

New Combinations in *Rothmannia* (Rubiaceae) and the Establishment of the Genus in the Philippine Flora

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New combinations with the genus *Rothmannia* for three former *Gardenia* species are proposed: *R. lagunensis*, *R. merrillii* and *R. negrosensis*. Neotypes are designated for *R. lagunensis* and *R. negrosensis*, while *R. merrillii* is lectotypified. With these three taxa *Rothmannia* is now established also for the Philippine archipelago.

KEYWORDS

flora, *Gardenia*, Philippines, *Rothmannia*, Rubiaceae, taxonomy

INTRODUCTION

The Philippine species of the paleotropical *Gardenia* Ellis is a heterogeneous assemblage of elements belonging to different rubiaceous genera (Ridsdale 1979, 1985; Tirvengadam 1983, 1998; Ali and Robbrecht 1991; Alejandro et al 2008). In the

recent revisionary work of Wong and Low (2011), only five species are treated to represent the genus in the archipelago. Furthermore, their proposal to exclude the three endemic *Gardenia* species, *G. lagunensis* Merr., *G. merrillii* Elmer and *G. negrosensis* Merr., is congruent with the unpublished combinations in *Rothmannia* Thunb., as proposed by C.P. Ridsdale (Leiden, The Netherlands) as cited by Alejandro and Liede (2003). Considering the aforementioned studies and supported by own molecular work in Philippine *Gardenia* (JG Chavez and GJD Alejandro, unpublished) we are here proposing the necessary new nomenclatural combinations under *Rothmannia* with comprehensive morphology and full illustrations.

New Combinations in *Rothmannia*

Throughout its taxonomic history, the genus *Rothmannia* and its allied genera, particularly *Randia* L. and *Gardenia* have changed considerably (Linnaeus 1781; de Candolle 1873; Hooker 1880; Ridley 1923). Despite the difficulty in the delimitation of the genera of Gardenieae (Shui et al 2003), Fagerlind (1943) recognized *Rothmannia* as a genus or segregate distinct from the *Randia-Gardenia* complex, a view that is widely accepted by several taxonomists. According to Tirvengadam (1983), Wong (1984) and Alejandro and Liede (2003); *Rothmannia* differs from *Gardenia* based on the following morphological characteristics: leaves with 3:3 nodal pattern, anisophyllous, lateral nerves in 6-9 pairs; stipules that are entire, triangular or ovate, and not fused at the base; absent domatia; inflorescences in rarely solitary cymes, with fascicled

