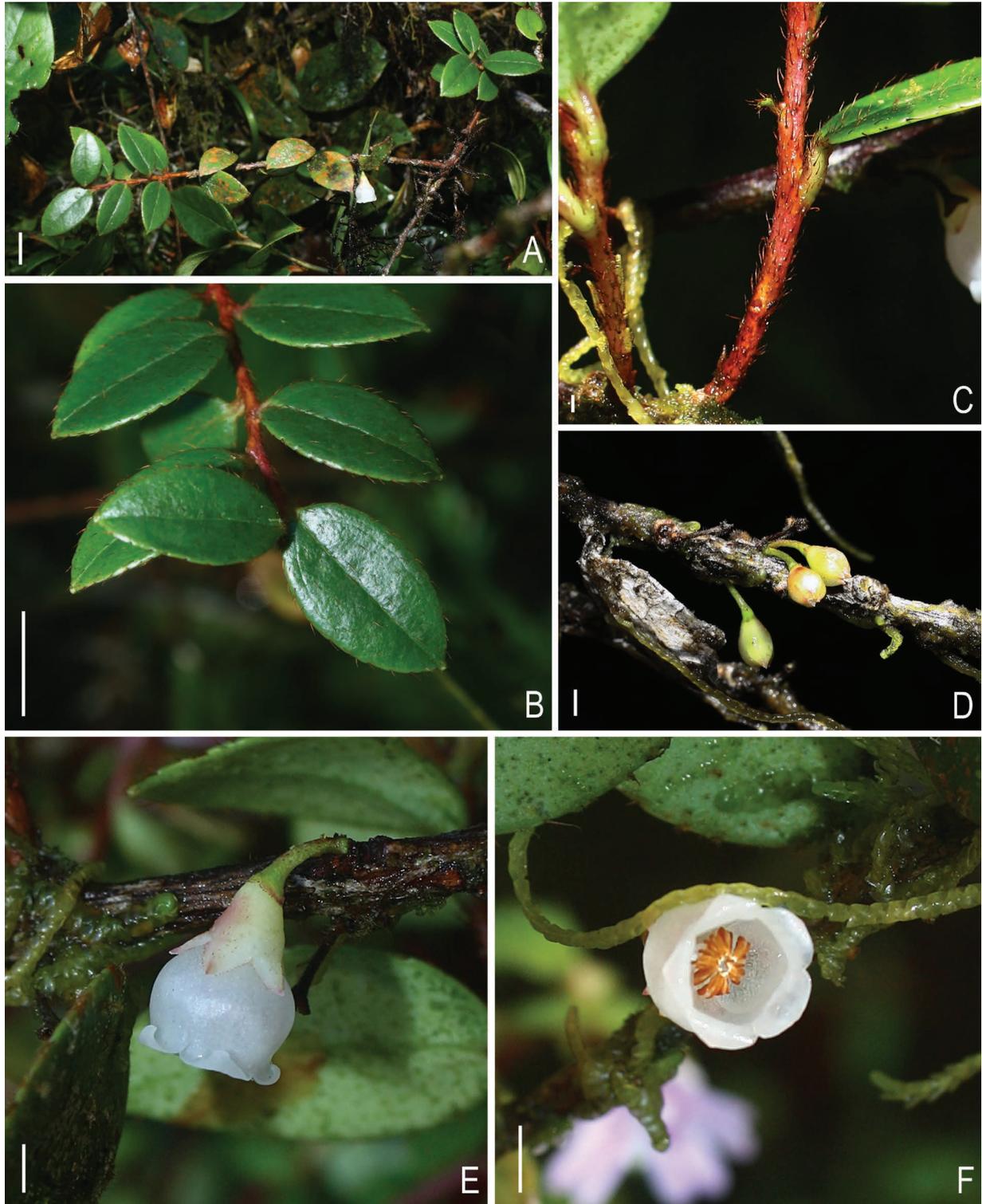


Fig. 1. *Diplycosia jiewhoei*: A. habit. B. twig. C. close up of leaves. D. inflorescence. E-F. Flower. Scale: A-B = 5 mm; C = 0.5 mm; D-F = 2 mm. All from *Ardi* 258. Photos: Wisnu H. Ardi.

