

Studies on *Begonia* (Begoniaceae) of the Moluccas II: a new species from Seram, Indonesia

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ABSTRACT. A new species of *Begonia* L., *Begonia galeolepis* Ardi & D.C.Thomas, is described from Seram, Maluku province, Indonesia. The species is endemic to Seram and belongs to *Begonia* section *Petermannia*. An identification key to the seven *Begonia* species known from the Moluccas is provided.

Keywords. *Begonia galeolepis*, Maluku Islands, Manusela National Park

Introduction

Our understanding of the *Begonia* L. flora of the Moluccas (also known as the Maluku Islands), an archipelago within Indonesia located between the islands of Sulawesi and New Guinea, is very limited because of the paucity of herbarium collections from the region and a lack of alpha-taxonomic baseline work on eastern Malesian *Begonia*. *The Begonia Resource Centre* (Hughes et al., 2015) comprises records of only 138 Moluccan *Begonia* specimens, most of which are not identified to species level, and the rest belonging to six species (Ardi et al., 2014; see identification key to the Moluccan species below).

Recent expeditions by Bali Botanic Garden, and a joint expedition between Bogor Botanic Gardens and Fairchild Tropical Botanic Gardens to major islands of the Moluccas (Halmahera, Seram and Ternate), have brought to light material of several *Begonia* species that do not conform with any species previously reported from the archipelago. Three endemic species have recently been described (Wiriadinata, 2012; Ardi et al., 2014) from material collected on Halmahera, the largest island of the Moluccas, raising the total number of Moluccan species to six (Ardi et al., 2014). From the second largest island, Seram, Hughes (2008) reported only a single species, *Begonia brachybotrys* Merr. & L.M.Perry. This species belongs to the *Begonia riekei* Warb. species complex, which shows a wide distribution east of Wallace's Line. However, given (i) Seram's substantial area (c. 17,100 km²) and topographical heterogeneity, (ii) the presence of diverse and suitable ecosystems including lowland rain forests and limestone hills, as well as (iii) the species-richness and prevalence of narrow endemics in *Begonia* (Hughes & Hollingsworth, 2008), this is likely to be an underestimation.

Hughes (2008) already noted that even the very limited herbarium material indicated that a number of species remain to be described from the archipelago.

A new species is described below from material collected on Seram and cultivated in Bali Botanic Garden and Bogor Botanic Gardens. The species is very distinct because of the presence of unusual appressed, fleshy and branched red scales on the stems and leaves (Fig. 1, 2). In common with the majority of Moluccan species, it belongs to *Begonia* sect. *Petermannia* (Klotzsch) A.DC., which is distinguished by protogynous inflorescences, two-flowered female inflorescences or solitary female flowers, three-locular ovaries with axile placentation and bilamellate placentae, fruits with equal or subequal wings, and anthers with unilaterally positioned slits (Doorenbos et al., 1998). All available *Begonia* specimens from BO, E, K, L and SING have been consulted, and hence it must be assumed, at least until more intensive collecting reveals otherwise, that this species has a restricted range and is endemic to Seram (Fig. 3).

***Begonia galeolepis* Ardi & D.C.Thomas § *Petermannia*, sp. nov.**

Species resembling *Begonia holosericeoides* Ardi & D.C.Thomas in the creeping habit and leaf shape, but differs consistently by the shorter peduncles of the female inflorescences (up to 5 mm long), the sparse to moderately dense indumentum of fleshy, branched, appressed red scales on stems, petioles and abaxial leaf lamina veins, and the very long pedicels of male flowers (up to 11 cm). In contrast, in *Begonia holosericeoides* the peduncles of the female inflorescences are 1.1–3.5 cm long, the petioles and stems show a dense indumentum of branched pinkish hairs, and the pedicels of the male flowers are 1.5–4 cm long. – TYPE: Indonesia, Seram, Manusela National Park, cultivated in Bogor Botanic Gardens, 19 May 2015 (voucher made from cultivated material), *Wisnu Ardi 102* (holotype BO; isotypes Herbarium of Bali Botanic Garden, KRB, SING) (Fig. 1–3).

