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The census continues: Two new montane species of *Mimosa* (Leguminosae Mimosoideae) from Southeastern Brazil

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Abstract

Many species and infraspecific taxa in *Mimosa* are narrow endemics. Following the same pattern, two new Brazilian species of the genus, *M. perplicata* and *M. serpensetosa* are described, both from the Southern Espinhaço Range (one from Serra do Cabral, the other from Serra de Capanema and Serra do Cipó), in Minas Gerais state, a region known as a key area for *Mimosa* diversity. The description of more species sharing affinities with *M. setosa* var. *paludosa* indicates that the latter may be acting as a species pump.

Key words: endemism, Espinhaço Range, Phylogenetic Species Concept, Taxonomy

Introduction

Mimosa Linnaeus (1753: 516) is one of the largest genera of Leguminosae Mimosoideae, with more than 500 species and around 200 infraspecific taxa (Barneby 1991, Simon & Proença 2000, Luckow 2005, Simon *et al.* 2011). Although Bentham (1842, 1846, 1875) and Barneby (1991, 1993, 1997) described the majority of taxa in the genus, new names are still being proposed (Simon *et al.* 2010, Särkinen *et al.* 2011, Silva & Tozzi 2011, Dutra & Garcia 2012). The recent description of a number of new taxa is not a mere consequence of new findings in underexplored regions. Instead, we believe that the current knowledge about *Mimosa* species diversity is in fact largely underestimated.

Many taxa in *Mimosa* are narrowly distributed endemics (Barneby 1991) and the high altitudinal areas of Central Brazil are amongst the main centers of endemism of the genus (Simon & Proença 2000, Luckow 2005). Amongst those, the Espinhaço Range, a mountain chain located between the Cerrado and Mata Atlântica domains in the states of Minas Gerais and Bahia is particularly rich in *Mimosa* taxa (Simon & Proença 2000). The Espinhaço landscape is dominated by *campos rupestres*, defined as open grasslands with scattered evergreen shrubs and subshurbs on poor, sandy, rocky soils with several rock outcrops, hosting high levels of plant endemism (Giulietti & Pirani 1988).

The Espinhaço Range is subdivided in several subunits, mostly called *serras*, and some of them, individually or grouped, have been recognized as areas of endemism (Echternacht *et al.* 2011). At its southwestern portion is located the Serra do Cabral, a 3000 km^2 plateau that despite being isolated from the core range by a large rift, shares with it geomorphological and floristic characteristics. At least 20 taxa of *Mimosa* are reported for Serra do Cabral (Barneby 1991, 1993, 1997, Hatschbach *et al.* 2006, Dutra 2009) and three of them are endemic to the area. The southern most portion of the Espinhaço comprises the Serra to Cipó, where 27 *Mimosa* species occur, with three taxa (two species and one variety) endemic to the area (Barneby 1991, Dutra 2009, Borges & Pirani 2013). The Serra do Cipó endemics belong to *M.* sect. *Calothamnos* Barneby (1991) (*M. barretoi* Hoehne [1938: 25], *M. macedoana* Burkart [1964: 389]) and to *M.* ser. *Pogocephalae* Barneby (1991: 718) (*M. bombycina* Barneby [1991: 722] var. *bombycina*). However, the three endemic species of Serra do Cabral belong to *M.* ser. *Setosae* Barneby (1991: 350) (*M. acroconica* Barneby [1991: 361]) and *M.* ser. *Pachycarpae* Bentham (1875: 439) (*M. bispiculata* Barneby [1997: 454], *M. chiliomera* Barneby [1993: 329]), which form together a monophyletic group (Simon *et al.* 2011) that is highly diversified and with most species endemic to cerrado areas of Central Brazil and adjacent Bolivia (Barneby 1991, Simon *et al.* 2009).

The distinction between *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* is given mainly by fruit type, which is a

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non-articulated craspedium in the former series and a craspedium in the latter (Barneby 1991). Simon et al. (2010), however, highlighted that this character does not allow a sharp separation between the series. Additionally, results of the molecular phylogeny of Simon *et al.* (2011) also indicate that, although forming together a clade, none of the series is individually monophyletic. Despite that, an increase in phylogenetic data is necessary to allow resilient taxonomic rearrangements. Hence, any new taxa fitting *M.* ser. *Setosae* circumscription, or being intermediate between these two series, should be conservatively described as belonging to *M.* ser. *Pachycarpae*, which, in case of a future taxonomic merging, will have nomenclatural priority over *M.* ser. *Setosae*.

Here we describe two new species of *Mimosa*, both belonging in *M.* ser. *Pachycarpae*, one for Serra do Cabral, and the other for Serra do Cipó and Serra de Capanema, adding two new endemic records to the Espinhaço Range in Minas Gerais state.

Material & Methods

Species concept and delimitation

The new taxa proposed here were delimited based on external morphology, following the Phylogenetic Species Concept (PSC), which view species "as the smallest aggregation of (sexual) populations or (asexual) lineages diagnosable by a unique combination of character states" (Wheeler & Platnick 2000; see also Nixon & Wheeler 1990).
Delimitation of the new species was achieved through the following procedure:

1. Specimens of the hypothesized new species (all collected at Serra do Cabral and Serra do Cipó) were included in sets by morphological similarity.

2. The defined sets were compared to close resembling species of *Mimosa* ser. *Setosae* and *M.* ser. *Pachycarpae*, to where they would belong according to Barneby (1991). Selected species for comparison with the new species from Serra do Cabral are: *M. acroconica* Barneby, *M. caliciadenia* Barneby (1991: 360) and *M. setosa* var. *paludosa* (Bentham 1842: 400) Barneby (1991: 354), all sympatric with it. The new species of Serra do Cipó was compared with: *M.setosa* var. *paludosa*, *M. setosa* var. *urbana* Barneby (1991: 358), *M. lithoreas* Barneby (1991: 388) and *M. chiliomera*, all but the first allopatric.

3. Morphological qualitative features of each taxa under study were scored in a matrix produced with Mesquite 2.75 (Maddison & Maddison 2011) and the varying ones retained for comparison (partial data are presented bellow, but matrices with all variable features observed are provided at MorphoBank [http://dx.doi.org/10.7934/P1220]).

4. Distinction between traits and characters were made based on the known variation for other taxa in the series. A first approach to a more objective procedure was made by Henderson (2004, 2006, 2011), but we understand that his method was prone to exclude informative characters due to variation in few widely variable taxa. Further developments of such methods are promising.

5. The hypothesized taxa were considered as different species by the presence of at least one distinctive character.

Morphological characterization

Morphological features of the new species (and species used for comparison) were described using specimens from CEN, K, NY, SPF, UB (acronyms according to Thiers, continuously updated) with use of a 10–60 × magnification microscope. Measurements were taken with a flexible ruler and optical ruler attached to the microscope. Terminology follows Harris & Harris (2001) and Radford *et al*. (1976).

Conservation status assessment

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 km^2. Values of AOO and Extent of Occurrence (EOO) are given. On the absence of at least three points of occurrence for any taxa, mandatory for GeoCAT, existing points were replicate and slightly dislocated on the map. For locations not georeferenced, the municipality coordinates were used.

