# REVISION OF *CALYCACANTHUS* (ACANTHACEAE: JUSTICIEAE: MONOTHECIINAE) WITH A NEW SPECIES FROM PAPUA NEW GUINEA

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**Abstract.** *Calycacanthus* is treated as comprising two species, *C. magusianus* and a newly described species, *C. insularis*. The genus is endemic to New Guinea and several adjacent islands. *Calycacanthus magnusianus* is widespread in Papua New Guinea, whereas *C. insularis* is only known from several islands of that country in the southern Solomon Sea. The two species are similar in corolla size, shape, and coloration, but differ in calyx coloration, anther size, and pollen morphology. Both species are described (macromorphology and pollen), their distributions are mapped, habitats and phenological data are summarized, and preliminary conservation assessments are discussed.

**Keywords:** *Calycacanthus*, Acanthaceae, New Guinea, pollen, lectotypification

The region from India through Indo-China and Malesia is a major center of diversity for the large, and mostly tropical family, Acanthaceae (Lawrence, 1951; Daniel, 1993). Islands comprising Papuasia, which lie at the southeastern extent of the Malesian Region, harbor a relatively rich assemblage of acanthaceous taxa, including endemic genera and species. There is no comprehensive taxonomic account of Acanthaceae for New Guinea, nor one for either of the political entities that comprise that island and the surrounding smaller islands; i.e., the Indonesian provinces of western New Guinea (formerly known as Irian Jaya) and the nation of Papua New Guinea on the eastern side of the island. The indigenous Acanthaceae of New Guinea, including surrounding islands of Indonesia (e.g., Aru Islands) and Papua New Guinea (e.g., Louisiade Archipelago), consist of 24 genera and 95 species (Cámara-Leret et al., 2020, with updates herein). Three currently recognized genera (*Calycacanthus* K. Schum., *Jadunia* Lindau, *Hulemacanthus* S. Moore; the unispecific genus *Gymnophragma* Lindau, described from Papua New Guinea, was excluded by Manzitto-Tripp et al., 2021) and 47 species of the family are endemic to the region. Another genus, *Leptosiphonium* F. Muell., is nearly endemic to the region, but also occurs in the nearby Solomon Islands. Recent studies involving these genera include: chromosome numbers (Daniel, 2000), molecular phylogenetics (Tripp et al., 2013; McDade et al., 2008, 2020), classification and identification keys (Manzitto-Tripp et al., 2021), and taxonomy (Wearn and Darbyshire, 2013).

*Calycacanthus* was described as a unispecific genus from Papua New Guinea by K. Schumann in an account of the flora of Kaiser Wilhelms Land (Schumann and Hollrung, 1889). *Calycacanthus magnusianus* K. Schum. has since been found to be widespread in that nation, both on the mainland and on several surrounding islands. That species has been noted among Acanthaceae for its cauliflory (Manzitto-Tripp et al., 2021), which is rare in the family. In the most recent classification of Acanthaceae (Manzitto-Tripp et al., 2021), the genus was included in tribe Justicieae, subtribe Monotheciinae, with seven other Paleotropical genera. Based on sampling to date, the closest relatives of *Calycacanthus* are certain species of *Jadunia* and *Ptyssiglottis* T.Anderson, both of which are endemic to New Guinea (McDade et al., 2020).

Studies of *C. magnusianus* in Papua New Guinea and in several herbaria have revealed the existence of a second species of the genus that is restricted to islands of that country in the southern Solomon Sea. Herewith, a monographic revision of *Calycacanthus* is provided to document the macromorphology and known ecological parameters (e.g., distribution, habitats, flowering/fruiting phenology) of both species. Because of their systematic importance among Acanthaceae, descriptions and/or discussions of pollen morphology and chromosome numbers are included. Preliminary conservation assessments based on IUCN (2022) criteria are discussed for both species.

## MATERIALS AND METHODS

From 9 July to 6 August in 1992, I collected Acanthaceae in Madang and Morobe provinces of Papua New Guinea, and studied a portion of the Acanthaceae collection at the herbarium (LAE) of that country's Forest Research Institute. In addition to my collections and selected materials at LAE, specimens of *Calycacanthus* were studied at BM, K, L, MO, RSA, and UC. Information from images of specimens at P and US (and some additional specimens at L) was also utilized; in specimen citations these are noted as "-image." For pollen studies, individual grains were removed from

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exposed anthers of herbarium specimens with an insect pin, mounted (untreated) onto scanning electron microscope (SEM) stubs coated with double-stick tape, sputter coated with gold/palladium for 50 seconds, and examined under 15KV on a Hitachi SU3500 SEM at CAS. Pollen measurements reported here are from specimens of *C. insularis* (*Brass 27599* at L, *28507* at L, *28517* at L) and *C. magnusianus* (*Daniel & Jebb 6518* at CAS, *Hoogland 5178* at LAE, *Reeve 1628* at K, *Sohmer & Katik 75123* at K). Measurements consist of the polar diameter (P) and the equatorial diameter (E). Palynological terminology generally follows that proposed by Walker and Doyle (1975), supplemented by Hesse et al. (2009). Preliminary conservation assessments are based on IUCN (2022) criteria for geographic range and GeoCat (2022) for calculations of extent of occurrence (EOO) and area of occupancy (AOO; based on IUCN default cell width of 2 km). Collections lacking latitude and longitude on labels were georeferenced (where possible) based on the locality data provided. In such cases, the coordinates are enclosed with brackets in the specimen citations.

## Taxonomy

***Calycacanthus*** K. Schum. in K. M. Schumann & M. U. Hollrung, Fl. Kais. Wilh. Land, 126. 1889. TYPE: *Calycacanthus magnusianus* K. Schum.

*Shrubs* to small trees, older stems lenticellate. *Leaves* opposite, subsessile to petiolate, blades ± membranaceous to subcoriaceous. *Inflorescences* of sessile to pedunculate dichasia or thyrses (bearing pedunculate dichasia) from axils of young leaves or from woody branches or trunks on older growth (i.e., cauliflorous, at least in *C. magnusianus*); dichasia up to 10 (or more)-flowered, sometimes modified and appearing ± linear. *Bracts* (when present) and bracteoles small, triangular to subulate. *Flowers* pedicellate, nototribic. *Calyces* dark red to pink or green, 5-lobed, lobes similar. *Corollas* pinkish to salmon colored or bright red, 38–50 mm long, externally pubescent with some or all trichomes glandular, tube funnelform, tube length:corolla length = 0.21–0.40 (–0.58), narrow proximal portion of tube ± abruptly expanded distally into throat, upper lip ± hoodlike, lacking a rugula, 2-lobed, lower lip often reflexed, 3-lobed. *Stamens* 2, inserted in tube at or near junction of narrow proximal portion and throat, sometimes exserted beyond upper lip of corolla, filaments glabrous, anthers 2-thecous, thecae equally to subequally inserted, parallel, equal to subequal in size, staminodes absent. *Pollen* 2- or 3-aperturate, exine reticulate. *Capsules* clavate, 15–34 mm long, with a sterile basal stipe and an ellipsoid fertile head having a slight medial constriction. *Seeds* up to 4 per capsule, ± discoid, rugose or tuberculate-ridged, lacking trichomes.

*Calycacanthus* consists of two species endemic to Papuasia. *Calycacanthus insularis* is restricted to the islands of southeastern Papua New Guinea in the Solomon Sea, and *C. magnusianus* occurs throughout much of Papua New Guinea and is also known from the northeastern portion of the Indonesian province of Papua on the Island of New Guinea (Fig. 1). Based on molecular phylogenetic data (McDade et al., 2020; Manzitto-Tripp et al., 2021), the genus pertains to subtribe Monotheciinae of the tribe Justicieae.

