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When the old guys knew better: The true identity of *Mimosa longepedunculata* and reestablishment of *M. tocantina* (Leguminosae, Mimosoideae)

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Abstract

Megadiverse genera usually have a complex taxonomy. One factor influencing this complexity is concerned to synonyms, which are often numerous in widespread and morphologically variable species. In this article we examined the case of *Mimosa longepedunculata* and *M. tocantina*, two sympatric narrowly distributed species from central Brazil, considered to be synonyms in Barneby's monograph. We show that this was an inaccurate taxonomic decision related to a misinterpretation of the type specimens and, possibly, also to sampling biases in field works. The definition of each species is here clarified and *M. tocantina* is reestablished and considered a distinct species from *M. longepedunculata*, having *M. pseudosetosa* as a new synonym. A regional identification key for the species is provided together with data on distribution and habitat, flowering and fruiting, conservation status, etymology, and notes on morphology. Illustrations, pictures and a full description of *M. longepedunculata* are also presented.

Keywords: Ernst Ule, Fabaceae, Nomenclature, Paul Taubert, Rupert Barneby, Taxonomy

Introduction

Mimosa Linnaeus (1753: 516) is a megadiverse genus with more than 500 species (Barneby 1991, Luckow 2005). According to Berry *et al.* (2005), megadiverse genera have long been avoided by botanists because of their complex taxonomy, wide geographic range and large contingent. Nevertheless, Neotropical *Mimosa* were fully revised and monographed by Barneby (1991), and since then, several new taxa have been described (e.g., Dutra & Garcia 2012; Grings & Ribas 2013; Morales *et al.* 2013; Särkinen *et al.* 2011; Savassi-Coutinho *et al.* 2012; Silva *et al.* 2011; Simon *et al.* 2010). The genus is mainly distributed in the Neotropical region and has two major centers of diversity, being one in Mexico and the other in Central Brazil (Luckow 2005).

It is not uncommon for such “giant genera” to also have species with a large number of synonyms due to the description of the same taxonomic entities by different authors and with different names. Within *Mimosa*, this is observed in species showing large morphological variability associated with a wide distribution area, such as *M. pigra* Linnaeus (1755: 13–14), a weedy species that has 15 names under synonymy (Barneby 1991; treated as *M. pellita* Humb. & Bonpl. ex Willd. [1806: 1037–1038]). However, most species in the genus are microendemics; therefore, in the few cases where a list of synonyms does exist, it is usually very small.

Nonetheless, the congruence of such factors as large number of species, existence of synonyms, and classification mainly based on micro characters demands extra care when describing new taxa in *Mimosa* in order to avoid inaccurate conclusions. Here we relate how the scanty type collection of one species belonging to this giant genus led a skillful author such as Rupert Barneby to make a mistaken taxonomic decision.

A mysterious plant

Chapada dos Veadeiros is a mountainous complex in central Brazil ranging from 800 to 1650 m in elevation (Munhoz & Felfili 2006). It is located about 300 km to the north of Brasilia in the State of Goiás. Even though this high flat plain region is included in the Cerrado Domain, where savanna physiognomies prevail, its elevated areas are mostly covered by “campos rupestres”, a type of vegetation found elsewhere in Brazil on sandy to rocky soils, showing

high levels of plant endemism (Giulietti & Pirani 1988), which is also reported in the Chapada dos Veadeiros (Simon & Proença 2000). The region was visited by many naturalists in the 19th and 20th centuries, such as Gardner, Pohl, Glaziou and Ule. Today, it remains an interesting area for botanical research and source of new plant species (e.g. Cavalcanti 2007; Pastore & Marques 2009; Simon *et al.* 2010).

Recent fieldwork conducted at Chapada dos Veadeiros revealed the existence of an intriguing *Mimosa* (Borges 915; 989), which was collected to the northeast of Alto Paraíso de Goiás. The plant is locally abundant and forms a dense population of treelets up to 3 m tall, with most parts covered by a prominent glandular indumentum. Its flowers bear white filaments and a setose calyx, and its fruit is an unjointed craspedium (Fig. 1–2). Those characters made it possible to assign it to *M. ser. Pachycarpae* Benth (1875: 439), a group highly diversified in the Brazilian Cerrado, particularly at Chapada dos Veadeiros, but not to any species present in Barneby's (1991) monograph, nor to any other taxa described afterwards (e.g., Barneby 1993, 1997; Simon *et al.* 2010).

Was it a new species, or something hidden into the complex taxonomy of *Mimosa*?

Barneby's Census

Barneby's (1991) monumental treatment for *Mimosa* is largely built upon the collections of Brazilian specimens obtained by Gert Hatschbach, from Museu Botânico Municipal de Curitiba, and by the New York Botanical Garden's Planalto Expeditions (hereinafter, PEx), conducted in collaboration with the Universidade de Brasília and the Instituto Agrônômico do Norte by Howard S. Irwin from 1964 to 1972 and through 1975 by William R. Anderson (<http://sciweb.nybg.org/science2/hcol/planalto/expeditions.asp.html>).

Irwin's final report to the National Science Foundation, in 1972, indicates that around 225,379 specimens were collected (<http://sciweb.nybg.org/science2/hcol/planalto/irwinplanaltofinalreport.pdf>). A significant part of those belong to *Mimosa*, including many new taxa, several of them from Chapada dos Veadeiros.

Within *Mimosa ser. Pachycarpae*, the above mentioned unnamed plant shared similarities with other species that are endemic to the Chapada dos Veadeiros: either with pachycaul treelets with congested leaves, glandular indumentum, and sometimes interpinnal spicules (*M. manidea* Barneby [1991: 417], *M. capito* Barneby [1991: 418–419], *M. oedoclada* Barneby [1991: 419–420] and *M. dominarum* Barneby [1991: 420–421]); or with treelets bearing glandular indumentum and somewhat long peduncles (*M. rheiptera* Barneby [1991: 405–406] and *M. struthionoptera* Barneby [1991: 406–407]); or, curiously, with a species that is a prostrate, sparsely spiculate shrub also with long peduncles (*M. longepedunculata* Taubert [1896: 432]). However, all those species may be distinguished from the peculiar unidentified plant by different combinations of its distinctive characters (Table I; see also identification key below). As it would be expected, most of the narrowly distributed species mentioned above have no taxa in synonymy, the only exception being *M. longepedunculata*, to which Barneby (1991: 407–408) assigned *M. tocantina* Taubert (1896: 431–432).

Explicit justifications of synonymizations are not usually present in taxonomic treatments, but it is somewhat intriguing that Barneby did not make any comment on his decision to merge two sympatric and narrowly distributed species described by a single author in the same publication (Taubert 1896).

