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A new species of *Diplycosia* (Ericaceae) from Mount Jaya, western New Guinea

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Abstract

Diplycosia puradyatmikai, a new species of Ericaceae, is described from Mount Jaya in the Indonesian province of Papua, western New Guinea. A detailed description, illustration, and comparisons with the similar species *D. kosteri* are provided.

Keywords: *Diplycosia*, new species, Papuasia, Indonesia, taxonomy, Ericales

Introduction

The tropical island of New Guinea is a centre of diversity for many plant groups, including the Ericaceae (Sleumer 1967; Argent 2015). For six of the nine genera that occur in New Guinea, i.e., *Agapetes* D. Don ex G. Don (1834: 862), *Dimorphanthera* (Mueller ex Drude 1889: 55) Mueller (1890: 63), *Diplycosia* Blume (1826: 857), *Paphia* Seeman (1864: 77), *Rhododendron* Linnaeus (1753: 395), and *Vaccinium* Linnaeus (1753: 349), the island is a centre of diversity (Sleumer 1960, 1967; Stevens 2004). In addition, *Gaultheria* Kalm. ex Linnaeus (1753: 395), *Styphelia* Smith (1793: 45), *Trochocarpa* Brown (1810: 548) also occur on the island. There are several recently published records of New Guinea Ericaceae, including those from checklists and generic notes, e.g., Argent (2006; 2015), Argent & Johns (2006), Stevens (2004), Takeuchi (2007), and Utteridge (2006); monographic floristic accounts by Sleumer (1960; 1960; 1967); as well as descriptions of new species, e.g., Argent & Conlon (2017), Danet (2005a; 2005b; 2010; 2012; 2015), Danet & Chaumeret (2016), Mambrasar & Hutabarat (2018), and Venter & Munzinger (2007).

Diplycosia remains one of the more poorly known genera in the family (Conlon 2015), and in New Guinea there has been no taxonomic revision since the Flora Malesiana account by Sleumer (1967), which included 21 endemic species. Subsequent to the Flora, numerous collections have been made, adding greatly to the number of available specimens for study but also resulting in many unidentified specimens, with one of them just recently published as a new species (Mustaqim *et al.* 2019). Taking into account these more recent collections, we are preparing an island-wide taxonomic revision of *Diplycosia*.

Diplycosia is strongly supported as monophyletic in molecular studies (Fritsch *et al.* 2011), with several putative synapomorphies, including entire leaf margins, fasciculate inflorescences, terminal anther tubules (Sleumer 1967), and a base chromosome number of $x = 18$ (Argent & Brunton 1984; Middleton & Wilcock 1990). Phylogenetic data support the placement of *Diplycosia* as nested with *Gaultheria* (Fritsch *et al.* 2011), and on this basis *Diplycosia* may eventually be included within *Gaultheria*, depending on the circumscription of the latter. Here we use *Diplycosia* as currently circumscribed as in, for example, Sleumer (1967) and Argent (2014).

Mount Jaya, the highest peak in South-East Asia at 4884 m a.s.l., is located in the central part of what is now called Papua Province — the eastern province in the Indonesian half of New Guinea (formerly known as Irian Jaya or Netherlands New Guinea). The flora of this area has been well documented since the area's development as a copper and gold mine by the PT Freeport Indonesia mining company in 1967 (Mealey 1996; Utteridge & de Kok 2007). A five-year programme to explore the area was started in 1997 by Rio Tinto, Royal Botanic Gardens, Kew and PT Freeport Indonesia (Utteridge & Edwards 2009), resulting in > 5000 collections, a detailed checklist to the alpine and subalpine flora of the region (Johns *et al.* 2006), and numerous new taxa (e.g., Chambers *et al.* 2005; Hind 2004; Hind & Johns 2002; Hind & Johns 2003; Utteridge 2000a; 2000b; 2001; 2002; 2003). Ericaceae are the most species-rich family in the subalpine and alpine vegetation of Mount Jaya (Utteridge & Edwards 2009). *Diplycosia* species from this area were treated in Argent & Johns (2006), with five species recorded: *D. edulis* Schlechter (1918: 163), *D. lorentzii* Koorders (1912: 881), *D. morobeensis* Sleumer (1942: 210), *D. rosea* (Sleumer 1957: 153), and *D. soror* var. *nuda* Sleumer (1963: 118). Examination of *Diplycosia* specimens at BO, K, L, and MAN (acronyms follow Thiers 2019, continuously updated), the herbarium at the Mount Jaya site (PT Freeport Indonesia, informally termed FRE), and consultation of the recent checklist in Argent & Johns (2006), revealed the occurrence of several unnamed taxa of *Diplycosia* due to incomplete material only being available. Therefore, a recent field trip in November 2018 was carried out to the Mount Jaya region to the original localities of these unnamed taxa with the aim to recollect them, and supplement the currently available material with mature flowering specimens to allow critical identification.

