



A new species of *Macrobium* (Fabaceae, Detarioideae) endemic on a Tepui of the Guyana Shield in Brazil

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Abstract

Macrobium aracaense (Fabaceae), a new endemic treelet species from Brazil, is here described and illustrated. Morphologically it is similar to *M. longipes*: both are treelets, the leaflets have the same shape and are covered by papillary epidermis on the abaxial surface, and the sepals apex are minutely ciliate. *Macrobium aracaense* occurs in sympatry with *M. discolor* var. *discolor* and *M. gracile* var. *confertum* in Serra do Aracá State Park, Amazonas, Brazil, and these four species can be easily differentiated by morphological characters, and their similarities and differences are here discussed.

Keywords: Brazilian Amazon, Serra do Aracá, white-sand forest

Resumo

Macrobium aracaense (Fabaceae) é uma nova espécie de árvoreta endêmica do Brasil, é aqui descrita e ilustrada. Morfológicamente é similar a *M. longipes*: ambas são árvoretas, os folíolos tem a mesma forma e são cobertos por papilas epidérmicas na face abaxial, e as sépalas tem o ápice diminutamente ciliado. *Macrobium aracaense* ocorre em simpatria com *M. discolor* var. *discolor* e *M. gracile* var. *confertum* no platô da Serra do Aracá, Amazonas, Brasil, e estas quatro espécies podem ser facilmente diferenciadas por caracteres morfológicos, e as semelhanças e diferenças entre elas são aqui discutidas.

Palavras-chave: Amazônia Brasileira, floresta de areia branca, Serra do Aracá

Introduction

In the Amazon, isolated patches of open vegetation associated with oligotrophic soils are found both on the lowlands (white-sand vegetation) and on plateaus of the sandstone table-mountains of the Guyana Shield (Berry *et al.* 1995, Prance 1996). The vegetation on such soils contains high endemism of genera and species, with a flora highly distinct from the surrounding tall forests on more fertile soils (Maguire 1979, Kubitzki 1990, Berry *et al.* 1995). The sandstone plateaus represent a conglomerate of spatially disjunct patches, and their isolation have been associated with high spatial endemism (Funk 2007). Also, the high-altitude flora differs substantially in composition from the lowlands (Huber 1987), although some lineages have diversified on these oligotrophic habitats along the altitudinal gradients in the region (Steyermark 1986, Huber 1988, Vicentini 2016).

In the Brazilian Amazon, sandstone plateaus are located on the southern portion of the Guyana Shield, along the border with Venezuela (e.g., Serra do Tepequém, Serra da Neblina and Serra do Aracá). Serra do Aracá is the southernmost extension of the Roraima Formation, consisting of Upper Precambrian quartzitic sandstone with intrusions of volcanic rock (Prance & Johnson 1992). This table mountain is surrounded in the lowlands by the largest area of white-sand campina (Adeney *et al.* 2016), which represents an immense field of paleo-dunes of recent stabilization (Carneiro Filho *et al.* 2002). Floristic inventories on the plateau of the Serra do Aracá recorded high endemism, which has been linked to its isolation in relation to other high-altitude mountains in the region (Prance & Johnson 1992,

Prance 1996, Costa 2017). The samples collected on the plateau to date have not yet being fully studied, and endemic species from the Serra do Aracá continue to be published in recent years (Secco & Rosario 2015, Barbosa-Silva *et al.* 2016).

Macrolobium Schreber (1789: 30) is a genus of about 70 to 80 species (Cowan 1953, Lewis *et al.* 2005, Estrella *et al.* 2012) with Neotropical distribution and most of its diversity concentrated in the Amazon biome (Ducke 1941, BFG 2015, Tropicos 2017). *Macrolobium* belongs to the order Fabales, family Fabaceae, subfamily Detarioideae, (LPWG 2017). It is spread over campinarana, savanna, restinga, várzea, igapó and terra firme forest (Ducke 1949, Félix-da-Silva *et al.* 2013). In Brazil, it is represented by 35 species and 26 varieties, of which 17 species are endemic (BFG 2015).

Macrolobium aracaense, known from some collections from the Plateau of the Serra do Aracá, could not be identified as any other published species. Here, we consider the morphological distinction of this species from other *Macrolobium* collections and the high-altitude occurrence as sufficient evidence supporting its circumscription as a new species, which is here formally described and illustrated.