Taxonomic treatment

Mimosa perplicata L.M. Borges, ***sp. nov.*** (Figs. 1, 2.A–B, 3.A, E)

Mimosa perplicata has lax, sinuous branches that form a fuzzy crown; leaves with a laminar interpinnal projection, sometimes lacking; secondary veins as prominent as the primaries; glabrous corolla lobes; and fruits with a pedicel more than 5 × longer than wide. These characters distinguish it from *M. setosa* var. *paludosa* (Benth.) Barneby, which does not form entangled crowns; bears leaves with a spiculate interpinnal projection, sometimes lacking; has primary veins more prominent than the secondaries; corolla lobes always pubescent either with trichomes, filiform setae, or glandular setae, or a combination of these; and fruits with pedicel less then 4 × longer than wide.

Type:—BRAZIL. Minas Gerais: Joaquim Felício, Serra do Cabral, Estrada Joaquim Felício–Várzea da Palma, 10,3 km de Joaquim Felício, campo e afloramentos rochosos, 17º41'24.1" S, 44º11'43.6" W, 1025 m, 26 April 2012, fl., *L.M. Borges et al. 647* (holotype SPF!, isotypes K!, NY!, P!, RB!)

Treelets to shrubs or (?)subshrubs up to 3 m, with a fuzzy crown formed by sinuous branches. Indumentum composed of simple trichomes, filiform setae and glandular setae with clavate head; branches, leaf axes, peduncles and fruits hirsute with filiform setae 2.2–6.2 mm long and fewer to sometimes absent glandular setae 0.4–2.5 mm long; leaf axes also pilose on adaxial surface with simple trichomes; stipules, leaflets and floral bracts acroscopic-ciliate with triple indumentum, floral bracts sometimes also with a few glandular setae on abaxial surface; branches and leaf axes armed with straight and broad-based aculei 2–6 mm long. Leaves (2)4–6-jugate; stipules 5.8–9.5 mm × 0.9–1.7 mm, lanceolate-ovate, acuminate, early caducous; petioles 3–4(–6.5) mm long, 0.8-1.2 mm diam., grooved on adaxial surface, sometimes restricted to the pulvinus 2–3 mm long; rachis 19–52 mm long, 0.6–1 mm diam., grooved on adaxial surface and with a spiculate to linear projection 0.7–1.2 mm long between each pinnae pair (sometimes absent), terminal projection 4.7–7 mm long, linear; basal rachillas 10–18 mm long, medial rachillas 13–22 mm long, distal rachillas 25–37 mm long, all 0.5–0.6 mm diam., 3–11 mm apart; leaflets 4.5–7 × 1.1–2 mm, 9–13 pairs on basal rachillas, 11–16 pairs on medial rachillas, 18–25 pairs on distal rachillas, narrowly-oblong, apex rounded to acute, base oblique, subcordate, rounded acroscopically, rounded–truncate basioscopically, 0.7–1.9 mm apart, 4–5 veins, prominent on abaxial surface, paraphyllidia 0.4–1.1 × 0.2 mm, subulate. Glomerules 8–13 × 7–9 mm, globose, 1-axillar to an almost fully developed leaf; peduncles (11–)31–49 mm long; floral bracts 3.5–5.8 × 0.6–1.3 mm, acute-spathulate, cymbiform, 3-nerved, veins prominent on adaxial surface; flowers 4-merous, diplostemonous; pedicel 0.1–0.2 mm long; calyx 0.3–0.9 mm long, cupulate, with a truncate rim or 4 irregular lobes 0.2–0.4 × 0.5–0.8 mm, triangular, ciliate with filiform setae 0.5–1 mm long and glandular capitate setae ca. 0.2 mm long; corolla 2.7–4.3 mm long, campanulate to infundibuliform, glabrous overall, lobes 1.1–1.5 × 0.9–1.3 mm, ovate, mucronate, 1-nerved, vein apex sometimes branching; filaments 9.8–15.5 mm long, glabrous, fused 0.1–0.9 mm at base, pink; anthers 0.4–0.6 mm long, glabrous; ovary 0.8–1.5 × 0.4–0.6 mm, narrowly oblong, tomentose with filiform setae 0.6–0.9 mm long, stipe 0.2–0.5 mm long, glabrous; style 7.5–15 mm long, glabrous; stigma porate, glabrous. Fruit a craspedium 29–40 × 9–10 mm, narrowly-oblong, papery, castaneous, apex acute, aristate, base cuneate; pedicel 3.4–5.5 mm long, ca. 0.7 mm wide; replum 0.8–1.4 mm wide; valves initially cracking only along margins together with separation from replum, but apparently breaking up entirely after seed dispersal into (3)7–9 articles, central ones 3–6 × 7.5–8.5 mm, monospermic, transversely oblong; seeds 5.8–6.4 × 3.6–3.9 mm, elliptic-ovate, foveolate, shiny dark brown, pleurogram present.

Additional specimens examined (paratypes):—BRAZIL. Minas Gerais: Joaquim Felício, Serra do Cabral, 28 July 1976, fl., fr., *P.E. Gibbs et al. 2374* (CEN!, UEC); 18 May 1977, fl., *P.E. Gibbs et al. 5027* (CEN!, UEC); campo rupestre, afloramentos rochosos, 900–1100 m, 21 December 1999, fl., fr., *G. Hatschbach et al. 69421* (MBM, NY!); 8 July 2001, fl., fr., *A.Q. Lobão et al. 614* (SPF!, VIC); campo rupestre, solo arenoso, 15 April 1996, fl., *G. Hatschbach et al. 64817* (HBG!, MBM, NY!, SPF!).

Distribution:—*Mimosa perplicata* is endemic to campos rupestres with sandy soils and often rock outcrops of Serra do Cabral in the municipality of Joaquim Felício, Minas Gerais, Brazil (Fig. 2 and 4).

Etymology:—The epithet is the Latin word for interlaced, "*perplicatus*", and makes reference to the plant's fuzzy crown, formed by its incurved, sinuous and somewhat lax branches (Fig. 1 A, 2 A and B). It is also allusive of its intricate relationship with the related sympatric species *Mimosa paludosa*, *M. acroconica* and *M. caliciadenia*.

Conservation status:—CR. GeoCAT analysis defined the area distribution of the species as less than 100 km^2, which, associated to the tendency for lost of habitat in the surroundings of Serra do Cabral State Park, where the

species was collected, place it in the Critically endangered category. However, if more individuals are found in other areas of Serra do Cabral, particularly in protected areas of the park, its status can be updated to Endangered, since the range's total area is less than 5000 km^2.