The new *Diplycosia* species described here was initially known from two collections from along the PT Freeport Indonesia access road from Timika to Tembagapura. The first specimen was collected in 1985 by Elizabeth A. Widjaja during a Herbarium Bogoriense expedition (Widjaja 2220), but the specimens only bear young flower buds. During the Kew programme, a second specimen was collected in 1998 (Barker 89), but only with fruit. The L duplicate of the Barker specimen was annotated by the Ericaceae specialist George Argent, from the Royal Botanic Garden Edinburgh, as a new species. Barker stated that the plant was found growing in disturbed mid-montane forest dominated by *Nothofagus* regeneration. During our recent expedition, we were unable to visit the locality of the Widjaja specimen, but were able to visit the locality of the Barker specimen, and two specimens bearing mature flowers were collected from stunted forest on a ridge rich in Ericaceae at an elevation of 2770 m.

After comparing both the earlier collections and the recently collected specimens to previously published species of *Diplycosia*, and all available specimens of *Diplycosia*, especially those from New Guinea, it is clear that the specimens are an undescribed species as first suggested by George Argent. Consequently, the number of *Diplycosia* species from Mount Jaya is now six, adding an additional species to the five recorded in Argent & Johns (2006).

New species description

Diplycosia puradyatmikai Mustaqim, Utteridge & Heatubun, *sp. nov.* (Figures 1 & 2)

Type:—INDONESIA. Papua: Mimika Regency, Tembagapura, road from Timika to Tembagapura, Mile 64, ridge north of Army Camp, 2770 m, 22 Nov. 2018, *Mustaqim* 2234 with *Puradyatmika* & *Dominggus* (holotype: BO!, isotypes: FIPIA!, MAN!).

Diagnosis:—Similar to *D. kosteri* Sleumer (1963: 117) in having hairy twigs, the absence of simple fine hairs, calyx with non-glandular bristles, glabrous filaments, the style shorter than 4 mm; but differs in the erect habit (vs scandent in *D. kosteri*), persistent twig bristles (vs early glabrescent), leaf blades usually broadly-ovate to suborbicular (vs elliptic) and comparatively smaller (0.8–) 1.6–2.8 × (0.7–) 1.5–2.5 cm (vs (2.5–) 2.8–4.5(–5.5) × (1.5–)2–3(–3.2) cm), the corolla tube widest near the base (vs widest near the mouth) with trichomes on the outer surface (vs glabrous), and shorter filaments (2.8–3 vs 3.5 mm long) and anthers 1.2–1.4 mm long (vs 1.8 mm long) (see also Table 1).

Description:—Many-branched terrestrial shrub to 1.5 m tall. *Twigs* brown, robust, cylindrical, bark finally longitudinally cracked, clad by golden brown bristles, bristles initially subappressed, later especially basally subpatent to patent and apically sometimes slightly forward-directed to appressed, variable in length up to 5 mm long, often gland-tipped, very tardily glabrescent, simple fine hairs absent. *Perulae* stipule-like, subpersistent. *Leaves:* *Petioles* usually red especially in lower half, 3–8 × 1.3–2 mm, grooved above, inserted on a slightly developed cushion, subappressed-setose, blades dark green and slightly shiny above, pale whitish beneath, laxly arranged, leathery, rigid, broadly ovate or ovate, suborbicular, less frequent broadly elliptic, subovate, very rarely elliptic, (0.8–) 1.6–2.8 × (0.7–)1.5–2.5 cm, base truncate, rounded or less frequent obtuse, apex rounded or less frequent obtuse, very rarely subacute, apiculate, terminal gland protruding from apex, margin revolute, shallowly crenulate throughout, teeth setose, bristles rather persistent, midvein impressed above, raised beneath, lateral veins (1 or)2(or 3) from near base of lamina or sometimes