### *Floral Morphology*

Flowers of the two species differ in calyx color, anther length, and pollen morphology. However, corollas of both species are very similar in size, morphology, and (to a lesser extent) in coloration, all features that likely reflect adaptation to similar avian pollinators. A collection of *C. insularis* (*Frodin 2177*) from Rossel Island notes that flowers were visited by a nectar-sucking "hummingbird-like bird." Given the location of this species, this possibly refers to either the honeyeater White-chinned Myzomela (*Myzomela albigula albigula* E. Hartert, Meliphagidae) or the Louisiade Flowerpecker (*Dicaeum nitidum rosseli* Rothschild & Hartert, Nectariniidae), both of which taxa are endemic to islands in southeastern Papua New Guinea, including Rossel Island (Pratt and Beehler, 2015; Tarburton, 2020).

### *Chromosome Numbers*

Subtribe Monotheciinae consists of eight Paleotropical genera that occur in Africa/Madagascar (*Ambongia* Benoist, *Champluviera* I. Darbysh., T.F. Daniel & Kiel, and *Monothecium* Hochst.) and primarily Asia/Malesia (*Calycacanthus, Cyclacanthus* S. Moore, *Jadunia*, *Marcania* J.B. Imlay, *Monothecium*, and *Ptyssiglottis*). Daniel (2000) reported a chromosome number of $n = 16$ for *Calycacanthus magnusianus* and an approximate count of $n$ = ca. 16 for *Jadunia biroi* (Lindau & K. Schum.) Lindau, one of its closest relatives (McDade et al., 2020). These appear to be the only known chromosome counts for taxa in the subtribe. Although the data are insufficient to be conclusive, $n = 16$ might be a common number elsewhere in the subtribe, at least among Papuasian taxa.

### *Palynology*

The two species of *Calycacanthus* have pollen of similar size and exine sculpturing. However, they differ in shape and in the number and types of apertures. Pollen of *C. magnusianus* (Fig. 2G–L) is prolate spheroidal to euprolate (likely varying in shape due to harmomegathic responses), 3-colporate, and 6-pseudocolpate. Pollen of this species resembling that studied here has been previously documented from other collections: drawing on *Clemens 970* at L, *Hoogland 4864* at BM (Scotland, 1990), and *Schodde 2396* (APSA, 2007). Similar 3-colporate, 6-pseudocolpate pollen occurs elsewhere among most genera of Monotheciinae, including in *Ambongia* (Muller et al., 1989), *Champluviera* (Darbyshire et al., 2019), *Monothecium* (e.g., Raj, 1961), and *Ptyssiglottis* (Hansen, 1992). Pollen of *C. insularis* (Fig. 2A–F) is globose-elliptic, 2-porate, and lacking in pseudoapertures. It is perhaps noteworthy that pollen among species currently treated in *Ptyssiglottis* include grains with various numbers and types of apertures, including colpori, pseudocolpi, and pores (Hansen, 1992). Two-porate pollen is known elsewhere among the acanthaceous tribes

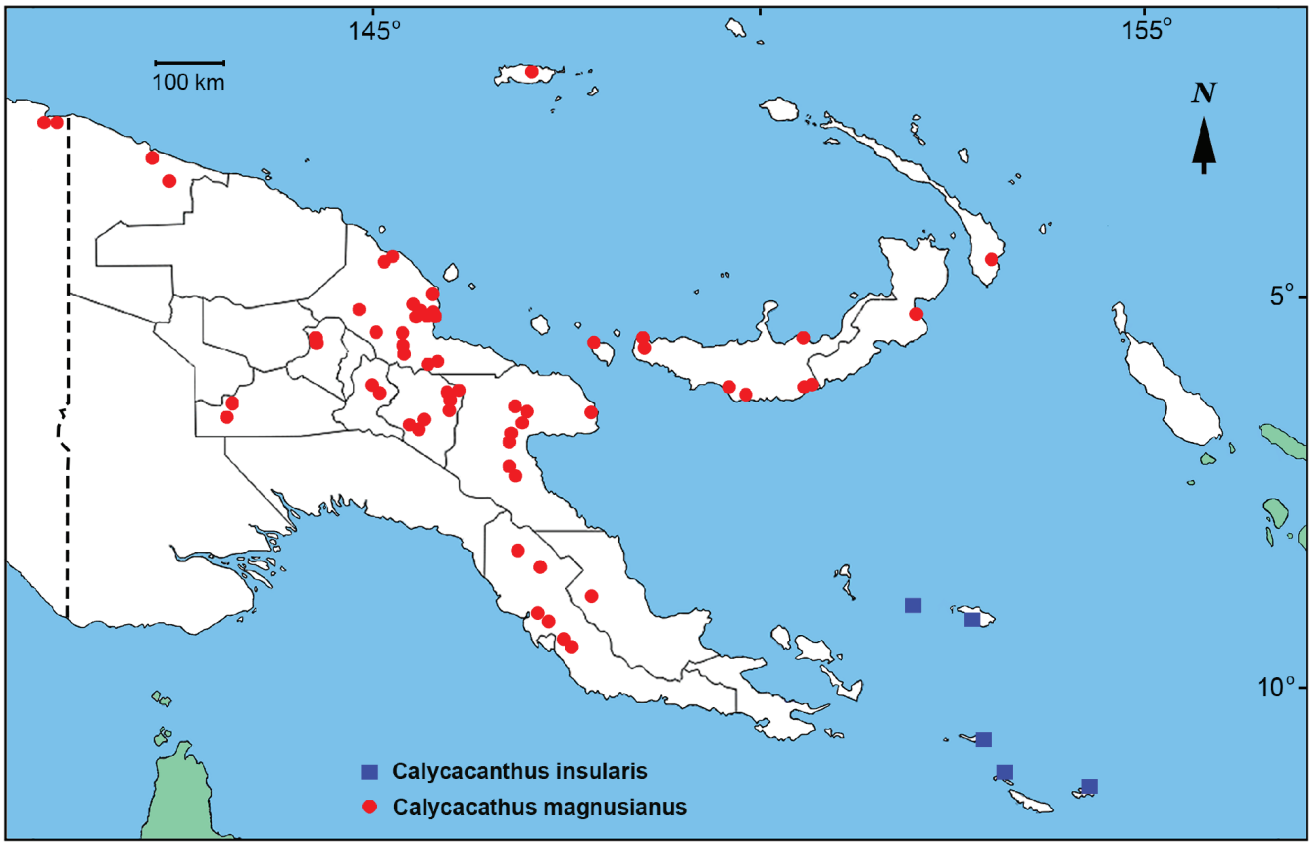


FIGURE 1. Map of eastern portion of the island of New Guinea showing part of the province of Papua in Indonesia (left of dotted line) and Papua New Guinea (showing all provinces) with distributions of *Calycacanthus insularis* and *C. magnusianus*. Portions of Australia (south of Papua New Guinea) and the Solomon Islands (east of Papua New Guinea) are highlighted in green.

Whitfieldieae (e.g., *Whitfieldia* Hook.; Manktelow et al., 2001) and Isoglossinae (e.g., *Stenostephanus* Nees; Daniel, 1998). However, 2-porate pollen in *Whitfieldia* and *Stenostephanus* differs from that of *C. insularis* by having very large and round ectoapertures. In addition, pollen of *C. insularis* has the appearance of being 2-brevicolporate because of the tapering of the ectoapertures at two opposite ends (i.e., diamond-shaped). However, the length:width ratio of the ectoapertures (1.4–1.7) places them well within the limits of pores rather than colpi (length:width > 2; e.g., Raj, 1961; Hesse et al., 2009). Given their shape, they are likely derived from shortened colpi. Other Acanthaceae that show markedly different apertural types in a monophyletic clade include *Ruellia* L. (colporate and porate, Tripp et al., 2009). Given the importance of pollen morphology in the classification of many taxa of Acanthaceae (Lindau, 1895; Scotland and Vollesen, 2000; Manzitto-Tripp et al., 2021), it is possible that the two species of *Calycacanthus*, which appear to be related to one another based on macromorphological characters, might pertain to different genera. Molecular phylogenetic studies should help to clarify their relationship to one another.