TABLE 1. Morphological comparison of specimens of the unidentified *Mimosa* (Borges 915; 989) and species it could be assigned to, according to Barneby (1991). H. Habit (PcTreelet: pachycaul treelet; PrShrub: prostrate shrub). CL. Congested leaves. GI. Glandular indumentum. IS. Interpinnal spicules. PL. Peduncle length (cm). + present; - absent

Taxon	Habit	CL	GI	IS	PL
<i>Mimosa</i> sp.	Treelet	+/-	+	+/-	20–23
<i>Mimosa capito</i>	PcTreelet	+	-	-	1–3
<i>Mimosa manidea</i>	PcTreelet	+	+	-	3–9
<i>Mimosa oedoclada</i>	PcTreelet	+	+	-	3–9
<i>Mimosa dominarum</i>	PcTreelet	+	+	+	3–6
<i>Mimosa rheiptera</i>	Treelet	+/-	+	-	5–8
<i>Mimosa struthionoptera</i>	Treelet	+/-	+	-	4–5
<i>Mimosa longepedunculata</i>	PrShrub	-	-	+/-	5–19

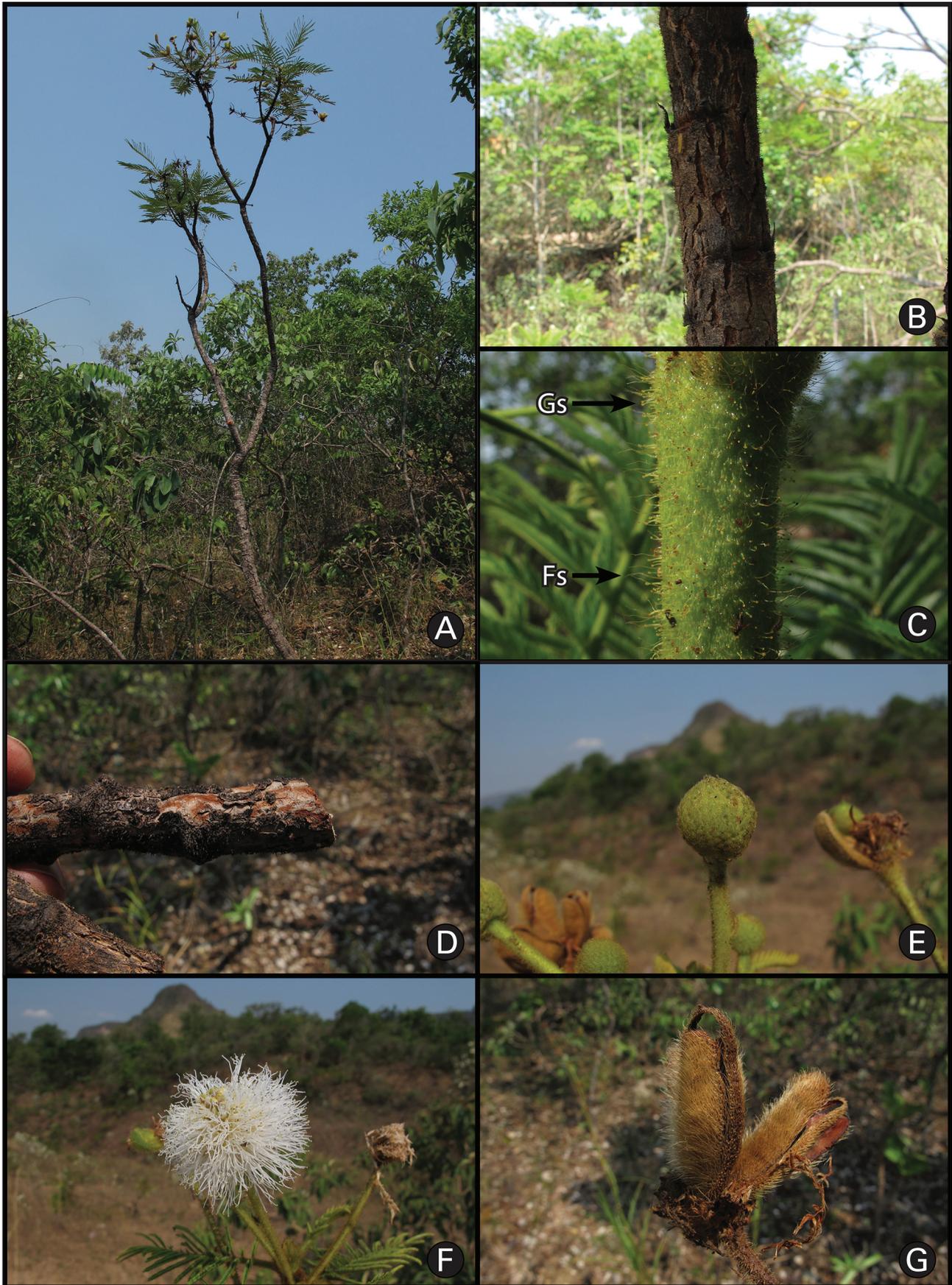


FIGURE 1. *Mimosa longepedunculata*. A. Habit. B. Trunk with persistent stipules. C. Branch with filiform (Fs) and glandular (Gs) setae. D. Branch with dehiscent peridermis. E. Globose immature glomerule. F. Glomerule with expanded white filaments. G. Fruits. (*Borges 915*, SPF).

