



Gravesia serratifolia (Melastomataceae: Sonerileae), a new species from Marojejy National Park, Madagascar

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Abstract

Gravesia serratifolia, a new species from upper elevations of Marojejy National Park in northeastern Madagascar, is herein described, illustrated, mapped, and compared with similar species. It is readily characterized by its sparingly branched habit, leaf blades coarsely serrate with a moderate to sparse lepidote indumentum on both surfaces, inflorescence of few-flowered dichasia, calyx obsolete or evident as depressed truncate undulations with prominent calyx teeth that are laterally compressed when fresh, filaments with rusty-brown glandlike indumentum, and dorso-basal staminal appendages linear-oblong and widely spreading to coiled. A conservation assessment of Vulnerable is recommended for this species based on IUCN Red List Categories and Criteria.

Résumé

Gravesia serratifolia, une nouvelle espèce originaire des hautes altitudes du Parc National de Marojejy, au Nord-Est de Madagascar, est décrite, illustrée, cartographiée, et comparée à des espèces qui lui ressemblent. Elle est caractérisée par son port peu ramifié; ses feuilles très serrulées dont le recouvrement de l'indument en lépidote des deux côtés de leur surface varie de modéré à éparse; son inflorescence pauciflore et dichasiale; son calice floral essentiellement non-lobé mais fortement denté, les dents étant comprimées à l'état frais; l'indument de ses filaments pourvu de sorte de glandes roux-sombres; ses appendices staminaux au niveau de la base dorsale, oblongues, et qui varient de largement diffus à enroulés. Le statut de conservation «Vulnerable» est recommandé pour cette espèce, suivant les Catégories et les Critères de la Liste Rouge de l'UICN.

Keywords: *Sonerileae*, conservation, new species, paleotropics, Madagascar

Introduction

Gravesia Naudin (1851: 333) is a monophyletic genus of about 115 species in the paleotropical tribe Sonerileae. It is mainly restricted to wet forested environments on the island of Madagascar. Outside of Madagascar, only five other species are collectively known from tropical regions of mainland Africa (Almeda & Ranarivelo 2018). The genus is readily recognized by its isomerous generally 5-merous (rarely 4-merous) diplostemonous flowers, prevailing isomorphic stamens, anthers that are inappendiculate or conspicuously appendiculate dorso-basally at or near the filament insertion, capsular fruits, and seeds that are \pm elongated, straight, or slightly curved and generally cuneiform (Perrier de la Bâthie 1932). With respect to habit, *Gravesia* appears to be more diverse than any other genus of Sonerileae (Almeda 2003). It includes rosulate herbs, radican suffrutescent herbs, shrubs (both large and small), climbing epiphytes with clinging adventitious roots, and lianescent shrubs. Many species of *Gravesia* have distributions that are restricted both geographically and elevationally which makes them especially vulnerable to anthropogenic habitat degradation and destruction.

The species proposed here was discovered in the course of routine identifications of Malagasy Melastomataceae at CAS. It is only the third species of *Gravesia* to be described from Madagascar (Humbert 1955; Almeda & Ranarivelo 2018) since Perrier de la Bâthie's (1951) treatment of the genus in *Flore de Madagascar et des Comores*. It appears to be largely restricted to higher elevations on the Marojejy Massif in northeastern Madagascar, a region of high

local endemism. The Marojejy Massif and the nearly adjacent Anjanaharibe-Sud Massif which are connected by the crescent-shaped forested corridor, Betaolana, constitute an important rainforest conservation unit that is known for its rich biodiversity and range-restricted species in many genera of flowering plants (Garreau & Manantsara 2003).

Materials and methods

Measurements of gross morphological characters are based on dried material of the type and paratypes cited here. The distribution map was constructed in Quantum GIS 2.18.7 (QGIS Development Team 2017) using coordinates provided on specimen labels. The geographic coordinates of specimens that lacked precise information were estimated using label information and Google Earth Pro. Among the specimens cited, geographic coordinates that were estimated *ex post facto* are included in brackets. The conservation status was assessed using IUCN guidelines (IUCN 2017). GeoCAT (Bachmann *et al.* 2011) was used to calculate the extent of occurrence and area of occupancy with a user-defined cell width of 2 km.