KEY TO THE SPECIES OF *CALYCACANTHUS*

1a. Leaves subcoriaceous; inflorescence of thyrses of dichasia in axils of leaves on new growth or in axils of leaf scars on woody branches or trunks (i.e., cauliflorous); calyx usually dark red during anthesis (rarely pink but usually fading to pink following anthesis); corolla pinkish to salmon colored; anther thecae 2.9–3.8 (–4.4) mm long; pollen 3-colporate, 6-pseudocolpate; capsule (18–) 20–33 mm long . . . . . *C. magnusianus*

1b. Leaves ± membranaceous; inflorescence of dichasia in axils of leaves; calyx green; corolla bright red; anther thecae 2.5–3.0 mm long; pollen 2-porate; capsule 15–19 mm long . . . . . *C. insularis*

1. *Calycacanthus insularis* T.F. Daniel, *sp. nov*. TYPE: PAPUA NEW GUINEA. Milne Bay: Misima Island, Narian [ca. 10°41'21.63"S, 152°49'25.76"E], 20 m, frequent in shrubberies on coral limestone, 4 August 1956 (fl, fr), *L. Brass 27599* (Holotype: L [Herb. Lugd. Bat. 958.003 106]; Isotype: US-image). Fig. 3–4.

*Shrubs* to 3 m tall, bark dark greenish brown, ± smooth, older stems sparsely pubescent to glabrate, younger stems quadrate-sulcate, at first ± evenly and sparsely pubescent with antrorse to antrorsely appressed eglandular trichomes 0.1–0.2 mm long and sometimes also puberulent with erect subglandular trichomes to 0.05 mm long (subglandular

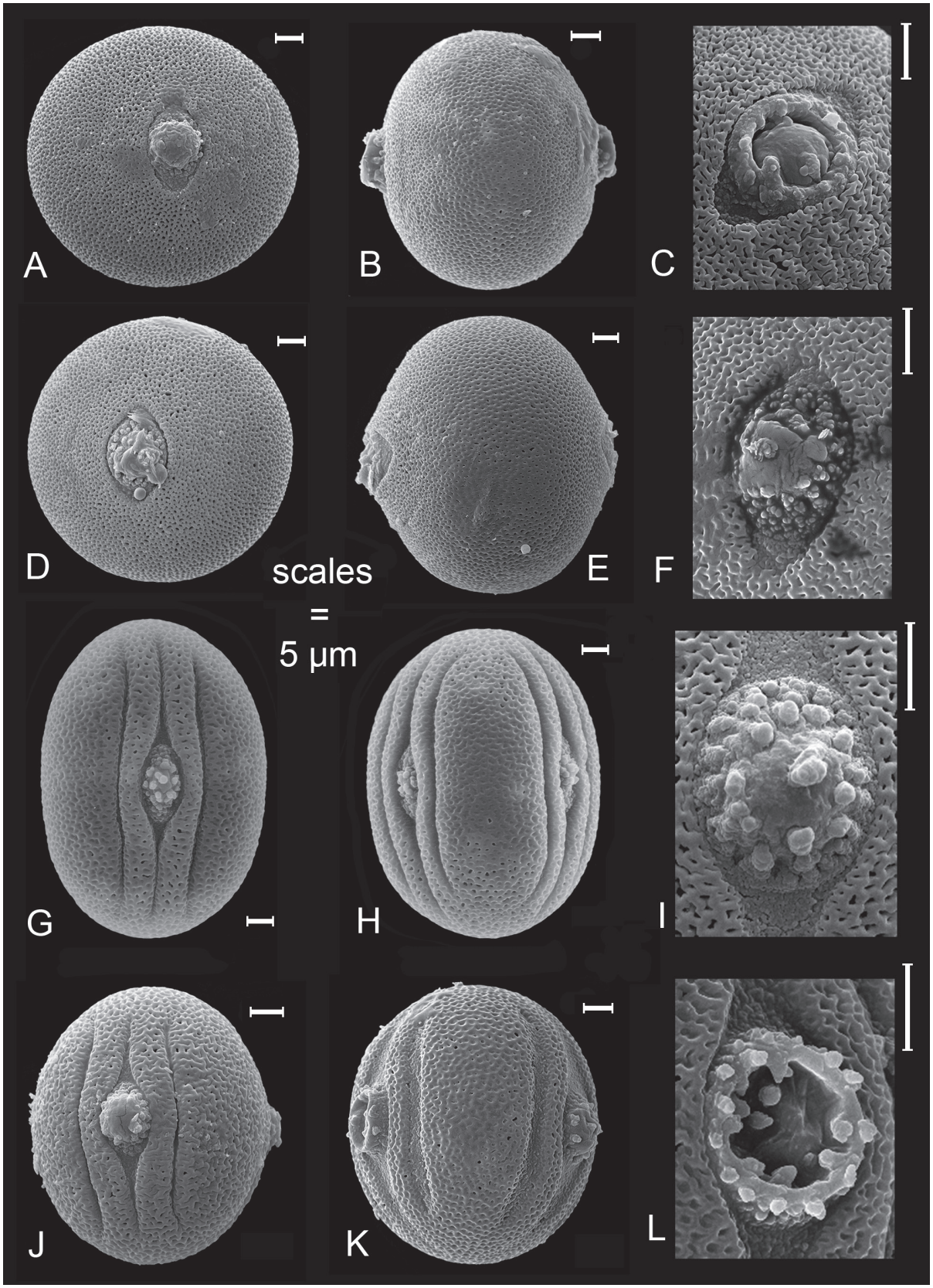


FIGURE 2. Pollen of *Calycacanthus*. **A**–**F**. C. *insularis*. **A**, equatorial/apertural view; **B**, polar or interapertural view; **C**, aperture (pororus); **D**, equatorial/apertural view; **E,** polar or interapertural view; **F,** aperture (pororus). **G**–**L**. *C. magnusianus*. **G,** equatorial/apertural view; **H,** equatorial/interapertural view; **I,** endoaperture (os); **J,** equatorial/apertural view; **K,** equatorial/interapertural view; **L,** endoaperture (os). A from *Brass 28517*; B, D, and F from *Brass 27599*; C and E from *Brass 28507*; G–H from *Daniel & Jebb 6518*; I from *Hartley 13163*; J from *Reeve 1628*; K–L from *Hoogland 5178*.


FIGURE 3.Holotype of *Calycacanthus insularis* (*Brass 27599* at L).