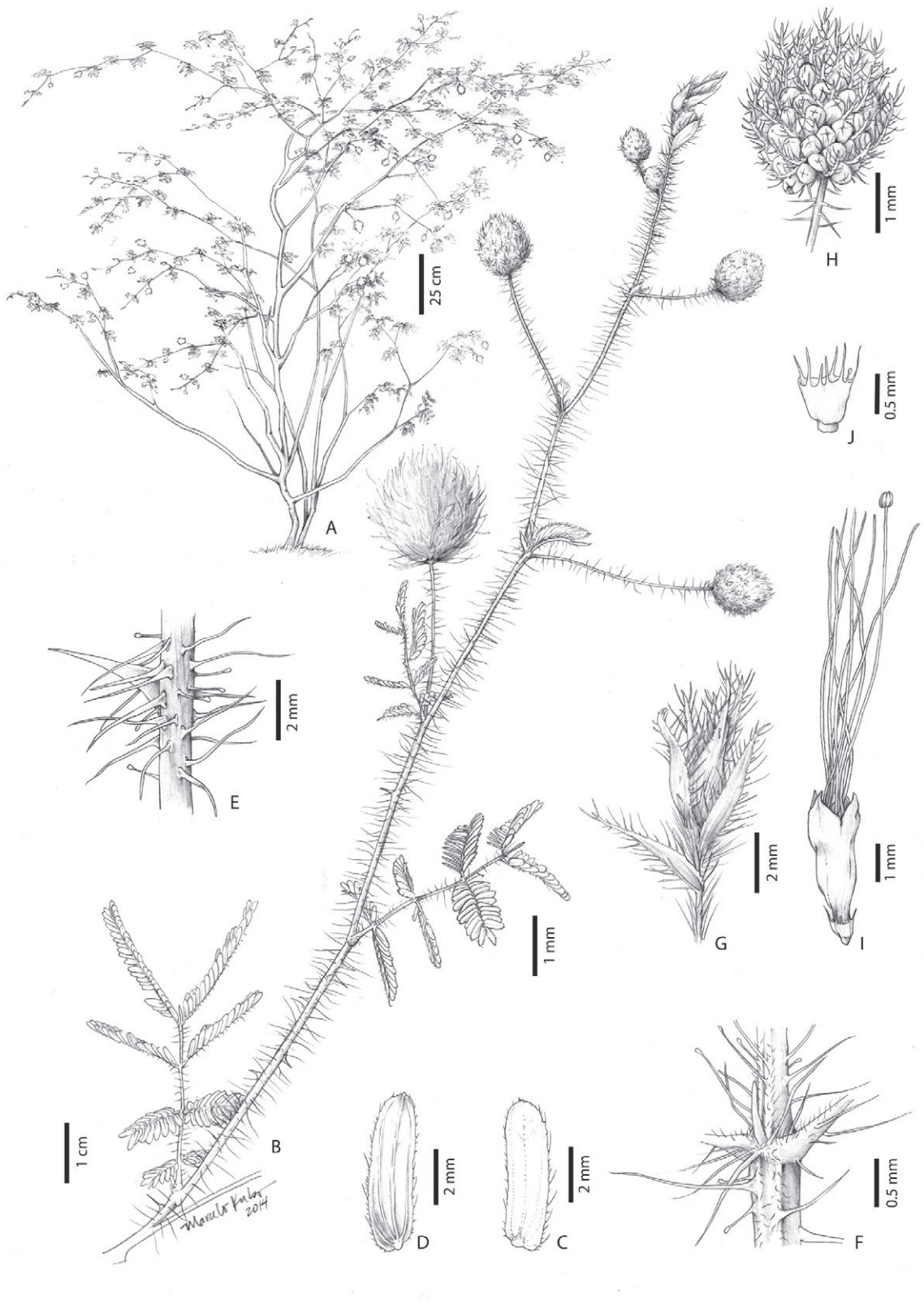

FIGURE 1. *Mimosa perplicata*. A. Habit. B. Branch. C. Adaxial surface of leaflet. D. Abaxial surface of leaflet. E. Branch detail showing the aculei and the indumentum composed by filiform and glandular setae. F. Detail of the rachis showing the interpinnal projection and triple indumentum of trichomes, filiform setae and glandular setae. G. Stipules at the apex of the branch. H. Glomerule with flowers in bud. I. Hermaphrodite flower. J. Calyx. Drawing by Marcelo T. Kubo.

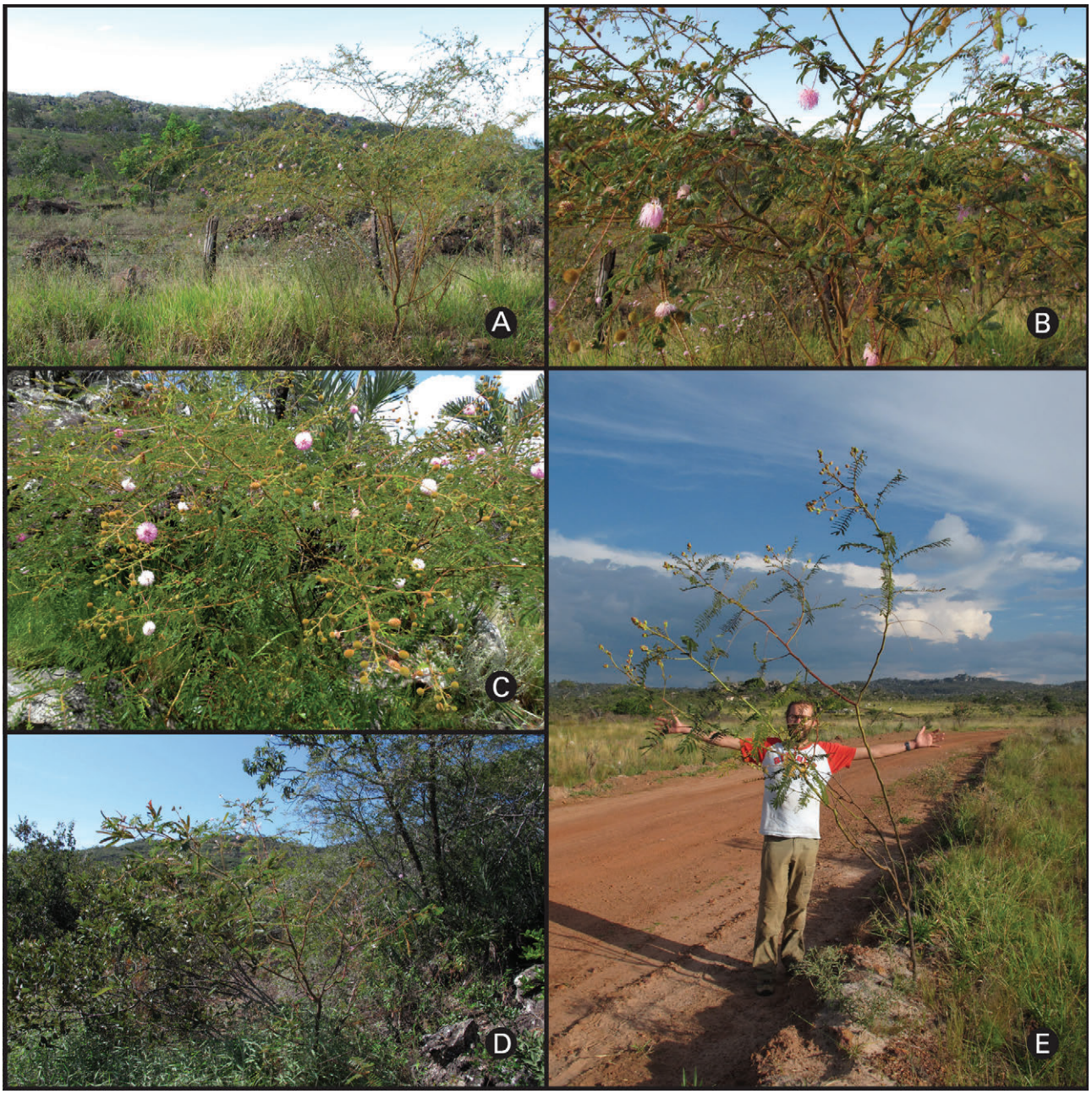

FIGURE 2. Habits of *Mimosa perplicata* and related species. A–B *M. perplicata*. C. *M. caliciadenia*. D. *M. setosa* var. *paludosa*. E. *M. acroconica* and Dr. B. Loeuille. All photos by L.M. Borges.