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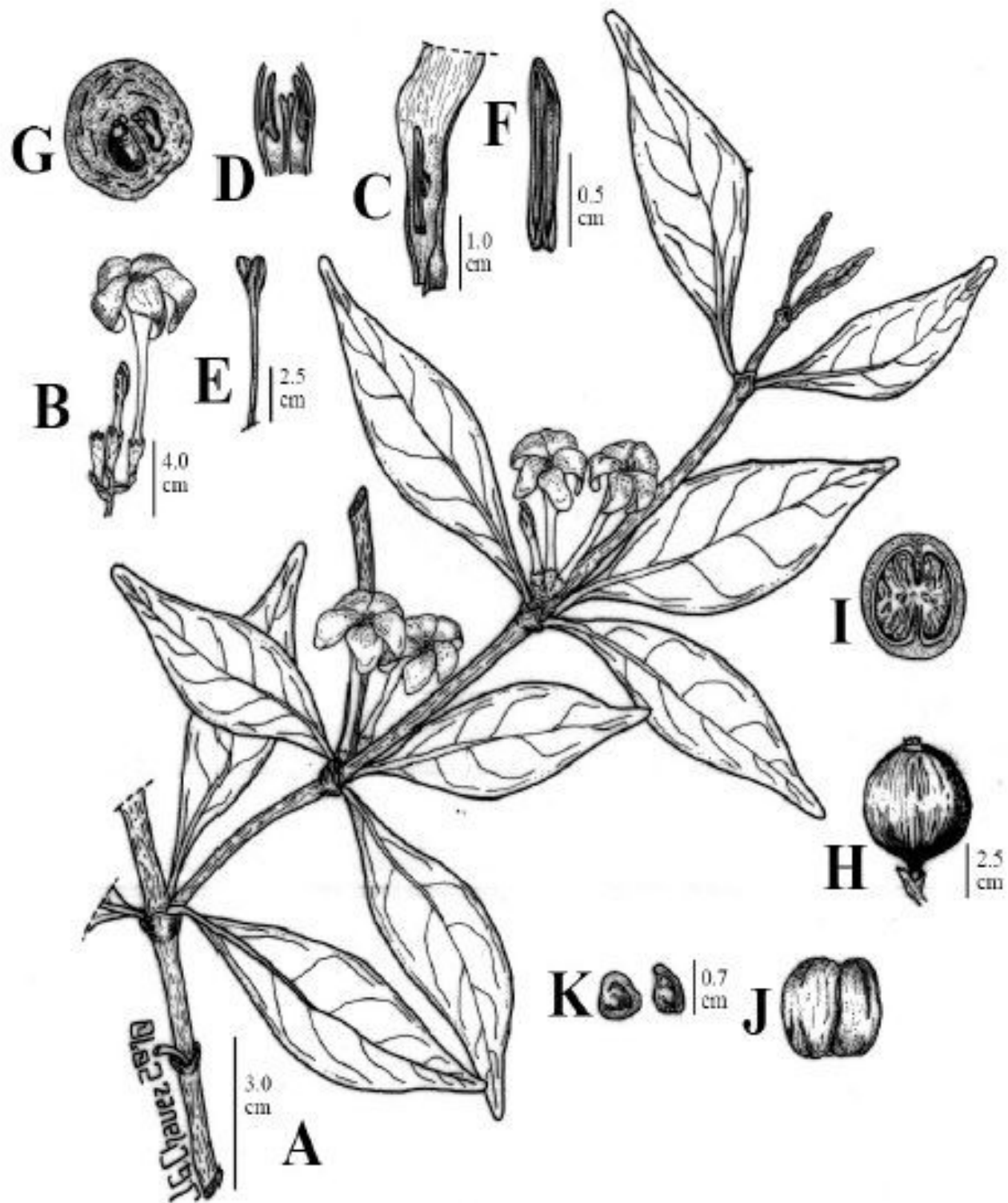


Figure 1. *Rothmannia lagunensis* (Merr.) Chavez and Alejandro, comb. nov. A, Flowering branch; B, inflorescence; C, portion of opened corolla; D, position of stigma to the corolla throat; E, style; F, anther; G, ovary c.s.; H-J, fruit; K, seeds. A-G, from Chavez & Yu 031 (USTH); H-K, from Ramos 14934 (L).

flowering heads; ovaries being bilocular; placentation axile; and the fruits are globular, indehiscent, without ridges, and the seeds are embedded in a fleshy pulp forming a single mass. The cladistic analyses of plastidial DNA datasets (*rps16* intron and *trnT-F* region) of the three *Gardenia* species (JG Chavez and GJD Alejandro, unpublished) elucidated that the enigmatic taxa are situated with the rest of the sampled *Rothmannia* species with strong support, which corroborates with the existing morphological characterization and delimitation. Therefore, we propose that these species should be transferred to *Rothmannia*: *R. lagunensis*, *R. merrillii* and *R. negrosensis*. With these nomenclatural amendments we establish the genus for the first time in the Philippine flora. The new taxa differ from each other in minor details (Table 1); *R. lagunensis* is distinguished from *R. merrillii* and *R. negrosensis* by its glabrous corolla throat, smaller leaf lamina and corolla lobes. On the other hand, *R. negrosensis* expresses almost the same vegetative and reproductive character as *R. merrillii* and only differs in that the inflorescence bracts, calyx and lower leaf surface especially at the midrib and secondary veins are densely pubescent.