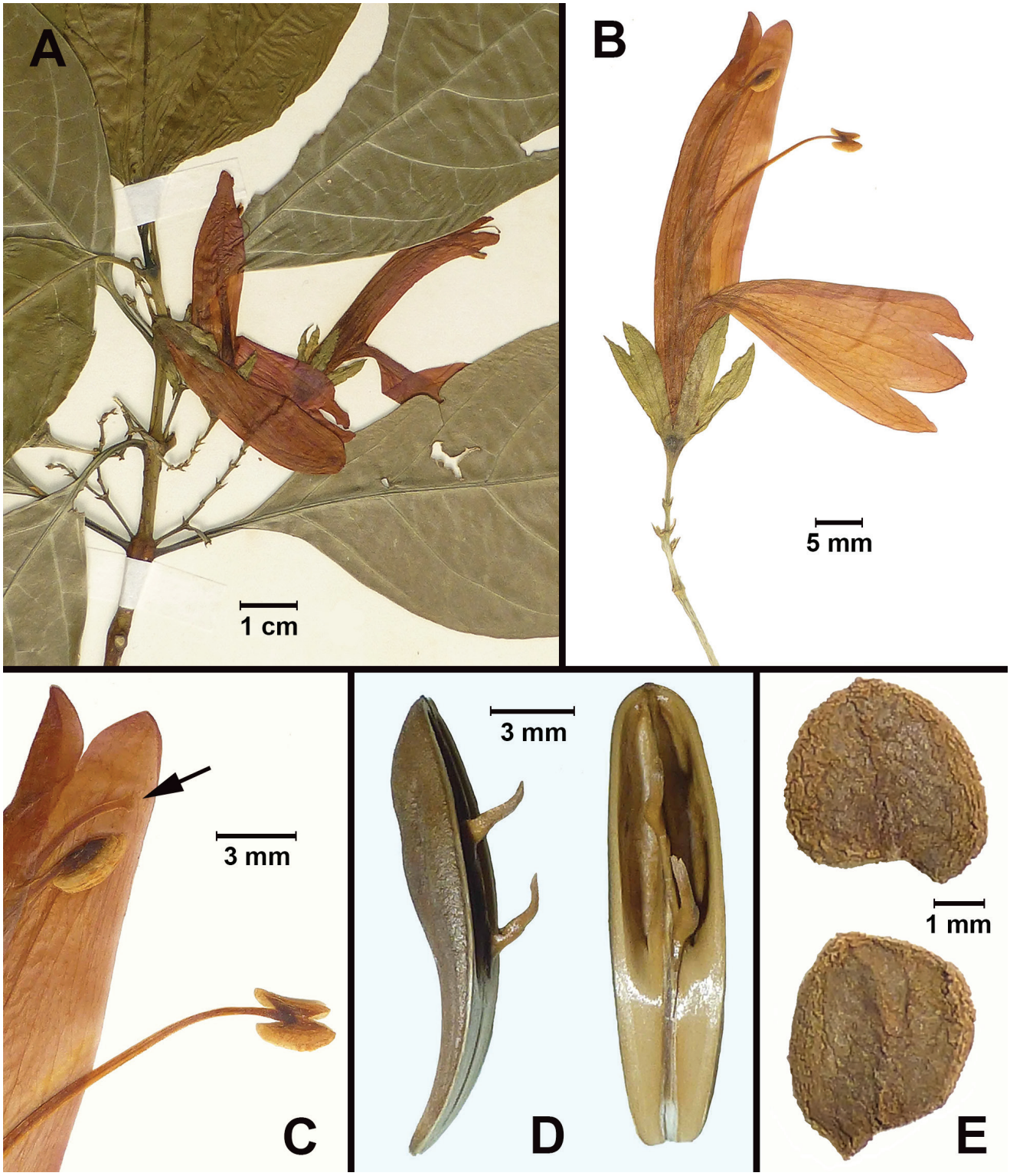


FIGURE 4. *Calycacanthus insularis*. **A**, nodes with inflorescences; **B**, dichasial branch with bracteoles and flower; **C**, distal portion of upper lip of corolla with stamens, style, and stigma (arrow); **D**, capsule valves, lateral view (left) and internal view (right); **E**, seeds. A from *Brass 28517* (L); B–C from *Brass 28507* (L); D–E from *Gillison NSG 25326* (L).

puberulent), trichomes soon ± concentrated in 2 or 4 lines on younger stems or becoming sparse to absent as stems age. *Leaves* petiolate, petioles to 28 mm long, blades dark green and ± shiny above, yellow-green below, ± membranaceous, (ovate-elliptic to) elliptic, 55–182 mm long, 17–67 mm wide, (1.8–) 2.2–3.4 times longer than wide, cuneate to subattenuate at base, acuminate at apex, both surfaces glabrous. *Inflorescences* of pedunculate dichasia from axils of leaves (i.e., with leaves present), dichasia opposite at nodes, 1 (–2) per axil, (1–) 3–10 (or more)-flowered, dichotomous or sometimes modified such that development occurs in only one axil per node of bracteoles for multiple nodes resulting in a ± linear appearance to dichasium, peduncles 4–14 mm long, secondary peduncles often shorter, both peduncles and secondary peduncles nearly glabrous to pubescent with antrorse to antrorsely appressed eglandular trichomes 0.05–0.10 mm long, sometimes also subglandular puberulent. *Bracteoles* and secondary bracteoles triangular to subulate, 1–2 mm long, 0.5–0.9 mm wide, abaxially pubescent with cauline type trichomes. *Flowers* with pedicels 6–15 mm long, pedicels pubescent like peduncles (or with subglandular trichomes absent when present on peduncles). *Calyces* green, 9.5–16.0 (–18.0 in fruit) mm long, lobes (lance-linear to) linear to oblong to elliptic to oblanceolate, 7–15 (–17) mm long, 1.3–4.5 mm wide, generally widest above base, subequal in size (variation mostly in width rather than length), abaxially glabrous or nearly so (sometimes with a few antrorse eglandular trichomes present, especially along midvein), margin ciliolate with trichomes like those of peduncles (or with the eglandular trichomes to 0.2 mm long). *Corollas* bright red, 39–46 mm long, externally pubescent with erect to flexuose glandular and eglandular trichomes 0.05–0.20 mm long, tube 8–18 mm long, 3.5–4.0 mm in diameter near midpoint, tube length:corolla length = 0.2–0.4, narrow proximal portion of tube (3.5–) 6.0–12.0 mm long, throat 4–7 mm long, 7–9 mm in diameter (measured flat) at mouth, throat length:narrow proximal portion of tube length = 0.3–0.9 (–1.3), upper lip 26–36 mm long, lobes 2.5–8.0 mm long, lower lip 23–33 mm long, lobes 4–9 mm long. *Stamens* 30–35 mm long, not exserted beyond upper lip of corolla, anther thecae white, equally to subequally inserted, 2.5–3.0 mm long, lacking basal appendages. *Pollen* globose-elliptic, 2-pororate, P (and apertural E) = 43–51 $\mu$m diam., interapertural E = 36–40 $\mu$m wide, apertural E: interapertural E = 1.1–1.2, ectoaperture tapered on 2 opposite sides (diamond-shaped), 16.0–16.5 × 10.2–11.7 $\mu$m, L:W = 1.4–1.7. *Styles* 37–45 mm long, distally glabrous, proximally sparsely pubescent with eglandular trichomes or nearly glabrous, stigma subcapitate (lobes inconspicuous or not evident), 0.2–0.4 mm long. *Capsules* 15–19 mm long, glandular puberulent with trichomes to 0.05 mm long, stipe 5–6 mm long, head 10–11 mm long. *Seeds* discoid, 3.5–3.7 × 2.8–3.8 mm, surfaces rugose-reticulate.

**Phenology:** flowering: April, August–October; fruiting: October.

**Distribution and habitat:** southeastern Papua New Guinea among the islands of Milne Bay Province in the southern half of the Solomon Sea (Fig. 1). Plants occur frequently to commonly at edges of clearings in rain forest, in secondary forest, and among shrubs on coral limestone at elevations from 10–25 m.

**Local name:** "kakuleia" (*Gillison NGF 25326*).

**Conservation:** Based its calculated EOO of 21,046 km$^2$ (mostly open ocean) and the AOO of 20 km$^2$, the species could be assessed as Endangered (EN) if sufficient information on fragmentation of the population and potential threats was known. Because its occurrences are restricted to small and relatively small islands, the distribution of *C. insularis* might be severely fragmented. However, dispersal distances remain unknown for its propagules. Little is known about potential threats on some of the islands on which the species occurs (e.g., Gawa and Nasai), but others are heavily populated (e.g., Misima and Sabari; Anonymous, 2021, 2022). Misima Island has a long history of mining activities (Anonymous, 2022), and known threats on Rossel Island include local timber harvests and shifting agricultural practices (Lamei, 2021). Although *C. insularis* is not specifically known to be impacted by these threats, and has been noted by collectors to be locally frequent to common, given the few known collections of the species, the possible severe fragmentation of its population, and the threats noted above on the islands, it could potentially be assessed as Endangered as B2(a)(b) with an inferred or projected decline in either habitat or the number of locations or subpopulations.