Material & Methods

Samples of *Macrolobium aracaense* were collected on the plateau of Serra do Aracá (ca. 1020–1260 m.a.s.l.), a sandstone table mountain (tepui) of the Guyana Shield in Brazil (0°57' N, 63°24' W), located in the Serra do Aracá State Park. Sampling was conducted during two expeditions to the Serra do Aracá State Park first: one in 2001 by Alberto Vicentini and a second one in 2017 by Francisco Farroñay. Specimens were analyzed with a dissecting stereomicroscope, and measured with a digital caliper. Morphological terms follow Cowan (1953) and Zarucchi (1990). We generated a map in the software R (R Core Team 2017) to show the geographic distribution of the new species *Macrolobium aracaense* and the morphologically similar *M. longipes* Cowan (1957: 344–345). We used IUCN (2017) criteria to determine the conservation status of the new species.

Taxonomic treatment

Macrolobium aracaense Farroñay, *sp. nov.* (Figs. 1, 2)

Type:—BRAZIL. Amazonas: Mun. Barcelos, Plateau of Serra do Aracá, 0°56'54" N, 63°23'20" W, 1261 m.a.s.l., 27 August 2001, A. Vicentini & R.C. Mesquita 1886 (holotype INPA!, isotype MO!).

Macrolobium aracaense is similar morphologically to *M. longipes*. Both species have bifoliolate leaves, with leaflets of similar shape (oblong-ovate to oblong-elliptic) and a rounded apex. Also, they share a papillary epidermis on the abaxial surface. They differ by the leaflets with strongly revolute margin and always bifoliolate in *M. aracaense* (vs. 1–3 pairs of leaflets with margin flat or slightly revolute), the bracteoles are green (vs. bracteoles red), and the flowers with a single white petal (vs. red petal), 4 sepals (vs. 5 sepals), stamens with sparsely pubescent filaments (vs. stamens with filaments glabrous), and ovary villose at the margin (vs. ovary totally glabrous). In addition, *M. aracaense* occurs only above 1000 m.a.s.l., while *M. longipes* is a lowland species.

Treelet 1–4 m. Branchlets brownish, essentially glabrous. Stipules early caducous. Leaves always bifoliolate; petioles 2.5–4.4 mm long; leaflets sessile to subsessile, 4–6.8 × 1.8–3.4 cm, coriaceous, oblong-ovate, oblong-elliptic, margin strongly revolute, moderately inequilateral at the base, apex rounded or retuse, both surface glabrous and discolour, adaxially lustrous, abaxially opaque with papillary epidermis; midvein slightly impressed above, prominent and glabrous below, secondary venation discernible on both surfaces. Inflorescences terminal and axillary, racemose, 5–9 cm long; peduncles 1.2–3.1 mm long. Bracteoles 10.6–12.7 × 5.6–7.9 mm, glabrous, persistent during fruit development, greenish. Flowers with pedicels 7.2–9.6 cm long; hypanthium cupuliform 3.1–3.7 mm long, 2.7–3.4 mm diameter, glabrous; sepals 4, elliptic to oblong-ovate, 5.6–7.7 × 5.5–6.6 mm, green with apex minutely ciliate; single petal, undulate, 8.5–11.2 × 6–9.7 mm, basally obtuse, apically rounded, glabrous, white with green lines; stamens 3, filaments 11.8–16.8 mm long, sparsely pubescent along the basal third; gynoeceum slightly sigmoid; ovary 3.2–3.8 × 1.9–2.2 mm with 3–4 ovules, villose at the margin; gynophore villose 3–3.5 mm long; style glabrous, stigma capitellate. Fruit 8–8.8 × 3.9–5 cm, green, acumen 1 mm long. Seed not observed.