Perennial, monoecious herbs, stems initially semi-erect, but prostrate and creeping in older plants, rooting at the nodes when in contact with the substrate, up to c. 40 cm long; stems, primary veins on the abaxial stipule surfaces, petioles, and primary and secondary veins on the abaxial leaf lamina surfaces with sparse to moderately dense indumentum of multicellular, fleshy, appressed, red scales up to 6×4 mm, the larger ones branched in the distal part, and all above-ground vegetative parts with microscopic glandular hairs. **Stem** branched; internodes 0.8–5.5 cm long, up to 1 cm in diameter, terete, green. **Leaves** alternate; **stipules** persistent, $1.8\text{--}2.5 \times 1\text{--}2$ cm, ovate to triangular, acuminate, setose, seta to 16 mm long, margin entire and sometimes slightly revolute, green to reddish with small paler spots, translucent at the margins; **petioles** c. 7–22 cm long, adaxially deeply channelled, with red scales forming a ring at the petiole-lamina transition; **lamina** basifixed, $16\text{--}23.8 \times 12.5\text{--}17.2$ cm, very asymmetric, broadly ovate to suborbicular, base cordate and lobes not or sometimes slightly overlapping, apex shortly acuminate, margin distantly dentate, the teeth bristle-pointed, adaxial surface shiny reddish dark green with bright green veins, glabrous, abaxial surface pale reddish green, primary veins 7–9, actinodromous, secondary veins craspedodromous. **Inflorescences** protogynous; female inflorescences 1–2-flowered,

one node basal to male inflorescences, peduncles up to 5 mm long; male inflorescences composed of 2–3 monochasial partial inflorescences, each monochasium with 2–4 flowers; *bracts* ovate to elliptic, 10–20 × 7–10 mm, green to red, with an abaxially prominent midrib and a sparse indumentum. **Male flowers:** pedicels 4–11 cm long, glabrous or glabrescent; *tepals* 2, broadly ovate, 9–18 × 11–15 mm, base slightly cordate, margin entire, apex rounded, white or white tinged with pink at the margin, abaxially sparsely hairy; *androecium* of 45–51 stamens, yellow, filaments 1–2 mm long, slightly fused at the very base, anthers 1–1.5 mm long, obovate, dehiscing through unilaterally positioned slits c. ½ as long as the anthers. **Female flowers:** pedicels 1.5–4 cm long, sparsely hairy, green–reddish; *tepals* 5(–6), white tinged with pink, unequal, the outer four larger, 9–15 × 6–11 mm, obovate, the inner one smaller, 6–15 × 4–5 mm, obovate, abaxially sparsely hairy to glabrescent; *ovary* obovoid, c. 10–15 × 6–8 mm (excluding the wings), green, glabrous or sometimes sparsely hairy, locules 3, placentation axile, placentae bilamellate, wings 3, red, base slightly rounded or cuneate, apex truncate, style basally fused, 3-branched, each styloidium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. **Fruits** on up to 5 cm long pedicels, seed bearing part obovoid, up to c. 17 × 10 mm (excluding the wings), sparsely hairy, dehiscent, splitting along the wing attachment, wing shape as for ovary, up to 11 mm at the widest point (subapically). **Seeds** unknown.