Because the dichasia are borne in the axils of leaves, only bracteoles are present in the inflorescences (Fig. 4A). The dichasia are sometimes expanded and elongate with branches bearing up to eight flower-bearing nodes. Dichasia are often asymmetric with one dichasial branch expanded to many more orders than other branches, and beyond the initial central (terminal) flower, they often bear only a single flower at each node of the paired bracteoles. On herbarium specimens the color of corollas is variously described as red, bright red, and deep red-pink.

**Additional specimens examined:** PAPUA NEW GUINEA. Milne Bay: Rossel Island, Jinjo (as "Jinju") [ca. 11°19'10.70"S, 154°14'29.02"E], *L. Brass 28507* (K, L); Rossel Island, Jinjo (as "Jinju"), *L. Brass 28517* (K, L); without specific locality, *D. Frodin 2177* (K, L); Nasai (as "Nassai") Island [09°10'20.32"S, 152°39'18.97"E], *H. Gay 984* (K); Gawa Island [ca. 08°57'22.62"S, 151°59'12.37"E], *A. Gillison NGF 25326* (K, L); Sabari (as "Sabara") Island, 11°05'S, 153°05'E, *E. Mann NGF 43370* (L-image only).

2. *Calycacanthus magnusianus* K. Schum. in K. M. Schumann & U. M. Hollrung, Fl. Kais. Wilh. Land, 126. 1889. TYPE: PAPUA NEW GUINEA. Madang ("Kaiser Wilhelmsland"): Wald bei Hatzfeldthafen [Hatzfeldhavn, ca. 04°24''13.86"S, 145°11'47.27"E], October 1886 (fl), *M. Hollrung 365* (Lectotype: [designated here]: K: [000884408]). Fig. 5.

*Shrubs* or small to medium-sized trees to 10 (–15) m tall, branches sometimes ± clambering, older stems glabrous or glabrate, younger stems subterete to subquadrate, glabrous or

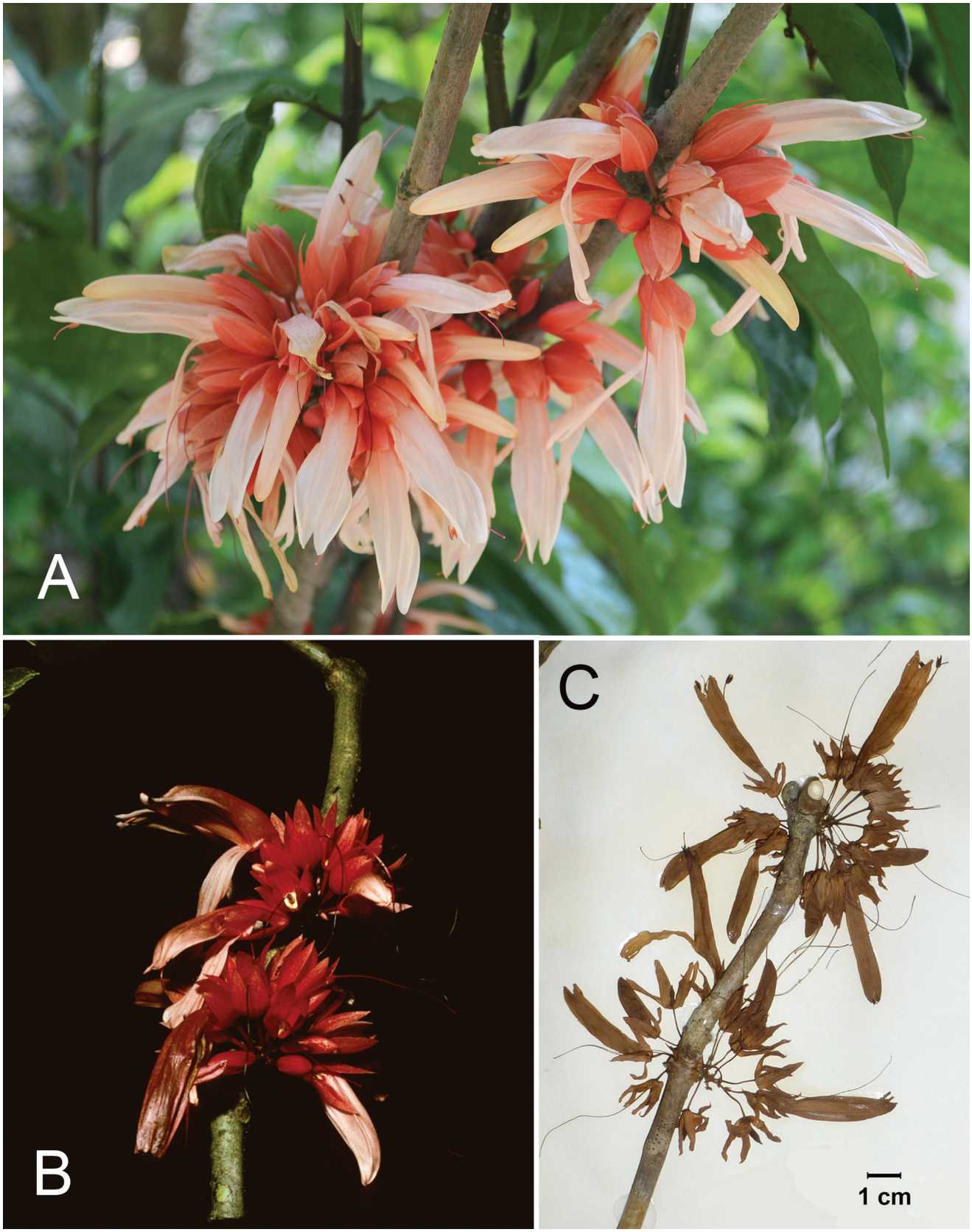


FIGURE 5. *Calycacanthus magnusianus*, inflorescences with flowers on woody stems. **A**, live plant cultivated in Singapore; **B**, plant in native habitat in Papua New Guinea; **C**, portion of herbarium specimen. A photo by K. H. Ooi, used with permission; B from *Daniel & Jebb 6518*, photo by T. Daniel; C from *Hoogland 4864* (K).