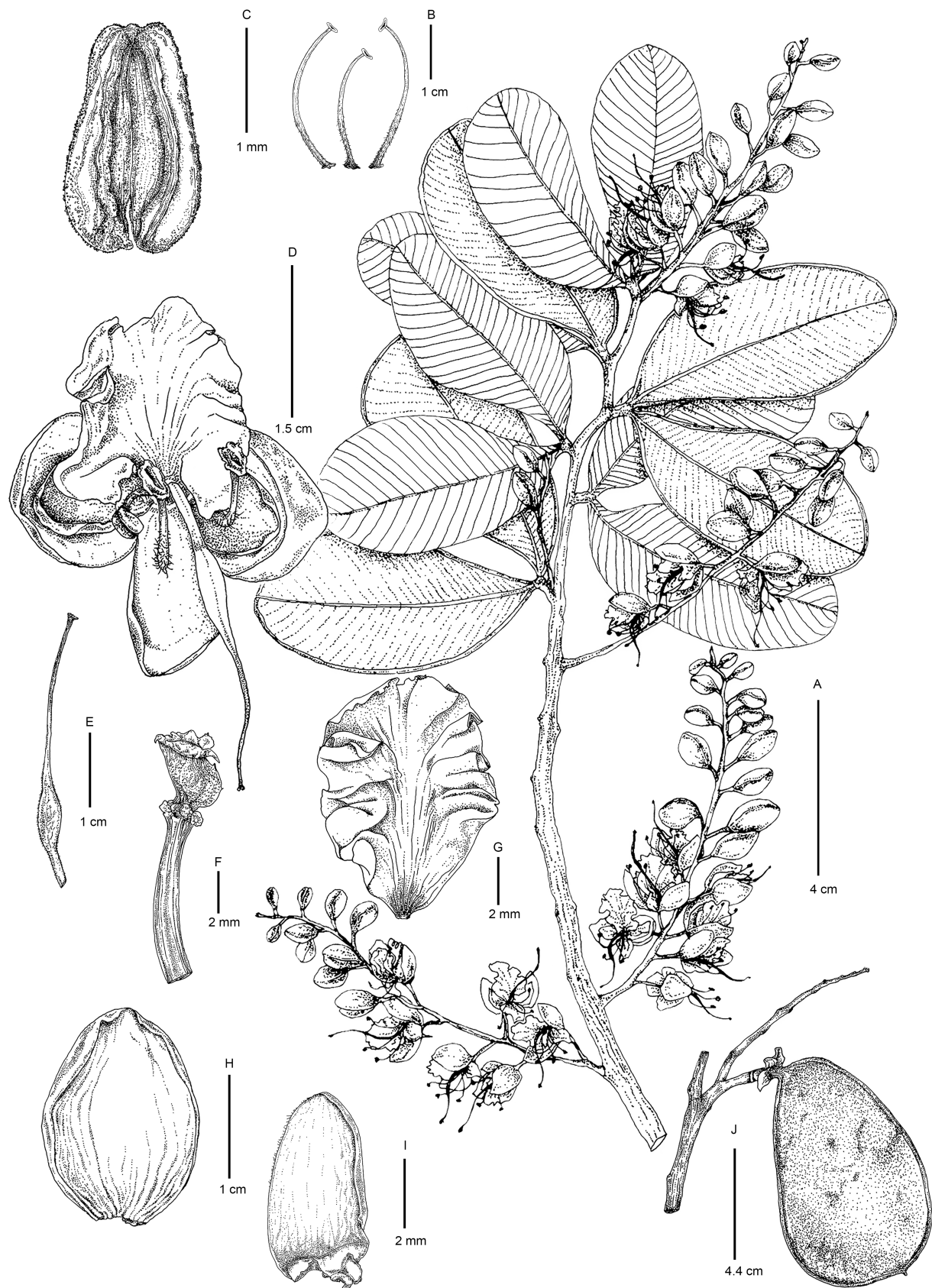


FIGURE 1. *Macrolobium aracaense*. A. Flowering branch. B. Stamens. C. Detail of an anther. D. Flower. E. Gynoecium. F. Hypanthium and pedicel. G. Single petal. H. Bracteole. I. Sepal. J. Fruit. (A–J from Farroñay & Oliveira 178, K from Vicentini & Mesquita 1886). Drawing by Marisabel U. Adrianzén.