Morphological Characters of Philippine *Rothmannia*

The height of shrubs and trees ranges from 5-18 m tall. *Branches* glabrous to pubescent. *Stipules* interpetiolar, not fused to a connate tube, entire, small, triangular to broadly ovate, inner surface hairy bearing colleters, outer surface glabrous to tomentose, margin not hairy. *Leaves* opposite-decussate with 3:3 branching pattern wherein only one leaf is normally developed and the others being vestigial or reduced in size, (sub)coriaceous to chartaceous, broadly elliptic to lanceolate; apex acute to acuminate; base cuneate or obtuse; adaxial surface glabrous to sparsely pubescent; abaxial surface (sub)glabrous to pubescent; lateral nerves 6-13 pairs, prominent; petiole 1-2 cm long, glabrous to pubescent. *Domatia* absent. *Inflorescence* is a cyme with fascicled flowering heads rarely solitary; (sub)glabrous to tomentose; habit lax or compact; terminal appearing axillary due to sympodial growth; involucre bracts absent; interfloral bracts and bracteoles glabrous to puberulent. *Flowers* 5-8 merous; actinomorphic; bisexual; homostylous; pedicelate; glabrous to pubescent. *Calyx tube* cup-shaped to shortly tubular; hairs present or absent; lobes reduced to minutely toothed; colleters absent. *Corolla* salverform; tube outer and inner surface glabrous to pubescent; purple speckles running down the corolla throat absent; lobes broadly elliptic to ovate; aestivation contorted to the left. *Stamens* inserted distal ¼ of corolla tube, separate, equal sizes. *Filaments* distinct, glabrous. *Anthers* dorsifixed, semi-exserted in corolla tube, linear, dehiscing via longitudinal slits. *Style* included in corolla tube, hairs absent. *Stigmas* 2-lobate. *Ovary* bilocular with numerous ovules; placentation axile. *Fruits* fleshy, berry-like, globose; smooth and even; crown of persistent calyx segments present. *Seeds* numerous, endospermic, embedded in a pulp forming a single mass; exotestal cells isodiametric, with thickenings in the inner tangential walls.

1. *Rothmannia lagunensis* (Merr.) Chavez & Alejandro, comb. nov. – Fig. 1; Map 1

= *Gardenia lagunensis* Merr. (1915) 110-111; (1923) 530. – Type: C.F. Baker 3176 (destroyed). Neotype designated here: Ramos 14934 (L).

Tree, up to ca. 12 m tall. *Branches* terete, grayish, or brown to black, puberulous when young, glabrous when mature. *Leaf blades* coriaceous, obovate to oblanceolate, 6-12 cm long, 4-6 cm wide, sparsely pubescent when juvenile being glabrous when mature; apex acute or abruptly acuminate, acumen blunt, 1-1.5 cm long; base acute to cuneate; midrib sunken above, prominently raised abaxially; lateral nerves prominent, 5-7 on each side; petioles glabrous, 0.5-1 cm long, 1.5 mm thick. *Stipules* broadly ovate, 2 mm long, 3-5 mm wide; apex apiculate, acumen 1 mm long; outer surface glabrous. *Inflorescence* terminal appearing axillary due to sympodial growth, 1- or 3-flowered cyme, glabrous; habit compact; subsessile with peduncle up to 1.5 cm long; bracts ovate, 1.5-2 mm long, 2 mm wide. *Flower* subsessile, 1-2.5 mm long, fragrant. *Calyx* cup-shaped, leathery, (sub)glabrous, 3-6 mm long, 4.5 mm wide, minutely toothed; lobes 5, triangular, 1-1.5 mm long, inside hirsute at apex. *Corolla* salverform, white, tube 6.5-8 cm long, expanding towards the apex, glabrous outside and to the interior including the corolla throat; corolla lobes 5, chartaceous, oblong to obtuse, 1-1.5 cm long, 0.5-1 cm wide. *Anthers* 5, inserted at the upper 1/3, linear, up to 12 mm long. *Style* and *stigma* up to 7 cm. *Fruits* globose or ovoid, 3-5 cm in diameter, smooth, crowned with persistent calyx teeth, drying black. *Seeds* irregular, elliptic to ovate, 6-7 mm long.

Phenology: Flowering December to July; fruiting May to December.

Common Names: Makaboyo (Neg.), malabukok (Tag.)

Habitat and Distribution: Luzon: Batangas; Angat, Bulacan; Camarines Sur; Palanan, Isabela; Montalban, Rizal; Atimonan, Quezon; Kalayaan and Paete, Laguna. Commonly found on mix Dipterocarp forests as an understorey plant at low altitudes, up to ca. 300 masl.

Proposed IUCN Conservation Assessment: Vulnerable (VU), due to its fragmented and declining distribution.

Notes: Merrill (1915) described this species as allied to *G. merrillii* (recognized here as *Rothmannia merrillii*) but being distinguishable by its vegetative parts and the more slender flowers with smaller corolla lobes. He designated the specimen C.F. Baker 3176 as the type of *G. lagunensis*. However, the holotype which was deposited in PNH was destroyed during the Second World War. We have the specimen of Ramos 14934 deposited in Leiden (L) from San Antonio, Province of Laguna as the neotype.