Notes:—Oldest collections of *Mimosa perplicata* were identified as *M. setosa* var. *paludosa* (e.g. *Hatschbach et al. 64817*), or *M. acroconica* (e.g. *Gibbs et al. 2374, 5027; Hatschbach et al. 64817; Lobão et al. 614*) both of which share a close relationship with this new species and are sympatric with it in Serra do Cabral. However, several characters, the main ones listed at Table 1 and pictured in Figures 2–3, allow the distinction between them (a complete nexus table showing all variable features between the species is provided at http://dx.doi.org/10.7934/P1220). Particularly, the morphological plasticity of *M. setosa* var. *paludosa* poses problems for recognition of related taxa, but *M. perplicata* always presents glabrous corollas and stipitate fruits, while *M. setosa* var. *paludosa* has pubescent corollas and fruits almost completely sessile (see diagnosis). Lack of trichomes and the low number of glandular setae is also striking in *M. perplicata*, but, although both appendages are usually abundant in *M. setosa* var. *paludosa*, their concentration may vary widely amongst specimens. *M. perplicata* was probably previously confused with *M. acroconica* due the concentration of stipules in the apex of shoots, before their early fall. Those, however, are broader (more than 4 mm wide) in *M. acroconica*, which may also be set apart for being a treelet with incurved ascending branches (Fig 2 E), abundant villous indumentum (Fig. 3 E) and glandular setae with capitate (not clavate) head (Fig. 1 E). The fuzzy

crown of *M. perplicata* resembles *M. caliciadenia*, which is endemic to the Diamantina plateau, at the main portion of the Espinhaço range. However, *M. caliciadenia* is different from the former species in bearing pin-headed glandular setae, aculeate foliar rachides, longer petioles and generally for lacking filiform setae on vegetative organs, although those may be randomly present. Further investigation is needed to find out if the species may also be a prostrate shrub, as indicated in *Hatschbach et al. 69421* and *Gibbs et al. 5027*, or if habit information was mistakenly recorded. We suppose that this may be an indication that the plants can become early fertile, while still small, when their lax branches make them appear to be prostrate.

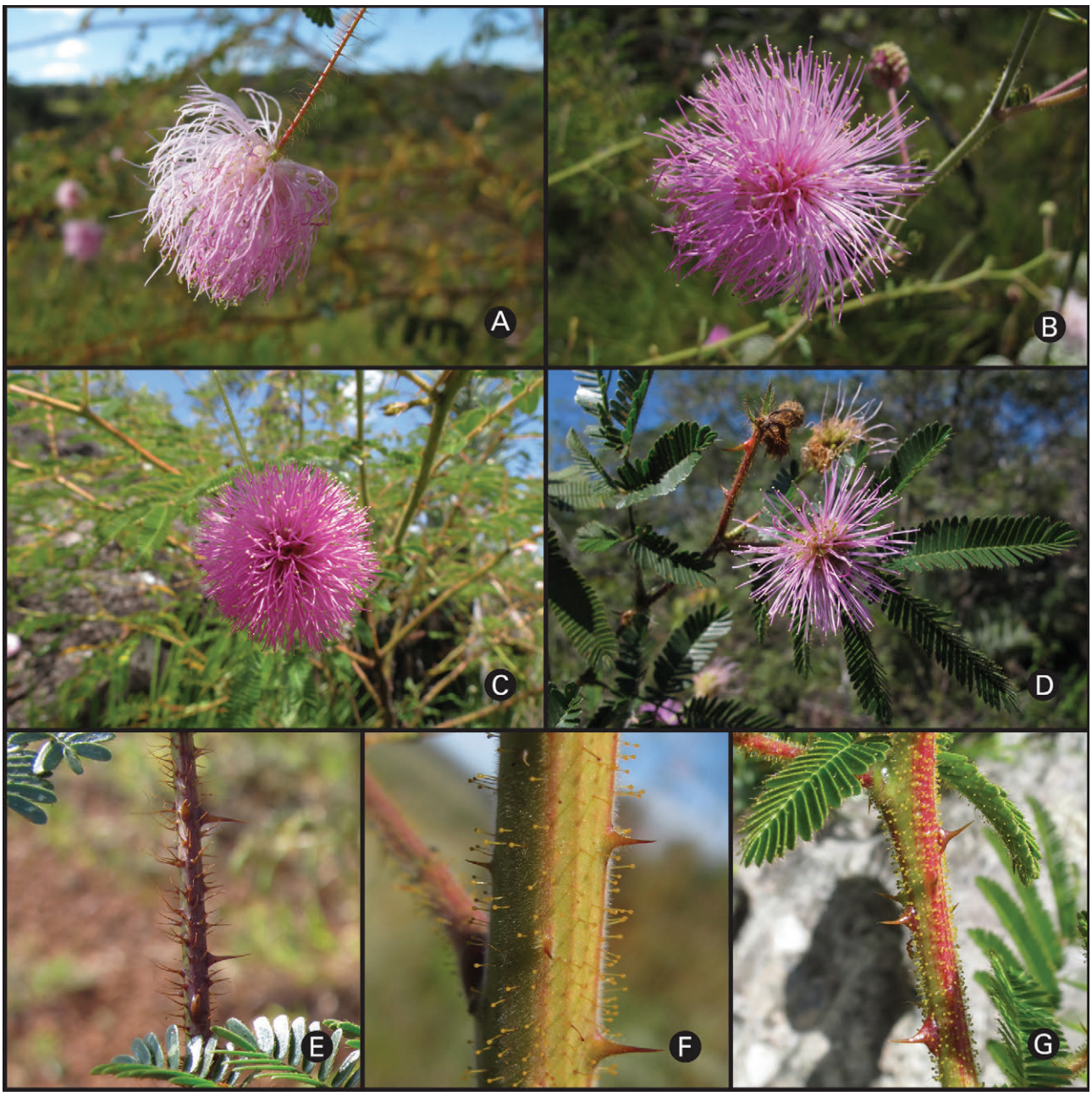

FIGURE 3. Glomerules and branch indument of *Mimosa perplicata* and related species. A, E. *M. perplicata*. B, F. *M. acroconica*. C, G. *M. caliciadenia*. D. *M. setosa* var. *paludosa*. All photos by L.M. Borges.

TABLE 1. Some characters distinguishing *Mimosa perplicata* from *M. acroconica, M. caliciadenia* and *M. setosa* var. *paludosa*. See text for further information not provided and comments.