± evenly pubescent (sometimes sparsely so) with antrorsely appressed to antrorse to erect eglandular trichomes to 0.3 mm long. *Leaves* subsessile to petiolate, petioles to 17 mm long, sometimes reddish tinged, blades subcoriaceous, dull dark green above, paler green below, elliptic to obovate-elliptic, 77–290 mm long, 25–145 mm wide, 2.2–4.6 times longer than wide, acute at base, acuminate to caudate at apex, abaxial surface glabrous (or pubescent with eglandular trichomes to 0.6 mm long), adaxial surface glabrous (or sparsely pubescent along midvein with eglandular trichomes to 0.6 mm long). *Inflorescences* of sessile to short pedunculate thyrses (bearing pedunculate dichasia) in axils of leaves of younger growth or in axils of leaf scars on older (woody and leafless) branches and trunks (i.e., plants at least partially cauliflorous), peduncles (if present) to 7 mm long, thyrses 1 (–2) per axil or leaf scar, up to 13-flowered, ± compact (i.e., rachis usually less than 2 cm long) or with well-developed lateral dichasia (i.e., much branched), opposite or alternate at nodes, dichasia dichotomous or sometimes modified such that development occurs in only one axil per node of bracteoles for multiple nodes resulting in a ± linear appearance to dichasium, rachis pubescent (sometimes sparsely so) with erect to antrorse (to antrorsely appressed) eglandular trichomes to 0.1 (–0.2) mm long and sometimes also with evenly disposed erect glandular trichomes to 0.1 mm long (i.e., glandular puberulent), secondary peduncles (i.e., those subtending dichasia) pubescent like rachis (and usually glandular puberulent even if rachis is not). *Bracts* and bracteoles triangular to subulate, 1–3 mm long, 0.3–1.1 mm wide, abaxially pubescent like rachis. *Flowers* with pedicels 2–13 (–16 in fruit) mm long, pedicels pink, pubescent like rachis and usually also glandular puberulent (especially distally) and sometimes also with erect to flexuose eglandular trichomes to 0.5 mm long (rarely nearly glabrous). *Calyces* usually dark red (rarely pink but usually fading to pink with age), 9–19 mm long, persistent and ± accrescent in fruit, lobes sometimes incompletely or irregularly separating from one another, usually spreading with age, lance-linear to linear to linear-elliptic, (5–) 9–17 mm long, (1.5–) 2.0–6.0 mm wide, widest at base or near midpoint, subequal in size, abaxially and marginally glabrous or pubescent like rachis. *Corollas* pinkish to salmon colored, 38–50 mm long, externally glandular puberulent (and sometimes also with a few eglandular trichomes to 0.1 mm long as well), tube 10–19 mm long, 2.5–3.7 mm in diameter near midpoint, tube length:corolla length = 0.3–0.4 (–0.6), narrow proximal portion of tube 4–12 mm long, throat 4–8 (–10) mm long, 6.5–8.0 mm diam. (measured flat) at mouth, throat length:narrow proximal portion of tube length = 0.3–1.5 (–2.0), upper lip 23–40 mm long, lobes to 4.5 mm long, lower lip 25–33 mm long, lobes to 5 mm long. *Stamens* 26–40 mm long, not exserted or exserted up to 5 mm beyond upper lip of corolla, anther thecae cream to yellowish to pinkish or reddish, equally inserted, 2.9–3.8 (–4.4) mm long, lacking a basal appendage or with a minute and inconspicuous appendage-like swelling or extension (0.1–0.2 mm long) at base. *Pollen* prolate spheroidal to euprolate, 3-colporate, 6-pseudocolpate, P = 43–56 $\mu$m, E = 36–44 $\mu$m (P:E = 1.1–1.4). *Styles* pinkish, 37–52 mm long, proximally glandular puberulent, distally glabrous, stigma appearing subcapitate or distinctly and subequally 2-lobed, 0.2–0.4 mm long. *Capsules* (18–) 20–34 mm long, glabrous or glandular puberulent with trichomes to 0.1 mm long, stipe (6–) 9–17 mm long, head 11.0–18.5 mm long. *Seeds* 3–4 × ca. 2.5–3.9 mm, surfaces coarsely rugose or tuberculate-ridged. ($n$ = 16; Daniel, 2000).

**Phenology:** flowering: throughout the year; fruiting: January–June, September–October. Collections with fruits are rare, but span much the same period as flowering; thus, fruiting likely also occurs throughout the year.

**Distribution and habitat:** island of New Guinea—Papua New Guinea (the mainland and several islands of the Bismarck Archipelago to the east) and in the northeasternmost portion of the province of Papua, Indonesia (Fig. 1). In addition to the collections noted below, Lindau (1894) cited a collection of "Turner" that he treated as *C. magnusianus* from Duke of York Island (East New Britain Province, between New Britain and New Ireland islands). Specimens identified as or attributed to *Calycacanthus* from the Solomon Islands at L (e.g., *Womersley & Whitmore BSIP1141*, *Lipaqeto BSIP3505*, *Gafui et al. BSIP9173*) do not appear to conform to *C. magnusianus* based on images of them. Plants occur infrequently to commonly, especially along streams, in primary and secondary lowland to montane rain forests, *Lithocarpus* (and *Lithocarpus-Castanopsis*) forests, and *Araucaria* forests at elevations from 25–2060 m. The species attains its highest elevation in the Eastern Highlands Province of Papua New Guinea near Okapa (*White NGF 9571*).

**Local names:** "fivis" (Bembi), "pidom bidom" (Rawa), "pissa'o" (Jal)—all from *Hoogland 4864*; "pisau" (*Pullen 1144 at LAE*); "qwasasang" (*Katik NGF 46741*); "tumeda" (Kutubu language; *Schodde 2396* ); "marip" (Sambui Village; *van Royen 16092*); "navilovilo" (*Frodin NGF 26270*); "Ikowote" (Ipma-Baruya language, Wauko Village) and "Wusale" (Ipma-Baruya language, Ande Village)—both from Jorim et al. (2012).

**Uses:** Fresh, macerated leaves are used to treat all types of external sores in the Eastern Highlands Province of Papua New Guinea (Jorim et al., 2012). The species is sometimes cultivated for ornamental use in botanical gardens of southeastern Asia (e.g., China and Singapore) and Australia.

**Conservation:** The EOO was calculated as 617,941 km$^2$ (half or more consisting of open ocean), and the AOO as 300 km$^2$. Based on the AOO, the species could be assessed as Endangered (EN), if information on threats was known. Without such information, this relatively widespread and sometimes locally common species is best treated as Data Deficient (DD) at the present time.

A holotype was not designated in the protologue. Specimens of Hollrung's collection were distributed from B, where a specimen was undoubtedly retained, but which is no longer extant there. A duplicate specimen at K (ex B) with information corresponding to the protologue is herewith designated as the lectotype.

Although mostly erect shrubs or trees, collections of *C. magnusianus* have rarely noted "scrambling branches" (e.g., *Verdcourt & Galore 5130*) and indicated (possibly erroneously) a climbing habit (e.g., *Paijmans 1419*). No evidence of an adaptation for climbing (e.g., twining,

adventitious roots, tendrils, etc.) was observed on any of the specimens studied. The thyrses possess at least two nodes that bear dichasia with up to four or more orders of development, and they sometimes appear to terminate in a dichasium. The density of glandular puberulence on parts of the inflorescence (except the corolla, ovary, and capsule) varies from absent (e.g., *Brass 5191* at UC) to sparse to dense; corollas, ovaries, and capsules are always externally glandular puberulent. Flowers are borne from ca. one meter above ground to near the shoot apex along the trunks of shrubs or trees, or "cauliflorous from youngest branchlets down to base of the plant" (*van Royen NGF 16254*). Cauliflory appears to be rare among Acanthaceae. In addition to its common occurrence in *C. magnusianus*, a similar occurrence (with inflorescences from leaf axils of young growth and from older woody stems) is reported for Neotropical *Justicia cauliflora* Durkee, which occurs in wet forests of Panama (Durkee, 1999). Colors of the "flower" provided on herbarium specimens are variously listed as red, light red, salmon-red, reddish orange, pink-red, bright pink, rose, rose-pink, pink, and white with pink patches. Based on most herbarium specimens that distinguish corolla from calyx colors, images, and personal observations of living plants, the calyx is red and the corolla is pinkish or salmon colored during anthesis (Fig. 5). Whatever descriptive terms are used for colors, the calyx is both colored (other than green) and darker in color than the corolla when both are present in the flower. However, the calyx fades to pink or nearly white after the corolla dehisces. *Hartley 13163* appears to differ from other collections by having anthers 4 to 4.4 mm long (vs. 2.9 to 3.8 mm long) and dark pink calyces and corollas simultaeously. In most other respects, including pollen, this collection generally conforms well to others of the species.