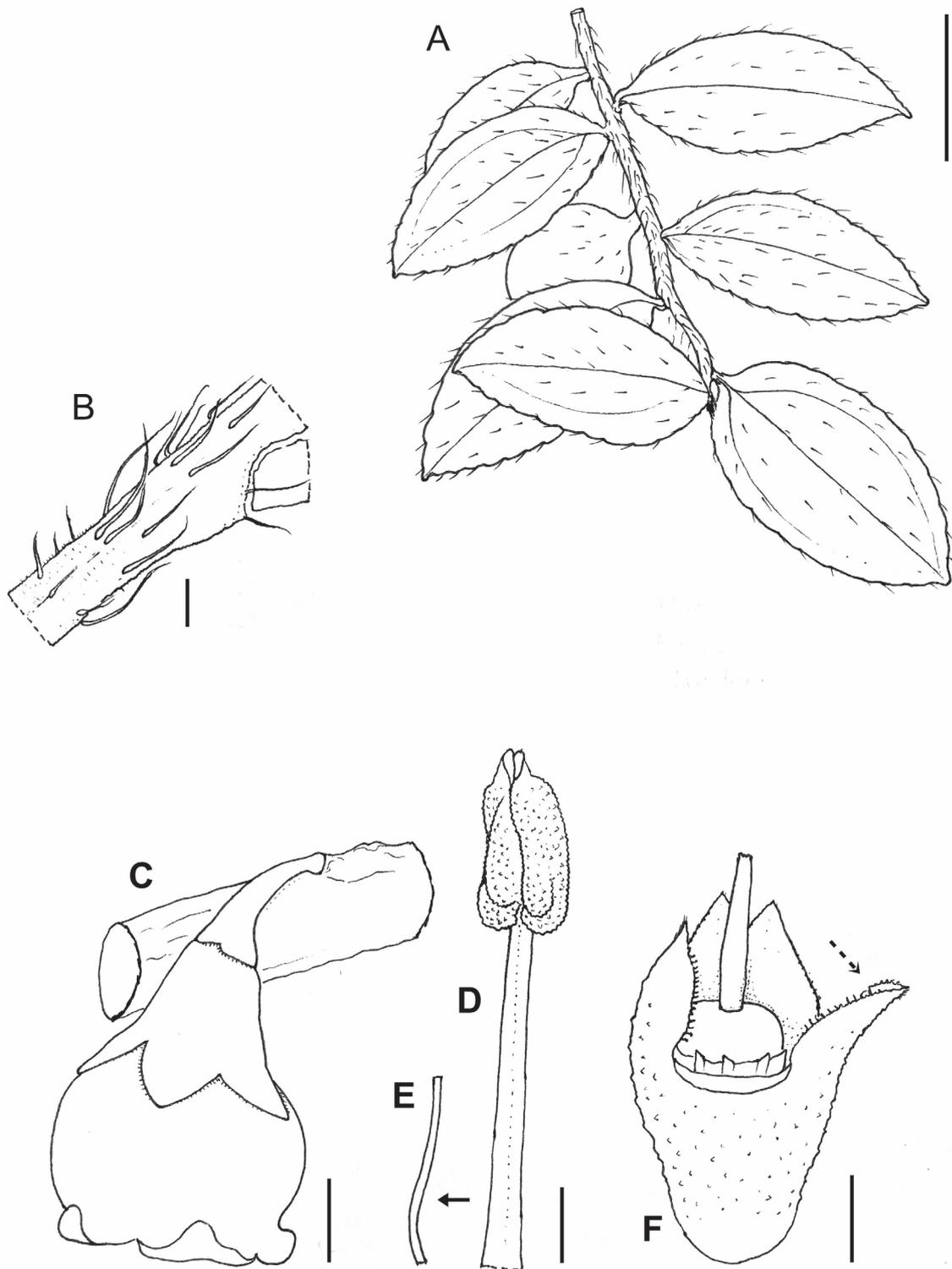


Fig. 2. *Diplycosia jiewhoei*. A. Leafy twig. B. Close up of young twig. C. Flower from defoliate stem. D. Stamen. E. Lateral view of basal part of the filament. F. Calyx, discs, ovary and style. The arrow show calyx lobes pulled out by hand. Scale: A = 5 mm, B = 0.5 mm, C = 2 mm, D–E = 0.5 mm, F = 1 mm. All from Ardi 258. Drawing: Wendy A. Mustaqim.