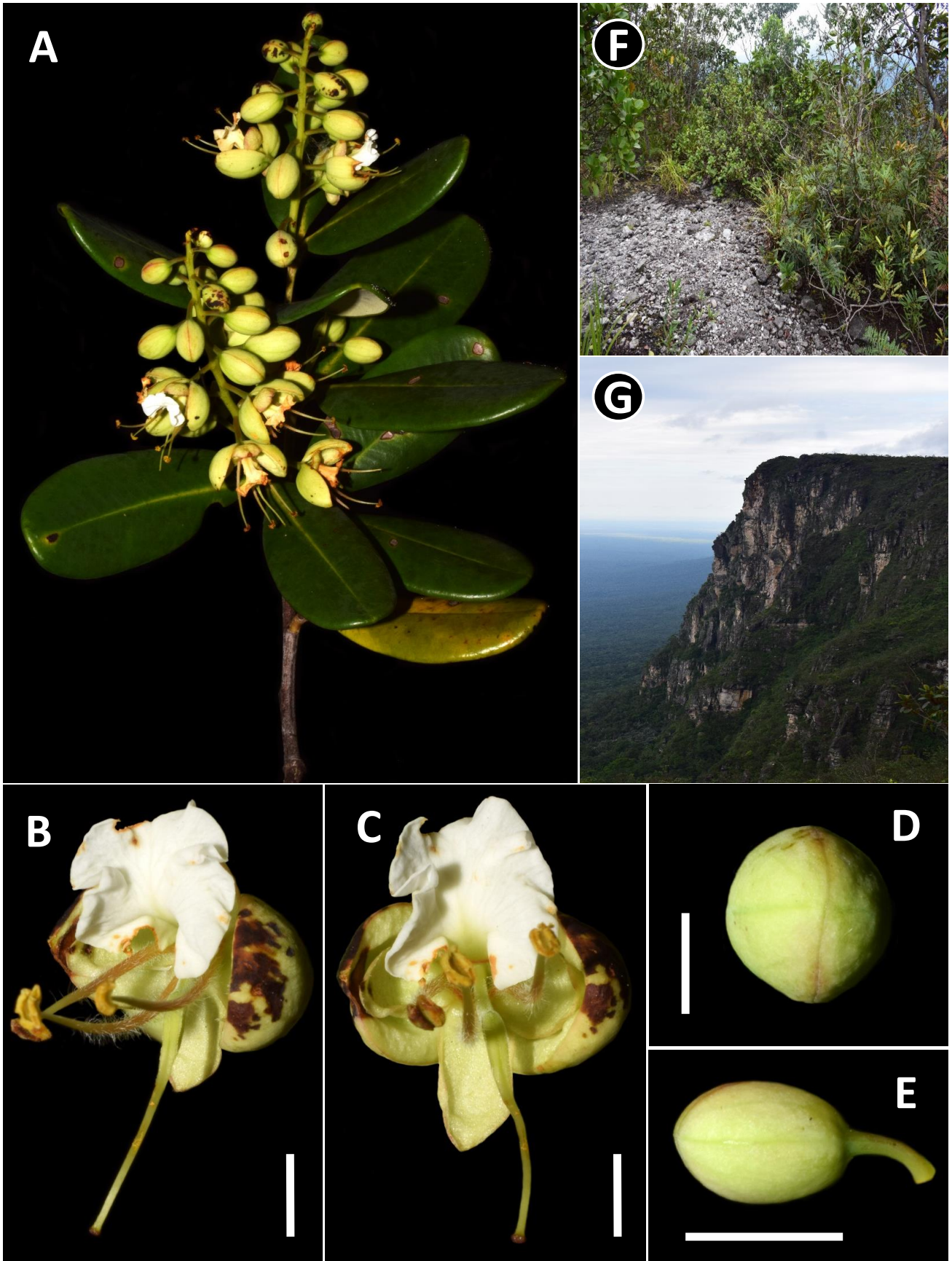


FIGURE 2. *Macrolobium aracaense*. **A.** Fertile specimen. **B.** Lateral view of flower. **C.** Frontal view of flower. **D.** Frontal view of flower bud. **E.** Lateral view of flower bud. **F.** Vegetation of white-sand rocky scrub. **G.** Panoramic view of Plateau of Serra do Aracá. Each white line represents 1 cm. Plant images from *Farroñay & Oliveira 178*.