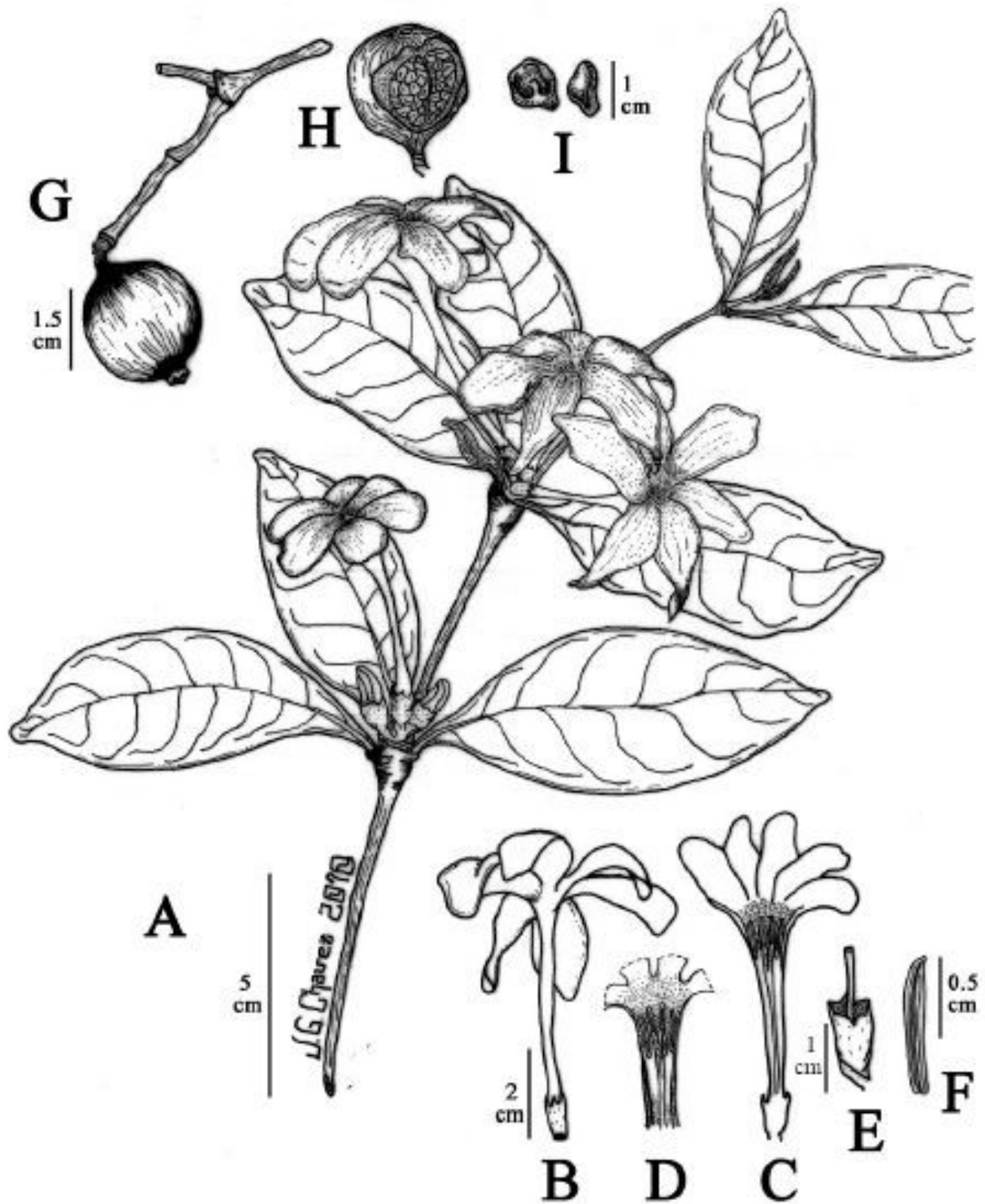


Figure 2. *Rothmannia merrillii* (Elmer) Chavez and Alejandro, comb. nov. A, Flowering branch; B, flower; C, portion of opened corolla; D, position of the stigma and anthers to the corolla throat; E, calyx; F, anther; G-H, fruit; I, seeds. A-F, from Chavez et al. 019 (USTH); G-I, from Chavez et al. 006 (USTH).