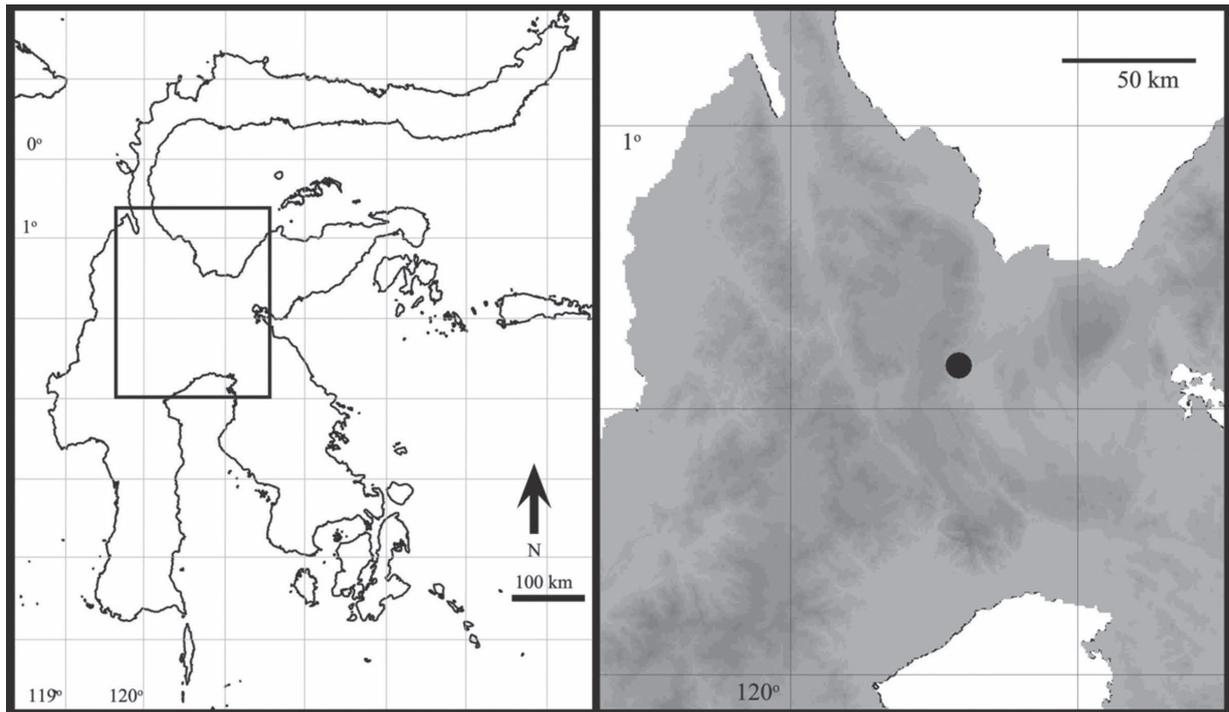


Fig. 3. Distribution of *Diplycosia jiewhoei* and *Vaccinium paludicoloum* var. *hirsutulum*, as well as the new location of *Diplycosia retusa* (see text for details).

Flowering and fruiting: Flowering material has been collected in August; fruiting unknown.

Conservation status: Vulnerable (VU D2). This species is only known from its type locality and only a few plants have been collected though time in the field was limited. However, it should be noted that there is a potential threat for this species associated with the the presence and maintenance of the provincial road from Tentena to Bada Valley. Following IUCN (2012) and IUCN Standards and Petitions Subcommittee (2017), this species can be regarded as Vulnerable since it is known from a restricted geographic range that could be considered as a single location and there is a potential threat of a nearby road and any associated works.

Additional specimens examined: INDONESIA: Central Sulawesi: Poso Regency: Tentena-Bada road divide, 1 Aug 2018, *WH Ardi 256* (BO!); *ibid.* *WH Ardi 259* (BO!).

Revised keys to species

Couplet 69 from the *Flora Malesiana* (Sleumer 1967) is modified to accommodate the new species:

- 69. Leaves ovate to subrotundate, all slightly though distinctly cordate at the base..... *D. crenulata*
- 69. Leaves ovate to elliptic, broadly cuneate to rounded (rarely in part also subcordate) at the base 69'
- 69'. Pedicels 1(–2) mm long; corolla short-cylindric or subcampanulate; anther sagittate, tubule 1 mm long..... *D. elliptica*
- 69'. Pedicels 4 mm long; corolla urceolate-subglobose; anther oblong, tubule 0.3 mm long..... *D. jiewhoei*

Couplets 14 and 15 from the key to *Diplycosia* of Sulawesi (Argent 2014) are modified to accommodate the new species.