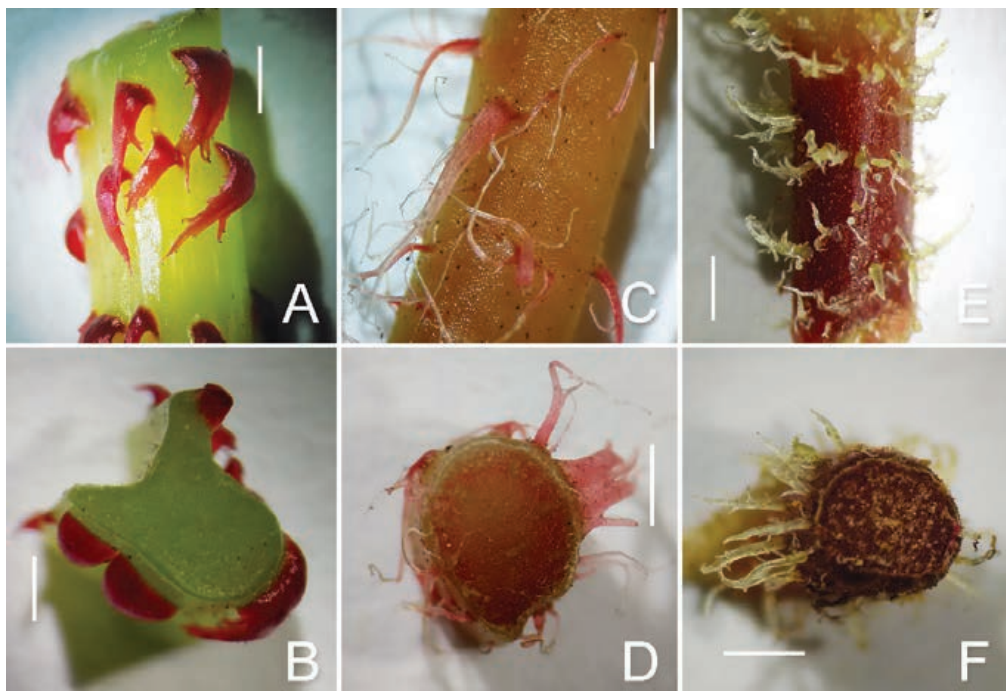


Fig. 1. Branched trichomes and scales in *Begonia* sect. *Petermannia*. **A–B.** *Begonia galeolepis* Ardi & D.C.Thomas, appressed, branched red scales. **C–D.** *Begonia holosericeoides* Ardi & D.C.Thomas, branched trichomes. **E–F.** *Begonia ozotothrix* D.C.Thomas, branched trichomes. Scale bars: A–F = 2 mm. (Photos: Wisnu H. Ardi)