	Glandular setae, head shape	Branches, filiform setae	Stipules, shape	Petiole, lenght relative to pulvinus	Corolla lobes, filiform setae	Fruit, valves segmentation
M. perplicata	clavate	present	lanceo-acuminate	1:1–2:1	absent	articulated
M. acroconica	capitate	absent	ovate–broadly ovate	1:1–2:1	present	integer
M. caliciadenia	capitate	absent/present	lanceo-acuminate	4:1 or more	absent	articulated
M. setosa var. ***paludosa***	clavate	present	lanceo-acuminate	4:1 or more	present	articulated

Mimosa serpensetosa L.M. Borges, ***sp. nov.*** (Figs. 4–6)

Mimosa serpensetosa is very similar to *M. setosa* var. *paludosa* (Benth.) Barneby, but differs from it particularly for being a prostrate subshrub (vs. erect shrub or treelet); and by its calyx rim with plane fringes gradually passing to filiform setae (vs. rim glabrous or ciliate not with filiform setae). Even though it shares a similar habit with *M. setosa* var. *urbana* Barneby, it differs from the latter by abundant presence of glandular setae (vs. almost or completely absent); presence of aculei (vs. absence); leaves's rachis twice or more as long as the petiole (vs. ca. equally long); and absence of filiform setae on fruit's valves (vs. presence). *M. serpensetosa* can also be distinguished from both species by its basal rachillas size ca. 1:2 of the medial ones (vs. 1:1).

Type:—BRAZIL. Minas Gerais: Santana do Riacho, Serra do Cipó, Estrada Santana do Riacho–Cardeal Mota, via Melo, cerrado de altitude, 19º13'34.5" S, 43º39'58" W, 814 m, 23 April 2006, fl., fr., *L.M. Borges et al. 104* (holotype SPF!, isotypes BHCB!, K!, NY!, P!, RB!, UB!, US!)

Prostrate to decumbent shrubs with distal portion of stems ascending up to 30 cm, forming dense thickets of tangled stems getting up to 1 m tall, or more when synflorescences strongly assurgent; branches and often rachides armed with straight and broad-based aculei 2.5–5 mm long, with a caducous loose apex that may break up with time. Indumentum composed of simple trichomes, filiform setae and glandular setae with clavate head; branches, leaf axes, and peduncles pubescent with simple trichomes, hirsute with filiform setae 2–4 mm long and glandular setae 0.2–0.3 mm long; stipules and leaflets pubescent on both faces with trichomes (leaflet surfaces sometimes glabrescent or glabrous [Glaziou 10616; 19125]), also ciliate with both kinds of setae (glandular ones rarely present on abaxial surface of stipules and absent on leaflets margin); floral bracts abaxial surface pubescent with trichomes, hirsute with glandular setae and sparsely tomentose with filiform setae, adaxial surface glabrous to slightly pubescent with trichomes; fruits overall pubescent with trichomes and hispid with glandular setae 0.3–0.5 mm or 1.5–2.5 mm long (shorter ones usually restricted to margins and longer ones only to valves), margins also hirsute with filiform setae 2.5–3.4 mm long, surface not completely concealed by the indumentum. Leaves 7–15-jugate, except for the usually 3–5-jugate ones at the reproductive axis; stipules 3–5.3 mm × 0.6–0.7 mm, lanceolate-acuminate, reflexed, caducous to shortly persistent; petioles 12–30 mm long, 1–1.5 mm diam., grooved on adaxial surface, the pulvinus 1.5–2.5 mm long; rachis 45–110 mm long, 0.8–1 mm diam., grooved on adaxial surface and with a spiculate projection 1–1.5 mm long between each pinnae pair (sometimes caducous or randomly absent), terminal projection 2–3 mm long, linear; basal rachillas 10–18(–35) mm long, medial rachillas 15–52 mm long, distal rachillas 20–57 mm long, all 0.2–0.5 mm diam., 7–10 mm apart; leaflets 2.5–5.6 × 0.8–1.5 mm, 22–28 pairs on basal rachillas, 31–43 pairs on medial rachillas, 29–50 pairs on distal rachillas, narrowly-oblong, inequilateral, 0.6–1.5 mm apart, apex acute to rounded, base oblique, subcordate, rouded-truncate, 4–5(?) veins, slightly prominent only on abaxial surface; paraphyllidia 0.4–0.7 × 0.1–0.2 mm, subulate. Inflorescence a terminal or axillary exserted double-raceme, which may form a frondose and exserted paniculate synflorescence. Glomerules 7–1.2 × 7–9 mm, spherical to slightly ellipsoid, 2–3-axillary to a suppressed leaf that expands almost together with the anthesis of its associate glomerule and is fully expanded during fruit maturation; peduncles 18–32 mm long; floral bracts 3.1–3.9 × 0.5–0.7 mm, narrowly acuminate-spathulate, cymbiform, 1-nerved; flowers 4-merous, diplostemonous, basal ones only staminate; pedicel ca. 0.2 mm long; calyx (including lobes and

indumentum) 1.2–2 mm long, cupulate, tube 0.3–0.5 mm long, lobes 1.1–1.9 mm long, indistinguishable, decompound in plane fringes gradually passing to filiform setae (very delicate in Glaziou 10616), a few glandular setae ca. 0.5 mm long sometimes present; corolla 3–4 mm long, infundibuliform, tube glabrous, lobes 1.1–1.5 × 0.9–1 mm, ovate, mucronate, 1-nerved, vein apex slightly prominent, tomentose with trichomes, filiform setae ca. 0.6 mm long and glandular setae ca. 0.2 mm long (the last absent in Glaziou 10616), indumentum not concealing lobes surface; filaments 10–11.5 mm long, glabrous, fused ca. 0.1 mm at base, pink; anthers 0.5–0.6 × 0.5–0.7 mm, glabrous; ovary 1.2–1.3 × ca. 0.7 mm, compressed, elliptic, margins tomentose with filiform setae 1.1–1.5 mm long and glandular setae ca. 0.1 mm long, stipe 0.2–0.3 mm long, glabrous; style 12.5–14 mm long, glabrous; stigma porate, glabrous. Fruit a craspedium 26–46(60) × 8–11 mm, narrowly oblong to oblong, papery, brown, apex obtuse to rounded, obliquely aristate, base cuneate, sometimes rounded; pedicel ca 0.5 × 0.5 mm; replum 1–1.1 mm wide; valves breaking together with seed liberation into 3–9 articles, central ones 4.5–5.1 × 7.8–9.2 mm, monospermic, transversely oblong; seeds 4.2–4.9 × 2.9–3.5 mm, ovate, lentiform, shiny dark brown, pleurogram present.