- 14a. Pedicels mostly < 2(–4) mm long; axillary bud scales as long as the petiole (unknown in *D. jiewhoei*) 15
- 14b. Pedicels > 6 mm long; without conspicuous axillary bud scales which if present are much shorter than the petiole 16
- 15a. Bracteoles and calyx lobes with a few long bristles *D. sagittanthera*
- 15b. Bracteoles and calyx lobes without any long bristles with an exception of few hairs in the apex of bracteoles in of *D. jiewhoei* 15'

- 15'a. Corolla 2.5 mm long; pedicels 1 mm long; tubules ca. $\frac{1}{2}$ as long as the anthers.....*D. supyanii*
 15'b. Corolla 7 mm long; pedicels 4 mm long; tubules ca. $\frac{1}{4}$ as long as the anthers *D. jiewhoei*
 In the key to *Diplycosia* of Sulawesi (Argent 2014) couplet 27 is modified to include *D. mekonggaensis* from Argent & Widjaja (2015).
 27a. Leaves sub-circular to broadly elliptic 27'
 27b. Leaves ovate to elliptic..... 28
 27'a. Calyx covered with dense bristles.....*D. mekonggaensis*
 27'b. Calyx glabrous.....*D. undata*

The rediscovery of *Diplycosia retusa*

Diplycosia retusa Sleumer, Bot. Jahrb. 71: 156 (1940).

Type: INDONESIA: Central Sulawesi (=Celebes): Topapu Mountains (120°15'E 2°0'S), 1300–1700 m, 17 Sep 1902, Sarasin 2097 (holotype: B†; isotype: L, fragm.).

Shrub, terrestrial or apparently also epiphytic, stem clambering, up to c. 2 m long. Twigs slender, glabrous. Petiole 4–5.5 mm long. Leaf lamina green, pale whitish beneath, sparsely arranged, thinly leathery, obovate, 10–40 × 5.5–20 mm, base tapering, apex rounded or nearly so, terminal gland thick and prominent, margin entire or with some minute glandular crenations on the somewhat cartilaginous margin, glabrous, mid-vein slightly impressed above, somewhat raised beneath, lateral veins 1–2 from near or slightly above the base of the lamina, indistinct to slightly impressed above, obscure beneath; glabrous. Inflorescence a 1–2-flowered fascicle from the axil of leaves. Pedicels 15 mm long, very slender, glabrous; bracteoles ovate, 1 mm long, glabrous; fruiting pedicels 11.5–13.5 mm long. Flowers 5-merous. Calyx white, totally c. 2.5 mm long, 5-lobed to near the base, lobes triangulate, acute, margin glandular ciliate. Corolla white with lobes tinged with pink, elongate-campanulate, c. 10 mm long, glabrous, lobes 3 mm long. Stamens c. 4 mm long; filaments linear, undulate, 2 mm long, glabrous, anthers 1.5 mm long, tubules 1 mm long. Ovary glabrous. Style 5 mm long, glabrous. Fruit blackish blue at maturity, bell-shaped, c. 8.25 mm across including the accrescent calyx, true fruit sub-depressed globose, 4 mm diam., calyx segments when immature appressed to the capsule, later free from it. Fig. 4.

Distribution: Endemic to Central Sulawesi.

Habitat and ecology: Terrestrial in upper montane vegetation on quartzite soil, 1300 to 1700 m.

Flowering and Fruiting: Flowering material collected in August and September; fruiting in August.

Conservation Status: Data Deficient (DD). More data is needed to assess the conservation status of this species.

Notes: *Diplycosia retusa* was known only from the type collection from Topapu Mountains, Sulawesi Tengah, Indonesia (Sleumer 1957, 1967; Argent 2014) collected by Sarasin in 1902 (Welzen 2017). Recently a specimen was collected in Bada Valley, Central Sulawesi. It is located approximately 30 km east of the locality where the holotype was collected. The species was found in the upper montane ecosystem at an elevation of about 1700 m on a peaty quartzite substrate.

Based on the latest revision (Argent 2014), this species may be recognized by its glabrous twigs, short petiole (4–5 mm long, now up to 5.5 mm long), largest leaves c. 40 mm long, 1-flowered inflorescence, corolla white c. 10 mm long, the pedicels glabrous and longer than 10 mm. It differs from the similar *Diplycosia gracilipes* J.J.Sm. by the glabrous stems and leaves (Argent 2014) and its white corolla (vs red).