slightly below middle, impressed above, lower ones less conspicuous, faintly raised beneath; upper surfaces clad with sub-spreading bristles, these persistent, partially very tardily falling off, lower surfaces laxly clad with slightly spreading bristles, most bristles persistent, both sides with dark glandular points. *Inflorescences* axillary from leafy or sometimes defoliate branches, 1- or 2-(or 3-)flowered, but only with 1 or 2 flowers open at any one time. *Pedicels* reddish, slender, 5.5–14 mm long at anthesis, subdensely set with crisped bristles, golden brown at anthesis, fruiting pedicels 6.5–13 mm long. *Bracteoles* dark reddish brown, broadly ovate, 0.9–1 mm long, obtuse, dorsally glabrous except for a few hairs near base, verruculose, margin densely ciliate. *Flowers* 5-merous. *Calyx* dark brown, campanulate, 3.8–4 mm long, tube strongly rugulose when dry, bristles nearly absent to sparsely scattered, appressed, lobes 1.7–1.9 mm long, acute, dorsally with lax and minute appressed bristles, together with the tube bristles scarcely visible in dried material due to wrinkled surface, margin ciliate and also usually with glandular trichomes. *Corolla* light green, red-tinged below lobes, remaining light green below sinuses and base to lower half, broadly urceolate, 4.8–5.5 mm long at anthesis, 4–5 mm wide, glabrous at base, distally clad with minute appressed crisped bristles which are sometimes glandular at its apex except the glabrous band below the sinuses of corolla lobes, lobes strongly reflexed, 0.9–1.2 mm long, glabrous. *Stamens* 10, S-shaped, dimorphic, with filaments 2.8–3 mm long, glabrous, papillose from the apex of the dilated base to apex, dilated base tapering in only 5 of the filaments, alternating with 5 non-tapered filaments, anthers echinulate, alternately ovate-cordate and oblong respective to the shape of the dilated base, 1.2–1.4 mm long including the tubule, base cordate. *Ovary* glabrous. *Style* white at base, gradually turning light green distally, cylindrical, 3–3.5 mm long, glabrous. *Fruit* initially dark red, turning black at maturity, ellipsoid-subglobose or subobovoid, 7.5 × 6–6.5 mm, calyx appressed to capsule.

Etymology:—The epithet refers to the current General Supervisor of Highland Reclamation and Monitoring at the PT Freeport Indonesia Mining Company, Pratita Puradyatmika, who has a great interest in the biodiversity of Mount Jaya, and worked with biologists over many years to undertake biodiversity inventories in and around the region.

Phenology:—Collected in flower in November, and in fruit in June and November. The submature and mature flowers seem to have different shapes: submature ones are subcylindrical-urceolate, becoming broadly urceolate at maturity.

Distribution and Ecology:—New Guinea: endemic to Mount Jaya. In disturbed mid-montane forest dominated by *Nothofagus* regeneration; also on ridge shrubbery, with many ericaceous plants including *Gaultheria pullei* J.J.Sm. (Smith 1915: 7), *Rhododendron* sp. and other unidentified *Diplycosia* sp.; 2700–2770 m a.s.l.

TABLE 1. Comparison of *D. puradyatmikai* with *D. kosteri*.

Characters	<i>D. puradyatmikai</i>	<i>D. kosteri</i>
Habit	Erect shrub, terrestrial	Scandent shrub, epiphytic
Leaves	(0.8–)1.6–2.8 × (0.7–)1.5–2.5 cm, broadly ovate, ovate, suborbicular, or less frequently broadly elliptic	(2.5–)2.8–4.5(–5.5) × (1.5–)2–3(3.2) cm, elliptic or subobovate-elliptic
Corolla	Light green tinged with red; tube widest near the base; hairy outside	Pink to red, sometimes yellowish; tube widest near the mouth; glabrous
Stamens	Filaments 2.8–3 mm long, anthers 1.2–1.4 mm long	Filaments 3.5 mm long, anthers c. 1.8 mm long
Style	3.5 mm long	4 mm long

Proposed IUCN Conservation Status:—This species has an EOO of 2.1 km² and AOO of 12 km², falling within Critically Endangered and Endangered thresholds, respectively. All available collections were made from a single location along the road from Timika to Tembagapura, which has a high intensity of human activity and a high possibility of habitat conversion, e.g. road maintenance with a resultant decline in the quality of habitat. The type locality is subject to routine human activity due to the presence of a PT Freeport Indonesia electric facility, and mature plants in this area are susceptible to routine vegetation clearing. We infer a decline in the number of mature individuals if these activities continue. Therefore, using the EOO value and from our observations *in situ*, we preliminarily assess *D. puradyatmikai* as Critically Endangered (CR B1ab(iii+v)).