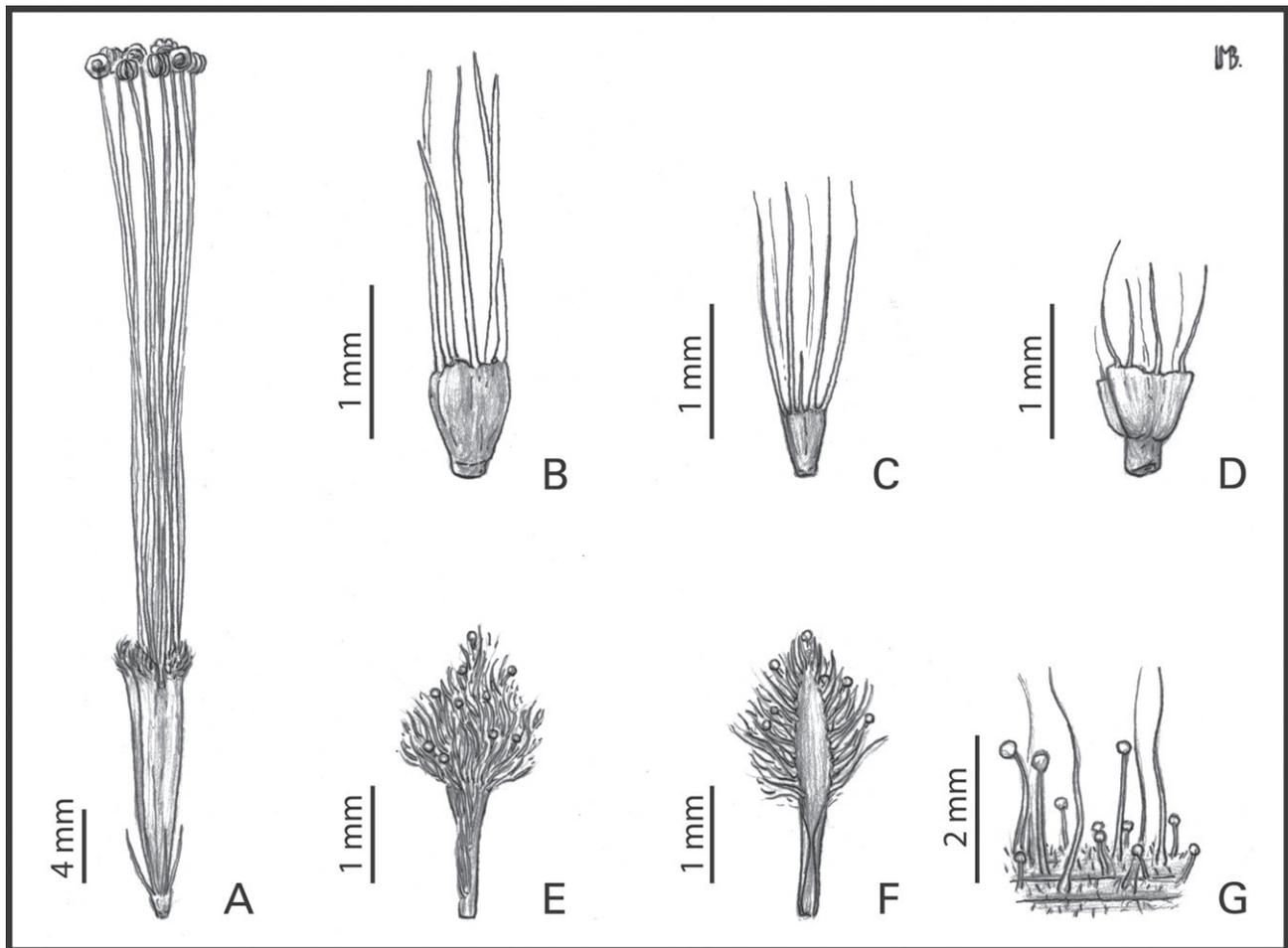


FIGURE 2. A–C; E–G. *Mimosa longepedunculata*. D. *M. tocantina*. A. Flower. B. Calyx with truncate rim (same scale as D). C. Lobate calyx. D. Calyx (same scale as C). E. Floral bract (abaxial surface). F. Floral bract (adaxial surface). G. Detail of the rachis surface showing the triple indumentum of trichomes and both filiform and glandular setae.

A journey into the past

Ule's collections—In September 1892, Ernst Heinrich Georg Ule (1854–1915), a German botanist and explorer, was in central Brazil, more precisely at the State of Goiás, collecting specimens during an expedition commissioned by the Brazilian government to find a suitable place to build a new capital, as well as to study its natural conditions, and he was responsible for researching the area's vegetation (Taubert 1896). Despite unfavorable dry conditions, Ule was still able to gather 450 Phanerogams and 310 Cryptogams (Taubert 1896). Among them were two mimosas from Chapada dos Veadeiros: a small tree from the Passatempo Stream valley (Ule 2830 [HBG, P, R]; Figs. 3–6) and a small shrub with pink flowers found in the hills of Vargem Grande (Ule 2826 [HBG, P]; Figs. 7–8). Besides working for the Brazilian National Museum (Urban 1906), Ule also had a contract to ship his collections to the Hamburg herbarium (Matthias Schultz [<http://migre.me/hgGRS>], pers. comm., based on letters archived at HBG), including those two particular mimosas that would remain unknown to science for a few years.

Taubert's descriptions—The specimens collected by Ule were studied particularly by Paul Hermann Wilhelm Taubert (1862–1867), who worked at the Royal Botanical Museum (now Berlin-Dahlen Botanical Garden and Botanical Museum) in Berlin from 1889 up to 1895 (Stafleu & Cowan 1986). In his treatment for the novelties found by Ule entitled “Report on the knowledge about the flora of the Brazilian Central State of Goyaz”, he described those two particular plants as *Mimosa tocantina* (Ule 2826) and *M. longepedunculata* (Ule 2830) (Taubert 1896). *M. tocantina* was compared to *M. setosa*, from which it could be distinguished by its longer peduncles. The identity of *M. longepedunculata* was also established by the presence of long peduncles, but in comparison to *M. gardneri* Benth (1842: 405), at that time a morphologically variable species that assembled four different taxa, but that did not present peduncles as long the ones observed in Ule 2830 (Barneby 1991).



FIGURE 3. Lectotype of *Mimosa longepedunculata*. (Ule 2830 [=Ule 7], HBG 506643). Image used with permission and provided by the Herbarium Hamburgense (HBG).



FIGURE 4. Isolectotype of *Mimosa longepedunculata* (Ule 7 [=Ule 2830], P 03150238). Image used with permission and provided by the Muséum National d'Histoire Naturelle (P).



FIGURE 5. Isolectotype of *Mimosa longepedunculata*. (Ule 7 [=Ule 2830], sheet 1, R 00003324). Image used with permission and provided by the Museu Nacional Herbarium (R).



FIGURE 6. Isolectotype of *Mimosa longepedunculata*. (Ule 7 [=Ule 2830], sheet 2, R 000003324a). Image used with permission and provided by the Museu Nacional Herbarium (R).

Despite sharing the presence of long peduncles, the descriptions of the species show that they differ in other features. Specifically, *Mimosa tocontina* is presented as a small shrub with ferruginous, but nonglandular, indumentum, rachides 6–10 cm long, ellipsoid-globose inflorescence, pink flowers and moderately setose-ciliate calyx (Taubert 1896: 431–432). *M. longepedunculata* is described as a small tree with setose, but also, in part, conspicuously glandular, indumentum (present in branches, leaflets and peduncles), rachides 20–22 cm long, globose inflorescence, white-pink flowers, a feature cited in the original description, but not present on specimen labels, and a long setose-ciliate calyx (Taubert 1896: 432).

Although based on a single collection of each species, Taubert (1896) had no doubt about their identity and made a precise statement about their differences, an opinion not shared by Barneby (1991).