Taxonomic Treatment

Gravesia serratifolia Almeda & H. Ranariv., *sp. nov.* (Figures 1 & 2)

Diagnosis: Distinguished from all *Gravesia* species by a combination of small (1–3.3 × 0.7–2.7 cm) coarsely serrate leaf blades that are moderately lepidote on both surfaces like young vegetative buds, calyx tube well-developed and flangelike, 1.5 mm long; calyx lobes obsolete or evident as depressed truncate undulations, calyx teeth 5, 0.75–1 × 0.5–0.75 mm, prominent and prolonged beyond calyx tube, laterally compressed when fresh but appearing knobby and callose-thickened when dry; filaments sparsely to moderately beset with rufescent simple (rarely branched) glandlike trichomes mostly less than 0.25 mm long that are commonly clustered or fascicled, and anther connective conspicuously prolonged dorso-basally ca. 0.5 mm above the junction with the filament into a linear-oblong widely spreading or coiled appendage 0.5–0.75 mm long.

Type:—MADAGASCAR. Antsiranana: SAVA, Andapa, Marojejy National Park, top of the massif, 2132 m, 14°26'57"S, 49°43'57"E, 13 December 2005, fl., H. Ranarivelo & D. Ravelonarivo RHS 857 (holotype: CAS!; isotypes: G!, MO!, P!, TAN!).

Sparingly branched shrub 50 cm to 1 m tall. Distal cauline internodes rounded-quadrate, deeply and inconspicuously canaliculate on two of the opposing faces, essentially glabrous, sparingly and irregularly lenticellate. Cauline nodes somewhat swollen at the base of each petiole with elevated somewhat pustulate U-shaped or V-shaped interpetiolar lines. Leaves opposite and decussate, isomorphic in size and shape in each pair, ± erect or ascending when fresh, the adaxial surface sometimes ± convex or with the blade margins curved downward at a gentle angle when fresh. Leaves semi-succulent when fresh becoming chartaceous when dry; petioles 3.5–6 mm long, canaliculate and glabrous on the adaxial surface, rounded and glabrous to lenticellate on the abaxial surface; blades bright green when fresh, irregularly flushed red along the margins, 1–3.3 × 0.7–2.7 cm, elliptic-ovate to ovate or suborbicular (rarely ovate-obovate), 5-nerved with inconspicuous acarodomatia where the inner pair of secondary veins diverge from the primary vein at the blade base, moderately and randomly lepidote on both surfaces like the young vegetative buds, the scales minute, sessile, and rusty brown, apex obtuse to rounded, base obtuse to bluntly acute or nearly rounded, the blade margins conspicuously and coarsely serrate for much of their length. Inflorescence a terminal simple dichasium of three flowers but often reduced to a solitary flower or occasionally somewhat congested and 5-flowered on an erect solitary peduncle (4–) 7–16 mm long; pedicels 2–4 mm long, glabrous, lenticellate and sometimes also sparingly rusty lepidote, the subtending bracts with petioles mostly 1 mm long and blades 2–5 × 1.5–4 mm, elliptic-ovate to obovate, 3-nerved, apex obtuse, base acute to cuneate, sparingly rusty-lepidote on both surfaces, the margins coarsely serrate; the bracteoles 1.5–2.5 × 0.25–0.5 mm, linear-oblong to narrowly oblanceolate, obscurely 1-nerved, apex narrowly acute, base narrowly attenuate, glabrous, the margins entire. Hypanthium (at anthesis) 4–5 mm long to the torus and 4–5 mm in diameter, broadly turbinate to infundibuliform, ± terete or only 2-costate on some hypanthia, essentially glabrous, often irregularly lenticellate and sparingly beset with a sessile rusty-lepidote indumentum that is caducous; calyx tube well developed and flangelike, 1.5 mm long; calyx lobes obsolete or evident as depressed truncate undulations, calyx teeth 5, 0.75–1 × 0.5–0.75 mm, prominent and prolonged beyond calyx tube, laterally