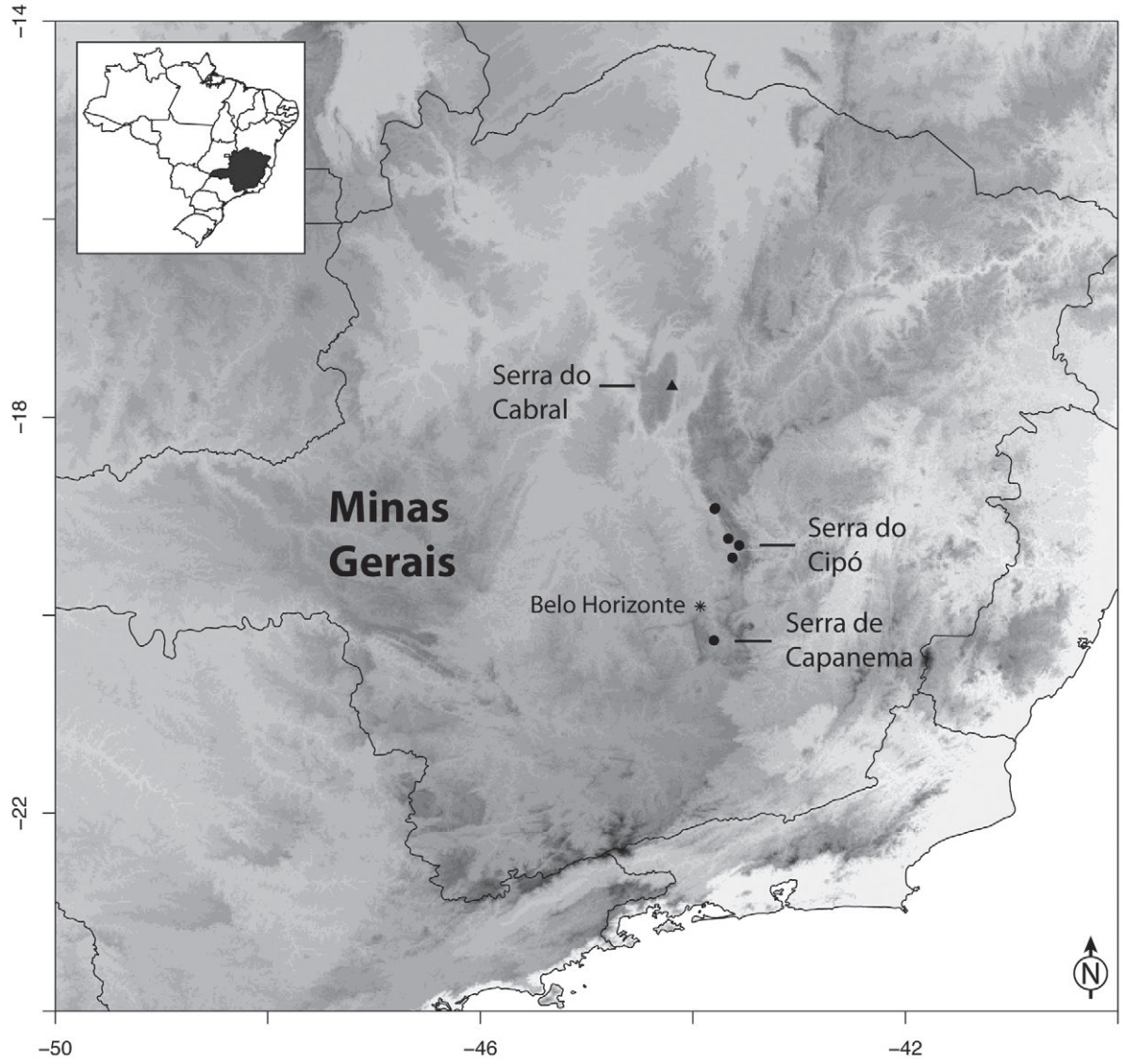

FIGURE 4. Distribution map of *Mimosa perplicata* (▲) and *M. serpensetosa* (●).

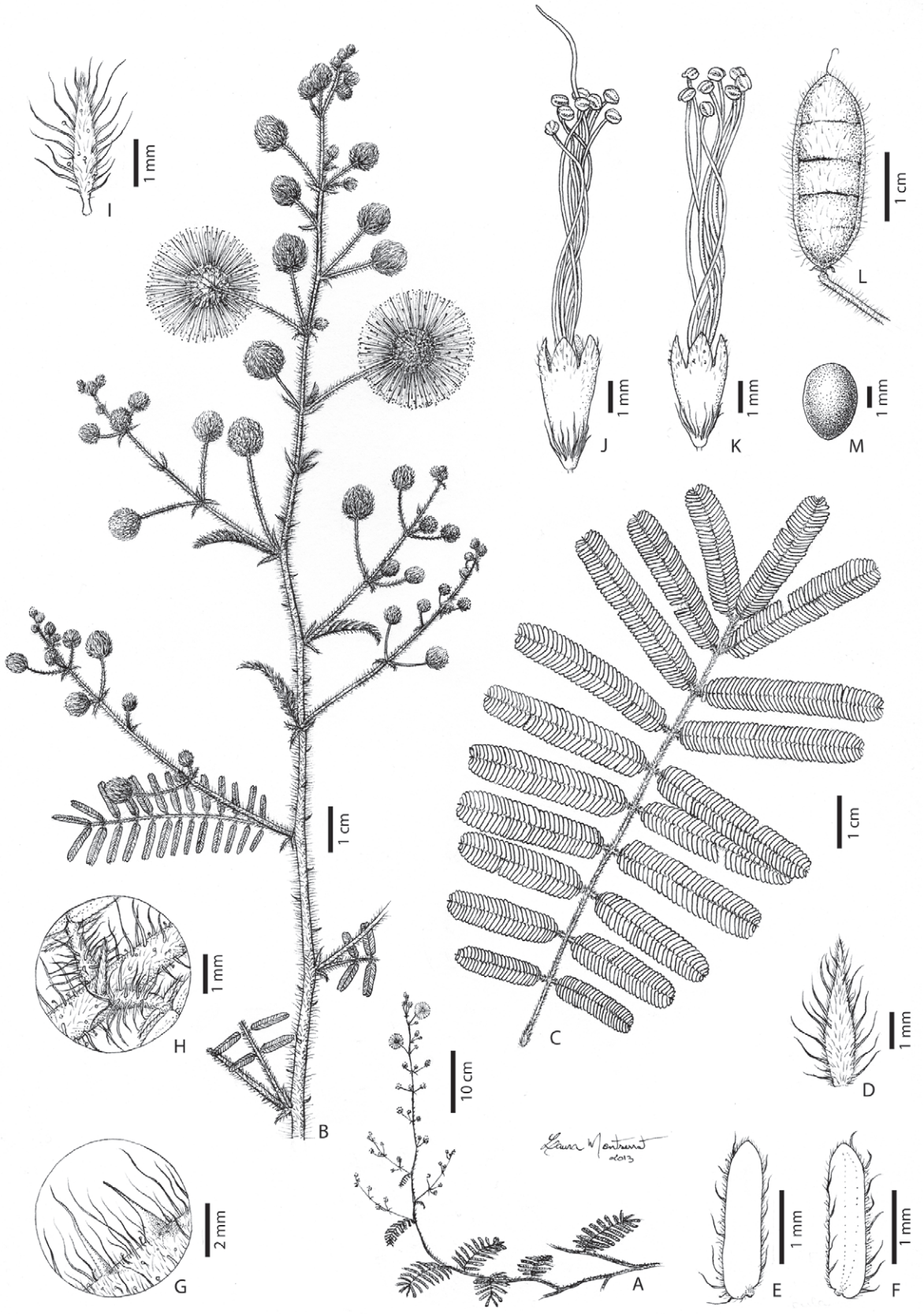

FIGURE 5. *Mimosa serpensetosa*. A. Habit. B. Branch. C. Leaf. D. Stipule (abaxial surface). E. Adaxial surface of leaflet. F. Abaxial surface of leaflet. G. Branch detail showing the triple indumentum of trichomes, filiform setae and glandular setae, aculei with loose apex (la) and after fall of apex (af). H. Detail of the rachis showing the interpinnal projection. I. Floral bract. J. Hermaphrodite flower. K. Masculine flower. L. Fruit. M. Seed. Drawing by Laura Montserrat.