Back to the Future

The Chapada dos Veadeiros was well explored during the PEx, and at least seven specimens of a procumbent shrub with ferruginous-setose indumentum, long peduncles and pink flowers were sampled along the main road of the Chapada (see specimens list for details on collections). All of these specimens were treated by Barneby (1991) as *Mimosa longepedunculata* and *M. tocontina* was considered a synonym of it. In the absence of nomenclatural priority between the names, the one applied was probably chosen based on its indication of a distinguishing feature of the specimens.

It is not clear why Barneby (1991) decided to synonymize *Mimosa tocontina* and *M. longepedunculata*. He indicates examination of the types of both species in HBG and P but not duplicates of the latter at R (Figs. 3–8). However, he did not annotate the sheet of *M. longepedunculata* in P (Fig. 4). Also, this specimen was not photographed, even though a photo of the P material of *M. tocontina* can be found at NY (NY Neg. 11812) (Barneby 1991). Moreover, besides citing the collection site of *M. tocontina* informed by Taubert (1896) (“Habitat in ditione Tocantini superioris in montosis ad Vargem grande”), Barneby (1991) added the P sheet’s label information (“nos morros da regio do Tocantins superior, Pizarao”; Fig. 8) on the treatment of the taxon. For *M. longepedunculata*, however, he relied only on the information supplied by Taubert (1896) (“Habitat in valle fluvii Passa Tempo in ditione Maranhao superioris”), without further reference to information of specimen labels from either HBG (“im Thale des Passa Tempo”; Fig. 3) or P (“Serra dos Viadeiros, no Valle do Passa Tempo”; Fig. 4). From that, it is certain that Barneby studied the types of both species and he was even able to establish the correspondence between the sheets in HBG and P, the latter lacking Ule’s official numbering sequence (Ule tended to use a provisional number, written at the upper left corner of the labels with black ink, and his official number, written in blue at the upper right corner, but it was not unusual for him to distribute duplicates annotated only with the provisional number; Matthias Schultz, pers. comm.).

Moreover, Barneby also studied one specimen of *M. longepedunculata* at K (*Heringer 2435*), which is cited as such in Barneby (1991), but that was annotated in 1983 as “*Mimosa andersonii* Barneby” (a *nomen in schedula*, which he never published), a fact indicating that, even briefly and under another name, he regarded it as different from *M. tocontina*. However, it appears that this was also unclear to him as, in the same year, he also applied this unpublished name to a specimen of *M. tocontina* held at UB (*Anderson 7190*).

Also, the fact that the description for *Mimosa longepedunculata* in Barneby (1991: 497–408) fits *M. tocontina* perfectly, but does not include the features of *M. longepedunculata* sensu Taubert (see above) lead us to conclude that, at the time he was establishing the relationship between the two species, he only had available the specimens collected during the PEx and, if not a loan, then just the photograph of *M. tocontina*’s type at P, besides his notes on the specimens studied in European herbaria. When this is coupled with the above-mentioned lack of details for *M. longepedunculata* specimens and information, as well as Barneby’s confusion with the definition and recognition of “*M. andersonii*”, it becomes evident that he failed to perceive the morphological features of *M. longepedunculata* as distinctive characters.

Based on the information provided and discussed above and after detailed examination of the types in HBG, P and R, together with our observations in the field, it is clear that Taubert (1896) was correct in making the distinction between *Mimosa tocontina* and *M. longepedunculata*. Therefore, the former is the name that should be applied to the procumbent shrubs with long peduncles found at Chapada dos Veadeiros, while the latter must be restrained only to *Heringer 2435* and to the no longer mysterious collections *Borges 915* and *Borges 989*.

With the clarification of the identity of these two species, a detailed description of *Mimosa longepedunculata* is required, as well as an update on the taxonomic information for *M. tocontina*, both of which are provided below.



FIGURE 7. Lectotype of *Mimosa tocantina*. (Ule 2826 [=Ule 3], HBG 506644). Image used with permission and provided by the Herbarium Hamburgense (HBG).



FIGURE 8. Isolectotype of *Mimosa tocantina*. (Ule 3 [=Ule 2826], P 00756072). Image used with permission and provided by the Muséum National d'Histore Naturelle (P).

Material & Methods

Morphological characterization

Morphological features of the described species were made with use of a 10–60 × magnification stereomicroscope. Measurements were taken with a flexible ruler and optical ruler attached to the microscope. Terminology follows Harris and Harris (2001) and Radford *et al.* (1976).

Conservation status assessment and map

Conservation status was assessed using the GeoCAT Tool (Bachman *et al.* 2011). Area of Occupancy (AOO) analysis was run with the IUCN default cell width of 2 km². Values of AOO and Extent of Occurrence (EOO) are given. The distribution map was produced with QGIS version 1.8.0 (Quantum GIS Development Team 2012). Georeference data of specimens collected during the PEX were obtained from the points produced by the New York Botanical Garden for the expedition's collection sites (<http://sciweb.nybg.org/science2/hcol/planalto/expeditions.asp.html>). Locations not georeferenced were either excluded, when potentially misleading, or replaced with the municipality of collection coordinates.

Taxonomic treatment

Identification Key

The following key distinguishes *Mimosa longepedunculata* from other treelet species with glandular indumentum and *M. tocantina* from other procumbent shrubby species belonging to *M. ser. Pachycarpae* and occurring at Chapada dos Veadeiros. It is largely based on the key for *M. sect. Habbasia ser. Pachycarpae* by Barneby (1991), also available at the New York Botanical Gardens's Barneby Legume Catalogue (http://sweetgum.nybg.org/legumes/barneby/mimosa_keys.php).

1. Procumbent shrubs; glandular setae absent 2
- Treelets, usually at least 2 m tall; glandular setae present on branches 3
2. Rosette-shrubs with prostrate branches; stipules barbate with orange-red setae 6–12 mm long; pinnae pairs distant 2–4 mm from each other *M. irwinii* Barneby (1991: 422–423)
- Procumbent shrubs with assurgent synflorescences; stipules strigose with yellowish or ochraceous setae less than 6 mm long; pinnae pairs distant 10–20 mm from each other *M. tocantina*
3. Stipules broadly ovate 15–30 × 7–13 mm 4
- Stipules narrowly triangular or triangular 3.5–16 × 0.5–5.5 mm 5
4. Filiform setae present on branches; peduncles 5–8 cm; glomerules without filaments ca. 20 mm diam.; corolla 7–8 mm *M. regina*
- Filiform setae absent from branches; peduncles up to 4 cm; glomerules without filaments ca. 12 mm diam.; corolla 4.5–6 mm *M. rhodostegia*
5. Glomerules in a long double-raceme, exserted more than 10 cm from foliage 6
- Glomerules among leaves (although not hidden by these), clearly not in an exserted double-raceme 8
6. A spiculate projection present on rachillas, between pinnae pairs *M. dominarum*
- Spiculate projection absent from rachillas 7
7. Branches indumentum largely composed by filiform setae; stipules 4–5 mm long; peduncles 5–8 cm long *M. rheiptera*
- Branches indumentum largely composed by simple trichomes; stipules 9–12 mm long; peduncles 4–5 cm long *M. struthionoptera*
8. Stipules 5–8 X 2.5–4.5 mm, triangular, persistent and densely covering the branches just below the leaves *M. manidea*
- Stipules triangular or broadly lanceolate to triangular and acuminate; if persistent, not densely covering the branch 9
9. Leaves congested and densely clustered at tip of branches; stipules broadly lanceolate and acuminate; peduncles up to 9 cm long; filaments pink *M. oedoclada*
- Leaves congested but not clustered at tip of branches; stipules narrowly triangular; peduncles more than 15 cm long; filaments white *M. longepedunculata*