2. *Rothmannia merrillii* (Elmer) Chavez & Alejandro, comb. nov. – Fig. 2; Map 1

= *Gardenia merrillii* Elmer (1906) 5-6; (1912) 1330; Merr. (1923) 530. – Type: Not designated. Lectotype designated here: Merrill 669 (US; isolecto NY).

Shrub to tree, up to ca. 13 m tall. *Branches* terete, with brown to black bark, glabrous. *Leaf blades* (sub)coriaceous, elliptic to oblong, or lanceolate to oblanceolate, 7-18 cm long, 6-8 cm wide, sparsely pubescent when young, becoming glabrous when mature; apex acuminate to cuspidate, acumen up to 1 cm long; base acute to oblong; midrib sunken above, prominently raised abaxially; lateral nerves prominent, 7-9 pairs; petioles glabrous, up to 1 cm long, 1.5 mm thick. *Stipules* broadly ovate to triangular, leathery, up to 3 mm long, 6 mm wide; apical process cuspidate, acumen up to 1 mm long; outer surface glabrous, densely hirsute at the base inside. *Inflorescence* terminal appearing axillary due to dichotomous growth, uniflowered or up to 5 flowered cyme, glabrous; habit compact; peduncle 1 cm long, bibracteate; bracts ovate, 2-5 mm long, 2 mm wide. *Flower* fragrant; pedicels subobsolete to 3 mm long, bibracteate; bracts ovate to triangular, with trichomes on the inner surface. *Calyx* cup-shaped, leathery, (sub)glabrous, 6-8 mm long, 6 mm wide, minutely toothed; lobes 5-7, triangular. *Corolla* salverform, white, tube 5-8 cm long, expanding towards the apex, glabrous outside and to the interior, densely pubescent at the throat; lobes 5-6, chartaceous, elliptic or lanceolate to obovate, 4 cm long, 1-2 cm wide. *Anthers* 5-6, inserted at the upper 1/3, 6-10 mm long. *Pollen* monad, triporate, foveolate. *Style* and *stigma* 3.5-6 cm long. *Fruits* (sub)globose, 2.5-5 cm in diameter, smooth, crowned with short persistent calyx teeth, usually drying black. *Seeds* flat, triangular, or ovate to orbicular, 8-10 mm long.

Phenology: Flowering January to August; fruiting April to January.

Common Name: Bagais (Myn.), bagawi (BisPn.), bagiw (Han., Myn.), balitungyun (Bng.), dayano (Pal., Tbw.), niyog-niyog (BisPn.), tayakan (Myn.).

Habitat and Distribution: Luzon: Cagayan; Isabela and Quezon. Mindoro: Baco; Bongabon; Golo Island; Mansalay; Paluan; Pinamalayan; Pola; Puerto Galera; San Jose. Negros: Mt. Kanlaon. Palawan: Aborlan; Bataraza; Busuanga; Culion Island; Narra; Puerto Princesa; Quezon; Taytay. Panay: Antique; Guimaras; Semirara Island. Romblon: Sibuyan Island. On low to medium altitudes (up to 350 masl) primary and secondary forests, common on the ultramafics of Palawan and Isabela. Also reported from non ultramafic localities. It is also documented on coastal forests of Mindoro.

Proposed IUCN Conservation Assessment: *Rothmannia merrillii* has a widespread distribution and is commonly encountered in the islands of Palawan and Mindoro, so the status

Least Concerned (LC) is appropriate. However, due to the increasing threats to its habitats, the status should be assessed periodically.

Notes: This species is variable in size of vegetative and reproductive parts depending on its habitat. Its glabrous vegetative and reproductive parts make it distinct from its closely allied to the much-indumented *Rothmannia negrosensis*. Elmer (1906) cited two type specimens for his taxon *Gardenia merrillii*, Merrill 669 collected in flower from Culion Island in February 1903 and Garcia sub Merrill 1226 collected in fruit in Mindoro in January 1903. The attempt to search for Merrill's specimen which was deposited in PNH was not successful, so that it might have been destroyed during the Second World War. Of the two syntypes we decided to choose the flowering collection and therefore, the well-preserved duplicate of Merrill 669 from US to serve as lectotype.

3. *Rothmannia negrosensis* (Merr.) Chavez & Alejandro, comb. nov. – Fig. 3; Map 1

= *Gardenia negrosensis* Merr. (1915) 111-112, (1923) 530. — Type: Everett 7255 (destroyed). Neotype designated here: Celestino 7333 (L).