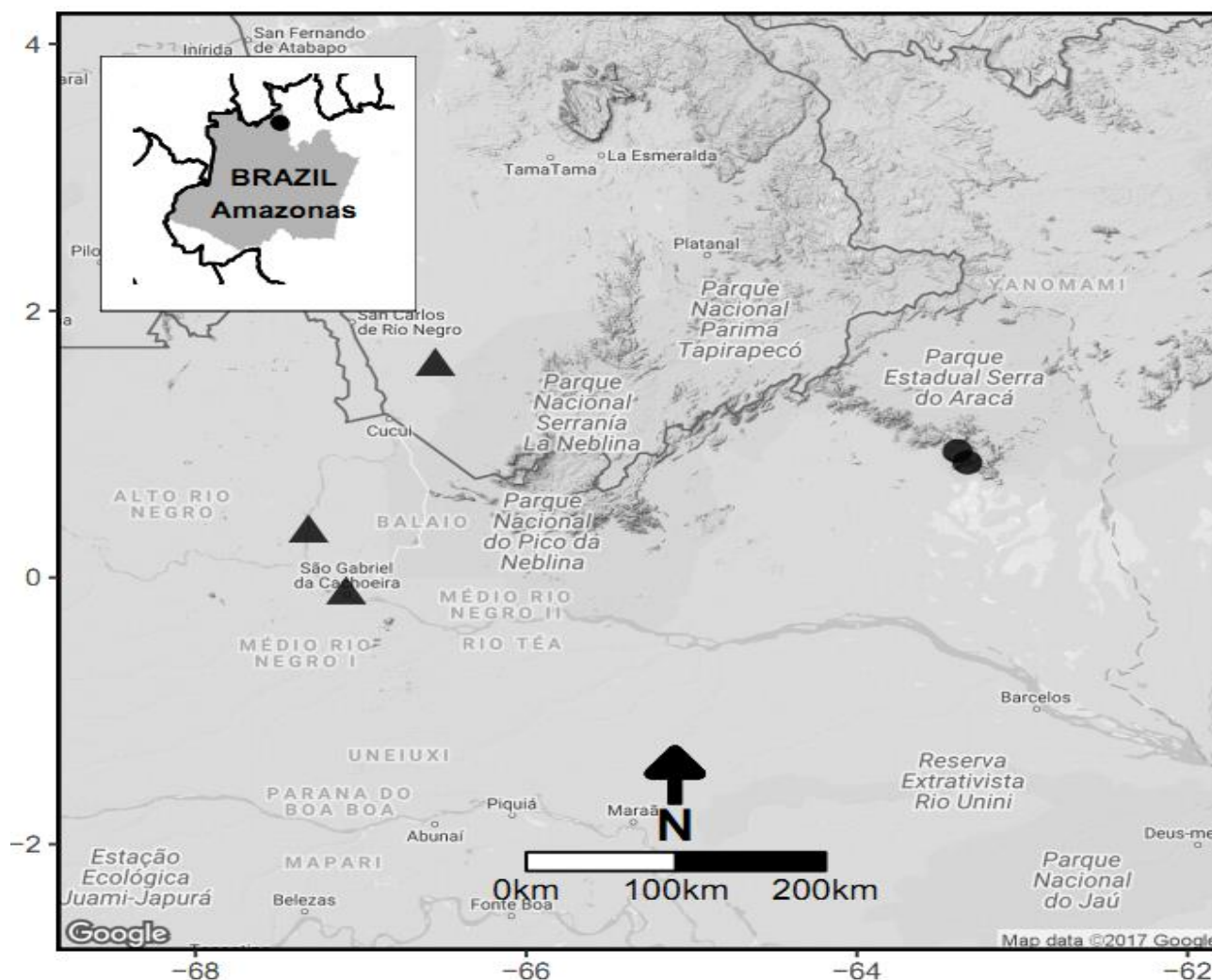


FIGURE 3. Distribution map of *Macrolobium aracaense* Farroñay (circles) and *M. longipes* R.S. Cowan (triangles).

Distribution and habitat:—*Macrolobium aracaense* is so far only known from two samples collected on the plateau of the Serra do Aracá, at 1200–1286 m high, in open scrublands (Figure 2 E–F). This vegetation type grows in areas where white sand has accumulated together with the rocks. According to Prance & Johnson (1992), the common woody species on this vegetation type are *Humiria balsamifera* Aublet (1775: 564), *Calliandra tsugoides* Cowan (1958: 143–144), *Calyptanthes clusiifolia* (Miquel: 1849: 533) O. Berg (1857: 39), *Ilex costata* Edwin (1965: 137) and *Tetrapteryx cordifolia* Anderson (1987: 107).