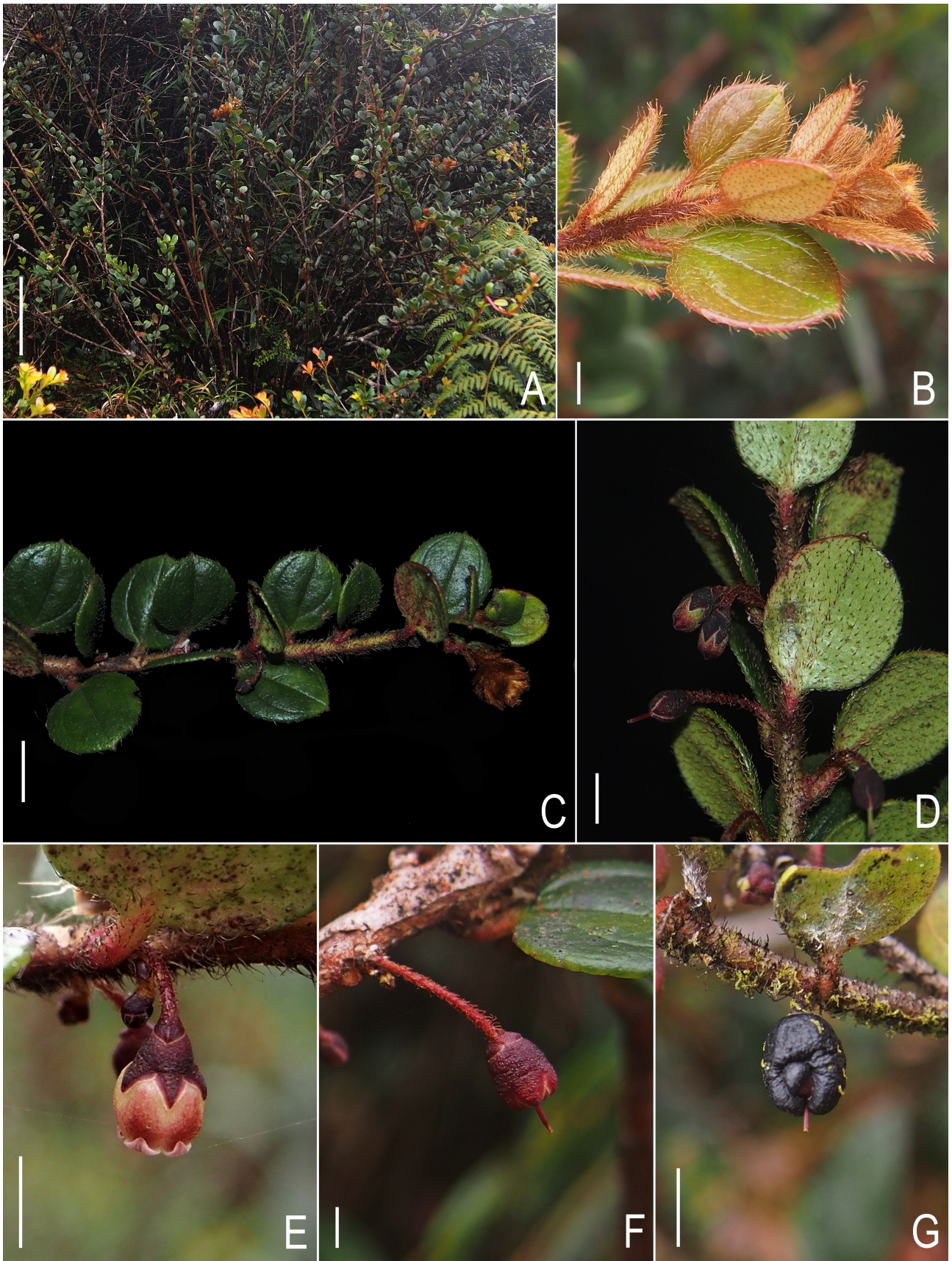


FIGURE 1. *Diplycosia puradyatmikai*. **A.** Living plant. **B.** Young leaves and buds with long golden brown bristles. **C.** Leafy twig. **D.** Leafy twig showing lower leaf surfaces and some flowers. **E.** Flower. **F.** Young fruit. **G.** Older fruit. Scale bar: A = 20 cm; B, C = 2 cm; D, E = 5 mm; F = 2 mm; G = 5 mm. A–F from *Mustaqim et al.* 2234 and G from *Mustaqim et al.* 2236. Photos by Wendy A. Mustaqim.