Some morphological differences have been found between the original and description from our recent collection. Our plant is a terrestrial shrub while the original description indicated it was epiphytic. Leaves on the recently collected material are smaller when compared to the description available in Sleumer (1967) and Argent (2014). The previous records of the leaf size was 30–40 × 15–20 mm, but our specimen is only 10–27 × 5.5–13.5 mm. We also recorded for the first time that there can be 1 or 2 flowers per axils, and that the colour of the living corolla is white with lobes tinged with pink. The calyx lobes in the mature fruits diverge from the capsule which appears to be a unique feature among *Diplycosia* species. This record supports the need for the documentation of the fruit characters to test their value in classification of *Diplycosia* as suggested by Argent (2014).

Additional specimens examined: Indonesia: Sulawesi: Central Sulawesi: Poso Regency, Tentena-Bada road divide, 1 Aug 2018, *Ardi 261* (BO!); *ibid*, *Ardi 272* (BO!).



Fig. 4. *Diplycosia retusa*. A. Habit. B. Flower. C. Fruit, lateral view. D. Fruit seen from above. Scale: A = 5 cm; B = 5 mm; C–D = 5 mm. All from *Ardi 272*. Photos: Wisnu H. Ardi.

A New Variety of *Vaccinium paludicolum*

The latest comprehensive account for Sulawesi's *Vaccinium* was published as part of *Flora Malesiana* monograph by Sleumer (1967) in which he reported 15 species and one variety. After Sleumer's work, no new taxa of this genus has been added from the island and only a study from Kartanagoro (2014) list species of this genus in his publication of the Ericaceae of Latimodjong. Many species of the genus *Vaccinium* in Sulawesi are narrow endemics (Sleumer 1967; Kartanagoro 2014).

Vaccinium paludicolum Sleumer Blumea 11: 53 (1961).

Type: INDONESIA: Sulawesi: Central Eastern part, subdiv. Kolonedale, between saddle and E slope of the Tomongkoba group, *Eyma* 3957 (holotype: L; isotype: A, BO, K [K000780726]!-image seen).

Terrestrial shrub, subscaudent, stem up to 0.5 m long (not recorded in var. *paludicolum*). Twigs slender, terete, densely and sub- to patently hirsutulous, bristles persistent. *Petiole* thickish, c. 1–1.5 mm long, hirsutulous. *Leaves* densely arranged, lamina ovate, 0.6–1.5 × 0.35–0.8 cm, coriaceous, apex shortly attenuate, subacuminate, or acute, tip blunt, rounded at the base, basal marginal glands distinct, distant from the petiole; midrib slightly impressed above, flat or slightly raised above, very obtusely and minutely raised beneath, secondary nerves and veins slightly inconspicuous or faintly distinct above; upper surface glabrous to hirsutulous on the midrib, lower surfaces glabrous or hirsutulous, blackish punctulate beneath. *Inflorescence* several racemes, borne from the upper axils, 3–10-flowered, flowers secund; rachis rather stoutish, densely yellowish hirsutulous, 0.2–3 cm long. *Pedicels* 3–4 mm long, yellowish hirsutulous; bract foliaceous, much smaller than the normal leaves, caducous or in part subsistent after anthesis. *Flowers* 5-merous. *Calyx* light green, tube campanulate, 1.25–1.5 × 2 mm, limb spreading or reflexed, 5-lobed, lobes deltoid, 0.5–1 mm long, apical gland absent; sparsely to very sparsely clad with whitish straight hairs. *Corolla* deep red, tubular, subampullaceous-cylindric, 7–8 × 2–2.5 mm when dry, rather abruptly attenuate in the upper third, glabrous or provided with some hirsutulous hairs outside, sparsely hairy inside, lobes suberect or ± reflexed, c. 0.5 mm long. *Stamens* 10, filaments alternately long and short, 2.7–5 mm and 2–4 mm long, respectively; anther-cells subquadrate, ecalcarate, c. 1–1.2 mm long including the tubule, the latter very short, transversely cut apically, the pore large. *Disk* glabrous. *Ovary* inferior. *Style* cylindrical, slender, 7–7.5 mm long, glabrous or provide with some hairs at the base. *Fruit* unknown.