FIGURE 6. A–C. *Mimosa serpensetosa*. A. Trailing branch. B. Exserted synflorescence. C. Interlaced branches self-raising the plant from soil level. D. Synflorescence of *M. setosa* var. *paludosa* Benth. Photos A–C by C.M. Siniscalchi; D by G.P. Lewis.

Additional specimens examined:—BRAZIL. Minas Gerais: Congonhas da Serra, fl., April–March [1887 (*fide* Urban, 1906)], *A.F.M. Glaziou 10616* (K!, P?); [Itabirito] Capanema, s.d., fl., *L. Riedel 8* (K!, LE!); [Itabirito], In campis sicois glareosis p. Capanema, fl., January 1825, *L. Riedel s.n.* (LE!); Santana do Pirapama, Serra do Cipó, fl., 28 November 2009, *A.P. Savassi-Coutinho et al. 1325* (ESA, K!); acesso pela Fazenda Inhame, Estrada velha para a mina de manganês, subida da Serra, campo sujo, 18º55'3.44" S, 43º47'20.46" W, 1236 m, fl., 13 November 2009, *D.C. Zappi et al. 2349* (K!, SPF!); Serra do Cipó (Serra da Lapa), Distrito de São José da Cachoeira, Estrada Santana do Riacho–Santana de Pirapama, trilha do Rio das Pedras, campo rupestre, fl., 20 February 2007, *V.C. Souza et al. 32910* (ESA, K!, SPF!); Fazenda Inhame (Serra Mineira), fl., 22 March 1982, *J.R. Pirani et al. CFSC 8055* (SPF!); Fazenda Toucan, trilha João Carrinho para trilha da Captação (A196), fl., 28 November 2009, *G.O. Romão et al. 2411*, (ESA, K!); Trilha subindo o morro, 18º55'31.1" S, 43º47'37.3" W, 950 m, fl., 27 November 2009, *A.P. Savassi-Coutinho et al. 1313* (ESA, K!); Trilha subindo o morro, 18º55'31.1" S, 43º47'37.3" W, 950 m, fl., 27 November 2009, *A.P. Savassi-Coutinho et al. 1309* (ESA, K!); Santana do Riacho, Serra do Cipó, trilha IBAMA–Cardeal Mota, atravessando o rio Cipó com o barquinho, estrada logo após a travessia, próximo à pousada Pepalantus, borda de cerrado, fl., 18 June 2007, *L.M. Borges & A. Ball 175* (SPF!); Rodovia Belo Horizonte–Conceição do Mato Dentro (MG 010), km 119.5, margem direita, recuo na estrada, beira de estrada em área de campo rupestre, ca. 19º17'38" S, 43º33'50" W, fl., 14 June 2010, *L.M. Borges et al. 432* (SPF); trilha para a Lagoa Dourada a partir das imediações da Pousada Engenho

Velho, cerrado, 19º25'08.9" S, 43º 37'34.1" W, 991 m, fl., 17 June 2010, *L.M. Borges et al. 463* (SPF!); Serra da Lapa, in glareosis sicois, January 1835, *L. Riedel s.n.* (G, P 03151826); Sertão, fl., October–November [1887 (*fide* Urban, 1906)], *A.F.M. Glaziou* 19125 (K!, P!).

Distribution:—*Mimosa serpensetosa* is endemic to altitudinal cerrados and campos rupestres of Serra do Cipó (north to Belo Horizonte, Minas Gerais, Brazil, on quartizitic substrate), and with two records from iron rich soils of Serra de Capanema (south to Belo Horizonte) (Fig. 4 and 6 A–B).

Etymology:—The species' name is derived from its creeping habit ("serpens") and setose ("setosa") indumentum, the latter also alluding to its similarity to elements of *Mimosa setosa* (*sensu* Barneby 1991).

Conservation status:—EN. According to GeoCAT analysis results (EOO = 1823.27 km^2; AOO = 24 km^2) the species may be classified as Endangered. This is corroborated by a tendency to lost of habitat, since all collections from Serra do Cipó, were made outside of the Serra do Cipó National Park. However, it is highly likely that the species also occurs in protected areas within it. Its occurrence at Serra de Capanema, on iron-rich soils, is indicated only by a few ancient records, so it needs to be confirmed by a modern collection as soon as possible, due to mining pressure in the area. Nonetheless, if Capanema is excluded from the GeoCAT analysis, the values of EOO and AOO change respectively to 323.76 km^2 and 20 km^2, but the conservation status remains the same.

Notes:—The earliest collections of *Mimosa serpensetosa* were made by Riedel near Capanema, one in 1825 (*Riedel s.n*. [LE]), and the other without date information (*Riedel 8* [K, LE]). Those are likely to be duplicates of the same collection event, but it is not possible to surely assert this. Specimens in G and P (*Riedel s.n.* [P 03151826]) indicate that Riedel also collected the species at Serra da Lapa, an early homonym for Serra do Cipó, in 1835. All modern collections of the species, however, are from Serra do Cipó, an area much more botanically explored than Serra de Capanema. It is not possible to assure that Riedel visited Capanema by January 1825, but in December 1824, Langsdorff's expedition left Diamantina heading to Ouro Preto, where they were by the beginning of February. In January 28th, Riedel left the expedition towards Serra do Caraça. There is no mention to Capanema in the diaries of the expedition, but is likely that he has reached the region, which lies close to Ouro Preto and Serra do Caraça (R. Mello-Silva pers. comm). In addition, *M. foliolosa* var. *pachycarpa* (Bentham 1842: 406) Barneby (1991: 380), a very common species from campos rupestres of Serra do Cipó, also occurs in altitudinal areas around Belo Horizonte that are close to Serra de Capanema, some of which have iron-rich soils. We believe this may reinforce the actual existence of *M. serpensetosa* in this area, as well as in others connecting it to Serra do Cipó, but its occurrence in this particular soil type must be investigated. Unfortunately, Capanema was mined and most of its original vegetation is missing.

Apparently the small size of the samples taken by Riedel and the lack of precise habit information, the species most distinguishing feature, made its true identity pass unnoticed by Bentham, who probably had access only to the specimen at Kew, which is mounted together with a collection of *M. setosa* var. *paludosa* (Riedel 584). Specimens latter collected by Glaziou were still identified as already known taxa by Taubert and also Barneby. The latter, however, left an extensive note in *Glaziou 19125* (K) discussing its affinities and pointing out the need for further investigation, also present in his monograph under taxon "265bis. *Mimosa* sp" (Barneby 1991, 426–427). Borges & Pirani (2013a) treated recent collections of *M. serpensetosa* as *Mimosa setosa* subsp. *setosa*, supposing an unconfirmed relation with *M. setosa* var. *pseudomelas* due to the lack of interpinnal projections. The projections are in fact present in both species, but may easily fall and hence seem absent, and *M. serpensetosa* is strongly dissimilar from this particular variety, markedly by type of habit, presence of aculei and leaf and fruit morphology.