Mimosa longepedunculata Taubert, Bot. Jahrb. Syst. 21: 432. 1896. Lectotype (designated by Borges & Pirani 2014):—BRAZIL. Goiás: Habitat in valle fluvii Passa Tempo in ditone Maranhao superioris, September 1892, fl., fr., *E. Ule* 2830 (HBG! [also annotated as “7”; “im Thale des Passa Tempo”]; isolectotypes: P! [only annotated as “7”; “Serra dos Viadeiros; no Valle do Passa Tempo”], R! [two sheets annotated only as “7”; one indicated as “im Thale des Passa Tempo obere Paranangebiet”, the other: “Serra dos Viadeiros; no Valle do Passa Tempo”]). Figs. 1–6; 10.

Treelets to 3 m, leaves congested, forming a lax rosette at tip of dichotomous branches with irregularly exfoliating peridermis. Indumentum composed of simple trichomes, filiform and abundant glandular capitate setae that make the plant viscous; all ochraceous and patent, but the trichomes lighter than the setae and the filiform setae somewhat sinuous. Branches, stipules, leaf axes and peduncles hirsute; leaflets ciliate, all with the triple indumentum; trichomes 0.2–0.3 mm long, filiform setae 1–5 mm long, glandular setae 0.3–1.2 mm long, only the shorter and more delicate setae present on leaflets, pulvinolules with a higher concentration of indumentum. *Leaves* 14–19-jugate; *stipules* 9–15 mm × 2.5–4 mm, narrowly triangular, slightly acuminate, caducous or persistent even in the trunks; *petioles* 33–75 mm long, 1.5–2 mm diam., grooved or not on adaxial surface, the dilated pulvinus 2–3 mm long; *rachis* 16.7–25.2 cm long, 1–1.6(–2.5) mm diam., grooved on adaxial surface and randomly bearing a spiculate projection ca. 0.5 mm long between pinnae pairs, terminal projection 4–5 mm long, linear; basal *rachillas* 22–48 mm long, medial *rachillas* 53–105 mm long, distal *rachillas* 60–98 mm long, all 0.3–0.5 mm diam., 10–25 mm apart, the distance decreasing toward the apex of the rachis; *leaflets* 4–7 × 1–1.7 mm, 21–27 pairs on basal *rachillas*, 35–41 pairs on medial *rachillas*, 35–38 pairs on distal *rachillas*, 0.7–2 mm apart, narrowly-oblong, straight to falcate, apex acute, base oblique, subcordate, rounded acroscopically, rounded-truncate basioscopically, veins 4–6-palmate, primary and secondary ones prominent on abaxial surface, but sometimes on both faces, secondary veins sometimes as prominent as the primary ones, paraphyllidia absent. *Glomerules* 13–22 × 15–20 mm, spherical, 2-axillar to an almost fully developed leaf, hence somewhat included in the foliage, but visible through the not densely congested leaves; *peduncles* 20.5–23 cm long, 1.2–2 mm diam., enlarging (probably also extending further) with development of fruits; *floral bracts* (3.7–)5–7 × 1–1.5 mm, narrowly acute-spatulate to fusiform, tomentose with filiform setae 1.2–2 mm long, and glandular setae 0.3–0.7 mm long; *flowers* 4-merous, diplostemonous; *pedicel* 0.1–0.2 mm long; *calyx* 0.3–0.9 mm long, shallowly cupulate, with 4 lobes 0.2–0.4 × 0.5–0.8 mm, triangular, sometimes irregular or absent, rim ciliate with thick and plane (rarely terete) setae 1.1–3.5 mm long, and less frequently also with glandular setae ca. 1.5 mm long, tube glabrous; *corolla* 6.5–8.3 mm long, narrowly infundibuliform or tubular, lobes 1.1–2 × 0.9–1.3 mm, ovate, mucronate, 1-nerved (vein apex sometimes branching), tomentose and completely concealed by filiform setae ca. 0.4–0.5 mm long, tube glabrous; *filaments* ca. 20–23 mm long, glabrous, fused 0.8–2.5 mm at base, white; *anthers* ca. 0.6 mm long, glabrous; *ovary* 0.3–1.7 × 0.5–0.7 mm, narrowly oblong, laterally compressed, tomentose with filiform setae ca. 0.8 mm long, *stipe* 0.8–1 mm long, glabrous; *style* ca. 25 mm long, glabrous; *stigma* porate, glabrous. *Fruit* a sessile unjointed craspedium 26–42 × 9–18 mm, narrowly-oblong to oblong, coriaceous, castaneous, apex acute to rounded, aristate, base cuneate, strigose with filiform setae with bulbous base 1–2.5 mm long, the long ones surrounded by small ones in a concentric pattern that does not completely conceal the surface, glandular setae 0.3–0.5 mm long present in margins, but usually not on valves, when present, generally concentrated near the margins; *replum* 0.8–3.2 mm wide; *mm*; *seeds* 3.9–5 × 3.3–3.5 mm, ovate to suborbicular, castaneous, pleurogram present.

Examined specimens:—BRAZIL. Goiás: Alto Paraíso de Goiás, Estrada Alto Paraíso, Terezina, 10 October 1979 (fl, fr imm), *E.P. Heringer 2435* (IBGE, K!, UB!, UEC); Alto Paraíso de Goiás, Estrada Alto Paraíso de Goiás–Nova Roma, à 3,2 km da saída de Alto Paraíso, 14°06'21.6" S, 47°29'18.6" W, 1110 m, 1 November 2012 (fl, fr), *L.M. Borges et al. 915* (SPF!; duplicates to be distributed to HBG, K, P, NY, RB, UB); Alto Paraíso de Goiás, Estrada Alto Paraíso de Goiás–Nova Roma, ca. de 3 km da saída de Alto Paraíso, aprox. 14°06'21" S, 47°29'18" W, 1110 m, 16 February 2012 (fr), *L.M. Borges et al. 989* (SPF!; duplicates to be distributed to K, NY).