**Additional specimens examined:** INDONESIA. Papua: Hollandia Stad, small wooded hill near post office, *H. McKee 1829* (K, L-image, LAE); Dessa Staat Hollandia, Kpg. Nemo, Eiland NNG bij de Tami River, [ca. 02°40'33.78"S, 140°54'0.31"E], *F. Rappard 875* (K, L, LAE); Onderafd. Hollandia, Nafri (Jautefah-baai), [02°40'25.08"S, 140°42'39.08"E], *F. Schram 2875* (L, LAE). PAPUA NEW GUINEA. Central: Mafulu [ca. 08°31'0"S, 147°01'00"E], *L. Brass 5191* (K, UC, US-image); Koitaki [ca. 09°24'49.11"S, 147°26'57.46"E], *C. Carr 12287* (BM, K, L); Sogeri Region, 09°28'S, 147°31'E, *H. Forbes 887* (BM); Tapini Subdistrict, Tapini area, 08°18'S, 146°48'E, *Y. Lelean NGF 46388* (K, L, US-image); Rubulogo Creek, ca. 18 mi N of Port Moresby [ca. 09°11'42.99"S, 147°13'30.13"E], *R. Pullen 6654* (K, L); Pt. Moresby Subdistrict, Kuriva Forestry Area, near Veimauri Rv., 09°05'S, 147°05'E, *H. Streimann & A. Kairo LAE 51530* (K, L, US-image); between S coast and Owen Stanley Range, Comm. M. Veitch 1897, *Burke s.n.* (K); Bisiatabu (near Rouna Falls), [ca. 09°25'26.20"S, 147°23'09.54"E], *C. White 360* (BM). Chimbu**:** Gumine Subdistrict, 25 km NE of Karimui [ca. 06°12'04.17"S, 144°58'22.86"E], *K. Paijmans 1419* (L); Chuave Distsrict, Kenangi, near Mai River [06°17'33.90"S, 145°05'14.15"E], *T. Reeve 1628* (K). Eastern Highlands: Purosa [ca. 06°39'57.46"S, 145°33'52.90"E], Okapa area, *L. Brass 31763* (K, L, US-image); Arau [ca. 06°20'49.68"S, 145°54'52.72"E], *L. Brass 32067* (K, L, US-image); Kassam, [ca. 06°13'58.05"S, 146°00'01.28"E], *L. Brass 32425* (L, US-image); Kainantu Subdistrict, Kassam, 06°15'S, 145°55'E, *R. Donunaba NGF 49116* (L); near Wanatabi, ca. 15 mi SW of Okapa [ca. 06°39'55.05"S, 145°26'12.45"E], *T. Hartley 13163* (K, L, RSA, US-image); Okapa Patrol Post, 06°35'S, 145°40'E, *E. Henty NGF 10612* (K, L); Kainantu Subdistrict, Kassam Pass, 06°12'S, 146°02'E, *E. Henty & M. Coode NGF 29185* (L); Kainantu Subdistrict, Kassam Pass, 06°15'S, 146°03'E, *A. Kairo & H. Streimann NGF 35717* (K, L, US-image); Kainantu Subdistrict, Aiyura–Lae Road, 3 miles from Station [ca. 06°20'51.08"S, 145°55'46.63"E], *A. Millar NGF 22719* (L); Kainantu Subdistrict, Kassam Pass, *A. Millar NGF 22734* (L); Akinantu Sub-district, Kainatu–Ramu Divide, *R. Robbins 984* (L); Kainantu Subdistrict, top of Kassam Pass, 06°13'S, 146°04'E, *H. Streimann NGF 47901* (L); Kainantu Subdistrict, above Aiyura and Noreikora valleys, "06°30'S, 145°75'E" [ca. 06°30'S, 145°55'E], *J. Wheeler ANU 5924* (K, L); Okapa Patrol Post, 06°35'S, 145°40'E, *K. White NGF 9571* (K, L); Okapa Subdistrict, vicinity Wonatabe, 15 mi S from Okapa, 06°35'S, 145°40'E, *J. Womersley NGF 17631* (K); Kainantu Subdistrict, Andandara, 06°30'S, 145°55'E, *J. Womersley NGF 24713* (L); Awande near Okapa, 06°35'S, 145°40'E, *J. Womersley NGF 24935* (K, L). East New Britain: Malpas, near Milim Wide Bay, 05°13'S, 152°02'E, *G. Weiblen 512* (L-image). Madang: Josephstaal District, 04°30'S, 145°02'E, *Ama & Takeuchi s.n.* (L-image); ca. 8 km WNW of Christensen Research Institute, ca. 2 km W of Baitabag Mission just W of Amron village, 05°08'S, 145°45'E, *T. Daniel & M. Jebb 6518* (CAS, K, LAE, MO); ca. 8 km W of Bagildik on Madang–Bogia Hwy., 04°55'S, 145°43'E, *T. Daniel & P. Forster 6575* (CAS); Ramu Valley, 68 km SW of Gum River, S of Madang toward Lae, 05°34'S, 145°25'E, *T. Daniel et al. 6529* (CAS); vic. of headwaters of Gogol River, ca. 20 km NW of Utu Mission, ca. 45 km (air) WNW of Madang, 05°05'S, 145°22'E, *T. Daniel et al. 6606* (CAS, LAE); Usino Subdistrict, Amiaba River, 05°25'S, 145°25'E, *D. Foreman et al. NGF 45850* (L, LAE), *NGF 45903* (L, LAE), *NGF 45989* (L, LAE); Bundi Subdistrict, Brahman, 05°44'S, 145°25'E, *E. Henty 49268* (L, LAE); Dumpu Subdistrict, Boringe, [05°50'S, 145°50'E], *E. Henty & Sayers NGF 20576* (K, L, LAE, US-image); near Amele village in hills behind Madang, [ca. 05°15'54.52"S, 145°38'36.97"E], *R. Hoogland 4864* (BM, K, L, LAE, US-image); along Puria River, foot (NE) of Mt. Hellwig, [ca. 05°52'11.87"S, 145°40'52.84"E], *R. Hoogland 5178* (BM, K, L, LAE, US-image); Madang Subdistrict, Gogol River, 05°10'S, 145°25'E, *P. Katik NGF 46504* (K, L, LAE); Urikina (Usino), 05°35'S, 145°25'E, *K. Kerenga & Y. Lelean LAE 73890* (LAE); hills of upper Ramu, *Lane-Pooke 637* (K); Constantinhafen [ca. 05°30'33.58"S, 145°01'28.69"E], *Lauterbach CAG 12* (L); Gogol TRP, 05°15'S, 145°45'E, *W. Moi 146* (LAE); Gogol Sapi-Catchment, 05°15'S, 145°35'E, *K. Rau 179* (LAE); Madang District, hill above Gum River near Ohu Village, 05°15'S, 145°41'E, *Regalado & Katik 1111* (F, K); Madang Subdistrict, Ramu Valley, ca. 5 mi SE