Flowering and fruiting:—Both flowering and fruiting plant specimens were collected in August.

Conservation status:—*Macrolobium aracaense* is known from only two collections. Due to incomplete information about its distribution, we assign the new species to the category of Data Deficient (DD), according to IUCN (2017) criteria.

Etymology:—The specific epithet “aracaense” alludes to the type locality on the Serra do Aracá, the only place where this species was found.

Discussion:—According to the taxonomic revision of the genus *Macrolobium* (Cowan 1953), this species should be included in *Macrolobium* section *Vouapa* Aublet (1775: 25), because of the cupuliform hypanthium, flowers with 4–5 sepals and an unguiculate petal. Within this section, there are only 12 species with bifoliolate leaves like *M. aracaense*, and *M. longipes* is the most similar, both are also species from white-sand vegetation. However, *Macrolobium aracaense* differs from *M. longipes* in many morphological characteristics (Table 1). The presence of papillary epidermis on the abaxial surface of the leaflets of *M. longipes* and *M. aracaense* (Figure 4 C–D) is associated with epicuticular wax and makes the leaf surface non-adherent and free of contaminants (Neinhuis & Barthlott 1997). Waxes form a protective barrier against water loss due to excessive perspiration, pathogen action, solar radiation and chemical inputs (Domínguez *et al.* 1998). Other species of *Macrolobium* from savannas in Roraima also present leaves with papillary epidermis (Ferreira & Flores 2013).