compressed when fresh but appearing knobby and \pm callose-thickened when dry. Petals 5, 13–19 \times 6–9 mm, narrowly obovate, obliquely apiculate at the apex, magenta, entire and eciliate. Stamens 10, isomorphic in size and shape, erect and \pm clustered around the erect style at anthesis; filaments 6–7 mm long and 0.5 mm in diameter, pale pink, compressed, sparsely to moderately beset with rusty brown simple (rarely branched) glandlike trichomes mostly less than 0.25 mm long that are commonly clustered or fascicled; anther thecae 4 mm long and 1 mm in diameter, yellow, oblong, \pm laterally compressed, the apical pore ventrally inclined; connective conspicuously thickened dorsally and prolonged dorso-basally ca. 0.5 mm above the junction with the filament into a linear-oblong widely spreading or coiled appendage 0.5–0.75 mm long. Ovary (at anthesis) 3 mm long and 2 mm in diameter, bluntly oblong-elliptic and somewhat tapered distally (at anthesis), glabrous, apex truncate to rounded, 1/3-inferior, 5-locular; style 10–12 mm long and 0.5–0.75 mm in diameter, pale pink but whitish distally, terete and \pm straight, glabrous and terminating in a punctiform stigma. Mature capsules and seeds not seen.

Phenology:—The type and two of the paratypes, which were collected in October and December, are in flower; these flowering specimens have a few post-mature ruptured capsules with no seeds. One other paratype that was collected in November has young fruits. Another paratype collected outside of Marojejy NP in March is in post-mature fruit.

Habitat and distribution:—Three of the five known collections of *Gravesia serratifolia* were collected at or near the summit of Marojejy National Park above 2000 m elevation (Figure 3). The fourth collection was purportedly made near Camp III. Our GPS readings in the field indicate that Camp III is at about 1319 m. We did not see this species around Camp III so we suspect that this collection was made at a somewhat higher elevation in ericoid vegetation. The single collection from outside the park boundaries was made at 1774 m. Four natural vegetational formations have been identified on the Marojejy Massif (Humbert 1955; Garreau & Manantsara 2003): humid dense forests occur below 800 m; medium-elevation rainforests occur between 800 and 1400 m; dense montane forests are found between 1400 and 1800 m; and what has been described as ericoid vegetation (Humbert 1955) or montane thicket (Garreau & Manantsara 2003) occurs above 1800 m. Most of the known collections of *G. serratifolia* were made in this latter formation which covers only about 1000 ha or 1.5 % of the area of Marojejy National Park.

Conservation status:—*Gravesia serratifolia* is mostly known from a limited area at upper elevations of Marojejy National Park and one outlying montane site northwest of the park. The EOO is 36.9 km² and the AOO is 8 km². Except for the single collection made outside of the park, all known populations of this species occur within the boundary of Marojejy National Park. Populations in the park are afforded some protection so it seems unlikely that they are severely threatened at this time. The lower elevation forests within and surrounding Marojejy NP suffer from diffuse but regular noncommercial pressure due to exploitation of forest products. Ecotourism at Marojejy NP is small-scale at present but increased human visitation to the high elevation montane thicket vegetation could become a potential threat because of its limited extent and the slow growth of plant species in this fragile formation (Garreau & Manantsara 2003). To date there has been no history of fire damage to the vegetational cover in the interior of Marojejy NP (Garreau & Manantsara 2003). However, low elevation habitats outside of the national park continue to experience out-of-control fires and areas in the Betaolana corridor are threatened by mining sites for topaz and beryl. In view of its limited area of occupancy, small population size (surely less than 1000 individuals), and number of known locations (≤ 5), we recommend a conservation classification of Vulnerable (VU): D2 for *G. serratifolia* at this time.

Etymology:—The epithet for this species, *serratifolia*, highlights the conspicuous serrate foliar margins that extend for most of the length of each mature leaf blade.

Additional specimens examined:—MADAGASCAR. Antsiranana: Massif de Marojejy, sommet face ouest, 2000–2137 m, [14°26'55.41"S, 49°43'59.89"E], Nov. 1972, yg. fr., *Morat 4091* (P, TAN!); Marojejy-Andapa, forêt à mousse Camp III, [14°26'11.7"S, 49°44'36.9"E], 11 Oct. 1988, fl., *Rakatozafy & Raharilala 2258* (TAN!); SAVA, Andapa, Marojejy National Park, top of the massif, 2132 m, 14°26'57"S, 49°43'57"E, 13 Dec. 2005, fl., *Ranarivelo & Ravelonarivo RHS 820* (CAS!, MO!, TAN!); Anjialavabe et Doany, Andapa, deuxième montagne d'Ankarongameloka, 1774 m, 14°14'S, 49°26'E, 11 Mar. 2006, old fr., *Ravelonarivo et al. 1872* (MO, P-online image!, TAN).