Of the *Mimosa* species used for delimitation of *M. serpensetosa* (see Material and Methods), two (*M. setosa* var. *paludosa* and *M. setosa* var. *urbana*) were compared with it at the diagnosis above. It is important to highlight that *M. setosa* var. *urbana* is distantly allopatric, occurring in cerrados surrounding the Federal District in Central Brazil. The other two, *M. lithoreas* and *M. chiliomera*, are the only humifuse species of *Mimosa* ser. *Pachycarpae* known to also occur in altitudinal areas of Minas Gerais state. *M. lithoreas*, which is known from only two collections, including the type, from campos rupestres surrounding the municipalities of Paracatu and Coromandel, may be differentiated by the lack of glandular indumentum in vegetative organs as well as prickles (vs. presence), apressed filiform setae (vs. patent), glabrous corollas (vs. tomentose), and by its non-dehiscent craspedia. *M. chiliomera* is endemic to Serra do Cabral and its following main characters may be used to distinguish it from *M. serpensetosa*: absence of interpinnal projections (vs. presence), absence of setae on leaflets margin (vs. presence), corolla indumentum compound only by simple trichomes and filiform setae that conceal the lobes' surface (vs. presence of triple indumentum not concealing the surface), as well as its prominent number of pinnae pairs (ca. 38 vs. 7–15), considered by Barneby (1993) as its most remarkable feature. Table 2 summarizes the main diagnostic characters between *M. serpensetosa* and the related species here highlighted (a complete nexus table showing all variable features between the species is provided at http://dx.doi.org/10.7934/P1220).

TABLE 2. Some characters distinguishing *Mimosa serpensetosa* from *M. setosa* var. *paludosa*, *M. setosa* var. *urbana*, *M. lithoreas* and *M. chiliomera*. See text for further information not provided and comments

	Habit	Prickles	Branches, glandular setae	Proportion of rachis length to petiole	Leaves, rachis, interpinnal projection	Calyx, plane fringes	Corolla lobes, glandular setae	Fruit, valves segmentation
M. serpensetosa	prostrate	present	present	2:1 or more	spiculate	present	present	articulated
M. setosa var. ***paludosa***	erect	present	present	2:1 or more	absent/ spiculate	absent	present	articulated
M. setosa urbana	prostrate	absent	absent/ present	1:1	spiculate/ laminar	present	present	articulated
M. lithoreas	prostrate	absent	absent	1:1 / 2:1 or more	absent	absent	absent	integer
M. chiliomera	prostrate	absent	absent	2:1 or more	absent	present	absent	?

Mimosa serpensetosa may be superficially mistaken with *M. foliolosa* var. *pachycarpa*, but the latter is a shrub with incurved ascending branches, with leaves lacking interpinnal projections of any kind, and its fruit is a non-articulated craspedium.

Specimens from Santana de Pirapama, located at the northwestern portion of Serra do Cipó and which was recently extensively surveyed (Zappi *et al.* 2014), tend to present bigger leaves, leaflets and glomerules, coarser filiform setae, as well as not to show the markedly villous branches that are seen on other specimens. Since those are mainly allometric variations, they are interpreted here as intraspecific geographical variation. Also, the majority of collections from this area, although not in detail, indicate the plants as being shrubs from 40 up to 100 cm and even 150 cm tall. That may cast doubt on the use of habit as a valid character to delimit the species. However, individuals from the southern portion of Serra do Cipó were observed forming dense thickets of interlaced stems (Fig. 6 C), what may explain how the species can reach up to 100 cm tall, and, if the synflorescence is greatly exserted and assurgent, maybe up to 150 cm. According to G.P. Lewis (pers. comm.), who has been collecting in Santana de Pirapama, the plants collected there were prostrate spreading shrubs that fit perfectly this scenario.

It is interesting to note that the fruits of *Mimosa serpensetosa* have typical craspedial dehiscence, but part of the articles tends to remain united at least partially (Fig. 5 L). This adds to the evidence that the main feature segregating *M.* ser. *Setosae* from *M.* ser. *Pachycarpae* may be artificial (Simon *et al.* 2010).

Discussion

Some cases of sympatric closely resembling endemic taxa have been previously reported in *Mimosa* ser. *Pachycarpae* (e.g. *M. capito* Barneby [1991: 417–419], *M. dominarum* Barneby [1991: 420–421]*, M. manidea* Barneby [1991: 417] and *M. oedoclada* Barneby [1991: 419–420] at Chapada dos Veadeiros, Goiás, Brazil). However, a peculiar situation is presented at Serra do Cabral: three narrow endemics, *M. acroconica, M. bispiculata* and *M. perplicata*, are found together with *M. setosa* var. *paludosa*, a widely distributed and morphologically plastic taxon, which is also known to bear a variable chromosome number (Dahmer *et al.* 2010).

Apparently, the occurrence of these four close resembling species in such a small area may indicate that *Mimosa setosa* var. *paludosa* is working as a pump for diversification of new taxa, as suggested by Darwin (1869; cited in Wilkins [2009]) and stressed by Knapp (2011). In this way the endemic mimosas of the area may be the product of speciation of or with population subsets of *M. setosa* var. *paludosa*, probably via different processes, such as hybridization and polyploidy, that would allow sympatric speciation. The similarities with *Mimosa caliciadenia*, however, point for the possibility of the low altitudinal gaps between Serra do Cabral and the Diamantina plateau to act as a barrier that promotes vicariant speciation. In the first case, molecular phylogenetic analysis with multiple accessions of those taxa would indicate para or polyphyly of the hypothesized pump species, and use of both plastidial and nuclear markers may highlight events of hybridization by discordant positioning of one or more taxa in the trees. In the second scenario, it is expected that phylogenetic analysis would present a sister group relationship between *M. perplicata* and *M. caliciadenia*. However, a more complex picture may be found, since *M. caliciadenia* is also very closely related to *M. setosa* var. *paludosa*.

Of the species of *Mimosa* ser. *Pachycarpae* and *M.* ser. *Setosae* occurring at Serra do Cipó, only *M. setosa* var. *paludosa* shares a close resemblance with *M. serpensetosa*. So, if included in the same kind of analysis described above, it could also be used to investigate the occurrence of sympatric speciation through a species pump mechanism, which may be linked to the environmental heterogeneity of the Espinhaço Range.

The range's role as a particular area for development of taxa evolutionary studies is reinforced by the discovery of these two new species. The high concentration of narrowly endemics at that region of the Espinhaço range may be an indicative of the presence of a pattern similar to that found by Davies *et al.* (2011) in the Cape Floristic Region. There, a large number of restricted species, and, by that, prone to become extinct, are associated with recently diversified lineages, as are the cerrado's *Mimosa* (Simon *et al.* 2009).

Development of studies dealing with processes are greatly improved when based on taxonomic investigation focused on pattern discovery of evolutionary end products such as the here proposed *Mimosa perplicata* and *M. serpensetosa*.

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