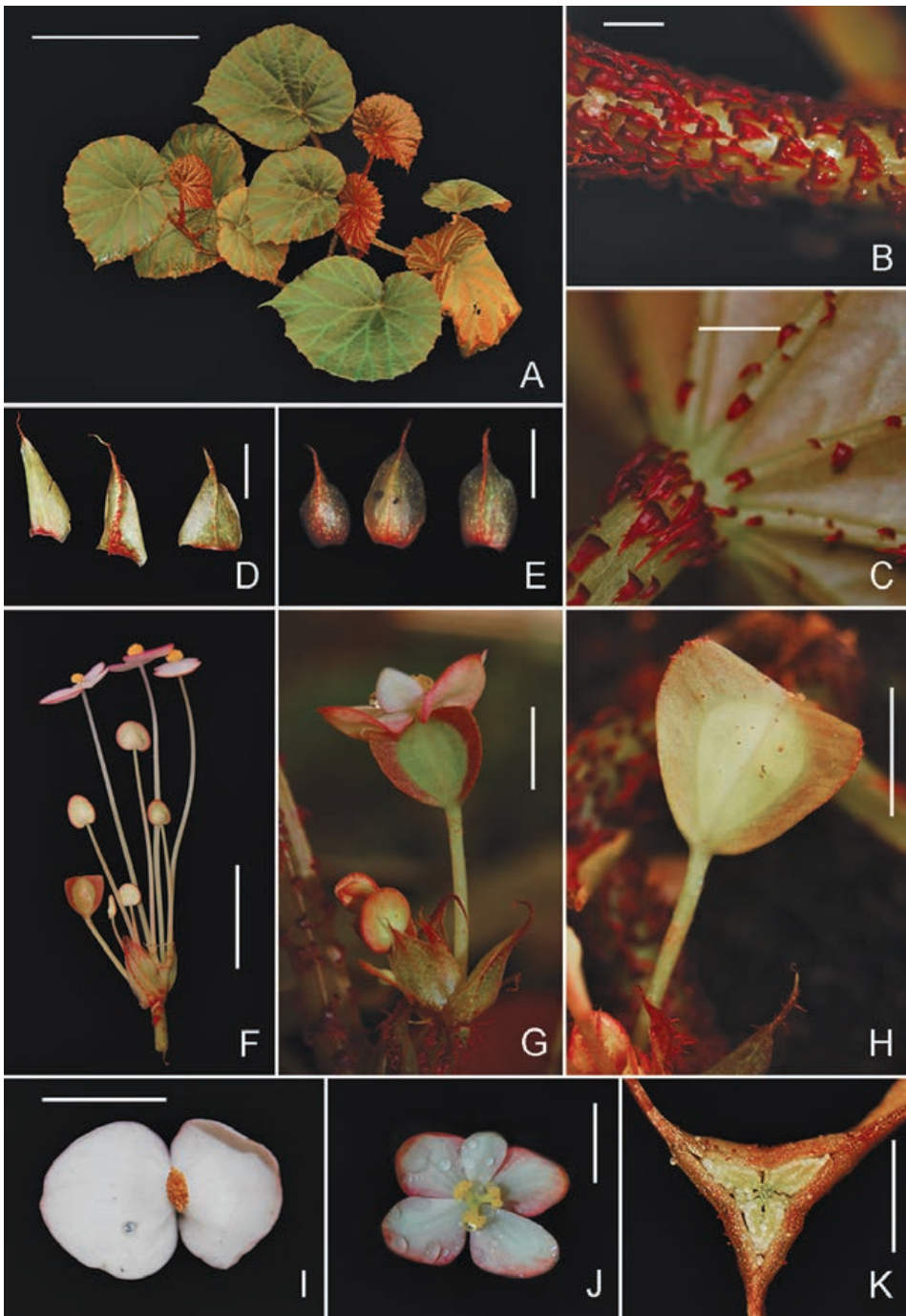


Fig. 2. *Begonia galeolepis* Ardi & D.C.Thomas. **A.** Growth habit in cultivation. **B.** Red scales on stem. **C.** Red scales on the petiole and abaxial leaf surface. **D.** Stipules. **E.** Bracts. **F.** Male inflorescence. **G.** Female inflorescence. **H.** Fruit. **I.** Male flowers. **J.** Female flower. **K.** Cross-section of ovary showing placentation. Scale bars: A = 20 cm, B, C, K = 5 mm, D, E, G–J = 1 cm, F = 4 cm. (Photos: Wisnu H. Ardi)