Discussion:—Perrier de la Bâthie (1932, 1951) divided *Gravesia* into three subgenera. The subgenus *Gravesia*, to which he assigned over 100 described species, was further divided into four sections largely based on habit and inflorescence architecture. The taxonomy of *Gravesia* in Madagascar has received little attention since Perrier de la Bâthie's flora treatment of the genus. The monophyly of its infrageneric groupings are yet to be tested in a phylogenetic context. Several of the sections in subgenus *Gravesia* include morphologically diverse species. We tentatively assign *G. serratifolia* to section *Pauciflorae* based on its shrubby habit with stems that exceed the leaves in length and few-flowered cymose inflorescence, but it does not match or appear to be particularly close to any of the species assigned to this section by Perrier de la Bâthie (1951).

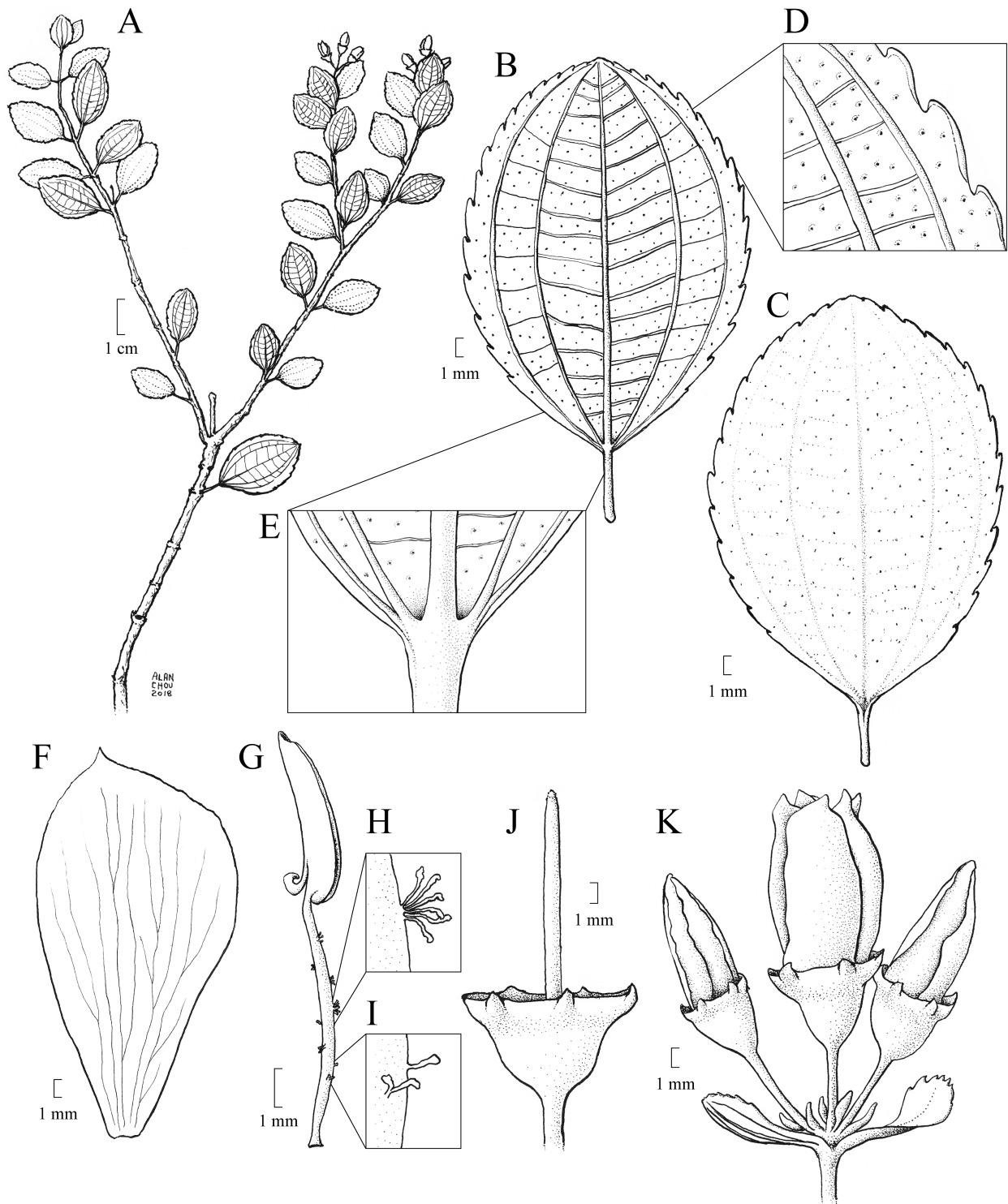


FIGURE 1. *Gravesia serratifolia*. A. Habit. B. Representative leaf (abaxial surface) C. Representative leaf (adaxial surface). D. Enlargement of a portion of abaxial leaf surface showing serrate margin and scattered lepidote indumentum. E. Enlargement of abaxial leaf base showing acarodromia where secondary veins diverge from primary vein. F. Petal (adaxial surface) G. Stamen (profile view). H. Enlargement of filament showing fascicled glandlike trichomes. I. Enlargement of filament showing solitary and branched glandlike trichomes. J. Hypanthium and style (at anthesis) with petals and stamens removed. K. Simple dichasium showing bracts and bracteoles. Drawn from Ranarivelo & Ravelonarivo RHS 857.



FIGURE 2. *Gravesia serratifolia* showing habit, leaves, inflorescence, and flower. (Photo: Éric Mathieu)