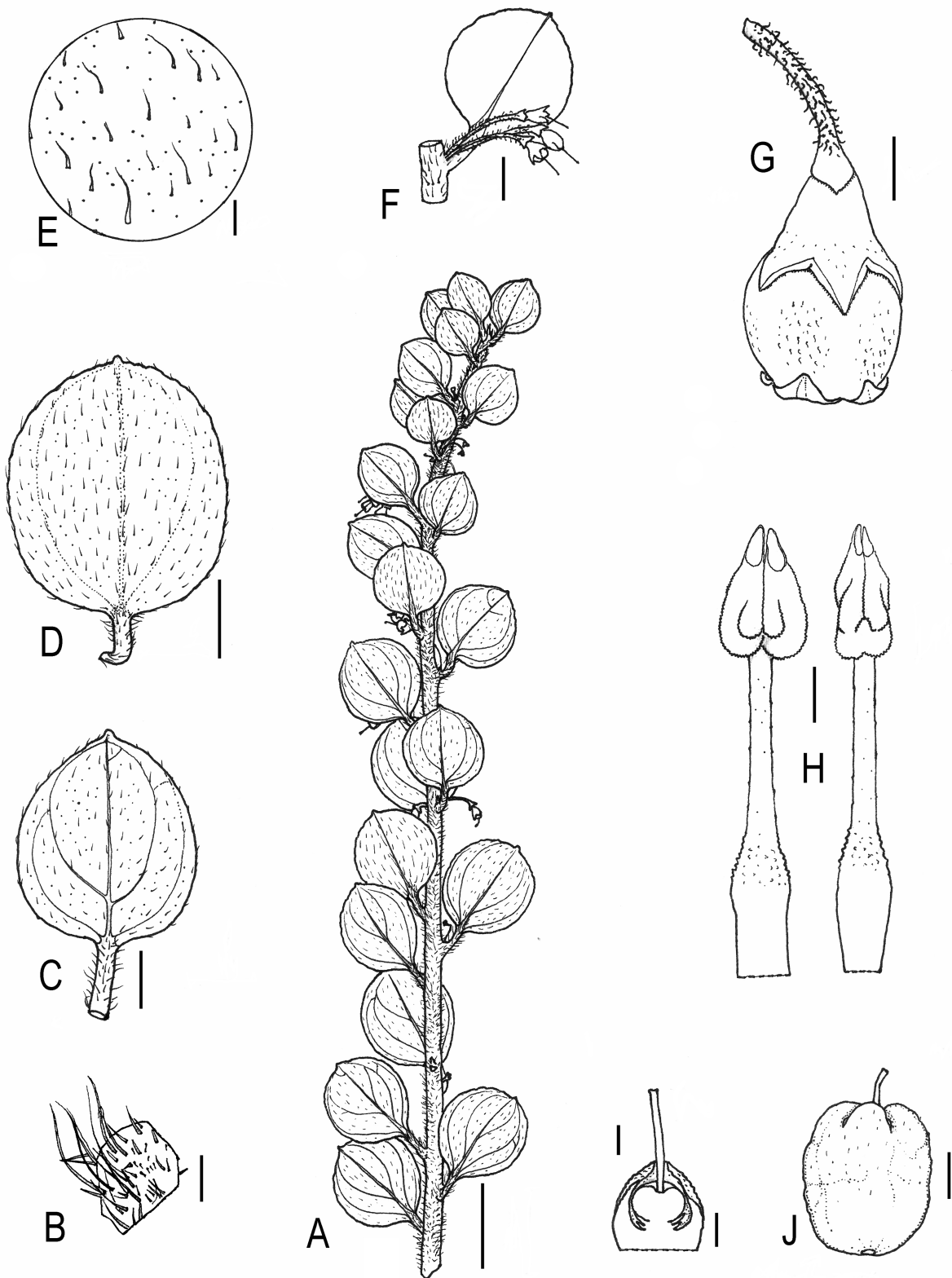


FIGURE 2. *Diplycosia puradyatmikai*. **A.** Branch. **B.** Branch bristles. **C.** Adaxial leaf view. **D.** Abaxial leaf view. **E.** Detail of abaxial surface of leaf. **F.** Inflorescence. **G.** Flower. **H.** Stamens (ventral view with filaments flattened). **I.** Longitudinal section of ovary and style. **J.** Fruit. Scale bar: A = 2 cm; B = 1 mm; C = 5 mm; D = 1 cm; E = 1 mm; F = 5 mm; G = 1 mm; H = 0.5 mm; I = 1 mm; J = 2 mm. A–I from *Mustaqim et al.* 2234 and J from *Mustaqim et al.* 2236. Drawn by Wendy A. Mustaqim.