Notes: *Vaccinium paludicolum* was described by Sleumer (1961). This species is to date known from three collections from the central part of the island. Based on Sleumer (1967), this species can be separated from other *Vaccinium* species by the foliaceous bracts persisting at anthesis, entire or nearly so leaf margin, glabrous leaves, the absence of gland at calyx lobes and callose thickening at its apex, the tubule that is shorter than the anther-cells, the absence of dorsal spur in the anthers, tubule ended in one broad tooth, leaves up to 1.2 × 0.8 cm, pedicelled flowers, and ampullaceous corolla which is 7 mm or longer.

Our recently collected specimen does not key out to but closely matched the description of *V. paludicolum* in Sleumer (1967). It differs by the presence of the hairs on the abaxial surfaces of the leaves, the outer side of the corolla and basal part of the style. We believe the specimen is *V. paludicolum* but represents an undescribed variety which is described below.

Key to the varieties of *Vaccinium paludicolum*

- 1a. Abaxial surface of leaves glabrous; corolla glabrous; style glabrous..... *V. paludicolum* var. *paludicolum*
- 1b. Abaxial surface of leaves hirsutulous; corolla with a few hairs outside; style with bristles at the base..... *V. paludicolum* var. *hirsutulum*

Vaccinium paludicolum var. *paludicolum*

Plant height unknown. *Petiole* c. 1 mm long. *Leaves* lamina 0.6–1(–1.2) × (0.4–)0.5–0.8 cm, midrib slightly impressed above, veins slightly inconspicuous, glabrous on both surfaces. *Inflorescence* 5–10-flowered; rachis (1–)1.5–2(–3) cm. *Pedicels* c. 3 mm long. *Calyx* tube 1.5 mm long. *Corolla* c. 2 mm wide, glabrous outside. *Stamens* with filaments alternately long and short, 2.7 mm and 2 mm long, respectively. *Style* c. 7 mm long, glabrous.

Distribution: Sulawesi: Central Sulawesi.

Habitat and ecology: On peaty quartzite plateau, 1700–2000 m.

Flowering and fruiting: Flowering materials have been collected from August to November

Conservation status: Data Deficient (DD). More data is needed to assess the conservation status of this species. No recent data available for this variety.

Notes. The description of the species above is mostly taken from Sleumer (1967).

Additional specimens examined: SULAWESI: Subdiv. Poso, Lake Poso, c. 2000 m, 9 Oct 1938, *Steup* 7 (BO); Poso, Bóro-Poéna, 1700–1800 m, on peaty quartzite plateau, 10 Aug 1937, *Eyma* 1615 (BO, L).

Vaccinium paludicolum var. *hirsutulum* Mustaqim, *var. nov.*

Diagnosis: Differ from *V. paludicolum* var. *paludicolum* in having hirsutulous abaxial sides of the leaves (vs glabrous), the corolla provided with hirsutulous hairs outside (vs glabrous), the style with few longish hairs at the base (vs glabrous), longer filaments (alternately 5 and 4 mm long vs 2.7 and 2 mm long). Figs 5, 6.



Fig. 5. *Vaccinium paludicolum* var. *hirsutulum*. A. Habit. B. Inflorescence showing secund flowers. Scale: A = 2 cm; B = 0.5 cm. All from *Ardi* 263. Photos: Wisnu H. Ardi.