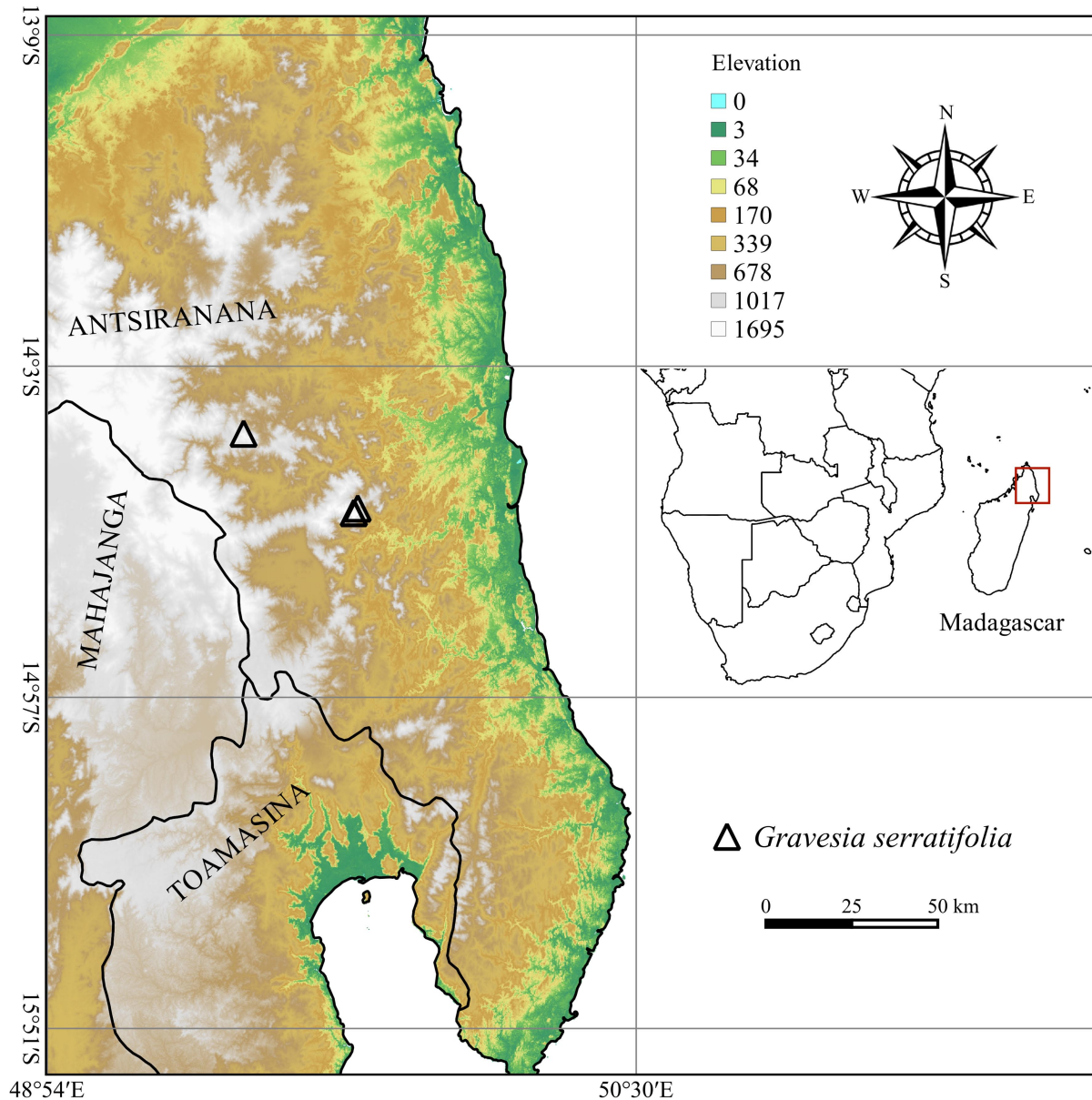


FIGURE 3. Geographic distribution of *Gravesia serratifolia*.

Gravesia serratifolia is readily distinguished from its congeners by the combination of coarsely serrate leaves that are elliptic-ovate to ovate or suborbicular, basally nerved and randomly beset with a minute lepidote indumentum on both surfaces (Figures 1B–E), flangelike unlobed calyx with prominent calyx teeth (Figures 1J, K), and rufescent trichomes on the filaments that are mostly clustered or fascicled (Figures 1G–I). Its closest relative appears to be *G. rubra* (Jum. & H. Perrier 1911: 274) H. Perrier (1932: 132), a species that Perrier de la Bâthie (1951) assigned to section *Macrophyllae* because of its large shrubby habit and paniculate inflorescence with an elongate peduncle and well-developed branches. Both *G. rubra* and *G. serratifolia* are similar in having glabrous rounded-quadrate distal internodes, 5-nerved leaves, glabrous hypanthia, conspicuous calyx teeth, and filaments that are beset with trichomes. *Gravesia rubra* differs most notably in being completely glabrous and in having much larger (5–8 × 1.3–2.2 cm) narrowly elliptic to elliptic-lanceolate leaves that are dentate and attenuate both apically and basally. It also differs from *G. serratifolia* in having broadly deltoid calyx lobes and filaments that are inconspicuously glandular pilose with the translucent solitary glands mostly less than 0.125 mm long (vs. simple or rarely branched rufescent trichomes mostly less than 0.25 mm long that are commonly clustered or fascicled). We initially considered the possibility that *G. serratifolia* might be a close relative of the sympatric *G. marojejyensis* Humbert (1955: 118) which is also endemic to high elevations on the Marojejy massif and known only from the type collection. When Humbert described the latter he assigned it to *Gravesia* sect. *Primuloideae* based on its repent radican suffrutescent habit with elongate internodes,

few-flowered contracted umbelliform cymes, and inflorescence peduncles that are longer than the pedicels. Both *G. serratifolia* and *G. marojejensis* share similar broadly turbinate to infundibuliform hypanthia and few-flowered inflorescences. The latter, however, does not appear to be closely related based on its broadly elliptic to nearly orbicular leaves that are coarsely denticulate, cordate at the base, conspicuously bullate on the adaxial surface, and beset with conspicuous rufescent trichomes on the elevated abaxial leaf veins and distal internodes. It also differs markedly from *G. serratifolia* in having a sparse cover of smooth spreading hypanthial trichomes, well-defined broadly deltoid calyx lobes, white petals with a yellowish flush on the abaxial surface, glabrous filaments, and blunt obtuse dorso-basal deflexed staminal appendages. In leaf shape and size and the few-flowered cymose inflorescences, *G. serpens* H. Perrier (1945: 101) and *G. venusta* H. Perrier (1932: 107) are somewhat reminiscent of *G. serratifolia* but both of these species belong to sect. *Scandentes* which consists of species that are consistently climbing epiphytes with clinging roots. The leaves of both of these species also differ in having consistently cordiform bases (vs. obtuse to bluntly acute or nearly rounded) and the margins are uniformly entire (vs. coarsely serrate).

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