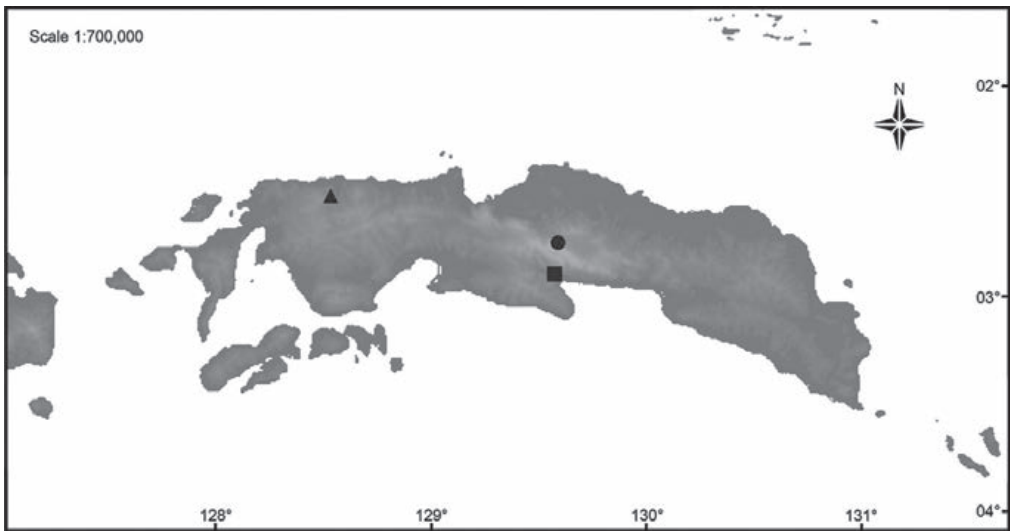


Fig. 3. Distribution of *Begonia galeolepis* Ardi & D.C.Thomas. Collection sites are indicated by a circle (Manusela National Park), a square (Japoetih) and a triangle (Buria). Specimen location information was georeferenced using the GeoNames geographical database at <http://www.geonames.org/>.

Habitat. Primary lowland rainforest, growing on vertical moist limestone walls, at river embankment, in half-shade to fully sun-exposed, at c. 20 m altitude.

Distribution. Endemic to Seram, Maluku Province, Indonesia. Locally common.

Etymology. The specific epithet is derived from the classical greek (“γάλεος” [galeos]= dogfish, small shark, and “λεπιδ” [lepis]= scale) and refers to the fleshy red scales on the petioles and stems, whose shape resembles shark scales (Fig. 1).

Notes. *Begonia galeolepis* is distinct within section *Petermannia* by a combination of several characters such as the creeping stem, the characteristic red scales on stems and leaves, few-flowered monochasial male inflorescences, and the very long pedicels of the male flowers (up to 11 cm long). Branched hairs are rare in Asian *Begonia*, and have been only described from two other species in section *Petermannia*, *Begonia holosericeoides* Ardi & D.C.Thomas from Halmahera (Ardi et al., 2014) and *B. ozotothrix* D.C.Thomas from Sulawesi (Thomas et al., 2009). The branched hairs of *Begonia ozotothrix* are much smaller, white and translucent and rounded in cross-section, and the hairs of *B. holosericeoides* are thinner, pinkish and show filiform apices in comparison to the thick, appressed red scales of *B. galeolepis* (Fig. 1). These scales rather resemble hairs found at the lamina-petiole transition in the Sumatran species *Begonia sublobata* Jack which, however, is otherwise morphologically dissimilar and belongs to section *Reichenheimia* (Hughes & Girmansyah, 2011). Similar hairs

are also found in some species of the American *Begonia* section *Gireoudia* (e.g. *B. heracleifolia* Cham. & Schldtl.), which is only very distantly related to Asian *Begonia* (Moonlight et al., 2015).

Provisional IUCN conservation assessment. Data deficient (DD). *Begonia galeolepis* is known from only five collections from five locations (Batoe Keye, G. Buria, Japoetih-Pileana, Manusela National Park, and W. Kasoe), two of which (Batoe Keye and W. Kasoe) could not be georeferenced with certainty (Fig. 3). This indicates that the species used to have a wide distribution on Seram. However, two of the collection sites, Buria and Japoetih, have been almost completely converted for human habitation and agriculture. The third collection site is in a legally protected area, Manusela National Park, where no signs of major anthropogenic disturbance were noticed. Further exploration is required to assess the species' current range on the island.

Additional specimens examined. INDONESIA: **Seram:** 18 Sep 1917, *L.M.R. Rutten 114* (BO); W. Kasoe, West Ceram, 28 Aug 1918, *L.M.R. Rutten 1607* (BO); Japoetih-Pileana, 27 Oct 1937, *P.J. Eyma 1811* (AA, BO); Batoe Keye, 29 Dec 1937, *P.J. Eyma 2474* (BO); G. Buria, Kec. Taniwel, 8 Dec 1984, *Ramlanto 310* (BO); cultivated in Bali Botanic Garden from vegetative material collected in Manusela National Park, 27 Apr 2011 (voucher made from cultivated material), *W.H. Ardi 61* (BO).