Tree, up to ca. 12 m tall. *Branches* terete, brown, sparsely pubescent when young, glabrous when mature. *Leaf blades* chartaceous or (sub)coriaceous, oblong, or widely elliptic to ovate, 13-23 cm long, 5-10 cm wide, densely pubescent when juvenile, becoming scantily pubescent or puberulent when mature; apex shortly acuminate or cuspidate, acumen up to 3 mm long; base cuneate or obtuse; midrib sunken above, prominently raised and pubescent abaxially; lateral nerves 7-13 pairs; petioles glabrous, up to 1.3 cm long, 1.3 mm thick. *Stipules* broadly ovate, leathery, up to 4 mm long, 5-7 mm wide; apical process acute to cuspidate, acumen up to 1 mm long; outer surface glabrous to slightly pubescent, densely hirsute at the base inside. *Inflorescence* terminal appearing axillary due to dichotomous growth, 3 to 6 flowered cyme, densely pubescent to tomentose; habit compact; peduncle up to 1.2 cm long, bibracteate; bracts triangular to broadly ovate, 2.8-4 mm long, 2-3 mm wide, with trichomes on the inner surface. *Flowers* fragrant, showy; pedicels subobsolete, up to 1 mm long. *Calyx* cup or funnel-shaped, leathery, pubescent or puberulent, 5-9 mm long, 6 mm wide, minutely toothed; lobes usually 6-8 toothed, triangular to ovate, up to 1 mm long. *Corolla* salverform, white, tube 7-10 cm long, expanding towards the apex, glabrous outside, densely pubescent or puberulent at the interior up to the corolla throat; lobes 6-8, chartaceous, broadly ovate to obovate, 3-5 cm long, 2-3 cm wide, puberulent along the fringes. *Anthers* 6-8, inserted at the upper part of the corolla throat, 1-1.3 cm long. *Pollen* monad, spheroidal, rugulose. *Style* and *stigma* 6.5-9 cm long. *Fruits* globose to ovoid, 2.5-6 cm in diameter, smooth, crowned with calyx teeth remnants, sometimes ferruginously pubescent near the apex when young, black when dry. *Seeds* flat, irregular, sub-orbicular to rounded triangular, 7-11 mm long.