Distribution and habitat:—*Mimosa longepedunculata* is known to occur in the hills surrounding part of Passatempo Stream and São Bartolomeu River, at Chapada dos Veadeiros, where it inhabits an area of cerrado with sandy soil around 1100 m in elevation. Although the areas are near water bodies, it is unlikely that the species occurs in proper riverine environments. Taubert (1896) indicates the collection site as being at the surroundings of the upper Maranhão River, but the type held at R indicates the collection site as the Paranã River region (“obere Paranangebiet”).

Flowering and fruiting:—The species was collected with flowers and fruits in September and November, and with fruits only in February.

Conservation status:—According to GeoCAT analysis results (EOO = 0 km²; AOO = 4 km² [consequence of the cell size of 2 km² used; if the “auto value” option of the GeoCAT tool is used, the AOO value is zero), the species may be classified as Critically Endangered. However, since only four collections of the species are known, the data may be considered insufficient, resulting in the categorization of this species as Data Deficient (DD).

Etymology:—The epithet makes reference to the long peduncles of the species, which are not exclusive to it, but very distinctive among other taxa within *Mimosa* ser. *Pachycarpae*.

Notes:—As stated above, the particular morphological features of *Mimosa longepedunculata* do not allow its inclusion in any particular groups defined by Barneby (1991) for *M.* ser. *Pachycarpae*. This may reflect a bias in

the subjective choice of characters defining groups in Barneby's classification. On the other hand, it may reflect the evolutionary history of *M. ser. Pachycarpae*. The existence of such a group with wide morphological variation, but also with closely similar species occurring sympatrically, poses a problem for the assumption of speciation processes based on reproductive isolation. It may be that *M. ser. Pachycarpae* is an example of how developmental recombination may play an important role in species diversification (see West-Eberhard 2005). Thus, the chimera-like morphological pattern seen in *M. longepedunculata*, coupled with the consequent impossibility to ascribe it to a proper group, may have its origins in phenotypic accommodation.

Mimosa tocantina Taubert, Bot. Jahrb. Syst. 21: 431–432. 1896. Lectotype (designated by Borges & Pirani 2014):—BRAZIL. Goiás: Habitat in ditone Tocantini superioris in montosis ad Vargem grande, September 1892, fl., *E. Ule* 2826 (HBG! [also annotated as “3”], isolectotype: P! [only annotated as “3”]; “nos morros da regio do Tocantins superior, Pizarao” = Ribeirão Pizarão, 14°10'S, 47°35'W (Barneby 1991)).

Figs. 2; 7–10.

Mimosa pseudosetosa Marc.F. Simon & C.E. Hughes, Syst. Bot. 35(2): 279, 281, fig. 1.B–C; fig. 4, **syn. nov.** TYPE:—BRAZIL. Goiás: Cavalcante, Vila Engenho, caminho para cachoeira Santa Bárbara, campo sujo, solo arenoso, 13°32' S 47°29' W, 1070 m, 12 October 2002 (fl, fr imm), *M. F. Simon* 453 (holotype: UB!, isotypes: CEN!, FHO, K!).

Mimosa longepedunculata sensu Barneby (1991: 407–408), except for the type (*Ule* 2830).

All specimens of *Mimosa tocantina* listed below where already described either by Barneby (1991: 407–408) as *M. longepedunculata* or by Simon *et al.* (2010: 279, 281–282), as *M. pseudosetosa*. Barneby's description fits exclusively specimens of *M. tocantina* and may be complemented by the description and illustrations of Simon *et al.* (2010). These latter authors were unaware of *M. longepedunculata* sensu Barneby, and described it as new species based on flowering specimens mainly collected at the northern portion of Chapada dos Veadeiros. Hence, a full description is not presented here and only complementary information about the species is given below.

Examined specimens:—BRAZIL. Goiás: Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 25 km N of Alto Paraíso, 1250 m, 23 March 1971 (fl, fr imm), *H. S. Irwin et al.* 33032 (K!, NY!, UB!); Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 25 km by road N of Alto Paraíso, 1700 m, 8 March 1973 (fl), *W.R. Anderson et al.* 6660 (NY!, UB!); Alto Paraíso de Goiás, Chapada dos Veadeiros, ca. 35 km north of Alto Paraíso de Goiás (formerly Veadeiros), 1000 m, 14 March 1969 (fl, fr imm), *H.S. Irwin et al.* 24308 (K!, NY! [2 sheets], UB!); Alto Paraíso de Goiás, 50 km ao norte de Alto Paraíso rumo à Teresina de Goiás, 13°50' S, 47°15' W, 1000 m, 7 January 2007 (fl), *M. F. Simon* 871 (FHO, UB!); Cavalcante, cerca de 30 km ao norte de Cavalcante, caminho entre Vila Engenho e cachoeira Santa Bárbara, 13°32'27" S, 47°29'17" W, 1050 m, 5 January 2007 (fl), *M. F. Simon* 864 (CEN!, FHO, HUEFS!, K!, UB!); Cavalcante, Chapada dos Veadeiros, 15–40 km W and N of Alto Paraíso, 1250–1500 m, 20 March 1975 (fl), *W. R. Anderson et al.* 11478 (K!, NY!, UB!); Cavalcante, Chapada dos Veadeiros, ca. 40 km N of Alto Paraíso, 1250, 24 March 1971 (fl, fr imm), *H. S. Irwin et al.* 33123 (NY!, UB!); Cavalcante, estrada de chão entre Cavalcante e Araí, 13°35'59" S, 47°31'30" W, 1190 m, 13 April 2004 (fl), *R. C. Mendonça et al.* 5528 (BAB, IBGE!, UB!); Cavalcante, Chapada dos Veadeiros, Rodovia BR 010, Teresina de Goiás-Alto Paraíso de Goiás, ca. de 24 km de Teresina (também a 34 km S de Teresina de Goiás), margem esquerda da estrada, 13°53'04.6" S 47°20'54.1" W, 1234 m, 23 March 2012 (fr), *L.M. Borges et al.* 594 (SPF!). Teresina de Goiás, 24 km by road S of Teresina, ca. 1250 m, 16 March 1973 (fr), *W.R. Anderson et al.* 7190 (K!, NY!, UB!); [Teresina de Goiás], Chapada dos Veadeiros, 54 km depois de Alto Paraíso, 18 March 1976 (fr imm), *J. Semir* 757 (K! [2 sheets], NY!, UB!, UEC); Teresina de Goiás, Rodovia GO-118, 5–8 km N de rio das Almas, 14 February 1990 (fl), *G. Hatschbach* 53971 (K!, MBM, NY!, UB!).