Notes:—This species does not key out in Sleumer’s comprehensive Flora Malesiana key (Sleumer 1967). It is morphologically similar to three Sumatran endemics, i.e. *D. pubivertex* Sleumer (1957: 131), *D. atjehensis* Sleumer (1957: 132) and *D. tetramera* Sleumer (1957: 136) in having bristles but no fine, simple trichomes on the twigs, a sparsely and shortly pubescent calyx (with trichomes < 1 mm long), a glabrous style and pubescent corolla. This species differs from *D. pubivertex* in the longer calyx (8–9 mm vs 3.8–4 mm in *D. puradyatmikai*), longer corolla (8–9 mm long vs 4.8–5.5 mm) and hairy ovary (vs glabrous); *D. atjehensis* in the hairy ovary (vs glabrous) and longer calyx lobes c. 4 mm long (vs up to 1.9 mm long); and from *D. tetramera* in the 4-merous flowers (vs always 5-merous in *D. puradyatmikai*) and densely arranged leaves (vs laxly arranged). In New Guinea, this species is most similar to *D. kosteri*, so far known only from Wandammen Peninsula at 800–1800 m a.s.l.; differences between the two species are given in the diagnosis and summarized in Table 1.

The dimorphic stamens in the new species described here, especially manifested in the anther cells, is a character new to *Diplycosia*; such stamens can be found in other ericaceous genera, including the New Guinean *Dimorphanthera* and *Paphia* (see also Stevens 2004). Confusion with these genera is unlikely, however, as both have inferior ovaries whilst the new species described here has a superior ovary —also a generic character for *Diplycosia* (Figure 2I). In addition, they differ from *Diplycosia* in having berries (vs capsules in *Diplycosia*) and the calyx that is adnate, at least partially, to the ovary at anthesis (vs free in *Diplycosia*) (Sleumer 1966). The new species is clearly a member of *Diplycosia* due to the superior ovary, capsular fruit and calyx entirely free from the ovary (Figure 2I). The discovery of dimorphic stamens is an important addition to the generic description of *Diplycosia*.

Additional specimens examined:—INDONESIA. Papua: Mount Jaya, site 124, trail behind Army Camp on road from Tembagapura to Timika, 2770 m, 23 Aug. 1998, *Barker 89* with *Beaman* (K, L-image seen [L.3786791]); Mount Jaya, near Tembagapura, road from Tembagapura to Timika, Mile 64, near old Army Camp, c. 2770 m, 23 Nov. 2018, *Mustaqim 2236* with *Puradyatmika & Domingus* (BO, FIPIA, MAN); Mount Jaya, road from Timika to Tembagapura, mile 54, 2700 m, 6 June 1985, *Widjaja 2220* (BO).

Key to the *Diplycosia* species of Mount Jaya

- | | | |
|---|---|---|
| 1 | Twigs glabrous or very early glabrescent and also without fine pubescence..... | 2 |
| - | Twigs covered with bristles..... | 4 |
| 2 | Pedicels at most 3 mm long at anthesis..... | <i>D. soror</i> var. <i>nuda</i> |
| - | Pedicels (5–)7 mm at anthesis..... | 3 |
| 3 | Trichomes on pedicels absent; tubules c. ¼ of the length of anthers..... | <i>D. lorentzii</i> |
| - | Trichomes on pedicels muriculate; tubules as long as anthers..... | <i>D. edulis</i> |
| 4 | Calyx without trichomes..... | <i>D. morobeensis</i> var. <i>morobeensis</i> |
| - | Calyx with trichomes..... | 5 |
| 5 | Corolla glabrous, pink to red; leaves elliptic or subobovate..... | <i>D. rosea</i> |
| - | Corolla pubescent outside, green suffused with red; leaves usually suborbicular, rarely broadly elliptic..... | <i>D. puradyatmikai</i> |

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