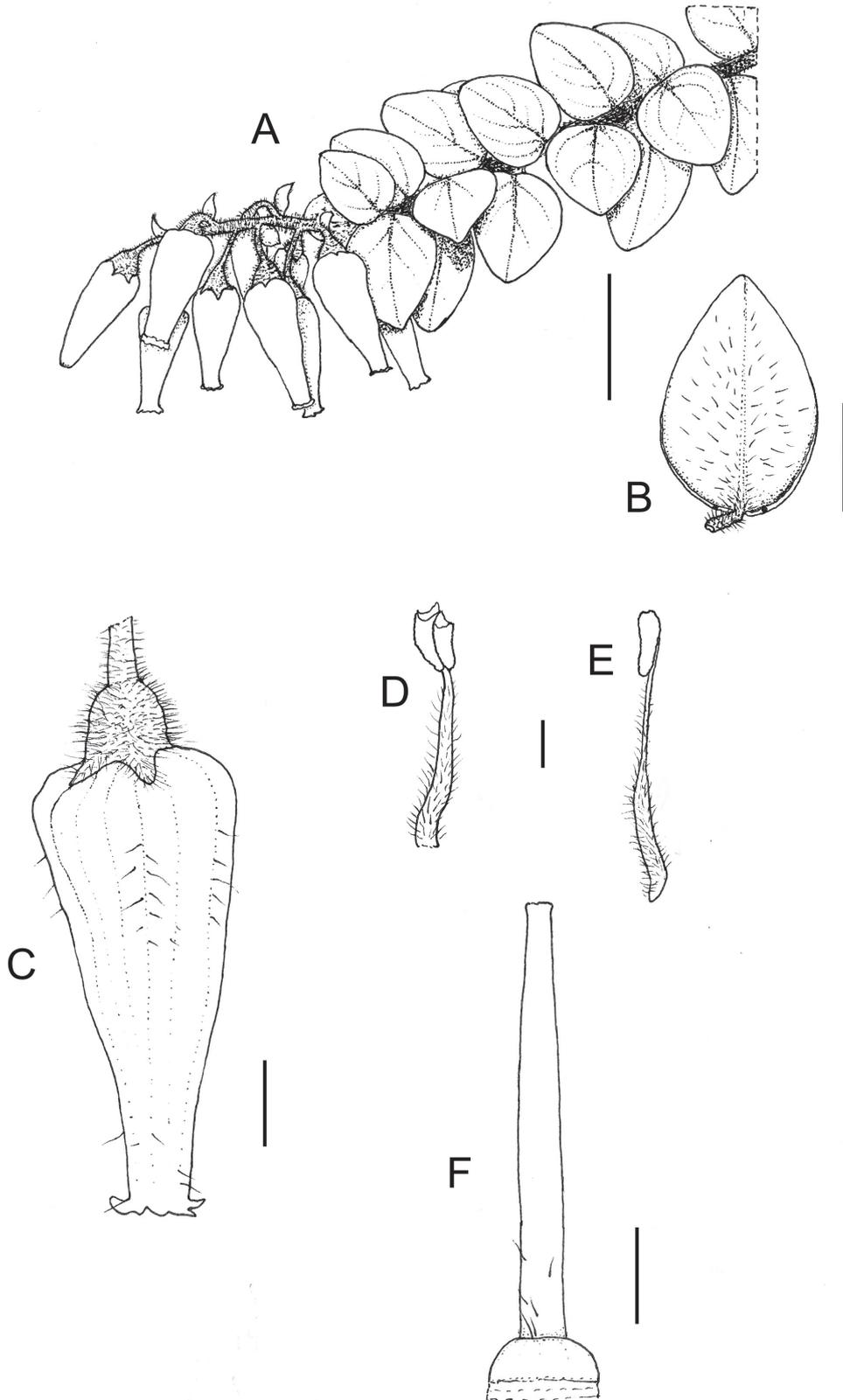


Fig. 6. *Vaccinium paludicolum* var. *hirsutulum*. A. Flowering twig. B. Abaxial view of leaf. C. Flower. D. Shorter stamen, alternatisepalous. E. Longer stamen. F. Style. Scale: A = 1 cm, B = 5 mm, C = 1 mm, D–E = 1 mm, F = 2 mm. All from Ardi 263. Drawing: Wendy A. Mustaqim.

Type: Indonesia: Central Sulawesi: Poso Regency: Tentena-Bada road divide, 1 Aug 2018, *WH Ardi* 263 (holotype: BO! isotype: CEB!).

Etymology: The varietal epithet is derived from the presence of hairs on some organs.

Plant to 0.5 m. *Petiole* 1–1.5 mm long. *Leaves* lamina 0.7–1.5 × 0.35–0.8 cm, flat or midrib slightly raised or faintly distinct above, adaxial surface hirsutulous along the midrib, abaxial surface hirsutulous. *Inflorescence* 3–9-flowered; rachis 0.2–1.8 cm long. *Pedicels* c. 4 mm long. *Calyx* tube 1.25 mm long. *Corolla* c. 2.5 mm wide, with some hirsutulous hairs outside. *Stamens* with filaments alternately long and short, 5 and 4 mm long. *Style* c. 7.5 mm long, provided with some hairs at the base.

Distribution: Sulawesi: only known from the type specimen collected in Tentena-Bada Valley Road divide.

Habitat and ecology: Growing in the upper montane forest ecosystem, near a small stream, 1700 m.

Flowering and Fruiting: Flowering August, fruiting unknown.

Conservation status: Data Deficient. Only one individual has been seen and information on populations size is unavailable and so this species can be regarded as Data Deficient (IUCN 2012).

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