Identification key to the *Begonia* species of the Moluccas

- 1a. Plants erect 2
- 1b. Plants creeping 3
- 2a. Leaves broadly ovate; female flowers with 2–5 tepals; male flowers with 2 tepals, anther connectives not projecting at apex *B. riekekei* complex
- 2b. Leaves oblong, elliptic or broadly elliptic; female flowers with 6 tepals; male flowers with 4 tepals, anther connectives projecting at apex *B. aptera*
- 3a. Leaf apex acuminate 4
- 3b. Leaf apex rounded 6
- 4a. Adaxial leaf surface densely hirsute with red hairs *B. sageaensis*
- 4b. Adaxial leaf surface glabrous 5
- 5a. Stems and petioles with sparse to moderately dense indumentum of fleshy, appressed and branched red scales; female inflorescence peduncles up to c. 5 mm long; male flower pedicels up to 11 cm long *B. galeolepis*
- 5b. Stems and petioles with dense indumentum of branched pinkish trichomes with filiform apices; female inflorescence peduncles up to 3.5 cm long; male flower pedicels up to c. 4 cm long *B. holosericeoides*

- 6a. Male flowers with two tepals; female inflorescence peduncles 2–3 mm long; ovary densely hairy *B. holosericea*
 6b. Male flowers with four tepals; female inflorescence peduncles c. 1 mm long; ovary glabrous or glabrescent *B. aketajawensis*

ACKNOWLEDGEMENTS. The authors would like to express gratitude to the Seram Expedition team from Kebun Raya Bali (I Made Ardhaka, Kadek Erosi Undaharta, and I Gede Tirta) for giving permission to use their materials, to the curators of A, B, BM, BO, CEB, E, K, L and SING for allowing us access to herbarium material, and to two anonymous reviewers and David Middleton for their constructive comments. WA's work was supported by a Singapore Botanic Gardens' Research Fellowship, which is gratefully acknowledged.

References

- Ardi, W.H., Kusuma, Y.W.C., Lewis, C.E., Risna, R.R., Wiriadinata, H., Abdo, M.E. & Thomas, D.C. (2014). Studies on *Begonia* (Begoniaceae) of the Molucca Islands I: Two new species from Halmahera, Indonesia, and an updated description of *Begonia holosericea*. *Reinwardtia* 14(1): 19–26.
- Doorenbos, J.M., Sosef, S.M. & De Wilde, J.J.F.E. (1998). The sections of *Begonia* including descriptions, keys and species lists. *Studies in Begoniaceae VI. Wageningen Agr. Univ. Pap.* 98(2): 1–266.
- Hughes, M. (2008). *An Annotated Checklist of Southeast Asian Begonia*. Edinburgh: Royal Botanic Garden Edinburgh.
- Hughes, M. & Girmansyah, D. (2011). Searching for Sumatran *Begonia* described by William Jack: following in the footsteps of a 19th century Scottish botanist. *Gard. Bull. Singapore* 63(1 & 2): 83–96.
- Hughes, M. & Hollingsworth, P.M. (2008). Population genetic divergence corresponds with species-level biodiversity patterns in the large genus *Begonia*. *Molec. Ecol.* 17: 2643–2651.
- Hughes, M., Moonlight, P., Jara, A. & Pullan, M. (2015). *Begonia Resource Centre*. Royal Botanic Garden Edinburgh. <http://elmer.rbge.org.uk/begonia/> (accessed on 7 Jul. 2015).
- Moonlight, P.W., Richardson, J.E., Tebbitt, M.C., Thomas, D.C., Hollands, R., Peng, C.I. & Hughes, M. (2015). Continental-scale diversification patterns in a megadiverse genus: the biogeography of Neotropical *Begonia*. *J. Biogeogr.* 42(6): 1137–1149.
- Thomas, D.C., Ardi, W.H. & Hughes, M. (2009). Two new species of *Begonia* (Begoniaceae) from Central Sulawesi, Indonesia. *Edinburgh J. Bot.* 66(1): 103–114.
- Wiriadinata, H. (2012). A new species of *Begonia* (Begoniaceae) from Sagea Lagoon, Weda Bay, Halmahera Island, North Moluccas, Indonesia. *Reinwardtia* 13(3): 263–270.