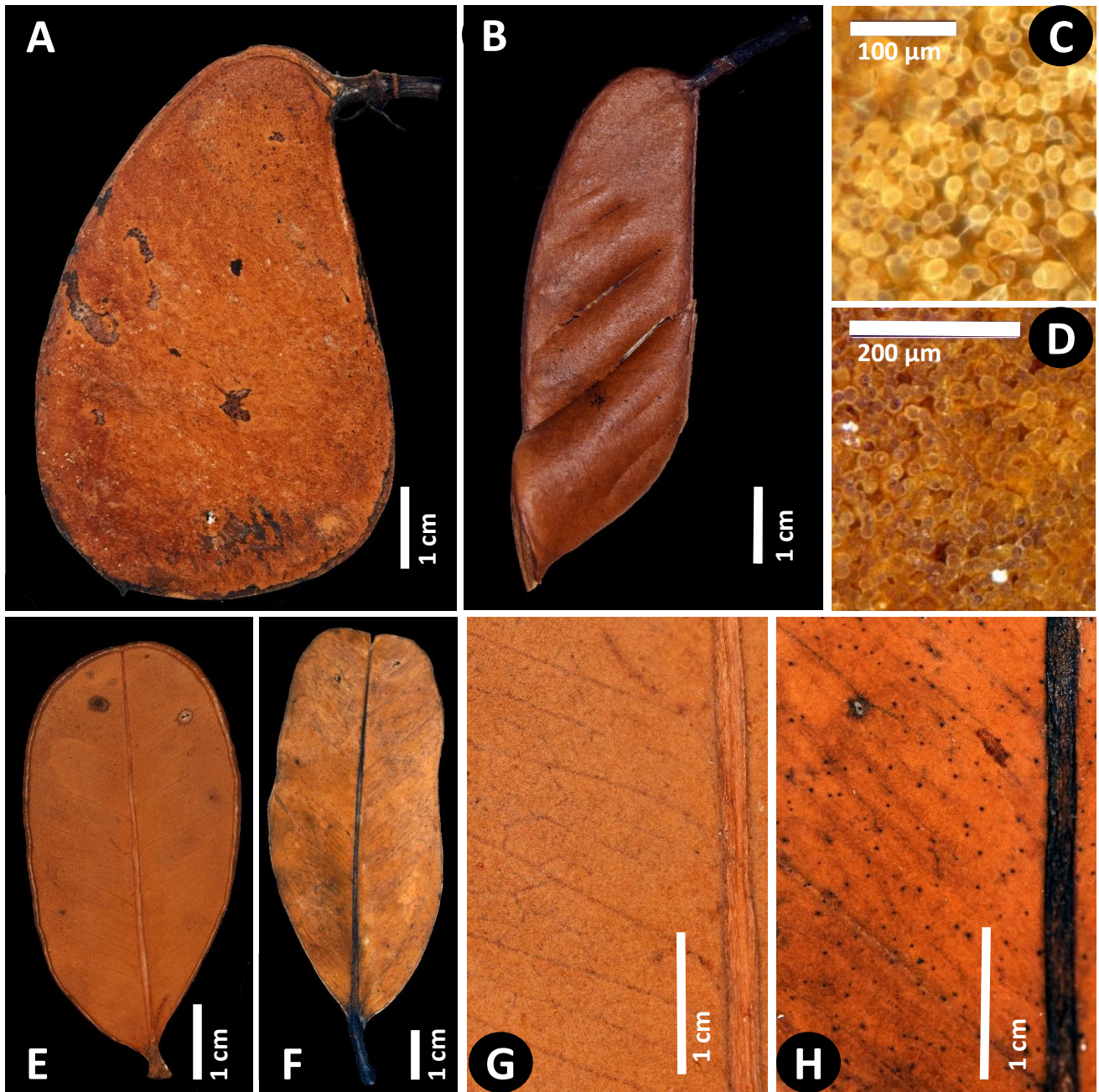


FIGURE 4. Comparison of *Macrolobium aracaense* with *M. longipes*. **A–B.** Fruits. **C–D.** Papillary epidermis. **E–F.** Leaflets. **G–H.** Abaxial surface. (**A, C, E, G.** *Macrolobium aracaense* from *Vicentini & Mesquita 1886*. **B, D, F, H.** *Macrolobium longipes* from *Huber & Medina 5849*).

Macrolobium aracaense has a restricted distribution and is apparently endemic to the plateau of the Serra do Aracá (1020–1260 m elevation), while *M. longipes* occurs at low elevations (100–150 m) in the Upper Rio Negro and Upper Orinoco regions (Cowan 1957, Félix-da-Silva *et al.* 2016; Figure 3). Although they are allopatric and occur at different elevations, hence reproductive isolation between these species could not be inferred, the large morphological and ecological differences indicate that it is an independent lineage that deserves to be formally recognized as a new species.

Additionally, *Macrolobium aracaense* is sympatric on the plateau of the Serra do Aracá with two other taxa of *Macrolobium* - *M. discolor* Bentham (1870: 222) var. *discolor* and *M. gracile* Spruce *ex* Bentham (1870: 223) var. *confertum* (Gleason 1931: 371) Cowan (1953: 274). *M. aracaense* is morphologically different from *M. discolor* var. *discolor* by possessing 1 pair of leaflets and glabrous inflorescence (vs. 3–7 pairs of leaflets and tomentose inflorescence), and from *M. gracile* var. *confertum* by having 1 pair of glabrous leaflets (vs. 18–30 pairs of tomentose leaflets).

TABLE 1. Comparison of vegetative and reproductive characters showing differences among *Macrolobium aracaense* and *Macrolobium longipes*.

Characters	<i>Macrolobium aracaense</i>	<i>M. longipes</i>
Stipules	Early caducous	2 × 0.6 mm
Petiole	2.5–4.4 mm long	4–15 mm long
Pairs of leaflets	Only 1	1–3 pairs
Leaflet apex	Rounded, obtuse or truncate	Rotund, truncate
Black spots on abaxial face	Absent	Present
Leaflet margin	Strongly revolute	Sometimes slightly revolute
Inflorescence	5–9 cm long	8–12.5 cm long
Petal	White, 8.5–11.2 mm long	Red, 9–15 mm long
Ovary	Villose	Glabrous
Filament	Sparsely pubescent	Glabrous
Habitat	Sandstone of Serra do Aracá	Savanna and White-Sand Forest

Additional specimens examined (paratypes):—BRAZIL. Amazonas: Mun. Barcelos, Serra do Aracá State Park, 0°86'35" N, 63°33'16" W, 1020 m.a.s.l., August 2017, *F. Farroñay*. & *R. Oliveira 178* (INPA!).

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