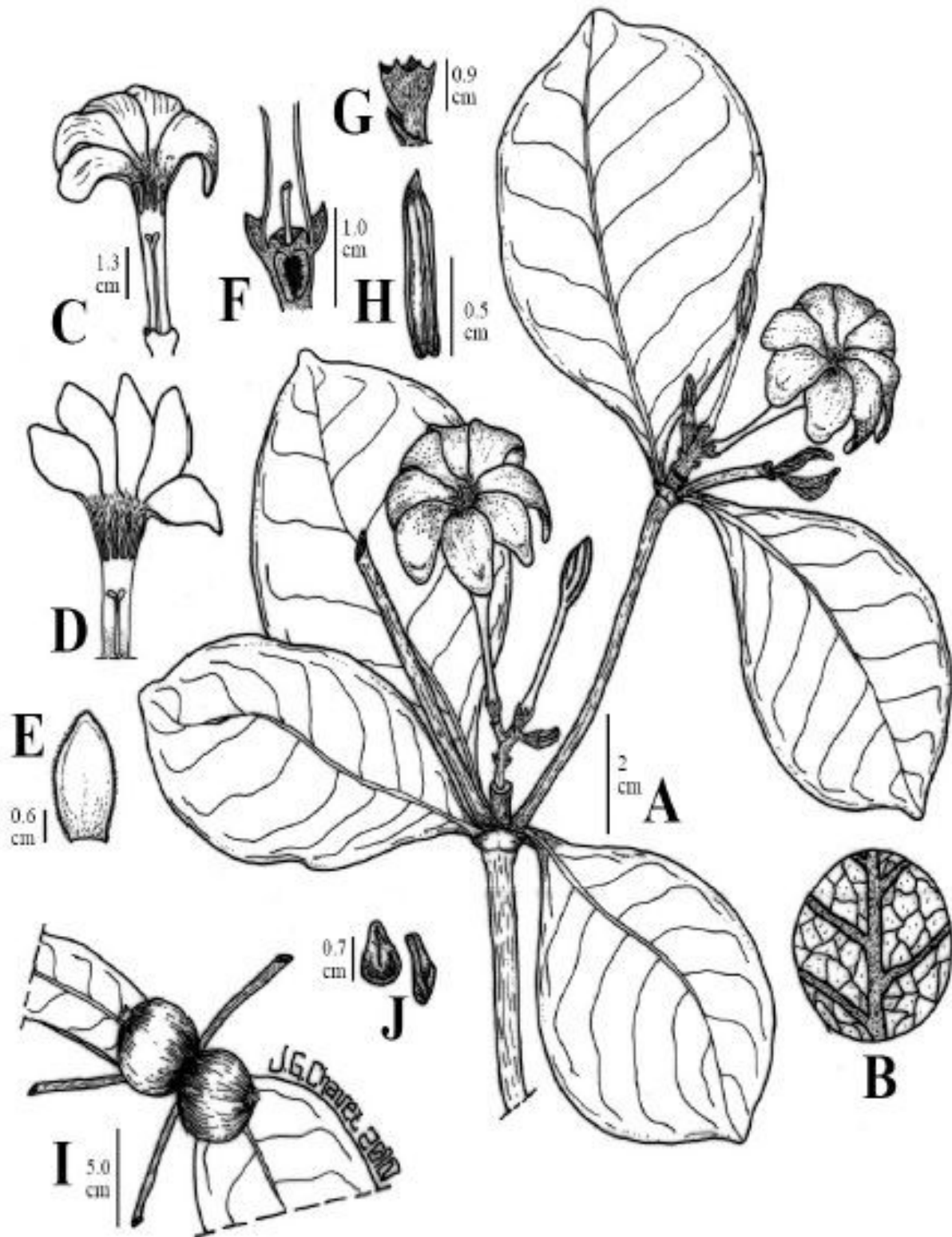
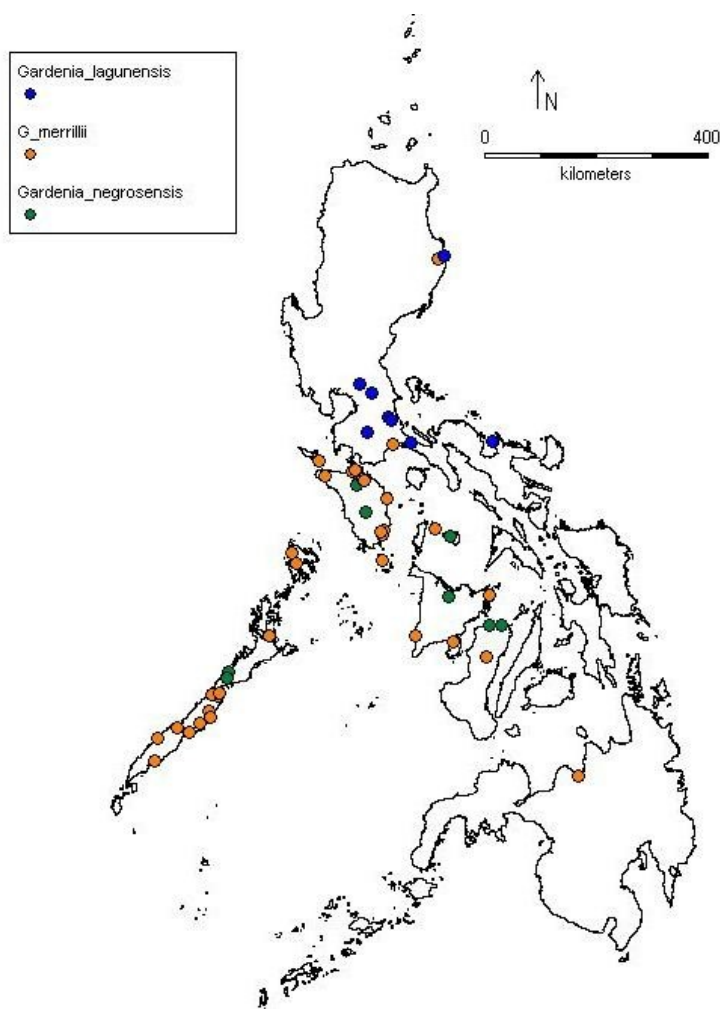


Figure 3. *Rothmannia negrosensis* (Merr.) Chavez and Alejandro, comb. nov. A, Flowering branch; B, leaf, abaxial surface; C, flower and position of stigma in the corolla tube; D, corolla throat; E, corolla lobe; F, ovary, l.s.; G, calyx; H, anther; I, infructescence; J, seeds. A-H, from Chavez GN005 (USTH); I-J, from Chavez & Frias GN001 (USTH).