Distribution and habitat:—*Mimosa tocantina* is endemic to Chapada dos Veadeiros, occurring in open formations, generally “campos rupestres” with rock outcrops, between 1000 and 1700 m in elevation. The species usually forms small aggregated populations with individuals surrounded by grasses. Soils are sandy or sandy and rocky, and may become waterlogged during the rainy season. Although wrong about the species identity, Simon *et al.* (2010), who studied specimens collected at Cavalcante and Terezina de Goiás municipalities, were correct in their prediction about its larger distribution area. When complemented by the collections studied by Barneby (1991), it extends farther to the south of Chapada dos Veadeiros, reaching Alto Paraíso de Goiás municipality (Fig. 10).

Conservation status:—EN. According to GeoCAT analysis results (EOO = 1043.90 km²; AOO = 44 km²), the species may be classified as Endangered.

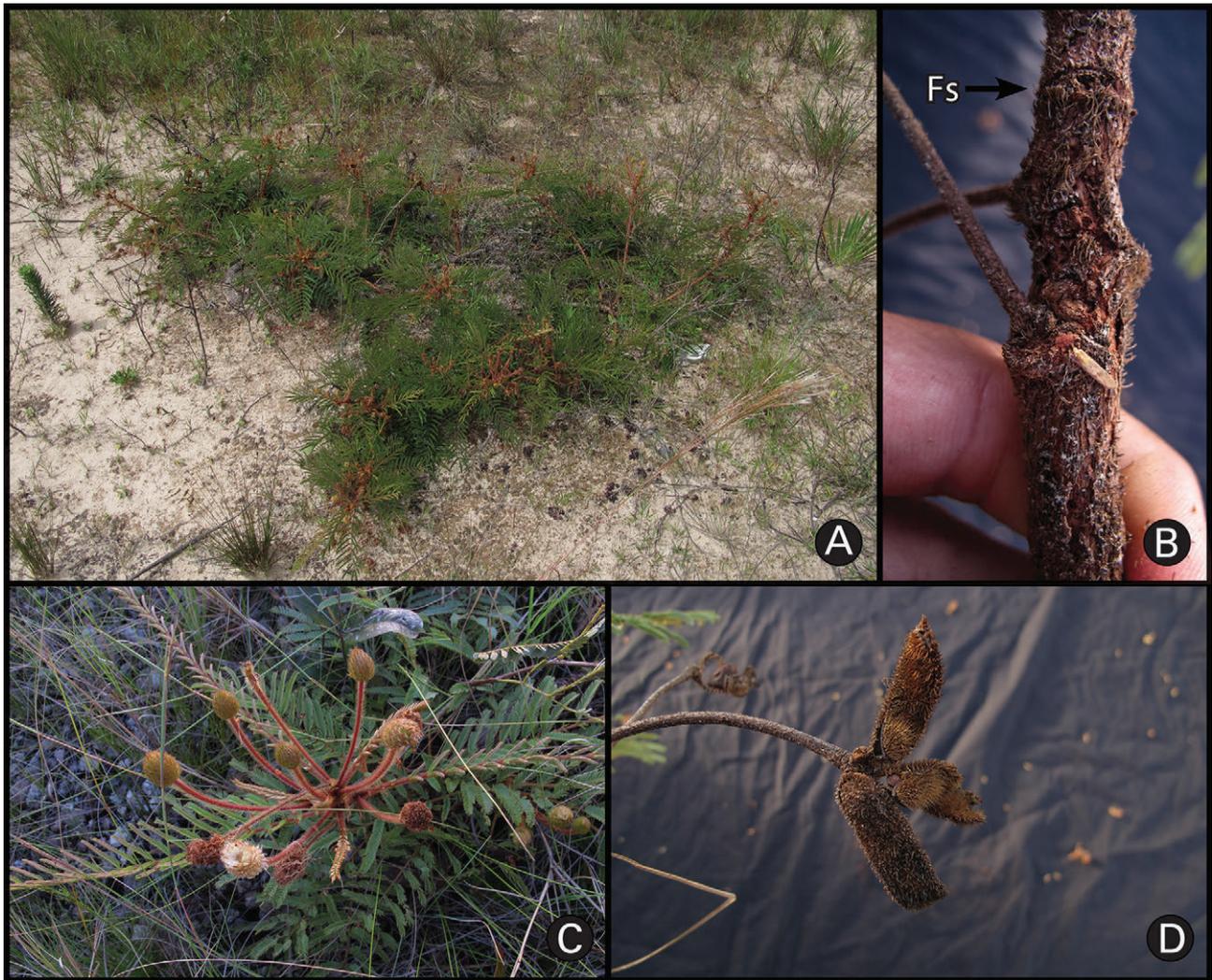


FIGURE 9. *Mimosa tocantina*. A. Habit. B. Branch with filiform setae (Fs). C. Apiculate immature glomerules. D. Fruits.

Flowering and fruiting:—Flowering specimens of *Mimosa tocantina* have been collected in September, October and from January through March. Specimens with mature and immature fruiting were collected only in March. It is probable that the individuals may still bear fruits until June and July, at least, but the lack of the showy pink flowers when the fruits are mature may make it difficult to visualize this procumbent shrub among the grasses and, thus, its collection.

Etymology:—The species was named after the region where it was collected by Ule, specifically, the headwaters of the Tocantins River, particularly near the Tocantinzinho River area. Amusingly, many new species from different genera published in Taubert (1896) were given just the same name.

Notes:—The overall habit of *Mimosa tocantina* recalls that of *M. albolanata*, which does not occur at Chapada dos Veadeiros, but is common in other areas of Goiás and Minas Gerais states, as well as the Distrito Federal (Barneby 1991). However, *M. tocantina*, besides its long peduncles, is distinguished by the presence of orange-reddish setae concentrated at the tips of shoots and in leaves under development (not present in *M. longepedunculata*). *M. irwinii*, *M. speciosissima* and *M. splendida*, all occurring at Chapada dos Veadeiros, also have the same kind of orange-reddish indumentum, but in them it is distributed all over the plants and not restricted to particular areas.