Faita airstrip, [ca. 05°40'05.20"S, 145°20'02.53"E], *J. Saunders 197* (BM, K, L, LAE, US-image); Ramu Subdistrict, N of Walium Patrol Post, 05°30'S, 145°24'E, *S. Sohmer & P. Katik LAE 75123* (BM, K, L, LAE); near Gogol River, Nara logging area block 8, *Verdcourt & Galore 5130* (K, L); 4 km N of Baisarik village, road to Taipensarik village, 05°13'S, 145°30'E, *J. Waikabu LAE 70351* (LAE); Constantinhafen, *O. Warburg 21212* (BM); Gogol Valley, 05°10'S, 145°25'E, *J. Womersley NGF 13470* (K, L, LAE); Tiganuntz River, near Aiome, tributary of main stream, [ca. 05°08'22.72"S, 144°43'46.08"E], *J. Womersley NGF 24762* (LAE). Manus: Manus Island, 02°02'S, 147°01'E, *M. Sands 2679* (K). Morobe: Oomsis,[ca. 06°41'00.83"S, 146°48'03.27"E], *L. Brass 29177* (K, US-image), *29278* (K, L, US-image); Sattelberg, [ca. 06°29'04.09"S, 147°45'59.92"E], *Clemens 970* (L); Boana, [ca. 06°25'46.39"S, 146°49'32.02"E], *M. Clemens 41657* (L, RSA, UC, US-image); Finschhafen-Umboi Is. Subdistrict, Sisilla River area, 05°29'S, 147°47'E, *B. Conn & P. Katik LAE 66043* (L); near Garagos Creek, on Bulolo Rd., *A. Floyd 7240* (L); ca. 2.5 miles N of Gurukor, 06°50'S, 146°38'E, *T. Hartley 9906* (L); Oomsis Creek, ca. 18 miles W of Lae, 06°43'S, 146°47'E, *T. Hartley 10441* (L, P-image); Kuali Creek, ca. 5 miles S of Wau, [ca. 07°22'22.85"S, 146°46'17.86"E], *T. Hartley 11471* (L); Wau Subdistrict, head of Sandy Creek, 07°20'S, 146°45'E, *A. Kairo & H. Streimann NGF 30936* (K, L); Wau Subdistrict, Upper Watut Valley, 07°11'S, 146°35'E, *A. Kairo & H. Streimann NGF 45238* (K, L); Lae Subdistrict, 3 mi from Suinim Village near Busu River, 06°35'S, 146°55'E, *P. Katik NGF 46741* (K, L); Lae Subdistrict, Gurako log. rd. 1 mile from Gabansis, [ca. 06°43'44.65"S, 146°46'22.07"E], *P. Katik & G. Larivita 38090* (L); Bulolo Subdistrict, Bulolo Forestry Plantation Road 6, 07°15'S, 146°40'E, *P. Katik & G. Larivita LAE 62039* (K, L, MO, US-image); Lae Subdistrict, Bupu Village, 06°20'S, 146°45'E, *A. Millar NGF 40979* (K, L); Lae Subdistrict, Garagos, 27 miles from Lae on Wau Road, [ca. 06°43'35.39"S, 146°42'33.27"E], *H. Streimann LAE 51927* (L); Bumsi River, tributary of Busu River, 06°27'S, 147°00'E, *P. van Royen NGF 16074* (K, L); Sambui-Gawan, Mon Hill, Rawlinson Range, 06°26'S, 147°00'E, *P. van Royen 16092* (K); Kauli Creek above Wau, 07°20'S, 146°45'E, *P. van Royen NGF 16254* (K, L, US-image); Lae Subdistrict, Oomsis Forestry Station, 06°43'S, 146°47'E, *J. Wiakabu & K. Kerenga LAE 73357* (K, L); Oomsis logging area, 20 mi from Lae, 06°40'S, 146°45'E, *J. Womersley NGF 17620* (K, L). New Ireland**:** Namatanai Subprovince, Hans Meyer Range, E of Mandih Lake, ca. 6 km WNW of Taron on east coast, 04°26'S, 152°59'E, *M. Sands et al. 2162* (K). Northern (Oro): Kokoda trail, 08°50'S, 147°45'E, *A. Millar NGF 23587* (K). Southern Highlands: near Waro airstrip, 20 km SSW of Kutubu, 06°31'S, 143°10'E, ca. 10 km farther E, *M. Jacobs 9135* (L); near Moro, Lake Kutubu [ca. 06°21'12.20"S, 143°15'43.39"E], *R. Schodde 2396* (K, L, US-image). Western Highlands**:** Hagen Subdistrict, Hallstrom Flora and Fauna Sanctuary, 05°35'S, 144°10'E, *A. Millar NGF 37701* (K, L); Jimmi Valley, Tagan River Valley, 05°30'S, 144°10'E, *J. Womersley & A. Millar NGF 8513* (K, L). West New Britain: 9 mi N of Kandrian, "16°15'S, 149°35'E" [06°07'50.59"S, 149°31'14.87"E], *J. Buderus NGF 23918* (K, L, US-image); District E. New Britain, Subdistrict Pomio, road W of Fulleborne Harbour, ca. 1 mi, "06°10'S, 150°40'E" [ca. 06°07'23.80"S, 150°35'47.91"E], *J. Croft et al. NGF 12999* (K, L); West Nakanai, Galilo Village, near Cape Hoskins, [05°28'30.49"S, 150°32'55.97"E], *A. Floyd 3548* (L); E of Airagilpua, Talasea, *D. Frodin NGF 26270* (K, L); Talasea, near Cape Gloucester Patrol Post, "05°27'S, 148°30'E," [05°26'50.04"S, 148°25'8.84"E], *D. Frodin NGF 26614* (K, L); Kandrian Sub-district, Dandeng Village, 06°15'S, 149°45'E, *A. Gillison NGF 22453* (L); ridge above Kilenge, "05°25'S, 148°25'E" [ca. 05°28'40.61"S, 148°22'3.36"E], *C. Ridsdale NGF 30416* (L); Kandrian Subdistrict, 06°06'S, 150°40'E, *D. Sayers NGF 21904* (L). West Sepik: 22 km E of Lumi, 03°29'S, 142°14'E, *P. Heyligers 1642* (LAE, CANB-image); 26 km W of Aitape, 03°08'S, 142°06'E, *P. Heyligers 1697* (LAE, CANB-image). Province not determined: Kaiser-Wilhelmsland, Rl. Baum in den Wäldesu des Rani Geb. [Kani Mt, Range?], *R. Schlechter 17498* (UC).

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## Index to the Numbered Collections

INDEX TO THE NUMBERED COLLECTIONS CONT.

*P. Heyligers 1642* (2), *1697* (2).

*M. Hollrung 365* (2).

*R. Hoogland 4864* (2); *5178* (2).

*M. Jacobs 9135* (2).

*A. Kairo & H. Steinman NGF 30936* (2); *NGF 35717* (2); *45238* (2).

*P. Katik NGF 46504* (2); *NGF 46741* (2).

*P. Katik & G. Larivita 38090* (2); *LAE 62039* (2).

*K. Kerenga & Y. Lelean LAE 73890* (2).

*Lane-Pooke 637* (2).

*Lauterbach CAG 12* (2).

*Y. Lelean NGF 46388* (2).

*W. Moi 146* (2).

*E. Mann NGF 43370* (1).

*H. McKee 1829* (2).

*A. Millar NGF 22719* (2); *NGF 22734* (2); *NGF 23587* (2); *NGF 37701* (2); *NGF 40979* (2).

*R. Pullen 6654* (2).

*F. Rappard 875* (2).

*K. Rau 179* (2).

*T. Reeve 1628* (2).

*Regalado & Katik 1111* (2).

*C. Ridsdale NGF 30416* (2).

*R. Robbins 984* (2).

*M. Sands 2679* (2).

*M. Sands et al. 2162* (2).

*J. Saunders 197* (2).

*D. Sayers NGF 21904* (2).

*R. Schlechter 17498* (2).

*R. Schodde 2396* (2).

*F. Schram 2875* (2).

*S. Sohmer & P. Katik LAE 75123* (2).

*H. Streimann NGF 47901* (2); *LAE 51927* (2).

*H. Streimann & A. Kairo LAE 51530* (2).

*P. van Royen NGF 16074* (2); *16092* (2); *16254* (2).

*Verdcourt & Galore 5130* (2).

*J. Waikabu LAE 70351* (2).

*J. Wiakabu & K. Kerenga LAE 73357* (2).

*O. Warburg 21212* (2).

*J. Wheeler ANU 5924* (2).

*G. Weiblen 512* (2).

*C. White 360* (2).

*K. White NGF 9571* (2).

*J. Womersley NGF 13470* (2); *NGF 17620* (2); *NGF 17631* (2); *NGF 24713* (2); *NGF 24762* (2); *NGF 24935* (2).

*J. Womersley & A. Millar NGF 8513* (2).