Map 1. Distribution of the three Philippine *Rothmannia* species.

Table 1: Significant morphological characters delimiting the three taxa of Philippine *Rothmannia* Thunb.

Plant Parts	<i>R. lagunensis</i>	<i>R. merrillii</i>	<i>R. negrosensis</i>
Leaves			
Size	<12 x 6 cm	6-18 x 5-8 cm	12-20 x 5-10 cm
Shape	elliptic-ob lanceolate	elliptic-ob lanceolate	ob lanceolate-oblong
Abaxial surface	glabrous	glabrous	pubescent
Inflorescences			
Texture	glabrous	(sub)glabrous	pubescent
Bracts	glabrous	(sub)glabrous	pubescent
Flowers			
Width	~4 cm	6-9 cm	6-9 cm
Corolla throat	glabrous	densely pubescent	densely pubescent
Calyx outer surface	glabrous	(sub)glabrous	pubescent

Phenology: Flowering February to May; fruiting May to August.

Common Name: Bato-bato (BisPn.), magupung (BisSL.), maliyamad (Sub.), paitan/ timbantimban (BisPn.)

Habitat and Distribution: Mindoro: Calintaan; San Teodoro; Negros: Cadiz City. Palawan: Puerto Princesa City. Panay: Capiz; Sibuyan Island. Usually documented growing in secondary forests or along streams in gallery forest, up to 350 masl.

Proposed IUCN Conservation Assessment: Vulnerable (VU), due to its restricted and declining distribution.

Notes: This species is manifestly very closely allied to *R. merrillii*, which it greatly resembles vegetatively and reproductively, differing only in its pubescent lower leaf surface, inflorescences and calyces. The basionym *G. negrosensis* was described by Merrill (1915) in the basis of Everett 7255, collected in the Himogaan River, Cadiz, Negros. Since the attempts in searching this specimen and possible duplicates in PNH, K, US, NY, P and L failed, we designated the specimen of Celestino 7333 in L as the neotype.

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Index of Collections

The numbers after the collectors and their collection numbers refer to:

1= *Rothmannia lagunensis*; 2= *R. merrillii*; 3= *R. negrosensis*

- Agama 21618: 2—Alambra 28093: 1—Alejandro 10-018: 1. Bernardo 27085: 2—Burley 128: 2.
- Celestino 3512: 3; 7333: 3—Celestino & Ramos 23090: 2—Chavez 003: 2; 004: 2; 005: 3—Chavez & Frias 001: 3; 002: 3; 027:3; 028: 3—Chavez & Yu 030: 1; 031:1—Chavez et al. 006: 2; 015: 2; 019: 2; 024: 2—Conicosa 29461: 1; Cordero & Espiritu 91599: 2; Curran 3517: 2. Dransfield 1237: 2.
- Edaño 21784: 2—Elmer 12246: 3; 13126: 2—Escritor 21571: 2.
- Garcia 22603: 3.
- Loher 1481: 1; 1482: 1—Lopez 41371: 2.
- Madulid 6897: 3—Maliwanag 221: 2—Marche 119: 2—Mcgregor 137: 2—Mendoza & Espiritu 91187: 2—Merrill 669: 2; 839: 2; 1195: 2; 1226: 2; 2888: 2; 11540: 2.
- Podzorski 2081: 2; 2091: 2.
- Ramos 140: 1; 14934: 1; 23845:1; 2635: 1; 22297: 1; 40890: 2; 41254: 2—Ramos & Edaño 29392: 1; 31358: 3—Reynoso et al. 14116: 2—Ridsdale 84: 2; 378: 2; 857: 3; 1096: 2; 1649: 3; 1689: 2; 1704: 2; 1809: 2—Ridsdale et al. 93: 2; Romero et al. 364: 2.
- Santos 5165: 2—Soejarto & Fernando 7384: 2—Soejarto & Madulid 9052: 2—Soejarto et al. 6608: 2; 7828: 1—Stone et al. 6307: 2—Sulit 11787: 2; 12549: 2; 17140: 2—Sulit & Conklin 16774: 2.
- Taleon 33906: 2.
- Varadarajan et al.1552: 2.