Final remarks

Since Barneby's monograph is largely based on the specimens gathered during the PEx, his merging of *Mimosa longepedunculata* and *M. tocantina* is probably related not only to the similarity between the two species, but also to the collection effort during the expeditions. Although many remote sites were explored at Chapada dos Veadeiros, most collections were usually carried out along the main road cutting through the region and along the road leading

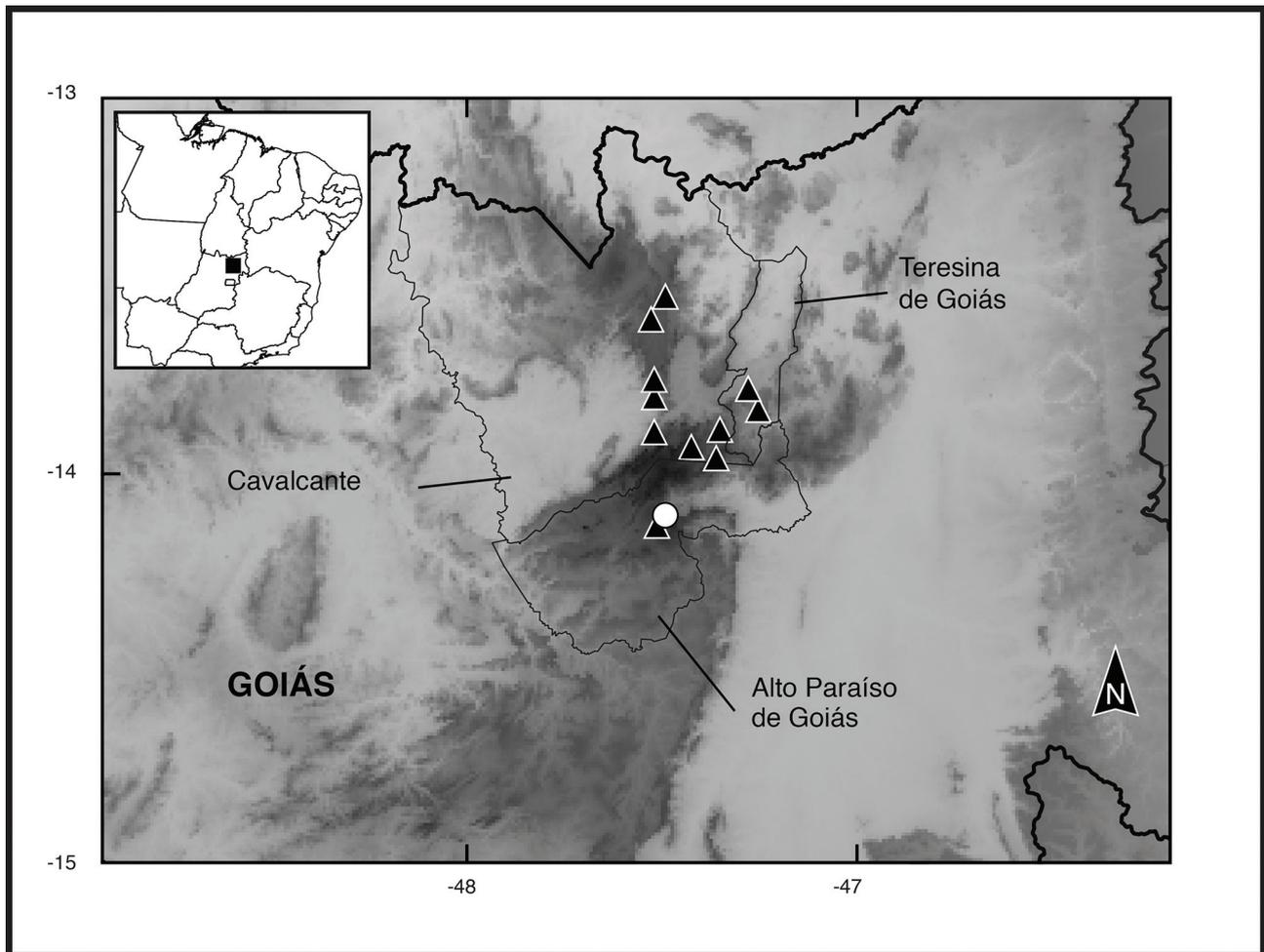


FIGURE 10. Northeastern Goiás area, Brazil. Range of *Mimosa longepedunculata* (○) and *M. tocantina* (▲). The boundaries of the Goiás State (thick line) and the municipalities (thin line) of occurrence are indicated.

to the Chapada dos Veadeiros National Park to the west of Alto Paraíso de Goiás. Of 74 PEx collection sites near this municipality, only one was at the road leading to Nova Roma (Expedition #9 on 07 March 1973; see Supplementary Table 1, available from the first author), which follows part of the São Bartolomeu River, and where *Borges 915* and *Borges 989* were collected. Also, none was near the type's collection site, at the Passatempo Stream, a small tributary of the São Bartolomeu located only 3–4 km to the south of the above mentioned specimens collection area.

The main road at Chapada dos Veadeiros runs along the top of altitudinal areas where open formations prevail and where it is possible to find extensive populations of *Mimosa tocantina*. However, the known collections of *M. longepedunculata*, except for *Heringer 2435*, which has no precise collection site information, are from “cerrado” areas in lower elevations to the east of Alto Paraíso de Goiás, where a transition to seasonally dry forest begins. Although a comprehensive analysis of collection pattern in the region does not exist, examination of *Mimosa* collections indicates that this particular area within the Chapada was only poorly explored by the PEx (Supplementary Table 1), and by other botanists conducting field expeditions in the region. The larger number of collections of *M. tocantina*, then, may have driven Barneby to understand *M. longepedunculata* as an extreme of variation of the former and to synonymize them, even though the type specimens labels do indicate the species distinct habit.

It is known that the “campos rupestres” present heterogeneous environmental conditions that influence the distribution of its vegetation, even in small areas (Rapini *et al.* 2008). For example, species that may be present in shallow sandy soils may not occur in nearby rock outcrops. In areas such as Chapada dos Veadeiros, where a mosaic of “cerrados”, “campos rupestres” and small patches of seasonally dry forest are found, the diversity of the flora sharply increases. Nonetheless, it has been strongly demonstrated for another area of “campo rupestre”, that the majority of biological sampling is done by roadsides (Madeira *et al.* 2008), what does not allow a proper assessment of the vegetation composition. As indicated by the results of the present study, in order to avoid biased sampling of natural environments and the inaccurate taxonomic decisions they may lead to, it is necessary to expand collection efforts to as many different areas as possible.

We have stressed here that fieldwork is a crucial part of taxonomy. However, in the midst of a biodiversity crisis, systematists are mostly focused on punctual collections of particular groups, aiming specially for sampling genetic material. It seems that future development of taxonomy requires a shift in that practice to the execution of well-planned expeditions focused on general collections covering areas poorly or unevenly explored, which will allow us to frame a more comprehensive picture of the flora.

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